SITE **BAESM Barrow-in-Furness** SITE OWNER Ministry of Defence **WASTE CUSTODIAN BAE Systems Marine Limited** LLW **WASTE TYPE** Is the waste subject to No Scottish Policy: **WASTE VOLUMES** Reported At 1.4.2022..... Stocks:  $0 \, \text{m}^3$ 1.4.2022 - 31.3.2030...... Future arisings -~3.0 m<sup>3</sup> 3.0 m<sup>3</sup> Total future arisings: Total waste volume:  $3.0 \, \text{m}^3$ Comment on volumes: All arisings are estimates and will consist of redundant liquid waste storage and treatment plant. Uncertainty factors on Stock (upper): Arisings (upper) x 1.5 volumes: Stock (lower): Arisings (lower) x 0.3 Shore based Waste Treatment Facility receives, treats and discharges aqueous waste. **WASTE SOURCE** Authorised discharge point for all radioactive aqueous waste on the BAE Systems Marine Limited Site. PHYSICAL CHARACTERISTICS General description: The waste will consist of redundant stainless steel pipework and plant. Physical components (%wt): Steel (100%) Sealed sources: The waste does not contain sealed sources. Bulk density (t/m3): Comment on density: Data obtained from internet - density of stainless steel. CHEMICAL COMPOSITION General description and The waste will consist of steel (100%). components (%wt): Chemical state: Neutral Chemical form of H-3: Surface contaminant - chemical form unknown radionuclides: C-14: Surface contaminant - carbonate Metals and alloys (%wt): No sheet metal. Bulk items (100%) of various dimensions. Type(s) / Grade(s) with proportions % of total C14 (%wt) activity 100.0 Stainless steel..... 100.0 Other ferrous metals..... Iron..... Aluminium..... Beryllium..... Cobalt..... Copper..... Lead..... Magnox/Magnesium..... Nickel..... Titanium.....

Uranium.....

	Zinc			
	Zircaloy/Zirconium			
	Other metals			
Organic	s (%wt):			
		(%wt)	Type(s) and comment	% of total C14
	Total cellulosics			activity
	Paper, cotton			
	Wood			
	Halogenated plastics			
	Total non-halogenated plastics			
	Condensation polymers			
	Others			
	Organic ion exchange materials			
	Total rubber			
	Halogenated rubber			
	Non-halogenated rubber			
	Hydrocarbons			
	Oil or grease			
	Fuel			
	Asphalt/Tarmac (cont.coal tar)			
	Asphalt/Tarmac (no coal tar)			
	Bitumen			
	Others			
	Other organics			
Other m	aterials (%wt):			
		(%wt)	Type(s) and comment	% of total C14
		(70111)	Typo(c) and common	activity
	Inorganic ion exchange materials			
	Inorganic sludges and flocs			
	Soil			
	Brick/Stone/Rubble			
	Cementitious material			
	Sand			
	Glass/Ceramics			
	Graphite			
	Desiccants/Catalysts			
	Asbestos			
	Non/low friable			
	Moderately friable			
	Highly friable			
	Free aqueous liquids			
	Free non-aqueous liquids			

	Powder/Ash		
Inorganic a	nnions (%wt):		
		(%wt)	Type(s) and comment
	Fluoride		
	Chloride		
	lodide		
	Cyanide		
	Carbonate		
	Nitrate		
	Nitrite		
	Phosphate		
	Sulphate		
	Sulphide		
	of interest for - eptance criteria:		
		(%wt)	Type(s) and comment
	Combustible metals		
	Low flash point liquids		
	Explosive materials		
	Phosphorus		
	Hydrides		
	Biological etc. materials		
	Biodegradable materials		
	Putrescible wastes		
	Non-putrescible wastes		
	Corrosive materials		
	Pyrophoric materials		
	Generating toxic gases		
	Reacting with water		
	Higher activity particles		
	Soluble solids as bulk chemical compounds		
	substances / - lous pollutants:		
		(%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		
Complexing agents (%wt):		
	(%wt)	Type(s) and comment
EDTA		
DPTA		
NTA		
Polycarboxylic acids		
Other organic complexants		
Total complexing agents		
Potential for the waste to .		

TREATMENT, PACKAGING AND DISPOSAL

contain discrete items:

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	Off-Site	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	

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 %				
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:

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
_	_	_	_	_	<u>-</u>

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)			. 0
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: Radioactive waste generated as a result of build, test and commissioning of nuclear

powered submarines at the site.

Uncertainty: Activity estimate is based on the nuclide mixture processed in this facility.

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 Waste Treatment facility is still operational so any waste is an estimate based on

number of tanks / sinks etc.

Other information: -

Waste at Bands and Future Bands and Waste at Bands and Future Bands		Mean radioactivity, TBq/m³				Mean radioactivity, TBq/m³				
H 3 Be 10 C 14 C 14 C 14 C 14 C 15 Na 22 A 126 C 136 C 136 C 137 A 129 A			Bands and	Future				Bands and	Future	Bands and
Be 10	-	1.4.2022	Code				1.4.2022	Code	arisings	Code
C 14				~9.5E-06	CC 2					
Na 22										
A 28				~1.25E-06	CC 2					
C136										
Ar 39 Ar 42 Ar 42 Ar 42 Ar 40 Ar 40 British H 1182 Ar 40 Ar 53 Ar 53 Ar 54 Ar 52 Ar 57 Ar										
A+42										
K 40										
Ca 41										
Mn 53 Mn 54 Fe 55 Co 60 Mn 54 Fe 55 Co 60 Mn 54 Fe 55 Co 60 Mn 58 Mn 59 Mn 58 Mn 59 Mn 58 Mn 59 Mn 63 Mn 59 Mn 63 Po 210 Rn 223 Rn 65 So 79 Kr 81 Kr 85 Rn 225 Rn 87 Sr 90 Zr 93 Mn 92 Zr 93 Mn 91 Mn 92 Nn 92 Nn 92 Nn 92 Nn 92 Nn 92 Nn 93 Mn 94 Mn 93 Mn 93 Mn 93 Mn 94 Mn 93 Mn 93 Mn 94 Mn 94 Mn 93 Mn 94 Mn										
Mn 54   Pb 205   Pb 210   Co 60   Bi 208   Bi										
Fe 55										
Co 60   Bi 208   Bi 210m   Ni 59   Ni 59   Ni 59   Ni 63   Po 210   Ra 223   Sa 79   Ra 225   Ra 226   Ra 226   Ra 226   Ra 227   Ra 226   Ra 228   Ra 229   Ra 230   Ra 231										
Ni 59										
Ni 63										
Zn 65   Ra 223   Ra 225   Rr 81   Ra 226   Rr 81   Ra 226   Rr 81   Ra 228   Ra 228   Rr 85   Ra 228   Ra 228   Rr 85   Ra 228   Ra 228   Rr 85   Ra 228   Rr 87   R										
Se 79   Ra 225   Ra 226   Ra 226   Ra 228   Ra 227   Ra 228   Ra		[								
Kr 81		[								
Kr 85   R8 228   R8 227   R8 227   R9 27   R9 27   R9 27   R9 27   R9 27   R9 27   R9 28   R		ĺ								
Rb 87   Sr 90   Th 227   Th 227   Th 227   Th 228   Th 229   Th 229   Th 229   Th 230   Th 232   Th 232   Th 234   Th 235   Th 236   Th		ĺ								
Sr 90     Zr 93       Zr 93     Th 228       Nb 91     Th 229       Nb 92     Th 230       Nb 93m     Th 232       Nb 94     Th 234       Mo 93     Pa 231       Tc 97     Pa 233       Tc 99     U 232       Ru 106     U 233       Pd 107     U 234       Ag 108m     U 236       Ag 10m     U 236       Cd 109     U 238       Cd 109     U 238       Sn 12m     Pu 238       Sn 121m     Pu 238       Sn 123     Pu 239       Sn 126     Pu 241       Sh 125     Pu 241       Sh 126     Pu 241       Sh 126     Pu 242       Te 125m     Am 241       Te 127m     Am 242m       1 129     Am 243       Cs 134     Cm 242       Cs 137     Am 243       Cs 137     Cm 244       Ba 133     Cm 245       La 137     Cm 246       La 138     Cm 248       Ce 144     Cl 249       Pm 147     Cl 250       Sm 147     Cl 250       Sm 147     Cl 250       Sm 151     Cl 154     Other b/g       1.5E-07     C C 2 <td></td>										
Th 228										
Nb 91										
Nb 92										
Nb 93m Nb 94 Mo 93 Tc 97 Tc 99 Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 123 Sn 124 Sn 122 Sn 126 Sb 125 Sb 126 Sb 125 Sb 126 Sb 125 Sb 126 Sc 134 Cc 133 Cc 134 Cc 135 Cc 137 Cc 138 Cc 137 Cc 138 Cc 144 Pm 145 Pm 147 Cc 1250 Pm 147 Sm 147 Sm 147 Sm 151 Eu 152 C 0ther a U 232 Cd 17 244 Cd 25 Cd 26 Cd 26 Cd 27 Cd 26 Cd 27 Cd 26 Cd 27 Cd										
Nb 94										
No 93   Pa 231   Pa 233   Pa 234   Pa 236   Pa 240   Pa 236   Pa 240   Pa 241   Pa 236   Pa 241   Pa 242   Pa 242   Pa 242   Pa 242   Pa 244   Pa 243   Pa 244   Pa 243   Pa 244   Pa 245   Pa 246   Pa										
Tc 97 Tc 99 Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 123 Sn 126 Sb 125 Sb 126 Te 127m Te 127m Te 127m Te 127m Te 127m Th 129 Cs 134 Cs 135 Cs 137 Ba 133 La 137 La 137 La 138 Ce 144 Pm 145 Pm 147 Pm 145 Pm 147 Sm 151 Eu 152 Eu 154  V 233 U 233 U 234 U 235 U 236 C U 238 C U 240 Sb 125 Sb 126 Fu 241 Fu 242 Am 241 Am 242 Am 241 Am 242 Cm 243 Cm 244 Cm 243 Cm 244 Cm 245 Cm 246 Cm 248										
Tc 99 Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 121m Sn 121m Pu 238 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 Cs 134 Cc 134 Cc 135 Cs 137 Ba 133 La 137 La 138 Cc 144 Pm 145 Pm 145 Pm 147 Sm 151 Eu 152 Eu 154  V 238 U 238 V 238 V 248 U 248 U 248 U 249 U 240 V 240 V 240 V 240 V 242 V 242 V 242 V 34 V 243 V 34 V 243 V 34 V										
Ru 106 Pd 107 Ag 108m Ag 108m Ag 110m Cd 109 Cd 113m Sn 12m Sn 121m Sn 123 Sn 126 Sb 126 Te 125m Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133 Cs 137 Cs 137 Ca 148 Ce 144 Ch 148 Ch 168 Ch 178 Ch										
Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 119m Sn 121m Sn 122m Sn 126 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 145 Pm 147 Sm 151 Eu 152 Eu 154  U 234 U 235 U 236 U 238 Np 237 Pp 236 Np 237 Pp 238 Np 237 Pp 238 Pp 239 Pp 240 Pp 241 Sb 126 Pu 241 Am 241 Am 242m Am 241 Am 242m Am 243 Cc m 242 Cm 243 Cc m 244 Cm 245 Cm 246 Cm 246 Cm 246 Cm 246 Cm 246 Cm 247 Cm 248 Cf 1250 Cm 248 Cm										
Ag 108m       Ag 110m       U 235       U 236       U 236       U 236       U 236       U 238       U 239       U 238       U 239       U 238       U 239       U 238       U 239       U 238       U 240       U 238       U 240       U 238       U 240       U 240       U 241       U 242       U 242       U 242       U 242       U 242       U 242       U 243       U 242       U 243       U 243       U 243       U 243       U 244       U 243       U 244       U 246       U 248       U 246       U 248       U 249       U 248       U 249										
Ag 110m       U 236         Cd 109       U 238         Cd 113m       Np 237         Sn 121m       Pu 238         Sn 121m       Pu 238         Sn 123       Pu 239         Sn 126       Pu 240         Sb 125       Pu 241         Sb 126       Pu 242         Te 125m       Am 241         Te 127m       Am 242m         I 129       Am 243         Cs 134       Cm 242         Cs 135       Cm 242         Cs 135       Cm 244         Cs 137       Cm 244         Ba 133       Cm 246         La 138       Cm 248         Ce 144       Cf 249         Pm 145       Cf 250         Pm 147       Cf 250         Sm 151       Cf 252         Sm 151       Other a         Eu 152       Other b/g         Eu 154       Total a						U 235				
Cd 109     U 238       Cd 113m     Np 237       Sn 119m     Pu 236       Sn 121m     Pu 238       Sn 123     Pu 239       Sn 126     Pu 240       Sb 125     Pu 241       Sb 126     Pu 242       Te 125m     Am 241       Te 127m     Am 243       I 129     Am 243       Cs 134     Cm 242       Cs 135     Cm 242       Cs 137     Cm 243       Ba 133     Cm 244       La 137     Cm 248       La 138     Cm 248       Ce 144     Cf 249       Pm 145     Cf 250       Pm 147     Cf 250       Sm 147     Cf 250       Sm 147     Cf 251       Sm 151     Other a       Eu 152     Other b/g       Eu 154     Total a     0										
Sn 119m						U 238				
Sn 121m	Cd 113m					Np 237				
Sn 123	Sn 119m					Pu 236				
Sn 126	Sn 121m					Pu 238				
Sb 125	Sn 123									
Sb 126						Pu 240				
Te 125m       Am 241         Te 127m       Am 242m         I 129       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       Cf 249         Pm 145       Cf 250         Pm 147       Cf 251         Sm 147       Cf 252         Sm 151       Other a         Eu 152       Other b/g       1.5E-07       CC 2         Eu 154       Total a       0       0										
Te 127m       I 129       Am 242m         Cs 134       Cm 242       Cm 242         Cs 135       Cm 243       Cm 244         Cs 137       Cm 244       Cm 245         La 138       Cm 246       Cm 248         Ce 144       Cf 249       Cf 249         Pm 145       Cf 250       Cf 251         Pm 147       Cf 252       Other a         Sm 151       Other b/g       1.5E-07 CC 2         Eu 152       Total a       0		ĺ								
1129										
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       Cf 249         Pm 145       Cf 250         Pm 147       Cf 251         Sm 147       Cf 252         Sm 151       Other a         Eu 152       Other b/g         Eu 154       Total a		ĺ								
Cs 135       Cm 243         Cs 137       Cm 244         Ba 133       Cm 245         La 137       Cm 246         La 138       Cm 248         Ce 144       Cf 249         Pm 145       Cf 250         Pm 147       Cf 251         Sm 147       Cf 252         Sm 151       Other a         Eu 152       Other b/g         Eu 154       Total a										
Cs 137       Ba 133         La 137       Cm 245         La 138       Cm 248         Ce 144       Cf 249         Pm 145       Cf 250         Pm 147       Cf 251         Sm 147       Cf 252         Sm 151       Other a         Eu 152       Other b/g         Eu 154       Total a		ĺ								
Ba 133       Cm 245         La 137       Cm 246         La 138       Cm 248         Ce 144       Cf 249         Pm 145       Cf 250         Pm 147       Cf 251         Sm 147       Cf 252         Sm 151       Other a         Eu 152       Other b/g         Eu 154       Total a		[								
La 137     Cm 246       La 138     Cm 248       Ce 144     Cf 249       Pm 145     Cf 250       Pm 147     Cf 251       Sm 147     Cf 252       Sm 151     Other a       Eu 152     Other b/g     1.5E-07     CC 2       Eu 154     Total a     0     0										
La 138     Cm 248       Ce 144     Cf 249       Pm 145     Cf 250       Pm 147     Cf 251       Sm 147     Cf 252       Sm 151     Other a       Eu 152     Other b/g     1.5E-07     CC 2       Eu 154     Total a     0		[								
Ce 144       Pm 145       Pm 147       Sm 147       Sm 151       Eu 152       Eu 154       Cf 249       Cf 250       Cf 251       Cf 252       Other a       Other b/g       Total a     0       0										
Pm 145     Cf 250       Pm 147     Cf 251       Sm 147     Cf 252       Sm 151     Other a       Eu 152     Other b/g       Eu 154     Total a       0     0		[								
Pm 147     Cf 251       Sm 147     Cf 252       Sm 151     Other a       Eu 152     Other b/g       Eu 154     Total a       0     0		[								
Sm 147     Cf 252       Sm 151     Other a       Eu 152     Other b/g       Eu 154     Total a       0     0		[								
Sm 151       Other a         Eu 152       Other b/g         Eu 154       Total a             1.5E-07       C C 2         Total a       0		[								
Eu 152       Other b/g       1.5E-07 CC 2         Eu 154       Total a       0		ĺ								
Eu 154 Total a 0 0		[							1 5 5 0 7	00.3
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	EU 155	<u> </u>		<u> </u>		i otai b/g	0		~1.09E-05	00 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

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