

PART 6

Plant & Operational Review





PART 6

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PLANT AND OPERATIONAL REVIEW

INTRODUCTION

- 6001 The plant and operational review contains four sections:
- A review of operating experience, which covers dose statistics and waste arisings, and describes the management system in place for recording and monitoring radiological incidents and accidents and operational problems.
 - A critical review of the plant, which shows that the level of safety in the Shiplift Facility will not be degraded by the reducing performance of life-limited items.
 - An examination of the issues surrounding eventual decommissioning.
 - An assessment of the Shiplift Facility against current standards.
- 6002 The principal items of plant in the Shiplift/Berth 12 Facility are the Platform (including Control and Protection), the EOT Cranes, the Berth 12 Crane and the Sea Water Cooling System.

REVIEW OF OPERATING EXPERIENCE

Operational Proving Period

- 6003 Every docking of a nuclear submarine in the Shiplift Facility up to the 17th occasion was conducted as part of an Operational Proving Period (OPP), and was individually authorised by CPCA. An OPP Report was issued after each undocking. The OPP Report described all occurrences during the docking period and provided a vehicle by which lessons learnt from each OPP were promulgated. Changes to operating documentation or equipment design were authorised in accordance with the Clyde Management System as discussed in Part 4 of this FSC.
- 6004 The Facility was non-operational from September 1999 to April 2000 to permit the replacement of the PLMS panels in order to achieve Y2K compliance and renew obsolete equipment. Changes in personnel at this time compounded by a non-operational period resulted in the requirement to restore SQEP for key positions. This SQEP recovery was achieved by active civilianisation, changes to operating documentation, a grounding trial of a Vanguard class submarine and the dockings of a Swiftsure and Hunt Class vessel.

Operating History

- 6005 **Shiplift.** Table 6.1 details the history of the last 20 dockings in the Shiplift over 20 years. This includes non-nuclear dockings as the same process is applied to each vessel and benefit can be taken for the success of these. The dockings from D59 onwards have been carried out after the installation of the new elastomeric pads at the bogie/strongback interface. Dockings D60 onwards were after the commissioning of additional Control and Protection modifications. During D72, HMS Sceptre completed the first 1 Day Docking. During D79, the first T Boat, HMS Torbay, was successfully docked and raised to pins. The Shiplift was out of action while Sea Water Pumps were repaired during October & November 2008. NBDD currently have an ongoing design solution regarding the issue of obsolescence of the Sea Water Pumps and their future replacement.

**RESTRICTED**Table 6.1 List of Dockings [REDACTED]

Docking No	Date	Class	Days On Pins	Annual Total on Pins	Success or Failure
D57	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D58	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D59	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D60	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D61	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D62	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D63	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D64	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D65	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D66	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D67	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D68	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D69	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D70	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D71	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D72	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D73	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D74	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D75	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D76	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D77	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D78	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - Second attempt
D79	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D79	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt
D81	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Success - First attempt

6006 Adherence to the EU working time directive and the Shiplift 12 hour shift system has resulted in the nuclear submarine berthing and unberthing evolutions being conducted on separate days from the docking as opposed to one continuous evolution.

6007 **Berth 12.** Records of the Berth 12 Occupancy from 2005 to the end of 2008 are listed in the Table 6.2 below. The total annual occupancy for all vessel classes over the 2006 period of [REDACTED] was above the assumed figure of [REDACTED] stated in the Probabilistic Risk Assessment; this was due to the downtime on 10/11 berth for catamaran maintenance and SSBN RAMP period. The 2006 Annual Review Facility Risk figures in Table 6.3. show that the Risk Proportion still remained well below the BSL and was lower than the 2007 figures*; this was mainly due to the [REDACTED] by S and T class vessels in the Shiplift.



Table 6.2 Berth 12 Occupancy (July to June)

Period	Occupancy (Days)			
	V	S&T	Other	Total
2005	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
2006	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
2007	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Table 6.3 Berth 12 Crane – Nuisance Trips

Risk Source	Vessel	Public Risk	Worker Risk	Crew Risk
Shiplift	S & T	0	0	0
	V	7.38×10^{-8}	6.48×10^{-8}	7.8×10^{-7}
12 Berth	S & T	9.58×10^{-7}	1.50×10^{-5}	9.85×10^{-6}
	V	1.84×10^{-6}	2.26×10^{-6}	6.08×10^{-6}
Totals		6.02×10^{-6}	3.73×10^{-5}	3.58×10^{-5}
BSL		10^{-4}	10^{-3}	10^{-3}
BSO		10^{-6}	10^{-5}	10^{-5}
Risk Proportion of BSL		3.8% (4.9%)*	1.7% (2.0%)*	1.9% (2.0%)*

- 6008 **EOT Cranes.** Although the probabilistic assessment is based on 3974 lifts per year, it is conservatively assumed that each crane will conduct no more than 2000 lifts each. With the main hoist undertaking 260 lifts and the ancillary hoist 1727 lifts. In practice annual usage is currently averaging less than 20% of the 2000 lift value.
- 6009 **Berth 12 Crane.** Although the probabilistic assessment is based on 3896 lifts per year, it is conservatively assumed that the crane will conduct no more than 1200 lifts each year. In order to address the arrival of the Astute class vessel the assumed number of lifts has been increased to 2878. In practice annual usage is currently averaging less than 72% of the 1200 lift value.

Operational Reliability and Availability

- 6010 As a result of the Periodic Safety Review (PSR) in 2001 more detailed record keeping of defects and failures has since been kept. A number of Facility modifications have also improved the overall operational reliability. For these reasons it is considered that operational experience gained since 2001 is more representative than that prior to 2001.
- 6011 Currently a Periodic Safety Review (PSR) is being undertaken on the Shiplift; the formal assessment is expected in December 2010.
- 6012 **Platform.** Over the past 5 years there has been one platform C&P failure that has resulted in the prevention of the successful first time docking of a vessel. Spurious tripping of protection relays regularly occurred; a design change was implemented and has since resolved the problem.

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- 6013 Reliability of the Platform to support the Probabilistic Risk Assessment (PRA) is based on a future projection of [redacted] dockings per year and Platform occupancy of [redacted] days per year. On 13/09/05 and after completion of a Reliability Assessment, HMS Sceptre undertook and successfully completed a [redacted] day docking period.
- 6014 **EOT Cranes.** The EOT Cranes have historically been subject to a high number of nuisance trips. These have now been significantly reduced (to an acceptable level) by synchronisation of the Transmission PLC and the provision of new radio controllers.
- 6015 **Berth 12 Crane.** The Berth 12 Crane has been in service for approximately 17 years. Over the past 8 years there have been no C&P failures of the Berth 12 crane that have resulted in a hazard to nuclear safety arising during lifting operations.
- 6016 The crane has exhibited a tendency to nuisance tripping and it has been concluded that these trips originate from the monitoring Programmable Logic Controller (PLC). A long term concession is currently in place for linking out the Long Travel (LT) PLC trips and continues to demonstrate a significant reduction in the nuisance trips.
- 6017 Due to obsolescent spares the Hoist Barrel Monitor Trip is linked out and a long term concession is currently in place.
- 6018 **Cooling Water.** The Shiplift was declared unavailable from 1st October to 30th November 2008; the cause being a defect on the seawater cooling pumps bearings. Driven by the issue of obsolescence of the Sea Water Pumps, NBDD currently have an ongoing design solution for their future replacement; this is presented in the SJP.

Activities Involving Ionising Radiation

- 6019 As a result of the activities conducted in this Facility, the following sources of ionising radiation may be present or be used:
- The NSRP of nuclear submarines at both 12 Berth and within the Shiplift building.
 - Primary Coolant. - Discharged either to a PET barge (12 berth only) or transferred through the Facility in carboys.
 - Solid Radioactive Materials. - Transferred through the Facility en-route to/from the APF or Nuclear Repair Facility.
 - NDE Radiography Sources. - Used for radiography in the Facility or onboard RN vessels.
 - Minor Sealed Radioactive Sources. - Smoke detectors and instrument check sources.
- 6020 No activities are carried out within the boundary of the Facility which could normally give rise to a contamination hazard. Therefore the potential for contamination is limited to a PET or primary spill during sampling. The likelihood of contamination arising or being spread is therefore negligible (HMNB Clyde RRA No.18 (Ref. ¹) refers).
- 6021 Radiological activities peculiar to the Shiplift specific activities include the conduct of diving operations including connection of services, flooding bonnets and swim throughs as discussed in Part 3, checking the vessel/platform interface under the



submarine hull and in potential controlled areas and dock bottom work on the docked submarine. The information presented in Table 6.4 is based on worst case contact dose rates and pessimistic estimated stay times.

Table 6.4 Estimated Doses for Routine Operations in the Shiplift Facility

Group	Maximum Contact Dose rates $\mu\text{Sv/hr}$	Activity Conducted	Estimated Stay Time (mins)	Estimated Dose μSv
Divers	30	Checks on Dock Operations	10	5
Contractors/ Base Staff	30	Work on Submarine Casing/Hull	Averaged over a working week 30	15
Shiplift Staff	30	Checks on cradles and alignment	5	2.5

6022 The HMNB Clyde Dose Management System database is produced annually and the 2008/9 maximum figure of $30\mu\text{Sv/hr}$ for 'contact on hull' was measured for submarines in the Shiplift. Doses that typically arise are less than the above stated maximum values (Table 6.4).

6023 The fitting of PMLF to SSN's is conducted by base staff at the relevant alongside berth. As discussed in Part 5 the current dose record system at HMNB Clyde does not permit collection of the radiation dose accrued by individuals in a way which can be separately attributable to the Shiplift Facility.

6024 The requirement to establish the activity based dose for the fitting of PMLF in order to inform a balance of risk argument has been recognised in the Shiplift FSC SJP (Ref.²) along with other operational data as discussed later.

Radiological Incidents and Accidents

6025 Radiological incidents and accidents occurring within HMNB Clyde will be dealt with in accordance with the Clyde Management System (CMS). There have been no significant occurrences to date. Lesser occurrences (e.g. nuclear safety events) are also reported in accordance with the CMS. Trend analysis is then conducted at a site level.

Operational Problems

6026 Any events which affect or have the potential to affect the NSRP are reported in the form of an Incident Report in accordance with JSP 518 (Ref.³) and the Clyde Management System (CMS).

6027 Shiplift Facility activities are conducted in accordance with approved operating documentation (see Part 4 of this FSC). Operators and users of operating documentation are encouraged to make comments about the documentation in general, and to record events and occurrences in particular. This system ensures that every event occurring during Shiplift Facility activities will be recorded and analysed by the documentation sponsor. Operating documentation change action will then be initiated as appropriate. Changes to operating documentation are processed as discussed in Part 4 of this FSC.

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- 6028 Shiplift staff at all levels are, both formally and informally, encouraged to participate in reviews and lessons learnt exercises with the aim of using continuous improvement to develop a positive safety culture. Wash-ups are always conducted after berthing/docking evolutions. The EHJ is included as Shiplift staff are involved in the berthing and unberthing operations at Royal Naval Armaments Depot (RNAD) Coulport and the activity is almost identical to that of the Shiplift.
- 6029 On no occasion has any shortfall or incident raised within the Facility had any effect or caused an incident on the vessel.
- 6030 Operating Procedures within the Clyde Management System direct the procedures to be followed to control and restrict untoward occurrences. These procedures include:
- a. **Platform.** The docking evolution is undertaken in stages. The vessel/cradle interface is checked at the 1m level and any concerns are addressed by the DNSAG before docking is allowed to proceed.
 - b. **EOT Cranes.** The EOT Crane evolution may be stopped by the Pendant Emergency Stop Operator (PESO) in the event of a long/cross travel or lifting excursion.
 - c. **EOT Cranes.** The EOT Cranes are not permitted to be used during Platform movements and are parked at the ends of the Facility when not in use.
 - d. **Berth 12 Crane.** Lifting and slewing operations may be stopped by the banksman using the emergency stop button on the crane legs.
 - e. **Berth 12 Crane.** Is not operated when the Shiplift is on ropes.
 - f. **Cooling Water System.** Seawater standby pumps are maintained in readiness.

Critical Review of Plant

- 6031 Annual Reviews are currently produced that identify the usage of the plant and any recorded shortfalls.
- 6032 Currently a Periodic Safety Review (PSR) is being undertaken on the Shiplift; the project utilises Life Time Extension (LTE) Reports, in conjunction with Safety Analysis and Safety Management Review. A formal assessment is expected in December 2010
- 6033 Additionally as part of the Shiplift LTE project, it was identified that a Hazard List and Fault Schedule are required to aid alignment with Modern Safety Methodology; this project is ongoing.

Material Assessment

- 6034 Material assessment of all NSI equipment is embodied in the relevant maintenance/inspection test procedures. Procedural reviews are carried out annually by the sponsor and re-approved by the approving body (DNSAG/NSAG) as changes occur or every 5 years as detailed in the Clyde Management System (CMS).



Operational Data

- 6035 Experience gained from the Periodic Safety Review has highlighted the need to formalise the extensive operational data kept. This data is used to provide valuable feedback as to the material state of the Facility and to further inform and validate the assumptions made in the safety case.
- 6036 The data recorded includes:
- EOT and 12 Berth Crane lifts including defects.
 - Decay heat levels prior to docking (not 12 Berth).
 - CDLPs, HDLPs and platform movements.
 - ICCP down time, platform fatigue cycles, SW pump running hours, platform brake usage and seismic monitoring data.
 - Maintenance records and equipment traceability (e.g. wire ropes) including defects.
 - The number of dockings, days on pins, TWS & SWS weapons embarked and plant state.
 - Helicopter flights and environmental conditions.
 - Dose figures for radiological activities.

Modifications

- 6037 The process for controlling modifications to the Shiplift Facility has been discussed in Part 4 and are processed in accordance with the Clyde Management System (CMS).
- 6038 The following modifications have been implemented as improvements in the design substantiation since the May 2005 review:
- Modification of Shiplift CPS Hoist Rotation Detection System Control Panel Fuses FS 18 & 19; installed with 9 Amp Siemens Fuses on all affected TX's.
 - Load calculations carried out for substantiation to use Anti-Condensation Heaters in Hoist Rotation Detection and Back-Up Limit Switch Panels.
 - Op Anchored Project has an electrical winch added and master drawings amended.
 - Modifications to the C&P System to test the PLMS2 Trip Contacts (MLTG) and the MCB Intertrip.
 - Modification to Shiplift Platform Load Monitoring System (PLMS 2), Replacement of 91 Zener Diode Modules to rectify poor connection problem resulting in spurious trips.
 - Use EPO-CHEM RL 500PF Paint System on Shiplift Cradle Bogies.

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- g. Modification to Shiplift Platform Relay Panel Wiring Replacement (110v AC Indication Circuit).
- h. Modification to Shiplift Platform HRDS Target/Sensor arrangement.
- i. Reduction of Shiplift Platform PLMS Individual Low Load Trip settings.
- j. Replacement of 12 Berth Crane Cast Iron Cable Reeling Guide Rollers.
- k. 12 Berth Crane Seismic Code Non-Compliance resulting in installation of Seismic Beam Brace.
- l. Modification to 10, 11 & 12 Berths Catamarans by attaching cleats for securing small vessels.

DECOMMISSIONING

General

- 6039 From a radiological viewpoint, the decommissioning of the Shiplift Facility will be a relatively simple process. The undocking and removal of the last submarine from the Shiplift effectively removes all radiological hazards, and subsequent actions will depend upon the MoD's plans for the Facility at that time. Any potential sources of radiation exposure or contamination, such as those contained in smoke detectors and installed radiation monitors, shall be addressed within the decommissioning plan and controlled in accordance with the IRR99 and the RSA93. Eventual demolition of the Shiplift Facility will continue as for a structure which has no nuclear safety or radiological implications. The Shiplift Facility is subject to periodic radiological surveys.
- 6040 Planning for decommissioning is recognised as being a requirement, however as the Shiplift Facility is presently at an early stage of its design life, and there are no challenges such as those associated with massive shield walls or activated / contaminated components, no detailed decommissioning plans have yet been formulated. The recognition that decommissioning requires consideration is also reflected in the DSRs, which will be updated later in the life of the Facility with appropriately expanded decommissioning plans, driven by the findings of formal periodic reviews in accordance with regulatory and HMNB Clyde requirements.
- 6041 AC35 (Decommissioning) requires the Authorisee to make and implement adequate arrangements for the decommissioning of any plant or process which may affect safety and produce and implement decommissioning programmes for each plant.
- 6042 The relevant equipment DSRs contain the majority of the Life information as not all the Facility equipment has the same life or is subject to the same environment or review. Notwithstanding the requirements to conduct an ageing review, as part of the Periodic Safety Review, key equipment milestone dates for survey or replacement to maintain life is a function of the maintenance systems whether M&E or Civils.

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- 6043 Current Authorisation Condition and SPSC compliance requires the management of decommissioning, Facility life issues and control of modification through the design control processes. These processes are inherent in the DSRs due to the way in which the current NSSJ is structured. Therefore Facility life is essentially equipment based, with operations continually reviewed under the auspices of the QA system, and subsequently should be being managed by the relevant equipment DSRs, by the Facility Design Managers (FDMs), on behalf of the FO under the current arrangements.

CURRENT STANDARDS

Comparison Against Current Standards

- 6044 The Shiplift Facility has been reviewed against the Design Standards, Codes of Practice and Approvals as detailed in Part 3 of the supporting DSRs that comprise the sub-systems of the Facility. The Periodic Safety Review currently being undertaken will address the comparison against current standards as discussed earlier and the results will be published in the Shiplift Periodic Safety Review Report (Ref.5).

Programme of Improvements

- 6045 A number of outstanding issues are identified in Table 7.3 of Part 7 of this report and Forward Actions (FA's) have been generated to address these and are represented in the Safety Justification Plan (SJP).
- 6046 A Reliability Centred Maintenance (RCM) study was undertaken to ensure the Platform's maintenance and resource requirements were correctly focused and the recommended improvements were then implemented.
- 6047 Continued improvements communications and interfaces with the Sub IP, Weapons IP to improve the conditional risk data and inform the PRA and required Shiplift docking information.
- 6048 The Shut Down Safety Case (SDSC) is currently ongoing and is represented in the Safety Justification Plan (SJP).
- 6049 Strategic Weapons System (SWS) SC1: Missile Deployment Operational Safety Case has been issued and demonstration of the assumptions made and bounding arguments are ongoing and any shortfalls will be presented as Forward Actions (FAs). This is reflected in the Safety Justification Plan (SJP).
- 6050 The Tactical Weapons Safety Case (TWS) has been captured within the Warship In Harbour justification and demonstrations of the assumptions made are ongoing and any shortfalls will be presented as Forward Actions (FAs). This is reflected in the Safety Justification Plan (SJP).
- 6051 A readiness review is being undertaken to ensure Astute Class vessels can be docked in the Shiplift. Any Shortfalls will be addressed as Forward Actions (FAs). This is reflected in the Safety Justification Plan (SJP).
- 6052 The Mobile Elevating Platforms (MEWP's) justification will support maintenance on site; demonstration is currently ongoing and is reflected in the Safety Justification Plan (SJP).

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- 6053 Batteries' Charging of a V Class vessel in the Shiplift has been justified and will be added to the scope of operation that can be undertaking within the Shiplift.
- 6054 A Safety Justification for a [REDACTED] Day Docking Period in the Shiplift is currently ongoing and is reflected in the Safety Justification Plan (SJP).
- 6055 The Shiplift with no vessel on the platform is one of the launch and recovery locations for the NATO Submarine Rescue System (NSRS). 12 Berth is also one of the possible launch locations and an assessment is currently ongoing and is reflected in the Safety Justification Plan (SJP).

SUMMARY

- 6056 Operations at the Facility are carefully controlled and managed to ensure that safe operation is maintained. This has been proven through successful operational experience which has benefited from the use of Facility Staff who are SQEP and has demonstrated that predictions in the substantiation are generally pessimistic.
- 6057 On completion of the Periodic Safety Review any required improvements required will be programmed within the Safety Justification Plan (SJP) then reviewed and updated on a regular basis.
- 6058 The NSI equipment is very reliable having considerably fewer defects than predicted and an improved reliability since the installation of PLMS2.
- 6059 All operations and maintenance are conducted under strict procedural control by SQEP operators and maintainers.
- 6060 The Facility has accrued an operating history since build and continually developed procedures based on this operating experience.
- 6061 Modifications were instigated to resolve plant spurious tripping problems; these have improved the overall operating efficiency of the plant.
- 6062 The SDSC, SWS and TWS Safety Cases demonstration are ongoing and their implementation are reflected in the Safety Justification Plan (SJP)
- 6063 A readiness review is being undertaken to ensure Astute Class vessels can be docked in the Shiplift.



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REFERENCES

¹ RRA No. 18

Radiological Risk Assessment No.18

² DJD 252/6/1

Shiplift Safety Justification Plan - Issue 9

³ JSP 518

Regulation of the Naval Nuclear Propulsion Programme - Issue 2