

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

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ISSUED: February 28, 1983

Forwarded to:

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SAFETY RECOMMENDATION(S)

M-83-24 through -33

About 0300 on February 15, 1982, the U.S. mobile offshore drilling unit (MODU) OCEAN RANGER capsized and sank during a severe storm about 166 nautical miles east of St. John's, Newfoundland, Canada; 84 persons were aboard. Twenty-two bodies have been recovered, and the remaining 62 persons are missing and presumed dead. The OCEAN RANGER is currently resting on the bottom in an inverted position in about 260 feet of water; its estimated value was \$125 million. ^{1/}

The Safety Board could not determine whether three of the four certificated lifeboatmen, other than the master, who were required by the OCEAN RANGER's Certificate of Inspection, were aboard at the time of the accident because documented crewmembers were not identified on the station bill. The licensed master was a lifeboatman by virtue of his license. The two ordinary seamen that were determined to be aboard by U.S. Coast Guard (USCG) records normally were not qualified to have been certificated lifeboatmen. It could not be determined from ODECO's personnel records if the required able seamen who would have qualified as lifeboatmen were aboard; the partial crew rotation twice weekly resulted in a constant change in individuals. To ascertain if the requirements of the Certificate of Inspection are fulfilled, those documented crew members should be so identified. The Safety Board believes that the station bill on MODU's should identify by name the certificated lifeboatmen assigned to each lifeboat.

The Safety Board believes that personnel qualifications and manning standards for U.S. MODU's are long overdue and that the USCG should act immediately to set such standards. The person-in-charge or the master of a MODU should be licensed and qualified in mobile offshore drilling operations and should have knowledge of USCG regulations, stability characteristics of MODU's, the operation of semisubmersible ballast systems, and lifesaving equipment. If there is no licensed engineer aboard, the person-in-charge or the master also should have knowledge of the unit's standard shipboard systems, other than the industrial machinery. Since the person-in-charge on the OCEAN RANGER was an unlicensed, undocumented individual, the USCG did not have any method of determining his qualifications. Although the USCG regulations address the responsibilities

^{1/} For more detailed information, read Marine Accident Report--"Capsizing and Sinking of the U.S. Mobile Offshore Drilling Unit OCEAN RANGER, Off the East Coast of Canada, 166 Nautical Miles East of St. John's, Newfoundland, on February 15, 1982" (NTSB-MAR-83-2).

of the person-in-charge, the USCG cannot enforce the rules without jurisdiction over the individual. A former person-in-charge (toolpusher) on the OCEAN RANGER testified that he could not recall ever reading the applicable USCG regulations and, furthermore, was unaware of his responsibilities and obligations under the regulations. The Safety Board believes that a better method to insure compliance with safety regulations is to require that the person-in-charge (normally, the toolpusher) be licensed by the USCG and be fully qualified in all aspects of MODU operation.

Having an unlimited master's license does not necessarily assure knowledge of MODU's. The prospective person-in-charge or master of a MODU, in addition to being licensed, should be examined by the USCG to determine his qualifications in mobile offshore drilling operations which would include knowledge of stability characteristics of MODU's, the operation of ballast systems on MODU's, and any lifesaving equipment peculiar to MODU's. The license of the person-in-charge or the master then should be suitably endorsed.

There is also a need for ODECO to prescribe the duties and responsibilities of the person-in-charge and the master. In its investigation, the Safety Board did not discover any ODECO documents which set forth the duties and responsibilities of the master, the person-in-charge, or the control room operator. Testimony from former and alternate persons-in-charge (toolpushers), masters, and control room operators indicated that they did not have a clear understanding of their duties and responsibilities when moored. The only statement of responsibility which appears in the OCEAN RANGER's operating manual designates the master as having responsibility for the stability of the rig at all times. Whether the master or the person-in-charge was responsible for safety equipment and drills was not clearly defined in the manual. The February 6, 1982, listing incident on the OCEAN RANGER involved a master, who was more than qualified under present manning standards because of his unlimited master's license, but who did not have sufficient knowledge of the OCEAN RANGER to operate the ballast system, a vital element in the safety of a drilling unit. As stated in the ODECO operations manual, the master was responsible for the stability of the OCEAN RANGER; however, when a new master reported aboard, insufficient time was allowed for him to be indoctrinated by the master he was relieving. A senior ODECO official testified that a licensed master would, by reason of his experience and background, be able to study the operations manual and then be able to ballast the rig himself. He also stated that there was sufficient staff aboard the drilling rig to assist the master in learning the ballast system. The Safety Board believes that ODECO did not provide a proper indoctrination period for the master when he joined the OCEAN RANGER on January 26, 1982, since he was not able to operate the ballast control system properly on February 6, 1982.

The OCEAN RANGER was drilling under contract to MOBIL, but ODECO was responsible for the safe operation of the OCEAN RANGER as a vessel. However, ODECO did not: (1) define adequately the duties and responsibilities of the person-in-charge (toolpusher) or the master regarding marine safety functions on the OCEAN RANGER; (2) provide suitable training programs or establish standard operating procedures for control room operators; (3) provide training and written guidance in emergency procedures for operating the ballast control system; and (4) provide a sufficient indoctrination period for masters newly reporting aboard. The Safety Board believes that the foregoing management deficiencies contributed to the listing problem on February 15th.

ODECO's management was responsible for clearly defining the toolpusher's and the master's responsibilities regarding marine safety functions. While ODECO assigned an industrial relations representative (IRR) to assist the toolpusher with training, safety procedures, and emergency drills, ODECO did not require the IRR to be a certificated lifeboatman, or possess a USCG license. Control room operators were provided with on-the-job training, but ODECO did not provide written guidance for this training or develop a description of the control room operator's duties and responsibilities. Testimony from several former crewmembers of the OCEAN RANGER who were familiar with the ballast control system revealed that no standard practice was ever established as to what valves could be left open or what particular ballast pumps would be used for maintaining trim on the rig. The rotation of crewmembers left ballasting procedures at the discretion of whoever was on duty. ODECO did not provide any standard operating procedures for the master or control room operators concerning pumping sequences, valve positions, or fueling and drill water loading procedures nor were any established on the OCEAN RANGER. ODECO's management should have established standard operating procedures so that the continuity of these processes would not be disrupted during normal crew rotation. Furthermore, ODECO did not establish any emergency procedures relating to either electrical or mechanical malfunctions in the ballast control console.

Although ODECO hired qualified masters for the OCEAN RANGER, no attempt was made to provide a new master with systematic instruction about the drilling unit's ballast system; it was left to the master to learn the system on his own. The OCEAN RANGER's operating manual lacked vital information as to the ballast configurations that should be used to counteract the effects of accidental flooding in any of the lower hull compartments and procedures to be followed to prevent accidental flooding of the chain lockers. The Safety Board believes that had ODECO implemented a more effective training and familiarization program in the operation of the ballast control system, the crew of the OCEAN RANGER might have been able to overcome the ballasting problems it encountered on February 14 and 15.

Ballast control room operators on self-propelled MODU's, such as the OCEAN RANGER, and nonself-propelled MODU's monitor the weight changes of such consumable items as fuel, drill water, cement, barite, drill pipe, casing, and other material, and daily calculate and compare the MODU's vertical center of gravity to the required value. To satisfy drilling requirements, they also maintain the MODU as near as possible to even keel, except for small amounts of list in any given direction, and maintain a 24-hour watch in the ballast control room. Because these functions are vital to the safety of the MODU as a vessel, they should be performed by trained persons who are either licensed or certificated by the USCG. Ballast control room operators should be required to have a working knowledge of the stability characteristics of MODU's and should be capable of operating the ballast control system. ODECO should prescribe the duties and responsibilities of ballast control room operators on its drilling rigs so that minimum training requirements can be established for those persons who are to become control room operators. Each prospective operator should be required to attend ODECO's stability school in New Orleans (or a similar school) before assuming the duties of ballast control room operator. On-the-job training should only be given after a person has been taught the basic principles of MODU ballast control. When operating in a marine environment, MODU's should have a marine organization aboard to be responsible for marine functions, such as lifeboatman. Furthermore, since the control room ballast operators are the only persons directly supervised by the master, the Safety Board believes that ballast control room operators on MODU's should be documented and certificated by the USCG so that there is some assurance that in the event of an emergency they can perform marine type functions, such as lifeboatman.

USCG and American Bureau of Shipping (ABS) stability standards applicable to the OCEAN RANGER require that the MODU be able to withstand the flooding of compartments extending within 5 feet of its operating draft. The 1979 IMCO MODU Code has similar requirements. These standards required that the OCEAN RANGER withstand the flooding of compartments within one of its columns near its 80-foot waterline. The OCEAN RANGER was designed with horizontal watertight bulkheads within each column to limit the amount of flooding in case of damage to a column. The USCG, the ABS, and the IMO do not have any standards for flooding of lower hull tanks or compartments on semisubmersible MODU's. Calculations performed after the accident indicated that the flooding of empty or partially empty forward ballast tanks on the OCEAN RANGER at its operating draft of 80 feet could have produced angles of list exceeding its downflooding angle. ^{2/} The lower hull compartments on MODU's, such as the OCEAN RANGER, can flood in several ways: (1) a piping failure could flood the pumproom; (2) a small structural failure could flood any tank or compartment; or (3) operational errors or electrical malfunctions could result in the flooding of empty tanks. Because the evidence indicated that the lower hull tanks can flood quickly and cause a significant list, the Safety Board believes that the USCG, the ABS, and the IMO should revise their stability standards for MODU's similar to the OCEAN RANGER to require that MODU's be capable of surviving the flooding of lower hull compartments at their normal operating draft. The revised standard also should include a requirement that there be a capability to dewater lower hull compartments at all angles of list after the assumed flooding.

In recognizing the need for a higher level of protection against flooding than required by USCG and ABS standards, ODECO designed the OCEAN RANGER to withstand the flooding of one chain locker or certain individual compartments in the lower hull at the 80-foot operating draft. In addition, the OCEAN RANGER's operating manual suggests that the master maintain the lower hull forward and after tanks full and the center tanks empty. This ballast configuration would, in effect, limit the list angle in case of accidental flooding. However, it was the practice of the masters and control room operators aboard the OCEAN RANGER to maintain the lower hull center ballast tanks full and to have some lower hull forward ballast tanks empty to minimize the amount of water pumped to alter trim. The Safety Board determined that on February 14, center tanks PT-8, ST-8, PT-9, ST-9, PT-10, ST-10, PT-11, and ST-11 were full while forward tanks PT-4, PT-7, and ST-7 were empty, and ST-4 was 55 percent full. The OCEAN RANGER's design and its operating manual did not consider the accidental flooding of empty lower hull forward ballast tanks. The operating manual does not address any maximum trim angle beyond which the ballast pumps could not be used to deballast the forward tanks or any precautions to be taken to prevent flooding of a chain locker by wave action through the chain pipe and wire rope trunk openings. The 25-square-foot wire rope trunk openings are not shown on the damage control drawing in the operating manual.

If the ballast distribution on February 14 and 15 had been closer to that recommended in the OCEAN RANGER's operating manual (i.e., center ballast tanks empty, forward ballast tanks full), the amount of trim resulting from flooding would have been greatly reduced, thus, preventing flooding of the chain lockers and keeping the trim within the range of the ballast pumps which may have prevented the loss of the OCEAN RANGER. However, the OCEAN RANGER was not required by USCG or ABS to survive the flooding of empty or partially empty lower hull tanks at the 80-foot operating draft.

^{2/} Downflooding angle is the static list angle at which flooding of internal compartments within a vessel will first begin. It is assumed that once internal compartments began to flood, other compartments will progressively flood and the vessel will eventually capsize and sink.

The Safety Board believes that ODECO should review and revise all its operating manuals to provide information to the crew of semisubmersible MODU's concerning list angles caused by the accidental flooding of empty lower hull tanks, guidance to prevent the flooding of chain lockers (including wire rope trunk openings) due to wave action and information on the limitations of the ballast pumps due to trim angle. Also, ODECO should incorporate in its designs a permanent pumping system for dewatering the chain lockers in case of flooding.

The OCEAN RANGER's operating manual stated that, under certain conditions, the MODU could experience a permanent list or trim in a seaway. This information was based on a Society of Naval Architects and Marine Engineers (SNAME) study in regular waves. Since the OCEAN RANGER was subjected to a random sea state on February 15, the Safety Board does not believe that it experienced any wave induced heel or trim angle. ODECO may have misinterpreted the results of the SNAME study since under real sea conditions this phenomenon may produce large-amplified, long-period rolling oscillating and not a steady heel or trim. Therefore, ODECO should revise its operating manuals for semisubmersible units to accurately reflect the problem a unit may encounter as the result of low GM and large, steep waves.

In normal operation, the visual display of valve positions provided the ballast control operator with an overall picture of which valves were open and what systems were lined up. The design of the ballast control system on the OCEAN RANGER did not provide any secondary display of information, such as a separate mimic board, to inform the operator of valve positions and pump operation if electrical power to the ballast control console was turned off. Since the actuating rods did not indicate clearly the positions of the solenoids, the ballast control room operator had to commit to memory or record the valve positions if it became necessary to operate the ballast system manually. Furthermore, there was no evidence that anyone aboard the OCEAN RANGER on February 15 had ever used the actuating rods or that there were any operating instructions for their use. Therefore, the Safety Board believes that ODECO should provide detailed instructions for the emergency operation of the ballast control systems aboard its other semisubmersible drilling units.

The ballast control room operator was responsible for maintaining the draft of the OCEAN RANGER as well as the trim and heel. The operator's only method of determining the draft, other than by calculation, was to look out the portholes at the four corner columns and read the figures on the draft gauges. The need to use a portable searchlight would have made this method difficult at night in rough seas or dense fog. Securing the deadlights over the portlights also would have made regular observations of the draft gauges awkward. Internal draft gauges with readouts directly in the control board, as found on other installations, would have provided a more accurate and quicker method of determining draft, and allowed the deadlights to be secured during severe weather.

Biennial inspections of U.S. mobile offshore drilling units operating off the coast of foreign countries present a logistical problem to the USCG. At times, MODU's operate in remote areas many miles offshore; therefore, it is necessary that owners of MODU's notify the USCG in advance when a MODU is ready for its biennial inspection. Title 46 CFR 107.215(b) states that the request may be made at least 60 days before the expiration date appearing on the unit's last Certificate of Inspection.

The OCEAN RANGER had been inspected initially by the USCG in December 1979 and was required to have a biennial inspection before December 27, 1981. The USCG also was scheduled to reinspect the drilling unit between October 1980 and February 1981. The biennial inspection was required by law and regulation while the reinspection was a self-imposed USCG regulation.

The USCG did not receive ODECO's request for a biennial inspection of the OCEAN RANGER until January 26, 1982, 1 month after its Certificate of Inspection had expired. After the request was made, the USCG and ODECO arranged for two USCG inspectors from the Providence, Rhode Island, Marine Safety Office to inspect the OCEAN RANGER while on site off the coast of Newfoundland on February 16. The ODECO Operations Manager in St. John's stated that the request for inspection was late because completion of the installation of the liferaft davits and USCG-approved lifeboats had been delayed by bad weather.

The Safety Board believes that ODECO did not act prudently. The USCG permitted ODECO 2 years to replace the Harding lifeboats with USCG-approved lifeboats, or to obtain USCG approval of the Harding lifeboats and to provide davit-launched liferafts, or to use U.S. approved lifeboats as a substitute for the davit-launched lifeboats. The Harding lifeboat's releasing gear was not approved but it was not addressed by the USCG. As a result of the failure of ODECO to comply with any of these options, the OCEAN RANGER was not equipped with USCG-approved lifeboat installations or davit-launched liferafts at the time of the accident. The Safety Board could not determine if this failure to comply with USCG requirements contributed to the loss of life on the OCEAN RANGER; however, the lack of compliance decreased the usable lifeboat and liferaft capacity. Under the existing wind and wave conditions, most of the nondavit-launched liferafts probably blew away before the persons in the water could board them. The three operational lifeboats (Nos. 1, 2, and 4) were in davits ready for use. The fourth lifeboat (No. 3) was lashed to the upper deck awaiting installation. Examination of the forward port Harding lifeboat (No. 1) after the accident revealed that the lifeboat had never been launched. It probably was inaccessible since the OCEAN RANGER had listed to the port bow and the wind and waves were coming from that direction. As a result, only the 50-person Harding lifeboat (No. 2) and the 58-person Watercraft lifeboat (No. 4) located on the stern were available for the 84 persons aboard. The two lifeboats should have provided sufficient capacity for evacuating all persons aboard; however, there is no evidence that the No. 4 Watercraft lifeboat on the stern was ever launched.

There is a need for ODECO to improve its compliance with U.S. inspection laws and regulations. One of the options offered by the USCG to deal with the lack of USCG-approved lifeboats in 1979 should have been accomplished on the OCEAN RANGER before the 1981-1982 winter season when severe storms and cold weather off the coast of Newfoundland can make working conditions most difficult and cause delays in the installation of any exposed equipment. ODECO should establish a policy of applying to the USCG for a renewal well in advance of the expiration date of a MODU's USCG Certificate of Inspection if the MODU is operating in international service.

USCG regulations required davit-launched liferafts on board the OCEAN RANGER. The liferafts on the OCEAN RANGER, although USCG-approved, were not davit-launched nor had they been serviced by a USCG-approved facility. The servicing facility used for the OCEAN RANGER liferafts may not have had the necessary repair parts, manuals, servicing bulletins, and packing instructions since it had not been approved to service the type of liferafts used aboard the OCEAN RANGER facility. Therefore, ODECO should establish procedures that require USCG-approved liferafts on its U.S. flag MODU's be serviced only at USCG-approved facilities as required by 46 CFR 160.051-6. When the results of the Canadian laboratory tests on the recovered liferafts are completed, the USCG should undertake a review of its liferaft specifications to determine if the specifications need revision.

As a result of its investigation, the National Transportation Safety board recommends that the Ocean Drilling and Exploration Company:

Require that the station bill on ODECO mobile offshore drilling units indicate by name the certificated lifeboatmen required by the U.S. Coast Guard Certificate of Inspection. (Class II, Priority Action) (M-83-24)

Require that all regular and relief masters and the persons-in-charge be fully instructed and qualified in the operation of the ballast control system on the semisubmersible mobile offshore drilling unit to which assigned. (Class II, Priority Action) (M-83-25)

Define in detail the nonindustrial duties and responsibilities of the master and the person-in-charge on all ODECO mobile offshore drilling units in all modes of operation. (Class II, Priority Action) (M-83-26)

Define in detail the necessary qualifications for ballast control room operators on ODECO semisubmersible mobile offshore drilling units, and require that the qualifications be met and that potential control room operators attend a stability school before being assigned to a MODU as a control room operator. (Class II, Priority Action) (M-83-27)

Review and revise the operating manuals for self-propelled and nonself-propelled semisubmersible mobile offshore drilling units to include general guidance on the duties of ballast control room operators and specific guidance regarding: (1) accidental flooding of empty or partially empty lower hull compartments or tanks and the appropriate countermeasures; (2) any limitations in the functionings of the ballast pumps due to trim or heel; (3) precautions for preventing flooding into chain lockers from wave action; (4) the effect of random seas on the drilling unit's roll period; and (5) duties and responsibilities of ballast control room operators. (Class II, Priority Action) (M-83-28)

Install a permanent pumping system to dewater the chain lockers on all new and existing mobile offshore drilling units. (Class II, Priority Action) (M-83-29)

Include in the operating manuals for semisubmersible mobile offshore drilling units detailed operating instructions for emergency operation of the ballast system in the event that the primary control system fails. (Class II, Priority Action) (M-83-30)

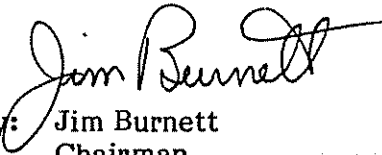
Install internal draft gauges with direct readouts in the ballast control rooms on semisubmersible mobile offshore drilling units. (Class II, Priority Action) (M-83-31)

Establish procedures to ensure that requests to the U.S. Coast Guard for renewal of U.S. Coast Guard Certificates of Inspection are initiated in time to avoid lapse of U.S. Coast Guard Certificates of Inspection for mobile offshore drilling units, especially those operating in international service. (Class II, Priority Action) (M-83-32)

Establish procedures to ensure that U.S. Coast Guard approved liferafts are serviced only at approved servicing facilities. (Class II, Priority Action) (M-83-33)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "... to promote transportation safety by conducting independent accident investigations" (P.L. 93-633). The Safety Board is vitally interested in any actions taken as a result of its safety recommendations. Therefore, we would appreciate a response from you regarding actions taken or contemplated with respect to the recommendations in this letter.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and McADAMS, BURSLEY, and ENGEN, Members, concurred in these recommendations.


By: Jim Burnett
Chairman