UNITED STATES COAST GUARD

INVESTIGATION INTO THE CIRCUMSTANCES
SURROUNDING THE

COMMERCIAL DIVING ACCIDENT

ONBOARD THE MOBILE OFFSHORE DRILLING UNIT
CLIFF'S DRILLING RIG NO. 12 ON MARCH 4, 1996
WITH THE LOSS OF LIFE

U.S. Department of Transportation
United States Coast Guard

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16732/ MC00011781
MAR 15 2001

COMMANDANT'S ACTION ON THE FORMAL INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE

COMMERCIAL DIVING ACCIDENT

ONBOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO. 12 ON MARCH 4, 1996 WITH THE LOSS OF LIFE

ACTION BY THE COMMANDANT

The report of the Investigation into the subject casualty has been reviewed. The investigative report, including the findings of fact, conclusions, and recommendations, is approved.

ACTION ON RECOMMENDATIONS

Recommendation #1: Commandant should require bailout bottles for all commercial diving operations, regardless of depth. The bailout bottles should have sufficient capacity to supply a diver with an appropriate volume of air at the deepest depth being worked. The facts of this case do not strongly support a recommendation for bailout bottles. Nevertheless, all diving experts consulted by the Investigating Officer agreed that bailout bottles come in so many sizes and configurations, and are so inexpensive that every dive should begin with the presumption that a bailout bottle will be used.

Recommendation #2: Commandant should require all unused auxiliary gas ports on diver worn life support equipment to be capped or blanked during all commercial diving operations. This will remove the possibility of water entering a diver's helmet if he inadvertently opens an emergency valve.

Recommendation #3: Commandant should require a standby diver dressed out and with a separate air supply, ready to quickly deploy for all commercial diving operations regardless of depth.

Recommendation #4: Commandant should require diving stages for all commercial diving operations regardless of depth, except where they would be impractical. This will speed entry to the water for divers and rescue divers and remove the need for rescue operations to work from personnel baskets. In this casualty, the rescue operation was itself so slow that using a crane operated Billy Pugh basket, as rescue platform did not significantly add to the delay. Nevertheless, there is no question that a diving stage at water level would have speeded up the rescue.

Recommendation #5: Commandant should require the Diving Supervisor and the Master or Person-in-Charge to develop a site-specific rescue plan designating the equipment and personnel that will be used for a rescue or removal of an injured diver from the water for all commercial diving operations.

Recommendation #6: Commandant should require that, prior to any commercial diving operation, the Diving Supervisor describe the rescue plan to all members of the diving team.

Recommendation #7: Commandant should require the Diving Supervisor to complete a Job Hazard Analysis before every commercial diving operation. See IO Exhibit 57, ADC Consensus Standards, pg. 3-9 to 3-10b.

Recommendation #8: Commandant should require Diving Supervisors to complete a pre-dive safety checklist suitable to the type of diving equipment and procedures to be used, prior to all commercial dive operations. See IO Exhibit 53, Navy Dive Manual, pg. 4-37 to 4-49.

Recommendation #9: Commandant should consider changing Coast Guard regulations to ensure accountability of commercial diving contractors for maintaining records and logs for their diving equipment. Commandant should also make minor changes to Coast Guard regulations in addition to those described above to ensure Offshore Installation Managers play a more active role in pre-dive safety preparations. Present Coast Guard diving regulations place record keeping responsibilities on diving supervisors. Diving supervisors are appointed on a job to job basis and their designation ends when the diving job they supervise ends. Many of the record keeping responsibilities, however, are continuous and must be completed between diving jobs, away from the dive site. The following recommended regulation changes illustrate how the commercial diving contractor and Offshore Installation Manager could be given a more responsible role in the record keeping and pre-dive safety processes.

a) At 46 CFR 197.204 [Definitions], Commandant should add a definition "Commercial Diving Contractor" to describe the person or business that provides commercial diving services.

b) At 46 CFR 197.484 (a) [Notice of casualty], after the words "person-in-charge", Commandant should include the words "Diving Supervisor or Commercial Diving Contractor."

c) At 46 CFR 197.486 [Written report of casualty], after the words "person-in-charge of a vessel or facility" Commandant should include the words "<u>or Diving Supervisor or Commercial Diving Contractor</u>."

d) Commandant should change 46 CFR 197.210 [Designation of diving Supervisor] as follows:

"The Commercial Diving Contractor shall designate in writing a Diving Supervisor for each commercial diving operation. The Diving Supervisor shall present the written designation to the Master or Person-in-Charge."

e) Commandant should change 46 CFR 197.402 (2) (i) [Responsibilities of the person-in-charge] as follows:

"Prior to permitting any commercial diving operation to commence, the Master or Person-in-charge shall examine the Diving Supervisor's written designation to ensure it is complete as required by Section 197.210."

f) Commandant should cross-reference 46 CFR 109.109 [Responsibilities of master or person-in-charge] with 46 CFR 197.402 [Responsibilities of person-in-charge].

g) Commandant should change 46 CFR 197.480(c) [Logbooks] as follows:

(c) The Diving Contractor and the Diving Supervisor conducting commercial diving operations from a vessel or facility subject to this subpart shall maintain a logbook for making the entries required by this subpart.

(d) The logbook required to be maintained by this subpart shall be taken to the jobsite for every commercial diving operation and shall be available for inspection by the Master or Person-in-charge, the United States Coast Guard or any other cognizant agency.

(e) The Diving Contractor shall retain the logbook required to be maintained by this subpart for a period of not less than three years.

h) Commandant should change 46 CFR 197.482 (d) [Logbook entries] as follows:

(d) The Diving Contractor and the Diving Supervisor shall insure that a record of the following is maintained:...

(e) The Diving Contractor and the Diving Supervisor shall insure copies of each of the records required under paragraph (d) are included in the operations manual required by 46 CFR 197.420. The records required under paragraph (d) must be maintained by the Diving Contractor for a period of not less than three years.

i) At 46 CFR 197.420 [Operations manual], Commandant should add the following:

(e) The operations manual must contain copies of the records required to be maintained by 46 CFR 197.482 (d) and (e).

j) At 46 CFR 197.450 [Breathing gas tests], Commandant should change the words " The diving supervisor shall ensure that" – to

"The Diving Contractor shall ensure that -

k) At 46 CFR 197.450 [Breathing gas tests], Commandant should add the following:

(d) The Diving Contractor shall maintain the above stated test records for a period of not less than 3 years.

Recommendation #10: Commandant should require the Dive Supervisor and Master or Person-in-Charge to execute a Declaration of Inspection verifying their respective duties have been competed before any commercial dive operation begins. See 46 CFR 35.35-30 for an example of the concept as it is applied to oil transfers.

Recommendation #11: At 46 CFR 197.204 [Definitions], Commandant should include a definition of "Diving Tender." Commandant should consider adopting the description of Diver Tender set out in the Navy Dive Manual. See IO Exhibit 53, Part 4-8.5.3.

Recommendation #12: At 46 CFR 197.204 [Definitions], Commandant should include a definition of "Dive Tending" or Tending.

Recommendation #13: Commandant should consider limiting the duties of a dive tender to only tending the dive umbilical during a commercial diving operation, as illustrated by the following wording.

At 46 CFR 197.432(c) [Surface-supplied air diving], Commandant should add the words:

; the person tending the diver shall have no other duties while the diver is under water;

Recommendation #14: At 46 CFR 197.204 [Definitions], Commandant should consider consolidating the definitions "*Commercial diver*" and "*Diver*" into one inclusive definition.

Recommendation #15: Commandant should establish minimum manning standards for all diving operations. Commandant should consider adopting the standards set out in the ADC Consensus Standards. See IO Exhibit 57, pg. 3-24 to 3-29.

Recommendation #16: Commandant should establish commercial diving qualification standards for Commercial Divers, Commercial Diving Tenders, and Commercial Diving Supervisors. Commandant should consider adopting the standards set out in the ADC Consensus Standards. See IO Exhibit 57, pg. 2-3 to 2-8.

Recommendation #17: In the absence of a diver qualification program, Commandant should publish criteria for OCMI's to use when reviewing SEILOD (Special Examination in Lieu of Drydocking) applications to evaluate qualifications of divers to safely conduct diving operations.

Commandant's Action on Recommendations #1 through #17: We concur with the intent of these recommendations. We are currently conducting a technical review of the Commercial Diving Operation regulations at 46 CFR 197. Upon completion of the review, the changes recommended in recommendations 1 through 17, will be included in an upcoming Notice of Proposed Rulemaking (NPRM) to the extent that they are warranted, feasible, and allowed by existing legislative authority. If necessary, we also may seek additional legislative authority.

Recommendation #18: Commandant should examine NVIC 12-69 and NVIC 1-89 to determine whether the older one should be cancelled and incorporated into the newer.

Commandant's Action on Recommendation #18: We concur with the intent of this recommendation. Both documents are being examined in conjunction with the review of the current requirements for commercial diving operations. Once the regulatory update is complete, a determination on whether one or both NVICs should be cancelled or combined will be made and up-to-date policy guidance will be provided.

Recommendation #19: Commandant should require dive operation inspection training for all marine inspectors.

Commandant's Action on Recommendation #19: We concur with the intent of this recommendation. Training on commercial diving operations will better prepare our marine inspectors and investigators to prevent and respond to incidents involving this sector of the marine industry. A Commercial Diving Orientation Course curriculum has already been developed. This new course will be formally incorporated into the Marine Safety training program for marine inspectors and investigators.

Recommendation #20: Commandant should remove the diving component from the MODU Inspector PQS workbook and establish a separate Performance Qualification Standards workbook for diving operations.

Commandant's Action on Recommendation #20: We concur with this recommendation. A separate Performance Qualification Standards (PQS) workbook for commercial diving operations is being developed in conjunction with the recently completed Commercial Diving Orientation Course curriculum.

Recommendation #21: Commandant should evaluate the adequacy of the MODU/SEILOD (Mobile Offshore Drilling Unit/Special Examination in Lieu of Drydocking) job aid, CG-840H-1 (9-92), to determine whether additional inspection items should be added to the diving checklist (pg. 20-22). See IO Exhibit 31.

Commandant's Action on Recommendation #21: We concur with this recommendation. An evaluation of the MODU/SEILOD job aid, CG-840H-1, is currently underway. The job aid's adequacy is being evaluated in conjunction with the commercial diving orientation training curriculum and the development of a performance qualification standards workbook (PQS) for diving operations. Appropriate modifications will be made when the evaluation is completed.

Recommendation #22: Commandant should publish guidance emphasizing that Coast Guard marine inspectors should not attempt to delegate dive safety enforcement duties to any third party, including classification society surveyors.

Commandant's Action on Recommendation #22: We concur with the intent of this recommendation. All guidance associated with dive safety enforcement duties is currently being evaluated in conjunction with the technical review of the Commercial Diving Operation regulations. When the regulatory update is complete, appropriate policy guidance, including clear delineation as to what duties may and may not be delegated to third parties, will be provided.

Recommendation #23: Commandant should require dive casualty investigation training for all marine safety casualty investigators.

Commandant's Action on Recommendation #23: We concur with the intent of this recommendation. We agree that it would be desirable for marine safety casualty investigators to have formal dive casualty investigation training in the event they were called upon to do such an investigation. However, diving casualties accounted for less than 4% of the total Coast Guard casualty investigation workload from 1995 to 2000. Given the limited training resources available to the Coast Guard, this level of frequency does not warrant formal training of all casualty investigators in this area at this time. However, several initiatives have been undertaken to improve the knowledge level of investigators in this area, including the development of a Commercial Diving Orientation Course for marine inspectors and investigators. Regarding investigations specifically, this diving casualty investigation was included as a case study at the 2000 Senior Investigating Officers (SIO) Conference. The case study was also included on a CD-ROM given to each attendee at the conference to be used at their field units for reference and local training on this topic.

Recommendation #24: Commandant should consider tasking Coast Guard divers to assist in the investigation of diving casualties. In this case, the IO was assisted by a former Coast Guard diver and a U.S. Navy Master Diver, both with exceptional insight. However, previous investigators to this casualty did not have those valuable resources. The Marine Safety Manual recommends that an IO investigating diving casualties have diving experience, but there are few IO's available with that background.

Commandant's Action on Recommendation #24: We concur with the intent of this recommendation. The Officer in Charge, Marine Inspection (OCMI) has the authority to use Coast Guard divers or U.S. Navy Divers to assist in any type of Coast Guard casualty investigation. The Office of Investigations and Analysis will encourage the use of these resources and will provide updated guidance to investigating officers in the Marine Safety Manual.

Recommendation #25: Commandant should consider seeking an agreement with the Navy Experimental Diving Unit and the U.S. Navy Diving School to provide assistance in Coast Guard diving casualty investigations.

Commandant's Action on Recommendation #25: We concur with this recommendation. The Coast Guard currently has a liaison at the Navy Diving School who has provided assistance to the Coast Guard in the past on investigations and we will continue to use our liaison. The Office of Investigations and Analysis will discuss the need for a Memorandum of Undertaking (MOU) with the U.S. Navy Diving program. Additional guidance on diving investigations will be provided in the Marine Safety Manual.

Recommendation #26: Commandant should establish a working group of industry experts to examine ways to improve safety practices in the commercial diving industry. The working group should consider whether the Coast Guard should adopt by reference the ADC Consensus Standards for commercial diving operations where they do not conflict with Coast Guard

regulations. The group also should consider whether the Coast Guard should require oil-free compressors be used on commercial diving operations. During this investigation, industry experts made many excellent recommendations to improve safety in the industry, many of which could not be included in this report because they were beyond the scope of the investigation. If a group is convened, it should seek input from Marine Safety Office Houston-Galveston, which recently initiated a commercial diving safety awareness and compliance program.

Commandant's Action on Recommendation #26: We concur with this recommendation. We believe the establishment of such a working group would present an excellent opportunity to exchange information related to this specialized segment of the marine industry. Many different structures for such a group are possible, including inclusion in an existing advisory committee as a working group. We will consult with existing advisory committees and partnerships to determine the most appropriate way to establish the group.

Recommendation #27: Commandant should forward a copy of this investigation to OSHA for consideration.

Recommendation #28: Commandant should forward a copy of this investigation to the Association of Diving Contractors.

Recommendation #29: Commandant should forward copies of this investigation to all Eighth Coast Guard District Coastal OCMI's.

Commandant's Action on Recommendations #27 through #29: We concur with these recommendations. We will forward copies of this report as recommended.

Recommendation #30: This casualty investigation should be closed.

Commandant's Action on Recommendation #30: We concur with this recommendation. This casualty investigation is closed.

W D Rabe

W. D. RABE
By direction

moa
16732
30 August 2000

SECOND ENDORSEMENT on report of formal investigation of commercial diver fatality on CLIFF'S DRILLING RIG NO. 12 on 4 March 1996

From: Commander, Eighth Coast Guard District
To: Commandant (G-MOA)

Subj: FORMAL INVESTIGATION INTO THE COMMERCIAL DIVING ACCIDENT ABOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO.12 ON 4 MARCH1996, WITH LOSS OF LIFE.

1. Forwarded recommending approval. I concur with the conclusions and recommendations.

2. This formal investigation was convened to determine why a diver needlessly lost his life. What the investigation uncovered was that the current dive regulations- coupled with the Coast Guard's inadequate experience in diving operations & casualty investigations- allow sub-par commercial diving operators to thrive. This investigation clearly and painfully outlined shortfalls in the commercial diving regulations, commercial diving operations, and Coast Guard marine inspections & investigations experience. The Investigating Officer's report thoroughly reflects the myriad of contributing causes to this casualty and purposefully outlines the numerous solutions to assist in preventing future needless deaths. The IO is commended for his outstanding efforts during the investigation and for this exceptionally comprehensive report.

3. Recommendations 5-8, which require specific dive supervisor responsibilities, should be implemented immediately. There were at least three diving casualty deaths in D8, since March 1996, that resulted directly from the person in charge or the dive supervisor's poor supervision & management. The Coast Guard's biggest impact on safe diving operations will be through effective regulations (incorporating ADC Consensus Standards), comprehensive training and interactive partnership with marine industry. Adoption of the recommendations spelled out in this report should be the first step toward the Coast Guard assuming its leadership role in commercial diving safety.

4. The Eighth District has forwarded a request for criminal referral to Commandant (G-MOA) against G&G Marine and Dan Gilbert. It is quite clear from this investigation that G&G Marine has continued to operate with little regard to diver safety. In the four years since the casualty occurred, G&G Marine has not implemented safety practices or equipment maintenance procedures, yet they are still conducting commercial diving jobs.

moa
16732
30 August 2000

SECOND ENDORSEMENT on report of formal investigation of commercial diver fatality on CLIFF'S DRILLING RIG NO. 12 on 4 March 1996

5. While this investigation discusses the marine inspector's failure to conduct an inspection of the dive station, numerous other obvious factors were missed that showed a lack of consistent guidance and leadership. The fact that the trainee thought that American Bureau of Shipping surveyor would handle the underwater portion including diving operations highlights the inconsistent training and misunderstood guidance that is prevalent for commercial diving operations in the marine inspection program. The fact that NVIC 1-89 is not applicable to this vessel yet was the standard guidance to be used by inspectors also highlights systemic problems in written guidance to field inspectors. Lastly, the fact that an IO did not initially go to the site of the casualty to secure the compressor & dive helmet and gather witness statements & evidence in a timely manner clearly proved that diving casualty investigations expertise was non-existent. This formal report is likely the first opportunity for the Coast Guard to establish a basis for improving our training and expertise in commercial diving inspections and diving casualty investigations. Recommendations 17-25 appropriately address steps for implementation that would hopefully prevent future recurrence of the problems noted. The solution to the vast problem is not to hold one marine inspector accountable; the solution is to take proactive steps to educate the field and institute value-added and timely training.

R. J. MORRIS
By direction

Copy: CO, MSO Port Arthur

16732
5 June 2000

FIRST ENDORSEMENT on report of formal investigation of commercial diver fatality on CLIFF'S DRILLING RIG NO. 12 on 4 March 1996

From: Commanding Officer, Marine Safety Office Port Arthur
To: Commandant (G-MOA)
Via: Commander, Eighth Coast Guard District

Subj: FORMAL INVESTIGATION INTO THE COMMERCIAL DIVING ACCIDENT ABOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO. 12 ON 4 MARCH 1996, WITH LOSS OF LIFE.

1. Forwarded recommending approval and closing of this casualty case.

2. Due to the time between the casualty and the taking of formal testimony and due to the inability to question the deceased, many facts cannot be determined with confidence. They do not all need to be known for this investigation to serve its purpose of improving safety. However, the investigator has developed the most likely scenario based on the few hard facts available. We will never be able to determine conclusively the details of what happened when Pilkington developed breathing difficulties 28 feet from the observation of other humans.

3. Clearly, the commercial diving regulations in 46 CFR 197 were not followed or enforced. Many people failed in their responsibilities, including the senior Coast Guard inspector. Only one or two differences in a myriad of contributing causes would likely have prevented this most unfortunate death. Regardless, there is room for improvement in 46 CFR 197 and having an active project in place to update those regulations should allow expedient changes.

4. I do not intend to pursue further investigation into the possible violation of regulations. First, more than four years have passed since the casualty, meaning timely enforcement is no longer possible. Second, there is no evidence of intentional violation of regulations. Third, the challenge to demonstrate accountability under the regulation is great, in that many of the apparent violations would be pursued against the dive supervisor. There was no designated dive supervisor and involved parties testify they thought someone else had that responsibility. Fourth, a number of the potentially responsible parties are no longer in business. Fifth, civil litigation cases were concluded more than a year ago. The businesses involved have learned their responsibility through the numerous investigation and litigation activities. In short, the time and effort to pursue further investigation and civil penalties is not worthwhile or in the best interests of safety.

G. W. Anderson

G. W. ANDERSON

U.S. Department of Transportation
United States Coast Guard

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16732
2 June 2000

From: LCDR Thomas Beistle, USCG
To: Commandant (G-MOA)
Via: (1) Commanding Officer, Marine Safety Office Port Arthur
(2) Commander, Eighth Coast Guard District

Subj: FORMAL INVESTIGATION INTO THE COMMERCIAL DIVING ACCIDENT ABOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO. 12 ON 4 MARCH 1996, WITH LOSS OF LIFE.

Summary:

On the afternoon of 4 March 1996, Brian Pilkington, a commercial diver, began an underwater inspection of the mat of the Mobile Offshore Drilling Unit (MODU) CLIFFS DRILLING RIG NO. 12 (Rig 12). Pilkington's dive lasted about three hours with him moving around the mat under the direction of two members of an inspection team on the deck of Rig 12 (See figure 1). At about 1645 hours, Pilkington indicated that he was having trouble breathing and soon thereafter quit communicating with the surface. A rescue operation was quickly initiated, but was unable to reach Pilkington for nearly 35 minutes. At about 1720 hours, Dan Wiitala, one of the inspection team members, reached Pilkington about 28 feet below the surface. Wiitala found Pilkington unconscious, floating face down at about a 45 degree angle to a horizontal plane. Pilkington's body could not float free because a hand axe attached to his diving belt was fouled on a pipe on the rig's mat. Wiitala cut the lanyard and brought Pilkington to the surface where he was lifted to the deck of Rig 12 in a personnel basket. Members of the crew began cardiopulmonary resuscitation (CPR) and then loaded him onto a helicopter for transport to St. Mary's Hospital in Port Arthur, Texas. The helicopter arrived at St. Mary's at 1820 hours. Brian Pilkington was pronounced dead at 2230 hours.

16732
2 June 2000

FORMAL INVESTIGATION INTO THE COMMERCIAL DIVING ACCIDENT ABOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO. 12 ON 4 MARCH 1996, WITH LOSS OF LIFE

Vessel Data:

Name:	CLIFFS DRILLING RIG NO. 12
O.N.:	D622669
Service:	Mobile Offshore Drilling Unit
Propulsion:	None
Gross Tons:	4109
Net Tons:	4109
Length:	220.00 feet
Breadth:	185.00 feet
Depth:	27.50 feet
Built:	30 June 1980, Bethlehem Steel Corp., Beaumont, TX
Owner/Operator:	Cliffs Drilling Co.
Manager:	Ronald Wayne Townsend
Manager's License:	Offshore Installation Manager (OIM)

Deceased:	Age:	Next of Kin:
Brian Pilkington	23	Wife

Parties In Interest:[1]

Peter J. Pilkington
Commercial Dive Safety Organization
2795 152nd Ave. NE
Redmond, WA 98052

Ronald Townsend

American Bureau of Shipping
Two World Trade Center, 106th Floor
New York, NY 10048

Counsel:

Joe Walker and
Thomas Mosele
4200 Westheimer, Ste 130
Houston, TX 77027

Bijan Siahatgar
Griggs & Harrison, P.C.
1301 McKinney, Ste 3200
Houston, TX 77010-3001

Michael Wilson
Kirlin, Campbell & Keating
5 Hanover Square
New York, NY 10004

[1] Cliffs Drilling Co. and Dan Wiitala were named as Parties In Interest but declined to exercise their rights at the Hearing. USCG Investigation, Vol. 1, pg. 3-5 and 128-132.

FORMAL INVESTIGATION INTO THE COMMERCIAL DIVING ACCIDENT ABOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO. 12 ON 4 MARCH 1996, WITH LOSS OF LIFE

G&G Marine 25933 Budde Road The Woodlands, TX 77380	Ruben Hope Hope, Causey & Schlacks, P.C. 2040 Loop 336 W, #125 Conroe, TX 77304
Kirk Austin	None

Findings of Fact:

Reactivation of Rig 12

1. In February 1996, Cliffs Drilling Co. began to reactivate Rig 12. The MODU had been stacked in Sabine Pass, TX for about eighteen months. Stacking, also called laying up or cold stacking, means that an owner has taken a vessel out of service and moved it to a protected area for storage. When a MODU is stacked, the owner may continue to have the vessel inspected to keep its Certificate of Inspection (COI) active. The owner may instead elect to allow the COI to lapse by not having the vessel inspected. Rig 12's COI had expired on 28 January 1996. On 4 March 1996, Rig 12 was being inspected to reactivate its COI for charter to Hercules Offshore, Inc. (Hercules).[2]

2. As part of the reactivation, Cliffs requested Coast Guard approval for a special examination in lieu of drydocking (SEILOD).[3] In its review of the SEILOD proposal, MSO Port Arthur examined it to determine whether the proposal met the Coast Guard's regulatory requirements and when marine inspectors would be available to conduct the exam. Based on the proposal, MSO Port Arthur granted the request for a SEILOD.[4]

3. Self-elevating units (jack-up rigs) must be examined in accordance with a plan submitted by the owner or operator at least 60 days in advance of the requested inspection date.[5] The plan must be submitted to Coast Guard Headquarters, G-MOC, for review and approval. However, plan approval authority had been delegated to the Officer in Charge Marine

[2] Horton, testimony, Vol. 2, pg. 5
[3] USCG Investigation, Vol. 4, IO exhibit 33 (Cliffs Drilling Co., Proposal to Conduct Inspection)
[4] USCG Investigation, Vol. 4, IO exhibit 32 (Letter to George Buddy Horton from Julio Martinez dated February 26, 1996)
[5] 46 CFR 107.261 - Drydock or Special Examination; 46 CFR 107.267 - Special Examination in Lieu of Drydocking (SEILOD)

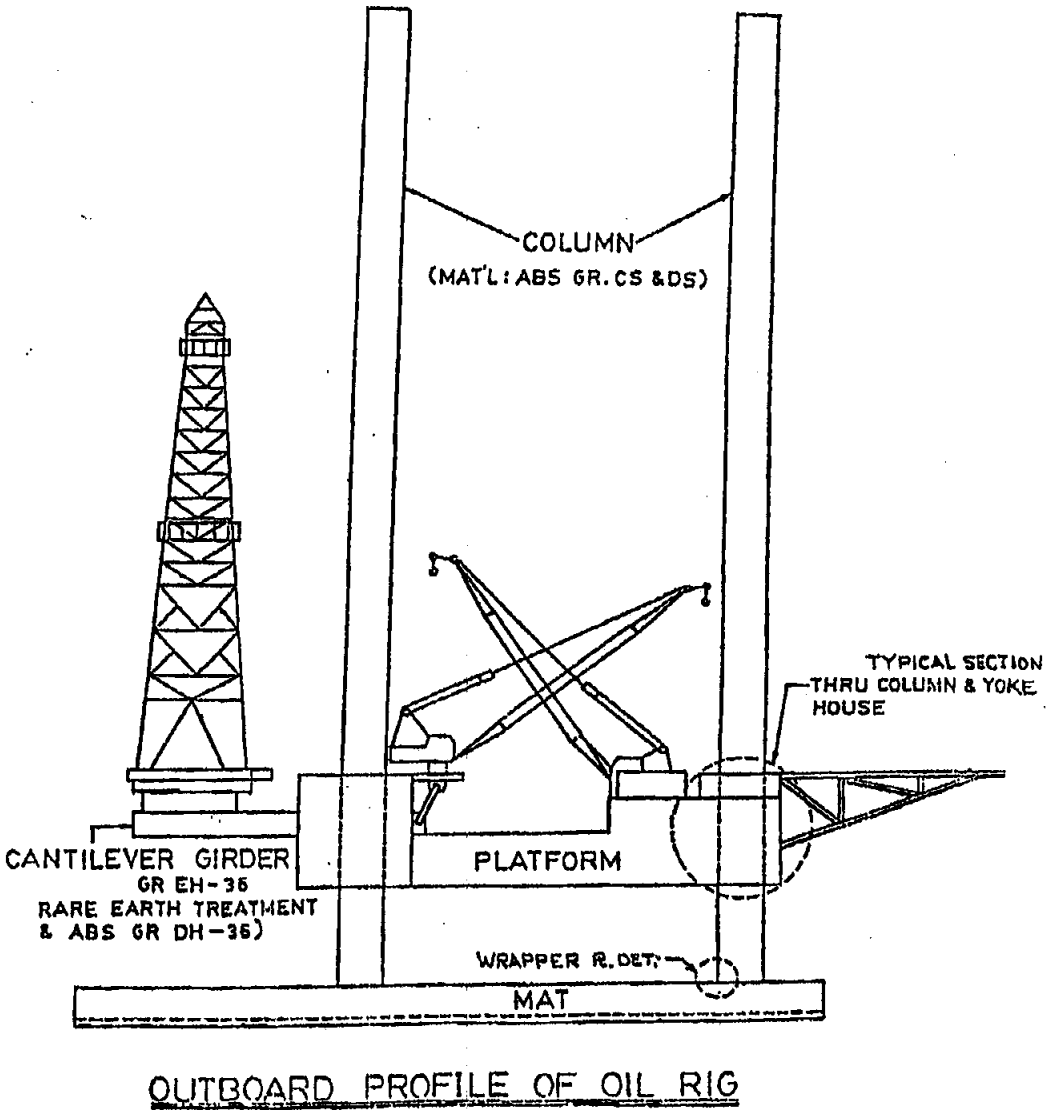

Figure 1: Mobil Offshore Drilling Unit

Inspection (OCMI).[6] Typically, if all the requirements set out in the regulations are met, the plan is approved. Cliffs' SEILOD proposal addressed all but two of the required items.[7] The proposal did not specify the inspection location or the name of the diving company to be used. SEILOD proposals often do not contain those two items because diver availability is often not known 60 days in advance and the need to find water clear enough to conduct an underwater inspection may cause the location to change. These items are usually identified

[6] Marine Safety Manual, Vol. II, Ch. 35.C.16 - Special Underwater Inspection in Lieu of Drydocking
[7] USCG Investigation, Vol. 4, IO exhibit 33 (Cliffs Drilling Co., Proposal to Conduct Inspection)

as the inspection date approaches, and the omission of these items is not normally cause to disapprove a proposal. Cliffs' proposal also did not meet the 60-day notice requirement. The short notice was caused by Cliffs' need to reactivate Rig 12 quickly to meet their charter agreement with Hercules. This too is common and would not normally be cause for disapproval.

4. In its application, Cliffs requested a waiver of a liveboating prohibition against diving from one hour after sunset to one hour before sunrise.[8] The Commandant may grant variances from the regulations, but OCMIs have not been delegated that authority.[9] Nevertheless, Marine Safety Office Port Arthur waived the sunset to sunrise restriction based on Cliffs' promise to take precautions to ensure diver safety. Cliffs took the promised precautions.[10]

5. The Coast Guard conducts SEILODs on MODUs according to Navigation and Vessel Inspection Circular (NVIC) 12-69. The Commandant, Office of Merchant Marine Safety (G-MVI-2) promulgated NVIC 12-69 on 12 December 1969. The SEILOD procedures were established because drydocks were not able to accommodate the large MODUs being built. Rather than exempt MODUs from drydock requirements, G-MVI-2 developed special examination methods not requiring drydocking. NVIC 12-69 imposes no requirements on OCMIs to evaluate divers, diving companies, or diving safety on SEILODs. NVIC 12-69 has not been canceled and remains an effective circular.

6. NVIC 1-89 was drafted almost 20 years after NVIC 12-69 to expand the SEILOD program to other classes of vessels.[11] Both NVICs addressed the SEILOD process and the latter is an outgrowth of the former. NVIC 1-89 clearly envisions a proactive OCMI role ensuring the safety of commercial diving operations related to SEILODs.

   Divers, Diving Equipment, and Operations: The underwater survey should not be conducted unless the inspector is satisfied that the equipment and procedures being used by the divers will provide a safe and meaningful examination of the ship. Safety must be foremost on the minds of all those working together on the actual diving operation. While matters in this regard are best left to the experienced, professional individuals normally found conducting this type of work, everyone involved in the survey should be alert to these needs and ensure that any requirements regarding this inspection can be safely accomplished. As required by 46 CFR 197.202, commercial diving operations

[8] USCG Investigation, Vol. 4, IO exhibit 33 (Cliffs Drilling Co., Proposal to Conduct Inspection) See 46 CFR 197 *et. seq.* Commercial Diving Operations; *Liveboating* means the support of a surface-supplied diver from a vessel underway. 46 CFR 197.204, 46 CFR 197.436(a)(2)

[9] 46 CFR 197.206

[10] Champagne, testimony, Vol 1, pg. 21

[11] Tank Vessels, Cargo Vessels, other miscellaneous vessels, and Oceanographic Research Vessels less than 15 years old. 46 CFR 31.10-21(e) and 46 CFR 189.40-3(e) also permit continued participation in the underwater survey program for vessels 15 years old and older. Vessels more than 15 years old that have not previously participated in the underwater survey program are ineligible.

taking place from vessels required to have Certificates of Inspection issued by the Coast Guard, regardless of geographical location, must comply with the provisions of 46 CFR Part 197 Subpart B – Commercial Diving Operations.

Acceptability of Diving Personnel and Equipment: A professional commercial diving firm should be employed by the owner. While specific approval is not required by the Coast Guard, a subjective evaluation by the OCMI or the attending inspector will be conducted. Such an evaluation may consider:

(a) Prior experience or training;

(b) Qualifications of dive team members in photography, nondestructive testing (NDT), underwater damage repair, and other training and experience;

(c) The degree of professional approach/attitude, as evidenced by an organized dive plan, personnel assignments, standby and backups, compliance with appropriate safety regulations (Coast Guard, Occupational Safety and Health Administration (OSHA), various states), etc.[12]

7. Circulars are not usually meant to be binding on either the OCMI or industry. Generally, the Commandant promulgates them as advice to industry, which was clearly the case with NVIC 1-89.[13] However, circulars also are strong advice on marine inspection issues to OCMIs. NVIC 1-89 clearly established a Commandant expectation that OCMIs examine commercial diving operations associated with SEILODs on vessels other than MODUs to determine whether the diving company is capable of conducting SEILODs safely.[14]

8. Two Memoranda of Understanding (MOU) between the Coast Guard and OSHA enabled the Coast Guard to act on behalf of OSHA for activities occurring on the Outer Continental Shelf, including commercial diving operations.[15] The MOUs enable Coast Guard marine inspectors to conduct periodic onsite inspections to ensure compliance with health and safety regulations. To accomplish this, the Marine Safety Manual establishes a Commandant

[12] U.S. Coast Guard Investigation, Vol. 4, IO Exhibit 30, (NVIC 1-89, encl. 1, para. 5.f.)

[13] "Underwater survey diving contractors *are encouraged* to use the guidance in enclosure (1) when preparing to conduct an underwater survey." NVIC 1-89, para. 4.b. (emphasis added)

[14] None of this, however, indicates intent by Commandant to relieve the vessel owner or diving contractor of responsibility for safety. Especially since many SEILOD dives are conducted when Coast Guard personnel are not present. "It must be stressed that the underwater survey program is an option that the ship's owners/operators have elected to use. Responsibility for the management of the vessel, its personnel, and maintenance of necessary safety and service systems remains at all times with the master and his representatives." See NVIC 1-89, encl. 1, para. 5.a.

[15] Memorandum of Understanding between the Coast Guard and OSHA dated December 19, 1979
Memorandum of Understanding between the Coast Guard and OSHA dated March 8, 1983

expectation that marine inspectors verify compliance with commercial diving regulations coincident with other inspection activities.[16]

9. At the time of the casualty, Rig 12 was undergoing a Classification Society (Class) survey in addition to a Coast Guard SEILOD. Class for Rig 12 was the American Bureau of Shipping (ABS). A classification society is an organization, other than a flag state, that issues Certificates of Class and/or International Convention Certificates.[17] The Coast Guard is statutorily responsible for safety of life and property at sea.[18] But the Coast Guard may rely on ABS reports, documents, and certificates to complete its inspection duties.[19] To complete Rig 12's inspection for certification and SEILOD, Coast Guard marine inspectors attended the vessel at least three times, on 1, 4, and 8 March 1996. During the inspection, they noted 37 deficiencies and worked with Cliffs' Director of Safety and Personnel, Buddy Horton; and Rig 12's Offshore Installation Manager (OIM), Ronald Townsend, to ensure that the deficiencies were resolved. By March 8, Cliffs had cleared a majority of the deficiencies and Rig 12 was deemed by the marine inspectors to be fit for its intended route and service. The inspectors issued a new COI and endorsed the vessel's International Oil Pollution Prevention certificate and record of inspection card. The marine inspectors also issued a CG Form 835 as a worklist of 21 additional items to be fixed aboard Rig 12.[20] While Rig 12 was laid up, its operations manual, like all other inspection requirements, had been allowed to lapse. On 4 March, a copy of the manual was on board Rig 12 under review by the Coast Guard. The manual had not been approved as of 4 March.[21]

10. To satisfy the inspection requirements of Class and the SEILOD requirements of the Coast Guard, Horton contacted Texas NDE, a company specializing in nondestructive testing. One of Texas NDE's owners, Kirk Austin, had worked for Cliffs on at least two other MODU inspections. Cliffs hired Texas NDE to do two types of nondestructive testing on Rig 12: (1) magnetic particle testing to detect cracks and welding discontinuities in the metal of the legs and mat and (2) ultrasonic testing (gauging) to determine hull thickness. Gauging was to be done at 40 spots selected by Class and Cliffs on the legs and mat of Rig 12. Typically, magnetic particle inspections are video taped for ABS and then submitted to the Coast Guard for review.

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[16] Marine Safety Manual, Vol. II, Chapter 16.E.1
[17] Marine Safety Manual, Vol. II, Chapter 23.B.3.a
[18] 46 USC Part B
[19] 46 USC 3316
[20] U. S. Coast Guard Investigation, Vol. 6, IO Exhibit 65 (USCG Inspection Case # MI96008514); U.S. Coast Guard Investigation, Vol. 4, IO exhibit 29 (Inspection Worklist, 835 dated March 4, 1996)
[21] Martinez, testimony, Vol. 2, pg. 150-151.

FORMAL INVESTIGATION INTO THE COMMERCIAL DIVING ACCIDENT ABOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO. 12 ON 4 MARCH 1996, WITH LOSS OF LIFE

Texas NDE

11. In 1996, Austin was Texas NDE's President and Operations Manager and had 15 years of NDT experience. Austin handled sales, hiring, payroll, and marketing in addition to doing much of the company's NDT work. Austin was certified by the American Society for Nondestructive Testing with Level II technical proficiency in ultrasonic, eddy current, and liquid penetrant testing. He also was Level III qualified in magnetic particle testing.[22] Texas NDE also employed Mark Wright, Dale McInnis, and Henry Hodge. Texas NDE began as a NDT company working on those portions of MODUs above the waterline. The company did not plan to do diving or underwater testing when it was formed. The company found though, that diving companies were reluctant to accept low paying shallow water jobs (defined by Austin as 30 feet or less) and Texas NDE saw potential for more work if the company included shallow water diving as part of its service. Of the four company employees, only Wright had prior diving experience. He had been a Marine Corps diver trained by the U.S. Navy. According to Austin, "[h]e was the one who kind of guided us on what we needed to think about."[23] By 1996, McInnis and Hodge had each made; at most, two or three shallow water surface supplied air dives for the company.[24] Austin's first surface supplied air dive was in 10 feet of water while working with a large diving company. Austin then took a YMCA SCUBA[25] class as a "starting point" to become proficient in commercial diving. The class met two nights a week for one or two months.[26] Aside from the 10-foot dive and the YMCA course, by 1996 Austin's total diving experience consisted of five or six shallow water commercial dives made over the span of about five years.[27] Prior to 4 March, Austin had dived on two shallow-water NDT inspections for Cliffs similar to the Rig 12 job.[28] When Horton hired Austin to do NDT of Rig 12, Texas NDE did not have enough personnel available to do the job and Austin subcontracted with G&G Marine to provide divers.[29]

G&G Marine

12. In 1996, Dan Gilbert was the owner, operator, and sole manager of G&G Marine (G&G).[30] Gilbert began sport diving in the 1960's while in the military and after leaving the service in 1970, he went to work as a commercial diver for International Marine Technology in Houston, Texas. Two years later, Gilbert left to work for Underwater Technology, Inc., also

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[22] Austin, testimony, Vol. 2, pg. 204-206
[23] Austin, testimony, Vol. 2, pg. 216, 233
[24] Surface supplied air diving means the diver is supplied with compressed breathing air from the dive location. See 46 CFR 197.204 (Definitions)
[25] Self Contained Underwater Breathing Apparatus means the diver is supplied with compressed breathing air from diver carried equipment. See 46 CFR 197.204 (Definitions)
[26] U.S. Coast Guard Investigation, Vol. 4, IO exhibit 39 (YMCA card)
[27] Austin, testimony, Vol. 2, 213-216
[28] Austin, testimony, Vol. 2, pg. 217, 235
[29] Austin, testimony, Vol. 2, pg. 223
[30] USCG Investigation, Vol. 4, IO exhibit 40, (Danny R. Gilbert, "Sworn Statement", Houston, May 19, 1999, pg. 23); Mr. Gilbert was still the owner/operator of G&G at the time of this writing.

based in Houston. Gilbert learned his trade "on the job" by watching other, more experienced divers and made over 100 surface supplied air dives every year for those companies. In that time, Gilbert conducted hull surveys, damage inspections, and cleaned ships' hulls. He worked in the Gulf of Mexico, Central and South America, and the Caribbean. In 1974, Gilbert started his own company, Gilbert Marine, and twelve years later merged with Taylor Diving & Salvage.[31] Gilbert worked at Taylor for 18 months as manager of ship diving. In that capacity, he solicited work cleaning ship hulls and conducting ship surveys. Gilbert bid jobs and assigned dive teams from a pool of 200 divers. One of his responsibilities was to assign and designate, in writing, dive supervisors for every job. In 1988, Gilbert left Taylor to start G&G Marine in Houston, Texas.[32]

13. At G&G, Gilbert hired workers, scheduled jobs, and directed field operations. G&G's practice for equipping its dive operations appears to be consistent with industry practice. "[The diver is] responsible for his -- what we call personal dive gear, which is your wet suit (if required), coveralls, booties, fins, weight belt, harness, knife, hand tools (i.e., crescent wrenches, a pair of pliers), gloves, a bailout bottle, if they want one. They are not required to supply their own diving helmet. We have one that's available."[33] Pilkington, Wiitala, and Austin all used their own helmets for the Rig 12 diving job.[34] Aside from the personal dive gear, "G&G supplied everything from the end of the hose back."[35] This meant that when G&G sent divers into the field, the company supplied air compressors, hoses, gauges, video equipment, and cables – the larger, more expensive equipment. G&G had once been a member of the Association of Diving Contractors (ADC), but by 1996 Gilbert had withdrawn G&G's membership for "personal reasons".[36] Nevertheless, in 1996 G&G's operations manual claimed that G&G still complied with all ADC standards. Both ADC and G&G's standards called for two divers and one tender on a dive like the Rig 12 inspection.[37]

14. G&G's procedures for outfitting a dive operation were not set out in the company's operations manual or any company policy.[38] When G&G sent divers to a job, diving equipment was selected and loaded at the direction of any one of several people. Gilbert

[31] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 16)
[32] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 20)
[33] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 106)
[34] Wiitala, testimony; Vol. 1, pg. 315-317.
[35] Wiitala, testimony, Vol. 1, pg. 169
[36] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 87)
[37] "There is no standard size dive crew. Each individual job will dictate the number of persons detailed for conduct of the dive operations. The dive crew composition will be dictated by physical and environmental conditions and, by regulatory requirements published by the various agencies under which the operations will be conducted. However; in no case shall G&G Marine operate with fewer persons than as set forth in the Diving Consensus Standards of the Association of Diving Contractors."; USCG Investigation, Vol. 4, IO exhibit 16, (G&G's Safe Practices and Operation Manual, pg. 1-4); Wiitala, testimony, Vol. 1, pg. 258-259; USCG Investigation, Vol. 4, IO exhibit 57, (ADC Consensus Standards, pg. 3-24(D))
[38] USCG Investigation, Vol. 4, IO exhibit 16, (G&G Safe Practices and Operation Manual)

apparently made equipment lists.[39] So, too, did the dive personnel.[40] Dan Wiitala, a G&G employee, testified that several years after he began working at G&G, one of the employees "raised a fuss" about needing a secondary air supply when diving.[41] Thereafter, it became company policy to send a secondary air supply on dives, though insufficient evidence was found to determine whether the policy was ever put into writing.[42] G&G did not require divers to use bailout bottles as a tertiary air supply, nor were bailout bottles discussed in G&G's safety manual.[43] G&G did maintain dive logs, but had a policy of throwing them away at the end of each pay period.[44]

15. In 1996, G&G did not have a shop manager or anyone charged specifically with routine equipment maintenance. At one time, for about a year in 1989 or 1990, G&G employed Mr. Al May strictly to maintain equipment. Mr. May also may have been responsible for ensuring that air quality testing on G&G's compressors was completed. When May left in about 1990, he was not replaced and no one else was designated as the equipment maintenance person. Nevertheless, for about a year after May left the company, G&G's maintenance program was efficient enough to ensure that air quality testing continued.[45]

16. Gilbert said that he was responsible for shop maintenance, but that all G&G employees would identify equipment problems and bring them to his attention.[46] From time to time, Gilbert also paid divers to work in the shop maintaining equipment.[47] Starting in about 1993, the maintenance program, at least for the Quincy 325 compressor used on Rig 12 (Compressor 2)[48] consisted of periodically changing the engine oil, compressor oil, and filters (See figures 2 & 3). Between February 1993 and March 1996, Compressor 2's engine oil was changed eight times, the compressor oil three times, and air intake filters four times. The compressor maintenance log required by 46 CFR 197.480, and 197.482(d) does not indicate that any other repairs or modifications were made to Compressor 2 during that period.[49] Gilbert indicated that routine maintenance like checking compressor oil levels, was done as equipment was loaded for shipping to dive sites. However, during his equipment

[39] USCG Investigation, Vol. 4, IO exhibit 15, (G&G equipment list)
[40] Wiitala, testimony, Vol. 1, pg. 136-138
[41] Wiitala, testimony, Vol. 1, pg. 152
[42] USCG Investigation, Vol. 4, IO exhibit 16, (G&G's Safe Practices and Operation Manual)
[43] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 92)
[44] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 91)
[45] Lawdermilk, testimony, Vol. 1, pg. 441-442, 447; 46 CFR 197.340 (Breathing gas supply) and 46 CFR 197.450 (Breathing gas tests)
[46] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 44)
[47] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 51)
[48] Generally referred to as Compressor 2 by G&G employees. USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 41)
[49] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, Exhibit 1); Wiitala, testimony, pg. 164-166; Lawdermilk, testimony, Vol. 1, pg. 442

loadout on 3 March 1996, Gilbert did not check Compressor 2 before it went out for the Rig 12 job.[50]

17. One employee working for G&G on 4 March 1996 was Kevin Todd Lawdermilk. He worked for G&G for seven years as a diver and occasionally as an in-house maintenance person.[51] Lawdermilk was familiar with all four compressors G&G owned in 1996, and had worked on each. Lawdermilk testified that G&G often would not buy replacement parts to do ordinary equipment upkeep. As an example, Lawdermilk testified that G&G employees would put red shop rags or Kotex pads in a supply side air intake filter housing when factory specified air filters were not available. Lawdermilk indicated that, before 4 March, there was a strong likelihood that a red shop rag weighted down by marbles had been put in the air intake filter housing of Compressor 2 in lieu of an ordinary filter. Lawdermilk did not know whether the rag had been removed or replaced by 4 March.[52] Lawdermilk also testified that Compressor 2 had malfunctioned on a diving job several months before the Rig 12 job and had been set aside so it would not be used on other jobs. To Lawdermilk's knowledge, Compressor 2 had not been repaired before the Rig 12 job. Wiitala also did not know whether Compressor 2 had a factory specified filter on 4 March since he did not check the air filter housing before using the compressor.[53]

18. When asked (three years after the casualty) to produce receipts for purchases of routine maintenance and parts for G&G's compressors, Gilbert produced four receipts, three dated in 1993 and one in 1998.[54] None of the receipts indicated purchases of an air filter for Compressor 2.

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[50] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 48)

[51] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 50-51); Lawdermilk, testimony, Vol. 1, pg. 443.

[52] Lawdermilk, testimony, Vol. 1, pg. 459-465, 510

[53] Wiitala, testimony, Vol. 1, pg. 513-514

[54] USCG Investigation, Vol. 4, IO exhibit 41, (McKenzie work order dated September 11, 1998) and U.S.Coast Guard Investigation, Vol. 5, IO exhibit 56, (McKenzie receipts for G&G Marine); Gilbert, testimony, Vol. 2, pg. 399

FORMAL INVESTIGATION INTO THE COMMERCIAL DIVING ACCIDENT ABOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO. 12 ON 4 MARCH 1996, WITH LOSS OF LIFE

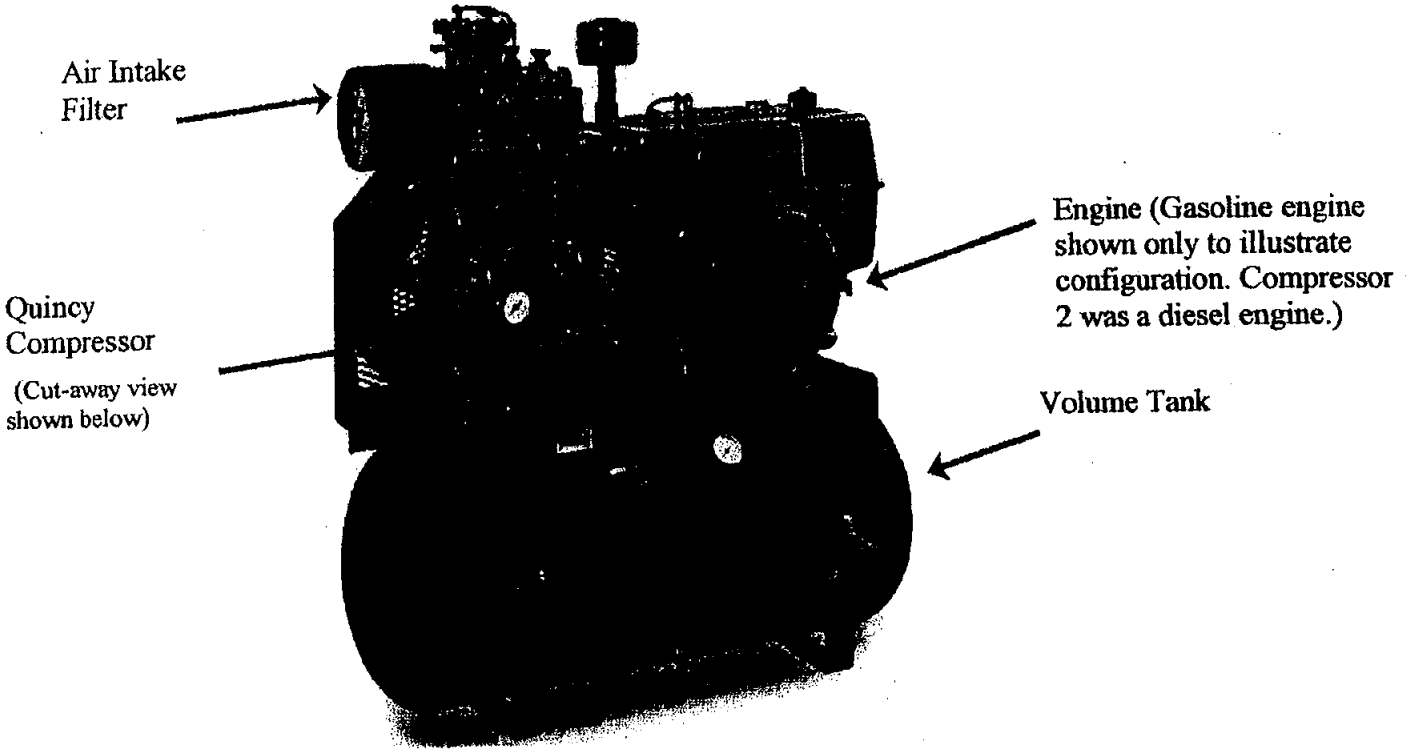

Figure 2: Quincy Compressor System

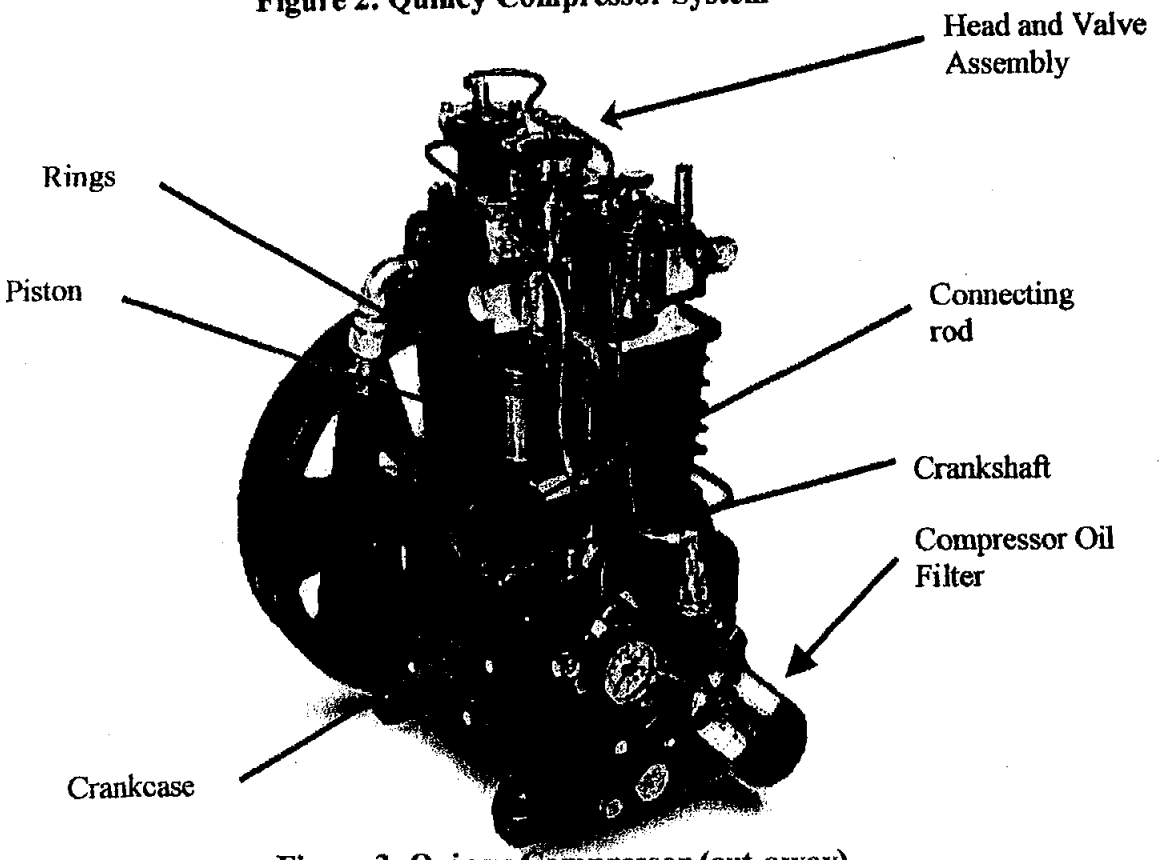

Figure 3: Quincy Compressor (cut-away)

19. G&G's diver training program focused on ship maintenance rather than diving fundamentals.[55] Gilbert believed that when a diver graduated from dive school he was fully qualified to dive on any company job.[56] This was not consistent with training and qualification programs at other, larger, diving companies or in the military. One large diving company operating in the Gulf of Mexico, Oceaneering, expects a prospective diver to begin his career by working two or three years as a dive tender, with the majority of his time spent assisting dive operations and doing light to moderate diving under close supervision. The employee then graduates from tender to diver and will spend one or two years learning his trade to become fully qualified. A diver can, but is not guaranteed to, progress over time to dive supervisor after more training.

20. G&G's practice, by comparison, was to use a prospective diver as a tender for two or three months during which time he might carry out five or six dives under the supervision of a more experienced diver. Depending on workload demands, G&G then would deem him to be a fully qualified diver. Training at G&G was on the job. "We don't hire just divers and we don't hire just tenders. We found over the years that our best people are people that we hire straight out of commercial diving school and we teach them how to dive the way we want them to dive. And we give them the opportunity to get in the water quicker than they would with Cal Dive or American Oil Field Divers or Oceaneering – somebody like that."[57]

Dan Wiitala

21. Wiitala was a commercial diver who, by March 1996, had worked for Dan Gilbert for approximately 13 years; which practically speaking, was his entire commercial diving career. Wiitala began recreational SCUBA diving about 1979. Four years later, he attended a six-month course at a commercial dive school in Houston and was hired by Gilbert (either when Gilbert was with Taylor or as he started G&G) three months after graduating. Wiitala started with Gilbert's company as a dive tender, a job he described as one of setting up dive stations, waking the divers, tending to a diver while he is in the water including holding his hose, and following directions. Additionally, at the end of day, the dive tender broke down the dive station and stowed and refueled equipment as directed. Wiitala went to work with immediate expectations of becoming a diver, but as the newest employee he expected also to do the more menial work. Wiitala described his progression from diver to dive supervisor as accidental.

Q. When did you first act as a dive supervisor for G&G?

A. That, I couldn't tell you. Several years.

[55] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 70-72)
[56] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 70-71)
[57] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 16)

Q. And what had you done in that process to become qualified to be a dive supervisor?

A. I don't know. I wish I knew, or I would have not done it.

Q. When did you know you were ready to be a dive supervisor?

A. I more or less got crowded into it. I never wanted to be.[58]

22. Wiitala later changed his estimate of the time to become a dive supervisor at G&G to five years. He quit working for G&G approximately 10 months after the death of Brian Pilkington.[59]

23. Wiitala indicated that compressors failed from time to time while on G&G diving jobs. When that happened, it was the dive supervisor's responsibility to diagnose the problem. For Wiitala, the process was simple; it would be obvious if the motor side quit because the compressor is loud and when it went silent it meant the motor had quit. But, if the compressor side quit, but not the motor, he would know by checking the air gauges.[60]

Brian Pilkington

24. Pilkington was a 23-year-old commercial diver with two years diving experience at the time of the diving casualty. Pilkington graduated from University Prep High School in Seattle, WA and became a certified SCUBA diver at the age of 21. Pilkington attended a commercial dive school, Divers Institute of Technology, Inc., in Seattle and graduated in February 1994. When he graduated, Pilkington was certified Level II in Ultrasonic Testing, Liquid Penetrant and Magnetic Particle by the American Society for Nondestructive Testing. Pilkington also received a certification deeming him proficient to perform maintenance and repair on the SuperLite 17 & 27 Helmets and KMB-18 & 28 Band Masks.[61] After graduating, Pilkington was first employed by Professional Divers of New Orleans and in 1995 he moved to Houston, TX with his wife, Julia, to work for G&G Marine. There was insufficient evidence to determine how many dives Pilkington made with G&G before 4 March 1996. The best evidence would have been G&G's dive logs. However, Gilbert testified that G&G maintained dive logs only until the end of each pay period and then threw them away. Gilbert indicated that Pilkington's dive logs for G&G had been destroyed.[62] The testimony indicates only that Pilkington had dived on several jobs for G&G before 4 March.

[58] Wiitala, testimony, Vol. 1, pg. 120, 145-146
[59] Wiitala, testimony, Vol. 1, pg. 146; Wiitala, testimony; Vol. 1, pg. 121
[60] Wiitala, testimony, Vol. 1, pg. 192-193
[61] USCG Investigation, Vol. 5, IO Exhibit 45, (Diving Records of Brian Pilkington)
[62] USCG Investigation, Vol. 4, IO Exhibit 40, (Gilbert Statement, pg. 91 – 94)

4 March 1996

25. On the evening of 3 March 1996, Gilbert contacted Pilkington and Wiitala to send them to a hull inspection job on Rig 12 out of Sabine Pass, Texas. Wiitala initially refused the job because he believed Pilkington was inexperienced and he did not know Austin. Wiitala reasoned that the team would be too small and Wiitala's responsibilities would be too great.[63] ". . . I figured I was going to be the only one out there doing everything or shouldering everything. And I didn't want any part of it."[64] Wiitala testified that after his initial refusal, Gilbert called back to promise Texas NDE would supply two additional divers. The dive team would total five: Wiitala, Austin, Pilkington and two divers from Texas NDE. Only then did Wiitala accept the job.[65]

26. Gilbert testified that after talking to Wiitala and Pilkington on the evening of 3 March 1996, he went to the G&G facility to prepare a load out list of equipment needed for the Rig 12 job.[66] Among the equipment on the list, two umbilicals were slated by Gilbert to be taken on the job. Gilbert stated that Pilkington arrived at G&G about 30 minutes later and together they gathered the equipment and loaded it into the bed of Pilkington's Nissan pickup truck. Gilbert said that during this process, he went into the office to get timesheets and dive logs to be delivered to Wiitala. Gilbert says that while he was in the office, Pilkington finished loading and checking the equipment to ensure it matched the loadout list. Gilbert instructed Pilkington to meet Wiitala at a roadside stop on Interstate 10 between Houston and Sabine Pass at 0500 hours the next morning.[67]

27. Coast Guard regulations require that a diving supervisor be appointed in writing and the appointment be given to the person-in-charge before diving begins.[68] The diving supervisor is required to provide an operations manual to the vessel's person-in-charge before diving begins; the manual is required to be at the dive location when diving begins.[69] According to Wiitala, Gilbert would customarily designate the dive supervisor for G&G diving jobs by inserting an appointing letter under the plastic cover of the operations manual sent to the dive location. Gilbert did not appoint a dive supervisor or send a company dive operations and safety manual to the Rig 12 dive location.[70] He testified that he expected a Texas NDE employee to be dive supervisor for the job.[71]

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[63] Wiitala, testimony, Vol. 1, pg. 265.
[64] Wiitala, testimony, Vol. 1, pg. 172
[65] Wiitala, testimony, Vol. 1, pg. 171-172
[66] USCG Investigation, Vol. 4, IO exhibit 15, (G&G equipment list)
[67] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 56-57)
[68] 46 CFR 197.210
[69] 46 CFR 197.420
[70] Wiitala, testimony, Vol. 1, pg. 147-148
[71] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 104-105)

28. Early on the morning of 4 March 1996, Pilkington met Wiitala on Interstate 10 as directed. They drove in Pilkington's truck to Sabine Pass where they were to meet a crew boat to take them to Rig 12.[72] Wiitala testified that he expected a three-person dive team to meet them in Sabine Pass, but instead they met only Austin. Nevertheless, the group did not talk about the problem or make any effort to call for more divers. No one appears to have stopped to examine whether there were enough divers to proceed safely. Wiitala testified that he did ask Austin where the other two divers were, but did not remember Austin's response. Wiitala testified that he was angry about the situation, nevertheless, he did nothing about it.[73] The team made an aborted attempt to reach Rig 12 on a crew boat too small for the sea state, which was described as choppy with two to four foot seas.[74] After returning to the dock and boarding a larger vessel, Austin, Wiitala, and Pilkington arrived at Rig 12 at about 1100 hours.[75] Upon their arrival at Rig 12, the group waited two hours to unload their gear because another dive team was loading its gear to depart the vessel.[76]

29. On 4 March 1996, Coast Guard inspectors arrived on Rig 12 at 1030 hours and worked on the vessel until 1630 hours.[77] During that time, although they knew commercial diving operations were underway, they did not visit the dive operation or inspect the dive station, its manning, or equipment.[78]

30. When the Coast Guard inspectors arrived on Rig 12, they met with the class society surveyor and rig personnel to plan the day's inspections. According to the break-in marine inspector that day "[w]e agreed that ABS would handle the entire inspection with regards to the underwater portion of the exam. *The meeting left me with the impression that ABS would also inspect the topside diving gear as well as the underwater progress of the diving operations.*"[79] At the time of the Rig 12 inspection, the break-in marine inspector had completed the basic marine inspector course at the Coast Guard's Reserve Training Center in Yorktown, VA. Diving operation inspections were not taught in that course. He had not attended the outer continental shelf inspector school taught jointly by the Coast Guard and industry to Coast Guard marine inspectors.

31. Contrary to the break-in inspector's perception, the class surveyor did not believe dive supervision was an area of overlapping responsibility with the Coast Guard. The ABS

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[72] Wiitala, testimony, Vol. 1, pg. 180
[73] Wiitala, testimony, Vol. 1, pg. 180-181
[74] Champagne, testimony, Vol. 1, pg. 39-40
[75] Wiitala, testimony, Vol. 1, pg. 181-182; Townsend, testimony, Vol. 3, pg. 115
[76] Wiitala, testimony, Vol. 1, pg. 182-183
[77] Townsend, testimony, Vol. 3, pg. 114, 116-117
[78] Wiitala, testimony, Vol. 1, pg. 269; Austin, testimony, Vol. 2, pg. 239
[79] USCG Investigation, Vol. 6, IO Exhibit 66, (Statement of T.L. Thomson dtd 12 May 1999) [emphasis added]; Near the end of the hearing, ABS objected to admission of this exhibit unless Thomson was made available for cross-examination. At the time, neither the IO nor the Parties in Interest were disposed to examine LT (jg) Thomson so late in the process. The IO agreed not to enter the statement. After further consideration, the IO determined that this information is relevant and necessary.

surveyor (who had performed well over 100 SEILODs) had no expectations of supervising the dive because diving operation inspection was not within the mandate of ABS. ABS surveyors do not inspect diving operations as an ordinary part of their work and the ABS Rules have no provisions for inspecting dive procedures or equipment. Furthermore, the ABS surveyor had never inspected a diving station, nor was he familiar with diving operations.[80]

32. At the hearing, the Coast Guard senior marine inspector for Rig 12, LT Julio Martinez, agreed with the ABS surveyor that the Coast Guard, not ABS, was responsible for inspecting dive operations. At the time of the hearing, three years after the inspection, Martinez vaguely remembered being on board Rig 12 on 3 March and believed that no diving operations were underway that day. But, he had no memory of visiting Rig 12 on 4 March.[81] Martinez testified that he would typically inspect a diving operation, if one were underway when he performed a MODU exam. To do this, he would use the Coast Guard's MODU/SEILOD job aid, CG-840H-1 (9-92) and ensure that all the items listed in the job aid were on board and available.[82]

33. When the team dive team reached Rig 12, the vessel was in the bottom-bearing mode in 37 feet of water at West Cameron Block 83.[83] The vessel was approximately eight miles south, south-east of the Sabine Pass East Jetty Light, 9.8 miles from the closest point of land. When the group reported aboard, Austin presented himself to Ronald Townsend and Buddy Horton. Horton coordinated a meeting between the supervisor of the other dive team, American Oilfield Divers, (AOD had cleaned Rig 12's legs and was familiar with the layout of the mat and legs), the ABS surveyor, and Austin to plan the upcoming job. Based on Austin's conduct, Townsend and Horton believed Austin was the dive supervisor even though Austin did not deliver the diving operations and safety manual to Townsend as the dive supervisor is required to do.[84] Townsend did not ask for or examine the diving supervisor's designation, as he is required to do by 46 CFR 197.402 (a) (2) (i). Neither Horton nor Townsend requested the safety and operations manual or diving supervisor written designation from Austin, Wiitala or Pilkington. Horton also assumed Austin was the dive supervisor based on past inspection jobs Austin had performed for Cliffs.[85]

34. Austin, on the other hand, did not consider himself the dive supervisor. He considered himself only a diver and NDT expert. He expected only to dive to do the magnetic particle

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[80] Everett, testimony, Vol. 2, pg. 327-328, 350

[81] Martinez, testimony, Vol. 2, pg. 130 - 131

[82] Martinez, testimony, Vol. 2, pg. 156-157; See USCG Investigation, Vol. 4, IO Exhibit 31, (MODU Drydock Inspection Book, pg. 20-22, Diving Supervisor appointed in writing, Live Boating variances, Log Books, operating manual, equipment, etc . . .)

[83] N 29-34.7/W 093-41.5; See USCG Investigation, IO Exhibit 69 (Canadian Workers' Comp. Bd. Study) for some discussion of commercial diving dangers in this depth of water.

[84] Townsend, testimony, Vol. 3, pg. 145; See too 46 CFR 197.420

[85] Horton, testimony, Vol. 2, pg. 18, 20, 25, 36

testing, but expected to have no other control over the diving operations. "I was the – to look for terms, I guess, would be the prime contractor; and I subcontracted two divers from G&G."[86] While Austin talked to Townsend and Horton, Wiitala and Pilkington set up the dive station on the port side of Rig 12 (See Figure 4 below).

35. The dive station (See Figure 5) consisted of a Quincy 325 air compressor connected by a 30-foot air hose to a 30-gallon volume tank. The volume tank was connected to an air manifold (a.k.a. air rack). Two high-pressure air bottles also were connected to the air rack to provide a secondary air supply if needed. The umbilical leading from the air rack to the diver's helmet consisted of an air hose, a communications line, a pneumofathometer, a lifeline, and the line from the NDT probe to the NDT monitor.[87] Next to the air rack was the communication box with batteries. Located nearby was the NDT scope used to interpret thickness readings measured by the probe operated by the diver.[88] The team set the compressor air intake upwind from the exhaust of the compressor's diesel engine.[89]

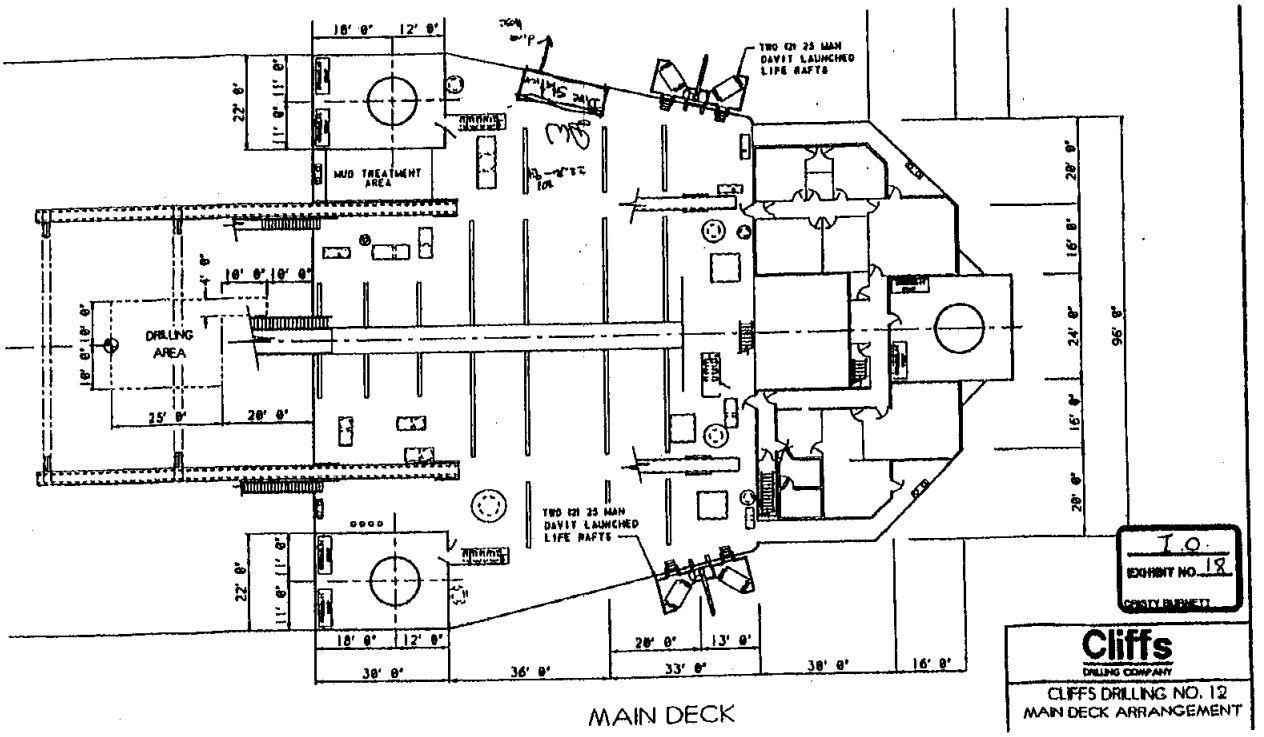

Figure 4: Main Deck Rig 12

[86] Austin, testimony, Vol. 2, pg. 225
[87] See USCG Investigation, Vol. 4, IO Exhibit 51, (Photograph of umbilical)
[88] Wiitala, testimony, Vol. 1, pg. 191
[89] Wiitala, testimony, Vol. 1, pg. 253

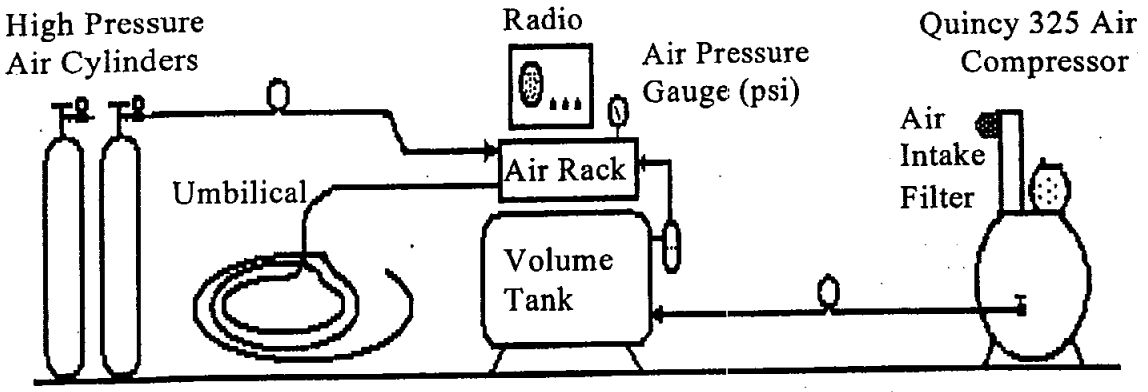

Figure 5: Schematic representation of Dive Station

36. Before the first dive, the dive team discovered their video cable was incompatible with the video equipment on board. They also discovered they had only one dive umbilical on-scene. Wiitala called Gilbert to request a compatible video cable be sent to the site. Wiitala did not raise the issue of the missing second dive umbilical or request another umbilical be sent to the dive site.[90]

37. Wiitala decided the team would begin ultrasonic testing while waiting for the video cable to be delivered.[91] Wiitala decided to send Pilkington down first to conduct the underwater portion of the ultrasonic testing. Ultrasonic testing was the least technical part of the dive and best suited for the less experienced diver. The testing required Pilkington to carry a lightweight probe called a transducer to pre-selected spots on Rig 12's hull. Pilkington was to hold the probe against the hull while an operator on the surface, Austin, interpreted the readings. One of the tools attached to Pilkington's dive belt was a roofing axe secured by a three-foot lanyard.[92] The axe was used to clean barnacles and rust from the hull so that the probe could be placed against clean metal. It could not be secured except at the end of the lanyard. Wiitala explained that when the diver worked underwater, he would hold the axe and transducer in one hand and pull himself along with the other. If the axe dropped, it fell to the diver's feet.[93]

38. While preparing to dive, Pilkington discovered he had forgotten to bring his weight belt. Wiitala testified that he was angry about the lapse and expressed his anger to Pilkington. Nevertheless, Wiitala loaned his weight belt to Pilkington so that the dive could begin. There was little discussion about using a bailout bottle. Wiitala testified that his personal bottle was available, but was set up to connect to his own helmet. Wiitala testified that Pilkington could

[90] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 60-61)
[91] Wiitala, testimony, Vol. 1, pg. 197-198
[92] Wiitala, testimony, Vol. 1, pg. 239
[93] Wiitala, testimony, Vol. 1, pg. 239, 242-244

have used Wiitala's bailout bottle, but "Brian chose not to mess with it because the dive was so shallow and seemed so easy."[94]

39. At about 1330 hours, Pilkington entered the 65 to 70 degree water for the first time.[95] Pilkington wore a neoprene wet suit and his own Kirby, Morgan SuperLite 27 Dive Hat (See Figures 6 & 7).[96] He also wore Wiitala's weight belt and a harness with a quick release to which the umbilical, a knife and axe were attached. A three-foot lanyard attached the roofing axe to the diver's belt.[97]

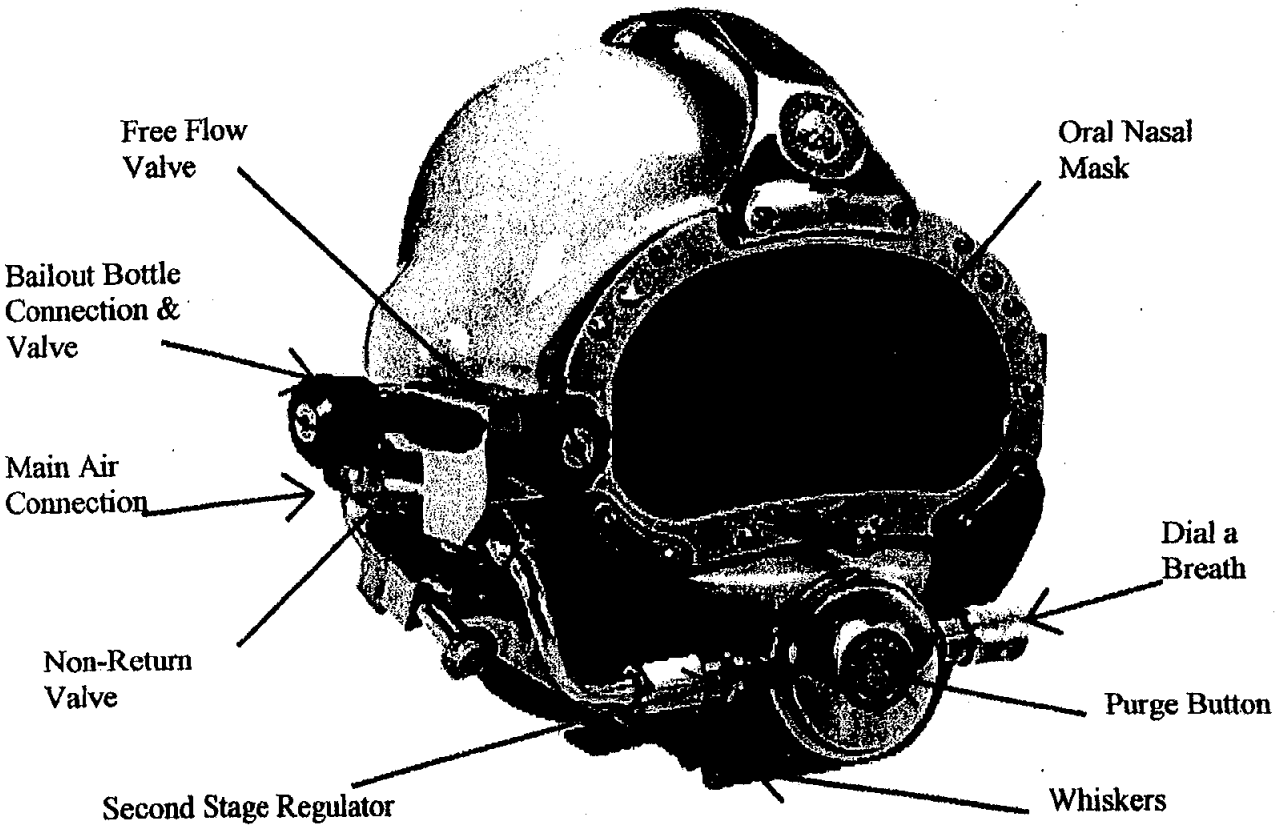

Figure 6: SuperLite 27 Dive Hat

40. Due to the gap between the deck of Rig 12 and the water, Pilkington was lowered to the surface in a personnel basket (also known as a Billy Pugh basket) attached to a crane operated by rig personnel. Rig 12 had three legs, two at the stern and one at the bow. An AOD diver had attached a down line to the mat of the rig and relayed to Wiitala "that the

[94] Wiitala, testimony, Vol. 1, pg. 315-317
[95] See USCG Investigation, Vol. 6, IO Exhibit 67, (Second Pilkington Investigation dated 17 August 1998, MC96003402)
[96] Serial Number 50609
[97] Wiitala, testimony, Vol. 1, pg. 315 – 330; 270 - 300

down line was tied to the bow leg . . .when in fact it was tied to the stern, or vice versa."[98] During the investigation, no one was able to explain why AOD had been hired to clean the 40 test spots and Texas NDE -- with its own set of divers -- was hired to do the testing. Since Pilkington had not dived on a MODU before, he relied on Wiitala to give him directions to the test sites. Misunderstanding about the orientation of the dive line confused the initial dive attempt and Wiitala ordered Pilkington to abort the dive so that the team could start again. When Pilkington reentered the water, he began conducting ultrasonic gauging at about 1345 hours. The gauging continued for about three hours with Pilkington periodically moving from one area to another. The work was described as "light," requiring little effort from the diver other than moving from one spot to another.[99] Wiitala continued to talk to Pilkington by radio; he testified that Pilkington periodically reported that he felt fine and that the work was going well.[100] Wiitala described the sounds he heard over the communications line as the normal sounds connected with a dive. Wiitala heard a background "whoosing" indicative of air free flowing in the helmet. "Just kind of – he [Pilkington] probably just had it [the free-flow valve] cracked open a little bit. I mean, you can hear a free flow when it runs, and he had it running definitely. . . . But obviously not to the extent that I thought he did."[101] Wiitala did not actively tend the umbilical. "I don't recall if I was standing on it with one foot or had somebody else holding it for me, . . ." Meanwhile, Austin was monitoring the NDT instruments and not involved in supervising or tending the diver.[102]

41. Wiitala testified that when Compressor 2 was first put on line, the gauges showed 150 psi. Three or four times during the dive, however, Wiitala noticed that the pressure dropped to 90 psi.[103] Each time Wiitala saw the pressure drops, he told Pilkington to close his free-flow valve to allow the compressor to regain pressure (See figure 6).[104] According to Wiitala, "You open this valve up [free flow valve] and you get quite a bit of air flow [in the helmet]. . . . It gives you a little extra air if you feel like you need a breather. Some guys need it – I always leave mine on just a little bit to keep everything defogged, keep everything circulating. Some guys really hog it on. . . . [meaning] [j]ust leave it too far on. And you're kind of overflowing the compressor's capability."[105]

[98] Wiitala, testimony, Vol. 1, pg. 204
[99] Wiitala, testimony, Vol. 1, pg. 210
[100] Wiitala, testimony, Vol. 1, pg. 213-214
[101] Wiitala, testimony, Vol. 1, pg. 206 - 209
[102] Wiitala, testimony, Vol. 1, pg. 262-265
[103] Wiitala, testimony, Vol. 1, pg. 194, 215, 219
[104] Wiitala, testimony, Vol. 1, pg. 196
[105] Wiitala, testimony, Vol. 1, pg. 217

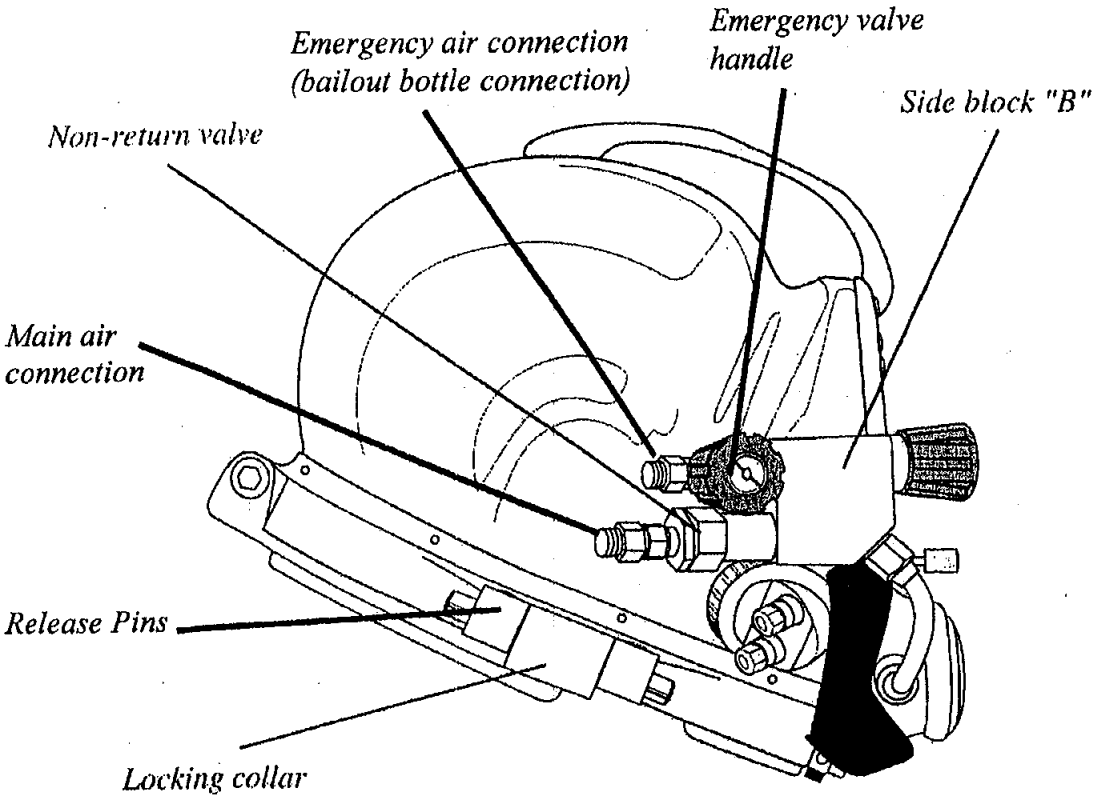

Figure 7: Side view of SuperLite-27 helmet

42. At about 1645 hours, Austin was watching the ultrasonic gauging monitor while Wiitala operated the air rack and directed Pilkington.[106] Wiitala checked the pressure gauge and saw that the pressure had again dropped to 90 psi. Wiitala told Pilkington once again to close his free flow valve, but Pilkington said that the valve was already closed. At this point, Wiitala realize there was a larger problem. Over the next several minutes Wiitala had a garbled conversation with Pilkington, during which Pilkington's manner became increasingly frantic and his breathing rapidly increased to the point it was apparent he was hyperventilating. "He [Pilkington] just kinda went into a whirl. He wouldn't really talk to me on an even keel, and he wouldn't respond to me. I mean, it just got away from him."[107] During the conversation, Pilkington complained of not being able to breathe and said that he heard a hissing noise. Pilkington speculated that he might have forgotten to tighten the airline to his helmet before

[106] Wiitala, testimony, Vol. 1, pg. 202
[107] Wiitala, testimony, Vol. 1, pg. 221

his dive and thought the line might have worked free.[108] Wiitala testified that Pilkington had not previously complained about his breathing.[109] As Pilkington continued to hyperventilate, Wiitala pulled on his umbilical to bring him to the surface. Wiitala discovered that the hose was fouled and he couldn't pull Pilkington up. Wiitala instructed Pilkington to unfoul himself so that Wiitala could haul him up, but Pilkington didn't respond.[110]

43. Wiitala then took Compressor 2 offline and changed the valve configuration on the air rack to feed Pilkington's umbilical from one of the standby high-pressure air bottles. According to Wiitala "[he] blew through" the air cylinder in 15 minutes, meaning that the bottle was used up in that amount of time.[111] Wiitala testified two high-pressure air bottles had been brought to Rig 12 but only one was pressurized.[112] The one high-pressure air bottle Wiitala was able to use contained 2250 psig of compressed air.[113] As the high pressure air bottle quickly depressurized, Pilkington continued to hyperventilate, and then his breathing "dropped to calm, controlled breathing, almost like he went to sleep."[114]

44. At 1650 hours, Townsend, the OIM, was told there was a problem at the dive station. Townsend ran to the station and discovered that rig personnel were stringing together 150 feet of oxygen-acetylene cutting torch hose to create a makeshift air line. The intent was to attach the line to Austin's dive helmet to supply Austin with pure oxygen from a welding torch high-pressure oxygen bottle.[115]

45. Wiitala had decided to send Austin down as a rescue diver because Austin was already in his wetsuit and it would have taken Wiitala too long to get dressed out.[116] Wiitala described his decision this way.

> It would have took me forever to get in my rig . . . . To be honest with you, my first reaction was to go in the water. I was going for my hat and realized it was incomplete. Or, to make it complete, it would be like, for lack of a better description, dressing an astronaut. I had to make up the suit and the whole nine yards.[117]

46. Several witnesses indicate that it took 15 to 20 minutes to configure the makeshift airline to Austin's helmet. A safety rope was wrapped around Austin's waist and he was lowered into the water by the same personnel basket used for Pilkington. Elapsed time from when Wiitala

[108] Wiitala, testimony, Vol. 1, pg. 220-223, 226
[109] Wiitala, testimony, Vol. 1, pg. 213-215
[110] Wiitala, testimony, Vol. 1, pg. 221 - 226
[111] Wiitala, testimony, Vol. 1, pg. 222-225, 235
[112] Wiitala, testimony, Vol. 1, pg. 235, 322
[113] Wiitala, testimony, Vol. 1, pg. 225
[114] Wiitala, testimony, Vol. 1, pg. 223
[115] Wiitala, testimony, Vol. 1, pg. 235, 237
[116] Wiitala, testimony, Vol. 1, pg. 234
[117] Wiitala, testimony, Vol. 1, pg. 302-303

decided to send a diver down to Pilkington to when Austin went into the water was approximately 20 minutes.[118] Austin made an initial dive but quickly returned to the surface complaining that the airline was too short and that he needed additional weight (indicating that he could not overcome the natural buoyancy of his neoprene wet suit). Rig personnel found several shackles and configured them so that they could be secured around Austin's waist. Additional air hose was attached for greater diving range and Austin began his second dive. After several minutes he returned to the surface and announced that he had found Pilkington's motionless body below, but could not bring him up because a line restrained him from floating free. Austin asked for wire cutters to use to free Pilkington and started to make a third dive. However, just before re-submerging, Austin decided he was not able to continue and refused to perform the dive.[119] Wiitala immediately put on Austin's helmet and entered the water. Wiitala reached Pilkington on his first try and grabbed Pilkington's hand to let him know help had arrived. Wiitala noted a steady stream of bubbles pouring from the whiskers of Pilkington's helmet (See figure 6).[120] Wiitala found Pilkington floating at a 45-degree angle to a horizontal plane, with a small amount of water in his helmet. Wiitala saw that Pilkington's axe had become fouled on a pipe running horizontally along the deck of the mat. Wiitala cut the lanyard connecting Pilkington's axe to his dive belt and pulled him to the surface.[121]

47. Townsend testified that he boarded the personnel basket to assist in the rescue effort and that when Wiitala brought Pilkington to the surface, Townsend grabbed the umbilical to pull Pilkington toward the personnel basket.[122] Townsend testified that as he pulled the umbilical, Pilkington's diving harness came free and then the airline came free from Pilkington's helmet.[123] Wiitala then shoved Pilkington toward the basket and Townsend hauled Pilkington into the basket.[124] Wiitala testified that he reached up while in the basket and depressed the locking collar's four release pins so the helmet would come off (See figure 7).[125] Townsend also testifies that the helmet was taken off in the basket as it was hoisted onto Rig 12's deck.[126] On the other hand, Steve Champagne, an independent contractor working on Rig 12, testified that when Pilkington was placed on the deck of Rig 12, Pilkington's helmet was still attached and locked to his diving collar. Champagne noted this because he had trouble taking Pilkington's helmet off to administer CPR. Champagne said that, while Pilkington was on the deck of Rig 12, Champagne was not able to release the helmet, causing Wiitala to have to remove it and allowing about a cup of water to spill from the mask. While Champagne struggled to release Pilkington's helmet, he noticed that the

[118] Champagne, testimony, Vol. 1, pg. 40
[119] Wiitala, testimony, Vol. 1, pg. 237-238; Townsend, testimony, Vol. 3, pg. 123
[120] Wiitala, testimony, Vol. 1, pg. 246, 317; Whiskers refer to black plastic vents on both sides of the helmet.
[121] Wiitala, testimony, Vol. 1, pg. 238-239, 245-248
[122] Townsend, testimony, Vol. 3, pg. 122-125
[123] Townsend, testimony, Vol. 3, pg. 125-127
[124] Townsend, testimony, Vol. 3, pg. 129, 142
[125] Wiitala, testimony, Vol. 1, pg. 249
[126] Townsend, testimony, Vol. 3, pg. 129-130

airline was still connected to the helmet.[127] Despite the conflicting testimony, all witnesses agreed that when Pilkington's helmet was removed, his face was blue.[128] Champagne and others began to administer CPR immediately.[129] The elapsed time for the rescue was approximately 30-40 minutes.[130]

48. About 8 minutes after CPR began, at around 1800 hours, a helicopter arrived on board Rig 12.[131] Pilkington was quickly hoisted into the helicopter and transported to St. Mary's Hospital in Port Arthur, TX; elapsed time was 13 minutes from the deck of Rig 12 to the hospital.[132] Doctors at the hospital attempted to resuscitate Pilkington for several hours, but he was pronounced dead at 2230 hours.[133] No one at the Coast Guard formal hearing was able to testify whether Pilkington displayed any signs of life when was brought back on board Rig 12. However, Dr. John Clark of the Navy Experimental Diving Unit speculated, based on the hospital reports, that the rescuers found or were able to restore a heartbeat (see Finding of Fact 62 below).

Post Casualty Events

49. An autopsy of Pilkington's body found that his lungs were boggy and congested and his stomach had no residual food fragments. The coroner concluded that Pilkington's cause of death was drowning.[134]

50. Cliffs properly notified the Coast Guard of the casualty and completed all necessary Coast Guard documentation.

51. Coast Guard Investigating Officers did not attend Rig 12 after the accident and did not secure Compressor 2 as part of the original investigation. By the time of this hearing, Compressor 2 had been disassembled and was not available for examination.

52. On 6 March 1996, Gilbert directed Lawdermilk to take Compressor 2 to McKenzie Equipment Co., Inc. (McKenzie) in Houston. Gilbert spoke to McKenzie's service manager. "I told him we had a compressor that we needed checked out, and I wanted him to look at it and give me a letter back saying that it was in good condition; it was running; it was maintaining pressure at 150 psi or it wasn't."[135] McKenzie would not certify the compressor

[127] Champagne, testimony, Vol. 1, pg. 28-39; See too Wiitala testimony, Vol. 1, pg. 373
[128] Wiitala, testimony, Vol. 1, pg. 250
[129] Townsend, testimony, Vol. 3, pg. 131
[130] Champagne, testimony, Vol. 1, pg. 42; Linzy, testimony, Vol. 1, pg. 101
[131] Champagne, testimony, Vol. 1, pg. 44; Townsend, testimony, Vol. 3, pg. 133; Linzy, testimony, Vol. 1, pg. 97-98
[132] Linzy, testimony, Vol. 1, pg. 105
[133] USCG Investigation, Vol. 4, IO exhibit 44 (Death Certificate of Brian Pilkington)
[134] USCG Investigation, Vol. 4, IO exhibit 27, (Autopsy report of Brian Pilkington)
[135] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 32)

as being functional and did not produce such a letter. Gilbert testified that someone from McKenzie called him back to say that the compressor would run and would hold pressure at 150 psi, but if the compressor wasn't repaired, " . . .you could have problems down the road."[136] The McKenzie employee told Gilbert that the repairs were so extensive it would be more cost effective to replace the compressor than repair it. Gilbert then directed McKenzie to replace the compressor. A McKenzie mechanic, Guy Kirby, broke down Compressor 2 and produced a deficiency report:

-Valve seat on head bad

-Unit needs overhaul – oil carryover

-Valves are not holding – needs new rings, bad carbon buildup

-Needs 110823-325 Overhaul Kit

-Rings HP

-Rings LP

-Air Filter

-6609 Head

Kirby concluded his write up by recommending Gilbert replace Compressor 2 rather than repair it.[137] Lawdermilk testified that when he returned to McKenzie's to pick up Compressor 2, a mechanic reported that the compressor's main problem was that a rag had been sucked through the cylinder.[138]

53. About two months after Compressor 2 was examined, a McKenzie employee, Marty Husband, was asked by the owner, Mary Ann McKenzie, to gather any available paperwork on the examination.[139] In the course of his investigation, Husband questioned Guy Kirby about Compressor 2 and gathered the deficiency report described above and contained in IO Exhibit 19. Husband described the exhibit. "Well, it's a teardown. It's basically a teardown inspection whereby Guy tore the compressor down, estimated what was wrong with it and what it would take to repair it as far as cost."[140] Husband described McKenzie's process for evaluating compressors. "[T]hey put it on a test standard run. They try and pump up pressure and maintain pressure with the compressor. . . It's done on every unit. And if it doesn't hold, then they start to disassemble it, which is usually the head section comes off first. So, that's what I say, basically what he found were the heads – the seats and the heads were bad. They had a lot of oil carryover and bad rings. So, based on the cost of the parts versus the cost of a new one, it exceeded 50 percent, which we would normally recommend a

[136] USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 33-34)
[137] USCG Investigation, Vol. 4, IO exhibit 19, (Invoice from McKenzie to G & G Marine)
[138] Lawdermilk, testimony, Vol. 1, pg. 485-486
[139] Husband testimony, Vol. 1, pg. 420
[140] Husband testimony, Vol. 1, pg. 387

replacement."[141] Husband testified that the oil carryover, bad rings, heads, and seats Guy Kirby described as bad were compressor parts, not engine parts.[142]

54. Several months after the casualty, as part of civil litigation related to the casualty, a hand-written page of notes was discovered and identified as the dive log of Dan Wiitala for 4 March. Wiitala's notes, made nearly contemporaneously with the casualty, begin by indicating that "[C]ompresser [sic] was not keeping up to 150 psi but maintained 80 psi."[143]

55. Lawdermilk also was deposed during the civil litigation in August 1997. He described a conversation he had with Wiitala on the night of 4 March 1996 about the Rig 12 dive. "He [Wiitala] had said that they had gotten out on the job and the compressor wasn't working right; so, he worked on it a little bit, got it holding air for a little while. And they initiated the job and was almost done with the dive that Brian was on when the compressor started losing air."[144] Lawdermilk went on to testify about the mechanical condition of Compressor 2 prior to the Rig 12 job.[145]

Q. Was that [Compressor 2] one of what you considered to be the three working compressors?

A. It wasn't working properly, but it was one of the compressors that we used.

Q. Was it normally used as a primary source of air?

A. No.

Q. Had you been having problems with that particular compressor?

A. Yes.

Q. For how long a period of time?

A. I can't say exactly, but probably two to three jobs prior to that.

Q. And what type of problems had you been experiencing with that compressor that was ultimately taken out to the Cliffs job?

A. It wouldn't – the pilot valves weren't functioning.

Q. What are pilot valves?

[141] Husband testimony, Vol. 1, pg. 387-389
[142] Husband testimony, Vol. 1, pg. 391
[143] See IO Exhibit 70
[144] See IO Exhibit 71
[145] See IO Exhibit 71

A. They're the air pressure source which controls the air pressure and the air volume.

Q. So, if you've got a pilot valve that's malfunctioning on a compressor, would that affect the ability of the compressor to hold air?

A. Sure.

Q. Would it affect the ability of the compressor to pump the proper volume of air?

A. Sure.

Q. And for at least two or three jobs, this particular compressor that was involved in Brian Pilkington's accident had had problems holding air?

A. Yes.

56. Several days after the casualty, Mr. Peter Pilkington, Brian's father, visited the G&G facility in Houston, Texas. Peter Pilkington found Brian's Kirby, Morgan SuperLite 27 helmet sitting on the floor of the G&G warehouse. Peter Pilkington confiscated the helmet and took it home. Peter Pilkington stated after the hearing that the helmet was not adjusted while in his custody.

57. Slightly more than a year after the accident, Pilkington's helmet was sent for examination to the Navy Experimental Diving Unit (NEDU) in Panama City, Florida. Mr. Peter Pilkington reports that the helmet was not used, repaired or adjusted while it was in his control, before being sent to NEDU. NEDU found that Pilkington's Kirby, Morgan SuperLite 27 diving helmet's demand regulator was not set according to the manufacturer's specifications. NEDU tested the helmet as it was set up when Pilkington used it. In the initial test, NEDU found that, at 80 psig, the helmet would perform "reasonably well to a depth of 33 fsw . . . which would supply gas to a moderately hard working diver, although the respiratory effort would be high, far exceeding the NEDU performance goal."[146] NEDU then tested the helmet at the air pressures recommended for the Kirby, Morgan SuperLite 27. In the words of NEDU, "Interestingly, during the set up, as supply pressure was increased to 165 psig, the helmet experienced free-flow from the second stage regulator at approximately 100 psig. This free-flow condition at 100 psig necessitated making a demand regulator internal adjustment prior to supplying the helmet with an optimum supply pressure of 165 psig. This suggests that either the regulator was adjusted anticipating a supply pressure less than the manufacturer's recommended minimum or that the regulator was improperly adjusted."[147]

[146] psig "pounds per square inch gauge"; fsw "feet of salt water"
[147] USCG Investigation, Vol. 4, IO exhibit 26, (SuperLite diving hat report, pg. 2)

58. At the formal hearing to investigate Pilkington's death, 22-24 June 1999, Master Chief Petty Officer Brick Bradford, a U.S. Navy master diver, testified about surface supplied air diving practices. Master Chief Bradford offered his opinion on a number of diving safety issues related to the casualty. He first discussed Austin's YMCA SCUBA training and whether that training was enough to allow Austin to work safely as a surface-supplied air commercial diver.

    Q. Based on [what you've heard about Austin's training], do you think that qualifies a person to be a dive supervisor?

    A. No, I do not.

    Q. Why not?

    A. And I would like to expand and say I don't believe that qualifies you to be a commercial diver either.

    Q. Okay. Why not?

    A. The issue of a commercial diver, first: He has no formal training in the rig that he's using. He knows nothing of the operational – it's possible that he knows nothing of the operational characteristics of the equipment, how to maintain that equipment, how to set that equipment up for use, how to properly use that equipment, how to recover from a possible emergency relating to that equipment. If he's doing – and it's obvious surface-supplied diving is the intended purpose of the SuperLite 27, may not be familiar with decompression procedures and those kind of things.[148]

59. In addition to Master Chief Bradford's analysis of Austin's capabilities, he also analyzed Wiitala's experience and ability to be a dive supervisor. In summary, he said that experience as a diver alone does not qualify a person to be a dive supervisor. The Master Chief referred to his own career in the U.S. Navy as an example. Master Chief Bradford said that after graduating from Navy diving school and working as a Navy diver, if he had been asked whether he could perform as a dive supervisor, "I would have told them I felt like I could have done it."[149] But, the Master Chief indicated, after he went to school to be trained as a dive supervisor, he learned how much more was demanded of a supervisor than he had known.[150]

60. Master Chief Bradford analyzed the predive procedures exercised by the G&G Marine employees before Pilkington began his dive.

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[148] Bradford testimony, Vol. 3, pg. 183-184
[149] Bradford testimony, Vol. 3, pg. 185-186
[150] Bradford testimony, Vol. 3, pg. 185-186

Q. From everything that you've heard so far . . ., regardless of whether it was done in the exact same fashion or . . . the same methodology that the Navy would do it, did the predive preparation occur, in your estimation, in a safe way?

A. No. . . . A diving supervisor was not assigned . . nobody [was] in charge. . . There is no – there is a lack of verification, if you will, as to whether or not the compressor has, in fact, been checked for a proper level of oil; that strain relief – if you use strain relief as your interface hoses between the compressor and the volume tank, are attached; that these connections are, in fact, secure, wrench tight; that they have been soap tested; that they're free from kinks, free from being stepped on; that they have been visually inspected for cuts, nicks, gouges, and other deformities; that the intake is, in fact, free from obstruction; that the intake is upstream of the exhaust – not only the prime mover; if it's a diesel or an engine, but also upwind from any other potential sources of carbon monoxide.

There is also the inspection of the umbilical itself, walking that out; the attachment to the hat. There is the inspection in the predive procedures for the hat itself. In this particular case . . . I see a problem in the industry. As a commercial diver, you are expected to show up on the site with your own hat. As I have heard, the company will provide you with the umbilical. You make the connection and you go to work. So, therefore, you have a great amount of variation as to whether or not any maintenance is done on the hat itself; and at that interface [the helmet/hose connection] you're setting yourself up for trouble. . . . And I see that as an industry problem.[151]

61. Master Chief Bradford believed that, because the umbilical was secured to Pilkington's dive harness, there was little potential that Pilkington's main airline had come loose during his dive. The Master Chief felt it was possible Pilkington had inadvertently unscrewed his main airline from his helmet near the end of his dive. The Master Chief characterized that scenario as "plausible".[152] But, he said "I have heard testimony that suggested, that we're asked if he went and checked the connection and felt that it was loose and attempted to tighten the connection and that, perhaps, then he went the wrong way. I believe that that is plausible. . . . But that would have been – that truly is secondary, in my mind, to – to the first issue, which is the guy did not have an adequate air supply and that corrective action was not taken in a timely manner when discovered."[153] Master Chief Bradford concluded that, during his dive, Pilkington experienced a condition called Hypercapnia.[154]

62. Dr. John Clark, the Scientific Director for the Navy Experimental Diving Unit also testified at the formal hearing on 22 – 24 June 1999. Dr. Clark adopted the analysis of Dr. David

[151] Bradford testimony, Vol. 3, pg. 199-201
[152] Bradford testimony, Vol. 3, pg. 215, 218
[153] Bradford testimony, Vol. 3, pg. 218-219
[154] Bradford testimony, Vol. 3, pg. 215

Youngblood made during the civil litigation.[155] Dr. Clarke added his own observations as follows:

> Most divers, if they're working hard and begin to sense a buildup of CO2, will ventilate, as this diver did, with a steady flow valve [free flow valve]. Then if this happens more than once or twice, typically the diver would stop work, take more of a breather; and once he's caught his breath again and things are back under control, continue working.
>
> From what I heard in the testimony yesterday, apparently the diver was operating a steady flow valve repeatedly and only closed the steady flow valve when the – somebody topside explained to him that he was going to lose gas pressure unless he did that. That situation undoubtedly crests to a point of panic. To me, the cause of panic would be the realization that he did not have enough gas perhaps, also if he could not make an escape to the top; but that is purely conjecture.
>
> *Obviously the diver was not getting the gas he needed,* whether it was from low ops from a compressor or due to the leakage of the gas umbilical. I certainly have no evidence to suggest that it's one or the other. I cannot tell. I don't see any evidence of that.
>
> Looking at the autopsy results, we have an indication that the diver, while being ventilated on a ventilator – and I'm assuming he did attain signs of rhythm again once he was in the hospital. Otherwise, he probably would not have been on the ventilator. In other words, the C.P.R. was effective in sustaining him to get his heart going. . . .
>
> [A]lthough some divers can work with a helmet that's putting out a low gas supply, other divers – and not necessarily do I mean inexperienced divers, but just other divers prefer to work with higher flow levels for their gas. Some divers will tolerate a large amount of CO2 in their bloodstream and get along just fine. I personally have worked with divers who have exercised very vigorously under hyperbaric conditions and claim that they're very happy – they're very comfortable, and then suddenly go unconscious because, in fact, they were comfortable because they weren't breathing hard; but at the same time their arterial CO2 was steadily climbing, steadily climbing and finally reached a point where unconsciousness snuck up on them and they were totally unaware and boom, they were out like that [indicating the test subject lost consciousness].
>
> And the other divers, which I basically consider to be safer divers, are those who do not like the feeling of having their gas restricted, who like keeping their arterial CO2 levels down and want a lot of gas. Eventually they'll reach a point when they feel they're not getting enough gas, and they'll stop. "I'm not doing this anymore" or "I'm going to stop and take a breather, catch my breath, ventilate," whatever.

[155] See USCG Investigation, Vol. 4, IO exhibit 28 (Statement of Dr. David Youngblood).

> I suspect all these things were going through Brian's mind at the time, and he undoubtedly did stop and ventilate himself. However, in spite of those efforts, if his gas supply was still wanting, his mental confusion would get progressively worse; and at some point he might have started taking actions that were not in his best interest.
>
> It is possible – again, solely conjecture – that in the confusion, he may have reached back and started releasing something he shouldn't have [referring to the possibility that Pilkington disconnected his main airline from his helmet]. I have no idea. But what we do know is that in the course of sustaining a large carbon dioxide insult, you become very anxious. It sounds like Brian was becoming anxious. Of course, if somebody cut off our air supply, anybody would become anxious; but CO2 alone can do that. And then you begin to be increasingly confused, mentally, and not able to think straight and not able to – at one point eventually, to not even be able to respond to what is being said by topside. You're not aware of anybody else talking to you. You're totally involved in yourself. It's a strange and very dangerous state that you end up in; and if the situation is not remedied immediately, then eventually CO2 can reach such high levels that you can convulse and become unconscious. Of course, at that point, if you have one in a helmet, then partial drowning is more or less inevitable. It will happen. . . .
>
> One question is how would water get into the helmet? That, to me, makes me believe that, perhaps, the umbilical was connected because in the course of making large respiratory efforts, it's quite possible to create negative pressures inside the helmet, enough negative pressure to balloon the neck dam backward and actually pull water up past the neck dam.
>
> It's also possible to pull water in through the exhaust valves. It's one of the concerns we have about using a helmet like this, as it is, for contaminated water diving. If you're making large respiratory motions, you will get water coming backwards through the exhaust valve.[156]

63. Dr. David Youngblood, a consultant in the civil litigation, offered the following analysis of the casualty:

> Based upon my review, I have reached the following opinions: Brian Pilkington commenced his inspection dive from the MODU early in the afternoon of 4 March 1996. There is no record of a pre-dive equipment check or an in-water check for leaks, but there would have been a flurry of bubbles initially since the water was cold and he was wearing only a neoprene wetsuit with no provision for hot water supply. Sudden immersion in cold water causes a marked increase in breathing rate, and, depending upon his position in the water the bubbles from his exhaust could have obscured any leaks.

[156] Dr. John Clark, testimony, Vol. 2, pg. 85-91 [emphasis added].

He began his underwater task of applying the ultrasonic device to sites on the mat previously cleaned by the AOD crew (in the relative comfort of hot water suits) but soon began to experience heavy breathing resistance in the demand mode, requiring a switch to free flow mode. This caused problems: the single compressor (there was no secondary or standby compressor) was unable to maintain adequate air pressure or flow on open circuit. Each attempt to "catch his breath" by switching to free flow brought admonition from topside to cease "free flow" to allow the faulty compressor to attempt to restore the pressure.

This cycle was repeated over several hours while Brian Pilkington attempted to complete his task despite the inadequate helmet ventilation. We can only estimate how inadequate it might have been since the compressor often fell to 80 psi or below – well below the optimal pressure for proper helmet function – and we can only estimate what the effect of 300 feet of hose and a possible leak at the helmet attachment might have been.[157] Simulations in a hyperbaric chamber have shown that the ability of the regulator to deliver adequate air at low pressures is severely compromised, particularly at high flow demands such as maximum exertion or even panic.

In a situation such as this the diver adapts by altering his breathing pattern. He begins to take long, slow breaths in order to avoid "bottoming out" the regulator. This alternative is subtle and almost subconscious in the early stages, but unless the diver is completely at rest, carbon dioxide begins to accumulate in the body. This "waste gas", the exhaust from the body's metabolic engine, has very definite and deleterious effects: it begins to drive the respiratory control center in the brain, which, in turn, drives the respiratory "pump", the lungs, diaphragm, and chest to increase the air flow.

This drive can be consciously controlled to a degree: that's what happens when you hold your breath. But conscious control requires an intense concentration and alertness. These qualities are short-lived as CO2 accumulates in the body, since CO2 is a potent narcotic, dulling the senses while driving the respiratory pump to work ever harder. The harder the respiratory muscles are forced to work the more CO2 they produce.

As CO2 accumulates in the body, it also causes blood vessels in the skin and the brain to dilate and deliver more blood. Since Brian Pilkington had no hot water suit, only a wetsuit which flushed cold water over his skin as he moved about, the CO2 accumulation caused a rapid heat loss from the skin and the body's core, especially the brain. A cold brain cannot concentrate. Thinking becomes fuzzy and confused, and simple situations become complex and dangerous. Brian Pilkington's hatchet slipped through the mat and the lanyard held him down. At another time it would have been a trivial entanglement, an

[157] Youngblood based his analysis on the testimony arising out of the civil litigation. That testimony differs somewhat from the testimony adduced at the Coast Guard's formal hearing. At the hearing, Wiitala testified that Compressor 2's gauge only dropped to about 90 psi. However, at the civil litigation and in Wiitala's dive log for the Rig 12 dive, evidence was developed to show that the pressure went lower. See FOF 42 and 54.

easy extrication. With his consciousness clouded by CO2 accumulation and hypothermia, he panicked.

As panic ensued he struggled violently, producing even more CO2, until the concentration was high enough to cause unconsciousness. By this time, the violent, uncontrollable drive to breathe against a "bottomed out" regulator had created cycles of negative pressure inside the helmet. The helmet is attached by a thin rubber neck dam or seal, and when pressure in the helmet becomes negative, water is sucked between the neck and the seal. This water accumulated in the lower part of the helmet as long as Brian was upright and struggling, but when he succumbed to the narcotic effects of the ever-increasing CO2, he lost consciousness and fell forward. The face plate and mask filled with water and he inhaled it.[158]

Analysis:

Helmet Flooding

1. As indicated by Dr. Clark, enough water entered Pilkington's helmet to cause him to asphyxiate and drown.[159] The amount of water was relatively small, described by Wiitala as less than a cup.[160] The NEDU report shows there were no material defects in the helmet or helmet's assembly indicating that the flooding was not the result of a helmet malfunction.[161]

2. There are several ways the helmet may have flooded. In every instance though, the precipitating event leading to the flooding would be a reduction of air volume and pressure to the diver's helmet. One scenario, which would result in helmet flooding, would be if low air pressures from Compressor 2 allowed water to enter the helmet under the neck dam.[162] The neck dam is designed to be functionally watertight, but if normal operating air pressure is not maintained in a helmet, water can seep under the neck dam as it flexes while the diver works.

3. Water also may have entered Pilkington's helmet if he experienced a complete interruption in his air supply. In that case, his demand regulator would have stopped working (called "bottoming out" the regulator). At that point, every time Pilkington inhaled he would have progressively evacuated the air in his helmet creating negative pressure. Pilkington would

[158] See USCG Investigation, Vol. 4, IO exhibit 28 (Statement of Dr. David Youngblood).
[159] See FOF 62
[160] See Finding of Fact (FOF) 46, 47, 49
[161] See FOF 54; See too USCG Investigation, Vol. 4, IO Exhibit 26 (SuperLite Diving Hat Report)
[162] See USCG Investigation, Vol. 5, IO Exhibit 50 (picture of neckdam)

have continued to gasp for air and violent attempts to breathe may have sucked water between the neck dam and the seal into his helmet.[163]

4. Finally, water may have entered Pilkington's helmet through the emergency air connection. In a last ditch attempt to trouble-shoot his emergency, Pilkington may have reached for the emergency valve handle directly adjacent to the main air connection. This connection is typically used to couple the bailout bottle to the helmet. When not used, the only barrier preventing water from entering the helmet is the emergency supply valve (See figure 7). When Pilkington's regulator bottomed out, he may have instinctively opened his emergency supply valve, the standard procedure taught in commercial dive schools, and allowed water to enter his helmet. If the emergency valve was opened, water would only have entered the helmet if the air pressure inside the helmet was extremely low (indicating an almost total interruption in air supply and pressure). Even the smallest pressure above ambient would have forced air out of the emergency valve which would have prevented water from entering.[164]

Hypercapnia

5. Master Chief Bradford, Dr. John Clark, and Dr. David Youngblood all concluded that during Pilkington's dive, he experienced a condition called Hypercapnia.[165] Inadequate ventilation of surface supplied helmets can cause Hypercapnia, which is an excess accumulation of carbon dioxide (CO2) in the diver's bloodstream and tissues. Carbon dioxide is naturally created from the body's own metabolic processes. In diving, the buildup of CO2 in the body can be exacerbated by a higher than normal concentration of CO2 in the breathing medium, poor ventilation, or because something interferes with the natural process of gas exchange in the lungs. Fresh air contains about 0.033 percent CO2. Proper carbon dioxide level in the body is maintained by breathing a sufficient amount of air to dilute the carbon dioxide generated by the body and delivered to the lungs. If helmet ventilation is inadequate, an increase in the CO2 level in the helmet will occur, producing an excess of carbon dioxide present in the gas breathed.[166]

6. An excess of carbon dioxide affects the brain differently than does a lack of oxygen (Hypoxia). However, similar symptoms such as confusion, inability to concentrate, drowsiness, loss of consciousness, and convulsions can result from Hypercapnia. Such effects become more severe as the level of CO2 increases. A diver breathing a gas containing 10 percent CO2 will generally lose consciousness after a few minutes. Breathing

[163] FOF 42, 43, 62
[164] FOF 62
[165] FOF 61
[166] U.S. Coast Guard Investigation, Vol. 4, IO Exhibit 53, (U.S. Navy Dive Manual, Vol. 1, Chpt 3)

15 percent CO2 for any length of time will cause muscular spasms and rigidity.[167] Headache, cyanosis, unusual sweating, fatigue, and a general feeling of discomfort may warn a diver if they occur and are recognized, but they are not very reliable warnings. Hypothermia also can mask the buildup of carbon dioxide because the respiration rate increases initially on exposure to cold water.[168]

7. A diver who loses consciousness because of excess carbon dioxide in his breathing medium, *and does not aspirate water,* generally revives rapidly when given fresh air. Increasing the level of CO2 in the blood stimulates the respiratory nervous center to increase the breathing rate and volume, and the heartbeat rate is often increased. Ordinarily, increased breathing is definite and uncomfortable enough to warn a diver before the level of CO2 in the air becomes very dangerous. However, variables such as work rate, depth, and the composition of the breathing mixture may produce changes in breathing and blood mixture that could mask any changes caused by excess CO2. In cases where the partial pressure of CO2 is above 0.5 atmospheres absolute, the shortness of breath usually associated with excess carbon dioxide may not be excessive and may go unnoticed by the diver, especially if he is breathing hard because of exertion. In these cases the diver may become confused and even slightly euphoric before losing consciousness. For this reason, a diver must be particularly alert for any marked change in his breathing comfort or cycle (such as shortness of breath or hyperventilation) as a warning of Hypercapnia.[169]

Fatigue

8. There is insufficient evidence to track the details of Pilkington's activity before his Rig 12 dive, but it is clear that at the time of the dive, he had had little rest over the previous 24 hours. Pilkington went to the G&G facility on the evening of 3 March to help load the dive equipment.[170] When the load out was complete, Gilbert told Pilkington to meet Wiitala at 0500 hours the next morning at a roadside stop on Interstate 10. Pilkington met Wiitala as directed, and then proceeded to Sabine Pass, TX to load the dive gear on a crew boat to depart for Rig 12 the morning of 4 March.[171] The team made an aborted attempt to reach Rig 12 on a small crew boat in seas so rough the boat had to return to the dock. The team then transferred the equipment to a second vessel and proceeded to Rig 12 again.[172] When they arrived on Rig 12, Pilkington helped set up the dive station and prepared to dive.[173] Finally, Pilkington made a three hours dive in 65 to 70 degree water.[174] "In cold water, [a diver's] ability to concentrate and work efficiency will decrease rapidly. Even in water of moderate temperature (60 degree F to 70 degree F), body heat loss can quickly bring on diver

[167] NOAA Diving Manual, Section 2.1.3.2
[168] U.S. Coast Guard Investigation, Vol. 4, IO Exhibit 53; (US Navy Dive Manual, Section 3-5.2)
[169] U.S. Coast Guard Investigation, Vol. 4, IO Exhibit 53; (US Navy Dive Manual, Section 3-5.2 [emphasis added])
[170] See FOF 25
[171] See FOF 28
[172] See FOF 28
[173] See FOF 28
[174] See USCG Investigation, Vol. 6, IO Exhibit 67, (Second Pilkington Investigation dated 17 August 1998)

exhaustion."[175] Finally, after the dive, an autopsy was done on Pilkington's body and the pathologist reported that Pilkington had no food in his stomach during the dive.[176]

Compressor 2

9. Helmet manufacturers establish a minimum/maximum supply pressure for their equipment. On diving jobs, the diving supervisor typically will adjust the airflow to the diver to create a pressure inside the diver's helmet above the manufacturer's minimum requirements. In the case of the Kirby, Morgan SuperLite 27 the manufacturer recommends a minimum air pressure supplied to the helmet of 115 psig with a normal recommended pressure between 135-165 psig over bottom pressure. Generally, the diving supervisor will increase the over bottom air supply to a higher setting if the diver is working hard. The diving supervisor determines the correct over bottom pressure for a diver's helmet by calculating the ambient pressure at the depth of the dive in feet of salt water (fsw) or feet of fresh water (ffw). The diving supervisor multiplies the depth by .445 for salt water or .432 for fresh water. The result is the pressure exerted by the water at the depth the diver is working. The supervisor then adds that pressure to the recommended manufacturer's minimum recommended helmet pressure to determine that job's safe working pressure. On 4 March, working in 28 feet of salt water, Pilkington needed 127 psig to meet the manufacturer's minimum safe operating requirements for the Kirby, Morgan SuperLite 27 helmet he was wearing.[177] The air pressure demand made by Pilkington's helmet on Compressor 2 was well within the normal operating tolerances of a Quincy 325 Compressor.

10. The standard output in actual cubic feet per minute (acfm) for a Quincy 325 compressor is 18.6 acfm at 175 psig at maximum rpm and 8.3 acfm at 175 psig at minimum rpm.[178] The demand of a Kirby, Morgan SuperLite 27 helmet at the manufacturer's recommended air pressure (115 psig to 165 psig over bottom pressure) is 8.0 acfm when adjusted to free-flow.[179] Therefore, a properly functioning Quincy 325 should be able to supply a free-flowing Kirby, Morgan SuperLite 27 helmet continuously without "bottoming out", since the free flow demand of the helmet is less than the standard output of the compressor.

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[175] USCG Investigation, Vol. 4, IO Exhibit 53, (U.S. Navy Dive Manual, Vol. 1, pg. 4-15)
[176] See FOF 49
[177] See USCG Investigation, Vol. 4, IO Exhibit 53, (U.S. Navy Dive Manual, Vol. 1, Chapter 6-3.2, Feb. 1993); MMP [minimum manifold pressure, psig] = 115 psig + (28 fsw x .445 psig/fsw) = 127 psig.
[178] USCG Investigation, Vol. 6, IO Exhibit 72; (Quincy QR-25 Brochure)
[179] USCG Investigation, Vol. 4, IO exhibit 26, (SuperLite diving hat report); USCG Investigation, Vol. 5, IO exhibit 53, (U.S. Navy Dive Manual, Vol. 1, Table 6-2, Feb. 1993)

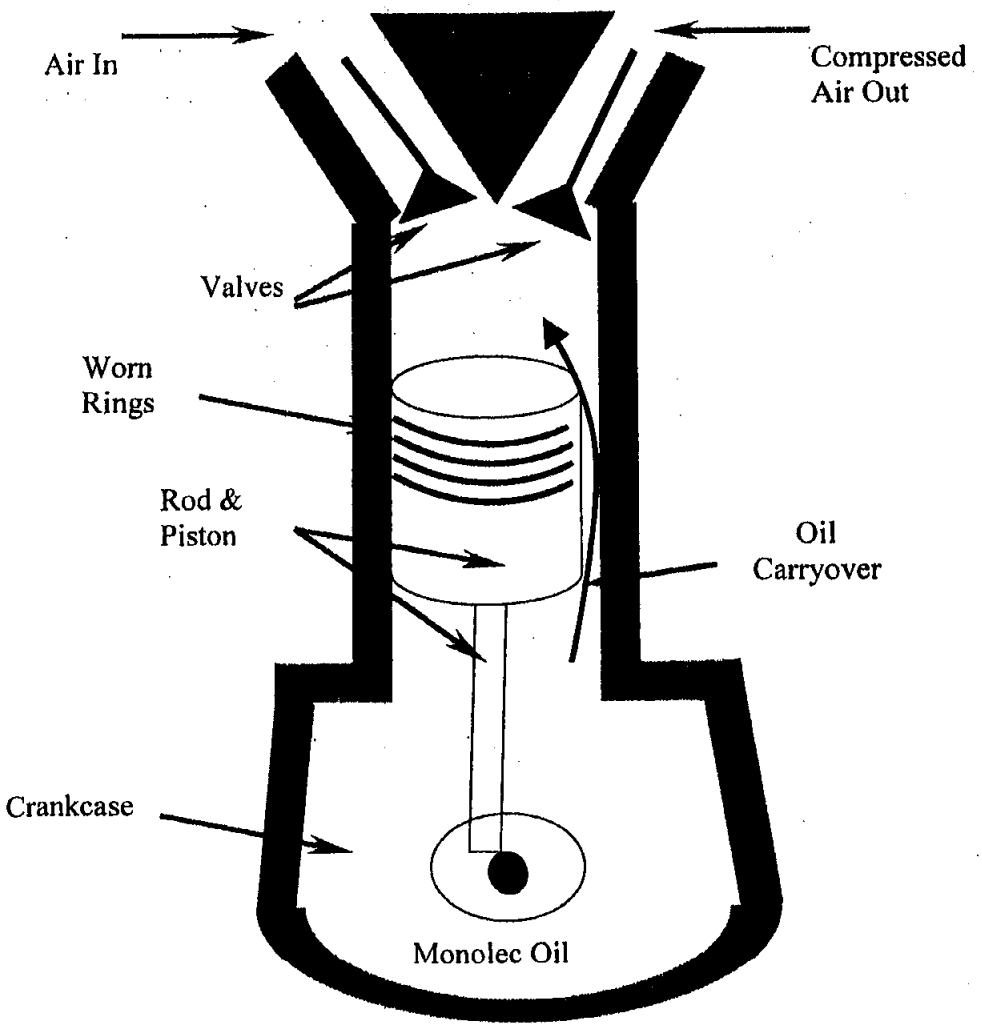

Figure 8: Representation of piston / cylinder assembly

11. Quincy 325 compressors have a cylinder and piston assembly that compresses air and sends it to a volume tank to be used by the diver. Air enters the cast iron cylinder through the air intake valve on the piston downstroke and is compressed during the piston upstroke. The compressed air is heated and forced out of the cylinder through the outlet valve to be stored in the volume tank. The compressor's piston, crankshaft, and connecting rods are lubricated every rotation of the crankshaft by oil in the crankcase. The piston rings keep the sides of the cylinder clean by scraping the oil from the sides on the downstroke. This keeps oil from entering the cylinder's upper headspace. However, if the rings deteriorate, through wear or lack of maintenance, the oil will blow by the rings and invade the head and valve assembly. The oil then mixes with the compressed air being sent to the volume tank and becomes a component of the diver's breathing air (See Figure 8).

12. When a diver inhales oil-saturated air, he risks developing a malady called Lipid Pneumonia. Lipid Pneumonia was a common affliction of caisson workers and deep-sea divers who, in the early days of diving, experienced excessive oil in their diving medium. Oil would coat the lung alveoli (air sacks), interrupting gas exchange at the interface between the gas in the lungs and the surface of the alveoli (external respiration). This is one reason why the hydrocarbon limit for divers' air is very low, 25-parts per million (PPM) total hydrocarbons and 5 mg/m^3 oil vapor. 5 mg/m^3 is approximately two one thousands of an ounce dispersed in a cubic meter.

13. All oil lubricated low-pressure air compressors used for surface supplied diving are equipped with two types of filters. At the suction side (air inlet) of the compressor an intake air filter prevents the air compressor from ingesting contaminants. Additionally, oil-lubricated compressors used for diving are equipped with a moisture/oil separator and a discharge filter. The moisture separator removes most of the condensation formed during the compression. The moisture/oil separator and filter also remove much of the lubricating oil that mixes with the condensate resulting in an emulsification. The discharge filter serves two functions: it filters particulates that pass through or are generated inside the compressor due to wear or damaged components, and picks up the final traces of oil that get by the moisture/oil separator. Moisture/oil separators require very little maintenance while the discharge filter requires periodic changes in accordance with the manufactures recommended intervals.

14. Evidence that Pilkington's casualty resulted from a poorly performing compressor comes from Pilkington's own helmet.[179] Pilkington's helmet regulator had been adjusted to compensate for low pressures. It is unlikely that Pilkington's regulator adjustments were accidental since, while attending diving school in Washington, Pilkington had been certified proficient to perform maintenance and repair on Kirby, Morgan SuperLite 27 helmets.[180] As

[179] USCG Investigation, Vol. 4, IO exhibit 26, (SuperLite diving hat report)
[180] See FOF 24

was stated in the NEDU report, Pilkington's helmet strongly suggests that the regulator had been purposely adjusted in the expectation it would be used with under-performing compressors. NEDU's report also indicates that Pilkington almost certainly never received air pressures above 100 psi from Compressor 2 during his dive on 4 March, since 100 psi or more would have free flowed his helmet.[181]

15. Dan Wiitala testified at the hearing that Compressor 2 produced 150 psi of air during most of Pilkington's dive, but that two or three times Wiitala noticed the air pressure had dropped to 80 – 90 psi. Wiitala testified that when Pilkington closed his free-flow valve, the pressure returned to 150 psi. Much of the evidence adduced at the hearing and during the civil litigation, however, contradicts Wiitala. Lawdermilk testified that Compressor 2 had experienced trouble on two or three diving jobs prior to the Rig 12 job. He testified that the compressor's pilot valve was not working properly.[182] A pilot valve is a device placed between the compressor and the volume tank. It ensures the compressor supplies air to the volume tank. When a pilot valve malfunctions, it can fail to signal the compressor to send more air to the volume tank. If that occurs, the diver will deplete the volume tank as he works and the compressor will not replenish the tank. Wiitala's own log made on 4 March 1996 says that Compressor 2 would not "keep up to 150 psi but maintained 80 psi."[183] This is supported by the fact that when Gilbert sent Compressor 2 to McKenzie's to have it function tested, it would not hold pressure and was in such disrepair that it was deemed more cost effective to replace rather than repair it.[184] Finally, the NEDU report indicated that Pilkington's helmet regulator was set in such a way that it would free-flow if it received pressure above 100 psi. Wiitala testified at the hearing that he talked to Pilkington during the dive and heard only noises typical of a free-flowing helmet that was "cracked open a little bit."[185] The background noise in a helmet with a second stage regulator free flowing at 150 psi would have been much more pronounced than the noise Wiitala said he heard. The weight of the evidence contradicts much of Wiitala's testimony and strongly suggests that his testimony about Compressor 2 is not credible.

16. Gilbert's testimony about Compressor 2 is also contradicted by the weight of other evidence. Gilbert testified that "someone" from McKenzie told him that Compressor 2 would hold pressure at 150 psi.[186] However, Marty Husband, a McKenzie employee testified that when his company received a compressor for maintenance, an employee would routinely put it on a "standard run" to see if it would pump up to and maintain standard pressure. Husband testified that if the compressor did not maintain pressure, McKenzie's routine practice was to tear it down to troubleshoot the problem.[187] The fact that McKenzie tore down Compressor 2

[181] See FOF 57
[182] See FOF 55
[183] See FOF 54
[184] See FOF 52, 53
[185] See FOF 40
[186] See FOF 52
[187] See FOF 53

and found numerous problems is persuasive evidence that Compressor 2 would not pump up to and maintain standard pressure for a properly functioning Quincy 325 air compressor. The weight of the evidence indicates that Compressor 2 never supplied air pressure above 100 psi. The most likely reason Pilkington's helmet was not adequately ventilated is that Compressor 2 was not producing adequate air quantity, pressure, or quality.

G&G Maintenance

17. Gilbert claimed G&G had a maintenance program. He described it as a process where equipment was checked just before it was used, by whichever G&G employee planned to use it.[188] After Al May, the full-time equipment maintenance person left G&G, the company did not replace him. G&G stopped performing the Coast Guard required compressor air quality testing about a year after May left and this was not an isolated maintenance oversight.[189] 46 CFR 197.450 requires dive supervisors to ensure compressor air quality is tested every six months and after every repair or modification. However, since the testing requires air samples be sent to a laboratory, the owner is in the best position to ensure that testing is done. G&G compressors routinely failed on diving jobs; so much so that the employees became skilled at trouble shooting and repairing them at the job site.[190] Lawdermilk testified that Compressor 2 had malfunctioned before the Rig 12 job and had not been repaired before being sent out on 4 March 1996.[191]

18. G&G often would not buy replacement parts to do ordinary equipment upkeep. G&G employees would use red shop rags as air intake filters for compressors. Lawdermilk indicated there was a strong likelihood that a shop rag weighted down by marbles had been used as an air intake filter on Compressor 2. Lawdermilk also testified that when he went to McKenzie's to pick up Compressor 2 after the accident, the mechanic reported that a rag had been sucked through the cylinder. If a shop rag was sucked into Compressor 2's air inlet, a complete interruption of airflow to the diver could have resulted.[192]

Wiitala

19. Wiitala believed he was qualified to be a tender and a diver for G&G as soon as he left commercial diving school. "I mean, I had gone to school for it. I feel like if you went to school to learn how to fly a plane, when you get out, you fly a plane."[193] Even though his progression to dive supervisor was unstructured and accidental, he also believed he was qualified to be a dive supervisor.[194] Nevertheless, even after having worked for Gilbert and

[188] See FOF 15, 16, 17, 18; See too USCG Investigation, Vol. 4, IO exhibit 40, (Gilbert statement, pg. 44-47)
[189] See FOF 15, 16, 17, 18; See 46 CFR 197.450 for air testing regulations.
[190] See FOF 23
[191] See FOF 17
[192] See FOF 17, 52
[193] Wiitala, testimony, Vol. 1, pg. 145
[194] See FOF 21; See too, Wiitala, testimony, Vol. 1, pg. 146

G&G for 13 years and at least eight years as a dive supervisor, Wiitala did not consider himself the dive supervisor on 4 March 1996. He testified that his conversation with Gilbert the night before convinced him that Austin would be the dive supervisor; a conclusion supported by the fact that Gilbert failed to send a designation letter or operations manual to Rig 12.[195]

20. Wiitala went aboard Rig 12 angry that Texas NDE had not supplied the two promised additional divers and was determined to not be saddled with dive supervisor responsibilities. Despite adopting a narrow view of his responsibilities, Wiitala attempted to do some of the work he characterized as dive supervisor-type duties.[196] Wiitala called Gilbert to send out another video cable; he directed Pilkington to make the first dive and while Pilkington was in the water, Wiitala directed Pilkington's movements. Wiitala also worked the dive station, monitoring the gauges, communicating with Pilkington, and managing the air rack.

21. Regardless of his intent, Wiitala was undoubtedly the *de facto* dive supervisor on Rig 12. This was consistent with past practice since, of the three divers on Rig 12, only Wiitala had ever been appointed as dive supervisor by G&G. Before the dive, Wiitala, Austin, and Pilkington overlooked many red flags that should have resulted in suspension of diving operations. But, of the three, Wiitala was unquestionably the best able to identify the problems.

22. Wiitala's initial concerns about the Rig 12 dive were piercingly accurate. When he turned down the job, Wiitala diagnosed the problem as being a lack of personnel to carry out the job. But, when that problem manifested itself on Rig 12, Wiitala failed to request two additional divers be added to the dive team. He also failed to request a second umbilical and, during Pilkington's dive, he failed to recognize the danger signal associated with repeatedly bottoming out Compressor 2 and repeatedly having to tell Pilkington to close his free-flow valve -- an indication that Pilkington was probably laboring for air.[197]

23. A strong indication of the root cause of Pilkington's casualty is reflected in Wiitala's own emergency response. Wiitala came to understand that Pilkington was not receiving enough air only after Pilkington said that he might have forgotten to tighten his airline. Wiitala responded almost instantly by taking Compressor 2 off-line and replacing it with a high-pressure air bottle. Wiitala clearly gave little credence to the possibility that Pilkington had failed to secure his airline. Wiitala's actions were consistent with his analysis, probably accurate, that Compressor 2 was malfunctioning.[198]

24. When Wiitala finally grasped the nature of the problem, he decided to send Austin down to effect a rescue. He made the decision because Austin was already in a neoprene wetsuit with

[195] See FOF 21, 25, 27
[196] See FOF 25, 28, 37, 40, 41, 42
[197] See FOF 28, 36; See too Dr. Clarke, testimony, Vol. 2, pg. 109-110
[198] See FOF 42, 43

a diving collar to which a helmet could be attached; on its face a rational decision. But, Wiitala overlooked several problems. Since there was no umbilical available, 20 minutes were wasted stringing together welding hose to supply oxygen to a helmet. Additionally, when Austin was put in the water he found the neoprene suit made him so buoyant he could not dive to Pilkington and more time was wasted making a weight belt out of shackles. Finally, all of this time was wasted because Austin, the least experienced diver by far, simply did not have the skill to effect a rescue under emergency conditions with improvised equipment. Wiitala indicated at the hearing that he had a Bailout Bottle available and set up for his helmet but he did not attempt to use it during the rescue because he would have had to don his entire wetsuit.[199]

25. In the end, Wiitala was able to don Austin's helmet without a collar, dive to Pilkington, and bring him to the surface – an evolution that took one dive and a matter of minutes. Wiitala's lack of effective control of the situation and obvious poor judgement before and during the rescue attempt indicates that, despite his many years in the diving industry, he had little understanding of the forces at work on 4 March 1996.[200]

Tending

26. There is insufficient evidence to determine whether Pilkington attempted line pull signals during his dive. Wiitala's testimony indicates that at worst he was "tending" Pilkington's umbilical by standing on it and at best, he may have had an untrained rig hand holding the line.[201] Wiitala likely would not have been able to feel line pulls with his foot and a rig hand would likely not have recognized line pull signals if they were made. G&G's safety and operations manual stated that the company complied with the ADC Consensus Standards.[202] The ADC Consensus Standards say that a dive tender "shall not be assigned any other task while the diver is under water."[203]

27. Based on the analysis above, the level of tending done to Pilkington's umbilical was inadequate. Nevertheless, Coast Guard regulations do not describe what is required of a dive tender and Wiitala's efforts, however slight, may have met the letter of the regulations.[204]

Backup Air Supply

28. When Wiitala switched over to the high-pressure air bottle, the bottle drained to ambient pressure in 15 minutes.[205] The second high-pressure air bottle was not pressurized and

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[199] See FOF 45, 46
[200] See FOF 46
[201] See FOF 40
[202] See FOF 13
[203] See USCG Investigation, Vol. 5, IO Exhibit 57, (ADC Consensus Standards, pg. 3-14)
[204] See 46 CFR 197.432(c)
[205] See FOF 43

Wiitala was not able to use it as a secondary air supply. Had it been full, another 15 minutes of air would have been available to Pilkington. Under normal circumstances, a high pressure air bottle of that capacity should supply about 75 minutes of air for a properly working Kirby, Morgan SuperLite 27 helmet with the free flow valve open.[206] One likely explanation for the bottle emptying so quickly can be found in the second stage regulator of Pilkington's helmet. The device is a spring biased demand regulator that can be externally adjusted with the helmet's "Dial-a- Breath" knob (See Figure 6) to fine tune the amount of air reaching the diver each time he inhales. The second stage regulator also has an internal adjustment which can be adjusted to set the general air pressure working parameters of the helmet. As the NEDU report indicates, Pilkington's second stage regulator internal adjustment had been set so that it would free flow, literally stay wide open, at any pressure above about 100 psi. The most likely reason the high pressure air bottle emptied in only 15 minutes is that the 150 psi of air the high pressure air bottle sent to the diver forced the second stage regulator to stay open until the bottle emptied. This, indirectly, also is evidence that Compressor 2 never produced or sustained the 150 psi of air as Wiitala claimed. Had Compressor 2 produced that volume and pressure of air, Pilkington would have experienced an almost continuous blast of air far beyond what any diver would feel comfortable; even those who tend to "hog it on." Another indicator that Wiitala's claim of almost continuous pressure at 150 psi is skeptical is that Wiitala stated that when he talked to Pilkington, he heard background noise consistent with the free flow valve being "cracked open a little bit." Had Pilkington's helmet been free flowing at the pressure Wiitala's testimony suggests, the background noise would have been obvious and likely would have impeded communications. Regardless of the above possibilities, the fact remains that there was not enough air to supply Pilkington along with a diving rescue operation. In fact, the dive team relied on a highly dangerous 100% oxygen gas bottle to supply the rescue diver.

Bailout Bottle

29. Pilkington did not dive with a bailout bottle.[207] No Coast Guard regulation required him to use a bailout bottle when diving in less than 130 feet of water.[208] Wiitala claimed that he offered to let Pilkington use his bailout bottle. But, Wiitala also indicated that he had expressed his irritation when Pilkington borrowed his weight belt. It is reasonable to presume that Pilkington was not eager to borrow even more equipment from his boss; especially equipment that would require reconfiguring before Pilkington could use it.[209]

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[206] USCG Investigation, Vol. 5, IO exhibit 53, (U.S. Navy Dive Manual, Vol. 1, Chapter 6-3.2, Feb. 1993);
T [min] = (33 fsw/ (D [dive depth] + 33 fsw)) x V [volume of air available] / F [helmet free flow rate];
where, V = (Pf [cylinder pressure] – Pmf [minimum cylinder pressure]) / 14.7 psig x C [floodable volume of cylinder], Pf = 2250 psig, Pmf = 220 psig, C = 8 cubic feet (ft^3), F = 8 cubic feet per minute (cfm), D = 28 feet salt water (fsw)

[207] See FOF 38

[208] 46 CFR 197.346(g)

[209] See FOF 38

Second Dive Hose

30. It was argued at the hearing that Pilkington caused his own death when he failed to abort his dive while knowing there was no back-up umbilical. It also was argued that Pilkington should have aborted his dive when he first noticed equipment problems.[210] The same criticism could be applied to Austin and Wiitala; they all had the opportunity to withdraw from the dive operation. Based on the testimony developed at the hearing, we know that Pilkington knew that there was no second dive umbilical available. However, there is insufficient evidence to determine what other unsafe conditions he knew about, either before or during the dive. The reasoning goes that if he knew about unsafe working conditions, Pilkington should have refused to work. Brett Gordon addressed this issue comprehensively in an article. To summarize Gordon's findings, workers have the right to refuse unsafe work under the Occupational Safety and Health Act, but they seldom do. In fairness, the same forces perhaps driving Pilkington to go ahead with the dive in the face of identified problems also may have been driving Austin and Wiitala to complete the dive.

> Employees in the United States have a right to refuse unsafe work in cases where the employee has a reasonable belief that performance of the work constitutes an imminent danger of death or serious physical injury [29 CFR 1977.12(b)(2) (1992)]. This has proven to be a strict standard that is rarely met by the employee. The employee has the burden of showing a reasonable belief under the circumstances and that the action taken was in good faith as 'any employee who acts in reliance on the regulation falls on the employee and he runs the risk of discharge or reprimand in the event a court subsequently finds that he acted unreasonably or in bad faith.' [Whirlpool Corp. v. Marshall, 445 U.S. 1, 21 (1980)]. More importantly, the regulation 'does not require employers to pay workers who refused to perform their assigned tasks in the face of imminent danger,' [Id. At 19]... In practice, the employee is forced to choose to either remain at a task while exposed to a substantial risk of harm, or be without work for a period of time until the dispute is resolved. An employee in these circumstances has little incentive to refuse unsafe work because the slim chance of proving the reasonableness of the belief in court does not outweigh the greater potential for lost pay.
>
> In addition to the limited scope of an employee's right to refuse dangerous work, an employee in the United States fears employer retaliation by exercising this right, despite an anti-retaliation provision in the OSH Act. [29 U.S.C. 660(c) (1988)]. The anti-retaliation provision of the OSH Act only protects an employee who proves that the refusal to perform a task was both reasonable and in good faith...

[210] See USCG Investigation, Vol. 6, IO Exhibit 68, (Parties in Interest Proposed Findings of Fact)

> Few employees are successful in their claims under the anti-retaliation provision in cases where they refuse unsafe work or file a complaint with OSHA. In 1989, only 559 of the 3,342 discrimination complaints filed by employees with OSHA resulted in litigation referrals by the Secretary of OSHA in U.S. district courts, and even fewer claims were actually successful.[Cite omitted][211]

Main Airline Connection

31. Wiitala's testimony raised the questions of whether Pilkington's main airline was secured to his helmet when he began his dive and whether Pilkington may have loosened the connection when he was underwater. Wiitala testified that before Pilkington quit talking, Pilkington said that he might have forgotten to tighten his airline.[212] The reasoning is that Pilkington may have reached up to his main air connection (See figure 7) and, while trying to tighten the fitting, loosened it instead. Master Chief Bradford opined that it was "plausible" that Pilkington had loosened his main airline connection near the end of his dive.[213] I disagree. The eyewitness testimony on this issue is contradictory, but some facts are undisputed. Townsend says that when he tried to pull Pilkington into the personnel basket, Pilkington's safety harness came free and the umbilical detached from Pilkington's helmet. Champagne, on the other hand, clearly remembers the hoses being connected to Pilkington's helmet when Champagne reached to remove the helmet on the deck of Rig 12.[214] Wiitala saw Pilkington's helmet underwater during the rescue and distinctly remembers seeing the line attached to the helmet and bubbles coming from the "whiskers" of Pilkington's helmet -- indicating that air was going through the helmet fitting to Pilkington's respirator.[215]

32. The most compelling undisputed fact on this question is that Pilkington was apparently still alive, although unconscious, when he was brought back to the deck of Rig 12. This shows that, even at the end of his dive, Pilkington received enough air to sustain life, but not enough to sustain consciousness.[216] It is possible that Pilkington failed to tighten his air hose to his helmet causing enough air to leak from the connection to make him blackout. The facts though, do not support the theory. Pilkington's dive lasted three hours with him doing relatively light work and moving constantly around the mat of Rig 12. Wiitala testified that three or four times during the dive, he noticed Compressor 2's pressure gauge slip from about 150 psi down to 90 psi. But when Wiitala told Pilkington to close his free flow valve, Wiitala testified that the system pressure returned to 150 psi. According to Wiitala, this was Compressor 2's normal operating pressure, indicating that when Pilkington closed his free-

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[211] Brett R. Gordon, "COMMENT: EMPLOYEE INVOLVEMENT IN THE ENFORCEMENT OF THE OCCUPATIONAL SAFETY AND HEALTH LAWS OF CANADA AND THE UNITED STATES", 15 Comp. Lab. L. 527, 1994

[212] See FOF 42

[213] See FOF 61

[214] See FOF 47

[215] See FOF 46

[216] See FOF 63

flow valve, the system returned to its maximum pressure and inferentially, proving that the system was practically airtight.[217]

33. Pilkington also did not loosen his main air connection completely at the end of his dive. All the eyewitness agreed that Pilkington's airline was connected to his helmet when he was brought to the surface.[218] There also is no evidence that Pilkington adjusted his hose connection during his dive, prior to raising the question to Wiitala. Therefore, for the loose hose connection theory to be possible, Pilkington would have had to: 1) wrongly suspect his main air connection was loose, and 2) misadjust the connection allowing a fraction, but not all the air in the line to escape, resulting in an almost instantaneous blackout.

Coast Guard Marine Inspectors

34. Had the Coast Guard marine inspectors inspected the dive station on 4 March 1996, they would likely have discovered at least three violations of Coast Guard regulations.

    1) 46 CFR 197.201(a) and (b) [Failure to designate dive supervisor in writing and failure to deliver designation to person-in-charge prior to diving];

    2) 46 CFR 197.420(A)(1) and (2) [Failure to provide operations manual to person-in-charge and have at dive location]; and

    3) 46 CFR 197.482(d)(2) [Failure to log compressor air test results].

    The marine inspectors were required by Coast Guard policy to inspect the diving station. The Marine Safety Manual clearly states that "[i]nspection of diving equipment and facilities *shall* be conducted when diving operations occur on . . . vessels inspected for certification..."[219] The marine inspectors were also strongly guided to conduct dive safety inspections by NVIC 1-89. "The underwater survey should not be conducted unless the inspector is satisfied that the equipment and procedures being used by the divers will provide a safe and meaningful examination of the ship. Safety must be foremost on the minds of all those working together on the actual diving operation."[220]

35. If the Coast Guard marine inspectors had inspected the dive station, they could have made some useful judgements about the dive team's qualifications by asking whether a dive plan had been completed and a pre-dive safety checklist and job hazard analysis had been done. However, if the inspectors had looked only at the divers' qualifications, they would have had

[217] See FOF 41, 42. Note Analysis para. 19; Wiitala's testimony about Compressor 2's max pressures is extremely suspect. Nevertheless, it can be inferred that the pressure gauge indicated max pressure for Compressor 2, regardless of whether it was 150 psi or something less.

[218] See FOF 46, 47

[219] Marine Safety Manual, Vol. II, Chapter 16.E.1 (emphasis added)

[220] See FOF 2 – 8 and 29, 30, 31, 31; See too USCG Investigation, Vol. 4, IO Exhibit 30 (NVIC 1-89, enclosure 1, para. 5.f.)

trouble deciding whether they were qualified to dive safely. Wiitala was a graduate of a dive school and had been a commercial diver for 12 years.[221] Pilkington was a graduate of a reputable dive school in the State of Washington and had already made several shallow water dives for G&G.[222] Only Austin was not a graduate of a dive school, but he had dived for Cliffs on two previous occasions.[223] Since commercial divers are not required to be licensed, or even to attend diving school, the inspectors would have been hard-pressed to judge whether the Rig 12 diving job could proceed safely based solely on the divers' credentials.

Conclusions:

1. The apparent cause of the death of Brian Pilkington was drowning. Pilkington inhaled water into his lungs, which disrupted gas exchange causing him to asphyxiate.

2. A contributing cause of the death of Brian Pilkington was that water entered Pilkington's helmet. There is insufficient evidence to determine how water entered the helmet. However, the weight of evidence indicates the most likely path of ingress was under the neckdam, drawn in as Pilkington gasped for air when he suffered a loss of air pressure. In the alternative, water may have entered the helmet through the emergency air connection if Pilkington opened the valve and concurrently experienced a complete loss of air pressure.

3. A contributing cause of the death of Brian Pilkington was that he succumbed to Hypercapnia (too much carbon dioxide in the blood), causing him to pass out and his face to fall forward in his helmet allowing him to inhale water.

4. A contributing cause of the casualty was Pilkington's fatigue, lack of nourishment, and hypothermia, which masked the symptoms of Hypercapnia.

5. Pilkington succumbed to Hypercapnia because Compressor 2 produced inadequate air volume or pressure to properly ventilate and remove Carbon Dioxide from his helmet. Compressor 2 probably never produced more than 80-90 psi during the Rig 12 dive.

6. Compressor 2 produced inadequate air volume and pressure to properly ventilate Pilkington's helmet because its valves would not seat and its pilot valve was not working properly, preventing the compressor from pressurizing the volume tank to a pressure above 80-90 psi as air pressure in the tank was depleted by the diver.

7. Since no air quality tests were done for Compressor 2, there is insufficient evidence to prove conclusively that air mixed with oil contributed to this casualty. Nevertheless, the

[221] See FOF 21
[222] See FOF 24
[223] See FOF 11

compressor teardown conducted by Guy Kirby and recorded at IO Exhibit 19 indicates that Compressor 2 almost certainly produced oil tainted air as oil blew by the compressor piston rings entering the head assembly to be sent downstream to the diver. A contributing cause of the casualty may have been that Pilkington was debilitated by the early stages of Lipid Pneumonia when he breathed oil saturated air, reducing the partial pressure of air sent to him and impeding gas exchange in his lungs.

8. A contributing cause of the casualty was G&G's failure to do compressor air testing.

9. Compressor 2 produced inadequate air volume and pressure and probably tainted air because G&G had an inadequate maintenance program that did not routinely check and repair Compressor 2, allowing it to fall into disrepair.

10. G&G did not have a good maintenance and repair program because it did not have anyone exclusively responsible for equipment upkeep. Instead, Dan Gilbert claimed to have titular charge of equipment maintenance but expected all employees when they used equipment to detect and repair mechanical problems.

11. G&G did not have a person primarily focused on equipment repair and upkeep because it did not hire anyone to do that job when Mr. Al May, the former shop manager, left G&G in 1990 or 1991.

12. A contributing cause of the casualty was G&G's poor quality control practices. G&G allowed poorly maintained equipment to be sent to jobs and not enough equipment to be sent to jobs. The fact that there is a question about whether Pilkington tightened the airline to his helmet before beginning his dive indicates lax pre-dive preparation by G&G employees.

13. A contributing cause of the casualty was that G&G failed to appoint a diving supervisor in writing, or in the alternative, Texas NDE failed to provide a diving supervisor.

14. A contributing cause of the casualty was that Ronald Townsend, the OIM, failed to require that a diving supervisor, appointed in writing, present to him the written appointment along with an operations and safety manual.

15. There is insufficient evidence to prove definitively that a red shop rag was ingested into the compressor air intake, but a contributing cause of the casualty may have been that a rag was ingested into Compressor 2's air intake reducing the air volume and pressure passing to Brian Pilkington.

16. A contributing cause of the casualty was that Pilkington's axe fouled in the mat piping of Rig 12, restricting Pilkington's ability to be pulled to the surface.

FORMAL INVESTIGATION INTO THE COMMERCIAL DIVING ACCIDENT ABOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO. 12 ON 4 MARCH 1996, WITH LOSS OF LIFE

17. A contributing cause of the casualty was the anxiousness and confusion brought on by carbon dioxide poisoning (Hypercapnia) which debilitated Pilkington's ability to think and respond to directions from the dive supervisor.

18. A contributing cause of the casualty was the dive team's inability to quickly muster a coordinated rescue attempt.

19. A contributing cause of the casualty was lack of a standby diver. A ready standby diver likely would have been able to save Pilkington's life. Lack of a ready standby diver with his own gear and air supply created an almost 30 minute delay in the rescue attempt.

20. G&G did not supply an adequate secondary air supply when it sent a high-pressure air bottle to the dive site that was not fully pressurized.

21. There is insufficient evidence to tell whether Pilkington attempted to communicate through line pulls. But, when Wiitala didn't tend the umbilical in his hand, Pilkington was unable to communicate to the surface through line pull signals. A contributing cause of the casualty may have been lack of communication between Pilkington and the surface.

22. Dan Wiitala did not have the training or temperament to be a dive supervisor.

23. Kirk Austin did not have the training or experience to be a standby diver or dive supervisor.

24. G&G was not in compliance with its own manning requirements as set out in its safe practices and operations manual in that a dedicated dive tender was not available.

25. A contributing cause may have been the helmet's internal adjustments made to the regulator affecting how the regulator responded to intermediate pressure. The adjustment was set in an unusual position allowing free-flow at normal operating pressures. This unusual setting indicates that Pilkington had experienced inadequate compressor air volume and pressure from G&G compressors and had adjusted his second stage regulator to compensate for the low air pressures. The setting probably explains why the first high-pressure air bottle drained so quickly.

26. The fact that the Rig 12 Operations Manual that was onboard at the time of the casualty– not the G&G safety and operations manual -- had not been approved by the Coast Guard did not contribute to the casualty or delay the emergency response, including the evacuation of Pilkington to the hospital.

27. A tertiary air supply (bailout bottle) may have saved Brian Pilkington's life.

28. Brian Pilkington's air hose was connected to his helmet. He did not fail to tighten it prior to diving nor did he loosen it during the dive.

29. A contributing cause of the casualty was that the Coast Guard marine inspectors failed to inspect the diving station as required by the Marine Safety Manual. Marine Inspectors should have inspected the dive station on Rig 12 in accordance with Marine Safety Manual Vol. II, Chapter 16.E.1. If they had, they likely would have determined that the diving operation lacked a dive supervisor appointed in writing, a dive operations manual, and a log with air test results for Compressor 2. This would likely have resulted in delay of diving operations and another compressor being used, increasing the chance Pilkington would have survived. The marine inspectors failed to meet the expectations of Marine Safety Manual Vol. II, Chapter 16.E.1.

30. Coast Guard marine inspectors likely did not inspect the diving station because at least one of them believed that the ABS surveyor would oversee safe diving operations during the NDT portion of the hull inspection.

31. Coast Guard marine inspectors should not have relied on the ABS surveyor to oversee diving operations to ensure diving safety. That was an inappropriate attempt to delegate Coast Guard authority.

32. The Rig 12 SEILOD was governed by NVIC 12-69. NVIC 12-69 does not impose a requirement for the Coast Guard to do safety-related analysis of the diving operations before approving a SEILOD.

33. NVIC 1-89 is more generally relied on by marine inspectors than is NVIC 12-69. NVIC 1-89, although literally not applicable to the Rig 12 SEILOD, clearly established an expectation for OCMI's to analyze SEILOD proposals to ensure diving operations can be conducted safely. By the standards set in NVIC 1-89, MSO Port Arthur failed to meet Commandant expectations to analyze the ability of the diving contractors to safely carry out a SEILOD on Rig 12.

34. The liveboating diving variance requested by Cliffs for the Rig 12 SEILOD was not necessary since Rig 12 was in a bottom bearing mode and was not self-propelled. The diving variance granted by MSO Port Arthur did not contribute to the casualty.

35. There is no evidence that drugs or alcohol contributed to this casualty.

36. There is evidence that Kirk Austin and Texas NDE, and/or Dan Gilbert and G&G Marine failed to designate a diving supervisor in accordance with 46 CFR 197.210.

37. There is evidence that G&G Marine and/or Dan Gilbert failed to provide an air compressor system with an efficient filtration system as required by 46 CFR 197.310 (c).

38. There is evidence that G&G Marine and/or Dan Gilbert failed to provide a primary breathing gas supply sufficient to support a diver and standby diver for the duration of the planned dive in accordance with 46 CFR 197.340.

39. There is evidence that Ronald Townsend failed to carry out the responsibilities of the Person-in-Charge of Rig 12 as required by 46 CFR 197.402.

40. There is evidence that Dan Wiitala failed to carry out the responsibilities of the diving supervisor as set out in the regulations listed below. Wiitala correctly pointed out that he was never appointed diving supervisor for the Rig 12 dive. However, when he began to act as the diving supervisor, he assumed responsibility for carrying out all of the dive supervisor duties, not just those he could easily accomplish.

    a. 46 CFR 197.404: Responsibilities of the diving supervisor

    b. 46 CFR 197.410: Dive procedures

    c. 46 CFR 197.420: Failure to provide ops manual

    d. 46 CFR 197.432: Failure to continuously tend diver in the water

    e. 46 CFR 197.450: Failure to conduct breathing gas tests

    f. 46 CFR 197.480 & 482: Failure to maintain a logbook

41. There is evidence that the senior marine inspector on board Rig 12, LT Julio MARTINEZ, USCG, failed to follow the requirements of Marine Safety Manual, Vol. II, Chapter 16.E.1 by not ensuring that the dive station was inspected on 4 March 1996 while diving operations were underway on a vessel inspected for certification. This matter has been forwarded to the Commander, Eighth Coast Guard District for further investigation.

42. There is evidence of a violation of 18 USC 1112 (Manslaughter) by G&G Marine and/or Dan Gilbert. This matter has been forwarded to the Commander, Eighth Coast Guard District for further investigation.

43. With the above exceptions, there is no evidence of actionable misconduct, inattention to duty, negligent or willful violation of law or regulations on the part of licensed or certificated personnel; nor evidence of any other failure of inspected equipment or material; nor evidence that any other personnel of the Coast Guard or of any other federal agency, or any other person contributed to this casualty.

FORMAL INVESTIGATION INTO THE COMMERCIAL DIVING ACCIDENT ABOARD THE MOBILE OFFSHORE DRILLING UNIT CLIFF'S DRILLING RIG NO. 12 ON 4 MARCH 1996, WITH LOSS OF LIFE

Recommendations:

1. Commandant should require bailout bottles for all commercial diving operations, regardless of depth. The bailout bottles should have sufficient capacity to supply a diver with an appropriate volume of air at the deepest depth being worked. The facts of this case do not strongly support a recommendation for bailout bottles. Nevertheless, all diving experts consulted by the Investigating Officer agreed that bailout bottles come in so many sizes and configurations, and are so inexpensive that every dive should begin with the presumption that a bailout bottle will be used.

2. Commandant should require all unused auxiliary gas ports on diver worn life support equipment to be capped or blanked during all commercial diving operations. This will remove the possibility of water entering a diver's helmet if he inadvertently opens an emergency valve.

3. Commandant should require a standby diver dressed out and with a separate air supply, ready to quickly deploy for all commercial diving operations regardless of depth.

4. Commandant should require diving stages for all commercial diving operations regardless of depth, except where they would be impractical. This will speed entry to the water for divers and rescue divers and remove the need for rescue operations to work from personnel baskets. In this casualty, the rescue operation was itself so slow that using a crane operated Billy Pugh basket as a rescue platform did not significantly add to the delay. Nevertheless, there is no question that a diving stage at water level would have speeded up the rescue.

5. Commandant should require the Diving Supervisor and the Master or Person-in-Charge to develop a site specific rescue plan designating the equipment and personnel that will be used for a rescue or removal of an injured diver from the water for all commercial diving operations.

6. Commandant should require that, prior to any commercial diving operation, the Diving Supervisor describe the rescue plan to all members of the diving team.

7. Commandant should require the Diving Supervisor to complete a Job Hazard Analysis before every commercial diving operation. See IO Exhibit 57, ADC Consensus Standards, pg. 3-9 to 3-10b.

8. Commandant should require Diving Supervisors to complete a pre-dive safety checklist suitable to the type of diving equipment and procedures to be used, prior to all commercial dive operations. See IO Exhibit 53, Navy Dive Manual, pg. 4 –37 to 4-49.

9. Commandant should consider changing Coast Guard regulations to ensure accountability of commercial diving contractors for maintaining records and logs for their diving equipment.

Commandant should also make minor changes to Coast Guard regulations in addition to those described above to ensure Offshore Installation Managers play a more active role in pre-dive safety preparations. Present Coast Guard diving regulations place record keeping responsibilities on diving supervisors. Diving supervisors are appointed on a job to job basis and their designation ends when the diving job they supervise ends. Many of the record keeping responsibilities, however, are continuous and must be completed between diving jobs, away from the dive site. The following recommended regulation changes illustrate how the commercial diving contractor and Offshore Installation Manager could be given a more responsible role in the record keeping and pre-dive safety processes.

a. At 46 CFR 197.204 [Definitions], Commandant should add a definition "Commercial Diving Contractor" to describe the person or business that provides commercial diving services.

b. At 46 CFR 197.484 (a) [Notice of casualty], after the words "person-in-charge", Commandant should include the words "Diving Supervisor or Commercial Diving Contractor."

c. At 46 CFR 197.486 [Written report of casualty], after the words "person-in-charge of a vessel or facility", Commandant should include the words "or Diving Supervisor or Commercial Diving Contractor."

d. Commandant should change 46 CFR 197.210 [Designation of diving supervisor] as follows:

> "The Commercial Diving Contractor shall designate in writing a Diving Supervisor for each commercial diving operation. The Diving Supervisor shall present the written designation to the Master or Person-in Charge."

e. Commandant should change 46 CFR 197.402 (2) (i) [Responsibilities of the person-in-charge] as follows:

> "Prior to permitting any commercial diving operation to commence, the Master or Person-in-Charge shall examine the Diving Supervisor's written designation to ensure it is complete as required by §197.210."

f. Commandant should cross-reference 46 CFR 109.109 [Responsibilities of master or person in charge] with 46 CFR 197.402 [Responsibilities of person-in-charge].

g. Commandant should change 46 CFR 197.480 (c) [Logbooks] as follows:

> (c) The Diving Contractor and the Diving Supervisor conducting commercial diving operations from a vessel or facility subject to this subpart shall maintain a logbook for making the entries required by this subpart.

(d) The logbook required to be maintained by this subpart shall be taken to the jobsite for every commercial diving operation and shall be available for inspection by the Master or Person-in-charge, the United States Coast Guard, or any other cognizant agency.

(e) The Diving Contractor shall retain the logbook required to be maintained by this subpart for a period of not less than three years.

h. Commandant should change 46 CFR 197.482(d) [Logbook entries] as follows:

(d) The Diving Contractor and the Diving Supervisor shall insure that a record of the following is maintained: . . .

(e) The Diving Contractor and the Diving Supervisor shall insure that copies of each of the records required under paragraph (d) are included in the operations manual required by 46 CFR 197.420. The records required under paragraph (d) must be maintained by the Diving Contractor for a period of not less than three years.

i. At 46 CFR 197.420 [Operations manual], Commandant should add the following:

(e) The operations manual must contain copies of the records required to be maintained by 46 CFR 197.482 (d) and (e).

j. At 46 CFR 197.450 [Breathing gas tests], Commandant should change the words "The diving supervisor shall ensure that" – to

The Diving Contractor shall ensure that –

k. At 46 CFR 197.450 [Breathing gas tests], Commandant should add the following:

(d) The Diving Contractor shall maintain the above stated test records for a period of not less than 3 years.

10. Commandant should require the Dive Supervisor and Master or Person-in-Charge to execute a Declaration of Inspection verifying their respective duties have been competed before any commercial dive operation begins. See 46 CFR 35.35-30 for an example of the concept as it is applied to oil transfers.

11. At 46 CFR 197.204 [Definitions], Commandant should include a definition of "Diving Tender". Commandant should consider adopting the description of Diver Tender set out in the Navy Dive Manual. See IO Exhibit 53, Section 4-8.5.3.

12. At 46 CFR 197.204 [Definitions], Commandant should include a definition of "Dive Tending" or "Tending."

13. Commandant should consider limiting the duties of a dive tender to only tending the dive umbilical during a commercial diving operation, as illustrated by the following wording.

    At 46 CFR 197.432 (c)[Surface-supplied air diving], Commandant should add the words:

    ; the person tending the diver shall have no other duties while the diver is under water;

14. At 46 CFR 197.204 [Definitions], Commandant should consider consolidating the definitions "*Commercial diver*" and "*Diver*" into one inclusive definition.

15. Commandant should establish minimum manning standards for all diving operations. Commandant should consider adopting the standards set out in the ADC Consensus Standards. See IO Exhibit 57, pg. 3-24 to 3-29.

16. Commandant should establish commercial diving qualification standards for Commercial Divers, Commercial Diving Tenders, and Commercial Diving Supervisors. Commandant should consider adopting the standards set out in the ADC Consensus Standards. See IO Exhibit 57, pg. 2-3 to 2-8.

17. In the absence of a diver qualification program, Commandant should publish criteria for OCMI's to use when reviewing SEILOD applications to evaluate qualifications of divers to safely conduct diving operations.

18. Commandant should examine NVIC 12-69 and NVIC 1-89 to determine whether the older one should be cancelled and incorporated into the newer.

19. Commandant should require dive operation inspection training for all marine inspectors.

20. Commandant should remove the diving component from the MODU Inspector PQS workbook and establish a separate Performance Qualification Standards workbook for diving operations.

21. Commandant should evaluate the adequacy of the MODU/SEILOD job aid, CG-840H-1 (9-92), to determine whether additional inspection items should be added to the diving checklist (pg. 20 – 22). See IO Exhibit 31.

22. Commandant should publish guidance emphasizing that Coast Guard marine inspectors should not attempt to delegate dive safety enforcement duties to any third party, including classification society surveyors.

23. Commandant should require dive casualty investigation training for all marine safety casualty investigators.

24. Commandant should consider tasking Coast Guard divers to assist in the investigation of diving casualties. In this case, the IO was assisted by a former Coast Guard diver and a U.S. Navy Master Diver, both with exceptional insight. However, previous investigators to this casualty did not have those valuable resources. The Marine Safety Manual recommends that an IO investigating diving casualties have diving experience, but there are few IO's available with that background.

25. Commandant should consider seeking an agreement with the Navy Experimental Diving Unit and the U.S. Navy Diving School to provide assistance in Coast Guard diving casualty investigations.

26. Commandant should establish a working group of industry experts to examine ways to improve safety practices in the commercial diving industry. The working group should consider whether the Coast Guard should adopt by reference the ADC Consensus Standards for commercial diving operations where they do not conflict with Coast Guard regulations. The group also should consider whether the Coast Guard should require oil-free compressors be used on commercial diving operations. During this investigation, industry experts made many excellent recommendations to improve safety in the industry, many of which could not be included in this report because they were beyond the scope of the investigation. If a group is convened, it should seek input from Marine Safety Office Houston-Galveston, which recently initiated a commercial diving safety awareness and compliance program.

27. Commandant should forward a copy of this investigation to OSHA for consideration.

28. Commandant should forward a copy of this investigation to the Association of Diving Contractors.

29. Commandant should forward copies of this investigation to all Eighth Coast Guard District Coastal OCMI's.

30. This casualty investigation should be closed.

T. D. BEISTLE
Investigating Officer