



DEVONPORT EXPLOSIVE SAFETY ADVISORY GROUP

Combined Heat and Power – North Yard Options – Issue 2

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**Author M Shearman
DERA(N)**



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Section Contact Devonport Explosive Safety & Advisory Group (DESAG)
B128 Building, HMS Drake, HMNB Devonport. PL2 2BG

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Background

1. Future Devonport Naval Base (NB) developments and initiatives in the North Yard area may lead to restrictive berthing within Weston Mill Lake (WML), (10 to 16 wharves); which would be operationally disruptive to the NB.
2. MVV Umwelt has proposed the development of a Combined Heat and Power (CHP) plant within North Yard reference drawing 009/02/D123356-001 Rev 1, Landscape Master Plan.
3. The NB berthing procedures require vessels to berth in accordance with the 'Derived Nuclear Berthing Limits' and the 'Warship in Harbour (WIH) Berthing Matrix'. The Nuclear limits ensure the safety of submarine reactor plants in the event of an unplanned explosive incident. The WIH Berthing Matrix demonstrates the NB understands the risks to workers and general public from berthing warships and that such risks are tolerable and As Low As Reasonably Practicable (ALARP). 15 to 16 wharves are preferred berths for vessels loaded with large quantities of explosives as the WIH categories are favorable.
4. All Mod sites, where explosives are either present and/or handled are known as Potential Explosion Sites (PES) and are licenced in accordance with Joint Service Publication (JSP) 482¹.
5. The Issues 2 changes to this document are a new drawing, 009/02/D123356-001 Rev E, with changes to the main plant position and layout. Ash processing will now be carried out off site and the original ash processing (IBA) area will only be used to support the construction phase, on completion of which the area will be returned to MoD. A revised method of calculating the 'Consultation Distance' introduced by the WIH regulator which requires reassessment of the plant to the NB Development Policy. A design change to the Devonport Landing Craft Co-location Project (DLCCP) to option 8A1 and the introduction of a new road adjacent to 14 wharf has required the reworking of the calculations within the WIH berthing Matrix.

Scope & Purpose

6. The purpose of this report is to assess the proposed MVV Umwelt CHP development in north yard in accordance with Warships in Harbour (WIH) policy and to ensure compliance to the Tamar ammunition buoys explosives licence regulations.

¹ MOD Explosive Regulations



7. The scope of the report is limited to the 'Landscape Master Plan' drawing 009/02/D123356-001 Rev 1 and the construction phase. The following vessels berthed within WML will be considered; Frigates (T23 & T22), Destroyers (T42), Carrier Vertical Strike (CVS), Landing Platform Dock (LPD) and Landing Platform Helicopter (LPH). Royal Fleet Auxiliary (RFA) vessels are not licensed to berth alongside at Devonport with a full explosive cargo however 14 to 16 wharves are regularly used by these vessels when only self defense stores are carried.

8. The DLCCP and CHP projects will be considered within this assessment because they are both in their development stages and could lead to additional berthing restrictions in WML.

9. The berthing arrangements to the south side of WML will change due to the proposals within the DLCCP; the length of wharf side available for berthing warships will be reduced. The remaining wharf side is only sufficient for two wharves, therefore for this document these will be named '11 wharf new' and '12 wharf new'.

Method

10. The development will be assessed in accordance with the three areas of the WIH procedures, reference footnote², these are; WIH NB Development Policy, threats to warships from alongside activities and WIH Berthing Matrix

11. Detailed information is required to carryout an accurate WIH assessment, eg population data, building use and construction etc. In the absence of this information assumptions will be made.

12. The development will be plotted onto NB maps and the explosives licence arcs overlaid. Any buildings that lie within these arcs will be required to comply with the explosives licence regulations.

CHP Development Background

13. The CHP development of north yard, proposed by MVV Umwelt is to an area of land to the north east of the NB. The site lies between 320 and 550 metres approximately from the nearest berth in WML; 14 wharf.

² Devonport NB Site Safety Case(WIH) Issue 1



14. The development can be divided into two areas; the Construction Support Area (CSA) and the main facility. The CSA covers an area 180 to 300 metres approximately from 14 wharf and will be used during the construction phase.
15. The main facility is 320 to 550 metres from 14 wharf and is principally constructed from metallic cladding materials on a structural steel framework. The chimney will be a steel fabrication. The only use of glass externally will be in the administration façade.

WIH Naval Base Development Policy

16. The WIH NB Development policy is a guidance to assist decision making when considering NB real estate redevelopment in the context of the risk presented by explosives in the quiescent state in ships. It is an adapted HSE assessment process known as PADHI (Planning Advise for Developments near Hazardous Installations) and involves setting a Consultation Distance (CD).
17. The assessment procedure comprises three distinct stages; Setting CD, Application of Sensitivity Levels and Advising the Planning Authority.

Consultation Distance

18. The CD is divided into 3 areas; Inner Zone, Middle Zone and Outer Zone which is calculated by the Duty holder. Assuming the vessel with the highest explosive content to berth within WML is a CVH the size of the zones are calculated to be:

Inner zone = 139.02 metres
Middle zone = 243.48 metres
Outer zone = 388.01 metres

19. The proposed development will be divided into 2 areas for this procedure; the IBA and the main site (plant area).

CSA = Middle zone
The Main site = Outer zone

Sensitivity Level of CSA and Main site = 1 (Based on normal working population)

Visitors invited onto the site, e.g. school children, would increase the sensitivity level to 3.



20. Having ascertained the zone in which the development lies and its sensitivity level the final stage involves application of the workings to the Decision Matrix.

The decision for the CHP plant with no visitors is **'Do not advise against'**

The decision for the CHP plant with visitors is main site **'Do not advise against'**. It is assumed no visitors will be on the CSA during the construction phase.

Threats to warships from alongside activities

21. Each berth within the NB has been assessed using Harbour Environmental Assessment Sheets (HEAS) which forms a database of the threats that the NB can present to a vessel berthed alongside. Vessels use the HEAS data and combined with internal threats and hazard data develop a Ship Explosive Safety Case (WIH).

22. Any additional threats to platforms from NB redevelopment will require reassessment of the berth HEAS in accordance with WIH policy and has the potential to limit berthing.

23. The following information was supplied by MVV Umwelt and gathered during CHP meeting, reference³.

24. The furnace lies 400 metres from the nearest berth (14 wharf) and is designed to withstand an internal blast from a calor gas cylinder explosion. Blast pressure from an incident on the main site would not threaten a warship at this distance. It is assumed fragmentation from an incident would not challenge a warship berthed at 14 wharf.

25. Within the main building there is a light fuel oil tank and a small quantity of chemicals both are bunded and incorporate fire detection and protection systems.

26. All pressure systems within the facility will be tested annually by a specialist insurance inspection authority.

27. There is no collision risk to vessels from lorries delivering waste to/from the site; a designated route enclosed within security fencing will be built.

³ CHP meeting 28th October 2009



28. There is no significant fire hazard to vessels berthed in WML. Waste materials are water quenched prior to removal from the CSA. The main facility utilizes fire sensors and is equipped with water cannons to extinguish fires.
29. During the construction phase tower cranes will be used in the main plant area, at least 350 metres away from the nearest berth; posing no threat to vessel berthing. Mobile cranes will also be used across the site but will not be a collapse threat to vessels. The chimney stack will be 85 metres tall approximately positioned at least 450 metres from the nearest berth; collapse of this structure will not be a risk to vessels berthed nearby.
30. The construction of a new access road adjacent to 14 wharf would add to the amount of traffic in this area therefore increasing the risk of vehicle collision to warships berthed alongside.
31. The only additional risk identified to warship berthing within WML would be the **increased risk of 'vehicle collision'** during the construction of the new access road. Speed restrictions imposed throughout the NB would mitigate the consequence and likelihood of a collision.

WIH Berthing Matrix

32. The purpose of WIH is to provide information underpinning the assurance to the duty holder that the site hazards are understood and managed, such that risks to workers and the general public from warships berthed alongside within Devonport are minimal and demonstrate that residual risks are tolerable and As Low As Reasonably Practicable (ALARP). The WIH risk is a function of both the warship and the harbour environment. In assessing the risk to third parties, (persons outside the warship), presented by WIH the relevant factors are:

- a. Threats to explosives
- b. Ship's safety systems
- c. Occupancy
- d. Consequences

33. The outcome of the risk assessment is the WIH Berthing Matrix which is a classification of berths into risk categories by class of warship. Vessels berthing within the NB are required to use the lowest risk berth available, as stated in the matrix.

34. The affect to vessels berthed within WML from the proposed CHP development will be assessed utilizing the WIH Methodology Tool Set. The



following assumptions are made within the tools to produce vessel to berth categories:

- a. 2006 berth occupancy figures were used for vessels berthed at each wharf.
- b. The following building factors were used for all buildings within the Consequence Model (CM); Standard brick and Residential glass. This relates to the most common type of construction within the assessed ranges.
- c. The explosive quantities and frequency of an event figures are taken from WIH Synthetic Warship Hazard Footprint Statements (SWHFS).
- d. There is one additional threat to warships berthed at 14 wharf; vehicle collision during the construction phase.

35. The assessment procedure comprises the following steps; Exposed personnel data, casualty levels, berth level risk assessment, risk reduction and achieving ALARP and allocation of berthing categories.

Exposed personnel data

36. In order to determine the number of personnel at risk from in-harbour events, a series of ranges in metres are drawn centered on each wharf. An estimate is then made of the number of personnel within each range.

Casualty levels

37. The WIH Consequence Model based on algorithms taken from Explosive Storage and Transport committee (ESTC) indoor and outdoor blast models is used to calculate the casualty levels for a series of explosive quantities. The model requires general building construction details as well as population.

Berth level risk assessment, risk reduction and achieving ALARP

38. The individual risk and societal risk is established using the WIH Tolerability Assessment Tool (TAT). The TAT is populated with platform data from SWHFS, vessel occupancy figures and outputs from the consequence model. Using this data the TAT generates a number of outputs which are



systematically assessed by the Naval Base Duty Holder.

39. At this stage the TAT will have demonstrated whether the level of risk posed by a vessel is tolerable and within Health and Safety Executive guidelines. The next stage is to establish the feasibility of reducing the risk further by introducing risk reduction measures.

WIH Berthing Matrix

40. The data generated by the TAT can be used to categorise the level of risk posed by a warship. This information can be used quickly to identify which available berths pose the lowest level of risk, thereby satisfying the remit to reduce to ALARP levels.

41. The effect to wharves within WML from the proposed CHP development will be assessed in two stages utilising the WIH Methodology Tool Set; stage one construction stage and stage two CHP plant operational.

From the information supplied reference 3 and drawing 009/02/D123356-001 Rev 1 the following assumptions have been made:

- a. During the construction stage the total number of workers on site will vary depending on the phase of the build; at its peak there is expected to be approximately 350 workers external.
- b. The 350 workers have been distributed across three areas; 20% across the CSA area, 5% across the new access road and 70% across the main facility area. A higher proportion of staff is expected in the main facility area to construct the CHP plant.

Plant Use

- c. The following population has been used for the main plant area:

Gatehouse = 3
Roaming staff within the plant = 4
Control Room = 4
Administration building = 6
Visitors = 40 (maximum)
Chemical deliveries = 1 per day external
Lorry deliveries = 6 per hour

- d. The population figures for the DLCCP Option 8A1 development have been included in this assessment.



e. Based on the WIH berthing Matrix Issue 2 dated April 10.

42. The WIH assessment determined the risk to warships would increase during the construction phase but not by an amount sufficient to change the berth categories in the matrix.

43. Applying the WIH process to the proposed developments, post construction, will produce the following berth matrix:

	CHP plant and DLCCP								
	T22	T23	T42	T45	LPD	LPD less WMR	LPH	LPH less WMR	CVS
11 wharf new	3	3	3	-	-	-	-	-	-
12 wharf new	3	3	3	-	-	-	-	-	-
14 wharf	4	4	3	2	3	4	2	4	2
15 wharf	4	4	4	3	3	4	3	4	2
16 wharf	5	5	5	4	4	5	3	5	3

Note: Red highlighted cells indicate where changes to the Berthing Matrix would be required.

Summary of the changes required to the berthing matrix:

- 14 wharf – T45 category 3 to 2
- 15 wharf – CVS category 3 to 2
- 16 wharf – T45 category 5 to 4
- LPD category 5 to 4
- LPH category 4 to 3

A **category 5** berth is described as a very low risk berth, consequences are not significant.

A **category 4** berth is described as a low risk berth, with societal implications and consequences.

A **category 3** berth is described as a low risk berth, consequences may be significant.

A **category 2** berth is described as a medium risk berth, with significant consequences.

44. Changes to the categories from 5 to 4 would not cause any significant restriction to the berthing of warships in WML.



45. The WIH assessment determined the risk to warships from the new developments **would increase** and therefore requires additional berthing restrictions to be imposed.

Risk Reductions Measures (RRM) and As Low As Reasonably Practicable (ALARP)

46. To meet the requirement for a risk to be considered Tolerable it must be shown that the risk is ALARP. That is to say all practicable RRM's have been incorporated or have a robust argument to show that they are grossly disproportionate.

Four RRM's were identified:

- i Do not build the CHP within the vicinity of warships. This is an option however the HEAS section of this document has demonstrated that the risk to warships from the CHP plant is low, when operational.
- ii The capability to evacuate staff from the site. MVV Umwelt has an evacuation plan which can be implemented in the unlikely event of a NB incident.
- iii Prohibit the berthing of warships at 14 wharf during the construction phase to remove the risk of vehicle collision. The loss of a berth within WML would be operationally disruptive to the NB therefore this would be a grossly disproportionate measure. Speed restrictions imposed throughout the NB would mitigate the consequence and likelihood of a collision.
- iv To reduce the level of glass used in the construction of the plant. In the unlikely event of an explosive incident injuries/fatalities can occur from the shattering of glazing material. The only use of glass externally will be the administration building façade.

47. There were two RRM's identified during the assessment process worthy of further action.

RRM (ii) above, the CHP plant would be required to implement its emergency evacuation plan in the unlikely event of a NB incident.

RRM (iv) above, it is recommended that blast resistant glazing materials, in accordance with MOD standards, are fitted.



Explosives Licence Compliance

48. All MoD sites where explosives are present and/or handled are licenced in accordance to JSP 482. The amount of explosives which can be licenced is determined by a number of factors, the main one being the observed minimum distance between the explosives and buildings or sites where members of the general public or personnel not involved in explosive handling either, work, live or congregate, this is known as the Inhabited Building Distance (IBD).

49. When creating an explosives licence two arcs are drawn from the Potential Explosion Site (PES); 1 x IBD (the yellow arc) and 2 x IBD (the purple arc).

50. Within the yellow arc there are to be no manned buildings of vulnerable construction or personnel not involved in explosives handling work or buildings deemed a vital installation. The proposed CHP options have **no** buildings or personnel within the yellow arc.

51. Outside the yellow arc but within the purple arc, personnel may be present subject to compliance of the explosives licencing criteria contained in JSP 482 for both the construction materials and height of the buildings. The proposed CHP options have **no** buildings or personnel within the purple arc.

Conclusion

52. The purpose of this report was to assess the proposed CHP development of north yard by MVV Umwelt in accordance with Warships in Harbour (WIH) policy and to comply with the Tamar ammunitioning buoys explosives licence regulations. The report considered the following vessels berthed within WML; CVS, LPH, LPD, T42, T22 and T23.

53. The development was assessed in accordance with three areas of the WIH principles; WIH NB Development Policy, Threats to warships from alongside activities and WIH Berthing Matrix.

54. The decision using the development policy was

no visitors to the site '**Do not advise against**'.
visitors to the main site '**Do not advise against**'.

55. During the construction phase the risk to a warship berthed at 14 wharf from vehicle collision would **increase**. Contractors **must abide** by the NB speed



restrictions to mitigate the consequence and likelihood of such an incident.

56. It is assumed from the information provided, that the CHP plant and processes do not pose any significant risks of explosion to vessels berthing at wharves within WML. This aspect will require reassessment if new information becomes available.

57. The RRM and ALARP assessment identified two RRM worthy of further action to reduce the consequence of an explosive incident.

i) Windows should be kept to the minimum, where they are required it is recommended that blast resistant glazing materials are used in accordance with MoD standards.

ii) The CHP plant would be required to implement its emergency evacuation plan in the unlikely event of a NB incident.

58. The WIH berthing risk assessment determined the risk to warships from the new developments would **increase and therefore requires additional berthing restrictions to be imposed.**

59. The additional restrictions appear to be driven by the DLCCP population rather than the CHP plant. To confirm this separate assessment would be required for each development. The restrictions to berthing have been discussed with the Queens Harbour Master who has agreed they are tolerable.

60. There are no areas of the CHP site that lie within the explosives licencing arcs; therefore no restrictions apply to the development.

61. The assessment of the proposed CHP plant in north yard includes the population figures for the DLCCP Option 8A1; no other developments have been considered.

62. The WIH assessment calculations/data sheets and background information are contained within the pack for this development, NBC(D)5/15/9C.

Abbreviations

ALARP	As Low As Reasonable Practicable
CD	Consultation Distance
CHP	Combined Heat and Power
CM	Consequence Model
CSA	Construction Support Area



CVS	Carrier Vertical Strike
DERA(N)	Devonport Explosive Risk Advisor (Nuclear)
DESAG	Devonport Explosives Safety Advisory Group
DESM	Devonport Explosives Safety Manager
DLCCP	Devonport Landing Craft Co-location Project
ESTC	Explosive Storage and Transport Committee
FAC	Fleet Accommodation Centre
HEAS	Harbour Environmental Assessment Sheet
HSE	Health and Safety Executive
IBA	Incinerator Bottom Ash
JSP	Joint Services Publication
LPD	Landing Platform Dock
LPH	Landing Platform Helicopter
MoD	Ministry of Defence
NB	Naval Base
NBC	Naval Base Commander
PADHI	Planning Advice for Developments near Hazardous Installations
PES	Potential Explosion Site
RFA	Royal Fleet Auxiliary
RRM	Risk Reduction Measures
SWHFS	Synthetic Warships in Harbour Footprint Statement
TAT	Tolerability Assessment Tool
WIH	Warships in Harbour
WML	Weston Mill Lake