Annex L

Extracts from Hawkins & Associates Ltd's Fire Investigation Report – C69/45210
dated 2 September 2010

2. BACKGROUND

2.1 The Yeoman Bontrup is a specialist stone carrying vessel with an internal self-unloading system so that it can unload stone without shoreside facilities. The vessel has 5 holds forward of the accommodation tower and bridge. The layout at the aft end of the vessel, where the fire developed, is shown in **Figures 1** through **10,** corresponding to deck levels from the Navigation Bridge Deck, E Deck, D Deck, C Deck, B Deck, A Deck, Upper Deck, 2nd Deck, 3rd Deck and Bottom Plan. The holds are individually hopper shaped in three sections across the vessel. Three conveyors are mounted longitudinally along the tank top to enable the stone to be moved aft to a cross conveyor, which then loads the stone onto a vertical lift belt.

2.2 The vertical lift belt rises in a conveyor tower situated at the front of the accommodation, see **Figure 11**. This lift belt deposits the stone into a hopper at the top of the conveyor, which then divides into two chutes called 'trousers'. The trousers guide the stone around the conveyor before feeding it onto a conveyor boom for discharging ashore.

2.3 The Yeoman Bontrup is capable of carrying approximately 100,000 tonnes of stone, but at the time of the fire had loaded approximately 71,000 tonnes. During loading on 2 July, the crew of the Yeoman Bontrup were carrying out maintenance in the conveyor lift tower at the front of the accommodation. The Second Engineer saw flames on the lift belt while he was standing on a platform adjacent to the belt below the third deck. He took a fire party through the Engine Room to fight the fire in the Power Pack Room. He noticed that the paint on the forward bulkhead of the Engine Room was blistering and catching fire. The fire had not spread to the Engine Room Workshop at this time. The fire spread to the third deck and to the Engine Room before an explosion in the Steering Gear Room at the stern of the ship tore the stern

deck and winch gear off the vessel. A section of the stern deck landed on the port side of the accommodation.

2.4 Prior to the discovery of the fire, the crew were conducting hot work at the top of the vertical lift conveyor, replacing the "Hardox" tiles in the trouser chute. The Chief Engineer reported that the crew were removing bolts and replacing the damaged hardox tiles with new ones. He said a sheet of plywood was placed over the conveyor belt as a working platform and that this was covered with a fire proof mat (see Figure 11).

2.5 The Steering Gear Room at the stern of the vessel was used as a storage area for chemicals and oils and a full list of chemicals onboard and layout of the Steering Gear Room was provided by the Chief Engineer and is attached in **Appendices B1** & **B2**. The list includes numerous hydrocarbon based chemicals with auto-ignition temperatures between 200°C and 230°C. Additionally, there are also numerous acids, alkalis and oxidising agents, including chlorination tablets, sodium hypochlorite and sodium nitrite. The exact location of each chemical is unknown, but the racks across the stern area are understood to have contained the oils and acids while the racks adjacent to the Bosun's Store in the Steering Gear Room contained alkalis. The location of the oxidisers and chlorinates has not been established.

2.6 The Chief Officer said that he started the hydraulic system to power the discharge boom approximately 10 to 15 minutes before the fire started. Hydraulic power was provided from the main hydraulic power packs in the Power Pack Room and controlled by switchgear within the Cargo Control Room. The Power Pack Room is on the third deck between the accommodation and Hold 5. The Chief Officer powered it up to move it inboard slightly to adjust the vessel's heel. It is unclear whether the hydraulic system was left running after the discovery of the fire.

3. ATTENDANCE IN IJMUIDEN

3.1 Circumstances of Attendance

3.1.1 Hawkins was asked to join the MAIB at 09:00 hours on 2 August 2010. I travelled to Amsterdam on 1 August 2010 and then onwards to Ijmuiden. I met with MAIB inspectors, on the morning of 2 August 2010. We were joined by the owner's representative, who escorted us to a launch to board the vessel.

3.1.2 We arrived onboard the Yeoman Bontrup at approximately 09:05 hours and were given a safety briefing. The owner's representative said that a sister ship, the Yeoman Bridge, would be arriving in Ijmuiden on 3 August 2010 and there was a possibility of conducting an examination of the undamaged vessel.

3.2 Inspection of Yeoman Bontrup on 2 August 2010

3.2.1 The inspection of the Yeoman Bontrup started in the Bosun's Store at the bow, working aft. There were large amounts of stores in the Bosun's Store including rubber belts for the conveyors; drums of oil and a work bench with welding and cutting equipment, (see **Photograph 1**).

3.2.2 Descending to the tank top at the forward end of the hold, there was no smoke damage, although some water was lying on the tank top at the forward end. Working aft, a layer of smoke deposits was present at frame 179 aft. At frame 167 the conveyor belt on the starboard side had burnt away (see **Photograph 2**). The hot layer build-up was sufficient to melt light fittings and cause drop down of the services.

3.2.3 Returning on-deck and moving aft, there was some blackening of the cargo at the aft edge of hold 5. The front of the accommodation had high levels of soot deposits to port and the deck aft of hold 5 was buckled severely (see **Photograph 3**). Three large round ventilator stacks were immediately ahead of the accommodation and served to ventilate the conveyor tunnels. The centre and port vents were fire damaged severely. The starboard vent was undamaged (see **Photograph 4**).

3.2.4 The conveyor boom on-deck was fire damaged severely and all GRP covering to the conveyor was burnt away as was the rubber conveyor belt itself.

3.2.5 At the front of the accommodation tower, the access door to port of the conveyor tower was open at the time of the fire (see **Photograph 5**), as was the internal door into the conveyor tower itself. The door to the starboard side of the conveyor tower was closed during the fire.

3.2.6 The access doors to the accommodation were closed on the port side, but two of the three doors on the starboard side of the accommodation were open at the time of the fire. The forward access door to the CO_2 room was closed; however, the doors from the deck to the accommodation and the Deck Workshop were open at the time of the fire. The remains of an arc welding cable were lying through the open doorway to the Deck Workshop (see **Photograph 6**).

3.2.7 Amongst the debris in front of the accommodation were the remains of oxy-acetylene hoses (see **Photograph 7**) and a high expansion foam generator.

3.2.8 The fuel oil tank (FOT) vents on the port side were blown open, indicating that the tank had experienced an internal over-pressure; however, there was little associated fire damage to the vents themselves (see **Photograph 8**). The FOT vents on the starboard side were not blown open but were all fire damaged severely.

3.2.9 The aft deck of the Yeoman Bontrup was mostly blown off. The deck to the port and starboard sides of the exposed Steering Gear Room had remained in place. However, the inner edges of the plating on the top of the tanks outboard of the Steering Gear Room had been torn from the bulkheads. The Steering Gear Room was open with the rudder head and steering gear exposed. The aft edge of the accommodation tower was fractured; with the bulkhead plating bent outwards from the Engine Room (see **Photograph 9**).

3.2.10 The stern deck lay on the port side of the accommodation tower. The underside of the deck section had heavy soot deposits. Paint remained on the top surface of the aft deck and the deck was relatively undamaged by fire (see **Photograph 10**).

3.2.11 A large hole existed in the deck plating in the Laundry and Clean Linen Locker on the main deck inside the accommodation tower. This was approximately over the Diesel Oil Service Tank in the Engine Room. The steel deck plating was burnt or melted away over an area of approximately 4 m^2 (see **Photograph 11**). The remaining accommodation was fire damaged severely throughout; however, the bridge had sustained little in the way of fire damage.

3.2.12 External doors of the lift conveyor casing were open above main deck level and numerous tools, including welding rods, remained in the stairwells. The lift conveyor chute or 'trousers' had numerous welded patches and oxyacetylene holes cut in it (see **Photograph 12**).

3.2.13 The Power Pack Room at the base of the lift conveyor casing was fire damaged severely. It contained the remains of oil drums, welding and cutting equipment. There was no clear evidence of failed hydraulic lines in this area. The remains of a work bench were to port. Witness marks revealed that the access way between the

Power Pack Room and the Engine Room Workshop on the port side was open at the time of the fire (see **Photograph 13**).

3.2.14 The Engine Room Workshop was fire damaged severely. A welding area to port had oxy-acetylene and arc welding equipment (see **Photograph 14**). Doors on the starboard side of to the Engine Room were distorted inwards (see **Photograph 15**). The aft door of the workshop had been open during the fire (see **Photograph 16**). The overhead gantries in the Engine Room had collapsed and there was severe distortion to the top of the steel columns. The forward starboard corner of the second deck around the engine opening had sustained severe fire damage to the Diesel Oil Service Tank. Numerous steel pipes had burnt away and deck beams and deck plating overhead were burnt or melted and had re-solidified on the deck plating below (see **Photograph 17**). Sight "glasses" in the Diesel Oil Service Tank had melted or burnt away.

3.2.15 A second area of severe fire damage was adjacent to the piping for the high pressure air tank. The steel had burnt away in the adjacent engine ductwork. All the main structural columns in the Engine Room had buckled where they met with 'A' deck above.

3.3 Inspection of Yeoman Bridge on 3 August 2010

3.3.1 On 3 August 2010 I inspected the Yeoman Bridge with the MAIB and owner's representatives. We met the Captain and viewed a General Arrangement plan of the vessel to familiarise ourselves with its layout.

3.3.2 I examined the conveyor system from the tunnels beneath the cargo holds and followed it back to the lift conveyor casing; all conveyors were running at that time.

Numerous small stones were falling down the lift conveyor casing while it was in operation.

3.3.3 I viewed the lift conveyor belt from the platform below the Power Pack Room on the third deck from where the Second Engineer on the Yeoman Bontrup reported having seen the fire initially. There was a clear view of the ascending buckets on the belt (see **Photograph 18**). The flexible rubber sides to the belt were clearly visible in the lift conveyor tower (see **Photograph 19**). A view down the tower showed the buckets in the rising and falling belt (see **Photograph 20**).

3.3.4 The Power Pack Room contained a work bench; oil drums, welding rods and cutting equipment (see **Photographs 21** to **23**). The adjoining door to the Engine Room was shut, but witness marks indicated it had been used regularly. There were no locking dogs and it was bolted shut. A retaining stud welded to the bulkhead adjacent to the door could be used to hold the door open at sea (see **Photograph 24**).

3.3.5 There were corrosive liquids stored beside the oil drums (see **Photograph 25**). In general, below decks, all available spaces and corridors were used for general storage, including storage of flammable liquids (see **Photographs 26** and **27**). The 'trousers' in the lift conveyor tower had numerous oxy-acetylene cut holes and welded patches on the outside of the chute (see **Photograph 28**) and nuts retaining the hardox tiles were rusted severely (see **Photograph 29**).

3.3.6 On deck, there were numerous drums of chemicals stored between holds 4 and 5 (see **Photograph 30**). These were reported to have been stored in racks across the transom in the Steering Gear Room. The chemicals included alkyl benzenes, sodium nitrite, acids, potassium hydroxide, sodium hypochlorite and hydrazine hydrate.

However, some corrosive chemicals remained in the Steering Gear Room (see **Photograph 31**) including chlorinating tablets (see **Photograph 32**).

3.3.7 In the Engine Room, air control pipes routed to the emergency shut down cylinders on the Diesel Oil Service Tank valve were disconnected from the valve. The air lines ran across the deck head adjacent to the Diesel Oil Service Tank (see **Photograph 33**). This was in a similar location to the burnt steel and deck beams on the Yeoman Bontrup. All sight glasses for the Diesel Oil Service Tank, vented oil tank and heavy fuel oil were made of plastic and not glass (see **Photographs 34** and **35**).

3.3.8 There were drums of the oxidising agent Dieselguard NB in the Engine Room outside the workshop (see **Photograph 36**). The two emergency shutdown control valves for the oil tanks were in the fire control room, one of the two valves shut the valve for the Diesel Oil Service Tank. The other valve closed all the remaining fuel supply valves in the Engine Room.

3.4 Inspection of Yeoman Bontrup on 4 August 2010

3.4.1 A re-examination of the damage to the Laundry, Diesel Oil Service Tank, the position of the Engine Room doors and the fire control valves was conducted on 4 August 2010. A detailed examination of the damage in the Steering Gear Room was also conducted.

3.4.2 The fire damage in the Laundry and Clean Linen Locker was most severe in the Clean Linen Locker with a small hole in the Laundry and most of the Clean Linen Locker floor burnt away. The ceramic tiles in the laundry remained in place, except at the hole in the floor. The drain pipe in the laundry floor directly over the Diesel

Oil Service Tank was intact, but the water trap lay upside down on clean tiles and stuck in debris beside the drain, see **Photograph 37**.

3.4.3 The hole over the Diesel Oil Service Tank was approximately in line with the air supply line from the emergency shutdown valves. A section of the air line was found in the debris. The shut down valve on the Diesel Oil Service Tank was in the 'open' position. The emergency shutdown valves in the fire control room had both been activated. The supply valve for the air reservoir for the air valves was in the 'open' position.

3.4.4 The bulkhead below the Engine Room and in line with the decking of the Steering Gear Room was displaced into the Engine Room, although some bulkhead plating at the top of the Engine Room was torn outwards.

3.4.5 There was severe distortion to double doors from the Engine Room Workshop to the Engine Room; however the aft door from the workshop to the Engine Room was in the 'open' position at the time of the fire. The glass in the window of this door was broken and lying in the debris outside the workshop.

3.4.6 The forward door to the Purifier Room on the starboard side of the Engine Room was open at the time of the fire, see **Photograph 38**. There were the remains of a piece of rope attached to the handle on the outside of the door. The edges of the rear door to the Purifier Room were free of soot, indicating that it was closed at the time of the fire. Glass in the Purifier Room doors was undamaged.

3.4.7 The door from the Engine Room to the Engine Store over the Engine Room Workshop was blown into the storeroom. The door was buckled around the lock and the striker plate on the door jamb was broken, see **Photograph 39**. The windows of the Engine Control Room over the storeroom had re-solidified at the bottom of

their frames and had not shattered, see **Photograph 40**. The door to the Engine Control Room was in place and fire damaged, but not buckled and the glass in the door had re-solidified at the base of the frame, see **Photograph 41**.

3.4.8 There was no significant fire damage at low levels in the Engine Room, although there was light heat damage to plastic materials at the third deck level. The door to the escape trunking at the aft end of the Engine Room at the lowest deck was buckled severely. The door was lying in the Engine Room and the door frame bent into the Engine Room, see **Photograph 42**.

3.4.9 The Steering Gear Room was exposed due to the explosion removing the stern deck. The damage to the components in the Steering Gear Room is shown in **Figure 12**. It contained over expanded 200 litre drums (see **Photograph 43**), crushed 200 litre drums (**Photograph 44**) and burnt 25 litre drums (see **Photograph 45**).

3.4.10 The aft bulkhead of the Rope Store on the port side of the Steering Gear Room had moved approximately 100 mm forwards, (see **Photograph 46)**. Drums stored aft of the Rope Store were crushed, (see **Photograph 47).** The drums stowed to starboard of the Rope Store had over-pressurised in the fire (**Photograph 48)**. The metal cabinets on the port side of the Steering Gear Room were displaced forward of their mountings while those on the starboard side were bent forward, but remained in place (see **Photographs 49** & **50)**.

3.4.11 There were numerous 200 litre drums with crease marks in their sides, which had subsequently over-expanded, see an example in **Photograph 51**. The hydraulic tanks for the steering gear were squashed slightly and electrical connection boxes on top of the motors for the hydraulic system on the steering gear were crushed, see **Photograph 52**. A matching connection box on electric motors forward of the steering gear was not crushed in the same manner.

3.4.12 There was almost no debris between the centre line transom stiffener and the next transom stiffener to port at the transom. Burnt and squashed remains of 25 litre tins were in the aft port corner. The tops of some of these tins had subsequently burnt during the fire. There were metal clip rings from the tops of plastic 25 litre drums amongst this debris, but there was no evidence of the drums themselves. The remains of an electrical cabinet, which had collapsed into the debris, was immediately to starboard of the centre line frame, see **Photograph 53**. There were severely crushed 25 litre and 200 litre drums between the rudder head and the transom, see **Photograph 54**. The remains of a heavy door with securing dogs lay in the debris to starboard of the rudder head.

4. DISCUSSION

4.1 The first witness accounts reported a fire on the belt at the base of the lift conveyor tower on the Yeoman Bontrup. The presence of a hotwork team at the 'trousers' raises the possibility that a piece of hot metal dropped down the casing tower and lodged on the belt.

4.2 The hotwork team have reported that they placed a plywood working platform on the near horizontal returning section of the conveyor belt and that this was covered with some form of fire proof mat. This was reported to have been placed on the descending part of the conveyor belt, which slopes slightly aft. The rising conveyor belt further aft was shielded by steel plating in the upper level, however at lower levels, the rising and falling buckets were about 60 cm apart and faced each other.

4.3 Any hot bolt head or cutting/welding slag falling from the 'trousers' could have rolled off the fire proof matting and fallen down the lift conveyor casing. The upturned buckets on the descending conveyor would deflect any falling debris aft and towards the upturned buckets on the ascending part of the conveyor belt. The falling stones, observed during the operation of the conveyor system on the Yeoman Bridge, confirm that a clear path exists for debris to fall down the conveyor lift tower.

4.4 The conveyor belt is not reported to be particularly combustible, in that previous fires on the belts have been extinguished relatively easily. However, the rubber side curtains are recognised as a significant fire risk. It is most likely therefore that a side curtain ignited after a segment of hot metal from the hotworks lodged in one of the conveyor buckets and the fire developed on the ascending part of the belt.

4.5 As the fire developed in the lift casing tower, the belt probably collapsed to its base causing a significant fire to develop there. The lift conveyor casing is immediately

forward of the Engine Room bulkhead and the fire would have heated the Engine Room bulkhead readily. The blistering and the flashing off of the paint on the bulkhead, observed by the Second Engineer, confirm this as the beginning of fire transfer to the Engine Room.

4.6 The Power Pack Room is situated directly over the lower belt casing. Numerous combustible materials were stored in the Power Pack Room and they are likely to have been ignited by the heat transfer through the deck plating. The access way from the Power Pack Room to the Engine Room Workshop was open at the time of the fire and the fire is likely to have transferred from the Power Pack Room to the Engine Room Workshop through this door.

4.7 The Engine Room Workshop contained oxy-acetylene cutting equipment, oils and other combustible materials, which would have promoted the rapid development of the fire. I consider the fire spread to the Engine Room via the Engine Room Workshop, the aft door of which was open. The starboard side doors to the Engine Room Workshop were forced into the Engine Room Workshop, by an over-pressure external to the workshop itself. There was similar damage to the storeroom door directly above.

4.8 There was a container of Dieselguard NB (sodium nitrite) outside the Engine Room Workshop doors on the Yeoman Bridge. Sodium nitrite is a powerful oxidising agent and if it was also present outside the workshop doors on the Yeoman Bontrup it would assist in a rapid development of the fire in this area and could possibly initiate an explosion. This would be consistent with the damage to the workshop and storeroom doors. The lack of over-pressure damage to the Engine Control Room above the storeroom suggests that the over-pressure outside the workshop did not occur until after the Engine Control Room windows had melted. The lack of damage to the Purifier Room doors and windows suggests that the over-pressure outside the

Engine Room Workshop doors was localised and not a result of a slow and sustained pressure rise within the Engine Room.

4.9 The development of the fire in the Engine Room is likely to have built up a layer of hot gases at the upper levels, melting windows in the engine control room and probably the plastic sight glasses of the oil tanks at upper levels. If the plastic sight glasses released oil when they melted, this would have increased the fuel loading in the Engine Room.

4.10 The air supply valve to the air pressure tank for the fire control valves in the Fire Control Room was open. Once the fire control valves were operated to shut down all the tank valves in the Engine Room, the air tank for the valves would have remained at full pressure, topped up from the ship's main air supply. It should be noted that the air line to the Diesel Oil Service Tank valve on the Yeoman Bridge was not connected and if this was also the case on the Yeoman Bontrup, the air supply to the valve would have been released directly into the Engine Room and the valve on the Diesel Oil Service Tank would not have closed. This is consistent with my observation of the valve on the Yeoman Bontrup. This would result in a continuous supply of air to feed the fire in the Engine Room. The severe and localised melting of the steel above the Diesel Oil Service Tank is unlikely to have occurred without a highly localised oxygen supply. It is likely therefore that high pressure air from the fire control valves provided this oxygen supply.

4.11 The second deck of the Engine Room is immediately adjacent to the Steering Gear Room. Heat transfer to the Steering Gear Room through the aft bulkhead of the Engine Room would have been significant. Soot deposition on the underside of the displaced stern deck indicates that significant smoke build up in the Steering Gear Room occurred before the displacement of the stern deck. This smoke build up

would be associated with significant levels of fuel in an oxygen depleted environment.

4.12 The plastic containers of oils, acids, alkalines and oxidising agents in the Steering Gear Room are likely to have been melted by the increasing temperatures. Once the containers were damaged, their contents would have reacted with each other, and if a fire had already developed the oxidising agents would react with the fuel rich atmosphere. It is likely that the oxidising agents, particularly Dieselguard NB and sodium hypochlorite, would rapidly accelerate combustion.

4.13 The lack of debris between the transom centre line vertical stiffener and the stiffener to port suggests an explosion might have originated at this point and it is of note that this roughly corresponds to the Chief Engineer's sketch indicating the boundary of the oil and acids store. It should also be noted that the electrical cabinets to port in direct line of this space were stripped from their mountings, whilst those sheltered by the steering gear were only bent around their fittings.

4.14 The crush damage to hydraulic tanks and electrical connection boxes is limited to those closest to the stern and the displacement of the Rope Store bulkhead suggests that a localised detonation occurred towards the stern of the vessel. The lack of crush damage to the electrical connection boxes forward of the stern gear indicates that the high over-pressures did not propagate further forward and that there was a rapid decrease in over-pressure. This is consistent with a small localised detonation in the area and subsequent rapid pressure decay. The drums appear to have been crushed then re-expanded when their contents boiled. The crush marks and subsequent expansion of 200 litre drums suggests that the explosion that removed the stern deck occurred before the entire space heated to the boiling points of the contents of the drums.

4.15 It is likely that a local detonation occurred at the transom creating drum shrapnel and causing the severe crush damage to the 200 litre and 25 litre drums in the immediate vicinity and displacing them from their original positions. Drums further from the seat of the detonation sustained crushing damage, but were not shredded into pieces of shrapnel. This localised detonation might have opened the Steering Gear Room to the atmosphere and allowed air to rapidly mix with the fuel rich atmosphere in the Steering Gear Room, causing the explosion that removed the stern deck.

4.16 The generation of white smoke and the fire ball in the videos I have viewed is consistent with the heating of hydrocarbons and the rapid oxidation of a vented fuel rich atmosphere. A fire ball developed as the fuel rich gas mixture in the Steering Gear Room mixed with the external atmosphere when the stern deck was torn from the vessel.

5. CONCLUSIONS

5.1 The fire on board the Yeoman Bontrup was probably caused by hot metal debris from hotwork in the lift tower casing falling into a bucket on the ascending section of the conveyor belt. It is likely that this hot metal ignited the flexible rubber side curtain of the belt. The belt is then likely to have collapsed to the base of the tower where it continued to burn.

5.2 The fire is most likely to have spread from the lift conveyor tower to the Engine Room and Power Pack Room by conduction through the steel deck and bulkhead plating and the subsequent ignition of combustible materials in both spaces. The door between the Power Pack Room and the Engine Room Workshop was open at this time and facilitated the spread of the fire subsequently to the Engine Room Workshop.

5.3 The aft door of the Engine Room Workshop was open and the fire has probably also spread to the Engine Room via this route in addition to the heat transfer through the forward bulkhead. The development of the fire in the Engine Room led to a hot layer of gases at the upper level, which melted the plastic sight glasses in the fuel lines in the Engine Room and possibly added to the fire load. The failure of the air supply lines to the emergency shut down valves in the Engine Room provided additional oxygen to the fire and caused severe localised melting of the steel work close to the ruptured air supplies.

5.4 The heat build up in the Engine Room has transferred to the Steering Gear Room and ignited combustible materials there. Although this fire was limited initially, the damage to containers of acids, alkalis and oxidising agents resulted in the rapid acceleration of the fire and caused a severe localised detonation of the chemicals stored in racking across the transom. The subsequent deflagration of the

atmosphere in the Steering Gear Room caused the stern deck to be torn from the vessel.

FIGURES 1 -12

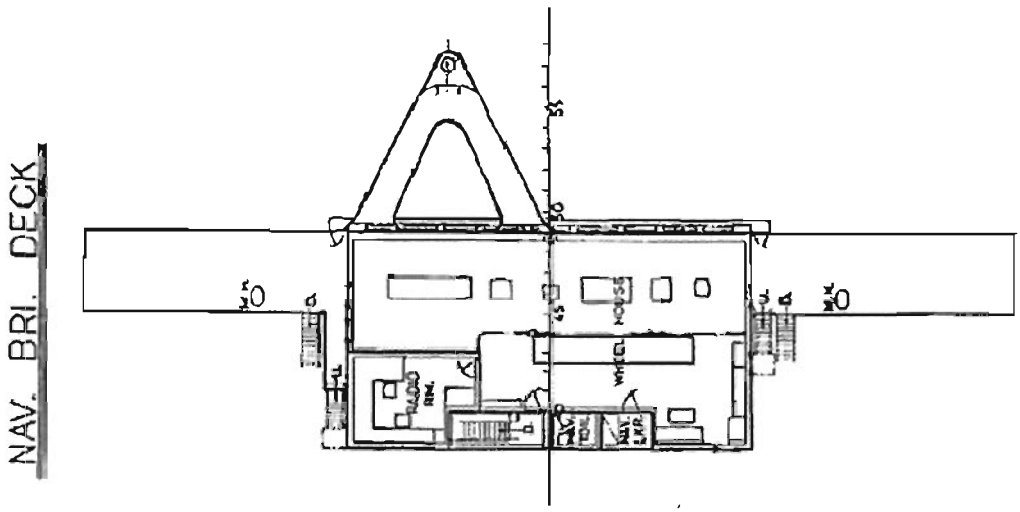


Figure 1
Navigation Bridge Deck.

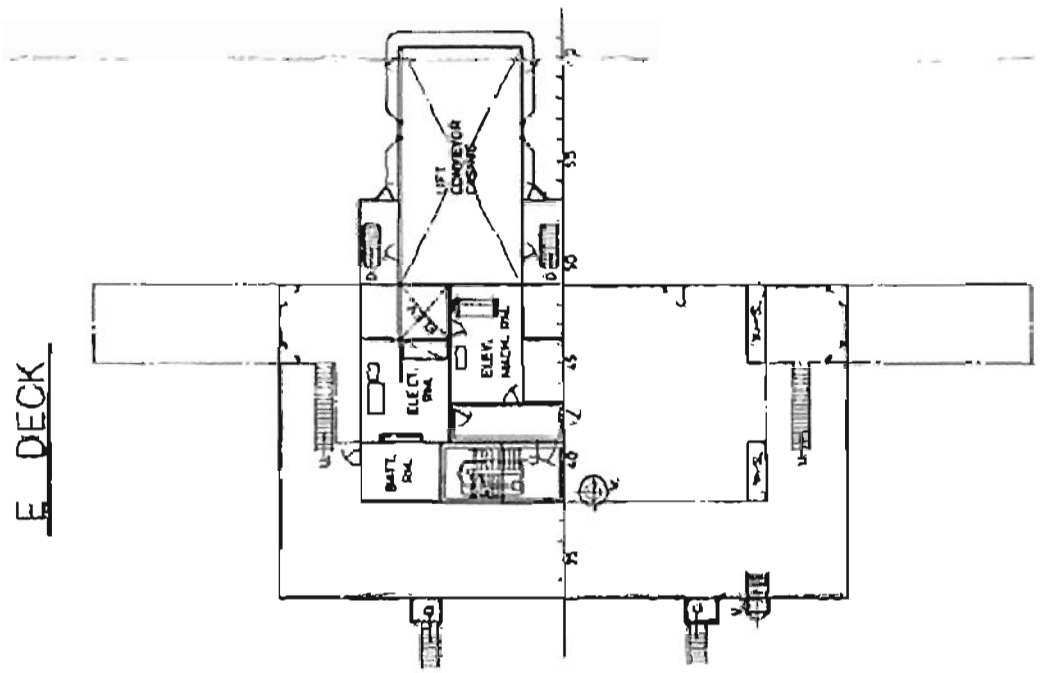


Figure 2
E Deck.

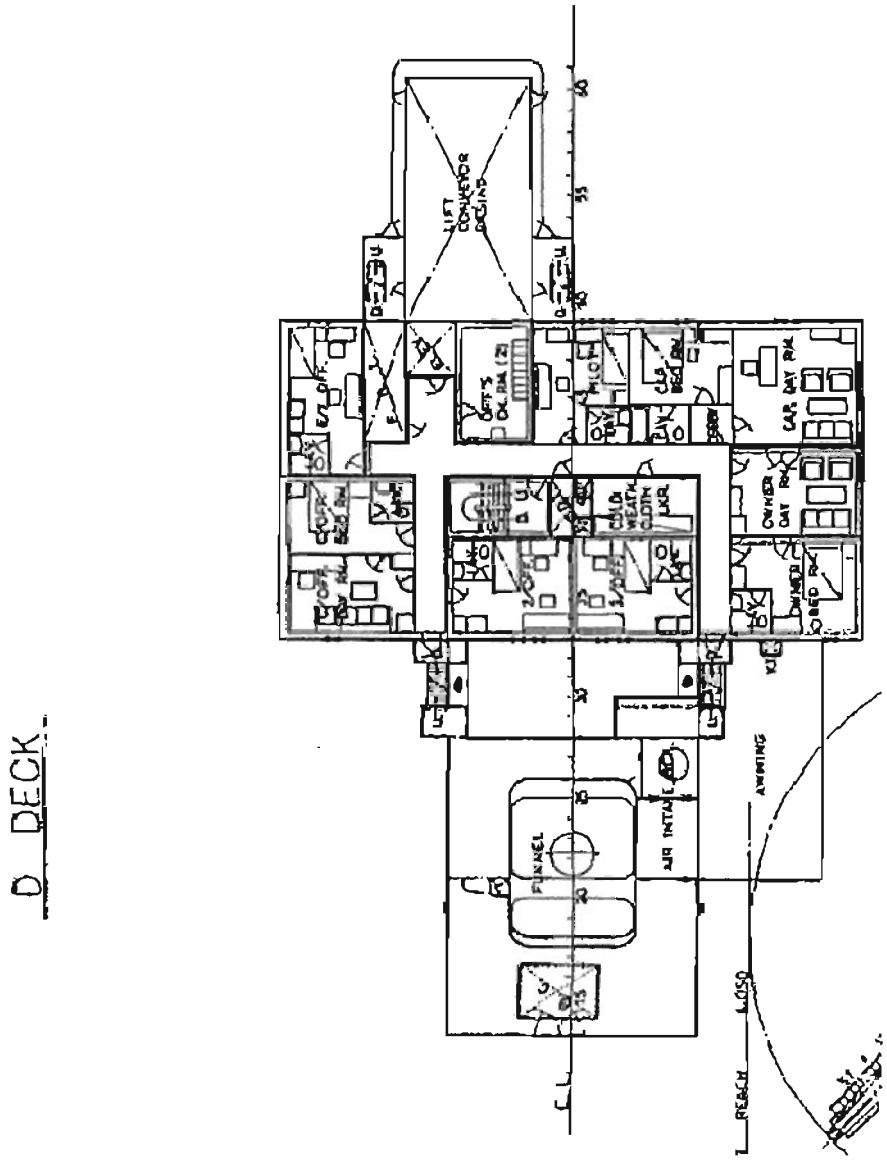


Figure 3
D Deck.

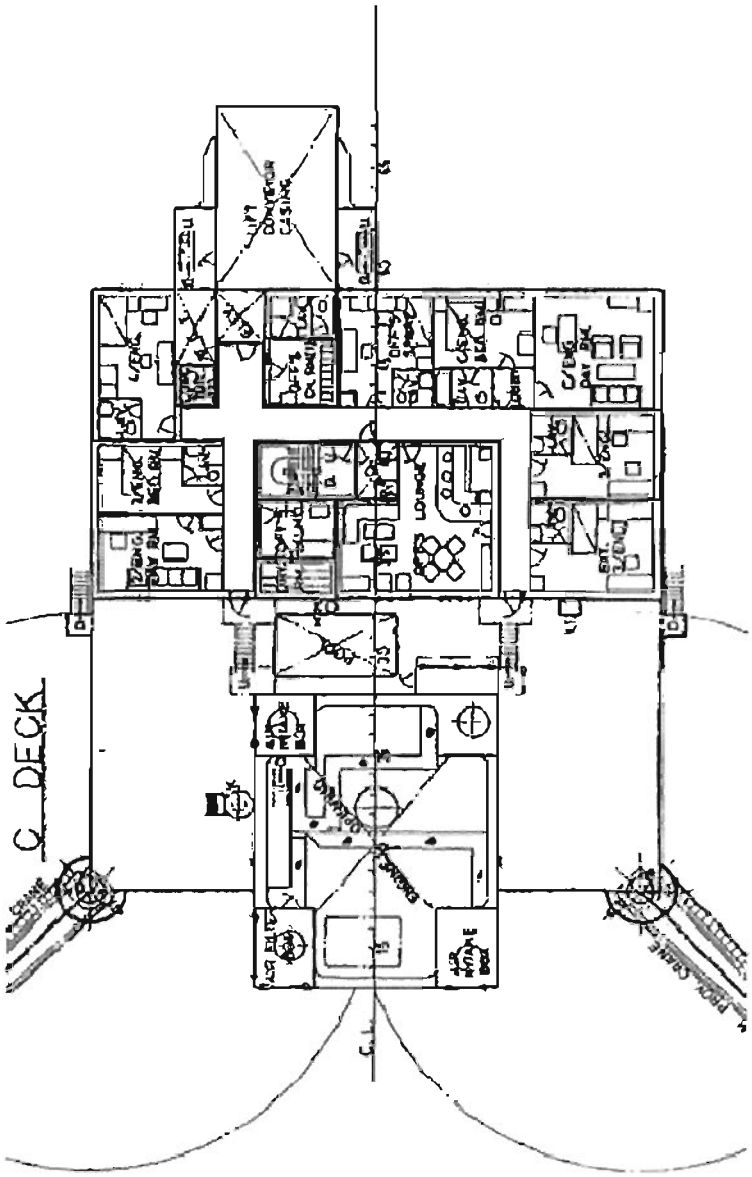


Figure 4
C Deck.

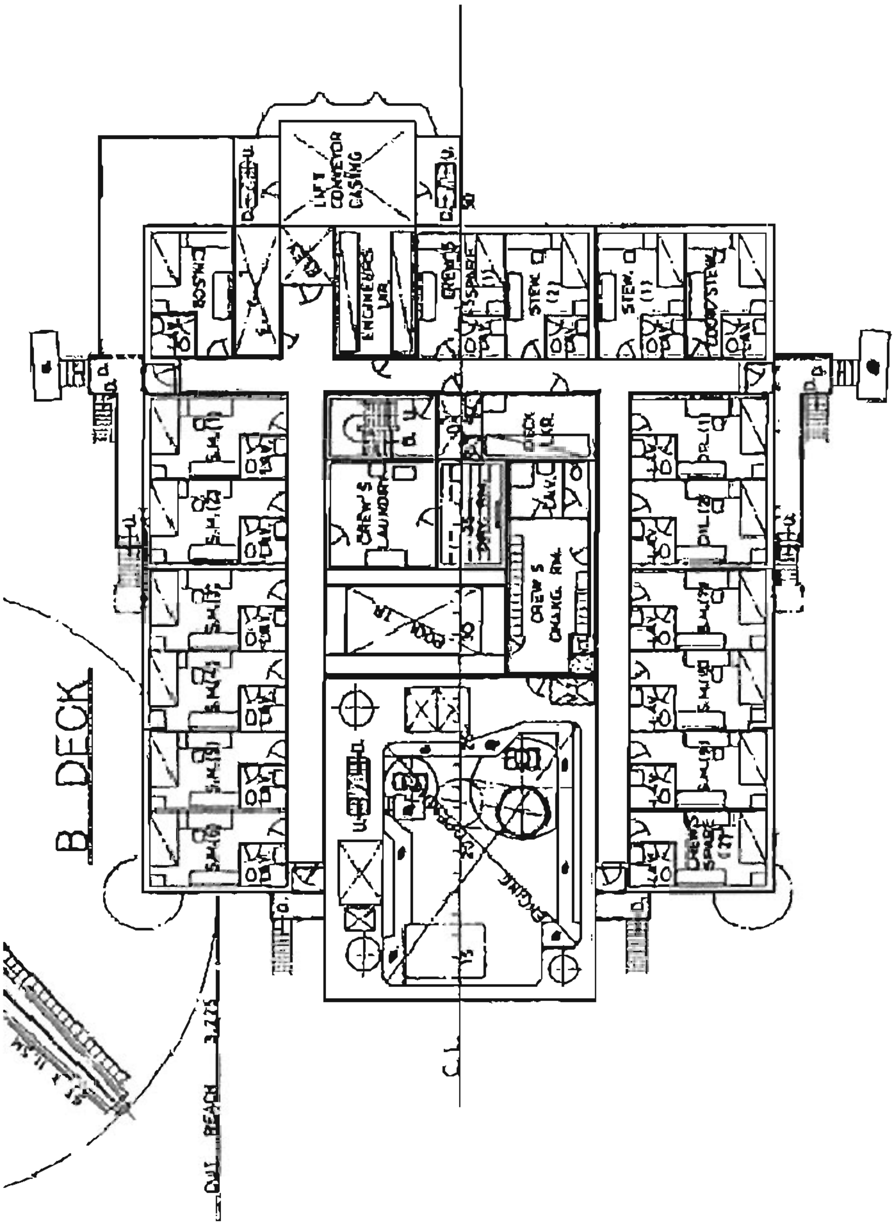


Figure 5
B Deck

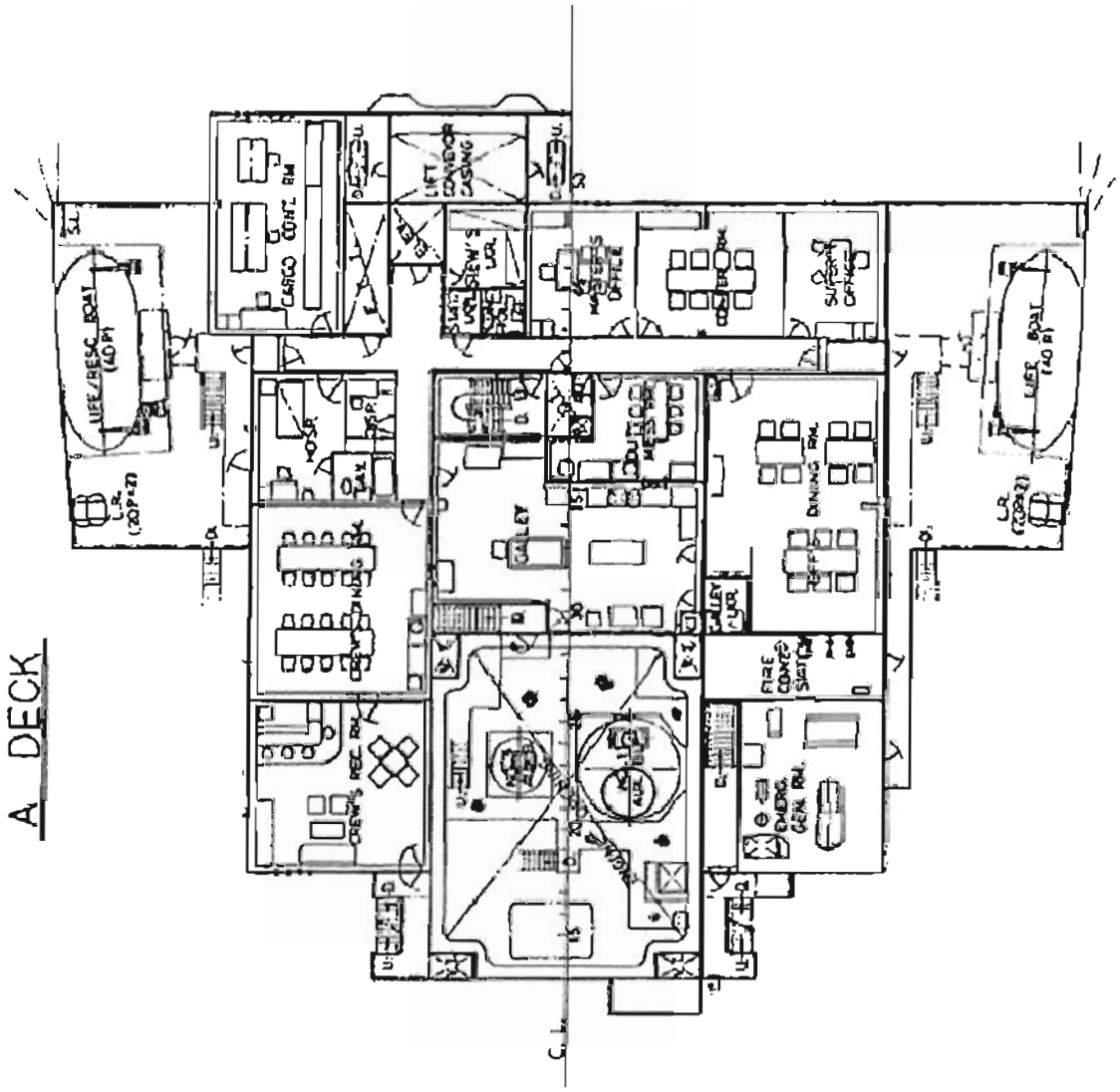


Figure 6
A Deck

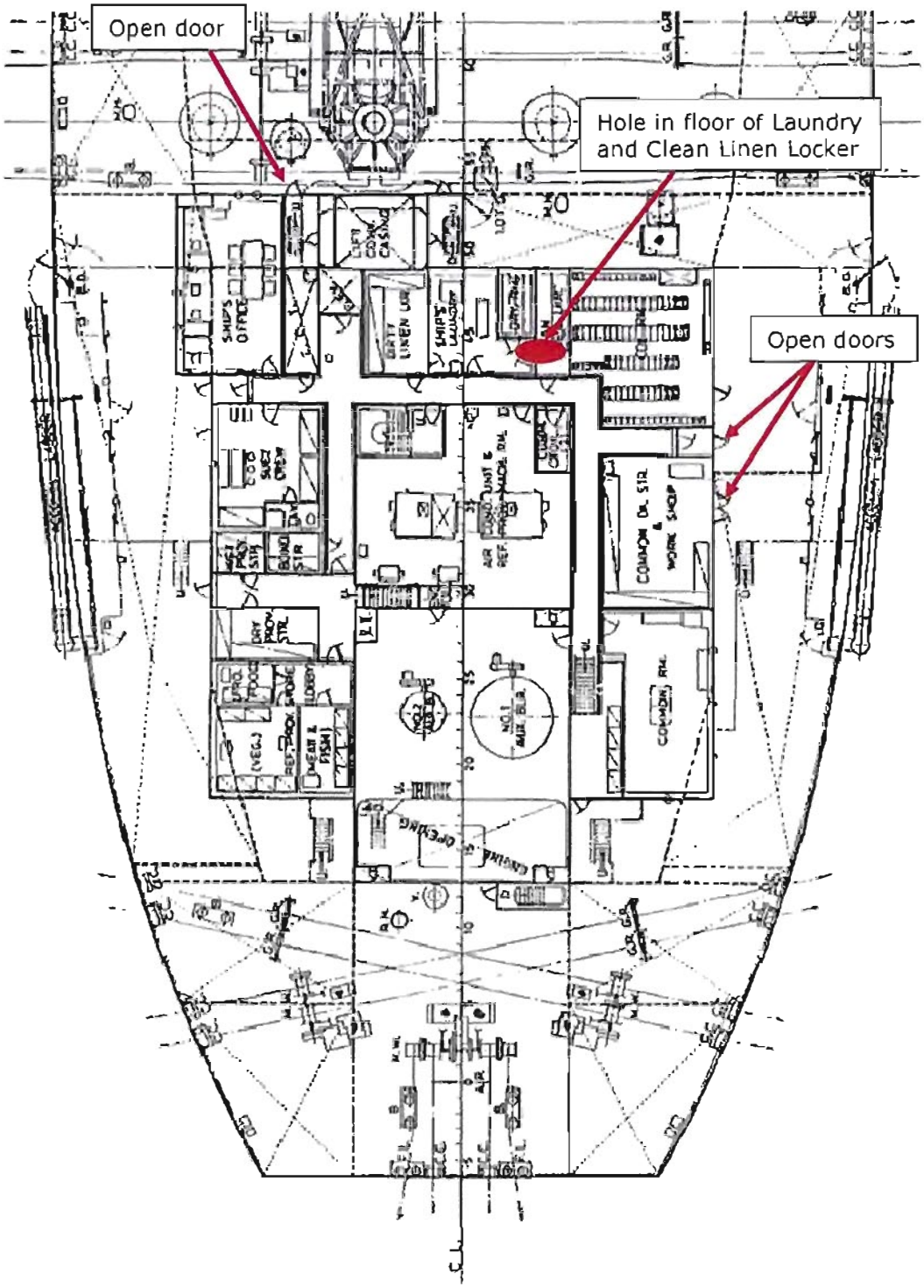


Figure 7
Upper Deck

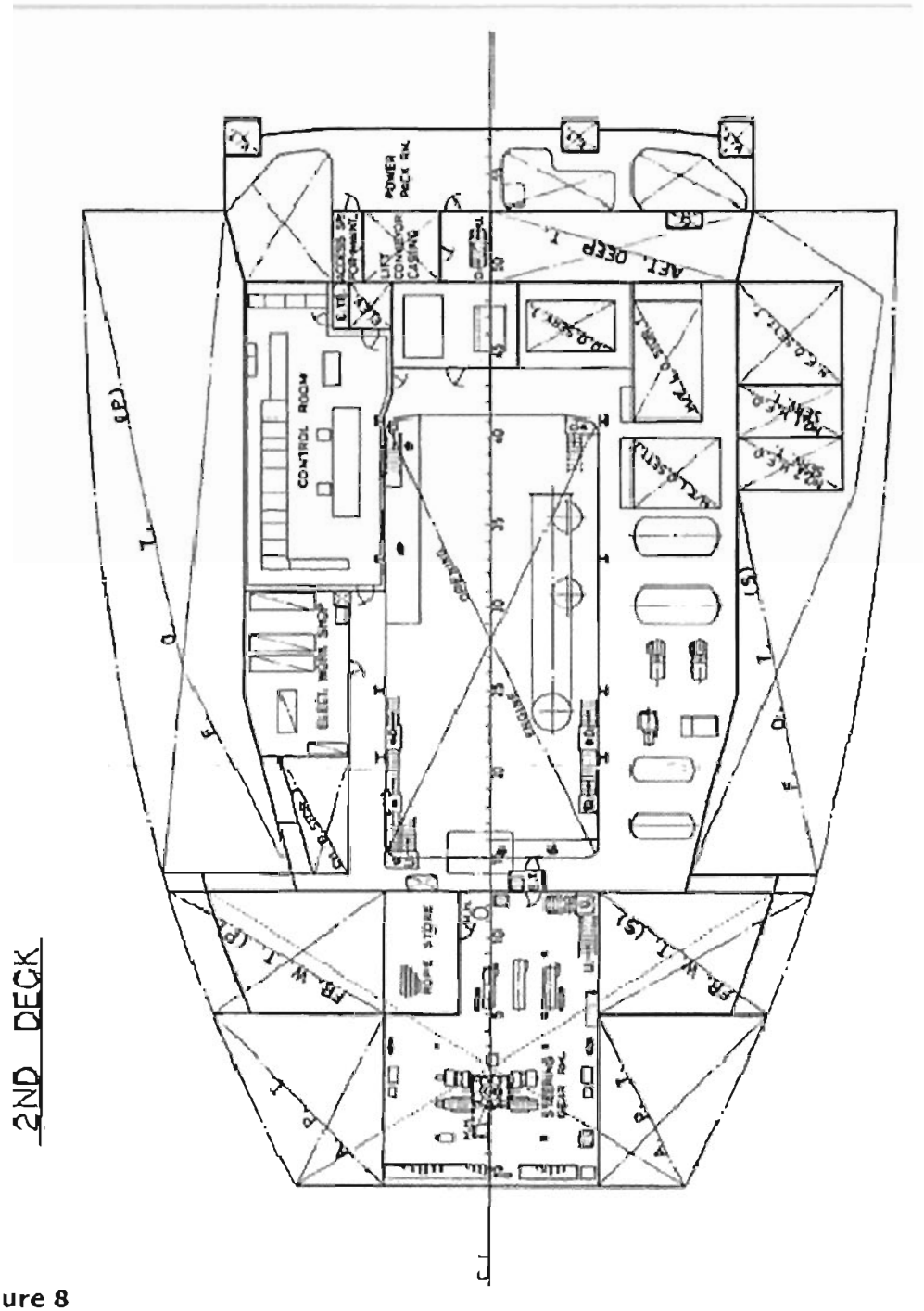


Figure 8
2nd Deck

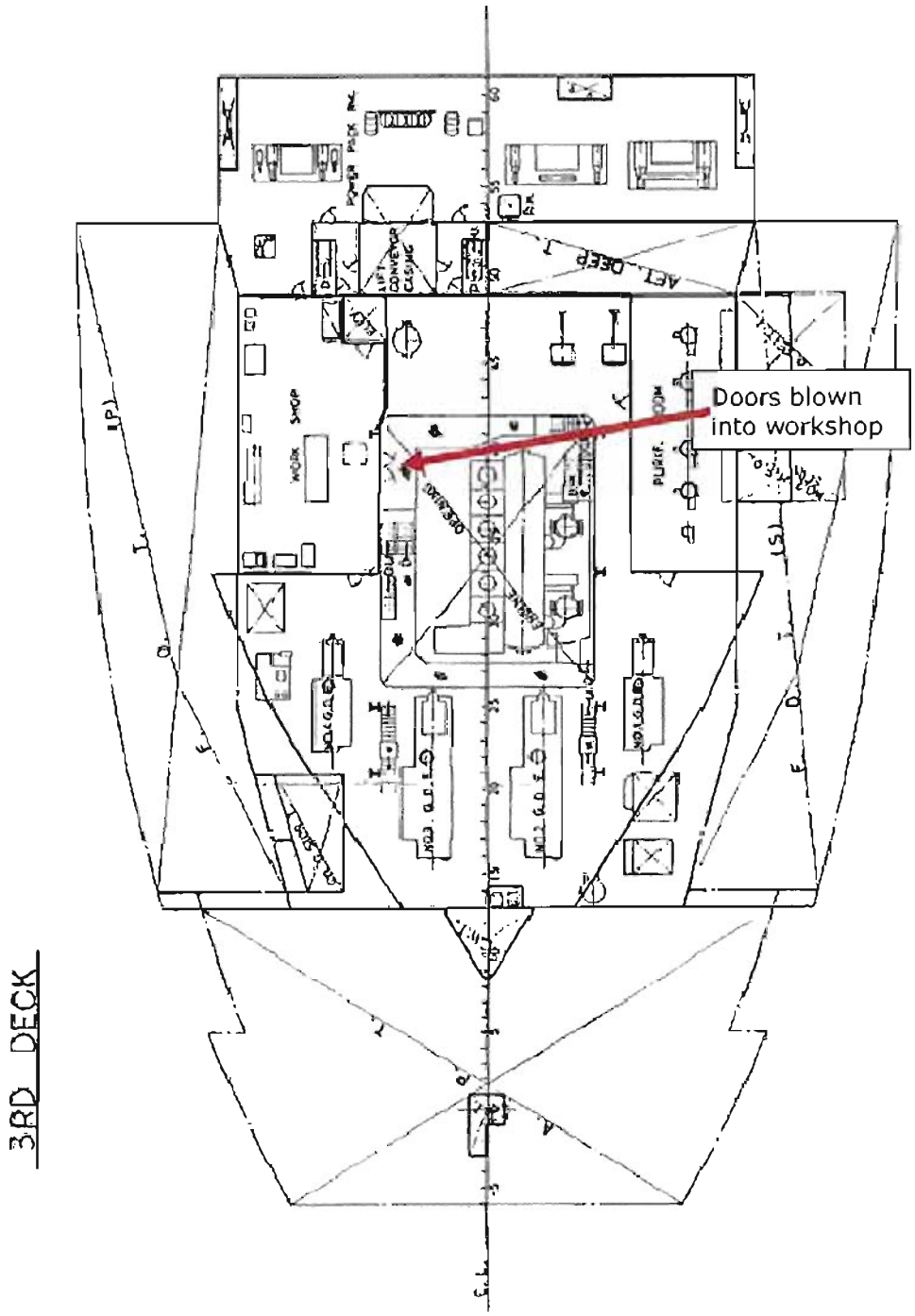


Figure 9
3rd Deck

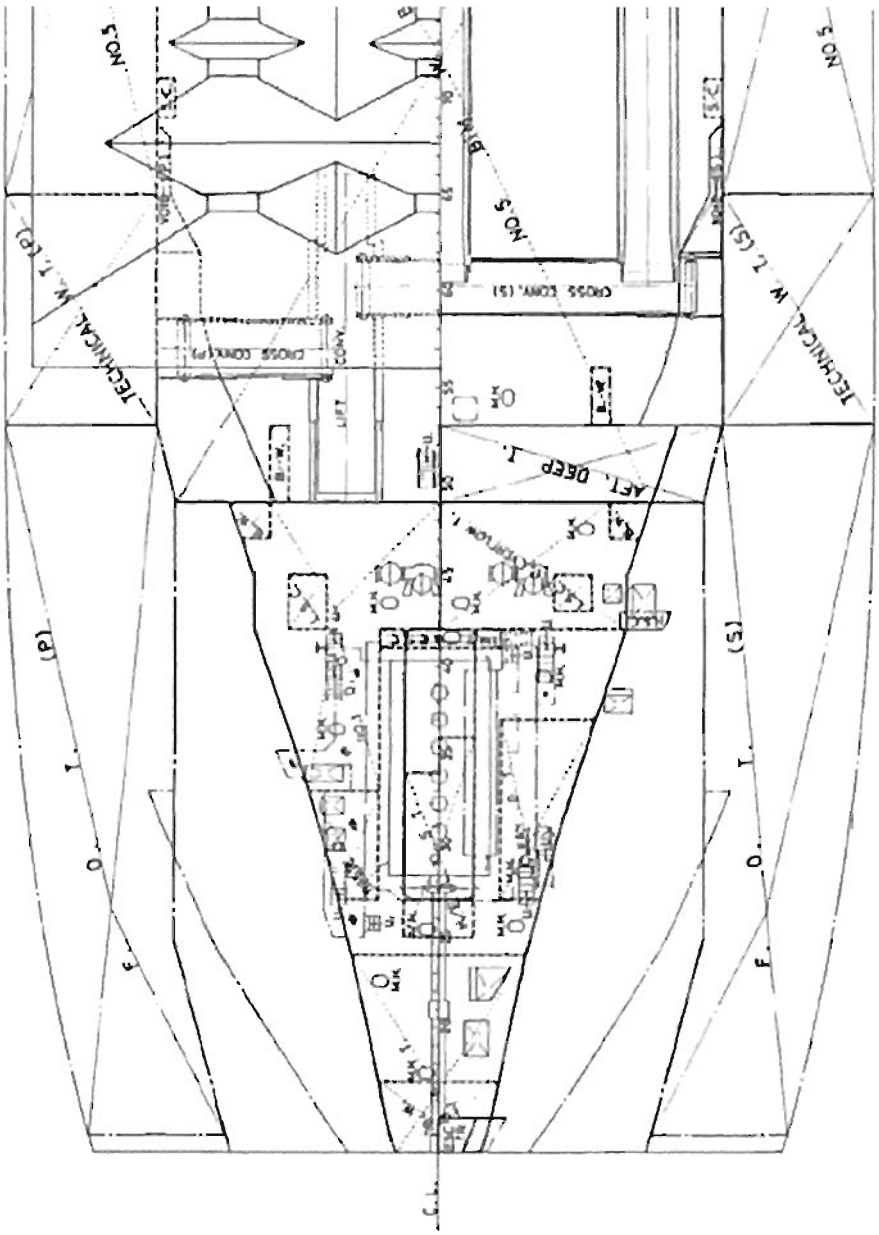


Figure 10
Bottom Plan

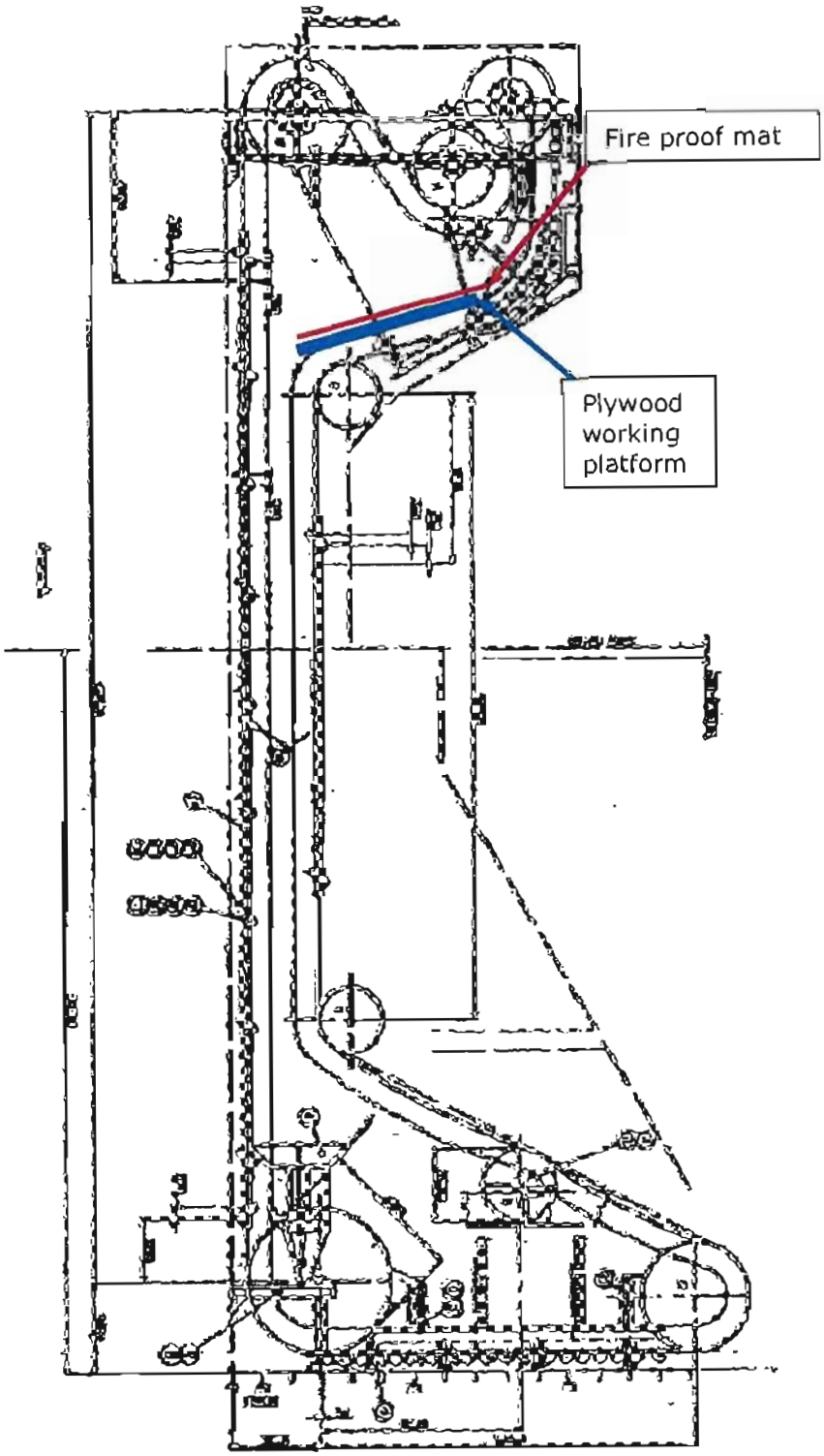


Figure 11
The lift conveyor.

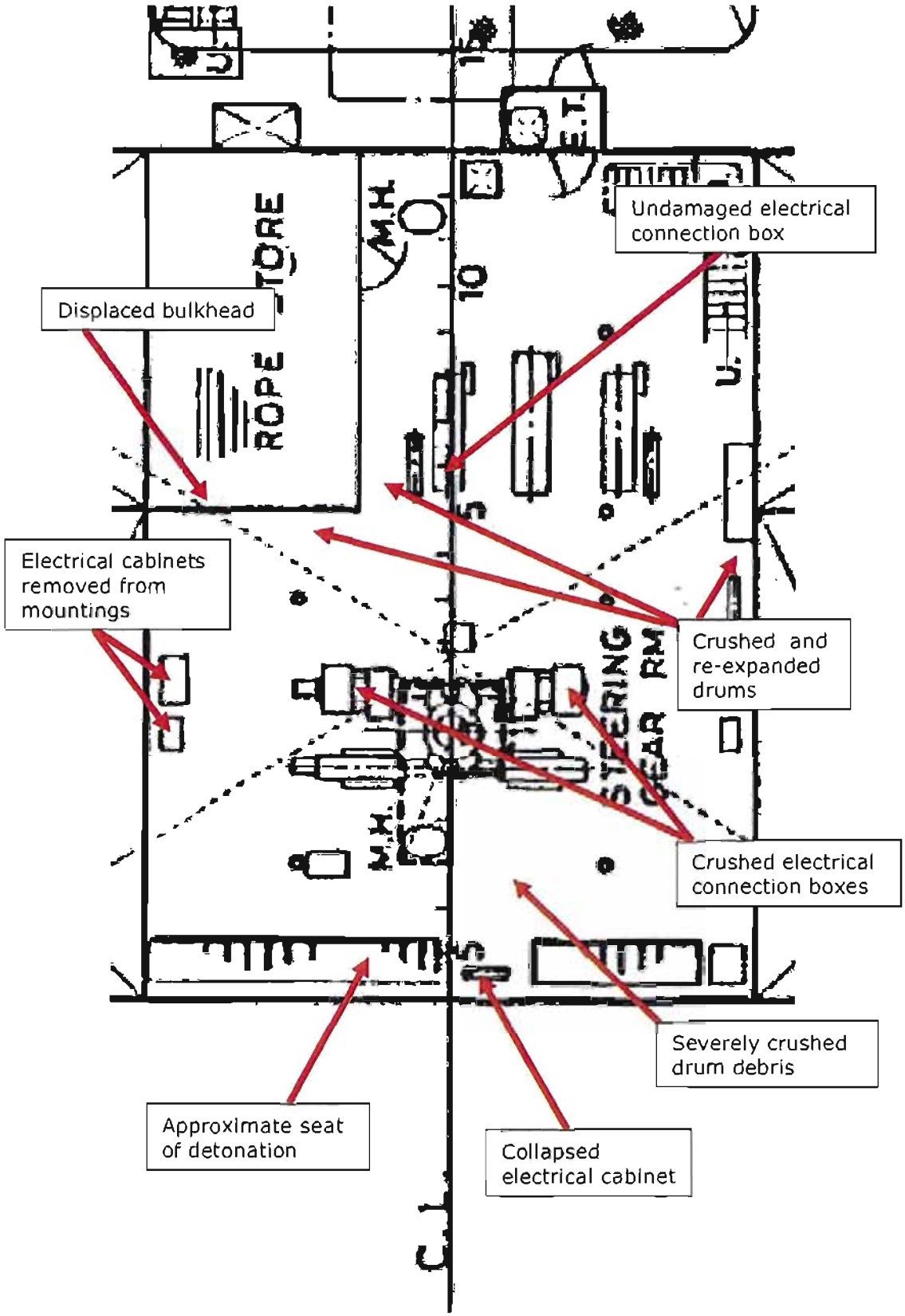


Figure 12
The damage in the Steering Gear Room

APPENDIX B1

List of chemicals stored on board

Chemical Inventory

m/v " YEOMAN BONTRUP "

Jun-10

UNITOR

		Unitor No.	Start of month	Received	Used	End of month	
1	Potable Water Stabilizer,kg	659 624916	173		10	163	neutral
2	Vaptreat,ltr	654 571364	55		5	50	neutral
3	Hand cleaner,ltr	651 571752	35		5	30	neutral
4	Gamazyme 700FN,kg	656 571711	103		5	98	neutral
5	Gamazyme BTC,botl	656 589945	32		0	32	neutral
6	Soot Remover,kg	650 571240	135		15	120	neutral
7	Boiler Coagulant,ltr	655 571331	80		5	75	neutral
8	Enviroclean,ltr	652 571380	125		15	110	neutral
9	Seaclean,lit	651 571752	40		5	35	neutral
10	Dieselguard NB, kg	653 571349	104		18	86	nitrit
11	Alkalinity control, ltr	653 571356	100		0	100	nitrit
12	Disclean, ltr	651 571687	60		0	60	acid
13	Metal-Bright,ltr	651 571661	100		0	100	acid
14	Descalex,kg	651 571646	170		0	170	acid
15	Clorinating tablets,kg	657 624858	25		1	24	acid
16	Liquitreat,ltr	655 571273	70		6	64	alkaline
17	Oxygen Control,ltr	655 571315	50		5	45	alkaline
18	Aquataff,ltr	651 607826	60		0	60	alkaline
19	Condensat control,ltr	655 571323	35		0	35	alkaline
20	Oxygen Scavenger Plus,ltr	655 698712	20		0	20	alkaline
21	Electrosolv – E,ltr	651 604389	100		0	100	petroleum
22	ACC Plus,ltr	651 698704	100		15	85	petroleum
23	Coldwash HD,ltr	651 571430	90		0	90	petroleum
24	Carbonclean LT,ltr	651575696	40		15	25	irritant
25	Hypochlorite sodium 14%	20366986	78		8	70	irritant
26	Hardness control,kg	655571299	60		10	50	irritant
27	Seacare O.S.D	652571570	100		0	100	irritant
28	Carbon Remover,ltr	651571604	15		0	15	irritant

RO Cleaner for PALL

30	Cleaner A, ltr		15	0	0	15	Acid
31	Cleaner B, ltr		10	0	0	10	Acid
32	Cleaner C, ltr		35	0	0	35	Acid
33	Cleaner D, ltr		12	0	0	12	Acid

4 Eng. _____ [redacted]

Chief Eng. _____ [redacted]

APPENDIX B2

Chief Engineer's notes on chemicals and stowage

Химия

1) Seacare OSD - 100 l
2) Cold wash - 75 l
3) Electrosolve - 125 l
4) Seaclean - 50 l
5) Alcalinity control - 125 l
6) Condensate control - 75 l
7) Oxygen control - 75 l
8) Boiler coagulant - 75 l
9) Liquatrit - 75 l
10) Potable water stabilizer - 125 kg
11) Deesel guard - 50 kg
12) Enviroclean - 75 l
13) ACC - 75 l
14) Oxygen scavenger - 25 l
15) Gamazyme 700 FN - 72 kg
16) Gamazyme BTC - 12 l
17) Gamazyme DPC - 5 kg
18) Toilet descaler - 1 kg
19) Soot remover - 100 kg
20) Descalex - 170 kg
21) Vaptreat - 75 l
22) Disclean - 50 l
23) Aquabuff - 50 l
24) Hardness control - 60 kg
25) Metall Brite - 100 l
26) Fuel Oil Dispersant - 35 l
27) Chemical for Fresh water chlorinating dosage unit - 60 l
28) Pall cleaner A - 15 l
29) Pall cleaner B - 15 l
30) Pall cleaner C - 15 l
31) Pall cleaner D - 15 l
32) Carbon clean H - 25 l
33) Carbon remover - 15 l
34) Hand cleaner - 30 l

CASTROL

AWH-M 32 – 600L (3 DRUMS)

AWH-M 68 – 1 DRUM

AWH-M100 – 1 DRUM

AWH-15 – 160 LTR (8 cans)

— " — 120 LTR (1 DRUM)

PD-68 — 190L (1 DRUM)

TQ-D – 60L (3 CANS)

5W/40 – 40L (2 CANS)

15W/40 – 120L (6 cans)

SN100 – 350L (15 cans)

SN 68 – 120L (6 cans)

SR 68 – 120L (6 cans)

PD46 – 180L (9 cans)

Icematic 299 - 150L (4 cans)

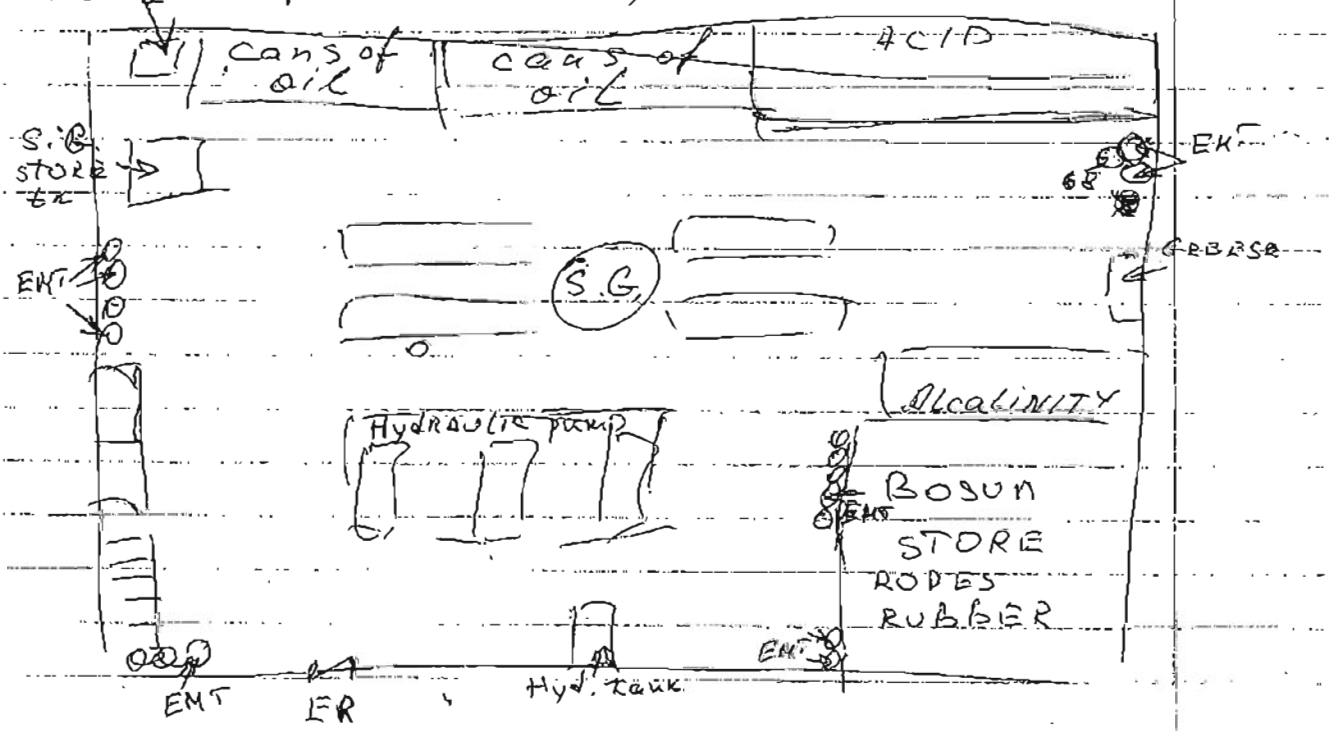
HG 220 — 250L (13 cans)

PC 220 – 320L (16 cans)

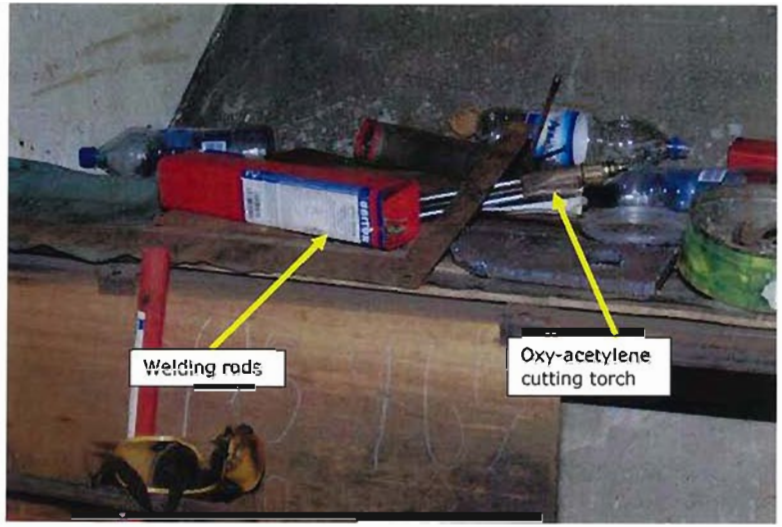
SX2 – 136 kg (7 cans)

AP3 – 54 kg (3 cans)

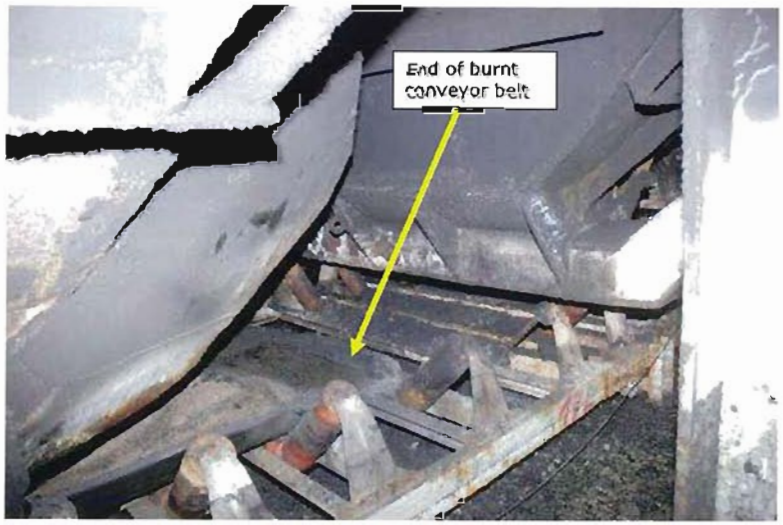
FUEL samples (12 months)



PHOTOGRAPHS 1 - 54

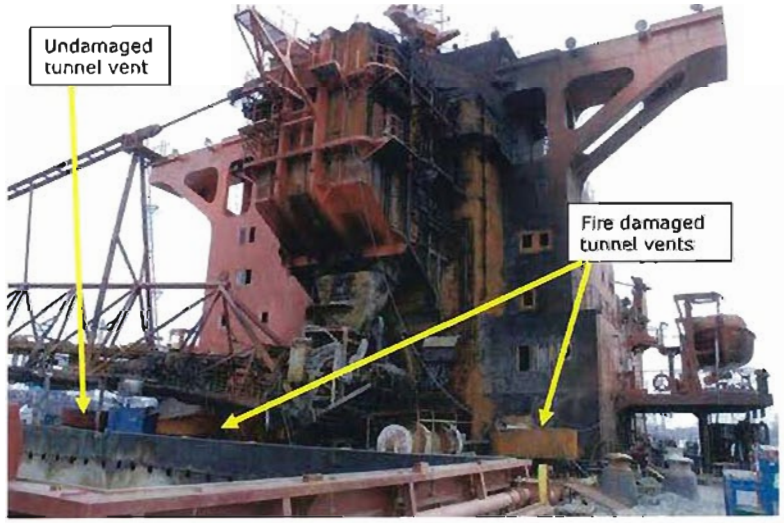


Photograph 1
The welding and cutting equipment in the Bosun's Store



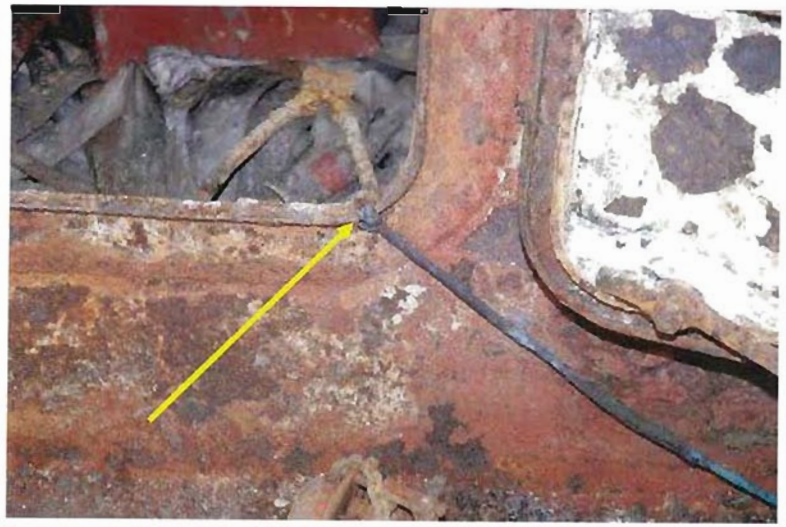
Photograph 2
The burnt away conveyor belt at Frame 167

Photograph 3
Buckling in deck plating between Hold 5 and the accommodation

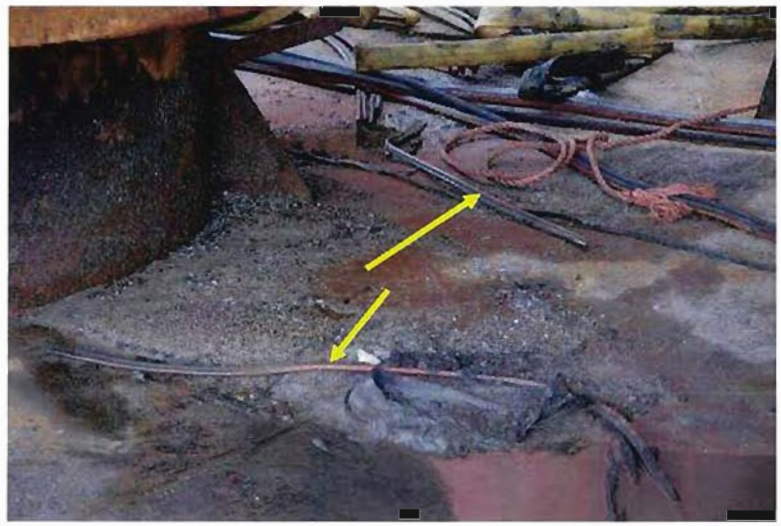


Photograph 4
Fire damage to the vents from the conveyor tunnels

Photograph 5
Open door on the front of the accommodation, to port of the lift conveyor casing



Photograph 6
The remains of a welding cable through the door of the Deck Workshop



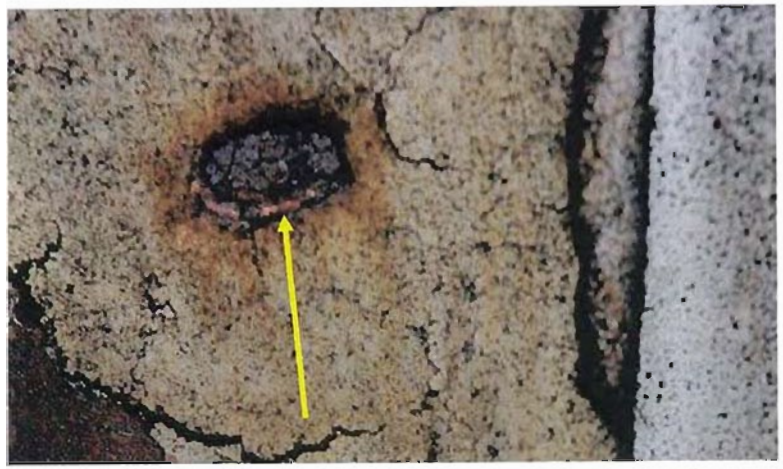
Photograph 7
The remains of oxy-acetylene hoses in the debris in front of the accommodation

Photograph 8
The "blown" Port FOT vents.

Photograph 9
The damage to the aft bulkhead of the Engine Room

Photograph 10
The section of the stern deck lying on the port side of the accommodation.

Photograph 11
The damage to the deck plating in the Laundry and Clean Linen Locker



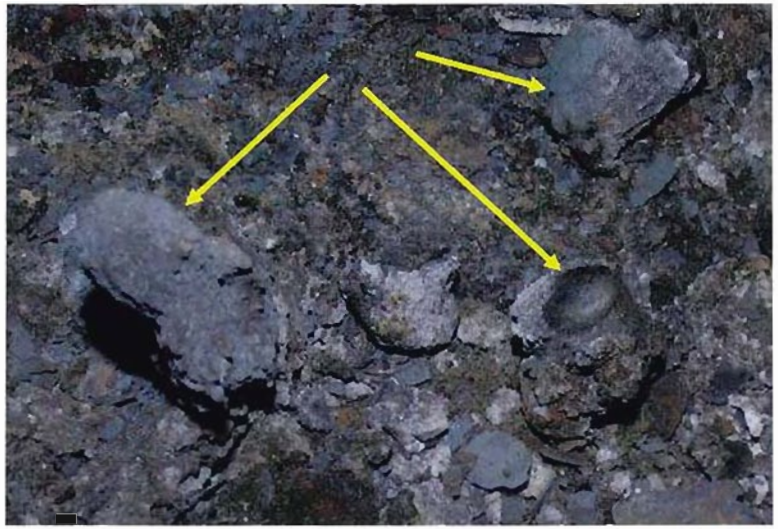
Photograph 12
A hole cut in the "trousers" in the lift conveyor casing.

Photograph 13
The access door between the Power Pack Room and the Engine Room Workshop.

Photograph 14
Welding equipment in the engine room.

Photograph 15
The doors on the starboard side of the Engine Room

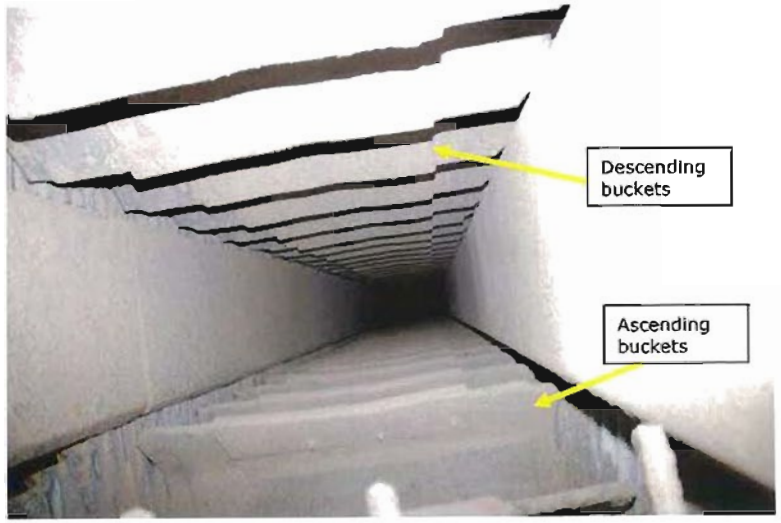
Photograph 16
The aft door to the Engine Room Workshop



Photograph 17
Resolidified melted steel adjacent to the Diesel Oil Service Tank

Photograph 18
The view of the ascending conveyor belt buckets from the platform below the third deck.

Photograph 19
The flexible rubber side on the lift conveyor belt



Photograph 20
The view down the lift conveyor tower with the ascending and descending buckets

Photograph 21
Oil drums in the Power Pack Room

Photograph 22
Welding rods in the Power Pack Room

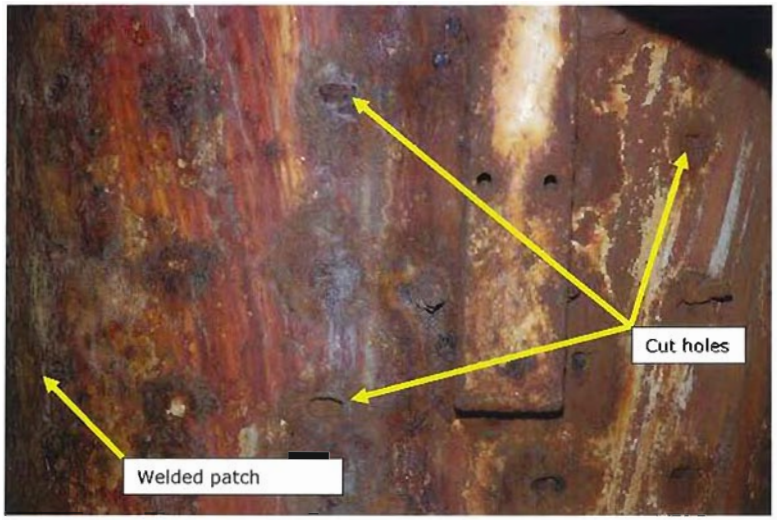
Photograph 23
Portable cutting equipment in the Power Pack Room

Photograph 24
The retaining bolt on the bulkhead to keep the access door to the Engine Room Workshop open at sea

Photograph 25
The corrosive liquids in the Power Pack Room

Photograph 26
The now empty racking across the transom previously used for chemical storage

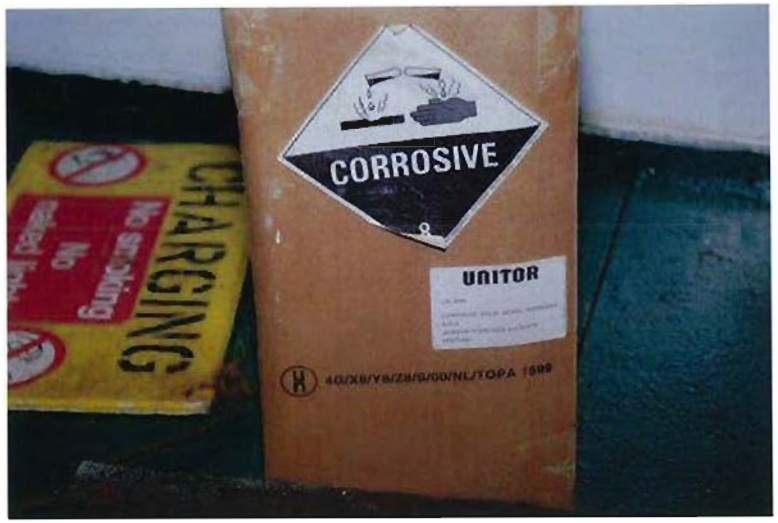
Photograph 27
The flammable liquids stored in a passageway



Photograph 28
The welded patches and holes cut in the "trousers" in the lift conveyor tower

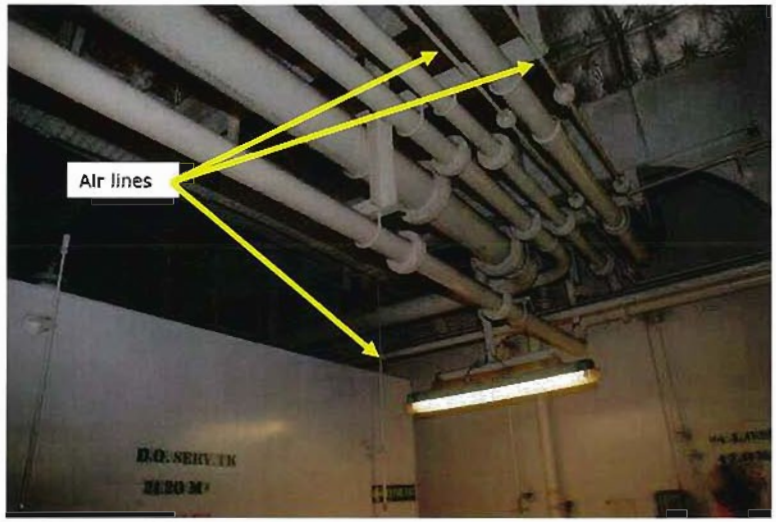
Photograph 29
The severely rusted nuts on the retaining bolts for the "Hardox" tiles

Photograph 30
The chemicals stored between Hold 4 and Hold 5

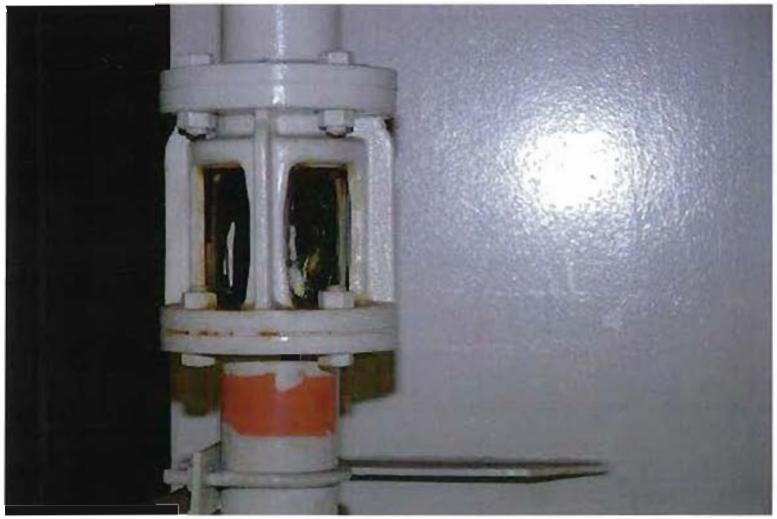


Photograph 31
The corrosive chemicals in the Steering Gear Room

Photograph 32
The chlorinating tablets in the Steering Gear Room



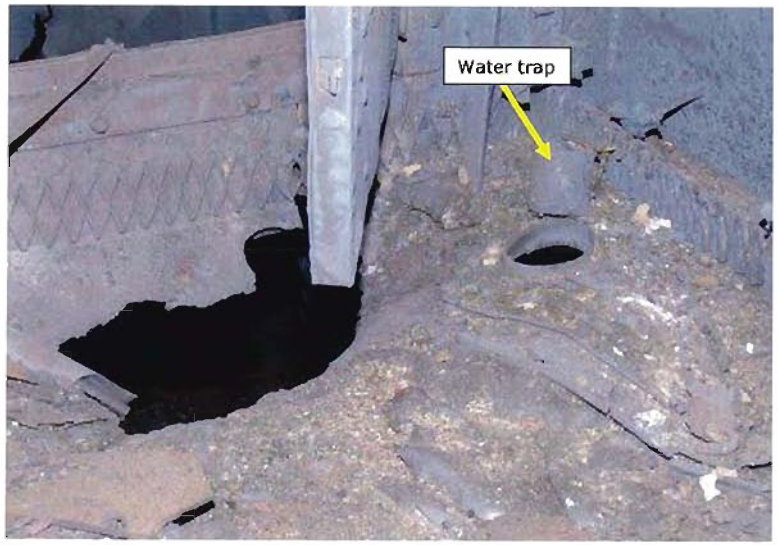
Photograph 33
The air lines above the Diesel Oil Service Tank



Photograph 34
The plastic sight glass in the Diesel Oil Service Tank fuel line

Photograph 35
The plastic sight glass in the Heavy FOT fuel line

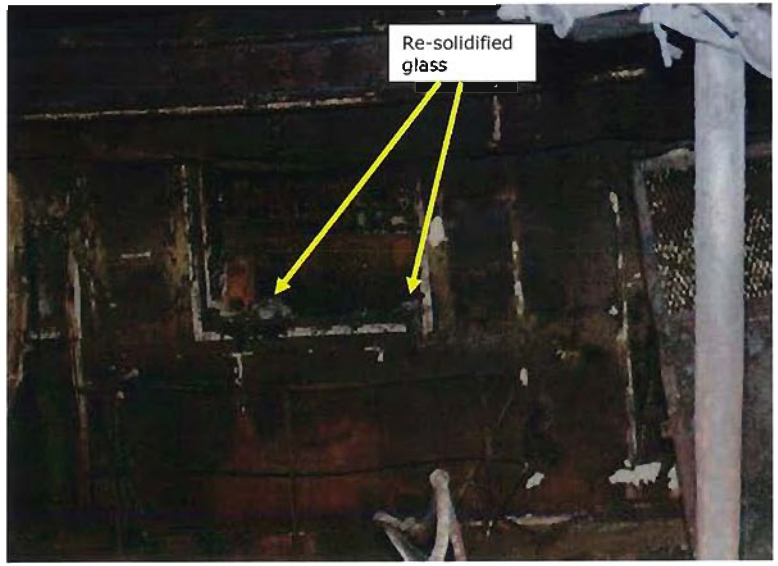
Photograph 36
The drum of Dieselguard NB outside the Engine Room Workshop door



Photograph 37
The water trap for the Laundry drain in the fire debris.

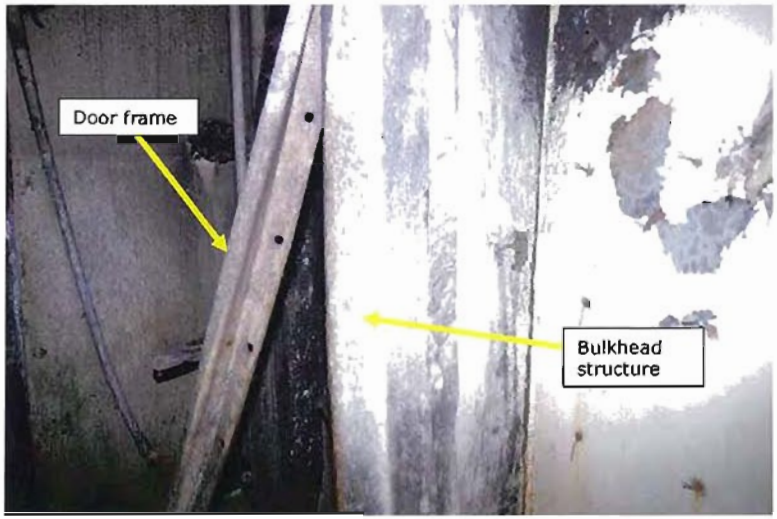
Photograph 38
The starboard door to the Purifier room

Photograph 39
The damage to the striker plate for the door to the Engine Store

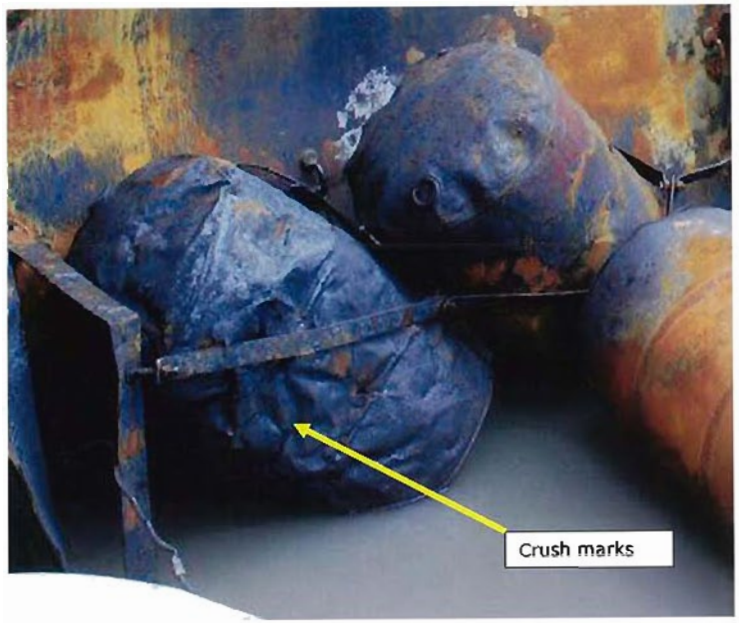


Photograph 40
The re-solidified glass in the windows of the Engine Control Room

Photograph 41
The resolidified glass in the window of the door to the Engine Control Room



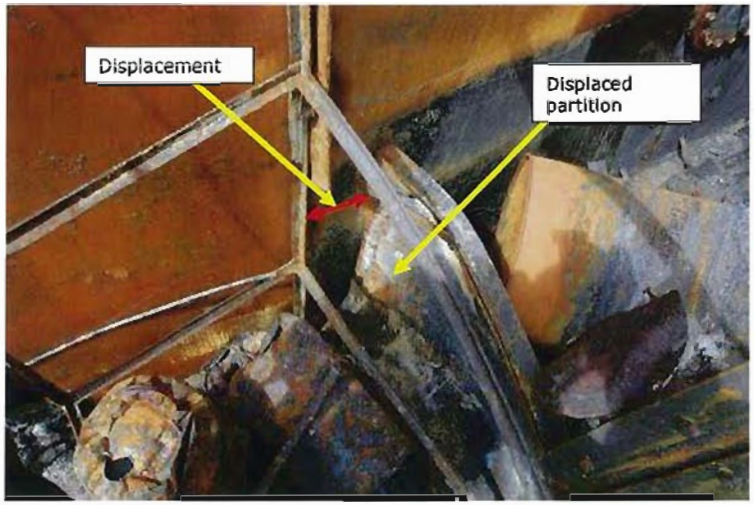
Photograph 42
The damage to the door frame for the emergency escape trunk at the aft end of the Engine Room



Photograph 43
An over expanded 200 litre drum (right) and one that has been previously crushed (left) in the Steering Gear Room

Photograph 44
A crushed 200 litre drum in the Steering Gear Room

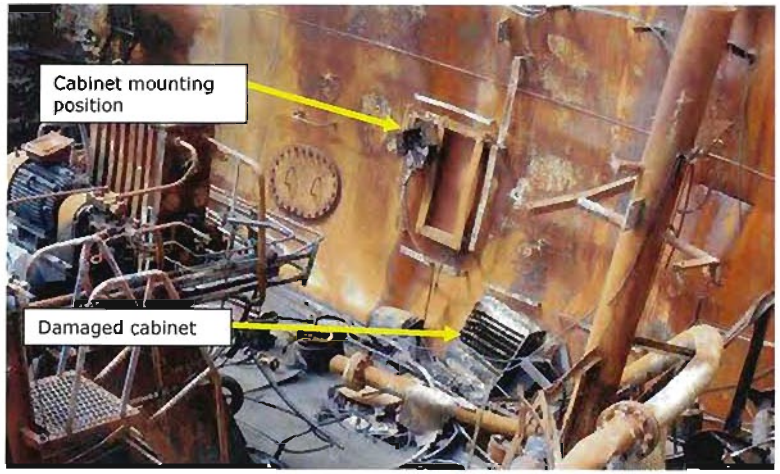
Photograph 45
The burnt 25 litre drums in the Steering Gear Room



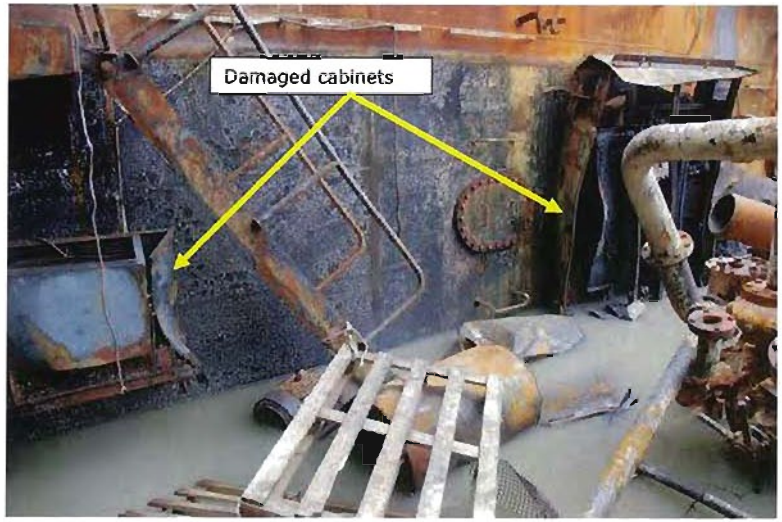
Photograph 46
The aft partition of the Rope Store

Photograph 47
The crushed 25 litre drums aft of the Rope Store

Photograph 48
Over pressurised 200 litre drums to starboard of the Rope Store

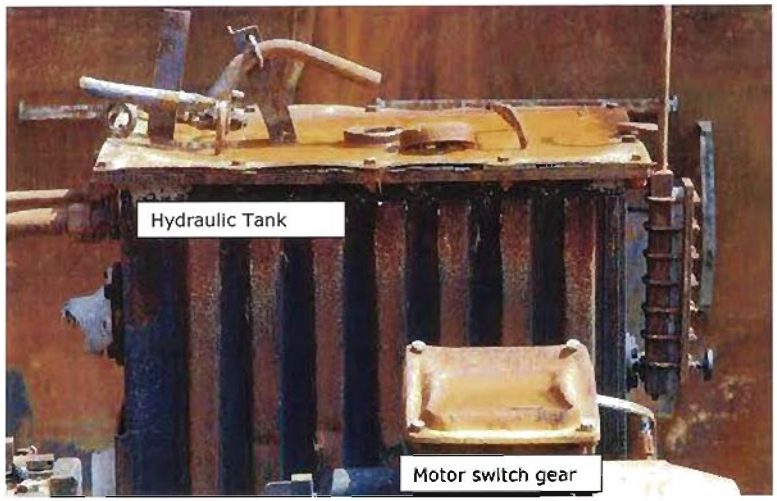


Photograph 49
The remains of cabinets on the port side of the Steering Gear room

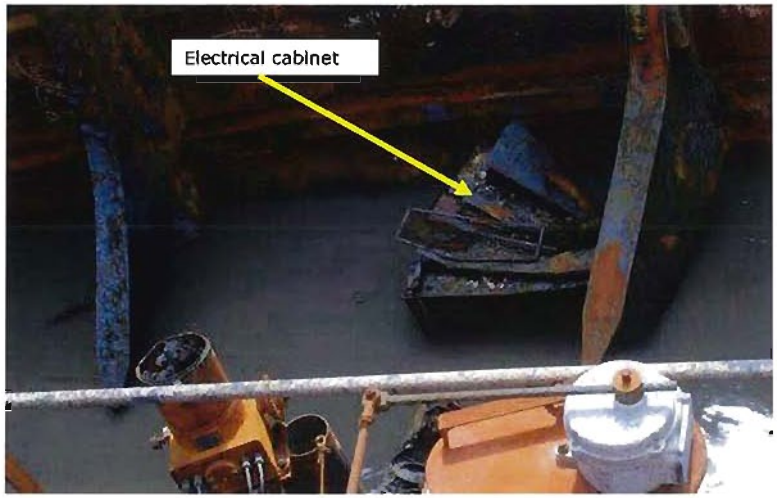


Photograph 50
The damaged cabinets on the starboard side of the Steering Gear room

Photograph 51
A 200 litre drum with creased sides which has subsequently over-expanded



Photograph 52
The crush damage to the top of the hydraulic tanks and motor switch gear



Photograph 53
The collapsed electrical cabinet to starboard of the centreline frame at the transom

Photograph 54
The remains of a severely crushed 200 litre drum between the rudder head and the transom