DEPARTMENT OF TRANSPORTATION

COAST GUARD

MARINE CASUALTY REPORT

SS TEXACO NORTH DAKOTA; EXPLOSION AND FIRE IN THE GULF OF MEXICO ON 3 OCTOBER 1973 WITH LOSS OF LIFE

U.S. COAST GUARD
MARINE BOARD OF INVESTIGATION REPORT
AND COMMANDANT'S ACTION

ACTION BY
NATIONAL TRANSPORTATION SAFETY BOARD

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16.Abstract

On October 3, 1973, the tankship TEXACO NORTH DAKOTA, en route from Tampa, Florida, to Port Arthur, Texas, experienced a violent explosion in the after pumproom. The force of the explosion caused the forward bulkhead, the after bulkhead, and the overhead to rupture. In the engineroom, abaft the pumproom, three persons died as a result of the explosion.

This report contains the National Transportation Safety Board's determination of probable cause. The report also contains the Marine Board of Investigation report and the action taken by the Commandant, U. S. Coast Guard.

The National Transportation Safety Board determines that the probable cause of the accident was the ignition of fuel-air vapors in the pumproom by hot gases, or other products of combustion, which were being ejected from a steam-driven air compressor.

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SS TEXACO NORTH DAKOTA; EXPLOSION AND FIRE
IN THE GULF OF MEXICO ON 3 OCTOBER 1973 WITH
LOSS OF LIFE

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TANKSHIP TEXACO NORTH DAKOTA
PUMPROOM EXPLOSION
GULF OF MEXICO
3 OCTOBER 1973

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

This casualty was investigated by a U.S. Coast Guard Marine Board of Investigation which convened at Port Arthur, Texas, on October 9, 1973. A representative of the National Transportation Safety Board observed part of the proceedings. The National Transportation Safety Board has considered only those facts in the investigative record which are pertinent to the Safety Board's statutory responsibility to determine the cause or probable cause of the casualty and to make recommendations.

SYNOPSIS

On October 3, 1973, the tankship TEXACO NORTH DAKOTA, en route from Tampa, Florida, to Port Arthur, Texas, experienced a violent explosion in the pumproom. The force of the explosion caused the forward bulkhead, the after bulkhead, and the overhead to rupture. Three persons died as a result of the explosion.

The National Transportation Safety Board determines that the probable cause of the accident was the ignition of fuel-air vapors in the pumproom by hot gases, or other products of combustion, which were being ejected from a steam-driven air compressor.

ANALYSIS

The Coast Guard Marine Board of Investigation did not obtain sufficient information to make a determination of probable cause for this accident. The Commandant, U.S. Coast Guard, did not reopen the Board of Investigation, but instead chose to obtain additional information, to analyze all evidence, and to make detailed comments in the "Commandant's Action" portion of this report. For this reason, the analysis is to be read in conjunction with the Coast Guard's Findings of Fact and the Commandant's Action.

Explosive Vapors

Pumproom Bilges -- On the TEXACO NORTH DAKOTA, residues were usually drained from pumps and related piping systems into the pumproom. Also, cargo products were siphoned from cargo tank pockets and from on-deck drip pans directly into the pumproom bilges. On the day of the explosion, diesel oil, aviation jet fuel, and gasoline were in the bilges. At the time of the explosion, gasoline was draining from a cargo pump discharge pipe into the lower pumproom. Vapors from these fuels mixed with the air and produced an explosive atmosphere.

The Coast Guard Marine Board commented that it is acceptable to discharge flammable and combustible products into pumproom bilges. Although the Commandant did not agree with this comment, the fact that it was made by high-ranking Coast Guard inspection officials indicates that the practice was acceptable to some Coast Guard authorities.

Ventilation Systems -- Testimony indicated that the power ventilation was not in operation at the time of the accident. If the power ventilation system had been working, the flow paths of the atmosphere in the pumproom probably would have prevented the explosive vapors from reaching the upper pumproom level. Although power ventilation systems are required by Federal regulations, there are no requirements concerning the operation of the systems.

Pumproom Atmosphere -- The doors to the pumproom were open, which allowed additional air to enter the upper level. The continual mixing of the new air, the existing fuel-air vapors, and the vapors rising from the pumproom bilges and from the newly spilled gasoline caused the fuel-air ratios in the upper pumproom to fluctuate.

At atmospheric pressure, the autoignition temperatures of the vapors range from 770° F. for gasoline to less than 500° F. for the other products that were in the pumproom. As the pressure of vapors increases, the autoignition temperatures decrease, so that at 10 atmospheres, the autoignition temperature of gasoline vapors is about 480° F.

Ignition Sources

Hand Tools -- Personnel on the TEXACO NORTH DAKOTA used the upper pumproom level as a workshop and small hand tools were stored in the pumproom area. Since the pumproom was not occupied at the time of the explosion and since there was no vessel rolling or pitching which could have caused the hand tools to fall and create an ignition spark, the use of the pumproom as a working area was not a factor in this accident.

However, the inadvertent dropping of a spark-producing device in an area where there may be explosive vapors is a hazard and could result in similar or more serious accidents in the future. The use of the pumproom as a tool storage area and a workshop is an unwarranted interpretation of Coast Guard regulations which permit the use of small hand tools in areas where explosive vapors are not prohibited. The removal of ignition-producing devices from pumprooms would lessen the probability of explosions.

Air Compressor -- The only pumproom machinery in operation at the time of the casualty was a steam-driven air compressor located in the upper pumproom. An operational test of the compressor was made after the explosion which showed that the compressor operated satisfactorily when driven by compressed air. The compressor was not examined internally.

The pressure which developed in the compressor's high-pressure air cylinder approached 10 atmospheres. The expected temperature inside the cylinder at 10 atmospheres was 570° F. However, conditions within the cylinder probably made the temperature higher than 570° F. With such a high temperature inside the cylinder, the introduction of the pumproom's atmosphere into the cylinder resulted in ignitions within the compressor. Such ignitions would not necessarily damage the air compressor to a degree that it would be noticed without a detailed internal inspection.

Shortly before the explosion, a witness said that the air compressor was observed to be "jumping on deck." Another witness stated that he thought it was "falling to pieces." At the same time, the witnesses heard abnormal sounds coming from the pumproom. They described the sounds as "boom-boom-boom...." with the intervals between the sounds decreasing. These sounds were probably caused by ignitions within the compressor. The ignitions became more frequent, which caused the compressor to act as a diesel engine. As the ignitions occurred within the air compressor, extremely hot products of combustion were released into the pumproom through a pressure relief valve.

The vapors in the upper pumproom were fluctuating between explosive and nonexplosive fuel-air ratios. Because of this fluctuation, the time lapse between the first ignitions within the compressor and the final explosion could not be determined. Since explosive vapors were prevalent in the upper pumproom area, where the air compressor was located, they probably were ignited by the hot gases or other products of combustion ejected from the air compressor. The ignition of the upper pumproom vapors created a flame front which traveled downward toward the confined lower pumproom area. The increasing reaction rate of the flame front created excessively high pressures which resulted in explosive damage to the pumproom, engineroom, and other areas of the tankship. The forward bulkhead, the after bulkhead, and the overhead were ruptured by the force of the explosion.

Commandant's Action

Additional evidence -- Details concerning air compressors in general and the TEXACO NORTH DAKOTA's compressor in particular were noticeably absent from the evidence obtained by the Coast Guard Marine Board of Investigation. The additional evidence used in the analysis and other remarks of the Commandant's Action have not been identified in the record. Since the National Transportation Safety Board's action relied heavily on the Commandant's portion of this report, the record cannot be considered complete.

Regulations -- The Commandant, in his review, identified several factors which contributed to the accident. As a result of his review, the U.S. Coast Guard has published proposed regulations which would prohibit the deliberate drainage of cargoes into the pumproom bilges and prohibit the use of air compressors in pumprooms. Also, the Coast Guard is studying the need for regulations on the operation of pumproom ventilation systems. The Safety Board concurs in these proposed Coast Guard actions.

The Safety Board also believes that any cargoes which are capable of producing toxic and explosive vapors in areas where persons work must be prohibited to provide a safer working environment for crewmembers. It is technically feasible to devise a system to direct any discharge, whether accidental or deliberate, into containers that will not ventilate into working areas. The products in the containers could then be transferred to holding tanks until they could be discharged at shore facilities.

Hazardous Practices

Supervisory Control -- The three most recent marine casualty reports 1/ concerning explosions on tank vessels emphasized the need for early identification of high risks involved with the transportation and handling of hazardous cargoes. In each of these cases, effective supervision by company and shipboard management could have reduced the severity of or prevented the explosions. Management has an inherent responsibility to identify and eliminate the hazards described above. Effective supervision by company and shipboard personnel can greatly reduce the risks involved. The fact that accidents of this type still occur indicates that past Coast Guard actions to insure that hazardous cargoes are handled properly have not proved effective.

Technology Transfer -- The Coast Guard investigative record did not indicate the number of tankships whose pumprooms are equipped with air compressors. The continued use of air compressors in pumprooms makes the tankships vulnerable to the same dangers that caused the explosion on the TEXACO NORTH DAKOTA.

The existence of air compressor-related hazards has been known for many years. The Department of the Interior (Bureau of Mines) has researched, published, and made information about these hazards available to other Federal agencies. The use of this information by the U.S. Coast Guard would have identified the risks involved in the use of air compressors in tankship pumprooms. If internal Coast Guard procedures required an active search for new technological information when evaluating the need for vessel regulations, the possibility of an inadvertent introduction of additional hazards on vessels might be reduced.

Risk Evaluation -- A formal hazard analysis of operations in tankship pumprooms would have identified the presence of volatile liquid in the bilges, the use of the pumproom as a workshop and a storage area for small tools, and the absence of regulations on the use of power ventilation as avoidable risks that could be eliminated.

The installation of an air compressor in the pumproom and an eductor system constructed solely to drain cargoes and cargo residue into the bilges compounded the risks already existing. A formal hazard analysis before either the air compressor or the eductor system were installed would have identified both as hazardous, and, as a result, the installations probably would not have been permitted.

Previous Recommendations -- The dangers of permitting cargoes to remain in pumproom bilges when the power ventilation is off have been stressed previously by the Safety Board. 2/ As a result of a pumproom

1/ Marine Casualty Report M/V VENUS, released 8-16-74;
Marine Casualty Report SS V.A. FOGG, released 11-21-74;
Marine Casualty Report OCEAN 80, released 6-17-75.

2/ Marine Casualty Report SS GULFSTAG, released 5-29-68.

explosion and the subsequent capsizing of the SS GULFSTAG, the Safety Board recommended that rules and regulations be promulgated by the Coast Guard to require that bumproom bilges be pumped out as thoroughly as possible and that pumproom power ventilation remain in operation whenever there is any amount of liquid cargo present in the bilges. Proposed regulations were considered by the Coast Guard but the regulations were not implemented.

The removal of the liquid cargoes from the pumproom and effective use of the power ventilation system in the manner recommended by the Safety Board probably would have prevented the explosion on the TEXACO NORTH DAKOTA. The Safety Board considers the presence of explosive vapors in locations where there is any activity, either human or mechanical, an unnecessary hazard which must be eliminated.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of the accident was the ignition of fuel-air vapors in the pumproom by hot gases, or other products of combustion, which were being ejected from a steam-driven compressor.

RECOMMENDATIONS

As a result of the analysis, the National Transportation Safety Board has made 9 recommendations to the Commandant, U.S. Coast Guard (See Appendix).

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

Adopted this 23rd day of September 1975:

John H. Reed, Chairman

Francis H. McAdams, Member

Louis M. Thayer, Member

Isabel A. Burgess, Member

William R. Haley, Member

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

APPENDIX

ISSUED: October 10, 1975

Forwarded to:

Admiral Owen W. Siler
Commandant
U.S. Coast Guard
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

M-75-19 thru 27

On October 3, 1973, the tankship TEXACO NORTH DAKOTA, en route from Tampa, Florida, to Port Arthur, Texas, experienced a violent explosion in the pumproom. The force of the explosion caused the forward bulkhead, the after bulkhead, and the overhead to rupture. Three persons died as a result of the explosion.

The National Transportation Safety Board determined that the probable cause of the accident was the ignition of fuel-air vapors in the pumproom by hot gases, or other products of combustion,which were being ejected from a steam-driven air compressor.

There are no Coast Guard regulations regarding the discharge of flammable or combustible cargoes into pumproom bilges, procedures for operating pumproom power ventilation systems, and the installation of air compressors in pumprooms. The operational procedures on board the TEXACO NORTH DAKOTA permitted the deliberate discharge of cargoes and cargo residue into the pumproom bilges. Since the power ventilation system was not in operation, explosive fuel-air mixtures permeated the upper pumproom where the air compressor was operating.

Other activities and conditions on the TEXACO NORTH DAKOTA can be hazardous when explosive vapors are present. One of these, the flow of fuel air vapors through air compressor piping to areas remote from the vapor source, can be eliminated by the proposed Coast Guard action of removing pumproom air compressors. However, the use of pumprooms, or any other areas where explosive vapors are not prohibited, as a workshop or a storage area for tools should not be allowed. A loose interpretation of a Coast Guard regulation which permits the use of small hand tools in such areas produces additional ignition sources which were not foreseen when the regulation was issued.

In addition to the possibility of an explosion, the presence of certain cargoes, such as benzene, can result in health impairment to crewmembers.

APPENDIX

Since crewmembers are required to work in the pumproom on various occasions, both deliberate and accidental cargo drainage into the pumproom bilges should be avoided.

The high-risk procedures on the TEXACO NORTH DAKOTA could have been identified and eliminated before the casualty by the application of available technological information. This information would have identified the risks involved in the use of air compressors in tankship pumprooms.

As a result of the loss of the towing vessel MARJORIE McALLISTER on November 2, 1969, the Safety Board recommended the use of systems analysis techniques to predict potential failures and accidents, and to guide requirements during the design and plan approval stages of ship construction. The explosion on the TEXACO NORTH DAKOTA indicates that the Coast Guard still is not employing adequate hazard analysis.

In the three most recently published Marine Casualty Reports involving explosions, the Safety Board cited hazards which could have been eliminated if there had been effective supervision by management. The explosion on the TEXACO NORTH DAKOTA also could have been prevented if management had identified and corrected the hazards present on the vessel.

Therefore, the National Transportation Safety Board recommends that the U.S. Coast Guard:

1. Expedite the promulgation of regulations prohibiting the deliberate drainage of cargoes into the pumproom bilges of tankships. (M-75-19) (Class II)

2. Insure that piping systems entering pumprooms are designed to preclude even accidental discharge of cargoes into the pumproom bilges. (M-75-20) (Class I)

3. Expedite the promulgation of regulations prohibiting the installation of air compressors in the pumprooms of tankships and requiring the removal of air compressors already installed. (M-75-21) (Class I)

4. Issue regulations concerning the operation of tankship pumproom power ventilation systems to insure the removal of explosive vapors before any activities are begun in the pumproom. (M-75-22) (Class I)

5. Prohibit workshops and the storage of tools in pumprooms of tankships in which the bilges are not prohibited by regulation from containing cargoes or cargo residue. (M-75-23) (Class II)

6. Institute a procedure which would require an active Coast Guard search for technology available in other federal agencies before

approval is granted for new types of equipment installations which may affect hazardous materials aboard ship. (M-75-24) (Class III)

7. Use formal hazard analysis during the next annual tankship inspection to identify pumproom explosion risks. (M-75-25) (Class III)

8. Use formal hazard analysis to evaluate the possibility of an explosion before approval is given for the design or modification of tank vessels. (M-75-26) (Class III)

9. Issue regulations to require adequate management and shipboard supervision during the transportation and handling of hazardous cargoes on tankships. (M-75-27) (Class III)

Reed, Chairman, McAdams, Thayer, Burgess, and Haley, Members, concurred in the above recommendations.

By: John H. Reed
Chairman

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

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5943/TEXACO NORTH DAKOT/
A-8 Bd

15 JAN 1975

Commandant's Action

on

The Marine Board of Investigation convened to investigate circumstances surrounding the explosion on board the SS TEXACO NORTH DAKOTA in the Gulf of Mexico on 3 October 1973 with loss of life

The record of the Marine Board of Investigation convened to investigate subject casualty has been reviewed; and the record, including the Findings of Fact, Conclusions and Recommendations, is approved subject to the following comments and determination of the cause by the National Transportation Safety Board.

REMARKS

1. The cause of the explosion was the ignition of a fuel-air mixture within the explosive range which was caused by the vaporization of an accumulation of petroleum products in the aft pumproom of the vessel. The source of ignition cannot be positively identified; however, it was most probably due to the emission of hot gases and other products of combustion from a steam driven air compressor which began to act as an internal combustion engine when the explosive atmosphere entered the compressor air intake.

2. Prior to discharging cargo at Tampa, Florida the vessel was loaded with gasoline, jet fuel, diesel oil, grade C fuel oil and asphalts. In preparation for loading other products it was common practice aboard this vessel to drain cargo residue from tanks, the cargo pumps and associated piping into the aft pumproom bilge. It was also common practice to remove residue by steam educting tank pockets which would not drain. Any product so removed would also be indirectly discharged into the aft pumproom. On the day prior to the casualty number 17 and 18 port tanks containing aviation jet fuel and number 17 and 18 starboard tanks containing diesel oil were drained into the aft pumproom bilge. There is evidence that the aft pumproom bilge contained gasoline, aviation jet fuel and diesel oil from the steam educting system. Cargo pump glands leaked permitting further

accumulation of various petroleum products into the bilge. Shortly before the explosion a three-fourths inch pipe plug was removed from the discharge line of number three cargo pump. Removal of this plug caused the contents of the discharge line and riser piping to drain to the bilge. The product contained in this piping was premium gasoline. Vaporization of fuel from all of these sources produced the necessary fuel-air mixture for the explosive atmosphere, however, the latter source is considered to have been most predominant.

3. The most probable source of ignition of combustible vapors within the pumproom is attributed to the emission of hot gases and other products of combustion from the steam driven air compressor. The compressor and its air intake are located on the upper level of the aft pumproom. It is theorized that when the explosive atmosphere entered the air intake the heat generated within the compressor air cylinders caused detonation within the cylinders. The compressor and the discharge piping are equipped with safety valves which relieved the overpressure created by detonation and allowed hot gases and other combustion products to enter the aft pumproom.

Unfortunately the compressor was not examined internally subsequent to the pumproom explosion. Such an examination may have provided additional evidence that detonation had occurred within the air chambers. However, support is found in the testimony of the boatswain and other members of the crew who describe the sounds emanating from the aft pumproom as, "boom, boom, boom." There is further testimony of Alphonse Malesheski, Able Seaman, who after hearing this noise looked in the pumproom and described the operation of the compressor as, "it was jumping on deck."

The theoretical probability of detonation occurring within the compressor, assuming no spark exists, is dependent upon the autoignition temperature of the fuel-air mixture present within the chamber and a heat source sufficient to attain the autoignition temperature. The autoignition temperature of a fuel under actual conditions may differ considerably from test conditions. It is dependent on such variables as the fuel and oxygen concentration in the air, the volume and shape of the chamber, the surface area of the heat source, and the pressure within the chamber. At one atmosphere the autoignition temperature under laboratory conditions of premium gasoline is 770°F while that of aviation jet fuel and diesel oil is less than 500°F. These temperatures will tend to decrease as the pressure (up to 100 atmospheres), the volume of the chamber and the surface area of the heat source increase.

The compressor is designed to operate against a pressure of 140 PSI. The pressure developed in the high pressure cylinder would, therefore, be slightly greater, approximately 10 atmospheres. Adiabatic compression of air at 79°F to pressure of 10 atmospheres will result in a temperature of 570°F. The actual temperatures that could be expected within the high pressure cylinder of the air compressor aboard the TEXACO NORTH DAKOTA differs due to the following factors:

a. Heat loss through cylinder walls causing temperature to decrease.

b. Actual temperature of the fuel - air mixture entering the low pressure cylinder was probably higher than the recorded condition shown in the vessel's log. This would result in even higher temperatures in the high pressure cylinder.

c. The compressor operating condition. It has been shown that worn parts and a dirty compressor will cause significantly higher temperatures within the compressor.

After many hours of compressor operation carbonaceous deposits will form within the compression chamber from the accumulation of lubricating oils and fuel vapors which may have entered the compressor through its air intake. A sample of carbonaceous deposit removed from an air compressor and tested by the Bureau of Mines revealed that an exothermic reaction occurred when the deposit was heated to a temperature above 572°F. The temperatures thus generated by an exothermic reaction of a carbonaceous deposit would be well above the autoignition temperature of premium gasoline.

In summary, autoignition of aviation jet fuel and diesel oil vapors could have occurred within the compressor due solely to the generation of heat by adiabatic compression. In order to attain the relatively high temperature needed for the autoignition of premium gasoline it appears that a heat source in addition to the heat of adiabatic compression is required. In this case an additional heat source may have been provided by an exothermic reaction of carbonaceous deposits since temperatures sufficient to have attained this reaction were likely.

COMMENTS ON CONCLUSIONS

Conclusion 1: That the draining of an indeterminate amount of gasoline from the cargo pump discharge piping into the pumproom provided the vapor source of fuel for the explosion.

Comment: The source of fuel vapor for the explosion is discussed in the Remarks, paragraph 2, of this Action and in the comment to Conclusion 10.

Conclusion 2: That, by observation, the origin of the explosion was in an area below the floor plate level on the port side between the foundations of numbers 7 and 8 cargo pumps.

Comment: This conclusion of the Marine Board is based on evaluation of the damage resulting from the explosion. It is well to point out that the overpressure created by a confined explosion will relieve through the weakest portions of the confined structure. In this case both doors to the pumproom house were open, thus, permitting the relief of overpressure in the upper

levels of the pumproom. Testimony indicates that there may in fact have been two explosions. It is possible that there was an initial explosion in the upper deckhouse of the pumproom which was observed as a blast of red flame. This explosion vented through the doors and the access hatch above. The flame front traveled down to the pump level and initiated a second explosion which vented through the surrounding bulkheads.

Conclusion 3: That, since the vessel was underway in relatively still air, the detection of gasoline fumes about the main deck in the vicinity of the pumproom just prior to the explosion gives indication that the pumproom ventilation system was in operation at that time.

Comment: In view of the contradictory testimony of the 1st pumpman stating that the ventilation systems serving the aft pumproom were not operating the morning of the explosion sufficient evidence is unavailable to support this conclusion.

All tank vessels handling Grades A, B, or C liquid cargo, with machinery located below the freeboard deck, and constructed or converted after 1 July 1951 are required to be equipped with power ventilation. The regulations, however, do not specify at which times these power ventilation sets must be in operation. The need for a regulation which would establish a time interval requirement and other alternatives are being studied.

Conclusion 4: That, by observation, there was no evidence that the source of ignition could have been caused by a defective pumproom lighting fixture, or a malfunctioning of any of the cargo pumps or their drive components, or from the ventilation systems, or from the steam-driven air compressor.

Comment: The probability of the steam driven air compressor being the source of ignition is discussed in detail in the Remarks, paragraph 3, of this Action. Regulations are being developed which will prohibit the installation of air compressors in the pumprooms of newly constructed tank vessels and require the removal of air compressors from the pumprooms of existing tank vessels.

Conclusion 5: That Mr. CONDE, Mr. McGEE and Mr. HIGHTOWER were killed almost instantaneously by the explosive force which swept through the engine room and that, although the death certificates indicate death was caused by extensive third degree burns, concussion and heat asphyxiation contributed to their deaths.

Comment: This conclusion is concurred with.

Conclusion 6: That there is evidence that TEXACO NORTH DAKOTA was in violation of 46 USC 222 in that the vessel was being navigated without the services of a third assistant engineer as required by the Certificate of Inspection.

Comment: This conclusion is concurred with.

Conclusion 7: That there is no evidence of misconduct, culpable inattention to duty, neglect or other willful violation of law or regulation on the part of any licensed or certificated persons, or that any failure of inspected material or equipment contributed to the casualty.

Comment: There is no indication in the record of the Marine Board of Investigation that any attempt was made by the master of the SS TEXACO NORTH DAKOTA to obtain a replacement for the third assistant engineer as required by 46 USC 222. It is considered that the failure of a master to make such an attempt constitutes evidence of negligence.

The lack of supervision on the part of the chief mate as discussed in conclusion 9 is also deemed to constitute evidence of inattention to duty or negligence.

Conclusion 8: That there is no evidence that any inspector, officer of the Coast Guard, or other officer or employee of the United States, caused or contributed to the cause of this casualty.

Comment: This conclusion is concurred with.

Conclusion 9: That the lack of supervision on the part of the Chief Mate of the activities of the 1st Pumpman FUERTES and Boatswain DEW in regard to the aligning of the pump and piping system associated with the tank cleaning operation, on the morning of 2 October 1973, was a contributory cause of the circumstances which created an explosive atmosphere in the aft pumproom.

Comment: This conclusion is concurred with. Since the lack of supervision on the part of the chief mate constitutes evidence of inattention to duty or negligence, the appropriate Officer in Charge, Marine Inspection has been directed to initiate further investigation under Suspension and Revocation Proceedings (R.S. 4450).

Conclusion 10: That the pumproom on the TEXACO NORTH DAKOTA is no different than the pumproom on other tank vessels; that due to the required cargo transfer operations of the vessel there was a necessity on occasion to drain or discharge flammable or combustible liquids in small amounts into the bilges; and that this is an accepted practice in a space which, by regulations, is considered to be hazardous and is so treated.

Comment: The Commandant does not concur with this conclusion. Pumprooms are designated as hazardous areas because combustible or flammable products may be present due to possible leakage from pumps, valves, piping and related equipment and because pumprooms have generally been contiguous with cargo tanks. This designation cannot be construed as authorization to utilize the space for cargo accumulation or retention in small or large amounts, the commonality of such a practice notwithstanding. Regulations are being developed prohibiting the drainage of cargo into the pumproom bilges.

Conclusion 11: That the erratic performance of number 3 cargo pump while being used to pump out number 16 starboard cargo tank was incorrectly evaluated by FUERTES in that it is more probable that the piping systems between the pump and the number 2 center cargo tank were misaligned than the losing of the pump suction.

Comment: This conclusion is not supported by the findings of fact. The reason for the erratic performance of number 3 cargo pump can not be established from the record of this investigation.

Conclusion 12: That the exact source of ignition could not be ascertained by the Board and thus it would be futile to expound theories.

Comment: The Commandant does not concur that it would be futile to expound theories as to the source of ignition. Valuable lessons have been learned in many casualties by proper evaluation of the available evidence and through the elimination process. This is particularly true in this casualty.

ACTION CONCERNING THE RECOMMENDATIONS

1. Recommendation 1: That action be initiated against Texaco, Inc., 135 E. 42nd Street, New York, New York 10016, the owner of TEXACO NORTH DAKOTA, for violation of 46 USC 222.

Action: Further investigation under administrative civil penalty procedures was instituted.

2. Recommendation 2: That due to existing circumstances, no action under 46 USC 239 (R.S. 4450) be initiated against the Master, J. H. WELCH, for violation of 46 USC 222.

Action: The appropriate Officer in Charge, Marine Inspection has been directed to initiate further investigation under suspension and revocation proceedings (R.S. 4450) for the failure of the master of the SS TEXACO NORTH DAKOTA to comply with the provisions of 46 USC 222.

A similar investigation has been directed in the case of the chief mate for his part in this casualty.

3. Recommendation 3: That no further action be taken and the case be closed.

Action: The record of this casualty will be forwarded to the National Transportation Safety Board for their review and action.

O. W. SILER
Admiral, U. S. Coast Guard
Commandant

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

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5800/TEXACO NORTH
DAKOTA

MAR 15 1974

From: Marine Board of Investigation
To: Commandant (G-MVI)

Subj: SS TEXACO NORTH DAKOTA, O.N. 265006; explosion in the Gulf of Mexico, on 3 October 1973, with loss of life

FINDINGS OF FACT

1. At approximately 0909 CDT on 3 October 1973, the Tankship TEXACO NORTH DAKOTA, enroute from Tampa, Florida to Port Arthur, Texas, in ballast, suffered an explosion in the aft pumproom resulting in severe structural damage and the loss of main propulsion and auxiliary power. Three crewmembers lost their lives and three others were injured.

2. Vessel data:

Name:	SS TEXACO NORTH DAKOTA
Official Number:	265006
Service:	Tankship
Built:	Newport News, Virginia 1953
Gross Tons:	12,789
Net Tons:	7,479
Length:	541.5'
Breadth:	75.2'
Depth:	40.8'
Propulsion:	Steam Geared Turbine
Horsepower:	13,650
Homeport:	Wilmington, Delaware
Owner:	Texaco, Inc., 135 East 42nd St., New York, New York 10016
Operator:	Texaco, Inc., 135 East 42nd St., New York, New York 10016
Master:	John H. Welch, 5029 Lakeside Drive, Port Arthur, Texas 77640 Merchant Mariner's Document Z-360154 License - Master Oceans 380796
Last Inspection for Certification:	29 June 1973, Mobile, Alabama

3. Personnel casualties:

a. The following crewmembers lost their lives as a result of this casualty:

Casimiro CONDE, Z-595130 - First Assistant Engineer
1711 Lakeview Drive, Port Arthur, Texas 77640
Next of Kin: Benedicta Conde, same address

Whitney P. McGEE, Z-188784-D1 - Second Pumpman
6433 39th Street, Groves, Texas 77619
Next of Kin: Angelina McGee, same address

Andrew W. HIGHTOWER, Z-824899-D1, Wiper
925 Spruce Street, Vidor, Texas 77662
Next of Kin: Gussie Hightower, same address

b. The following crewmembers sustained personal injuries as a result of this casualty:

Ronald JOHNSON, Z-1181323 - Fireman Watertender
1717 East 19th Street, Port Arthur, Texas 77640

Elton HILL, Z-1130627 - Oiler
5140 Minnie Avenue, Port Arthur, Texas 77640

c. The following crewmember sustained personal injury subsequent to the explosion while engaged in lifeboat handling operations:

Leroy CHAPMAN, Z-600454 - Able Seaman
1831 Nashville Avenue, Port Arthur, Texas 77640

4. The weather at the time of the casualty was clear, with a slight sea, bright sunlight and good visibility. The wind was from the southeast approximately 12 to 15 knots. The air temperature was 79°F, the sea temperature was 83°F, and the barometric pressure was steady at 30.05".

5. On the 27th and 28th of September 1973, the TEXACO NORTH DAKOTA loaded a mixed cargo consisting of gasolines, diesel oil and aviation jet fuel at the refinery docks of Texaco, Inc., Port Arthur, Texas. On 28 September 1973, the vessel was then shifted up river to the refinery docks of Texaco, Inc. at Port Neches, Texas. Final loading operations at this installation were completed upon onloading cargoes of asphalt and "C" Grade fuel oil.

6. The vessel was laden with 142,827 barrels of mixed petroleum products loaded as follows:

Gasolines: Center Tanks 1, 2, 3, 4, 7 and Wing Tanks 10 P & S, 11 P & S, 12 P & S, 13 P & S, 16 P & S.

Jet Fuels: Center Tanks 8, 9 and Wing Tanks 17 P, 18 P.

Diesel Oil: Wing Tanks 17 S, 18 S, 19 P & S, 20 P & S, 21 P & S.

Fuel Oil "C" Grade: Wing Tanks 15 P & S.

Asphalts: Center Tanks 5 P & S, 6 P & S and Wing Tanks 14 P & S.

7. The vessel has a unique tank system in that center tanks numbers 5 and 6 have been modified by the installation of a centerline bulkhead resulting in four tanks across in this area. The wing tanks opposite the center tanks numbers 7, 8 and 9 have been divided by transverse bulkheads forming two wing tanks per side for each of the center tanks. The center tanks are numbered 1 thru 9 and the wing tanks are numbered 10 thru 21. All tanks are numbered from forward to aft.

8. Upon completion of the loading at Texaco, Inc. at Port Neches, Texas, on 29 September 1973, the TEXACO NORTH DAKOTA took departure from Sabine Pass, Texas, bound for Tampa, Florida. The vessel had on board 18,167 tons of cargo and with necessaries the total deadweight was 19,119 tons. The resultant was a draft forward of 31'3", aft of 33'6" and a mean of 32'4½".

9. On 1 October 1973, the SS TEXACO NORTH DAKOTA arrived in Tampa, Florida, after a routine passage from Port Neches, Texas. Discharging operations were commenced at approximately 1550, on 1 October 1973, and were completed at approximately 0830 on 2 October 1973 without incident or any abnormalities noticed during the discharge period.

10. The sailing board was posted at 0200, 2 October 1973, indicating a sailing time of 1030 that day. At the appointed time, the vessel was in readiness to sail, excepting that one crewmember, William G. O'STEEN, Third Assistant Engineer, had failed to return from shore leave. The sailing was delayed until 1045 during which time the Master, John H. WELCH, consulted with the Chief Engineer, William J. WAHL, regarding this matter. It was their consensus that the vessel could be safely navigated from Tampa, Florida, to Port Arthur,

Texas, without the services of a Third Assistant Engineer. The Master advised OCMI, Port Arthur, Texas, by letter of his decision. It was agreed that the other two Assistant Engineers, a First and a Second, would stand six hour watches overlapping the 8 to 12 watches normally stood by the Third Assistant, and the Chief Engineer would relieve as necessary for meals. The vessel thus departed its berth in Tampa, Florida, at 1045, 2 October 1973, enroute to Port Arthur, Texas.

11. Prior to the departure of the vessel from its berth in Tampa, Florida, the ballasting of number 2 cargo tank was commenced. During the period while the vessel was being assisted in maneuvering away from the dock, ballasting was secured. After the tug was released, ballasting was resumed and continued until number 2 center tank was filled to approximately 8 feet from the top. Number 2 center tank was then designated as the slop tank to receive discharges from any tank cleaning conducted during the voyage to Port Arthur.

12. After clearing the harbor and at about 1300 on 2 October 1973, the cleaning and ballasting of number 4 center and number 13 port and starboard cargo tanks was commenced. This operation was completed and pumping was secured at approximately 2000 that evening. The vessel then had a calculated draft of 11'6" forward and 19'6" aft, the mean being 15'6". Under the existing conditions, the vessel ran well during the night.

13. On the morning of 3 October 1973, the vessel was on course 274° True, with the main engine turning 91.8 R.P.M., corresponding to a sea speed of approximately 17 knots. The vessel became alive, so to speak, in the routine manner for such a vessel at sea. The morning meal was served and the deck and engineroom watches were relieved. As of 0800, Bruce S. FERNIE, Third Mate, was the deck watch officer, and John R. MOTHERSHED, Quartermaster, was standing by the helm with the steering on automatic pilot. In the engineroom, Casimiro CONDE, First Assistant Engineer, was the engineer on watch, standing the first half of the 8 to 12 watch, and was actively engaged in making repairs to the lube oil purifier located at the floor plate level of the engineroom on the port side of the main engine. Elton HILL, Oiler on watch, was monitoring the plant status at the main engine throttle controls located on the platform level and in the forward starboard area of the engineroom. Ronald JOHNSON, Fireman/Watertender on watch, was attending to his routine duties in the firing aisle between the boilers in the fireroom. Andrew W. HIGHTOWER, Wiper, was also in the engineroom, engaged in the duties of his rating.

14. At approximately 0750, Billy M. DEW, Bosun, met with William P. JENSEN, Chief Mate, and they laid out the days' work for the deck crew. The following work assignments were made:

Timothy L. CHISHOLM, A.B., painting of the forward davit for #1 lifeboat.

Bird HOPKINS and George S. POTTER, Deck Maintenance men, to remove runarounds and put up blanks at the cargo piping crossheaders located on the main deck aft of the midships superstructure.

Alphonse MALESHESKI, A.B., and Oran J. MOUTON, O.S., to chip the fashion plate at the junction of the main deck gunwale with the after superstructure on the port side.

Leroy CHAPMAN, A.B., and Frank THOMAS, Quartermaster, to spot chip #2 lifeboat davits.

Marcelino TORRES, O.S., to spot chip outside of the ship's office on the midships superstructure.

Billy M. DEW, Bosun, and Armand A. HERRERA, Deck Maintenance men, to check the necessary crossheader runarounds and valve arrangement of the piping system prior to bottom washing number 16 starboard cargo tank.

Francisco FUERTES, 1st Pumpman, to align and operate #3 main cargo pump located in the aft pumproom to effect the removal of the tank washings from number 16 starboard cargo tank and to discharge these washings into the cargo line on the main deck.

Whitney P. McGEE, 2nd Pumpman, to make repairs to a small steam valve from the forward cargo heating system.

At approximately 0800, FUERTES, McGEE, CHISHOLM, HOPKINS, POTTER, MALESHESKI, MOUTON, DEW and HERRERA began work on their assigned duties. CHAPMAN, THOMAS and TORRES, members of the 4 to 8 watch did not begin work on their assigned duties until 0900.

15. The Master and the other crewmembers were about the vessel either at rest or engaged in routine matters.

16. Shortly after they had begun washing number 16 starboard cargo tank, DEW and HERRERA noticed that the slops

were not being removed by the cargo pump in that they were building up in the bottom of the tank. They stopped the washing and observed the slops, which after a short while appeared to be receding and being pumped out. They again commenced to wash the tank and after a period of another few minutes the slops again began building up in the bottom of the tank. The washing was secured at this time. DEW went aft and advised FUERTES that the tank washings were not being removed.

17. FUERTES evaluated the problem and decided that the pump had lost its suction and it would therefore need to be primed to restore suction. He felt this could be accomplished by connecting a portable salt water service hose line to the pump piping system. Whereupon, he stopped the pump and descended to the grating level next above the lower level. It was his intention to install a universal hose coupling in the drain connection located in the horizontal section of 12" diameter pump discharge piping from the number 3 main cargo pump between the non-return discharge valve and the tee connecting this line with the vertical riser to the main deck and the recirculating-filling line valve. Upon determining the pipe size for this drain connection, FUERTES then went on deck and obtained a proper sized fitting from DEW. FUERTES returned to the drain connection in the pumproom and removed one of the pipe plugs in the 3/4" diameter tee fitting on the horizontal section of the pump discharge line. Upon removal of the pipe plug, static pressure in the riser sprayed gasoline and wetted FUERTES and his clothing. FUERTES, without first replacing the pipe plug, immediately left the pumproom and went to his foc'sle to change his clothes and cleanse his burning skin. The liquid in the riser was Texaco Sky Chief Gasoline, the last product which was discharged using number 3 main cargo pump and the same product last carried in the number 16 starboard cargo tank.

18. At about 0900, McGEE went into the engineroom looking for CONDE, the 1st Assistant. HILL, the Oiler, told him that CONDE was repairing the lube oil purifier located on the floor plate level. It was McGEE's purpose to obtain a replacement valve to complete the repair to the heating coil piping system.

19. MOUTON had come forward to the shelter deck area to tell DEW that his chipping gun was not working. DEW told MOUTON to go get it and bring it back so that it could be repaired. MOUTON returned to where he had been working and at this time MALESHESKI, his work partner, said, "I smell gas, let's quit

chipping for the time being". As DEW, in the meantime, came out to check on the work at the crossheaders, he heard a rumbling sound like thunder. He thought that it was the steam driven air compressor in the pumproom that was malfunctioning, so he ran aft to shut the compressor down. He tried to enter the aft pumproom through the port door in the deckhouse but, because of the intense heat, he was forced back and clear of the door. Moments later, and at approximately 0909, a violent explosion rocked the vessel.

20. The heart of the explosion occurred in the lower level and on the port side of the aft pumproom. The force carried away the forward bulkhead of the aft pumproom in way of number 9 center tank, and portions of the after bulkhead of the pumproom on the port and starboard sides in way of the engineroom below the fuel oil settling tank. The machinery access hatch located atop the pumproom deckhouse was blown upward and laid back to starboard. Massive amounts of distortion occurred to the associated bulkheads, deck plating, framing, piping, ducting and fittings. The concussion carried into the machinery spaces and thence upward and out through the machinery casing doors into the crew quarters, destroying numerous partition bulkheads and doors. The flash of the explosion was seen emanating from the openings in the deckhouse of the pumproom and through the engineroom and fireroom. This was followed by heavy black smoke. The intense heat scorched the paint work in these spaces. However, secondary fires of any significant nature did not follow.

21. Upon sensing the explosion, the Master, John H. WELCH, ran from his cabin to the ship's bridge and asked the officer on watch, Third Mate Bruce S. FERNIE, what had happened. FERNIE replied it sounded like an explosion in the engineroom. It was noted that the propellor shaft tachometer was indicating a gradual decrease in R.P.M.'s. The Master immediately set off the general alarm, attempted unsuccessfully to put the engine order telegraph on "Stop", and ordered the Radio Officer to send a distress call and notify the Coast Guard of the Ship's position and situation. He then went on the aft deck and organized the crew into a firefighting detail. Going further aft, he met the Chief Engineer and learned that attempts to enter the engineroom were unsuccessful due to extreme heat and smoke, and that the vessel had lost all power in the engineroom and had only the electrical power available from the emergency generator. He then ordered the Chief Steward to determine if any men were missing. Shortly thereafter, he was notified that CONDE, McGEE and HIGHTOWER could not be accounted for.

22. Since there was no apparent fire in the engineroom or pumproom, all portable firefighting equipment was kept in readiness in event of a fire breaking out and a "reflash" watch was set. Thereupon the Master returned to the bridge and, upon being informed that two men, HILL and JOHNSON, were seriously injured and burned, he requested via radio that the Coast Guard dispatch a helicopter to evacuate these crewmen. Shortly, a report came forward that one of the missing men had been blown overboard. Number 3 lifeboat was then ordered made ready and launched to conduct a search. Later, when a search party was able to enter the engineroom, the bodies of the missing men were found and the boat was recalled. Prior to taking the lifeboat back aboard, an external survey of hull damage was made which proved negative.

23. At the time of the explosion, Ronald JOHNSON, Fireman/Watertender, was standing his normal watch in the fireroom and Elton HILL, Oiler, was at his station on the throttle platform. JOHNSON was knocked unconscious and thrown to the floor plates in the corner of the fireroom. When he recovered consciousness, the fireroom was full of smoke. He found a ladder and attempted to climb up, but was forced back by heavy smoke. He then found another ladder which led aft and up to the steering engineroom and made a successful escape to the main deck via this route. HILL, immediately after the explosion, tried to escape aft through the fireroom, but this route was blocked by heat and smoke, so he went down below to the floor plate level on the starboard side and then went aft through the shaft alley and made a successful escape to the main deck via this route. After HILL and JOHNSON arrived on the stern they were wrapped in blankets for shock and HILL's hands were soaked in ice water. They were taken to the hospital in the midships house and were later evacuated from the vessel by Coast Guard helicopter at 1017 and taken to the New Orleans Public Health Service Hospital.

24. The Chief Mate, William P. JENSEN, was in the ship's office in the midships house at the time of the explosion. He ran out of the office and looking aft saw a flash of fire come out of the starboard side of the pumproom. He set off the general alarm outside the Third Mate's room and ran aft along the catwalk to the pumproom. Realizing there was no fire in the pumproom, he went into the upper level and looked around. A small piece of manila line was smouldering and he stamped it out with his foot. He then went inside the after deckhouse and obtained a self-contained breathing apparatus. He attempted to descend to the lower levels of

the pumproom to determine whether anyone was down there, but the extreme heat and dense smoke prevented him from doing so. He then received a walkie-talkie from the Second Mate and went to the upper level of the engineroom. Again, the heat and smoke prevented him from going below to look for shipmates. Shortly thereafter, he took charge of number 3 lifeboat to search for the crewmember reported overboard. Upon his return, he obtained a large portable signal light from the bridge and went to the aft pumproom. This time he was able to descend to the lower level and determine that there was no one in this space.

25. The Chief Engineer, W. J. WAHL, was walking from his bedroom to his office located adjacent thereto on the starboard side of the after deckhouse on the boat deck when the explosion occurred. His first reaction was that an explosion had occurred in the engineroom and he attempted to enter through the machinery casing door from the starboard passageway but was unable to do so due to the intense heat and smoke. He then went down to the next level and tried to enter and again was unable to do so. He then went out on deck and saw that the machinery access hatch atop the pumproom was blown upward and realized the explosion had been in the pumproom. He then went up on the weather deck and instructed some of the crew to render first aid to the injured. Later, when the machinery spaces had sufficiently cooled and cleared of smoke, WAHL and Lereal DAIRE, the Second Assistant Engineer, entered and secured the boilers, sea valves and other machinery for the safety of the vessel.

26. The Second Mate, W. F. DELAGE, was asleep in his stateroom in the midships house at the time of the explosion. When he emerged from the deckhouse he observed smoke and steam on the after deck; he returned to his room, picked up a flashlight, and proceeded aft where he met the Chief Mate on the catwalk. He then went forward again, obtained walkie-talkies for himself and the Chief Mate and went to the bridge to inform the Master they were going to attempt to enter the engineroom. After being involved in various activities, he checked the pumproom for fire again and then decided to release CO_2 into the pumproom to prevent a reflash. He pulled the control cable for the aft pumproom cylinder bank; however, he did not follow the posted instructions and pull the control cable for the pumproom valve which would have released the CO_2 into the pumproom.

27. The bodies of the three crewmen initially not accounted for were found in the engineroom. Mr. McGEE was found near

the machine shop and Mr. HIGHTOWER was found on the forward end of the LP turbine, both on the platform level. Mr. CONDE was found near the lube oil separator on the floor plate level.

28. The Master decided to transfer ashore for safety those crewmembers he considered unnecessary for manning the vessel under tow. At 2140, 3 October 1973, as the vessel lay dead in the water, fifteen crewmembers and the bodies of the deceased were disembarked to the M/V MELISSA. The bodies were removed to McCleary Funeral Home, Morgan City, Louisiana, where they were attended by the Deputy Coroner for St. Mary Parish, H. H. Sykes, Jr., M.D., who determined the immediate cause of death was extensive 3rd degree burns as a consequence of an explosion in the pumproom aboard TEXACO NORTH DAKOTA. Autopsies were not performed. Subsequently, Mr. CONDE and Mr. McGEE were interred at Greenlawn Memorial Park, Port Arthur, Texas, and Mr. HIGHTOWER was interred at Forest Lawn Cemetery, Beaumont, Texas.

29. At 2325, the TEXACO NORTH DAKOTA was taken under tow by the M/V CINDY and commenced an uneventful journey to Alabama Dry Dock and Shipbuilding Company, Mobile, Alabama, arriving safely there the afternoon of 5 October 1973.

30. The membersof the Board were present when the vessel arrived at Mobile and were able to obtain first-hand impressions of the damage.

31. Aft pumproom details are as follows:

a. The aft pumproom of the TEXACO NORTH DAKOTA conforms to the basic configuration and layout commonly found on tankships. In addition to having a small access deckhouse above the main deck, it extends downward to the keel. It is bounded on the after side by the fuel oil settling tanks and below the 16' waterline by a step bulkhead under these tanks which is common with the engineroom. Outboard, port and starboard, it is confined within the shell plating under these tanks. The forward bulkhead is common to the number 9 center cargo tank, from the keel to the main deck. Sandwiched between the aftermost cargo wing tanks numbers 21 port and starboard, and the forward inboard corners of the bunker tanks, is an "L" shaped cofferdam port and starboard, which extends from the main deck downward and outward and is bounded outboard by the shell plating.

b. Illumination at the main deck and lower levels is provided by explosion-proof lighting fixtures serviced from the spaces aft of the pumproom.

c. Ventilation is provided by three systems:

(1) An 8500cfm non-sparking exhaust fan, located on the lower pumproom after bulkhead on the starboard side, driven by an electric motor located in the engineroom. The shaft penetrates the bulkhead through a stuffing box fitted with a packing gland containing lantern rings and grease fittings. The exhaust vents to the atmosphere through the deckhouse above the boat deck.

(2) A 4000cfm non-sparking supply fan, located on the upper pumproom after bulkhead on the port side, driven by an electric motor located in the CO_2 Room. The shaft penetrates the bulkhead through a stuffing box fitted with a packing gland containing lantern rings and grease fittings.

(3) Natural ventilation consisting of a ducting system leading from the upper pumproom after bulkhead on the centerline to the atmosphere adjacent to and starboard of the supply inlet described above.

d. The above described ventilation drive motors are mechanically remotely controlled from within the aft pumproom deckhouse.

e. Fire extinction equipment is provided in the form of a fixed carbon dioxide system located on the upper deck level and aft of the space protected. Controls for this installation, which consist of cylinder and valve control pull cables for the spaces protected, are located near the cylinder storage room.

f. Located in the deckhouse, in addition to the usual storage lockers and workbench, is a steam-driven compressor to provide air services on deck to power maintenance tools and other necessary equipment.

g. The pumping installation consists of six (6) Waterous positive displacement rotary pumps, each driven through reduction gears by a steam turbine located in the lower engineroom. The shafting to each unit passes through a grease lubricated bulkhead gland. Pump rotor shaft seals (4 each pump) are of the mechanical type rather than the packed gland type. Four (4) 715 barrels per hour (BPH) units numbered 1, 2, 7 and 8 normally serve the wing tanks numbers 16 through

21 and two (2) 2860 BPH units numbered 3 and 4 serve numbers 7, 8 and 9 center tanks. Number 3 pump also has a direct connection to the number 16 wing tanks. Each pump is connected to suitable piping to effect filling, discharging and ballasting of the cargo tanks. The pump drive turbines and the cargo piping valves can be controlled at the main deck level.

h. A steam-driven bilge pump provides the necessary dewatering service.

32. Several of the cargo pump discharge pressure gauges and speed indicators located in the aft pumproom deckhouse were inoperative prior to the casualty.

33. The 1st Pumpman, Francisco FUERTES, was making his first voyage on this class vessel and had been aboard for a period of 16 days.

CONCLUSIONS

1. That the draining of an indeterminate amount of gasoline from the cargo pump discharge piping into the pumproom provided the vapor source of fuel for the explosion.

2. That, by observation, the origin of the explosion was in an area below the floor plate level on the port side between the foundations of numbers 7 and 8 cargo pumps.

3. That, since the vessel was underway in relatively still air, the detection of gasoline fumes about the main deck in the vicinity of the pumproom just prior to the explosion gives indication that the pumproom ventilation system was in operation at that time.

4. That, by observation, there was no evidence that the source of ignition could have been caused by a defective pumproom lighting fixture, or a malfunctioning of any of the cargo pumps or their drive components, or from the ventilation systems, or from the steam-driven air compressor.

5. That Mr. CONDE, Mr. McGEE and Mr. HIGHTOWER were killed almost instantaneously by the explosive force which swept through the engineroom and that, although the death certificates indicate death was caused by extensive third degree burns, concussion and heat asphyxiation contributed to their deaths.

6. That there is evidence that TEXACO NORTH DAKOTA was in violation of 46 U.S.C. 222 in that the vessel was being navigated without the services of a Third Assistant Engineer as required by the Certificate of Inspection.

7. That there is no evidence of misconduct, culpable inattention to duty, neglect or other willful violation of law or regulation on the part of any licensed or certificated persons, or that any failure of inspected material or equipment contributed to the casualty.

8. That there is no evidence that any inspector, officer of the Coast Guard, or other officer or employee of the United States, caused or contributed to the cause of this casualty.

9. That the lack of supervision on the part of the Chief Mate of the activities of the 1st Pumpman FUERTES and Boatswain DEW in regard to the aligning of the pumps and piping system associated with the tank cleaning operation, on the morning of 3 October 1973, was a contributory cause of the circumstances which created an explosive atmosphere in the aft pumproom.

10. That the pumproom on the TEXACO NORTH DAKOTA is no different than the pumproom on other tank vessels; that due to the required cargo transfer operations of the vessel there was a necessity on occasion to drain or discharge flammable or combustible liquids in small amounts into the bilges; and that this is an accepted practice in a space which, by regulations, is considered to be hazardous and is so treated.

11. That the erratic performance of number 3 cargo pump while being used to pump out number 16 starboard cargo tank was incorrectly evaluated by FUERTES in that it is more probable that the piping systems between the pump and the number 2 center cargo tank were misaligned than the losing of the pump suction.

12. That the exact source of ignition could not be ascertained by the Board and thus it would be futile to expound theories.

RECOMMENDATIONS

1. That action be initiated against Texaco, Inc., 135 E. 42nd Street, New York, New York 10016, the owner of TEXACO NORTH DAKOTA, for violation of 46 U.S.C. 222.

2. That, due to existing circumstances, no action under 46 U.S.C. 239 (R.S. 4450) be initiated against the Master, J. H. WELCH, for violation of 46 U.S.C. 222.

3. That no further action be taken and the case be closed.

W. D. ALLEY
Captain, U. S. Coast Guard
Chairman

J. E. DeCARTERET
Commander, U. S. Coast Guard
Member

S. H. PIERPOINT
Commander, U. S. Coast Guard
Member and Recorder