



Submarine Refit Complex Operations

**Request for Agreement to Implement Modification NED-MNC-240-13424, 14 Dock
Butterley Crane Safety Justification for the Shortfall in Crane Rail Withstand, Solely for
the Purpose of Docking Tireless in 14 Dock**

Project Assessment Report ONR-DRDL-PAR-14-028
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EXECUTIVE SUMMARY

Title

Request for Agreement to implement the modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for the shortfall in crane rail withstand, solely for the purpose of docking Tireless in 14 Dock.

Permission Requested

Licence condition 22(1) requires that “the licensee shall make and implement adequate arrangements to control any modification or experiment carried out on any part of the existing plant or processes which may affect safety.” Devonport Royal Dockyard Ltd (DRDL) (the Licensee) wrote to the Office for Nuclear Regulation (ONR) in December 2014 requesting agreement to implement a Category B Modification for the 14 Dock Butterley Crane Safety Justification for the Shortfall in Crane Rail Withstand, solely for the purpose of docking HMS Tireless in 14 Dock.

Background

14 Dock is part of the Submarine Refit Complex on the DRDL Licensed Nuclear Site and acts as a repair and maintenance facility for Trafalgar Class nuclear powered submarines. Excavations carried out in the first half of 2012 at the north of 14 Dock exposed deficiencies with the as-built concrete reinforcement bars for the 14 Dock East crane rail support (corbel). DRDL carried out an assessment of options to address these deficiencies and concluded that it was necessary to implement a vehicle access barrier and vehicle restrictions in addition to those already in place on 14 Dock.

Agreement was given by ONR in June 2012 to a modification solely for the docking of HMS Tireless in 14 Dock, recognising that a revised safety case would be required from DRDL to ONR prior to further dockings in 14 Dock. The scope of the modification covered the installation of a vehicle access barrier and associated administrative controls on vehicle access.

Agreement was subsequently given by ONR to similar modifications for further dockings, as follows:

- Agreement in November 2012 to a modification solely for the docking of HMS Triumph.
- Agreement in November 2013 to a modification solely for the docking of HMS Turbulent.

In line with ONR’s requirements, in both cases, DRDL had made improvements since the previous docking.

Overall, DRDL concluded that introducing the new vehicle impact barrier as a passive engineering system to protect against accidental vehicle impact and the changes to the management arrangements demonstrate the risk from these operations is acceptable and ALARP.

Assessment and inspection work carried out by ONR in consideration of this request

ONR has carried out assessment work, which has focussed on the adequacy of DRDL’s response to the requirements identified in the Project Assessment Report for the previous docking, namely:

- Examination, Inspection, Maintenance and Testing arrangements for the vehicle barrier.
- Identification of further improvements.
- Demonstration of progress towards a permanent installation.

ONR’s assessment also sought assurance from the Defence Nuclear Safety Regulator and included consideration of a readiness review by the DRDL Internal Regulator.

Matters arising from ONR's work

The assessment concluded that DRDL's responses covering the areas identified above are adequate.

ONR considers that the permanent installation should be completed by the earlier date of either:

- The start of inactive commissioning of the 14 Dock Reactor Access House; or the
- Decision Date plus two years for the 14 Dock Periodic Review of Safety.

ONR's expectations for future dockings after HMS Tireless are:

- Where a vehicle impact barrier is required by the safety case, the safety functional requirements for a vehicle impact barrier are to be clearly defined and categorised.
- The vehicle impact barrier is to be designed to deliver the safety functional requirements and is to be classified accordingly.
- The classification of the components of the vehicle impact barrier is to enable the overall classification of the vehicle impact barrier to be fully met.
- These components are to be designed, specified and manufactured in compliance with the classification requirements.

ONR also expects that, providing there are safety functional requirements to be delivered by a vehicle impact barrier, a permanent barrier is installed prior to the start of active commissioning of the 14 Dock RAH.

Conclusions

This Project Assessment Report concludes that DRDL's modification document NED-MNC-240-13424, "14 Dock Butterley Crane Safety Justification For The Shortfall In Crane Rail Withstand" presents an acceptable basis for implementing the proposed modifications to the 14 Dock safety case, solely for the purpose of docking HMS Tireless in 14 Dock.

Recommendation

The project assessment report recommends that the Superintending Inspector for the Propulsion sub-programme:

- Accepts this Project Assessment Report.
- If the PAR is accepted, signs and issues the Licence Instrument No. 558 under arrangements made under Site Licence Condition 22 of Schedule 2 to Nuclear Site Licence No. 50B thereby agreeing to implement the modification: NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for The Shortfall In Crane Rail Withstand, Solely for the Purpose of Docking Tireless in 14 Dock.

LIST OF ABBREVIATIONS

ALARP	As low as reasonably practicable
DD	Decision Date
DDL	De-fuel, De-equip and Lay-up Preparation
DNSR	Defence Nuclear Safety Regulator
DRDL	Devonport Royal Dockyard Ltd.
EIMT	Examination, Inspection, Maintenance and Testing
HMS	Her Majesty's Submarine
IOI	Identified Operating Instruction
LLTT	Low Level Transfer Trolley
OI	Operating Instruction
ONR	Office for Nuclear Regulation
ORR	Operational Readiness Review
PRS	Periodic Review of Safety
RAH	Reactor Access House
SRC	Submarine Refit Complex
SSC	Structure, System and Component

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1 PERMISSION REQUESTED

1. Devonport Royal Dockyard Ltd (DRDL) (the Licensee) wrote to ONR on 3 December 2014 (Ref.1) requesting ONR's 'Agreement' under arrangements made under Licence Condition 22(1) to implement the following Category B modification:
 - NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification For The Shortfall In Crane Rail Withstand (Ref. 2).

2 BACKGROUND

2. 14 Dock is part of the Submarine Refit Complex (SRC) on the DRDL Nuclear Licensed Site and acts as a repair and maintenance facility for Trafalgar Class nuclear powered submarines. The SRC was originally constructed and commissioned in the 1970s. Since the 1990s a programme of improvements has helped to ensure that the complex remains compliant with modern nuclear safety standards.
3. Excavations carried out in the first half of 2012 for the new 14 Dock Reactor Access House (RAH) Low Level Transfer Trolley (LLTT) turntable at the north of the dock exposed deficiencies with the as-built reinforcement bars for the 14 Dock East crane rail corbel. To address these deficiencies, DRDL carried out an optioneering assessment and concluded that it was necessary to implement a vehicle access barrier and vehicle restrictions in addition to those already in place on 14 Dock.
4. The vehicle access barrier design comprised a steel beam barrier supported on concrete dock blocks tied together with steel pins. The barrier is lifted out of position when required to allow vehicle access beyond the barrier. The design concept is that the assembly comprising the barrier and concrete dock blocks will start moving when impacted by a moving vehicle and arrest the movement by friction between the dock blocks and the ground before the vehicle could impact a crane.
5. Agreement was given by ONR in June 2012 by the issue of Licence Instrument (LI) No. 545 (Ref. 3) to a modification solely for the docking of a HMS Tireless in 14 Dock. The scope of the modification covered:
 - Introduction of the 14 Dock Entrance Vehicle Barrier and associated administrative safeguards to prevent large vehicles (>34 t) entering 14 Dock East;
 - Modification of the administrative control of smaller vehicles entering 14 Dock East.
6. ONR's assessment that led to the issue of LI 545 (Ref. 3) is set out in Project Assessment Report (PAR) ONR-DRDL-PAR-12-009 (Ref. 4). This PAR also concluded that a revised submission would be required from DRDL to ONR prior to further dockings in 14 Dock and that DRDL should give consideration to the requirements of a permanent installation.
7. Agreement was subsequently given by ONR in November 2012 by the issue of Licence Instrument No. 547 (Ref. 5) to a modification solely for the docking of HMS Tireless in 14 Dock. DRDL had made improvements since the previous docking, as follows:
 - Substitution arrangements for unavailability of the vehicle barrier.
 - Inclusion of cold weather arrangements.
8. ONR's assessment that led to the issue of LI 547 (Ref. 5) is set out in ONR-DRDL-PAR-12-021 (Ref. 6). This PAR also concluded that, should DRDL have any further

dockings before a permanent installation is implemented, the following would be required:

- A revised submission from DRDL prior to such further dockings.
 - Examination, Inspection, Maintenance and Testing (EIMT) arrangements for the vehicle barrier prior to the next docking.
 - DRDL should work to identify further improvements, where reasonably practicable, prior to each future docking until a permanent installation is implemented.
 - Demonstration of progress towards a permanent installation prior to each docking.
9. Agreement was subsequently given by ONR in November 2013 by the issue of Licence Instrument No. 551 (Ref. 7) to a modification solely for the docking of HMS Turbulent in 14 Dock.
10. ONR's assessment that led to the issue of LI 551 (Ref. 7) is set out in ONR-DRDL-PAR-13-009 (Ref. 8). The assessment covering the following areas concluded that DRDL's responses were adequate:
- EIMT arrangements for the vehicle barrier.
 - Identification of further improvements, where reasonably practicable.
 - Demonstration of progress towards a permanent installation.
11. ONR also concluded (Ref. 8):
- The permanent installation should be completed by the earlier of:
 - The start of inactive commissioning of the 14 Dock Reactor Access House.
 - Decision Date plus two years for the 14 Dock Periodic Review of Safety (PRS).
 - DRDL should identify further improvements, where reasonably practicable, prior to each future docking in 14 Dock until a permanent installation is implemented.
 - DRDL should demonstrate progress towards a permanent installation prior to each docking.
12. The scope of DRDL's safety assessment in the modification document is applicable to all vehicle movements on 14 Dock which have the potential to interact with the 14 Dock dockside cranes. The safety assessment identified the following principal initiating events:
- Runaway Vehicles – vehicle impacts from any vehicle brought into the SRC which is based on the 100 t capacity mobile crane.
 - Vehicle Impacts within the Dock – this includes those vehicles of 34 t or less which are allowed to be brought into the dock by removal of the barrier.
 - Rail vehicles – impacts leading to a crane collapse from rail vehicles.
13. These initiating events from vehicle impact could result in the following fault sequences:
- Vehicle impact leading to crane collapse on to the submarine.
 - Vehicle impact leading to crane collapse on to the dock caisson.
 - Direct impact on the submarine.

14. DRDL's submission identifies and considers a bounding case, namely vehicle impact which bounds all other potential forces on the crane, including seismic events.
15. Overall, DRDL concluded that introducing the new vehicle impact barrier as a passive engineering system to protect against accidental vehicle impact and the changes to the management arrangements demonstrate the risk from these operations is tolerable and ALARP.

3 ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF THIS REQUEST

3.1 OVERVIEW

16. ONR notes that DRDL's submission has undergone independent peer review (Ref. 9) and has been accepted by the Management Safety Committee (Ref. 10).
17. ONR has carried out a programme of work focussed on the adequacy of DRDL's response to the requirements identified in the PAR (Ref. 9) for the previous docking, namely:
 - Completion date for the permanent installation.
 - Identification of further improvements, where reasonably practicable.
 - Demonstration of progress towards a permanent installation.

3.2 COMPLETION DATE FOR THE PERMANENT INSTALLATION

18. ONR concluded in the PAR (Ref. 9) for the previous docking that the permanent installation of the vehicle impact barrier should be completed by the earlier of:
 - The start of inactive commissioning of the 14 Dock RAH.
 - Decision Date plus two years for the 14 Dock PRS, 30 January 2015.
19. The 14 Dock RAH will not start before 30 January 2015 and hence the earlier of these dates is Decision Date (DD) plus two years for the 14 Dock PRS, namely 30 January 2015.
20. DRDL had stated (Ref. 11) that its intention was not to use the existing vehicle impact barrier after DD + 2 years. Furthermore, 14 Dock would be removed from service at DD + 2 years to undergo upgrade works for De-fuel, De-equip and Lay-up Preparation (DDL P), which will include the installation of the 14 Dock RAH.
21. During the period that HMS Turbulent was in 14 Dock in 2013/14, uncertainties have arisen over the DDL P programme and DRDL decided to use 14 Dock for a docking of HMS Tireless between the completion of HMS Turbulent's docking and the installation of the 14 Dock RAH.
22. DRDL has stated (Ref. 1) that the DDL P programme uncertainties have meant that it has not been possible to make significant progress in defining the longer-term requirements for the vehicle impact barrier.
23. DRDL recognised the requirement to operate the facility beyond DD + 2 years that arises from the proposed additional docking of HMS Tireless. In response to this, DRDL has carried out a review of the design and operation of the existing vehicle impact barrier against the scope of activities to be carried out in 14 Dock whilst HMS Tireless is in the dock (Ref. 1).

24. This review has resulted in a number of improvements being made to the management arrangements associated with operation and maintenance of the vehicle impact barrier. Assessment of these improvements is considered in Section 3.3.
25. ONR's conclusion in the previous assessment (Ref. 8) that the permanent installation should be completed by DD + 2 years was influenced by:
 - The then prevailing docking plan that 14 Dock would not be used between the docking of HMS Turbulent and the installation of the 14 Dock RAH.
 - The scope of the PRS for 14 Dock (Ref. 12) being only up to DD + 2 years, as DRDL intended to only use 14 Dock for DDLP with a new safety case to be implemented.
26. In the light of the proposed additional docking of HMS Tireless, DRDL has carried out a review of its PRS in order to extend the scope of the PRS beyond DD + 2 years. This is being assessed separately by ONR.
27. ONR considers that DRDL's approach to this change in operational plans is appropriate. Furthermore, ONR considers that it would be disproportionate not to agree to the use of the vehicle impact barrier as a means of dealing with the shortfall in crane rail withstand for the docking of HMS Tireless purely because the change in operational plans has led to an additional docking that was not foreseen when ONR set its regulatory expectations.
28. However, this is subject to satisfactory assessment in respect of the other areas identified in Section 3.1.

3.3 IDENTIFICATION OF FURTHER IMPROVEMENTS

29. Since the issue by ONR of LI 551 (Ref. 7) in November 2013, DRDL has identified as a result of operational experience and implemented three further improvements to the management arrangements through changes to Identified Operating Instructions (IOIs) and Operating Instructions (OIs) to:
 - Improve the clarity of the arrangements when the vehicle impact barrier is not fully available, such as during maintenance.
 - Refer to "vehicles weighing" in place of "gross vehicle weight".
 - Ensure that rail vehicles as well as road vehicles are considered within the arrangements.
30. DRDL has also carried out an optioneering study (Ref. 13). This recognises that the current vehicle impact barrier is an interim solution for use until an optimised final solution has been determined. The optioneering study considers the feasibility and practicability of upgrading the current vehicle impact barrier to a Class 1 Structure, System and Component (SSC).
31. The context for this is that the vehicle impact barrier is required to be a Class 1 SSC, but the dock blocks were manufactured in accordance with DRDL's quality standards for a Class 2 SSC. The dock blocks form the majority of the overall mass of the structure, with the frictional forces being proportionate to the mass, and remain essentially intact in the event of an impact. These dock blocks were manufactured in 2007 and were used in preference to manufacturing new blocks in order that the barrier could be in place as quickly as possible. ONR concluded in ONR-DRDL-PAR-12-021 (Ref. 6) that these dock blocks were adequate for the temporary vehicle impact barrier.
32. The optioneering study (Ref. 13) identifies two areas for further consideration:

- Replacement of the concrete blocks with new ones manufactured as Class 1 components.
 - Replacement of the block connecting bars with higher grade bars.
33. DRDL concludes that the continued use of the existing concrete blocks and block connecting bars is the ALARP approach.
34. DRDL base this conclusion on the following for the concrete blocks:
- Replacement of the concrete blocks by new ones would involve substantial time, cost and disruption, with the potential for operational disruption, and with limited benefit.
 - Sampling and testing of the existing concrete blocks, as a partway approach, would provide limited additional robustness to the overall safety justification.
35. DRDL base this conclusion on the following for the block connecting bars:
- The cost of replacing the block connecting bars would not be high, but this is balanced against the limited safety benefit from increased factors of safety.
36. ONR recognises that this conclusion the continued use of the existing concrete blocks and block connecting bars is the ALARP approach is made in the context of the current vehicle impact barrier being a temporary installation. Furthermore, its use for the docking of HMS Tireless is anticipated to be its final use before 14 Dock is used for defuel dockings with the RAH in place. ONR considers that this is acceptable for the docking of HMS Tireless, but is unlikely to be acceptable for the permanent installation, given that DRDL has recognised shortfalls against its own requirements and ONR's regulatory expectations.
37. ONR considers this to be an adequate response to the requirement set by ONR in ONR-DRDL-PAR-13-009 (Ref. 8) for DRDL to identify further improvements, where reasonably practicable, prior to each future docking until a permanent installation is implemented.
38. Taking account of DRDL's position (Ref. 13) that the safety requirements for a vehicle impact barrier during defuel activities have yet to be defined, ONR's expectations for future dockings after HMS Tireless are:
- Where a vehicle impact barrier is required by the safety case, the safety functional requirements for a vehicle impact barrier are to be clearly defined and categorised.
 - The vehicle impact barrier is to be designed to deliver the safety functional requirements and is to be classified accordingly.
 - The classification of the components of the vehicle impact barrier is to enable the overall classification of the vehicle impact barrier to be fully met.
 - These components are to be designed, specified and manufactured in compliance with the classification requirements.

3.4 DEMONSTRATION OF PROGRESS TOWARDS A PERMANENT INSTALLATION

39. In its optioneering study report (Ref. 13), DRDL outlines its position regarding a permanent solution. Reference is made to work that was undertaken in 2012/2013 to identify the preferred forms of construction for a Fixed Barrier and an Opening Barrier to enable design to progress towards selection of a preferred option.
40. DRDL emphasises that this work was based on assumptions as to future safety requirements to be delivered by the vehicle impact barrier. Consequently, the work progressed to the development of a concept. DRDL stopped the work in April 2013,

awaiting finalisation of safety functional requirements for defueling operations using the 14 Dock RAH.

41. Since that time, there have been delays in the 14 Dock RAH programme. In that context, ONR considers this to be an adequate response to the requirement set by ONR in ONR-DRDL-PAR-13-009 (Ref. 8) for DRDL to demonstrate progress towards a permanent installation at each docking until a permanent installation is implemented.
42. ONR recognises that DRDL is planning on the basis that the use of the current vehicle impact barrier for the docking of HMS Tireless is anticipated to be its final use before 14 Dock is used for defuel dockings with the RAH in place.
43. Taking account of these factors, ONR expects that, providing there are safety functional requirements to be delivered by a vehicle impact barrier, a permanent barrier is installed prior to the start of active commissioning of the 14 Dock RAH.

3.5 DEFENCE NUCLEAR SAFETY REGULATOR ASSURANCE

44. As part of the joint working arrangements, recognising DNSR as the competent authority for the Naval Nuclear Reactor Plant, ONR sought assurance that DNSR had no objection to ONR issuing a Licence Instrument agreeing to the implementation of the modification covering the vehicle impact barrier.
45. DNSR advised by email (Ref. 14) that they were not aware of any specific assurances required for the vehicle impact barrier, or indeed any submarine interface with it. Consequently, they do not consider that any DNSR assurance is required to support its permissioning of the vehicle impact barrier by ONR. Furthermore, DNSR also advised that there are no reasons why ONR should not permission the vehicle impact barrier modification solely for the docking of HMS Tireless and that DNSR supports it in principle.

3.6 READINESS REVIEW BY THE DRDL INTERNAL REGULATOR

46. In order to ensure that safety committee and independent peer review actions have been suitably addressed, DRDL's Internal Regulator will conduct an Operational Readiness Review (ORR) to confirm readiness to proceed with the docking of HMS Tireless in 14 Dock. The scope of the ORR will include the implementation of the vehicle impact barrier.
47. Any significant findings from the ORR process will be included in the Plant Manager's Hold Point Plan. This was discussed during the site intervention undertaken in February 2015 by the ONR SRC Site Inspector (Ref. 15).
48. Relevant points from that intervention are:
 - The Plant Manager's Hold Point Plan is in draft and is recorded in the latest revision of the Activity Permissioning Schedule.
 - Close-out of ORR findings has been added as an internal hold point.
49. ONR considers that DRDL's use of the ORR provides confidence that DRDL is taking appropriate steps to the implementation of the proposed modification.

4 MATTERS ARISING FROM ONR'S WORK

50. For this assessment, effort has been concentrated on the adequacy of DRDL's response to the requirements identified in the PAR (Ref. 8) for the previous docking.

51. The assessment covering the following areas concluded that DRDL's responses are considered to be adequate:
- Completion date for the permanent installation.
 - Identification of further improvements, where reasonably practicable.
 - Demonstration of progress towards a permanent installation.
52. ONR considers that the permanent installation should be completed by the next docking in 14 Dock, which will correspond to the start of active commissioning of the 14 Dock RAH, based on DRDL's current programme.

5 CONCLUSIONS

53. ONR's assessment has concluded that the Category B Modification "NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification For The Shortfall In Crane Rail Withstand" presents an acceptable basis for implementing the proposed modifications to the 14 Dock safety case solely for the docking of HMS Tireless in 14 Dock.
54. The Licence Instrument 558 (Ref. 16) "Agreement to Implement the Modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for The Shortfall in Crane Rail Withstand, Solely for the Purpose of Docking Tireless in 14 Dock" has been prepared for consideration by the Superintending Inspector. An associated QA Check Sheet has been completed (Ref. 17).

6 RECOMMENDATIONS

55. The project assessment report recommends that the Superintending Inspector for the Propulsion sub-programme:
- Accepts this Project Assessment Report.
 - If the PAR is accepted, signs and issues the Licence Instrument No. 558 under arrangements made under Site Licence Condition 22 of Schedule 2 to Nuclear Site Licence No. 50B thereby agreeing to implement the modification: NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for The Shortfall In Crane Rail Withstand, Solely for the Purpose of Docking Tireless in 14 Dock.

7 REFERENCES

1. *DRDL letter 23738R to ONR, 3 December 2014, Request for Agreement to Implement the Modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for The Shortfall in Crane Rail Withstand, Solely for the Purpose of Docking Tireless in 14 Dock. TRIM Ref. 2014/469085.*
2. *DRDL Document 000050560 - Modification / Experiment On Existing Plant - NED-MNC-240-13424 - 14 Dock Butterley Crane Safety Justification For The Shortfall In Crane Rail Withstand. Issue 3 Version 3.2 dated 21 November 2014. TRIM Ref. 2014/469107.*
3. *ONR letter 71236N to DRDL, 20 June 2012, Licence Instrument No. 545, Agreement to Implement Modification NED-MNC-240-13424 14 Dock Butterley Crane Safety Justification for the Shortfall in Crane Rail Withstand, Solely for the Purpose of Docking Tireless in 14 Dock. TRIM Ref. 2012/241123.*
4. *ONR Project Assessment Report ONR-DRDL-PAR-12-009 Revision 0, Agreement to Implement Modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification For The Shortfall In Crane Rail Withstand, Solely for the Purpose of Docking Tireless in 14 Dock. TRIM Ref. 2012/241384.*
5. *ONR letter 71242N to DRDL, 19 November 2012, Licence Instrument No. 547, Agreement to Implement the Modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for The Shortfall In Crane Rail Withstand, Solely for the Purpose of Docking Triumph in 14 Dock, TRIM Ref. 2012/439909.*
6. *ONR Project Assessment Report ONR-DRDL-PAR-12-021 Revision 1, Request for Agreement to implement the modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for the shortfall in crane rail withstand, solely for the purpose of docking Triumph in 14 Dock. TRIM Ref. 2013/16916.*
7. *ONR letter 71259N to DRDL, 6 November 2013, Licence Instrument No. 551, Agreement to Implement the Modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for The Shortfall In Crane Rail Withstand, Solely for the Purpose of Docking Turbulent in 14 Dock, TRIM Ref. 2013/387085.*
8. *ONR Project Assessment Report ONR-DRDL-PAR-13-009 Revision 0, Request for Agreement to implement the modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for the shortfall in crane rail withstand, solely for the purpose of docking Turbulent in 14 Dock. TRIM Ref. 2013/387065.*
9. *DRDL document IPR Certificate for CR-13424 Issue C. DNSQ/IPR 1400.09 dated 20 November 2014, TRIM Ref. 2014/469103.*
10. *DRDL document Minutes of the Management Safety Committee Meeting 170 held on 3 September 2014, TRIM Ref. 2014/469119.*
11. *DRDL letter 23698 to ONR, 18 October 2013, 14 Dock Vehicle Impact Barrier: Review of Progress to date and Confirmation of Way Forward in Support of Future Dockings in 14 Dock. TRIM Ref. 2013/384498.*
12. *Periodic Review of Safety Report: 14 Dock PRS Global Assessment Report: 14 Dock Facility/ Periodic Review of Safety, 000054381 Revision 1, Version 1.5, November 2012. TRIM Ref. 2013/5877.*
13. *Optioneering Study Report – Review of 14 Dock Vehicle Impact Barrier for Dockings in 14 Dock Under NED-MNC-240-14328, 000107101 Issue 1.3, October 2014. TRIM Ref. 2014/469123.*
14. *Email from DNSR to ONR, 4 February 2015, 14 Dock Vehicle Impact Barrier - Assurance Update. TRIM Ref. 2015/44495.*

15. *ONR Intervention Record, Site Intervention Undertaken at Devonport in February 2015 by the SRC Site Inspector, ONR-DEF-IR-14-198, TRIM Ref. 2015/66450.*
16. *ONR-DRDL-LI-558, Agreement to Implement the Modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for The Shortfall In Crane Rail Withstand, Solely for the Purpose of Docking Tireless in 14 Dock, Unique Number DRDL 71259N, TRIM Ref. 2015/77944.*
17. *ONR-DRDL-LI-558 QA Check Sheet, Agreement to Implement the Modification NED-MNC-240-13424, 14 Dock Butterley Crane Safety Justification for The Shortfall In Crane Rail Withstand, Solely for the Purpose of Docking Tireless in 14 Dock, TRIM Ref. 2015/77964.*