6.12 GALLERY

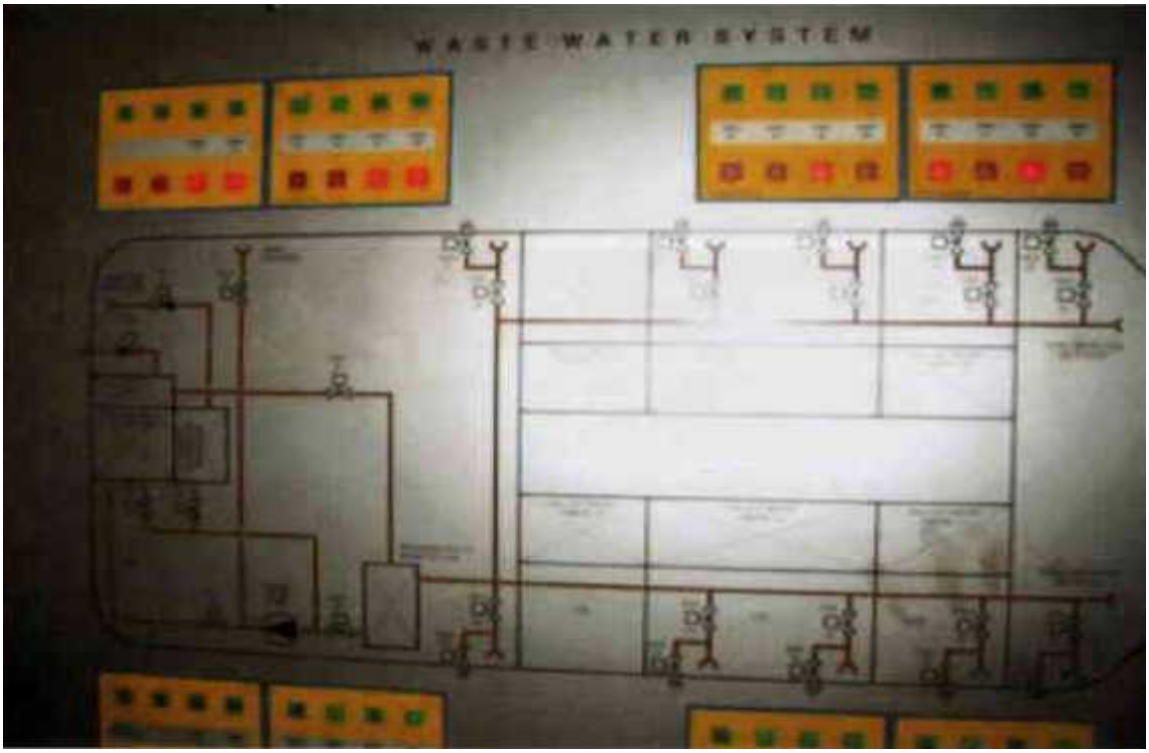

Figure 1 - Mimic Plate Showing Valve Arrangements for the Water Management System

Figure 2 - The Aft Well Deck and Emergency Generator Room

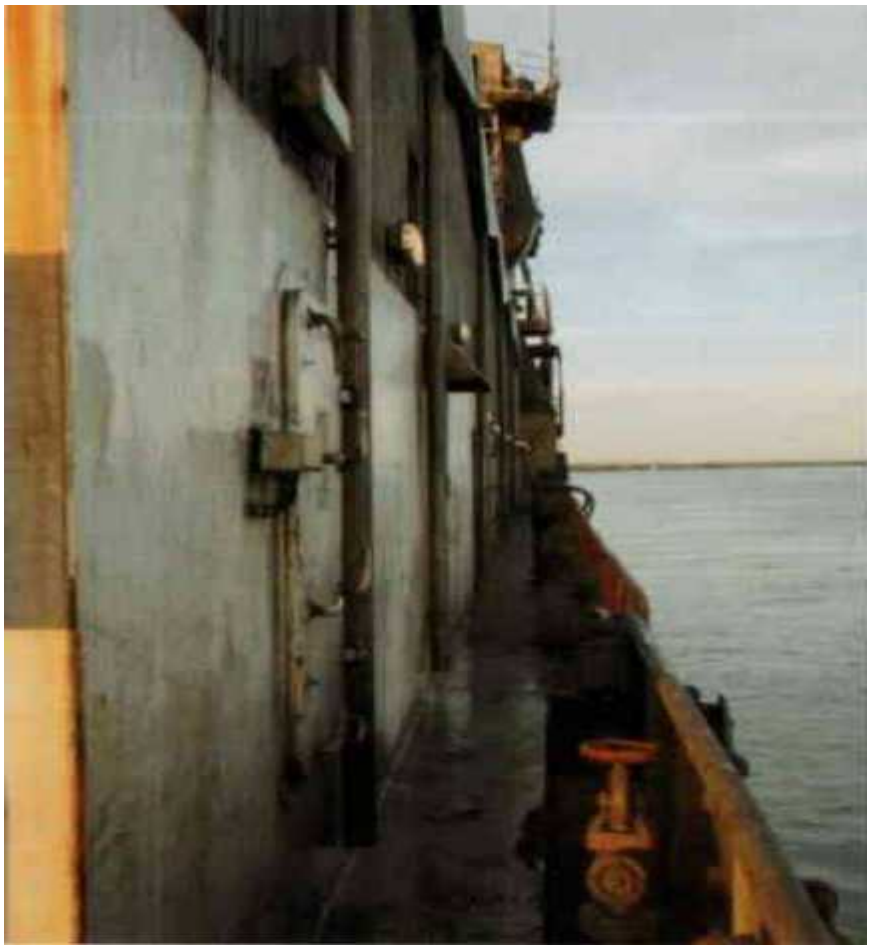

Figure 3 - Starboard Deck and Downpipes

Figure 4 - Deck Drain on Starboard Walkway

Figure 5 – Downpipe Extending from Roof Gutter on the Port Side Walkway

Figure 6 - Deck Drain on the Port Side Walkway

Figure 7 - Aft Well Deck Sump

Figure 8 - Washdown Outlets from under the Conveyor

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Figure 10 - Conveyor Port Side Walkway Showing Concentrate Deposits on Port Deck

Figure 11 - Accumulated Concentrate on the Port Side Walkway

Figure 12 - Concentrate in the Cargo Hold in Typical Inclination

WUNMA BOARD OF INQUIRY

CHAPTER 7 THE OPERATIONAL REVIEW BY THOMPSON CLARKE SHIPPING

[1] Mr Malcolm Mewett took up the position of Port Operations Manager at Zinifex in early 2006. Prior to that he had been employed by both Pasminco and Zinifex in various positions in connection with operations at the Rosebery Mine and the Hobart Smelter. In the course of acquainting himself with the operations of the *Wunma* after he arrived at Karumba he found that he had "a bookcase of audits and documents".[1] But what he wanted was an overview of the entire operation.

[2] With the support of the Zinifex group office, Thompson Clarke Shipping was engaged to undertake an operational review. The existing Vessel Operations Management Agreement was due to expire in September 2007. The major objective of the Thompson Clarke review was to evaluate methods by which the next ship operations contract could be made more effective, both commercially and technically. To do this Thompson Clarke had to determine commercial and operational issues arising from the current contract.

[3] Its review was undertaken in the latter half of 2006 and consisted of a review of documents, interviews with Zinifex and Inco management in Sydney and Karumba, interviews with the ship's officers and crew, a voyage on the *Wunma* and observations of the ship and shore cargo handling systems. The result was a report dated 4 December 2006.

[4] The report identified a number of shortcomings with the ship's operation at that time. A copy of the report was made available to Inco in early January 2007 in advance of a meeting held in mid-January 2007.[2]

[5] The Thompson Clarke Operational Review addressed a wide range of issues, many of which are not of immediate relevance to the Inquiry. Accordingly, this Chapter does not purport to summarise the entire contents of the 4 December 2006 report

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1 Mr Mewett; T.381.

2 Statement of Malcolm Mewett Exhibit 41, para 93. Mr Mewett; T.382.

which addressed various aspects of the commercial and contractual arrangements that governed the ship's operation and which might govern her operation under a new contract.

[6] The report raised a number of issues in relation to the crew including "crew churn rates", their employment conditions and issues of Occupational Health and Safety ("OH&S"). Some aspects of the Operational Review in relation to the crew and its management have been noted elsewhere. OH&S issues included the management of dust migration into accommodation areas which led to a recommendation that there be a root cause analysis of product spillage that might necessitate an ergonometric survey to determine effective cleaning methods around and underneath the conveyor belts and pullies. The report addressed an extensive number of crew issues.

[7] It also made findings concerning communications between Zinifex and Inco and suggested a review of the function and roles of Inco's Karumba Manager, including the Manager's role in liaising with Zinifex whilst at the same time having managerial responsibility for, or operational involvement in the *Wunma*. It recommended attendance at Zinifex meetings by the ship manager's operational and technical personnel from head office so as to improve communications and vessel management.

[8] In relation to cargo handling arrangements, the Thompson Clarke report made the following findings in relation to the process of cleaning spilled concentrate:

> "After loading, the cargo deck becomes very hot and humid. The air extraction system and scrubbers fitted appear to be ineffectual in addressing the build up of heat. We query whether the recent expensive replacement of the shed covering and its supports was in no small measure due to the humidity and heat problem. We also query the extent to which persons working in the cargo deck area are being subjected to OH&S risks."[3]

In connection with the passage to the export vessel the following findings were made:

> "During the passage to the ocean going vessel, the opportunity is taken to clean the spillage in the cargo spaces and at transfer chutes and along walkways. There is excessive heat and/or humidity problems in the cargo deck with the need to address heat stress

[3] Thompson Clarke Operational Review, Exhibit 49, CB137, para 6.1.5.

> management issues that lead to reduced productivity on the part of the crew. With the limited space available to work in, there is much manual shovelling of a heavy commodity during the clean up process. It is also a particularly dirty job and raises OH&S issues."[4]

[9] The following observations were made in relation to the return passage to Karumba:

> "Time on the return passage is used to clean the cargo deck using a small bob-cat to push the residual concentrate missed by the bucket wheel reclaimer into a pile for discharge to the ocean vessel on the next discharge run and to prevent the residual cargo from consolidating. Some cargo adheres to the sides of the cargo deck and is knocked down. A consequence of this is that the bob-cat which is running over the top of the concentrate in the deck transfers it to the after (sic) end. The concentrate can also be wet with water leeching from the cargo. Consequently the whole of the after (sic) end including the engineering workshops and stores are extremely dirty.
>
> The vessel is also washed down with fresh water on the return passage. With the WUNMA having to be on an even keel, the wash down water does not flow away easily especially as the drainage is poor. This wet mixture is then tramped over the ship as it is the main walkway from for'd to aft as well as providing one of the accesses to the cargo deck. When dry, a residue of concentrate remains which again can be spread all over the ship. There is a residue tank (located under the bob-cat) into which all wash down water flows. Anecdotal evidence suggests that the capacity of the tank is not large enough when there has been heavy rain."[5] (emphasis added)

[10] The report recommended a specialist task force be set up to address the fact that cleaning and cleanliness of the vessel was not satisfactory. The task force was to be representative of all parties including the ship manager, operating crews, Zinifex with technical advice as appropriate with short term and long term issues being addressed.

[11] The Thompson Clarke reported upon various aspects of the materials handling plant. One aspect of its findings was in relation to spillage from conveyors and included a recommendation that the reasons for spillage be established and corrective action implemented "for the short term and the longer term".[6]

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4 *Ibid* para 6.1.7.
5 *Ibid* para 6.1.9.
6 *Ibid* para 7.2.

[12] In general, the report found the general cleanliness and cleaning of the vessel was "far from satisfactory", particularly around the stern region of the vessel and that the design of the vessel was not conducive to efficient cleaning processes.

[13] The report reviewed the repair and maintenance of the ship, and operational issues in connection with them. It posed a number of questions in relation to the functions of the crew:

> "To what extent are the crew an operating crew and/or maintenance crew? How many crew members are required and what qualifications and experience is needed? How are the functions best handled and time allocated? Cleaning is a major issue for consideration and with a new contract looming, it may be opportune to re-examine such issues. To what extent are 'Leading Hands' (qualified and experienced, with very limited experience or untrained) capable of undertaking equipment or engine maintenance or carrying out routine repairs?"[7]

[14] The report was critical of the absence of scheduled maintenance downtime. It observed:

> "Ocean going vessel transfer appears to take precedence to maintenance which is fitted in around cargo requirements. This does not allow maintenance to be programmed or for contractors to come in or spares to be sourced in time. The system appears to have grown up by default and lack of communication within INCO/Zinifex rather than by design. Scheduled maintenance periods need to be established."[8]

[15] In discussing maintenance issues the report reiterated that the aft well deck, the winch deck and the intermediate deck were extremely dirty "with exposed concentrate present".[9] It reported:

> "Access to the cargo deck is neither airtight or watertight and the doors separating the cargo deck from the well deck are ill fitting. This area is extensively used for mooring and cleaning of the cargo deck. The area is also open to the elements of rain, wind and sun. Concentrate is always and easily transferred on boots and clothing from here throughout the vessel."[10]

[16] Thompson Clarke conducted a desktop review of the vessel's design and raised a number of issues which were said to be of a major nature requiring consideration in

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7 *Ibid* para 9.1.2.
8 *Ibid* para 9.1.2.
9 *Ibid* para 9.1.2.

the near future on the assumption that work could be carried out at the 2009 dry docking. These issues included the fact that the main engines "generally lack power". Another issue was that the "cargo doors at the end of the vessel did not contain the dust within the well deck".[11] In relation to "EPA considerations" the report stated there was a need to be pro-active:

> "Wash down of decks is not effective. Scupper arrangements on deck are inadequate as vessel is on even keel and excessive water/concentrate mix occurs. Query if wash down water going overboard due to small sheerstrake retaining lips. Dust on canopy and elsewhere not washed down and can blow around the vessel. Holding tank capacity inadequate at times of heavy tropical rain. Major cleaning issues around the stern of the vessel."[12]

[17] The report also identified a need for Zinifex and Inco to be pro-active in relation to OH&S issues:

> "When cleaning, the crew are working in a very hot and humid environment in the cargo deck. Ventilation and air extraction improvements are required."[13]

[18] In connection with major works and their timing, the report recommended design work be undertaken between 2007 and 2009 on the wash down tank to increase its capacity. These works were proposed for the dry dock in 2009 and were required for "additional water from improved wash down systems and also rain". Scuppers were also to be designed to improve the cleanliness of the vessel, with improved scupper systems being constructed at the programmed dry dock in 2009. Well deck doors were to be redesigned to make them dust proof with new doors being fitted at the dry dock in 2009. It recommended improvements to the cleanliness of the stern of the vessel with ongoing cleaning and a possible redesign of the area.

[19] Although situated in the part of the report dealing with cargo handling arrangements, the Thompson Clarke report made the following significant findings in relation to cyclone preparedness:

> "There are different procedures outlined in the SQS Manuals as to actions to be taken in the event of cyclones. It appears to be unclear

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10 *Ibid* para 9.1.2.
11 *Ibid* part 10, p.25.
12 *Ibid* Part 10, p.25.
13 *Ibid Part* 10, p.26.

> as what procedure will be followed under various cyclonic scenarios. With seven years experience having been obtained since WUNMA started, it is considered that INCO/Zinifex should be well prepared ahead of any cyclone heading for Karumba and that Zinifex should know well in advance what action is going to be taken to protect their vessel which is vital to their ongoing operations. A separate paper has been prepared on this issue – refer Attachment 'C'."[14]

[20] After reviewing the procedures/documents and after discussions with several personnel, it appeared to Thompson Clarke that there were a number of different views as to what will happen in a cyclone situation and what action should be taken. It noted that in the light of past experiences (eg Cyclone Larry):

> "… the vessel's operations to date as well as other developments it is considered prudent to review cyclone preparedness for the WUNMA. Given the approach of the cyclone season, it is recommended that this review be undertaken as a matter of urgency."[15]

[21] After reviewing the procedures in the vessel's SQS and the three courses of action outlined in the cyclone procedure, it was noted there was no timeframe for those actions and they were not consistent with actions recommended in another part of the SQS which contemplated departure for the designated anchorage at Sweers Island. The Thompson Clarke report observed that while weather forecasting of cyclone activity is now pretty accurate "it is never really possible to determine the exact path of the cyclone until the last few hours". It stated that given the operating history of the vessel, it should be possible to "refine and determine the preferred action to take, rather than leave the range of alternatives open, leaving the Master to decide which of the above alternatives to take and when to take it".

[22] The review of the vessel's cyclone preparedness then included the following significant paragraph:

> "It would therefore seem feasible to ensure that the WUNMA is not caught with a full cargo on board during the approach of a cyclone and the issue is at what point of time should cargo operations be suspended for safety reasons. This does not appear to be addressed in the operating procedures."[16]

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14 *Ibid* para 6.1.10.
15 *Ibid* Attachment C, p.2.
16 *Ibid* Attachment C, p.4.

[23] As was pointed by Counsel for Inco at the hearing, the cyclone procedure in the SQS did address the time at which cargo operations should be suspended. It provided for loading to cease upon a Blue Alert (when a Watch Alert is effective, ie gale force winds greater than 40 knots expected within 48 hours, but not less than 24 hours). Mr Clarke accepted this point. He explained:

> "… what I was concerned about was that given the whole scope of those particular alerts it was too late to do anything with the ship that is perhaps constrained in how she might take action to avoid the cyclone. She is not a fast ship and it is matter of getting in and out of the port. So whilst it did say that it was my view that all of this was really coming too late, perhaps I may not have expressed myself very thoroughly in the aspect of my report that refers to cease loading cargo.
>
> So too late if it is within 48 hours but not less than 24 hours is referred to?---Yes. I believe it's too late and it would need to take much earlier action than what is actually set out in the procedures."[17]

[24] The Thompson Clarke review identified an alleged deficiency in the ship's operating procedures that, if not addressed, risked the ship being caught with a full cargo on board during the approach of a cyclone. Its observation warranted consideration. That further consideration might have provided the occasion for Mr Clarke to explain that his concern was that the procedure to cease loading in the SQS cyclone procedure came too late. Any such advice may have prompted the implementation of a procedure of the kind adopted in earlier years, as described by Captain Frank Thomson in his evidence or as described by Captain Heath Daniel in his email to the Regional Harbour Master of 22 September 2005. If not, it may have prompted the implementation of at least an interim procedure for loading to cease when a low pressure system was low in the Gulf during the "cyclone season".

[25] The Thompson Clarke report raised for consideration the alternative of remaining alongside the wharf. It did not observe that this alternative appeared to be precluded by the Port of Karumba Cyclone Contingency Plan. Instead, it noted the absence of this alternative in the ship's cyclone procedure and posed the question: "

> "… While going to sea during the approach of a cyclone is a conventional and safe approach taken by large vessels in port, an

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17 Mr Clarke; T.870.

> issue is whether this option is applicable and safe for the WUNMA?"[18]

[26] It then noted the following operating characteristics of the ship that were said to be relevant to decisions to be made when cyclones are approaching:

> "The WUNMA is a shallow draft vessel especially in the ballast condition.
> She has very high sides and is extremely sensitive to wind effects.
> The canopy covering the well deck appears to be fragile.
> She has very limited power – only 3 x 780Kw or 2,340Kw in total.
> Her maximum speed in good sea conditions is about 10 – 11 knots.
> There is limited freeboard and non watertight openings around the stern ramp.
> She carries a very small crew – many of whom currently lack basic training or who are inexperienced.
> All the crew are located right forward – an uncomfortable location in rough seas."[19]

[27] The review then posed a series of questions that arose as a result of the ship having those characteristics. They included the following:

> "What height of waves might be experienced in and around Karumba?
> Partial or total destruction of the canopy by wind, sea or unsecured objects?
> What objects might become unsecured? Boats? Loading boom? Safety rails? Other internal damage of canopy covering by wind through openings at stern or on top of canopy?
> Ingress water into well deck over the stern?
> Ingress of rain into well deck?
> Ability, or otherwise, to rid well deck of water?
> Free surface effect of water in well deck and effect on stability?
> Is tank capacity for excessive rain water adequate? Overflow arrangements?
> Ability or otherwise to control the vessel in high seas given likelihood of reduced power available to avoid engine racing (ie propellers coming out of the water)?
> Have some of the crew ability and knowledge and experience to hand cyclones at sea."[20]
>
> (Emphasis added)

[28] The Thompson Clarke Review described the course of action contained in the SQS as "a set of standard generic solutions". It recommended:

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18 *Ibid* Attachment C, p.4.
19 *Ibid* Attachment C, p.4.
20 *Ibid* Attachment C, p.4.

> "… Given the limited locality of WUNMA's operations and with considerable meteorological data available, it is considered that a risk assessment should be carried out to establish the level of risks involved under alternative scenarios by considering the factors outlined above (together with any other factors) and a risk minimization strategy drawn up. The objective is to ensure that WUNMA as a critical asset is best protected, that potential damage to the vessel can be avoided and that continuity of operations can be resumed as soon as the cyclone passes."[21]

[29] The Thompson Clarke Review advised that the risk assessment be undertaken "as a matter of urgency":

> "It is important that Zinifex should be prepared in advance of a cyclone and that any potential for confusion in the procedures is eliminated. As the cyclone season is fast approaching, it is considered that the preparation of a risk assessment and risk management strategy be undertaken as a matter of urgency involving all parties notably the Ships Masters and Assistant Masters, Zinifex, INCO, Ports Corporation of Queensland, Queensland Transport and others as necessary such as the vessel designers."[22]

[30] Finally, the Thompson Clarke Review pointed to a longer term solution:

> "For the longer term, it may be worth exploring the potential of laying a cyclone mooring buoy in the Norman River or alternatively for'd and aft cyclone moorings in the river. This option would be the closest and probably the most protected location and would also minimize any lead times required by other alternatives."[23]

[31] The suggestion that a cyclone mooring buoy in the Norman River be explored was precisely the suggestion made by Captain Alan Boath on 14 July 2004 when representatives of the ship's managers and owners raised the issue of discontinuing the cyclone mooring buoy at Sweers Island. It will be recalled that Captain Boath advised in July 2004 that there was a problem with the ship having no cyclone moorings. The record of the meeting with him was:

> "He feels the best solution is for Zinifex to have a mooring in the Norman River, a discharging system at the wharf to cater for those times when the Wunma may be caught with product on board when a cyclone is approaching, and procedures in place to move to the mooring in the river."[24]

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21 *Ibid* Attachment C, p.5.
22 *Ibid* Attachment C, p.5.
23 *Ibid* Attachment C, p.5.
24 Exhibit 41, CB77.

[32] Captain Boath's advice in July 2004 was not exactly what Zinifex wanted at the time. It chose not to follow it. More than three years later Thompson Clarke were giving Zinifex the same advice.

[33] But apart from this advice concerning a long term solution, the Thompson Clarke Report suggested that a risk assessment and risk management strategy be undertaken as a matter of urgency. The reasons for that urgent review were apparent from the questions which were posed concerning, amongst other things, the ingress of rain into the well deck, the ingress of seawater into the well deck over the stern and the ability of the ship to rid the well deck of water.

[34] The element of urgency injected at page 5 of Attachment C to the Thompson Clarke Report was not included in the Executive Summary to the report on the separate, short discussion of cyclone preparedness at paragraph 6.1.10. However, Mr Mewett gave evidence that he read the entire report and the annexures.[25] He explained that the issue of cyclone preparedness was one component of perhaps 30 or 40 issues that needed to be addressed.[26] The issue of cyclone preparedness was not elevated above other matters in the report and Mr Mewett had numerous discussions with the author of the report, Mr Richard Clarke. Issues of churn rate and other issues over labour were more of a concern and occupied a large part of their discussions.[27] The cyclone preparedness issue was "one amongst quite a few that had been elevated to high priority".[28]

[35] On the issue of cyclone preparedness, Mr Mewett gave evidence that in terms of timing, Zinifex tackled the issue with Inco as soon as it practically could and that, unfortunately, it ran out of time.[29] In addition, he explained that the issue of cyclone preparedness was not something that was going to be resolved in a couple of months.[30] That certainly is true in connection with the kind of study that Zinifex subsequently engaged the Australian Maritime College to undertake. If, for instance, Zinifex in December 2006 had engaged the Australian Maritime College to undertake a study, it would not have been prepared prior to the marine incident. It

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25 Mr Mewett; T.418.
26 Mr Mewett; T.382.
27 Mr Mewett; T.418.
28 Mr Mewett; T.418.
29 Mr Mewett; T.382.
30 Mr Mewett; T.382.

also is unlikely that any kind of comprehensive risk assessment could have been undertaken over December 2006 and January 2007 if it was to involve, all the parties suggested by Thompson Clarke, including Masters, Zinifex, Inco, the Ports Corporation of Queensland, Queensland Transport and other necessary parties, such as the vessel's designers. However, some risk minimisation strategies could have been developed in the meantime. For instance, the Thompson Clarke Review reported on the risk of the ship being caught with a full cargo on board during the approach of a cyclone, and that the issue of at what time cargo operations should be suspended was not addressed in the ship's operating procedures. That matter could, and should, have been addressed as a matter of urgency in December 2006 and January 2007. It was not.

[36] It is possible to envisage steps that could have been taken after the receipt of the Thompson Clarke Report and prior to the incident, such as a procedure to ensure that the ship was not loaded if a low pressure system was in the Gulf during the cyclone season, and the provision of additional, pumping facilities to discharge water in the well deck in an emergency situation.

[37] In the circumstances that prevailed in January 2007, as explained by Mr Mewett, it was not unreasonable for Zinifex to refer the Thompson Clarke Report to Inco to address and to expect it to respond to the matters raised, including cyclone preparedness. Unfortunately, Inco did not take any interim measures prior to the incident to address the issues raised by the Thompson Clarke Operational Review in relation to loading conditions and the operation of the water management system in cyclonic conditions.

[38] The matter should have been addressed by Inco as managers of the ship in the first instance, and, failing that, by Zinifex itself. Inco were asked to comment on the Thompson Clarke Report.[31] But the meeting in mid-January did not address the cyclone issue. Inco prepared a seven page document which addressed the following topics:

> "1. Responsibility for the operation of the shore re-claimer and MHP systems
> 2. Employment and management of maintenance personnel

[31] Mr Mewett; T.419.

3. Crew issues
4. Vessel capacity to load 5000 tonnes
5. Vessel design
6. Commercial management to ensure Zinifex receive the most effective result for the operational budgets agreed."

The document was not provided to Zinifex, but was the basis for discussions between Inco and Zinifex at the January 2007 meeting.[32] Inco's written response did not address the issue of cyclone preparedness raised by the Thompson Clarke Report. Inco's written response acknowledged that the Thompson Clarke Report "does highlight some of the operational issues that need to be reviewed. However there are a number of comments and conclusions that we do not agree with". Its written response did not purport to be a detailed critique of the Thompson Clarke Report. Inco's document simply does not address Thompson Clarke's review of cyclone preparedness.

[39] Had Inco done so by addressing cyclone preparedness as a matter of urgency and considered the questions raised by Thompson Clarke about the ingress of water into the well deck of the ship in cyclonic conditions and the ability of the ship to rid herself of that water, the incident may not have happened.

[40] Inco was reasonably entitled to conclude that some aspects of the Thompson Clarke Report on cyclone procedures did not take account of recent developments in relation to the development of its new cyclone procedure. It was also entitled to reject the view of Thompson Clarke that the preferred action in the event of a cyclone be refined and determined, rather than leaving the Master with a range of alternatives. But there were important issues in the Thompson Clarke Report that arose under the current procedure, and which warranted attention and response.

[41] The Thompson Clarke Operational Review provided an opportunity for Inco and Zinifex to address both short term and long term issues in relation to cyclone preparedness. It was unlikely that long term solutions could be devised and implemented prior to the incident. But short term solutions were required as a matter or urgency. These included:

(a) improving procedures to ensure that the ship was not caught with a full cargo on board during the approach of a cyclone;

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[32] Captain Dally; T.548, T.579.

(b) procedures to prevent the ingress of water into the stern well deck and to ensure that the ship had either pumping or freeing facilities to rid the well deck of water;

The issues raised and questions posed by the Thompson Clarke Review in relation to cyclone preparedness proved prophetic. The opportunity to provide at least short term solutions to these problems prior to the incident was missed.

[42] As the manager of the ship, Inco inadequately responded to the issues raised in the Thompson Clarke Operational Review about the management of water on board the ship in cyclonic conditions, knowing what it did about the shortcomings of the water management system. Cyclone preparedness was one of many issues raised by the Thompson Clarke Review. But it was not addressed even in passing in Inco's written response, and there is no evidence that the concerns raised by Thompson Clarke about the management of water in a cyclone were referred to Inco's then Operations Manager or the Fleet Technical Manager for response, including recommendations to better manage water on the well deck if the ship went into open waters to avoid a cyclone.

[43] In January 2007 and prior to the incident, Inco simply did not address the substance of the issue that was raised in the Thompson Clarke Report about the risk of the ship being caught in a loaded condition. It simply did not address the pointed questions raised by Thompson Clarke about the ingress of seawater into the well deck over the stern, the ingress of rainwater into well deck and the ability, or otherwise, of the ship to rid the well deck of water. Captain Dally said that when he read these points he formed the view that when there was torrential rain the ship could pump water ashore.[33] But, of course, that was not an option in a cyclone. He thought that if it became a safety issue, then "they could release it".[34] He "felt the vessel could deal with it".[35] But he had no evidence or analysis to support that feeling. Inquiry into the operation of the water management system by him or other Inco management would have revealed that the design and operation of the water management system, particularly the constant blocking of side deck drains and valves with concentrate,

33 Captain Dally; T.549.
34 *Ibid*
35 *Ibid*

did not permit the ship to rid the well deck of the water that would accumulate in a cyclone.

[44] The problems with the design *and* operation of the water management system are well-summarised in Inco's Submissions in Reply to the Inquiry:

> "The evidence is overwhelming that the system as designed and built, coupled with the concentrate the vessel was engaged to transport, and the method by which it was loaded, meant that the drainage system would inevitably become blocked. Further, once a blockage was located and removed another or the same blockage would inevitably occur. Mr McDonald gave evidence that the deck drains could only be checked properly when the vessel was laid up which was two or three times a year.
>
> To place matters in perspective, the drainage system, free of blockages and with valves properly working and diverted to the sea, could not have coped with the volume of rain and sea water the Wunma experienced leading up to the incident. Most of the water falling onto the decks, canopy, or coming over the side, would find its way to the well deck. The water continually accumulating in the well deck could not possibly escape through the small sump drain even with the bung removed."[36]

[45] These problems were known to Inco at the time they received the Thompson Clarke Report and prior to the incident.

[46] The penetrating questions posed by the Thompson Clarke Report about the operation of the water management system in cyclonic conditions went unanswered by Inco in January 2007. Unfortunately, it took the voyage of the *Wunma* on 6 and 7 February to answer those questions.

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[36] Inco Submissions in Reply, 9 November 2007, paras 1.3 and 1.4

WUNMA BOARD OF INQUIRY

CHAPTER 8: LOAD LINE AND RELATED DESIGN ISSUES: THE INGRESS OF WATER AND THE MEANS TO FREE IT

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WUNMA BOARD OF INQUIRY

CHAPTER 8 LOAD LINE AND RELATED DESIGN ISSUES: THE INGRESS OF WATER AND THE MEANS TO FREE IT

8.1 INTRODUCTION

[1] The questions posed by the Thompson Clarke Operational Review in December 2006 about the design of the ship, the ingress of water into the well deck and the ability to rid the well deck of water were questions that should have been asked by others much earlier. This Chapter reviews the process by which the ship came to be registered in 1999 and its registration upgraded in 2005 without these matters being adequately addressed. This will involve discussion of some technical issues concerning the ship's load line and compliance with the *USL Code*. Any discussion of these load line and design issues should recognise certain matters.

[2] The first is the inevitable tension between the objectives of:

(a) clearing water overboard that may accumulate in the well deck in the interests of marine safety; and

(b) keeping water mixed with concentrate out of the marine environment.

[3] The second is that the resolution of that tension in terms of the ship's design occurs in an anticipated operational context. For instance, in 1997 when the ship was being designed for service between the Port of Karumba and the Roadstead, it was not anticipated that the ship would encounter seas that would cause its well deck to flood. The ship was not expected to venture into those kinds of seas because it would be impossible to safely discharge its cargo into the export ship in such conditions. In the event of a cyclone, it was anticipated that the ship would use a cyclone mooring in the Norman River.

[4] The third is that assumptions that are made at the design stage about the operation of a ship may be falsified by experience. For instance, assumptions were made that the ship's water management system would operate as a "first flush" system and that its "dirty water tanks" were adequate to collect water that would accumulate in the aft well deck. These assumptions were falsified by experience.

[5] The fourth matter is that the system of registration in 1999 permitted the ship to be registered on the basis of a Lloyd's Register certificate and a Certificate of

Compliance for Loadline from an accredited person without the registration authority itself verifying that:

(a) the ship provided a weathertight barrier to the entry of water into the well deck of the ship; and

(b) arrangements existed for the ship to rid itself of water that accumulated on that deck.

These matters were not verified by the registration authority in 2005 when it upgraded the ship's registration.

8.2 BACKGROUND

[6] As previously noted, if a commercial ship is over 24 metres in load line length then a load line certificate is required for the purpose of registration in Queensland. In addition, with the exception of fishing ships and sheltered water passenger ships, all Queensland commercial ships that are over 24 metres in length require a load line certificate to operate legally. Classification societies can issue International load line certificates on behalf of flag state administrations or a local load line certificate. A classification society load line certificate replaces the need for a load line certificate issued under the *TOMS Regulation*.[1] The *TOMS Regulation* applies the relevant parts of Section 7 of the *USL Code* to the assignment of freeboard.

[7] The provisions of *USL Code* Section 7 are based on those of the *International Convention on Load Lines*, 1966, and have the objective of ensuring the safety of the ship by:

(a) providing a weathertight barrier to the entry of water into the ship;

(b) providing adequate reserve buoyancy; and

(c) implementing arrangements for the clearance overboard of water that could accumulate on deck.

[8] The first of these objectives is set by defining as the "freeboard deck" the "uppermost complete deck, exposed to weather and sea, which has permanent means of closing all openings in the part exposed to the weather and below which all openings in the sides of the vessel are fitted with permanent means of watertight closing", but permitting a lower deck to be used.[2]

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1 *TOMS Regulation*, s.115(2)(b).

2 *USL Code*, Section 7, paras 3.22.1 to 3.22.4.

[9] Reserve buoyancy is ensured by establishing a minimum freeboard below the freeboard deck that is required to be maintained at all times.

[10] The "conditions of assignment" detail arrangements for securing the watertight integrity of the ship, such as required coaming and ventilator heights, and for clearing water that could accumulate on a deck, such as the location and area of freeing ports. Requirements are based upon whether the relevant opening is located above or below the level of the freeboard deck.

[11] Section 7 Load Lines of the *USL Code* was enacted on 4 September 1989. The 1966 *International Load Line Convention* has been amended by the Protocol of 1988 and revised by further amendments to the Protocol of 1988 (Resolution MSC.143(77)).[3] However, Section 7 Load Lines of the *USL Code* has not been amended since it was first enacted, apart from amendments in 1996 in relation to vessels under 24m in length.

8.3 HISTORY

[12] It is necessary to recap some aspects of the history of registration of the ship in Queensland, and to supplement this history with further details in relation to load line and related design issues.

[13] In September 1998 Queensland Transport contemplated that certificates would be issued by Lloyd's Register including an International Load Line Certificate.[4] On 16 February 1999 Lloyd's Register in Sydney advised Queensland Transport:

> "… it is out understanding that as the vessel is not intended for international voyages, the requirements of the International Convention on Loadlines 1966 are not applicable in this case and therefore Lloyd's Register will not be issuing the International Loadline Certificate.
>
> Consequently, **it is assumed that the vessel will be required to comply with the USL Code in respect of Loadlines** and that the Loadline Certificate will be issued by Queensland Transport **without any involvement from Lloyd's Register**."[5]
>
> (Emphasis added)

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3 IMO Resolution MSC.143(77) *Adoption of Amendments to the Protocol of 1988 relating to the International Convention on Load Lines, 1966.*

4 MSQ registration file, folio 6; Exhibit 118.

5 Exhibit 49, CB6.

[14] In June 1999 Queensland Transport was requested to make a "policy decision" in relation to a load line certificate for the ship.[6] The policy issue related to the acceptance of the concept of an "equivalent deck" for determining the freeboard to be assigned for load line purposes. The concept of an "equivalent deck" was not contained in the *USL Code* and Queensland Transport was asked whether it would accept such a concept as the registration authority that would receive the load line certificate. The policy decision was referred to the then Principal Advisor (Vessel Standards and Compliance), Mr Werner Bundschuh, who advised the Senior Naval Architect that the approach was reasonable.[7]

[15] Mr Bundschuh explained in his evidence:

> "A group of Australians, including Don Gillies, pioneered the concept of operating large ships without hatch covers to protect them from ingress of water into the cargo holds. Some of his ships were built and operated in Europe and later on some of the European countries brought the design into general use. It took a number of years for class societies to incorporate rules for the concept and it wasn't until 2005 that the International Maritime Organisation (IMO) adopted rules that allow freeboard corrections for recesses in the freeboard deck. The policy approach I applied was to assume the ship's hold is open to the sea and to then determine if the ship still meets the safety standards. If the ship meets the relevant stability and water tight integrity standards then there is no safety issue and the design may be accepted as an equivalent arrangement. In 1999 requirements regarding this approach to freeboard correction were not included in the IMO Rules or in the USL Code."[8]

[16] On 18 August 1999, Lloyd's Register advised the ship's designer ("STS") that the load line marking had been applied to vessel in the Chinese shipyard as calculated by STS and based upon the concept of an "equivalent deck".

[17] An application for registration of the ship was made in August 1999.[9] A Certificate of Registration for Class 2C issued on 25 August 1999[10] following receipt of, amongst other documents, a Certificate of Compliance for Loadline issued by STS,

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6 MSQ Registration file, folio 23; Exhibit 118.
7 Exhibit 94, Part 1, paras 26 and 59.
8 Exhibit 94, Part 1, para 50.
9 Exhibit 49, CB25 and 26.
10 Exhibit 49, CB28.

on 17 August 1999.[11] The accompanying Geometric Freeboard Calculation contained the following note:

> "The 'equivalent deck' is by distributing the side buoyant spaces above the cargo deck evenly across the width of the vessel. The freeboard deck is taken to be this equivalent deck."[12]

[18] On the 20 October 1999, the Maritime Safety Branch of Queensland Transport sought clarification from STS about the load line.[13] This request for clarification refers to the freeboard deck being at a height of 7.85 metres, notwithstanding that STS had previously prepared and submitted a Geometric Freeboard Calculation dated 18 August 1999 based on the "equivalent deck" concept that had been used as the basis for the freeboard markings that had been applied to the vessel in the shipyard in China in August 1999.[14]

[19] In response to the request for clarification STS sent a fax on 21 October 1999, explaining its calculation of freeboard and enclosing copies of its Geometric Freeboard Calculation dated 18 August 1999, a Loadline Marking Drawing and a sketch of the hypothetical deck position concept.[15] STS advised:

> "As requested Details on MV Wunma:-
>
> 1. Loadline Length – 96% of 108m = 103.68m
> 2. Freeboard Deck – hypothetical deck at 5.61m above Baseline, after redistribution of buoyancy in tanks above well deck, into cargo well.
> 3. The Deckline is the top of the well deck i.e. 4.5m + 0.01m = 4.51m above baseline.
> 4. Freeboard is 0.66m to the deckline.
> 5. The loaded draft is then 4.51 – 0.660 = 3.85m
> 6. GRT is calculated at 4868 tonnes.

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11 Exhibit 49, CB20; Exhibit 118.

12 Exhibit 49, CB21.

13 Fax dated 20 October 1999 from Werner Bundschuh to Dion Alston of ASDMAR: Exhibit 118.

14 Refer to fax dated 12 August 1999 from Lloyd's Register China to Dion Alston of STS advising that the load line markings had been verified that day as being in accordance with STS Drawing No 110MON98-L05/1.

15 Fax dated 21 October 1999 from Dion Alston of STS to Werner Bundschuh of MSQ.

> The loadline marking drawing, a sketch of the hypothetical deck position and the geometric freeboard calculation is attached for your information. I hope this helps to clarify the situation.
>
> The geometric freeboard is calculated to the theoretical deck giving a value of 1.601m, whilst the assigned freeboard of 1.764 exceeds this requirement. To the actual deck this is 0.660m, corresponding to a draft of 3.85 from the baseline, as per the stability book.
>
> The redistribution of buoyancy represents the equivalent deck of a conventional type ship to which the geometrical calculations of the USL section 7 could be applied. This approach is sound provided the stern door is watertight up to the hypothetical deck height. The cargo well is completely covered, and has an aft sump to remove liquid on deck as the vessel tends to trim by the stern. Water must displace the cargo to have any significant free surface effect. The stability with the cargo well flooded is adequate even with the large free surface experienced.
>
> A similar analysis was used on the similar ship 'Aburri', and I trust that you appreciate the principles used, especially considering the designated area of operation."

[20] The following passage from that letter assumes importance in the light of events:

> "This approach is sound provided the stern door is watertight up to the hypothetical deck height. The cargo well is completely covered, and has an aft sump to remove liquid on deck as the vessel tends to trim by the stern."

It is true that the cargo well was "completely covered" by a canopy, the purpose of which was to contain dust and to prevent rain from falling on the cargo. But in no sense was the canopy an "enclosed superstructure" in terms of load line requirements. This aspect was comprehensively addressed by an expert witness, Mr Taylor, in his report. In short, the bulkheads of the canopy were not of a structure that would comply with classification rules. The doors (referred to in the evidence as the "barn doors") at the aft end of the cargo hold were not designed to, and did not, prevent water from entering the cargo hold. In general, the canopy structure did not comply with the definition of "weathertight" in either the *USL Code* or the Lloyd's Register Rules for ships. That the canopy is not an "enclosed structure" in terms of load line requirements was accepted by other witnesses including Mr Bundschuh.[16]

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16 Exhibit 94, Part 1, para 47.

[21] The quoted passage refers to the sump removing water from the well deck. For the reasons discussed in relation to the ship's water management system, the capacity of the sump to remove large volumes of water, either into the "dirty water tanks" or through the small drain to sea, was limited.

8.4 THE USL CODE AND THE CONCEPT OF AN "EQUIVALENT DECK"

[22] Clause 3.22.1 of Section 7 of the *USL Code* states:

> "A reference to the freeboard deck of a vessel, subject to this clause, shall be read as a reference to the uppermost complete deck, exposed to the weather and sea, which has permanent means of closing all openings in the part exposed to the weather and below which all openings in the sides of the vessel are fitted with permanent means of watertight closing."

It contemplates that the freeboard deck will be a physical deck fitted with actual closing devices. Clause 3.22.2 states:

> "In the case of a vessel in which the uppermost complete deck exposed to the weather referred to in paragraph 3.22.1 is a discontinuous deck, the reference to the freeboard deck of the vessel shall be deemed to be a reference to a line of reference formed by the lowest line of that discontinuous deck and the continuation of that line parallel to the upper part of that discontinuous deck."

[23] Both these clauses refer to a deck "exposed to the weather". The canopy over the cargo space is not a weathertight[17] enclosure, and should be disregarded when seeking to determine what is the "uppermost complete deck" exposed to the weather.

[24] Lloyd's Register Rules do not appear to include a definition of an "uppermost complete deck", and there is therefore some uncertainty as to whether 'complete' in this context means a deck that extends to both sides from the bow to the stern, or is in one plane, e.g. without steps, or is a reference only to watertight integrity. Lloyd's Register Rules Part 3, Chapter 1, Section 6 Clause 6.2.1 provide the following definition:

> "The freeboard deck is normally the uppermost complete deck exposed to weather and sea, which has permanent means of closing all openings in the weather part, and below which all openings in the

[17] Weathertight is not defined in Section 7 of the *USL Code*. However Resolution MSC.143(77) introduced in Sub-regulation 3(13) a definition of weathertight as meaning "*…that in any sea conditions water will not penetrate into the ship*".

> sides of the ship are fitted with permanent means of watertight closing."

This wording is identical to that contained in the ILLC and refers to an "uppermost complete deck" deck, although neither source provides a definition of the term.

[25] The various definitions refer to an "uppermost complete deck" exposed to the weather. In this regard the well deck could be considered as the freeboard deck since it extends longitudinally. However, transversely the well deck does not extend to the sides of the vessel, but stops at the intersection with the inboard sides of the two deckhouses that form the sides of the cargo hold.

[26] On one view, the only deck on the *Wunma* that meets the above criteria in the *USL Code* and can be considered as the freeboard deck is the well deck that is 4.5 metres above the baseline and which forms the bottom of the cargo space.

[27] An alternative approach to the assignment of freeboard is that adopted by STS. STS stated in its fax of 21 October 1999 that "This approach is sound provided the stern door is watertight up to the hypothetical deck height". But this approach encounters problems when regard is had to certain features of the *Wunma*:

- Any rolling of the vessel effectively lowers the height to the top of the watertight portion of the stern door (2.16 metres above the well deck) when measured from the waterline.
- There are two openings located one each side of the stern ramp. These openings have a sill height about 2.13 metres above the well deck and are not fitted with weathertight closing devices, thus allowing the entry of heavy seas into the aft part of the cargo space.
- The doors at the aft of the cargo hold are not watertight, so water can readily flow into the main cargo space.
- The construction of the canopy structure enclosing the cargo space is not weathertight to marine standards. Therefore the canopy cannot be considered to be a fully enclosed superstructure in terms of the *USL Code.*
- The capacity of the aft sump and associated piping, tanks and pumps is probably adequate for collecting and removing leachate from the cargo or wash-down water, but is not adequate to quickly clear away any water from heavy seas entering the aft end of the vessel.

[28] The ILLC 1966 (reflected in Section 7 of the *USL Code*) is based upon a conventional ship configuration that was common when the convention and the earlier 1930 Load Line Convention were first formulated; typically a vessel with two or three "islands" or superstructures, eg foc's'le, bridge and poop. Much of the terminology in the ILLC reflects these origins and, in the case of more recent non-standard ship designs, has prompted the need for amendments to the ILLC[18] and numerous IACS[19] Unified Interpretations.[20] These interpretations may offer possible ways of considering the configuration on the *Wunma*, but they are not part of the existing Section 7 of the *USL Code*.

[29] Section 7 of the *USL Code* provides a means for calculating a credit for any enclosed superstructure on the freeboard deck provided the superstructure meets the definition of in Clause 3.23.1 which defines a superstructure as:

> "extending from side to side of the vessel or with the side plating of the structure not being inboard of the shell plating by more than 4 per cent of the breadth of the vessel."

The two separate houses along the sides of the well deck on the *Wunma* do not fit within this definition. But, an allowance could be calculated based on the well deck being the freeboard deck, taking account of the enclosed houses along both sides of the well deck.

[30] The alternative approach adopted in the "equivalent deck" concept essentially treats the side deck as the freeboard deck, and makes adjustments downwards to take account of the well. This approach treats the well as, in effect, a recess, in the freeboard deck. If account was not taken of it, the assigned load line would be too high on the ship's side, allowing the ship to be loaded more deeply than was safe.[21] The approach adopted by the "accredited person", and accepted as a matter of policy by Queensland Transport, was to calculate the loss of equivalent volume represented by the cargo hold, reducing the actual deck height taken to be the freeboard deck from 7.85 metres to an "equivalent deck" height of 5.61 metres. If it is permissible to regard the side deck as the "freeboard deck" then this approach can be said to

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18 The Protocol of 1988 relating to the ILLC and the revised protocol of 1988 (IMO Resolution MSC.143(77).

19 IACS – The International Association of Classification Societies.

20 There are currently about seventy two individual Interpretations of the ILLC, 1966 published by IACS.

increase the assigned freeboard, reduce the maximum loaded draft and, overall, increase the safety of the ship over that provided by a calculation that adopted the side deck as the "freeboard deck". However, for the reasons given by Mr Taylor in his report, there are good reasons to not treat the side deck as the "freeboard deck" within the *USL Code* definition.

[31] In any event, in June 1999 Queensland Transport was requested to make a "policy decision" in relation to the adoption of an "equivalent deck" concept. Mr Bundschuh considered that the approach was reasonable. He explained this in his evidence to the Inquiry:

> "In my mind this method is not a failure to comply with the USL Code; the ship could have been assigned a freeboard using the USL Code with all conditions of assignment complied with; but this would have resulted in an unseaworthy ship if fully loaded. Rather, by adopting the 'equivalent deck' method, the accredited person filled a lacuna in the Code for this type of ship; a lacuna that I note has since been filled in the International Convention in a very similar way to that adopted for this ship. Consequently, no exemption from the Code was sought, granted or even required."[22]

[32] In simple terms, one approach works from the "bottom up": it takes the well deck to be the freeboard deck, and makes adjustments upwards on account of the deck houses. The other approach works from the "top down": it starts with the side deck as being the freeboard deck, and adjusts down to take account of the "recess" constituted by the cargo hold . Each converges on a similar load line.

[33] In summary, the term "equivalent" deck is not used in the *USL Code,* yet, as a result of a policy decision by Queensland Transport in 1999, it was accepted in the freeboard calculations for load line purposes. As Mr John Kernaghan, a naval architect with over 40 years experience in the marine industries, stated in an expert report, although not specifically addressed in the rules, there is a "logical case" to be made for such a concept. However Mr Kernaghan stated:

> "This however needs to be fully supported by comprehensive submissions such that the full implication of using this dispensation are realised and the vessel and operating procedures can be set accordingly."[23]

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21 Statement of Werner Bundschuh, Part 4; letter 19.8.07; Exhibit 94, para 1.6.

22 Exhibit 94, Part 4, letter 19.8.07 to the Inquiry, para 1.9.

23 Exhibit 109, p.23.

[34] Another expert witness, Mr Graham Taylor, a naval architect with 35 years experience, observed:

> "…given the relatively few vessels under MSQ jurisdiction that have been assigned load lines, I consider that a more appropriate approach would have been for MSQ to have insisted on a conventional application of Section 7 of the USL Code or, if that proved unsatisfactory, sought guidance from LR on the correct approach to adopt for what is a vessel whose design differs markedly from that of a conventional vessel on which the original ILLC, and the USL code had been predicated.
>
> LR is one of the largest classification societies with a major portion of the world fleet and therefore vast experience in the application and interpretation of the ILLC and its amendments. This approach of seeking guidance from LR would also have been reasonable given that MSQ had originally anticipated that LR would be issuing a Load Line certificate to the vessel."

[35] Mr Kernaghan observed in this context that Lloyd's Register passed the responsibility to MSQ when it indicated that it expected a load line certificate to be issued by Queensland Transport without any involvement from Lloyd's Register:

> "It would appear that in 1999 there was reluctance by all involved to take responsibility for the use of the 'equivalent deck'. MSQ was the last in the line and had no-one left to pass it to."

Both experts also remarked on the fact that MSQ could have sought guidance from AMSA, which represents Australia at the IMO.

8.5 IMPLICATIONS OF ADOPTING THE "EQUIVALENT DECK" APPROACH

[36] The adoption of the "equivalent deck" approach required consideration of its implications in two major respects:

(a) The first was arrangements to free water.

(b) The second was to have regard to the terms and intent of *USL Code* Section 7 in providing a watertight barrier to the entry of water, and specific regard to the standard of watertight protection required by *USL Code* Section 7 for the emergency generator room, including its radiator vent. The extent of protection of spaces below the 7.85m side deck varied between "watertight" and "weathertight" according to whether the side deck or the well deck was nominated as the freeboard deck.

8.6 ARRANGEMENTS TO FREE AND DRAIN WATER

[37] IMO Resolution MSC.143(77) that was adopted by IMO on 5th June 2003, and entered force internationally on 1 January 2005. It allows freeboard corrections for recesses in the freeboard beck. In 1999 it was not included in the IMO Rules or in the *USL Code*. Nevertheless, reliance was placed upon it by Mr Bundschuh in his evidence as supporting the policy decision taken in 1999 to accept the "equivalent deck" concept. However, the recess constituted by the cargo hold on the *Wunma* is by definition in Regulation 3 (15) of Resolution MSC.143(77) a well:

> "A well is any area on the deck exposed to the weather, where water may be entrapped. Wells are considered to be deck areas bounded on two or more sides by deck structures."

[38] This gives rise to a need to meet the criteria in Clause 22 (Freeing Ports) of Section 7 of the *USL Code.* This clause defines the need for freeing ports and the methods for calculating the size and disposition of freeing ports on a vessel.

[39] The intent of the requirements for freeing ports in Clause 22 the *USL Code* is similar to that of the ILLC, namely to require freeing ports in any space where water may be entrapped. Clause 22.1 of the *USL Code* Section 7 states that a "well" shall have:

> "adequate provision……for rapidly freeing and draining the decks of water."

[40] *USL Code* Section 7 Clause 22.2 states that:

> "For the purposes of this clause, adequate provision for rapidly freeing and draining the freeboard deck of water shall be deemed not to have been made unless there is provided on each side of the vessel in each well on that deck:
>
> (a) a minimum freeing port area ascertained in accordance with the next seven succeeding sub-clause: or
>
> (b) if the assigning authority so directs a greater minimum freeing port area in respect of the vessel on the grounds that the minimum freeing port area so ascertained would be insufficient – a minimum freeing port area equal to the area so directed."

[41] Clause 22.12 states specifically:

"In vessels having superstructures which are open at either or both ends, adequate provision for freeing the space within those superstructures shall be provided."

[42] It is helpful to quote the conclusion of Mr Taylor as to whether the arrangements of the aft well deck met the requirements of Section 7 of the *USL Code* in relation to freeing water:

"127. The access way on the *MV Wunma* is, because of the openings in the transverse bulkhead in way of the transom a *well* that should be provided with freeing ports in accordance with the requirements of Section 7 Clause 22 *Freeing Ports* of the USL Code, or other adequate alternate means provided to effectively clear this *well* of the water that might enter as a result of heavy seas. The fact that rainwater collected from the canopy can also accumulate in the *well-deck* reinforces the need for adequate freeing and drainage arrangements.

128. The fact that rainwater drainage is not collected by a closed system but flows along the *side-deck* inside the dust-cover enclosure on the port side, and possibly through the additional scuppers into the cargo hold, potentially compromises the safety of the vessel and its cargo.

129. The height of the sill of each side opening in the aft transverse bulkhead is 2.13 metres above the well-deck and the watertightness of the stern ramp up to a height of 2.16 m effectively creates and defines the size of the *well*. At the same time the height of sills above the *well-deck* means they cannot be considered as freeing ports since they fail to meet the requirement in Clause 22.13 of Section 7 of the USL Code that states that the lower edge of freeing port openings to be as near as practicable to the deck.

130. The absence of any effective barrier to the flow of water in the access way moving forward into the main hold means that the whole of the cargo hold effectively becomes a *well* that needs to be adequately drained.

131. The entry of water into the hold will cause any zinc or lead concentrate cargo stored in the hold to exceed its TML (Transportable Moisture Limit) which, in conjunction with the movement of the vessel, will progressively liquefy the cargo with consequences for the vessel's stability due to the free surface created and the impact of sloshing loads on the structure.

132. Although there is a canopy over the cargo hold it does not meet the requirements of a weathertight enclosure as required by the USL Code and therefore the whole of the cargo hold should be considered as a *well*.

133. The waste water drainage system may be adequate for the handing of leachate from the cargo and wash down water from hold cleaning operation. However, it is extremely doubtful that it could adequately handle the additional rain water collected from the canopy roof and open decks or the water that may enter through the openings in the transom.

134. The type of vessel and the cargoes carried means that maintaining all the scuppers clear of cargo residue is difficult and there is likelihood that they may not be available when needed to clear large quantities of water.

135. The *Dust Control Waste Water System* cannot therefore be considered as a substitute for the provision of freeing ports to clear water from the access way *well*, as contemplated in Section 7 of the USL Code.

136. The *purpose* of freeing ports, their size and location is to ensure that entrapped water readily flows overboard. Conversely the waste water drainage system relies on a combination of gravity and pumping to transfer water.

137. Reliance on a system that requires activation of valves and pumping to clear accumulated water is contrary to the intent of freeing ports that do not require human intervention. Also on a vessel such as the *MV Wunma* cargo residue can accumulate throughout the vessel, raising the possibility of blockages and failure of valves to operate correctly."

[43] These views were generally supported by Mr Kernaghan, who stated that the intent of the *USL Code* is clear: a well is any space where water might accumulate, and that the accumulation of water in passageways should be minimised by freeing ports. Mr Kernaghan agreed that the waste water system was not a substitute for the provision of freeing ports to clear water, and that there should be adequate drainage that does not rely on mechanical means.[24]

[44] In summary, one important implication of the recognition of the cargo hold as a recess or well in the freeboard deck is the need to adequately drain it.

8.7 EMERGENCY GENERATOR ROOM ARRANGEMENTS

[45] At the aft end of the *Wunma* there are deckhouses on the port and starboard quarters, including one on the starboard side that houses the emergency generator room. A radiator for cooling the emergency generator is located in way of a vent opening. The height of the sill of this vent is about 600 mm above the aft intermediate deck

on which the emergency generator room is situated ie 5.50 metres above the baseline. There is no closing device fitted to this opening.

[46] The first aspect concerning compliance with the *USL Code* and Lloyd's Rules is the ventilation arrangements, and the position of a radiator vent. The Board adopts the evidence of Mr Taylor, with whom Mr Kernaghan agreed, that the radiator vent does not meet the relevant requirements of Sections 7 and 9 of the *USL Code*. The Board notes that the hull and machinery was certified by Lloyd's Register as complying with its rules, rather than the *USL Code*, but reference to the *USL Code* is apposite in connection with design issues that relate to load line issues, since Lloyd's Register and others anticipated that the ship would be required to comply with the *USL Code* in respect of load lines.

[47] Mr Taylor's evidence on this matter was as follows:

> "195. Clause 29.6.2 of Section 9 of the *USL Code* states that:
>
> > 'An emergency generator shall be installed in a space affording protection from the weather and such space shall be adequately ventilated to allow the generator to operate at full power.'
>
> 196. Clause 3.21 of Section 7 of the USL Code categorises openings (in the ship's decks and other structures) as being of two types for the purposes of determining the standard of sill heights and weathertight closures required. The more severe of these (Position 1) relates to the freeboard deck, raised quarter deck and all exposed superstructure decks in the forward quarter of the ship's length. Other openings on exposed superstructure decks are categorized as Position 2.
>
> 197. The ventilation openings of the Emergency Generator Room are required to be able to remain open in all weather and sea conditions, they are required by USL 7.17.6 to have coaming heights (above the deck on which they are situated) of at least 4.5 metres if in Position 1 and 2.3 metres for Position 2.
>
> 198. Whilst the deck on which the Emergency Generator Room is situated may strictly come within the definition of Position 1, in my view the protected location of the radiator ventilator opening should result in some reduction of requirements, and the Position 2 height of 2.3 metres should therefore be applied.

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[24] Exhibit 109, p.27.

199. The radiator vent does not meet these requirements.

200. Incidentally, the same considerations outlined in the previous two paragraphs apply to the main Engine Room Ventilation openings, save that the openings would be in Position 1.

201. The arrangement of the radiator vent gives rise to a basic inconsistency in the arrangement of the emergency generator room, namely that access to the room from the alcove is through a watertight door yet just around the corner in the recess there is the vent which is not fitted with any means of closing.

202. Consistent with the foregoing, LR surveyor L. Porrett conducted a survey after the incident of the *MV Wunma* on the 17th February 2007 and issued an Interim Certificate which included a number of Conditions of Class. Included in those conditions was a requirement due by 05/07 (May 2007) that:

> 'Emergency Generator radiator intake to be modified by fitting steel trunking incorporated into natural vent approx 1m to port of current location thereby raising water ingress height 2.5m above current location. Plans of modification to be submitted for approval prior to commencement of work.'"

[48] The second issue is the location of the Emergency Generator Room. In that regard Mr Taylor concluded:

> "The location of the Emergency Generator Room would meet the requirements of the USL Code and Lloyds' Rules if the well-deck is treated as the '*uppermost continuous deck*'. But if the side deck at 7.85 metres above baseline were considered to be the '*uppermost continuous deck*', the arrangement of the Emergency Generator Room would fail to meet the requirement of the USL code and LR Rules that it be located above the '*uppermost continuous deck*'."

[49] His reasons for these conclusions are as follows:

> "207. Clause 29 of Part 4 of the USL Code refers to the Emergency Electrical Installation. The required position for the Emergency Generator Room is set by USL clause 9.29.2.1, which states:
>
> > 'The emergency source of power including any fuel supply shall be situated outside the propulsion machinery casing, not forward of the collision bulkhead and be above the uppermost continuous deck.'

208. In Section 3 of LR Rules, *Emergency source of electrical power* of Part 6, Chapter 2, Clause 3.2.2, refers to the location of the emergency source of power in similar terms to that in the USL Code, namely:

> 'The emergency source of electrical power, associated transforming equipment, if any, transitional source of emergency power, emergency switchboard and emergency lighting switchboard are to be located above the uppermost continuous deck and be readily accessible from the open deck.'

209. Both the USL Code and the LR Rules raise the question of which is the 'uppermost continuous deck'? Is it the *well-deck* located 4.50 metres above the baseline or the *side deck* that is 7.85 metres above the baseline?

210. If the latter case applies, then the arrangement of the emergency generator is contrary to the requirements of the USL Code.

211. Since the *MV Wunma* is classed with LR, I believe that they would, when approving the design and surveying the construction of the vessel, have applied their own Rules.[25] On that basis, I infer that LR treated the well-deck as the 'uppermost continuous deck', so that the location of the Emergency Generator Room complied with their rules."

[50] Mr Kernaghan agreed with these observations, and noted that an Emergency generator room is normally well above the waterline.

8.8 THE RELEVANCE OF THESE MATTERS TO THE INCIDENT AND THE INGRESS OF WATER INTO THE EMERGENCY GENERATOR ROOM

[51] During cyclonic conditions, a large volume of rainwater is likely to collect in the well deck from drains and deck scuppers that is in excess of the capacity of the dust control waste water drainage system to clear.

[52] Because the two openings side of the stern ramp are not provided with any means of closing, during heavy seas or storms, sea water could pass through these openings into the ship and pass into the vicinity of the Emergency Generator Room.

[53] Also, depending on the severity of the storm and heavy seas, additional water could enter the vessel via the upper part of the opening in way of the stern ramp that is not

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25 Lloyd's Register *Rules and Regulations for the Classification of Ships.*

fully closed when the ramp is stowed in the at sea condition. This water would also flow into the well deck.

[54] This area is effectively a well without any freeing ports or other alternative means of adequately draining the space during storm and cyclonic conditions. Thus any water that accumulates in this well (whether sea water, rainwater or a combination of both) cannot escape other than to flow forward past the swing doors into the cargo hold.

[55] Mr Taylor concluded:

> "188. In my opinion the failure to recognise that the access way was a *well*, and therefore of the need to provide freeing ports in accordance with the requirements of the USL Code, contributed to the situation where significant quantities of water could accumulate in the *well* exacerbated a situation when water also entered the vessel through the openings in the transom bulkhead.
>
> 189. The arrangements for handling the run-off of rainwater from the canopy, in particular the provision to direct the water into the *Dust Control Waste Water System*, failed to adequately consider that this system would not be able to handle the additional quantities of water resulting from high rainfall during a cyclonic event.
>
> 190. The *Dust Control Waste Water System* relies upon manual intervention, e.g. operation of valves and a pump contrary to the philosophy of freeing ports that by their size and location allow for the natural drainage of a *well*.
>
> 191. The openings in the transom bulkhead that were not fitted with any means of closing meant that large quantities of water could enter the vessel. The location of these openings in way of the alcoves, in particular on the starboard side where the alcove is adjacent to the emergency generator room would, during storm and heavy sea conditions, allow water to enter the vessel in proximity to the emergency generator room.
>
> 192. The absence of appropriately sized freeing ports in the aft well deck or other appropriate means to efficiently remove water that did enter the vessel as required by the USL Code could have contributed to the ingress of water into the Emergency Generator Room, and ultimately to the ship being entirely blacked out."

[56] Mr Kernaghan commented on these conclusions. In respect of the opinion expressed in paragraph 188 of Mr Taylor's report, Mr Kernaghan observed:

> "I would generally agree with this statement, there does seem to be an issue regarding the freeing ports, although as stated previously the designer would expect the vessel to be operated in a suitable manner, and not have large amounts of water hitting the aft end on a regular basis. I would also have expected that there should have been procedures in place (by sea drains and scuppers etc) to ensure that water was expelled from the vessel before accumulating in the well deck area."[26]

[57] In relation to paragraph 192 of Mr Taylor's report, Mr Kernaghan agreed that the design of the ship should have prevented water entering the Emergency Generator Room. He observed:

> "However, the blackout was caused by having the switchboard in the EGR, if this was placed in another (higher) location the incident may not have happened."[27]

8.9 THE TAYLOR REPORT

[58] Mr Taylor was asked by the Inquiry to address:

(a) the Certification for Loadline of the *Wunma*, particularly compliance with Section 7 of the *USL Code* in respect of water-freeing facilities;

(b) the relevance of these matters to the ingress of water into the Emergency Generator Room;

(c) whether the arrangements for the Emergency Generator Room met with the requirements of the *USL Code* and Lloyd's Register Rules.

[59] Some passages of Mr Taylor's report have been quoted above in the course of discussing a number of discrete issues. It is appropriate to set out the conclusions to his report:

> "1. In Section 7 of the *USL Code* freeboard calculations are by reference to the freeboard deck, as defined in Clause 3.22.1. This is a reference to:
>
> > '… the uppermost complete deck, exposed to the weather and sea, *which has permanent means of closing* all *openings in the part exposed to the weather and below which all openings in the sides of the vessel are fitted with permanent means of watertight closing.*'

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[26] Exhibit 109, p.28.
[27] Exhibit 109, p.28.

2. The term ‘equivalent deck’ is not used in the *USL Code* or in the ILLC. Yet it was a concept used in freeboard calculations that were submitted in respect of a Load Line Certificates, and was the basis for the original registration of the *MV Wunma*.

3. The canopy enclosing the cargo space in not an ‘enclosed superstructure’ as defined in Section 7 of the *USL Code*.

4. There was a failure to recognise that the access way was a *well* and therefore of the need to provide freeing ports.

5. Irrespective of the methodology applied to the vessel, there were requirements relating to freeing ports contained in the *USL Code* and the ILLC, that were not met in the design of the *MV Wunma*. In particular, adequate provision was required for rapidly freeing and draining water from the aft well deck.

6. The absence of any barrier that would prevent water that had accumulated in the access way *well* from flowing forward into the main cargo hold introduced a risk that the water would enter the cargo hold.

7. The provision to collect and retain rainwater from the canopy and the decks to avoid water contaminated with cargo residue going overboard unduly relied on using the *Dust Control Waste Water Drainage System.*

8. The *Dust Control Waste Water Drainage System* is not a substitute for the provision of freeing ports to clear the large quantities of water that can accumulate in the well deck aft and failed to adequately consider that this system would not be able to handle the additional quantities of water resulting from high rainfall during a cyclonic event.

9. In heavy seas and storm conditions the absence of closing devices on the two openings located each side of the stern ramp would allow large quantities of water to enter the vessel. In addition, the fact that the stern ramp opening is only watertight up to a height of about 2.16 metres above the well deck means that large seas could also enter the vessel through the upper portion of the stern ramp opening.

10. The absence of appropriately sized freeing port allows for the accumulation of rainwater and seawater during cyclonic conditions in the aft well deck in proximity to the Emergency Generator Room.

11. The Emergency Generator Room radiator vent does not meet the relevant requirements Sections 7 and 9 of the *USL Code*.

12. The location of the Emergency Generator Room would meet the requirements of the *USL Code* and Lloyd's Rules if the well deck is treated as the *"uppermost continuous deck"*.

13. The accumulation of water on the aft deck during cyclonic conditions due to the absence of appropriately sized freeing ports, and the location of the Emergency Generator Room radiator vent at an inadequate height above the well deck, permits the ingress of water into the Emergency Generator Room with severe consequences for the ship's operation."

8.10 THE KERNAGHAN REPORT

[60] Mr Kernaghan was engaged by the solicitors for Zinifex. Some passages of his report have already been quoted in connection with certain specific load line issues. However, Mr Kernaghan's report extended to a broader review of the design of the ship. Mr Kernaghan observed that for certain standard vessels there are "standard designs". But for designs such as the *Wunma*, where there are unique and very specific requirements in their trade, a design must be developed to satisfy specific requirements. These "specialist ships" are designed to well-established principles so that, as built, they can operate well within appropriate safety parameters. But to a large extent their successful operation depends upon appropriate operating procedures.[28] In design terms, the *Wunma* differs from a traditional bulk carrier design which has a totally enclosed cargo hold with watertight transfers, transverse bulkheads and cargo hatches. A traditional bulk carrier would have resulted in a relatively long cargo load and discharge times. To achieve the loading rates required of the *Wunma* an "open deck" vessel was designed with its main/cargo deck just above the design water line. The application of the provisions of the *USL Code* that are applicable to other vessels, if applied to the *Wunma*, would have reduced her cargo capacity. In general terms the assignment of a deeper allowable draft for vessels such as the *Wunma* assumes that she will not encounter seas that will be such that waves can cause flooding in the cargo deck. As Mr Kernaghan stated:

> "In operational terms this is achieved by either restricting such a vessel to waters, such as the Gulf of Carpentaria, that do not have storms for most of the year, where ingress of water would not be possible, or alternatively having the vessel powered such that they can avoid the extreme environmental events such as cyclones."[29]

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28 Exhibit 109, para 3.1.4.

29 Exhibit 109, para 3.2.3, p.11.

[61] Mr Kernaghan noted that MSQ required written evidence from Lloyd's Register at the time of the registration upgrade in 2005 that structurally the ship could perform beyond coastal voyages. However, as Mr Kernaghan observed:

> "For this to be effective the vessel must set sail well in advance of any cyclonic conditions such that it can clear the storms in a timely manner."

[62] In respect of load line issues, as already noted, Mr Kernaghan generally supported the use of the "equivalent deck" method of assignment for the load line as an acceptable approach from the design context. However, his support for such approach depended upon operational constraints on the vessel being set for its intended service within the Gulf of Carpentaria and that "suitable arrangements were in place for the vessel during severe weather events such as cyclones".[30] Whilst Mr Kernaghan generally supported the "equivalent deck" method, he agreed with Mr Taylor that a more rigorous approach to the matter was required by MSQ and would have expected other qualified agencies to have been consulted.[31] For instance, the issue of using an "equivalent deck" for the assignment of freeboard raised issues concerning the position of the Emergency Generator Room. If the uppermost continuous (freeboard) deck is set as the side deck and not the well deck, then the Emergency Generator Room should be positioned above the side deck and not below the deck as is the case of the *Wunma*.[32]

[63] Consistent with his approach to the link between design parameters and operating conditions, Mr Kernaghan concluded that a full analysis of the capabilities of the vessel in cyclonic conditions was required before it was permitted to proceed into cyclonic conditions with a full load. According to Mr Kernaghan:

> "Such an analysis would include considerations such as:
>
> - the ability of the vessel to expel water landing on the canopy and other parts of the vessel
> - the ability to expel water from the well deck;
> - the ability of the vessel to handle cyclonic seas in the Gulf of Carpentaria; and

30 Exhibit 109, para 3.6.6.
31 Exhibit 109, para 6.2.1.
32 Exhibit 109, para 6.2.2.

- a consideration of the above in loaded, partially loaded and unloaded conditions."[33]

[64] In connection with the ingress of water and its collection in the cargo hold and aft well deck, Mr Kernaghan stated:

> "One would have assumed that the vessel's operating procedures should be such that the deck drains be turned to the sea so as to ensure that the water coming off the canopy and the deck was diverted to the sea and not into the well deck. This along with the release of water via the sump drain and the use of pumps from that area should have been sufficient to expel water to prevent flooding to the extent that water would breach the Emergency Generator Room. This assumes that the rainfall is not so heavy as to totally overwhelm the ability to expel water by the above methods and that the above systems are operational."[34]

[65] Mr Kernaghan's report made recommendations in relation to the design and operation of the vessel. It is appropriate, at this point, to record that Mr Kernaghan recommended a full risk assessment of the operation of the ship:

> "A full Risk Assessment of the operations of the "WUNMA" should be conducted. All present Masters and all those involved with "WUNMA" operations should be involved in the assessment procedure and play a full part in the development of mitigation strategies. The Risk Assessment should be undertaken by specialist independent consultants and cover the full operations of the "WUNMA" from loading the cargo through to offloading at export vessel and return to port. This Risk Assessment should be completed as soon as possible and no later than the start of the cyclone season in November 2007."

[66] Mr Kernaghan's report is a helpful reminder of the fact that ships are designed on assumptions that the ship will operate in certain conditions, and that operating procedures should be consistent with the design intent. The evidence establishes that the *Wunma* was not originally designed and not intended to operate in cyclonic conditions. Moreover, as Mr Kernaghan noted, one would have assumed that the ship's operating procedures would be such that the deck drains would be turned to sea so as to ensure that water coming off the canopy and the deck was diverted to the sea and not into the well deck and that rainfall was not so heavy as to totally overwhelm the ship's ability to expel water by drains and pumps and that those

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33 Exhibit 109, para 7.3.14, p.37.
34 Exhibit 109, para 7.7.8, p.49.

systems would be operational. But such an assumption about the operation of the ship was falsified by experience in relation to the operation of its water management system whereby a large volume of water might accumulate in the aft well deck within 30 minutes of a tropical downpour.

8.11 ROLE OF MSQ IN RELATION TO LOAD LINE AND RELATED DESIGN ISSUES

[67] The Queensland registration authority in 1999, Queensland Transport's Maritime Safety Branch, relied, as previously noted, on a Lloyd's Register provisional interim certificate in relation to the ship's hull and machinery and a Certificate of Compliance for Loadline issued by an "accredited person", namely ASDMAR Pty Ltd. The Certificate of Compliance for Loadline assigned the ship's freeboard on the basis of a geometric freeboard calculation that employed the concept of an "equivalent deck". Although such a concept was not reflected in the *USL Code*, a policy decision was made to accept the assignment of the ship's freeboard on this basis for the reasons explained by Mr Bundschuh. Although Mr Bundschuh gave evidence about his "dismay" that the owners decided not to have Lloyd's Register issue a load line certificate,[35] no inquiries were made by Queensland Transport of Lloyd's Register concerning the assignment of the ship's freeboard or its conditions of assignment.

[68] The 2005 registration upgrade occurred without any new Lloyd's Register certificate, as such, but on the basis of reports from Lloyd's Register about its review of the strength of the vessel that assured Mr Bundschuh that the ship was "structurally up to standard".[36] No new Certificate of Compliance Loadline had been requested by MSQ's letter of 11 May 2005 as a requirement for the registration upgrade, but one dated 24 August 2005 was provided in conjunction with the application to upgrade the ship's registration.

[69] Under the Queensland system after a vessel is issued its initial load line certificate authorised surveyors make periodic load line inspections and load line surveys. MSQ normally issues a load line certificate for a period of five years so that a ship owner must obtain a new Certificate of Compliance for Loadline every five years and forward it to MSQ when applying to renew the load line certificate. Under the

35 Exhibit 94, Part 1, para 58.
36 Exhibit 94, Part 1, para 66.

Queensland system, in the absence of a certificate of load line from a classification society, a Certificate of Compliance for Loadline is issued by an "accredited person" who has the responsibility to certify that the ship is seaworthy for load line purposes. The relevant form includes a declaration in relation to the assignment of the ship's freeboard under the relevant section of the *TOMS Regulation*, that the ship has been marked for its load line and that the ship is seaworthy for load line under the relevant Regulation on conditions that are set out by the "accredited person" in the declaration. The Queensland system operates on the basis that compliance with the *USL Code*, strictly speaking, is not a consideration for MSQ as the registration authority, that compliance with Section 7 of the *USL Code* regarding load line is a matter for the "accredited person" in issuing the Certificate of Compliance for Loadline and that MSQ should not "look behind the certificates of compliance to verify that the accredited person has complied with the relevant provisions in the *USL Code*".[37] That said, in the case of the *Wunma*, Mr Bundschuh was approached in 1999 by the "accredited person" to ascertain whether the method being used to assign the freeboard for the ship was appropriate.

[70] In reviewing the involvement of the then Maritime Safety Branch of Queensland Transport at the time (later to become "MSQ"), it is important to distinguish between:

(a) the assignment of freeboard; and

(b) conditions of assignment.

[71] Mr Bundschuh's response in 1999 concerning the method to assign the freeboard of the ship appears to have assumed that the freeboard deck for the purpose of calculating load lines was the side deck situated 7.85 metres above the baseline. Applying Section 7 of the *USL Code* by reference to that deck resulted in a freeboard that was not appropriate in that the freeboard did not take into account the recess in the deck constituted by the cargo hold. If account was not taken of the cargo hold as a void, the load line assigned would have been too high up the ship's side, allowing the ship to be loaded more deeply than was safe.[38] The freeboard that is calculated under Part 5 of Section 7 of the *USL Code* is the "geometric freeboard". An assigning authority may increase the assigned freeboard above that of the

37 Exhibit 94, Part 4, letter Mr Werner Bundschuh to the Inquiry dated 19 August 2007 paras 1.2 – 1.5.

38 Exhibit 94, Part 4, para 1.6.

geometric freeboard for safety reasons. One reason is to ensure that the ship has adequate stability in all operating conditions including the deepest loaded draft. If the relevant assigning authority assigns a freeboard that increases the freeboard greater than the calculated geometric freeboard, it does not involve an exemption from the requirements of the *USL Code*.

[72] In relation to conditions of assignment in the case of the *Wunma*, according to Mr Bundschuh, Queensland Transport received assurances that the conditions of assignment of the ship were met in two ways:

> "First, by receiving a certificate of compliance for load line. Secondly, by noting that the ship was classed and approved by Lloyds which indicated that it had treated the main deck at side which was 7.85 metres above the base line as the freeboard deck."[39]

[73] As to other design issues, as previously noted, the Queensland registration authority operates a different regulatory regime from those in other jurisdictions. It does not itself approve designs, assign freeboard or survey ships. The system of registration is based upon the receipt of certificates of compliance from accredited persons or classification societies.

[74] The difference in the regulatory system is illustrated by the fact that, according to Mr Ballantyne, the designer of the *MV Aburri* which operated in Northern Territory waters, the relevant official from the Northern Territory government was directly involved in the issue of whether freeing ports should be installed in that ship. By contrast, in the case of the *Wunma*, the Queensland registration authority did not itself consider whether the *Wunma* required the installation of freeing ports in order to comply with the *USL Code*. In the case of the *Wunma*, the Queensland registration authority assumed that Lloyd's Register, as the classification society, had addressed conditions of assignment and it also relied on a Certificate of Compliance for Loadline from an accredited person.

[75] The extent to which the Queensland registration authority was removed from active consideration of the design of the ship, let alone the kind of operational procedures discussed by Mr Kernaghan and others, is illustrated by the fact that in the case of the *Wunma*, the design was approved and surveyed by Lloyd's Register and

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[39] Exhibit 94, Part 4, para 1.21.

Queensland Transport/MSQ did not obtain a comprehensive set of drawings. As Mr Bundschuh explained:

> "We weren't really in a position to get into the details that would even enable us in some cases (to) even identify some of those particular issues."[40]

[76] In the advisory role that it played in mid-1999 in making a policy decision concerning the use of the concept of an "equivalent deck", the Queensland Transport did not see the need to obtain a complete set of drawings and to understand where, for instance, freeing ports were located. It assumed that these matters were being attended to by others. The matter for its consideration was the policy issue of the assignment of load line in the case of a ship with a cargo hold running along its length.[41]

[77] In 1999 the Queensland registration authority did not have an understanding that there was an intent that water be kept on board the ship for environmental reasons.[42]

[78] It was not until about 2005 when it was considering cyclone contingency planning that Mr Bundschuh first understood that this was an issue but then only "in a very general sense" arising from discussions in which parties expressed concerns about discharge of water overboard. It was only then that Mr Bundschuh became generally aware of the issue of water being kept on board the vessel for environmental reasons. But he did not ascertain specific details in relation to the matter until after the incident in 2007.[43]

8.12 OVERVIEW OF LOAD LINE AND RELATED DESIGN ISSUES

[79] The *USL Code*, like the *International Convention on Load Lines*, seeks to ensure the watertight integrity of ships by rules known as "conditions of assignment". This includes rules that are intended to clear water that accumulates on decks via freeing ports and other arrangements. The rules also deal with closing arrangements. Their requirements depend on whether the opening is above or below the "freeboard deck", with more stringent requirements for openings below the deck that is nominated as the freeboard deck. The requirements vary between "weathertight" (as for an

40 Mr Bundschuh; T.772.
41 Mr Bundschuh; T.772.
42 Mr Bundschuh; T.754.
43 Mr Bundschuh; T.754.

"enclosed superstructure") and "watertight". Accordingly, the determination of the "freeboard deck" on the *Wunma* assumed importance in relation to the assignment of freeboard and the "conditions of assignment".

[80] A ship's compliance with "conditions of assignment" is normally considered in the course of plan approval and the ship's survey following construction. In the case of the *Wunma* the designer assumed that freeing ports were to be installed near the stern ramp.[44] But they were not. Lloyd's Register, which certified the ship's hull and machinery, advised Queensland Transport in February 1999 that it would not be issuing an International Load Line Certificate, that it assumed that the ship would be required to comply with the *USL Code* in respect of load lines and that such a load line certificate would be issued by Queensland Transport without any involvement from Lloyd's Register. Lloyd's Register apparently was not involved in discussions with Queensland Transport about the selection of the "freeboard deck" for load line purposes, or whether adequate arrangements existed to free water from the well deck in compliance with the requirements of the *USL Code*.

[81] In granting the ship's registration in 1999, the registration section of Queensland Transport assumed that Lloyd's Register played a role in assessing the watertight integrity of the vessel. Mr Bundschuh stated that watertight integrity was "integrated into their (Lloyd's) rules".[45] He noted that correspondence from Lloyd's Register had nominated the side deck that was 7.85 metres above the base line as the "freeboard deck" for load line purposes and that the provisional interim certificate issued by Lloyd's Register on 18 August 1999 certified compliance with their rules.[46] Mr Bundschuh gave the following evidence about the scope of the survey conducted by Lloyd's Register:

> "Is not the certificate limited to hull and machinery?---Well, to certify hull and machinery, which is the general term used, they also covered off all the plan approvals and surveying of the vessel which covered all compliance with their hull. Now, I regard hull as including the steel structures including the watertight doors, things like this, and in fact you may notice in some of the correspondence that we were copied in on they even asked for us, that is the issuing authority, as to whether or not they could substitute I think a watertight door in lieu of a sliding door in one particular case below deck. So there is

44 Exhibit 97; para 25.
45 Mr Bundschuh; T.745.
46 Mr Bundschuh; T.745–746.

> evidence to indicate that they addressed those issues and there is also correspondence from Lloyds actually indicating that they assigned – that they applied their rules considering the freeboard deck at side at 7.85 metres."[47]

[82] The assumption on Mr Bundschuh's part was that Lloyd's Register had verified the adequacy of conditions of assignment. That assumption may not be unreasonable to the extent that rules that are designed to ensure watertight integrity are integrated into the Lloyd's rules and the provisional interim certificate was taken as certifying the watertight integrity on the ship's hull. However, any assumption that Lloyd's Register verified, let alone certified, conditions of assignment for load line purposes as complying with the requirements of the *USL Code* is not supported by relevant correspondence in early 1999.

[83] Lloyd's Register in Shanghai facsimile 5 February 1999 advised Lloyd's Register in Sydney that the designed freeboard deck was 7.85 metres above the base line.[48] It did not address conditions of assignment for load line, anticipated that any certificate of load line would be issued without any involvement of Lloyd's Register and advised that "the watertightness below the freeboard deck for the classification purposes would form the subject of separate communication". If there was any separate communication from Lloyd's Register about this topic it was not conveyed to Queensland Transport.

[84] A facsimile from Lloyd's Register in Sydney to Queensland Transport of 16 February 1999 advised that Lloyd's Register would not be issuing an International Load Line Certificate and that it was assumed that the vessel would be required to comply with the *USL Code* in respect of load lines and that a load line certificate would be issued by Queensland Transport without any involvement from Lloyd's Register. It is not unfair to say, as Mr Kernaghan said in his report, that Lloyd's Register passed the responsibility to others in connection with the issuing of a certificate in respect of load lines. Under the Queensland system this was principally to the "accredited person" who issued the Certificate of Compliance for Loadline and indirectly, Queensland Transport which received such a certificate for registration purposes.

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47 Mr Bundschuh; T.746.

48 Exhibit 49, CB3, para 6.

[85] The adoption by the "accredited person" of an "equivalent deck" concept for the purpose of geometric freeboard calculations and assigning the ship's freeboard can be defended as filling a "lacuna" in the *USL Code* for such a type of ship. That said, sound reasons existed to question whether the side deck was a "freeboard deck" within the meaning of the *USL Code*.

[86] The alternative of applying the *USL Code* and selecting the well deck as the freeboard deck and "working up" to take account of the buoyancy provided by deckhouses above the well deck (the approach favoured by Mr Taylor) reaches roughly the same practical result as to the appropriate full load draft as the "top down" approach reflected in the "equivalent deck" concept.

[87] Accordingly, it can be said that the "equivalent deck" concept, although not contained in the *USL Code*, represented a logical and defensible approach to the calculation of freeboard/the maximum draft at which the ship could safety operate. But if that approach is taken to the assignment of load line, it has significant implications for the "conditions of assignment". On either approach to the determination of the "freeboard deck", requirements in the form of "conditions of assignment" exist for openings beneath the deck to be closed, for spaces to be either "watertight" or "weathertight" and for the location of the emergency generator room and its radiator vent. Further, and critically, the *USL Code* included requirements for freeing ports.

[88] Lloyd's Register, the "accredited person" for the purpose of issuing the Certificate of Compliance for Loadline and Queensland registration authority, assumed that it was someone else's responsibility to ensure that "conditions of assignment" complied with the *USL Code*. In fact, they did not in certain important respects that are relevant to the incident:

(a) Once it is recognised that the cargo hold constituted a well, and a potentially large one at that, the *USL Code* requirements imposed a requirement for freeing ports to ensure that water would not accumulate on the well deck.

(b) If the side decks were treated as the freeboard deck, then the emergency generator room was located below it, contrary of the requirements of the *USL Code*.

(c) In any event, the radiator vent into the emergency generator room was at a height that did not comply with the requirements of the *USL Code*.

[89] This situation reveals a significant shortcoming in regulatory arrangements that permitted the ship to be registered in Queensland. They can be summarised as follows:

(1) The "mix and match" system by which Lloyd's Register only partially certified the ship led the regulator to assume that the Lloyd's Register certificate extended to matters affecting conditions of assignment for load line purposes.

(2) To the extent that this assumption was justified, the Queensland registration authority did not assume the role of checking that arrangements for freeing of water, the location of the emergency generator room and openings at the stern of the vessel complied with the *USL Code* or, more generally, of ensuring from the design perspective, that the ship was fit for its intended area of operation.

(3) The role of the "accredited person" for the purposes of issuing a Certificate of Compliance for Loadline was not limited to simply assigning the ship's freeboard. It extended to declaring that the ship was seaworthy for load line under section 85 of the *TOMS Regulation* 1995 in restricted off-shore waters. The certificate was relied upon by the Queensland registration authority as certifying that conditions of assignment were met. Just as the Queensland authority assumed that conditions of assignment had been addressed by Lloyd's Register as part of the process of surveying and certifying the ship, the "accredited person" may have adopted a similar assumption. That is not to overlook the significance of its own declaration that the ship was seaworthy for load line in restricted off-shore waters. However, it highlights the potential problems associated with the "mix and match" approach that permitted part of the ship to be certified by a classification society that did not issue a certificate for load line purposes. Under such a system erroneous assumptions can be made that certificates issued by a classification society cover conditions of assignment for load line purposes such as watertightness below the freeboard deck when they do not.

(4) Queensland Transport accepts Certificates of Compliance, and accepted the Certificate of Compliance for Loadline dated 17 August 1999, without

perceiving that it had any role to "look behind"[49] the certificate to satisfy itself that the ship was seaworthy for load line. Such an approach may reflect the legislative scheme which is based upon an accreditation system under which it is the accredited person, and not Queensland Transport, that certifies compliance with the relevant provisions governing the matter to be certified. But it raises the question of the circumstances in which Queensland Transport should "look behind" a certificate of compliance. In the case of the design of a non-standard ship which raised issues concerning the application of the "equivalent deck" concept, it was appropriate for MSQ to seek the views of others with greater experience in relation to the assignment of load line and its implications in the case of a vessel with a novel design. This should have involved reference to Lloyd's Register concerning the implications of nominating the side deck as the "freeboard deck" for load line purposes, particularly its implications in respect of conditions of assignment.

[90] The "accredited person" that issued the Certificate of Compliance for Loadline dated 17 August 1999 was ASDMAR Pty Ltd. Although its Managing Director, Mr Ballantyne, gave evidence that he believed the ship was constructed with freeing ports in its stern,[50] the naval architect employed by that company who signed the declaration on 17 August 1999 could not have, since he had advised ISM on 1 July 1999 that freeing ports in the well deck were not essential for the safety of the ship in connection with its delivery voyage.[51] Mr Ballantyne did not recall discussing the matter with the naval architect, Mr Alston, at the time.[52] Mr Ballantyne acknowledged that it is normal practice for an open well deck to have freeing ports.[53] His evidence was that his company's design was for the *Wunma* to have freeing ports with flaps in the stern with a combined area of two or three square metres.[54] Mr Ballantyne inferred that the decision not to install them was taken during the ship's construction on the basis that their absence was not detrimental to the safety of the ship.[55] Calculations had been undertaken by ASDMAR Pty Ltd on

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49 Exhibit 94, Part 4, paras 1.4 and 1.5.
50 Exhibit 97, para 25. Mr Ballantyne; T.795.
51 Exhibit 49, CB16.
52 Mr Ballantyne; T.797.
53 Mr Ballantyne; T.795.
54 Exhibit 97, para 25. Mr Ballantyne; T.795.
55 Mr Ballantyne; T.795.

swamping the whole well deck, whether in ballast or a loaded condition, and, according to Mr Ballantyne, swamping the whole well deck "still would not sink the vessel".[56]

[91] The tension between the objective of keeping water mixed with concentrate out of the marine environment, and complying with the requirements of *TOMS Regulation* in relation to load lines was captured in the following remarks of Mr Ballantyne:

> "…if you wore your environmental hat you wouldn't have the freeing ports. If you had your surveyor's hat on and were working to the letter of the law, you would have to have them."[57]

[92] In issuing a Certificate of Compliance for Loadline on 17 August 1999, ASDMAR Pty Ltd, through its employed naval architect, knew that the ship did not have freeing ports as would normally be installed in a well deck, which would be required if you were "working to the letter of the law". In this case the law was section 85 of the *TOMS Regulation 1995* that applied the requirements of the *USL Code*, including its requirements for freeing ports.[58] Perhaps the Certification of Compliance for Loadline issued by ASDMAR Pty Ltd on 17 August 1999 was influenced by the "precedent" set in respect of the *Aburri* where, according to Mr Ballantyne, the authorities initially required the installation of freeing ports, but later directed that they be welded back up in the interests of environmental protection.[59] The belief of the naval architect who issued that the Certificate of Compliance for Loadline on 17 August 1999 that freeing ports were not essential to the safety of the ship may explain his preparedness to certify that the ship was seaworthy for load line under section 85 of the *TOMS Regulation* 1995 in restricted off-shore waters. But that section applied part of the *USL Code* that required the installation of freeing ports.

[93] Under a regulatory system that revolves around certificates of compliance from accredited persons, and in which the registration authority chooses not to "look behind" such a certificate, the Certificate of Compliance for Loadline dated 17 August 1999 provided an assurance to the Queensland registration authority that the

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56 Mr Ballantyne; T.795.
57 Mr Ballantyne; T.794–796.
58 Part 2 of Section 7 of the *USL Code* relates to conditions of assignment including freeing ports.
59 Mr Ballantyne; T.794.

ship's arrangements complied with the *USL Code* concerning conditions of assignment.[60]

[94] To the extent that the Queensland registration authority had regard to ships that operated without hatch covers and adopted the policy approach of assuming that the *Wunma's* cargo hold was open to the sea, the focus of attention was upon the ship's stability. The evidence indicated that the ship had adequate reserves of intact stability to survive, even if the cargo hold was flooded.[61] Whilst a ship's stability is an essential element of safety, it is not the only element. Safety is also ensured by meeting the intent and terms of provisions in relation to load lines. In simple terms, a ship like the *Wunma* might be treated as having an open hold that, even when flooded, does not compromise the ship's stability. But the objective is to avoid her hold being flooded in the first place.

[95] Reliance was placed by Queensland Transport in making its policy decision concerning the "equivalent deck" concept upon open container ships. The development of "open-top" containerships pioneered by Don Gillies among others resulted in IMO MSC/Circ.608/Rev.1 *Interim Guidelines for Open-Top Containerships*, dated 5 July 1994. The provisions of these guidelines require, among other things tank testing to determine the maximum ingress of water into each hold in seas of "approximately 8.5m" significant waveheight and the fitting of redundant pumping systems to each open hold capable of discharging the water overboard. Under this philosophy there is a safety issue if the ship is not capable of dealing with this water ingress.

[96] In his evidence, Mr Bundschuh made reference to container ships being constructed and allowed to go to sea without any covering on them.[62] But the relevant rules[63] provide for active pumping of water ingress at a rate faster than the ingress as an alternative that was developed to freeing water through freeing ports. No such active pumping arrangements have been fitted to *Wunma*, despite the relevant IMO document having been adopted before the ship was designed and constructed. Any

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60 Exhibit 94, Part 4, para 21.
61 Mr Ballantyne; T.801; T.751; T.795.
62 Mr Bundschuh; T.749.
63 IMO MSC/Circ.608/Rev.1 *Interim Guidelines for Open-Top Containerships*, dated 5 July 1994.

pumping arrangements of this type would have needed to be capable of pumping cargo slurry as well as water.

[97] Mr Bundschuh made mention of open-hatch ships for local authority use being relatively common as they are often used for dredges and hopper barges.[64] However, such vessels are not comparable to *Wunma* and do not require freeing ports as they are generally built with bottom-opening doors or split hulls, such that their cargo and any water accumulating in the hold can be readily and quickly discharged by gravity if necessary to secure the vessel's safety.

[98] The ship was not fitted with either freeing ports or active pumping systems capable of freeing water ingress into the aft well deck or cargo hold. The level of water ingress had to reach the cut-outs at the side of the stern door or the openings in the stern, all of which are approximately 6.5 metres above baseline, before it went overboard.

[99] Mr Bundschuh stated that "the watertight integrity and freeing arrangements should be such that at no stage should the load line be actually immersed in water".[65] This concept was not reflected in the loading conditions in the ship's "Trim and Stability Booklet and Inclining Experiment Report"[66] which make no allowance in the loaded departure condition for any water, either in the dirty water tanks or on the aft well deck, despite the fact that the ship is arranged and operated to collect rainwater. The ship's arrangements were such that, during the incident, the ship became heavily overloaded due to the presence in the well deck and cargo space of some hundreds of tonnes of rain water and sea water. Mr Bundschuh stated that the arrangements for accumulation of water were unknown to him and, having come to his attention, "definitely has to be attended to".[67]

[100] The frank acknowledgment in his oral evidence and witness statement that these issues need to be addressed highlights the fact that regulatory arrangements in 1999 and 2005 permitted these issues to not be addressed by Queensland Transport in registering the ship. Even in 2005, when MSQ's registration section was generally

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64 Mr Bundschuh; T.772.

65 Mr Bundschuh; T.749.

66 Located in Folder 6(2), top 71 pages (Note that this is superseded version, presumably updated in current version to reflect revised maximum draft of 3.95m)

67 Mr Bundschuh; T.754.

aware of issues concerning the retention of water on board the vessel for environmental reasons, the concern of its registration section principally was upon the ship's stability and its strength. Having received assurance from Lloyd's Register that the ship was "structurally up to standard" and assuming that load line requirements were met, MSQ's registration section upgraded the ship's registration without investigating the respects in which the ship's water management system and the retention of water on board during cyclones might affect its safety. The continuing assumption appears to have been that the design of its water management system was appropriate to avoid the collection of large volumes of water on decks, that freeing ports existed as required by the *USL Code* and that the ship's operating procedures were adequate to avoid the retention of water on board. Those assumptions may have been based to some extent upon the previous receipt of certificates from Lloyd's Register in relation to the hull of the vessel and the Certificate of Compliance for Loadline. However, MSQ did not see its role as looking behind these certificates or testing the validity of assumptions that the design and operation of the ship's water management system ensured that the ship was fit for its intended operation, including its operation in open waters avoiding cyclones once its registration was upgraded.

[101] That MSQ regarded these issues as someone else's responsibility can be seen, in part, as a reflection on the regulatory arrangements which base registration in Queensland of a ship such as the *Wunma* upon the receipt by MSQ of relevant certificates from accredited persons and classification societies.

[102] The limited role played by MSQ is shown in its response to the incident and the registration of the *Wunma* after the incident. The registration of this ship was initially suspended by the Regional Harbour Master, following which certain Restricted Use Flags were issued which, in effect, granted an exemption from registration upon certain conditions. The notice suspending the registration issued on 16 February 2007 recorded that the ingress of water into the ship's Emergency Generator Room, shorting the emergency switchboard and resulting in power failure suggested that "the watertight integrity of the ship's hull and superstructure had been compromised and as a result the ship could not comply with the conditions of assignment of its load line". MSQ instructed its Senior Naval Architect to liaise with an accredited surveyor and through the accredited surveyor with Lloyd's

Register about its requirements for the ship. The Lloyd's surveyor introduced a condition of class in an interim certificate issued on 17 February 2007 that a stormwater management plan be prepared and submitted to Lloyd's Register Sydney Plan Appraisal Centre and Flag "detailing methods to control/store discharged water during monsoonal downpours and methods employed to prevent stormwater accumulation submerging the load line". It also imposed numerous other conditions of class including that the emergency generator radiator intake be modified by fitting steel trunking and raising its ingress height 2.5 metres above its current location.

[103] In his witness statement for the purpose of the Inquiry, Mr Bundschuh recognised that water being retained in the ship for environmental reasons, together with cargo on board, must not put the ship too low in the water and immerse the load line. One way to deal with that problem is for the ship to carry less cargo during cyclone seasons and that this could be reflected by the imposition of loading conditions for operating during cyclone seasons. Mr Bundschuh indicated that if Lloyd's Register amended the loading conditions he would state them explicitly in any future registration certificate. Mr Bundschuh recognised that the other way of dealing with the potential immersion of the load line was to "manage the stormwater that has not drained off the ship".

[104] The recognition of these matters after the incident begs the question of why loading conditions for operating during cyclone seasons and the management of stormwater were not considered sooner by the relevant classification society, the ship's designer, the ship's operator and MSQ itself. Those matters will be addressed in the next Chapter.

8.13 CONCLUSION

[105] Compliance with statutory requirements for load line provided the occasion for "conditions of assignment" to be imposed to ensure the watertight integrity of the ship and to clear water that accumulates on decks. The process by which the ship was partially certified by Lloyd's Register in respect of its hull and machinery, but not certified by Lloyd's Register in respect of load line, permitted these issues to be neglected during the process of registration in 1999 and when the ship's registration was upgraded in 2005.

[106] These matters are directly relevant to the incident. One of the factors that led to the abandonment of the ship on 7 February 2007 was the loss of power and systems following the flooding of the Emergency Generator Room. This flooding took place through a radiator vent that did not comply with the *USL Code*. The location of this vent and its potential to compromise marine safety seems to have been missed by all concerned prior to the incident.

[107] If a more rigorous approach had been adopted to the ship's compliance with the provisions of Section 7 of the *USL Code* for load line purposes, then the location of the Emergency Generator Room below what was taken to be the "freeboard deck" and the location of this radiator vent in breach of the *USL Code* may have been detected at the registration stage. Having gone undetected at that stage, subsequent surveys of the ship apparently assumed that both the Emergency Generator Room and its radiator vent complied with the *USL Code*.

[108] In August 1999 when Lloyd's Register issued its provisional interim certificate in relation to the ship's hull and machinery, certain assumptions may have been made by it and others about the operation of the ship's water management system as a "first flush system" and that the ship's "dirty water tanks" were adequate to collect water that would collect in the well deck. Those assumptions were negated by the later operational experience of the ship and, in any event, were not reflected in operating procedures. In 1999, these matters may not have been foreseen by those involved in the design and construction of the ship. However, reference to the provisions of Section 7 of the *USL Code* in 1999 would have led to the conclusion that the ship's cargo hold constituted a "well" and that the *USL Code* required the installation of freeing ports to rid the well deck of any water that would collect in it. Compliance with the *USL Code* in this regard required the installation of freeing ports in the stern ramp in the location that the ship's designer, Mr Ballantyne, assumed that they had been installed. If freeing ports were not appropriate, lest they allow water mixed with concentrate into the marine environment, then some other arrangements were required to address the risk that large volumes of water, in excess of the capacity of the dirty water tanks, might accumulate in the aft well deck

[109] Insistence upon their installation so that the ship's conditions of assignment complied with the requirements of Section 7 of the *USL Code* would have brought into stark focus the competing objectives of:

(a) shedding water that may accumulate in the aft well deck via freeing ports in the interest of marine safety; and

(b) keeping water mixed with concentrate out of the marine environment.

[110] Those competing objectives remain to this day. So does the need for design solutions to address them. But regulatory arrangements that permitted the ship to be registered in circumstances in which conditions of assignment did not comply with Section 7 of the *USL Code* meant that these issues were addressed by the Queensland registration authority after the incident, not before it. The fact that it took the incident to highlight the need to address the loading conditions for operating during cyclone seasons and the operation of the ship's water management system highlights significant shortcomings in regulatory arrangements at the time the ship was first registered in Queensland in 1999 and at the time her registration was upgraded in 2005.

8.14 GALLERY

Figure 1 - The *Wunma* under Power

Figure 2 - View from the Cargo Hold to the Aft Well Deck

Figure 3 - The Load Line

Figure 4 - The Canopy Roof

Figure 5 - The Aft Well Deck Sump

Figure 6 - The Stern Ramp

Figure 7- The Emergency Generator Room

Figure 8 - Radiator Vent - Emergency Generator Room

Figure 9 - Emergency Generator Radiator adjacent to Vent

Figure 10 - Emergency Generator Switchboard

WUNMA BOARD OF INQUIRY

CHAPTER 9: SYSTEMIC ARRANGEMENTS AT THE TIME OF THE INCIDENT

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CHAPTER 9 SYSTEMIC ARRANGEMENTS AT THE TIME OF THE INCIDENT

9.1 OVERVIEW OF OPERATIONAL ENVIRONMENT

[1] Before addressing the events of the days immediately preceding the incident, it is appropriate to summarise the physical and operational environment in which these events were to occur.

[2] No cyclone mooring existed in the Norman River to replace or supplement the "de-commissioned" cyclone mooring at Sweers Island. In the event of a cyclone, the ship was unable to remain alongside the Zinifex wharf with extra mooring lines and other precautions, without exposing the ship's Master and the ship's manager to potential adverse consequences. These included civil liability in the event the ship or the wharf was damaged. The wharf had not been engineered to sustain the loads that might be placed upon it by the ship in the event of a cyclone. If the ship or the wharf was damaged her owner and the authorities could rely on the fact that remaining alongside the wharf after a Red Alert under the Port CCP was a breach of that plan, and that the SQS Cyclone Procedure did not include remaining alongside the wharf as an option.

[3] The option in the SQS Cyclone Procedure of anchoring off Karumba came with its limitations, given the inherent unpredictability of cyclones and the risk that a cyclone might intensify and head in that direction.

[4] The option of heading for open seas, and either proceeding to Weipa or remaining in open waters, confronted a number of difficulties:

Insufficient Searoom

- Depending on the location and path of the cyclone, there may be insufficient searoom to avoid the cyclone. The geography of the Gulf and the presence of unsurveyed areas in the Southern part of the Gulf, limited the scope for cyclone avoidance.

Insufficient Time

- Avoiding a cyclone required the ship to leave port in sufficient time. For instance, if the cyclone was expected to head towards the South East Gulf in an Easterly or South-Easterly direction, the ship had to leave Karumba with

sufficient time to be well North of its expected path and the cyclone's "dangerous quadrant". The option of going to sea was only mandated under the Port CCP upon a "Blue Alert" (destructive winds forecast within 16 hours) and under the SQS Cyclone Procedure upon a "Red Alert" (when the Bureau of Meteorology has advised that a "Warning Cat 2 Alert" is effective, ie destructive winds are expected greater than 70 knots within 24 hours). If the ship waited for such an alert before leaving Port, winds might be such that the ship could not safely navigate the channel. If she could, there still may be insufficient time, given the ship's likely speed, to take effective cyclone avoidance steps.

Loading Conditions

- Ideally the ship should be unloaded to avoid the risk of being swamped. If the ship was fully loaded, the risk of seawater ingress into the aft well deck in a heavy, following sea was increased, and means to rid the ship of such water were essential. The retention of rainwater on board a fully loaded ship posed a danger of overloading. As Mr Bundschuh explained in his evidence:

> "In a full load condition if you have a water management system that relies on keeping water on board, you are then in serious danger of actually overloading the vessel. That is the context in which the water management system has to come into play to make sure that when operating in full load you are not going to keep on water that immerses the load line."[1]

Water Management System

- Similar, though not as acute, issues in relation to the discharge of water existed if the ship was not loaded. Without adequate means to store or discharge water, it would collect in the aft well deck, and enter the cargo hold.

9.2 "FIRST FLUSH" SYSTEM NOT OPERATIONAL

[5] Aspects of the ship's design, coupled with her operating practices, did not prevent water accumulating in the aft well deck. Her novel design directed rainwater onto the ship's side decks as part of an intended "first flush" system. The "first flush" system was not achieved in practice for two basic reasons. First, the presence of concentrate on decks and in drains caused side deck drains and valves to become

[1] Mr Bundschuh; T.767, T.770.

blocked, and they could not be easily unblocked. Second, even if decks and drains could be kept relatively clear of concentrate, the water that would be discharged to sea through side deck drains would be, at best, only "relatively clean". To discharge water mixed with concentrate was understood to contravene the owner's "no spills" policy, and the requirements of MARPOL. As a result, rarely were deck drains opened to the sea, and the practice was adopted of returning to port when the "dirty water tanks" were full. In any case, the capacity of side deck drains to discharge the volume of water that might be dumped onto the side decks in a tropical downpour was limited, resulting in water accumulating in the aft well deck once the "dirty water tanks" were full.

[6] The installation of freeing ports near the stern ramp, either of the kind the ship's designer, Mr Ballantyne, assumed had been installed or in some other form,[2] might have enabled the ship to rid the well deck of water. But freeing ports were not installed, presumably since the view was taken that the ship had sufficient stability without them and that open freeing ports near the stern ramp would allow "dirty water" to enter the marine environment.

[7] That the ship's water management system was unable to operate as a "first flush" system in accordance with its design intent may not have been appreciated in 1999 when the ship was first registered in Queensland. That the ship did not operate as a "first flush" system and adopted the practice of returning to port once the "dirty water tanks" were full was known by the ship's owner and operator when they sought and obtained a registration upgrade to Class 2B for the purpose of voyages into open waters to avoid cyclones.

9.3 NO RISK ASSESSMENT OF WATER MANAGEMENT SYSTEM

[8] No proper risk assessment was undertaken of the operation of the ship's water management system in open seas in cyclonic conditions, and its consequences for the seaworthiness of the ship. If they considered the operation of the ship's water management system at all, those who advocated or endorsed the proposal to allow the ship to head into open waters in cyclonic conditions seem to have assumed that the ship's water management system would be able to discharge the rainwater that

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[2] For instance a freeing port that could be closed with a shutter when cleaning/hosing down was in progress to contain "dirty water" on board and which could be open when required to free accumulated water that needed to be discharged to sea in the interests of safety.

the ship would collect on such a voyage and any seawater that might find its way on board in heavy seas.

[9] It may have been reasonable for some parties to assume that the ship's deck drains would be turned to the sea and that they would operate. As Mr Kernaghan stated in his expert report:

> "One would have assumed that the vessel's operating procedures should be such that the deck drains be turned to the sea so as to ensure that the water coming off the canopy and the deck was diverted to the sea and not into the well deck. This along with the release of water via the sump drain and the use of pumps from that area should have been sufficient to expel water to prevent flooding to the extent that water would breach the Emergency Generator Room. This assumes that the rainfall is not so heavy as to totally overwhelm the ability to expel water by the above methods and that the above systems are operational."[3]

[10] Inco, which managed the ship and knew that her deck drains were prone to being blocked with concentrate and that blocked valves could not be easily fixed, could not have reasonably assumed that the ship's water management system would be able to discharge the rainwater that the ship would collect on a voyage in cyclonic seas and any seawater that might find its way on board in heavy seas. Any assumption by Inco about the operation of the water management system was adopted without adequate consideration of how that system operated in practice, and how it might operate in open waters in cyclonic conditions without freeing ports or active pumping systems with sufficient capacity to remove water collecting in the aft well deck.

[11] Zinifex knew that in its normal operations the ship's water management system did not operate a "first flush" system, and that rather than direct rainwater to sea after her "dirty water tanks" were full, the ship returned to port. Further inquiries by Zinifex into the matter might have called into question any assumption that it made that the ship's water management system would be able to discharge the rainwater that the ship would collect on a voyage in cyclonic conditions. In 2004/2005 Zinifex was reasonably entitled to assume at the time of the registration upgrade that Inco and their maritime consultants had considered the design and operation of the water management system in the course of developing proposals to go to sea in cyclonic

[3] Exhibit 109, p.49, para 7.7.8.

conditions, and that before upgrading the ship's registration MSQ would need to be satisfied that the ship's design and operating procedures were adequate to allow a lengthy voyage to be undertaken in cyclonic conditions.

[12] Any such assumptions on the part of Zinifex were challenged by the Thompson Clarke Operational Review in December 2006. At that stage, it was reasonable for Zinifex to rely on Inco to address these matters. There was inadequate time before the incident to implement the Thompson Clarke recommendation that a risk assessment be carried out to establish the level of risks involved under alternative scenarios and to consider the questions posed by Thompson Clarke (which included the capacity of the dirty water tanks, the ingress of water into the well deck and means to rid it). Thompson Clarke proposed that the risk assessment involve numerous parties, and such an assessment could not have been undertaken and completed prior to the incident.

[13] The registration section of MSQ in 2005 focused on the assurance received from Lloyd's Register about the strength of the ship. MSQ permitted the registration to be upgraded to enable the ship to go to sea in cyclonic conditions without adequate consideration of how the water management system operated in practice, and how it might operate in open waters in cyclonic conditions without freeing ports or active pumping systems with sufficient capacity to remove water collecting in the aft well deck. The registration section of MSQ treated this as an operational matter to be addressed by the ship's operators as part of their general safety obligations, and that such operational matters were the province of another section of MSQ.[4]

[14] Captain Cole's advice to the EPA about the relative risks of going to the cyclone mooring buoy at Sweers Island and of going to sea assumed that MSQ would look at the seakeeping ability of the ship, her power and her capacity to discharge water to sea during cyclones. His assumption was misplaced. The focus of attention of MSQ's registration section was on the ship's strength in cyclonic seas, and not her capacity to discharge water.

[15] The consultant directly engaged by Inco and indirectly engaged by the ship's owner to develop the proposal to discontinue use of the cyclone mooring at Sweers Island and to allow the ship to go into open waters does not appear to have addressed, or

been asked to address, the operation of the ship's water management system in cyclonic conditions. The operational experience that the consultant claimed justified the change in operating procedures did not include the ship's operation in cyclonic conditions.

[16] Neither Lloyd's Register nor the accredited designer, was engaged prior to the September 2005 registration upgrade to undertake an overall risk assessment of the ship's operation in cyclonic conditions**.**

[17] The review commissioned from Lloyd's Register in late 2004 was of global and local strength in cyclonic seas. There was no consideration of the operation of the ship's water management system in those conditions. The Lloyd's Register report of 25 January 2005 of the ship's strength was based on the assumption that it was unlikely that the ship would be fully loaded during a voyage in cyclonic conditions. But no written operating procedure required the ship to not load once a low pressure system that might develop into a cyclone entered the Gulf during "cyclone season".

[18] The continuing assumption from her designer seems to have been that if water entered the ship's well deck, it would not exceed the height of the "spill points" at the top of the stern door[5] and even with a swamped well deck the ship had sufficient stability. In short, the ship was strong enough and she had adequate stability even if her cargo hold was swamped. She would not sink.

[19] Mr Ballantyne agreed during his examination that the ship had the strength and stability to undertake a voyage in cyclonic conditions. [6] But his evidence was that his company did not design the ship to undertake such voyages, particularly when fully loaded.[7] He was highly critical of permitting the ship to go to sea fully loaded.[8] The role that his company played in late 2004 was to facilitate and transmit the Lloyd's Register review of the ship's strength.[9] It was involved in discussions with Lloyd's Register in late 2004 concerning the likely state of the ship in cyclonic conditions, and it is apparent that his company knew that the registration upgrade was being sought for the purpose of going to sea to heave to in cyclonic conditions.

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4 Exhibit 94, Part 1, paras 70-77.
5 The view taken prior to its delivery voyage in 1999: see Exhibit 49, CB16.
6 Mr Ballantyne; T.806; T.843-844.
7 Mr Ballantyne; T.801; T.804; T.807.
8 Statement of Stuart Ballantyne; Exhibit 97, para 50. Mr Ballantyne; T.809-810.

Mr Ballantyne was not asked to undertake an overall assessment of the ship's seakeeping capabilities in cyclonic conditions.[10] Prior to the incident he assumed that the ship's water management system operated as a "first flush" system.

[20] In August 2005 his company issued a Certificate of Compliance for Loadline and applied on behalf of ISM and the owner for the registration upgrade. The absence of any advice from Mr Ballantyne to Captain Dally and others when he was consulted in relation to the registration upgrade and attended a meeting with Captain Dally and others on 13 September 2004 about his reservations about the ship going into open seas to avoid cyclones is perplexing.

[21] Mr Ballantyne explained that if "they chose to go to a heave to that is their choice but personally I wouldn't do it."[11] He said he was not asked for his opinion and if he had been asked for his opinion he would have been quite vocal.[12] He said that the purpose of his attendance on 13 September 2004 was that the owners and Inco wanted to be upgraded to a Class 2B, and Mr Ballantyne's company was asked to check whether the vessel was "structurally capable of doing that"[13] He did not recommend that the ship should go to sea in the Gulf, whether loaded or unloaded.[14] Such a course was contrary to his original advice to the owners prior to the ship's delivery.[15] His evidence was that by 13 September 2004 a decision had been made that the ship was going to be sent to sea in the event of a cyclone, draft procedures had been prepared and submitted by Captain Dally and the only thing that was looked at for the purpose of the change was the structural aspects of the ship.[16]

[22] Inco did not adequately address the operation of the ship's water management system in cyclonic conditions. Its Operations Manager was not directly involved in the review. Its Fleet Technical Manager was overseas during the relevant period. Its Managing Director, who assumed the role of facilitating the registration upgrade and the development of new cyclone procedures, did not personally undertake any such

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9 Mr Ballantyne; T.809.
10 Mr Ballantyne; T.808.
11 Mr Ballantyne; T.809.
12 Mr Ballantyne; T.817–818.
13 Mr Ballantyne; T.816.
14 Mr Ballantyne; T.807.
15 Mr Ballantyne; T.801-802.
16 Mr Ballantyne; T.808.

assessment, or a general risk assessment of the ship's seakeeping properties in cyclonic conditions.

[23] Inco had the Lloyd's Register reports on the ship's strength. The absence of expressions of concern to Inco from the ship's designer about the proposal to permit the ship to undertake voyages in cyclonic seas (which the designer assumed would be in an unloaded condition) may have induced Inco to conclude that Lloyd's Register and the ship's designers did not envisage a problem with the registration upgrade.

[24] But Inco was not entitled to assume that either Lloyd's Register or the ship's designer knew about the operation of the ship's water management system: that it was prone to being blocked with concentrate and did not operate in normal operations as a "first flush" system. There is no reliable evidence before the Inquiry that permits the Board to conclude that they knew about these things. Accordingly, Inco was not entitled to assume that either Lloyd's Register or the ship's designer had undertaken a risk assessment of the ship's performance, its water management system and its seaworthiness in cyclonic conditions.

[25] Inco may have derived support from the views that Captain Cole gave to the EPA about the relative risks of going to the cyclone mooring buoy at Sweers Island and going to sea, but further inquiry of Captain Cole would have revealed that he assumed that the capacity of the ship to effectively discharge water to sea during a cyclone was something that had or would be looked at by others in granting a registration upgrade.

9.4 NO COMPREHENSIVE RISK ASSESSMENT

[26] No-one assessed these things. More generally, no-one involved in the process of seeking and approving the registration upgrade undertook a comprehensive risk analysis of the ship's seakeeping properties in cyclonic conditions.

[27] The function of the Board of Inquiry is not to attribute or apportion blame for the fact that no comprehensive risk analysis of the ship's seakeeping properties in cyclonic conditions was undertaken. But the fact that none was undertaken and, if anyone considered the issue at the time, they assumed that it was someone else's responsibility, constitutes a systemic failure that contributed to the incident.

9.5 REGULATORY ARRANGEMENTS

[28] In part, that failure can be characterised as a regulatory failure. There is nothing inherently wrong with a system, like the Queensland system, that imposes general safety obligations and other specific obligations on those involved in a ship's operation, with the regulatory authority having the roles of registering ships on the basis of certificates from accredited persons and classification societies and enforcing the safety obligations of operators and other participants in the maritime industry.

[29] It is not the role of a regulatory authority like MSQ to draft operating procedures for ships like the *Wunma* and it lacks the resources to closely monitor the ship's daily operations. Absent matters raising concerns or suspicions to the contrary, MSQ might reasonably assume that the daily operations of a ship like the *Wunma* are being undertaken in accordance with the law, in accordance with procedures developed by a certified ship manager, and, in the case of the *Wunma*, in accordance with a safety management plan that was audited by AMSA.

[30] Shipping inspectors, including the Manager Remote Area Service in Karumba, did not inspect the ship, having many other tasks to perform, and if they had done so they probably would have deferred to the expertise of those who had developed the ship's operating procedures.

[31] MSQ's regulatory function under the relevant legislation is not to itself survey a ship, to devise the ship's operating procedures or to closely review her operations unless it has cause to do so. Its function in registering a ship does not constitute a guarantee that she will be operated safely. That obligation rests on those involved in her operation, including her owner, operator, Master and crew, and is enforced by MSQ. But the registration process should have ensured, in the words of Mr Bundschuh, "that from a design, structural and safety equipment perspective, the ship was fit to operate."[17]

[32] The issue that faced MSQ in 2004/2005 was not one concerning the normal operations of the ship between the Port of Karumba and the Karumba Roadstead. It was faced with a proposal that required MSQ's approval, namely the upgrading of

[17] Exhibit 94, Part 1, para 71.

her registration to permit her to go into open waters to avoid cyclones. Despite the advice that had been given to representatives of the ship's owners and operator in July 2004 by Captain Boath that they should consider a mooring in the Norman River and a discharge system at the wharf to cater for the occasions when the ship may be caught with cargo on board with a cyclone approaching, the ship's owner and operator had taken a different course. They had decided to discontinue use of the cyclone mooring at Sweers Island and not propose a cyclone mooring in the Norman River or anywhere else in its place. They had procured strength assessments from Lloyd's Register.

[33] MSQ was consulted and offered the opportunity to comment on proposed new cyclone procedures. The dynamic was that, under pressure from indigenous communities and representatives of native title holders who had legitimate concerns about the risks posed to the environment and their cultural, social and economic welfare by the ship's use of the cyclone mooring at Sweers Island, Zinifex had developed plans to discontinue its use, thereby relieving the EPA of the need to decide whether to require an environmental assessment. In some respects Zinifex, its consultants and Inco presented MSQ with a *fait accompli*. The owners and operators did not intend to use the cyclone mooring buoy at Sweers Island. Despite the concerns of MSQ officers such as Captain Boath, Captain Diack and Captain Watkinson about the danger this posed to the safety of the ship and her crew, those officers perceived that MSQ could not force the use of the cyclone mooring at Sweers Island. MSQ was faced with the fact that the operators and owners of the ship effectively had resolved not to use the dedicated cyclone mooring at Sweers Island, and was provided with evidence from Lloyd's Register that the ship had the strength to undertake a voyage in cyclonic seas in the Gulf. Faced with these facts, permitting the ship to voyage into open waters more than 50 nautical miles from shore can be said to have given her greater options and searoom to engage in cyclone avoidance.

[34] Ultimately, whether the ship should use the cyclone mooring at Sweers Island was a matter for the Master of the ship in the circumstances, including the prevailing sea and weather conditions, and the path and intensity of the expected cyclone. MSQ could not reasonably impose as a condition of the ship's registration, or by the proper exercise of some other power, an absolute rule that the ship had to use the

cyclone mooring in the event of a cyclone. To require her to use the cyclone mooring in some circumstances may have required her to head into trouble.

[35] MSQ acquiesced is the "decommissioning" of the cyclone mooring at Sweers Island without insisting that it be replaced by another cyclone mooring. Officers of MSQ concerned with operational matters, Captain Diack and Captain Boath, maintained their view that a cyclone mooring was essential for the safe operation of the ship. Despite their opposition to the upgrading of the ship's operation, her registration was upgraded by the grant of a restricted Class 2B registration in September 2005 by Mr Bundschuh. In doing so, the safe operation of the ship was left to the operators of the ship.

[36] If MSQ reached the view that it was unsafe for the ship to operate without a cyclone mooring buoy, then a preferable course would have been for it to insist on the owner investigating the construction of a cyclone mooring in the Norman River, and, depending on those investigations, to have a cyclone mooring installed there. If the owner refused to pursue that course and permitted the cyclone mooring at Sweers Island to expire or become inoperable, then MSQ could have contended that the ship's operators were in breach of their general safety obligation, and taken enforcement action.

[37] Instead, despite the opposition of Captain Diack and Captain Boath, the registration system administered by MSQ permitted the ship to be registered in Class 2B to undertake voyages to avoid cyclonic conditions, leaving the safe operation of the ship in open waters to those operating the ship. Given the concerns expressed by Captain Diack and Captain Boath, a different approach was called for.

[38] The registration section of MSQ should have been attentive to the operational conditions in which the ship might venture into open waters, conscious of what, if anything, prevented the ship from being caught in a loaded condition if required to do so and alive to the issue of whether an overall assessment had been undertaken of the ship's seakeeping ability in cyclonic conditions It was essential for MSQ to be satisfied that the ship had the strength to undertake a voyage in cyclonic conditions. It was equally essential for it to be satisfied that, if her cargo hold was swamped, she had sufficient reserve buoyancy and stability to remain afloat. But to be satisfied of these things was insufficient to be satisfied that the ship would be seaworthy and

safe in cyclonic conditions. For instance, the operation of the ship's unique water management system in cyclonic conditions, and its impact on the safe operation of the ship, were matters that warranted consideration. The very risk that the ship might be swamped if she went into cyclonic conditions fully loaded was another. The absence of freeing ports or an active pumping system in the aft well deck to discharge water was another. The registration section of MSQ should have considered all of these matters in deciding whether or not to upgrade the ship's registration to undertake voyages in open seas in cyclonic conditions. If the registration section was not satisfied that these matters had been adequately addressed by others, it could hardly be satisfied that the ship was fit for her intended area of operation.

[39] The registration section of MSQ in 2005 was content to rest on reports about the ship's strength from Lloyd's Register, a Certificate of Compliance for Safety Equipment (Class 2B) and a Certificate of Compliance for Loadline, leaving how the ship might safely operate in cyclonic conditions to others to devise and another section of MSQ to enforce.

[40] It might be said that this is how the system in Queensland is intended to operate, with accredited persons certifying the ship's load line and the like and the registration authority being required to act on those certificates. If this is how the system is intended to operate, it should be improved. For instance, the registration system is not concerned with the powering of a ship. If the ship has the required certificates in respect of her design, construction, load line and emergency equipment, she may be registered. The fact that she has manifestly inadequate power to avoid being blown ashore in extreme conditions seemingly is not a matter for the registration section of MSQ.[18] It assumes that no owner would commission a ship with such inadequate power.

[41] A better system would be to inject greater controls over the safe operation of a ship at the registration stage. The receipt of certificates from accredited persons or classification societies, coupled with obligations on operators to operate ships safely, may be sufficient in many cases to entitle a ship to registration. The general divide between MSQ's administration of the system of ship registration and other parts of

[18] Mr Bundschuh; T.744-755.