SITE Sizewell A

Nuclear Decommissioning Authority SITE OWNER

**WASTE CUSTODIAN** Magnox Limited

**WASTE TYPE** LLW

Is the waste subject to

Scottish Policy:

Nο

**WASTE VOLUMES** 

Reported At 1.4.2022..... Stocks:  $0 \, \text{m}^3$ 1.4.2092 - 31.3.2095...... 1043.0 m<sup>3</sup> Future arisings -Total future arisings: 1043.0 m<sup>3</sup> Total waste volume: 1043.0 m<sup>3</sup>

Comment on volumes: Waste arisings are assumed to occur at a uniform rate over 3 years. Final Dismantling &

> Site Clearance is assumed to commence in 2088 with reactor dismantling commencing in 2092 and lasting for three years. Volumes and radioactivity have been calculated for 85

years after reactor shutdown, i.e. 2091.

Uncertainty factors on

volumes:

Stock (upper): Х Stock (lower):

Arisings (upper) x 1.2

Arisings (lower) x 0.8

**WASTE SOURCE** Wastes arising from contamination control procedures during plant dismantling.

#### PHYSICAL CHARACTERISTICS

General description: A variety of combustible and non combustible materials. No large items are expected.

Metallic pipe and other items (~50% vol), plastic pipework, sheet and other items (~10% Physical components (%vol):

vol), rubber gloves and other items (~5% vol), clothing (~5% vol), wood (~5% vol), encapsulated sludge (~5% vol), air filters (~5% vol), combustible material (e.g. paper

sheet) (~15-20 % vol). Percentages of constituents are very uncertain.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m3):

Comment on density: The density is likely to lie between 0.5 and 1.5 t/m3.

#### **CHEMICAL COMPOSITION**

General description and components (%wt):

The waste is expected to include cloth (~5%vol), plastics (~15%vol), paper (~15%vol), wood (~5%vol), rubber (~5%vol), encapsulated sludge (~5%vol) and metals (~50%vol).

Percentages of constituents are very uncertain.

Chemical state: Neutral

Chemical form of radionuclides:

H-3: The chemical form of tritium has not been assessed. C-14: The chemical form of carbon 14 has not been assessed. CI-36: The chemical form of chlorine 36 has not been assessed.

Se-79: The selenium content is insignificant. Tc-99: The technetium content is insignificant. Ra: The radium isotope content is insignificant. Th: The thorium content is insignificant. U: The uranium isotope content is insignificant. Np: The neptunium content is insignificant.

Pu: The plutonium isotope content is insignificant.

Metals and alloys (%wt): Items will have been cut for packaging but an assessment of item dimensions has not

been made. Metal thicknesses will probably be typically 1-3 mm.

% of total C14 (%wt) Type(s) / Grade(s) with proportions activity

Stainless steel..... <<1.0

Other ferrous metals..... ~50.0 Apart from steels only small

quantities of metals and alloys are

expected.

Iron.....

Aluminium	<<1.0		
Beryllium	0		
Cobalt			
Copper	<<1.0		
Lead	0		
Magnox/Magnesium	. 0		
Nickel			
Titanium			
Uranium			
Zinc	0		
Zircaloy/Zirconium	0		
Other metals	<<1.0	"Other" metals may be present in trace quantities.	
		y be present. Halogenated plastics and ru ve not been determined.	bbers are
	(%wt)	Type(s) and comment	% of total C14
Total cellulosics	~25.0		activity
Paper, cotton	~20.0		
Wood	~5.0		
Halogenated plastics	<7.5		
Total non-halogenated plastics	<7.5		
Condensation polymers	<3.8		
Others	<3.8		
Organic ion exchange materials	0		
Total rubber	~5.0		
Halogenated rubber	<2.5		
Non-halogenated rubber	<2.5		
Hydrocarbons			
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics	TR		
Other materials (%wt): Graphite may be pre	esent in at	least trace quantities.	
	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	0		
Inorganic sludges and flocs	0		
Soil	TR		
Brick/Stone/Rubble	TR		
Cementitious material	~5.0	encapsulated sludges	

Sand		
Glass/Ceramics	0	
Graphite	TR	
Desiccants/Catalysts		
Asbestos	0	
Non/low friable		
Moderately friable		
Highly friable		
Free aqueous liquids	0	
Free non-aqueous liquids	0	
Powder/Ash	0	
Inorganic anions (%wt): Not fully assessed.		
	(%wt)	Type(s) and comment
Fluoride	TR	
Chloride	TR	
lodide	0	
Cyanide	0	
Carbonate	TR	
Nitrate	TR	
Nitrite	TR	
Phosphate	TR	
Sulphate	TR	
Sulphide	TR	
Materials of interest for No materials likely to waste acceptance criteria:		re or other non-radiological hazard have been identified.
	(%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		
Putrescible wastes	0	
Non-putrescible wastes		
Corrosive materials	0	
Pyrophoric materials	0	
Generating toxic gases	0	
Reacting with water	0	
Higher activity particles		
Soluble solids as bulk chemical		

compounds.....

Hazardous substances / non hazardous pollutants:

Complexing

Not expected but if any, present in trace quantities only.

	(%wt)	Type(s) and comment
Acrylamide		
Benzene		
Chlorinated solvents		
Formaldehyde		
Organometallics		
Phenol		
Styrene		
Tri-butyl phosphate		
Other organophosphates		
Vinyl chloride		
Arsenic		
Barium		
Boron		
Boron (in Boral)		
Boron (non-Boral)		
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		
agents (%wt): Yes		
	(%wt)	Type(s) and comment
EDTA		
DPTA		
NTA		
Polycarboxylic acids		
Other organic complexants		
Total complexing agents	TR	

Potential for the waste to contain discrete items:

Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; All stainless items assumed DIs. NB if recycled then DI Limits n/a.

#### TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		100.0

Comment on planned treatments:

**Disposal Routes:** 

Disposal Route	Stream volume %	Disposal density t/m3
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	100.0	1.0

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

17 04 05, 17 02 01, 17 02 03, 20 01 01

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

Disposal Route	Stream volume %			
Disposal Noute	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:

Opportunity	ortunity Comment
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Waste Packaging for Disposal: (Not applicable to this waste stream)

Container	Stream volume %	Waste loading m <sup>3</sup>	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other			

Other information: -

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage:

Waste Characterisation

Form (WCH):

-

Waste consigned for disposal to LLWR in year of generation:

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: Contamination by activation products from the reactor structure.

Uncertainty: Only very approximate estimates have been made of the specific activities. The activities

quoted are those at the time of Final Dismantling & Site Clearance (about 85 years after

Station shutdown).

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:

The specific activities were calculated from a weighted mean of the specific activity of all

the ILW and LLW streams.

Other information: The activities quoted are those at 85 years after reactor shutdown, i.e. in 2091. There may

be some contamination by Cs137.

#### **WASTE STREAM Secondary Wastes LLW** 9F320

Nuclide			Mean radioactivity, TBq/m³				Mean radioactivity, TBq/m³			
Be 10	Nuclide		Bands and	Future		Nuclide		Bands and	Future	Bands and Code
C14	H 3			2.23E-06	CC 2	Gd 153				8
Na 22	Be 10				8					8
A126	C 14			7.12E-05	CC 2	Ho 166m			1.61E-09	CC 2
Ci 36	Na 22				8	Tm 170				8
Ar 39	Al 26			1E-09	CD 2	Tm 171				8
A	CI 36			1.66E-07	CC 2					8
K 40										8
Ca 41										8
Mn 53 Mn 54 Mn 54 Fe 55 Co 60 1.16E-08 CC 2 Bi 208 Ni59 Ni63 2.56E-05 CC 2 Bi 208 Ni63 2.56E-05 CC 2 Bi 208 Ni63 2.56E-05 CC 2 Bi 200 Ra 225 Ra 225 Ra 225 Ra 225 Ra 225 Ra 225 Ra 227 Ry 81 Ra 228 Ra 28 Ra				<b>-</b>						8
Mn 64   Fe 55				2.3E-07						8
Fe 55										8
Co 60										8 8
Ni 59				1 16F-08						8
Ni 63										8
Zn 66   Se 79										8
Se 79				2.002 00						8
Kr 81							Ī			8
Kr 85       Rb 87       8       Ra 228       Ac 227       Sr 90       6       Th 227       Th 228       Th 228       Th 228       Nb 91       Th 228       Nb 91       Nb 92       Nb 94       8       Th 230       Nb 93m       Nb 94       2.28E-09       CC 2       Th 234       Mo 93       1.24E-08       CC 2       Pa 231       Pa 233       Tc 97       8       Pa 233       Tc 97       8       U 233       U 233       U 235       U 233       U 233       U 236       U 236       U 236       U 235       U 236       U 238       Np 237       Np 237       Np 237       Np 237       Np 237       Np 237       Np 238       Np 237       Np 238       Np 238       Np 238       Np 239       Np 236       Np 238       Np 236       Np 236 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>8</td></t<>										8
Sr 90 Zr 93 Nb 91 Nb 92 Nb 93m Nb 94 2.28E-09 CC 2 Th 224 Mo 93 Tc 97 Tc 99 Ru 106 Pd 107 Ag 108m Ag 10m Cd 109 Cd 113m Sn 121m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Tb 128 Sb 126 Tb 129 Tc 127m Tc 12						Ra 228				8
Tright   T	Rb 87				8	Ac 227				8
Nb 91	Sr 90				6					8
Nb 92 Nb 93m Nb 94 Nb 94 Nb 93 Nb 94 Nb 93 Tc 97 Tc 97 Tc 99 2.76E-09 CC 6 Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133 La 137 La 137 Ba 133 Ce 1444 Pm 145 Pm 145 Pm 147 Sm 151 La 138 Cc 2 2 Other by	Zr 93				8					8
Nb 93m Nb 94 Nb 93 Nb 94 Nb 92 Nb 106 Nb 1023 Nb 1023 Nb 107 Nb 19m Nb 1.19E-07 Nb 123 Nb 123 Nb 126 Nb 126 Nb 126 Nb 126 Nb 126 Nb 126 Nb 127 Nb 128 Nb 126 Nb 126 Nb 126 Nb 127 Nb 128 Nb 12					8					8
Nb 94					8					8
Mo 93										8
Tc 97 Tc 99 Ru 106 Ru 106 Ru 107 Ag 108m Ag 110m Ag 110m Cd 109 Cd 113m Sn 12m Sn 12m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 I 238 Cs 134 Cs 135 Cs 137 Ba 133 Ba 133 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 145 Pm 145 Pm 145 Pm 147 Sm 151 Eu 152 I 238  2.76E-09 CC 6 U 233 U 233 U 235 U 236 U 236 U 236 U 238 Np 237 Sn 123 Sn 126 Pu 238 Pu 239 Pu 240 Sb 126 Ru 124 Am 241 Am 242m Am 241 Cm 244 Cm 243 Cm 243 Cm 244 Cm 244 Cm 246 Cm 244 Cm 246 Cm 246 Cm 246 Cm 246 Cm 246 Cm 248 Cf 250 Cm 247 Cf 250 Cm 248 Cf 250 Cf 250 Cf 251 Sm 147 Sm 147 Sm 151 La 155 La 157 La 158 Cm 246 Cd 240										8
Tc 99 Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 119m Sn 121m Sn 123 Sh 126 Sb 126 Te 125m Te 127m Te 127m Te 1179 Sa 1133 La 133 La 137 La 138 Ce 144 Pm 145 Pm 145 Pm 147 Sm 151 La 152 Sm 151 Pu 108  2.76E-09 CC 6 8 U 233 U 234 U 234 U 235 U 236 U 236 U 238 Np 237 Pu 236 Pu 238 Pu 239 Pu 239 Pu 239 Pu 240 Pu 240 Pu 240 Pu 240 Pu 241 Pu 242 Am 241 Am 242 Cm 244 Cm 246 Cm 247 Cm 246 Cm 248 Cm 248 Cf 250 Cf 251 Cf 251 Cf 251 Cf 252 Cf 252 Cf 252 Cf 255 Cf 2				1.24E-08						8
Ru 106 Pd 107 Ag 108m										8 8
Pd 107 Ag 108m Ag 110m Ag 110m Cd 109 Cd 113m Sn 119m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 151 La 152 Sm 151 Sm 151 La 152 Sm 151 Sm				2.76E-09						8
Ag 108m Ag 110m Cd 109 Cd 113m Sn 119m Sn 119m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 Cs 134 Cc 135 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 151 Pm 147 Sm 151 Pd 236 Pd 238 Pd 236 Pu 238 Pu 239 Pu 240 Pu 240 Pu 241 Pu 241 Pu 242 Pu 243 Pu 244 Pu 243 Pu 244 Pu 245 Pu 246 Pu 246 Pu 248 Pu 246 Pu 248 Pu 249 Pu 249 Pu 249 Pu 240 Pu 241 Pu										8
Ag 110m Cd 109 Cd 113m Sn 119m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 151 Pm 146 Pm 145 Pm 147 Sm 151 Pm 146 Pm 145 Pm 147 Sm 151 Pm 146 Pm 145 Pm 147 Sm 151 Pm 148 Pm 1				2.45.00						8
Cd 109       8       U 238         Cd 113m       8       Np 237         Sn 119m       1.19E-07       CC 6       Pu 238         Sn 123       8       Pu 239         Sn 126       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 241         Te 127m       8       Am 243         I 129       8       Am 243         Cs 134       8       Cm 242         Cs 135       6       Cm 243         Cs 137       8       Cm 244         Ba 133       8       Cm 244         La 137       8       Cm 246         La 138       8       Cm 248         Ce 144       8       Cf 249         Pm 147       8       Cf 251         Sm 151       4.16E-09       CC 2       Other a         Eu 152       2.71E-08       CC 2       Other b/g	_			2.46-09						8
Cd 113m	_									8
Sn 119m       8       Pu 236         Sn 121m       1.19E-07       CC 6       Pu 238         Sn 123       8       Pu 239       Pu 239         Sn 126       8       Pu 240       Pu 241         Sb 125       8       Pu 241       Pu 242         Sb 126       8       Pu 242       Pu 241         Te 127m       8       Am 241         Te 127m       8       Am 242m         I 129       8       Cm 242         Cs 134       8       Cm 243         Cs 135       6       Cm 243         Cs 137       8       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       Cm 248       Cm 249         Ce 144       8       Cf 250         Pm 147       8       Cf 251         Sm 147       8       Cf 252         Sm 151       4.16E-09       CC 2       Other a         Eu 152       2.71E-08       CC 2       Other b/g						Np 237				8
Simple						Pu 236				8
Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152 Sb 126  8 Pu 240 Pu 241 Pu 242 Am 241 Am 242 Am 241 Am 242m Am 243 Cc 2 Other a Cd 245 Cd 249 Cf 252 Cd 246 Cf 252 Cd 247 Cd 246 Cd 247 Cd 248 Cd 248 Cd 248 Cd 249 Cd 251 Cd 252 Cd 252 Cd 251 Cd 252 Cd 251 Cd 252 Cd 251 Cd 252 Cd 251 Cd 252 Cd 252 Cd 251 Cd 252 Cd 253 Cd 253 Cd 253 Cd 253 Cd 253 Cd 254 Cd 25	Sn 121m			1.19E-07	CC 6					6
Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 241         Te 127m       8       Am 242m         I 129       8       Cm 243         Cs 134       8       Cm 242         Cs 135       6       Cm 243         Cs 137       8       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       6       Cm 248         Ce 144       8       Cf 249         Pm 147       8       Cf 250         Sm 147       8       Cf 252         Sm 151       4.16E-09       CC 2       Other a         Eu 152       2.71E-08       CC 2       Other b/g	Sn 123	Ī			8					6
Sb 126     8     Pu 242       Te 125m     8     Am 241       Te 127m     8     Am 242m       I 129     8     Am 243       Cs 134     Cm 242       Cs 135     Cm 243       Cs 137     Cm 244       Ba 133     Cm 245       La 137     Cm 246       La 138     Cm 248       Ce 144     Cm 248       Ce 144     Cm 249       Pm 145     Cm 249       Pm 147     Cm 250       Sm 151     4.16E-09     CC 2       Cm 152     Other b/g	Sn 126				8					6
Te 125m Te 127m I 129	Sb 125				8					8
Te 127m  I 129  Cs 134  Cs 135  Cs 137  Ba 133  La 137  La 138  Ce 144  Pm 145  Pm 147  Sm 147  Sm 151  Eu 152  Cs 154  Am 242m  Am 242m  Am 243  Cm 242  Cm 244  Cm 244  Ba Cm 245  Cm 246  Cm 248  C					8					8
129										6
Cs 134 Cs 135 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152 Cs 134  C Cm 242 Cm 243 Cm 244 Cm 245 Cm 246 Cm 246 Cm 248										8
Cs 135 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152  Cs 135  C m 243 C m 244 C m 245 C m 246 C m 248										8 8
Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152  C										8
Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152  Cm 245 Cm 246 Cm 248 Cm 248 Cm 248 Cf 249 Cf 250 Sm 151 Cf 251 Sm 151 Cf 252 Other a Cf 252 Other b/g										8
La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152  Cm 246 Cm 248 Cm 248 Cf 249 Cf 250 Sm 151 Sm 152 Cf 252 C										8
La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152 C 2 C 2 C C 2 C C 2 C C 2 C C C 2 C C C C C C C C C C C C C C C C C C C C										8
Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152  Cf 249 Cf 250 Sf Cf 251 Sf Cf 251 Sf Cf 252 Other a Cf 252 Other b/g										8
B     Cf 250       Pm 145     8     Cf 251       Pm 147     8     Cf 251       Sm 147     8     Cf 252       Sm 151     4.16E-09     CC 2     Other a       Eu 152     2.71E-08     CC 2     Other b/g										8
Pm 147     8     Cf 251       Sm 147     8     Cf 252       Sm 151     4.16E-09     CC 2     Other a       Eu 152     2.71E-08     CC 2     Other b/g										8
Sm 147     8     Cf 252       Sm 151     4.16E-09     CC 2     Other a       Eu 152     2.71E-08     CC 2     Other b/g						Cf 251				8
Sm 151     4.16E-09     CC 2     Other a       Eu 152     2.71E-08     CC 2     Other b/g										8
Eu 152 2.71E-08 CC 2 Other b/g				4.16E-09						
						_				
Eu 154   8   Total a   0   0	Eu 154					Total a				
Eu 155 8 Total b/g 0 1.00E-04 CC	Eu 155				8	Total b/g	0		1.00E-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.

- Measured activity
   Derived activity (best estimate)
   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