

MARINE CASUALTY REPORT

CONTINENTAL OIL RIG 43-A
EXPLOSION AND FIRE WITH NO LOSS OF LIFE
GULF OF MEXICO, 24 OCTOBER 1967

U.S. COAST GUARD
MARINE BOARD of INVESTIGATION REPORT
and COMMANDANT'S ACTION

ACTION BY
NATIONAL TRANSPORTATION SAFETY BOARD

DEPARTMENT OF TRANSPORTATION
WASHINGTON D.C. 20591

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DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:

.5943/Continental Oil Company
43-A Platform

29 November 1967

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

Subj: Continental Oil Company Platform 43-A; explosion and fire in Gulf of Mexico on 24 October 1967, with no loss of life and minor injuries

Findings of Fact:

1. At approximately 0800 (CDT) Tuesday, 24 October 1967, an explosion and fire occurred aboard Continental Oil Company's "A" Platform, located in Block 43, Grand Isle Area, Gulf of Mexico, latitude 28° 59' 53.167" north, longitude 89° 51' 21.769" west. The platform was completely devastated by the fire; property damage amounted to approximately three and one-half million dollars. There were eight (8) persons aboard the platform at the time of the explosion. There was no loss of life and only minor injuries.
2. At the time of the casualty the weather was clear, with wind coming from the southeast at 5 to 8 mph. Sea conditions were one to two foot swells from the southeast.
3. Platform 43-A is owned and operated by Continental Oil Company, whose local office is in Harvey, Louisiana. This platform functioned as a production facility which acted as a collection and processing point for crude oil produced by wells in adjacent fields. After processing, the gas and oil were transported ashore via pipeline. The main deck of the platform, measuring 146 feet (northwest by southeast) by 110 feet (northeast by southwest), was supported by sixteen legs at a height of 55 feet 6 inches above Mean Gulf Level, in approximately 112 feet of water. A second deck, or cellar deck, at the 40-foot level consisted of steel gratings, as did the subcellar deck at the 9-foot level. Boat landings, also constructed of steel gratings, were located at the foot of the stairways and at a height of approximately 6 feet above the water. Stairways leading from the boat landings to the top deck of the structure were located on the west corner of the northwest end, and the east corner of the northeast end of the platform. (Exhibits 1 and 3 orient the structures located on the top deck of the platform). The fog horn had been relocated to the south corner of the platform and was gas-operated. The doghouse, a portable building resembling a small house trailer, was equipped with four bunks for emergency use by persons who might be stranded aboard the platform due to adverse weather conditions. This building, which served as the office for platform operations and records, also contained an electric coffee urn and electric stove. The generator building contained two generating units: one natural gas-driven generator was in operation, supplying general service power to the platform; the diesel engine-driven generator was not in operation. The pump building contained three oil transfer pumps. The southeast

end of this building had been removed and a fourth transfer pump had been installed between the generator shack and the pump building. All four transfer pumps were driven by reciprocating natural gas-burning engines, equipped with magneto ignition systems. The northwest wall of the pump building was open in the area of the roof riser, to provide ventilation through the building.

4. Equipment for processing oil and gas was located on the top level, with input and discharge piping extending to the second level. Pipelines leaving and arriving at the structure extended vertically, parallel with the legs of the structure. Unprocessed crude oil flowed into 43-A platform by pipeline from wells in adjacent source fields and platforms, as follows:

<u>SOURCE FIELD</u>	<u>PLATFORM</u>	<u>DIAMETER PIPELINE</u>	<u>DISTANCE OF SOURCE</u>
32	J	6 inch	4,907.1 feet
40	A	8 inch	43,211 feet
71	B	12 inch	28,265 feet
69	C	6 inch	8,310 feet
69	K	10 inch	14,618 feet

Processed crude left the 43-A platform via a 12 inch line and was piped to Grand Isle 47-A platform, located 12 miles southwest of the platform 43-A, and then to shore. A 16 inch line delivered high pressure gas (800 - 1000#) to 43-A, from West Delta 69-K platform, where a network of gas delivery lines joined. The output of this line at 43-A was fed through a "gas sales metering station," located in the meter house on the southwest side of the platform. Provisions were included for the dehydration of this gas prior to sales metering.

5. Incoming crude oil was piped directly into the primary separator at an input pressure of approximately 400 psi. The primary separator was designed for a working pressure of 500 psi, and equipped with a 3 inch diameter relief valve set to relieve at that pressure. The function of the separator was the removal of entrapped gases from the crude oil by gravity. Oil collecting in the separator was removed from the vessel by level-actuated dump valves. Gas products were taken off at the topmost point of the separator dome. Discharge from the primary separator flows to the secondary separator. Gas and oil separation is continued in the secondary separator. The normal operating pressure of the secondary separator is 60 to 100 psi. The output of the secondary separator is controlled by level-actuated dump valves and is discharged through a 12 inch header to a 3,835 barrel rectangular storage tank. The secondary separator is also fitted with a 3 inch diameter relief valve set to return at approximately 230 psi. Lifting of this relief valve had been experienced on a previous occasion. The exact date of this occurrence is indeterminate. MR. [REDACTED] testified that the cause of the actuating of the relief valve was traced to sand in the secondary separator.

6. The storage tank, located on the top level of the platform, served as a sump for the four oil transfer pumps. The four transfer pumps took suction on the storage tank by means of a 14 inch diameter header and discharged the oil into the 12 inch diameter lines leading to 47-A platform. The storage tank was constructed of mild steel, 1/4 inch thickness, and designed to withstand a head of 13 feet of water. The tank extended 52 feet longitudinally in a northwest, southeast direction; 32 feet transversely in a northeast, southwest direction, and 13 feet deep. A solid transverse bulkhead, located approximately 7 feet from the southeast end of the tank, divided the tank into two separate tanks, the smaller having a 500 barrel capacity, and the larger a 3,335 barrel capacity. A 14 inch diameter equalizing line located externally on the southwest side of the tank, joined the two compartments. The equalizer line penetrated the longitudinal wall of both tanks approximately 6 feet from the bottom of the tank, and was "U"-shaped. An expansion trunk located on the east corner of the storage tank served as the penetration points for two 8 inch and two 10 inch diameter vent lines; the 10 inch vents serving the larger tank compartment and the 8 inch lines serving the smaller compartment. The vent lines extended vertically out the top of the expansion trunk and then made a 180 degree bend vertically downward. Immediately above the tank top, the lines changed direction 90 degrees and extended horizontally, parallel with the top of the tank, for a distance of approximately 30 feet, before turning upward 90 degrees and extending vertically to a height of approximately 30 feet, where they were open to the atmosphere. The larger compartment of the tank was equipped with two level-indicated devices; one a plastic sight glass and the other a float or displacement type device which registered tank level by means of an air signal output read in pounds pressure. The air signal output also served to actuate a high-level alarm and safety system shutdown signal. The pressure read-out from the level indicator was displayed in the doghouse, and the sight glass was visible outside on the top deck of the platform. Collection trays, which were piped to an overflow collection sump at the bottom level of the platform, were located below the top deck. The function of this system was to catch any spillage from the storage tank and carry it to the sump, which was attached to a well guide near the water. A gas-powered sump pump which started when the oil in the sump reached a predetermined level, pumped the oil back up to the storage tank. The configuration of the sump was such that it was enclosed with a perforated cover at the top. Incoming oil to the two tank sections was supplied by separate 12 inch lines from the 12 inch secondary separator discharge header.

7. Gas extracted from the oil in the separation process flowed from the separator dome to either the compressor header or to flare. The direction of this flow is governed by the demand of the gas compressor in operation, by a back-pressure operated dump valve. Gas flares are a system used to remove waste gas from the platform and dispose of same. Two underwater flares, located on the southwest side of the 43-A platform, extended near the sea bottom and flared gas by discharging the gas into the water approximately 90 feet below the surface. Gas taken from the compressor header is

compressed to 800 to 1000 psi and piped ashore, after first passing through the gas sales meter station. Also associated with the gas processing system are suction scrubbers which remove residual oil from the gas prior to compression. Gas is tapped off prior to the sales meter and piped as fuel to drive the prime movers for four oil transfer pumps, the solar turbine-driven gas compressor, one White reciprocating gas compressor, one reciprocating generator and a small sump pump. Gas is also used as the actuating media for the control valves of the safety system.

8. Prime movers aboard the platform driven by other internal combustion engines included: a permanently installed diesel-driven generator located in the generator building, which supplied power to the platform's distribution system; a temporarily installed diesel-driven generator (referred to as the rental generator); and a deep well pump driven by a GM-371 diesel engine. The deep well pump, located on the west corner of the platform, served as a fire pump and was also used as the source of water for washing down. The exhaust system of the pump engine was equipped with a horizontal muffler and flame arrestor.

9. The diesel-driven rental generator was a portable unit which had been placed aboard the platform to serve as a temporary source of A.C. power to drive the cooling system fan for the solar turbine compressor. The rental generator was located on the top deck of the platform near the west corner of the storage tank. Its exhaust system was equipped with a horizontal muffler and was not insulated. This exhaust system had been observed emitting sparks on previous occasions, but it could not be determined if sparks had been emitted the day of the casualty. The electrical connection from the generator to the solar turbine cooling fan was a temporary installation consisting of a large diameter 3-conductor cable, approximately 100 feet in length. The connection to the generator was made by metal lugs on the cable to bolts on the generator output terminals and covered with a rubber flap. The connection was not insulated or enclosed. The opposite end of this cable was made up to the leads of the turbine cooling fan motor by means of metal clips and friction tape. This connection was laying on the metal deck.

10. Other electrically operated equipment aboard the platform consisted of: two air compressors located in the compressor building; one solar turbine cooling fan located on the southeast end of the platform; two air conditioners located inside of the doghouse; an electric stove and an electric coffee pot located in the doghouse; one ventilating fan in the generator building; one ventilating fan in the pump building; one air conditioner in the microwave building, and the microwave equipment itself. Explosion-proof fixtures were installed as lighting appliances; however, non-explosion-proof fixtures with incandescent bulbs of indeterminate wattage were present in the Supply Shed, and fluorescent lighting fixtures in plastic housings had recently been installed under the heliport.

11. Fire-fighting equipment aboard the platform consisted of: a deep well fire pump with four (4) 1-1/2 inch hose stations, each equipped with 150 feet of hose, located on the top deck; one dozen 30-pound dry chemical portable extinguishers; three (3) fifteen-pound portable carbon dioxide extinguishers; three (3) semi-portable hose-reel units, each containing 150 pounds of dry chemical. The portable and semi-portable units were located throughout the top deck of the platform. Fixed CO₂ systems were installed with storage tank blanketing and storage tank vent flooding capabilities. Activation of the storage tank CO₂ system could be accomplished manually from stations located at the top of either stairway or automatically by means of a temperature sensitive element, and located in the top of the storage tank vent risers. A sprinkler head, which could be supplied with water from the fire pump, was installed in the top of each of the tank vents.

12. At approximately 0630 on 24 October 1967, a crew of six (6) men arrived at the 43-A platform. After routine watch relief, the relieved crew departed the platform and the working crew remained aboard the platform, with pumper [REDACTED] in charge. Other persons in the working crew aboard the platform were: Continental Oil Company employees - [REDACTED] pumper; [REDACTED] roustabout; B & J Wire Line Service personnel - [REDACTED]. Two other persons aboard the platform, [REDACTED], who had arrived aboard the platform at 0715 that morning, were not members of the working crew but employees of U. S. Industries, a safety system sales and service company. The safety system equipment aboard the 43-A platform was not USI equipment, thus these two men had no specific duty aboard 43-A other than establishing the location of the USI equipment in that area, and were awaiting transportation to another platform. The crew aboard the 43-A platform rotated in 12-hour shifts. Personnel assigned to the crew were quartered aboard the nearby drill tender EAGLE, located approximately 5 miles southeast of the 43-A platform, and transported to the platform for their shift via vessel. Upon completion of their assigned shift, the on-duty crew was replaced by a relief crew and returned to the drill tender.

13. Emergency drills were not held or scheduled aboard 43-A platform. Transient personnel were not instructed concerning any specific emergency procedures, or the locations of lifesaving equipment aboard the platform.

14. Monthly safety meetings were conducted for all available Continental personnel from the platforms. Attendance at these meetings was required of all supervisory personnel as frequently as their duties permitted.

15. No Smoking signs were posted, and smoking restrictions aboard the platform were strictly enforced. Designated smoking areas were the boat landings and inside the doghouse. Personnel arriving aboard the platform were immediately advised of smoking regulations and permissible smoking areas.

16. Periodic inspection of the lifesaving and firefighting equipment aboard the platform is a responsibility charged to platform and field supervisory personnel by Continental Oil Company policy.

17. At approximately 0730 Mr. [REDACTED] assigned clean-up work to roustabouts [REDACTED]. These men proceeded with their assigned work in the vicinity of the pipe manifold. Mr. [REDACTED] went to the metering storage cabinets to change meter recording charts. Mr. [REDACTED] was attending to administrative duties in the doghouse. The two USI men were also in the doghouse awaiting transportation. Mr. [REDACTED], assisted by pumper [REDACTED] made preparation to receive "pigs" or pipe scrapers, through four (4) lines running in to 43-A platform. The first pig trap to be lined up was in the 10 inch line leading in from 69-K field. This was accomplished almost immediately upon Mr. [REDACTED] arrival at 43-A platform at 0630. By approximately 0745 the pig traps had been aligned in the 6 inch line leading in from 69-C field, and the 12 inch line from 71-B field.

18. The running of pigs is a routine pipe-cleaning operation which is carried out on a monthly basis. A "pig" is a device used to clean the inside of pipelines, by forcing it through the pipeline with the pressure of the oil and gas mixture in the line. The body of the pig is cylindrical and hollow, with a diameter less than that of the pipe to be cleaned. The leading edge acts as a scraper against the pipe walls to remove built-up material from the pipe and hold it in the pig's hollow body. The trailing end is formed by a solid concave surface, upon which the pressure of the fluid normally conducted in the lines (approximately 400 psi pressure on the line from 69-K) acts to propel the pig. The pig is placed in the line at the well-head end of the line, and after traveling the length of the pipe line is removed by means of a pig trap on the 43-A platform. As the pig arrives at the trap it enters a dead-ended chamber and is arrested, while the oil flows through a 6 inch bypass line. The oil and gas mixture is then redirected through the normal flow line and the pig trap and pig are removed by means of bolted flanges. When the piping associated with the pig trap is in a normal flow configuration, (the pig trap bypassed), a 10 inch HYDRIL valve in the line is associated with the safety system. The HYDRIL valve is equipped with a remote control actuator which closes the valve upon signal from the safety system. This actuator is also equipped with a fusible plug which will cause the valve to close when subjected to enough heat to melt the plug.

19. The safety system is a gas-operated remote control system which provides a remote means for operating valves in all piping systems arriving at or leaving the platform in the event of an emergency. When actuated, this system closes the oil inlet and discharge lines, and opens the gas lines to flare. Actuator stations for the safety system are located as follows: on the face of the pump building adjacent to the northeast corner of the storage tank; on the northeast and southwest ends of the pipe manifold, and on the northwest boat landing, equipped with a ring for operation by means of a boat hook. The actuator station adjacent to the storage tank was also equipped with a remote shutdown which when actuated would secure the oil transfer pumps and gas compressors. A high level in the storage tank also actuated the safety system. This system had been actuated by a false high level in the oil storage tank approximately ten days before the casualty. At that time the system did function and close the safety system valves, with the exception of the gas flare lines, which were actuated to the open position.

20. After completing the pig trap alignment and supervising ignition system repair work on one of the transfer pumps, [REDACTED] returned to the doghouse, where he received word by radio, at approximately 0730, that the pig had left 69-K. At approximately 0800 [REDACTED] heard a sound which he identified as the arrival of the pig from 69-K. [REDACTED] then proceeded to the second or cellar, deck where the pig traps were located, after first sending [REDACTED] for tools. [REDACTED] upon satisfying himself that the pig was in the trap, closed the pig trap inlet and outlet valves and started to open the 10 inch HYDRIL valve in the normal flow 10 inch line in order to reestablish flow which had been interrupted when the 6 inch bypass line was closed off. As [REDACTED] was opening the 10 inch HYDRIL valve, he heard a rush of gas and a bang. He then noted oil running down from the upper level in the vicinity of the corner of the storage tank, where the expansion trunk was located. This flow of oil was followed almost immediately by a flow of fire atop the oil. [REDACTED] upon seeing the fire, ran towards the ladder on the southeast end of the platform. As he started up the ladder he was met by [REDACTED] and [REDACTED] coming down the ladder. The six (6) men proceeded down the stairway to the boat landing. None of the men had life preservers in their possession at this time. [REDACTED] took the life ring and electric waterlight located at the boat landing, and entered the water. [REDACTED] and [REDACTED] entered the water without any lifesaving equipment. [REDACTED] and [REDACTED] returned to the top deck of the platform via the southeast stairway. [REDACTED] cast loose a life float which was located near the top of the stairway under the heliport. He then proceeded to the safety system actuator valve located in front of the doghouse near the southeast stairway and actuated what he thought to be the safety system actuator valve. [REDACTED] testified that he later learned that in his haste he had actually operated a valve in an adjacent water line. [REDACTED] and [REDACTED] returned to the boat landing on the southeast end of the platform, and after donning buoyant work vests procured by [REDACTED], entered the water.

21. Storage for the work vests was inside the doghouse. A metal box containing 12 to 24 Coast Guard approved life preservers was located directly outside and to the left of the doghouse exit, but these jackets were not used. Additional ring buoys equipped with waterlights were located on the top deck on the southeast side, and on the lower level boat landing on the west corner. A second life float was located on the top level at the southwest side of the platform. The two life floats were equipped with waterlights, paddles and a painter. As the life float cut loose by [REDACTED] fell from the 55-foot level, the painter, which was secured to the rail, momentarily fouled, then freed itself under the weight of the life float which landed on the water on the southeast side of the platform.

22. The six (6) men remained afloat in the water with the aid of the life-saving apparatus. Subsequent explosions came from the platform, and fire covered the water beneath the platform. Another explosion emanated from the gas sales meter area. The platform was subsequently engulfed by flames. The fire continued burning for approximately forty eight (48) hours. All wells and pipelines leading to and from the 43-A platform were secured at their sources. The safety system valves which were bypassed when the pig traps were aligned did not stop the flow of oil into the structure.

23. Mr. [REDACTED], who had gone into the compressor building for tools approximately 3 to 4 minutes after the arrival of the pig from 69-K, heard the relief valve on the secondary separator open. [REDACTED] left the compressor building via the northeast door and headed towards the secondary separator. At this time he heard a rumbling sound come from the storage tank. Looking at the storage tank, [REDACTED] saw oil spraying out of the riser type tank vents located on the east corner of the storage tank. He started towards a set of emergency shutdown controls when an explosion interrupted his actions. [REDACTED] then saw flames emanating from the storage tank in the vicinity of the expansion trunk where the riser vents penetrate the top of the storage tank. Flames propagated almost instantaneously across the southeast end of the storage tank, and then towards the southwest side of the platform, blocking [REDACTED] path toward the fire pump. [REDACTED] at this point joined the group of men who escaped the platform down the stairway on the southeast corner.

24. Mr. [REDACTED] was sitting in the doghouse attending to administrative duties prior to the arrival of the pig from 69-K. After the pig arrived, [REDACTED] heard what he described as an unusual noise. He left the doghouse and upon stepping out on deck, heard and saw the secondary separator relief valve lifting. [REDACTED] then looked toward the storage tank and saw a mist which appeared to him to be coming from the top of the expansion trunk. The tank appeared to swell and become distorted along the southeast edge of the tank. A rupture took place at the expansion trunk, and [REDACTED] saw gas vapor coming from the ruptured area. Flames then swirled upward in the vapor area above the expansion trunk. [REDACTED] exited the platform via the southeast stairway, and entered the water.

25. Mr. [REDACTED] was standing in front of the metering device storage cabinet, preparing to change gas recorder charts at 0800, when he heard the secondary separator relief valve lift, and then saw oil coming out of the riser vents, followed by an explosion, and fire from the storage tank. Mr. [REDACTED] testimony places the origin of the fire on the top corner of the tank nearest the crane. [REDACTED] after seeing the fire, ran to the boat landing on the southeast side of the platform and then returned to the top level of the platform with [REDACTED], to obtain lifesaving gear. [REDACTED] after getting two life jackets, returned to the boat landing with [REDACTED] and entered the water.

26. Messrs. [REDACTED] and [REDACTED] were cleaning in the area of the pipe manifold on the southeast end of the platform. Both men heard an increase in flow in the piping manifold and then an explosion. Both men, upon seeing the fire spread, left the top level of the platform by means of the southeast side ladders to the boat landing, and entered the water.

27. Messrs. [REDACTED] and [REDACTED] were sitting in the doghouse prior to the arrival of the pig from 69-K. They heard a sound which they thought to be the boat which was to pick them up striking the platform. Both men proceeded to the west corner of the platform and looked down to the water. Seeing no

boat, they turned back towards the doghouse. At this time they heard an explosion and saw an object propelled into the air in the vicinity of the expansion trunk on top of the storage tank. The two men ran down the stairway on the west corner to the cellar deck level. As they descended the stairway, a flash fire occurred on that level which blocked further downward exit. [redacted] and [redacted] returned to the top level and were cut off by fire in all directions and could not reach their work vests which they had placed near the crane. They jumped into the water on the northwest side of the platform near the fire pump. Once in the water they swam in a southerly direction down the southwest side of the platform.

28. The Crew Boat MR. BUD was proceeding on a heading of approximately 160° magnetic, with twenty (20) passengers aboard, piloted by Mr. [redacted]. As the vessel was approximately 2-1/2 to 3 miles distant from the 43-A platform, Mr. [redacted] saw a flash, bearing 020 degrees relative. [redacted] headed the MR. BUD towards the 43-A platform. As his vessel neared the platform, Captain [redacted] saw persons jumping into the water. He maneuvered the vessel from the stern steering station about the southeast end of the platform and picked up three men, including [redacted]. [redacted] then swung the vessel towards two men who were in the water with no life preservers. He picked up one of these men and threw a life preserver to the second. The attitude of the vessel, with respect to the man in the water to whom the life preserver had been thrown, had changed, and this man was now in front of the vessel. The life float with three men aboard was floating astern of the MR. BUD. The life float appeared to Captain [redacted] to be drifting in towards the platform. Captain [redacted] left the stern controls and headed forward to the cabin control station. At this time [redacted] halted Captain [redacted] from proceeding to the forward controls. [redacted] then bypassed [redacted] and proceeded to the forward control station, where he found that the controls could not be operated. He then returned to the after control station, where he found [redacted] holding the engine controls. [redacted] immediately yielded control of the vessel to Captain [redacted] who maneuvered the vessel to within 75 feet of the platform and picked up the three men from the life float. The remaining man in the water, [redacted], was picked up by the Crew Boat CAPTAIN PHIL, and transferred to the MR. BUD, who transported all eight survivors to the drill tender EAGLE.

29. Captain [redacted] received first aid treatment for a minor burn from a crewmember of the Coast Guard Cutter POINT SAL, which came alongside the MR. BUD to render assistance.

30. All eight men rescued from the platform were transported to Our Lady of the Lake Hospital in Galliano, Louisiana, and released after treatment for shock. All men were ready to return to work within 72 hours after the casualty.

31. The MR. BUD is an inspected small passenger vessel. A triennial certificate of inspection, which is to expire on 24 May 1970, had been issued to the vessel. The certificate of inspection permits a route of "Gulf of Mexico, not to exceed one hundred (100) miles from land while engaged in the offshore oil industry." A maximum of twenty eight (28) passengers is permitted. A crew of one ocean operator and one deckhand for operation of less than twelve hours in any twenty-four hour period is required by the certificate of inspection. The gross tonnage as indicated on the certificate of inspection is 53 tons. [REDACTED] holds a valid license as "Operator of Mechanically Propelled Passenger-Carrying Vessels" issued by the Officer in Charge, Marine Inspection, New Orleans, Louisiana, for "Waters other than ocean and coastwise," with a tonnage endorsement of not more than 100 gross tons.

Conclusions:

1. It is concluded that the cause of the casualty was the rupture of the 3,835 barrel storage tank by an excessive pressure, exerted internally. The exact source of this pressure cannot be definitely determined; however, it may be reasonably concluded that the gas pressure arrived at the platform with the pig from 69-K. After passing through the primary separator, and causing the secondary separator relief valve to lift, the gas reached the storage tank at a pressure in excess of 230 psi due to probable failure of the level-actuated dump valves, possibly due to fouling by sand.
2. The riser vent system, although open to the atmosphere at a height of 30 feet, contributed to the casualty as the vent pipes upon leaving the expansion trunk made numerous changes of direction, both horizontally and vertically. The designed pressure head of the storage tank is 13 feet of water. The approximate specific gravity of this oil is .87. Therefore, under static conditions, the designed pressure of the tank would be exceeded with a height of oil in the vent of more than 15 feet.
3. A second factor contributing to the tank failure was the "U"-shaped section of pipe which connected the two compartments of the tank. This pipe may have acted to throttle the flow of oil from the smaller compartment and contributed to the development of over-pressure.
4. The sequence of storage tank failure was as follows:
 - a. The tank was subjected to over-pressure.
 - b. The bolted flange vent elbow mounting plate on the expansion trunk of the 500 barrel compartment moved, allowing the escape of gas fumes.
 - c. A spray of oil and gas was observed from the top of the vents some 30 feet above the tank top.
 - d. The tank then failed by bursting at the expansion trunk, spewing the area with oil and gas.
5. It is concluded that a most probable source of ignition for the gas and oil emitted from the tank after rupture was the rental generator installation which included: an uninsulated exhaust pipe; sparks issuing from the open exhaust pipe, and non-explosion-proof terminal connections.
6. Additional sources of vapor ignition included:
 - a. The magneto ignition system of transfer pumps which was thought to have caused earlier small fires.
 - b. The non-explosion-proof incandescent lighting temporarily installed in the warehouse.
 - c. The non-explosion-proof equipment in the generator house, together with the generator switchgear.
 - d. A spark resulting from unknown metal to metal contact at initial tank failure.
7. Platform 43-A is an unmanned platform as defined by 33 CFR 140.10-45, as persons are not living and accommodated aboard the platform.

8. The difference between an unmanned platform which is attended by working personnel on a round-the-clock basis, and a manned platform, as determined by the quartering of personnel aboard, does not appear to be adequate criteria for the omission of: emergency drills on a periodic basis, and the posting of an emergency bill. On this structure there is clear intent that it shall be manned continuously.
9. The actions of the person in charge, [REDACTED], were appropriate and timely in providing lifesaving equipment to the persons in the water.
10. [REDACTED] action of operating the water valve instead of the safety shutdown valve, may be attributed to the lack of contrasting characteristics of the safety system shutdown actuator to other nearby valves.
11. Firefighting equipment aboard the platform was in excess of that required by 33 CFR 145 for an unmanned platform; however, the rapid spreading of the fire precluded the use of any firefighting equipment.
12. Lifesaving equipment aboard the platform complied with the requirements of 33 CFR 144.10 for an unmanned platform, and functioned in a satisfactory manner.
13. Means of escape from the platform complied with the requirements of 33 CFR 143.05-10 for an unmanned platform. In fact, two means of escape were provided. [REDACTED] and [REDACTED] jumped into the water from the top deck, a height of approximately 55 feet, without injury, as they had previous Naval training in this procedure.
14. The general arrangement and layout of the platform did not consider any specified areas to be more hazardous than others.
15. The outfitting of the main deck with a common collection sump with air venting at the top is considered a poor installation.
16. Prevailing weather and sea conditions were ideal for the rescue of personnel in the manner accomplished.
17. The prompt actions of Mr. [REDACTED] operator of the MR. BUD, in diverting his craft to the scene of the casualty contributed greatly to the survival of persons escaping from the platform, and are noteworthy.
18. Captain [REDACTED] was operating under the authority of his operator's license as the MR. BUD was operated inside the line of demarkation of Inland and International Rules of the Road, which is considered Inland Waters.
19. The incident aboard MR. BUD between Mr. [REDACTED] and Mr. [REDACTED], concerning control of the vessel, in no way indicates any act of misconduct on the part of either person; but, rather, a misunderstanding on the part of [REDACTED] as to the intentions of [REDACTED] brought on by the anxiety of the situation.

20. There is no evidence that any law or regulation relating to Fixed Structures on the Outer Continental Shelf has been violated.

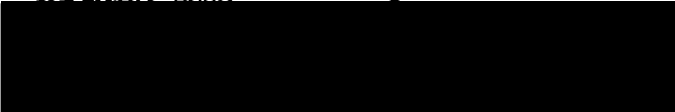
21. There is no evidence that any personnel of the Coast Guard or any other government agency contributed to this casualty.

Recommendations:

1. The provisions for tank venting similar to those set forth in 46 CFR 55.10-60, should be made applicable to storage tanks on platforms of this nature, on the Outer Continental Shelf.
2. At the present time 33 CFR 140.10-25 differentiates between a manned and unmanned structure by (a) continuous occupancy, (b) persons living and accommodated thereon. The primary consideration is duration of occupancy, and on the structure under investigation there is clear intent that it shall be manned on a twenty-four hour (12 by 12) watch basis. Therefore, the definition of a manned platform as set forth in 33 CFR 140.10-25 should be revised to include any structure which is occupied by personnel for a period in excess of twelve (12) hours.
3. All emergency bills and emergency drills should include instructions to personnel concerning procedures for entering the water from high elevations.
4. Hazardous areas should be recognized and so designated by the general arrangement of the artificial island. The Class-Division concept found in the National Electrical Code and as set forth in the Electrical Engineering Regulations (CG-259) should be made applicable to this type structure.
5. Provisions should be made for the requiring of the use of explosion-proof equipment according to the areas defined by paragraph 4. above, and included in Sub-chapter N.
6. The normal avenue of departure from the top level of a platform is via two remotely located escape routes to the water level boat landings. It appears that the location of some life preservers at the lowest level, and a means to remotely launch or release the life floats from this level, is desirable.
7. The outfitting of the main deck with a common collection sump is probably widespread throughout offshore platforms due to the need for the control of any pollution problem. Therefore, 33 CFR 143 should include requirements concerning a non-hazardous venting arrangement.

8. Provisions for distinctive shape and marking of emergency shutdown devices installed aboard the platform should be included in 33 CFR 146.05-35.


EDWARD J. WORREL, JR.
CAPTAIN, USCG


RICHARD O. HAUGHEY
COMMANDER, USCG


LIEUTENANT, USCG



DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

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5943/CONTINENTAL OIL
COMPANY PLATFORM 43-A
C-8 Bd
17 FEB 1968

Commandant's Action

on

The Marine Board of Investigation convened to investigate the explosion and fire on board the CONTINENTAL OIL COMPANY PLATFORM 43-A on 24 October 1967 without loss of life

1. 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 final determination of the cause of the casualty by the National Transportation Safety Board.
2. At about 8 a.m. on 24 October 1967 an explosion and fire occurred aboard CONTINENTAL OIL COMPANY PLATFORM 43-A. The platform functioned as a collection and processing point for crude oil and gas produced in adjacent wells. While no personnel are berthed on the platform it is manned on a 24-hour basis and at the time of the explosion there were 8 persons on board. There was no loss of life and only minor injuries.

REMARKS

1. In the administration of matters relating to the statutory duty of the Coast Guard to promote safety of life and property, the utilization of the U. S. Coast Guard Merchant Marine Council has in the past proven both beneficial and effective. The Merchant Marine Council is a deliberative body, similar to a board, established to advise the Commandant as to policy in connection with matters pertaining to maritime safety. It has no operating authority or responsibility. In general, the Council considers proposals affecting maritime safety, conducts public hearings and provides a forum where these proposals and other problems affecting the public, industry, labor and others may be considered.
2. The report of this Marine Board of Investigation will be forwarded to the Merchant Marine Council for its consideration of the issues raised and the recommendations submitted.

Disposition of Recommendations


- Recommendation 1. This recommendation is concurred with and will be forwarded to the Merchant Marine Council for its consideration.

Recommendation 2. The Board's recommendation that the definition of a manned platform as set forth in 33 CFR 140.10-25 should be revised to include any structure which is occupied by personnel for a period in excess of twelve (12) hours will be considered. It is noted that when a structure is so designated certain additional items of safety equipment and certain operating procedures are required. On the CONTINENTAL 43-A structure some of these items were voluntarily provided by the owners for the protection of personnel working on board the structure. However, where the operational procedure calls for the continuous manning of the structure, as was the case in this instance, it would seem appropriate and desirable that those items of safety equipment designed for personnel protection now required on manned structures also be provided on structures that are or are designed to be continuously manned.

Recommendation 3. No action will be taken concerning instructions for entering the water from high places since it is noted that the industry Manual of Safe Practices in Offshore Operations November 1967, contains the recommended instructions.

Recommendations 4-8. Recommendations (4) through (8) concerning the need for designating hazardous areas, explosion proof equipment, relocating life preservers and life float releases, venting collection sumps and distinctively marking the emergency shutdown devices will be considered.

2. Subject to the foregoing remarks, disposition of the Recommendations and the final determination of the cause of the casualty by the National Transportation Safety Board, the record of the Marine Board of Investigation together with Findings of Fact, Conclusions and Recommendations is approved.



W. J. SMITH
Admiral, U. S. Coast Guard
Commandant

CONTINENTAL OIL COMPANY PLATFORM 43-A
EXPLOSION AND FIRE IN GULF OF MEXICO
OCTOBER 24, 1967

ACTION BY NATIONAL TRANSPORTATION SAFETY BOARD

This casualty was investigated by a U. S. Coast Guard Marine Board of Investigation convened at New Orleans, Louisiana, on November 2, 1967. A representative of the National Transportation Safety Board attended the proceedings.

ANALYSIS

The function of platform 43-A was to collect and process crude oil produced from nearby wells. The oil and extracted gas were then piped ashore. Attachment No. 1 is a scheme of the main flow components involved in the casualty. The main part of the processing in this type of operation took place in a primary and a secondary separator. The function of these was the separation of the gas from the crude oil, utilizing gravitational and centrifugal forces. Incoming crude oil, at a pressure of approximately 400 p.s.i., was piped directly to the primary separator which had a relief valve set to open at 500 p.s.i. Gas products were taken off at the top of the separator while the oil which collected in the lower part of the separator discharged, by means of level actuated dump valves, to the secondary separator where the process was continued. The normal operating pressure on the secondary separator was 60

to 100 p.s.i. and it was fitted with a relief valve set at 230 p.s.i. Crude oil collected in the secondary separator was discharged, through its dump valves, to a storage tank from whence it was pumped ashore. The dump valves were individually operated by liquid level control devices using the production gas as an operating medium and responding to the level indication from floats in the separators. The level of the oil was maintained at a point which provided a liquid seal at the separator oil outlet. There were two dump valves on each separator. The valves were located at the same level but the sensing devices were at different levels. Both valves would operate during periods of heavy load. The primary separator dump valves were a single port type, while those on the secondary separator were double-ported. The gas supply to the controllers and various instruments was protected, in the event of failure of the main source, by a secondary system and finally by a supply of bottled gas which would cut in automatically. However, malfunction of a controller on the primary separator, such as by obstruction of a relay nozzle, had been known to result in the dump valve hanging open.

Included in the work scheduled on the day the casualty occurred was a routine pipe-cleaning operation consisting of running a "pig" through the lines coming to the platform from the wells. A pig is a device used to clean the inside of the pipe by propelling it through the pipeline with the pressure of the oil and gas mixture in the line. The leading edge acts as a scraper to remove built-up material from the walls. The pig is placed in the pipeline at the well-head end of the line and, after traveling the length of the line, is removed by means of a pig trap on the 43-A platform. The pig trap is a dead

end chamber in the pipeline fitted with isolation and bypass valves. It is normal to experience an increased oil volume ahead of an arriving pig and an increased gas volume behind it.

At the time of the casualty, the pig traps in three of the five lines coming to the platform had been lined up to receive pigs and the person in charge of the platform crew was on the level below the main deck operating the valves on one trap following the arrival of the first pig. He closed the trap stop valve and the 6-inch bypass valve and began opening the 10-inch stop valve in the main line to reestablish the normal flow. He heard a rush of gas and a bang and saw oil running down from the upper level in the vicinity of the corner of the storage tank. Fire followed the oil almost immediately.

The first evidence of unusual conditions on the main deck was the operation of the relief valve on the secondary separator. This was followed in rapid sequence by a rumbling sound in the storage tank, the spraying of the oil from the tank vents, rupture of the tank, a loud explosion-like noise, and fire. Attachment No. 2 indicates the hypothesis of the plant situation at the time of the casualty.

In analyzing the facts and the sequence of events, it appears that there is a relationship between the casualty and the operation of the pig, and that the following conditions existed and events transpired:

1. The liquid level in the separators was at a low operating level due to reduced amount of crude oil coming aboard with three of the five lines bypassed and therefore throttled at the pig traps.
 2. A large volume of gas arrived behind the pig.
-

3. The closing of the trap isolation and bypass valves prior to opening the main valve stopped all flow in that line, further reduced the amount of crude oil in the system, and permitted more gas rising through the elevated section of piping from the sea floor to displace the crude oil and accumulate behind the main valve.
4. As the main valve was opened, this large volume of gas passed immediately to the primary separator.
5. Gas passed through the primary separator dump valve(s) to the secondary separator, subjecting it to an above normal pressure and causing its relief valve to open.
6. Gas at approximately 230 p.s.i. passed through the secondary separator dump valve(s) and expanded into the storage tank causing the rumbling noise and the spray discharge from the vents.
7. The vents did not have the aggregate area to relieve this volume of gas at the high flow rate, and the tank was subjected to over-pressure.
8. The tank ruptured.
9. Fire developed immediately due to ignition of the spewing oil and gas mixture.

Insofar as ignition is concerned, the Coast Guard report indicates many possible sources involving the various pieces of equipment and fixtures on the platform or it could have been caused simply by sparks generated by and during the tank failure.

With regard to the high gas pressure in the secondary separator and the storage tank, it is logical to assume that this condition involved faulty operation of the dump valves on the primary and the secondary separators. A study of the valves, their method of operation, and operating experience indicate that the condition which developed most probably was the result of:

1. Dump valve hanging open.
2. Dump valve leaking.
3. Malfunction of the dump valve controller.
4. A combination of the above.

With the primary dump valve hung open, the oil level would be lowered to the point that the discharge pipe would lose its liquid seal, permitting high pressure gas to pass to the secondary separator. The crude oil in the secondary separator would be discharged to the storage tank at a higher than normal rate because of the much higher (230 p.s.i.) gas pressure behind it. With the secondary separator dump valve also hung open (not likely), or if the deterioration that the double-ported valve sustains in normal wear had resulted in its failure to seat tight against the oil flow from the secondary separator (most likely), the high gas pressure would force the oil through the valve until the secondary separator discharge pipe lost its liquid seal, permitting the gas to pass through to the storage tank. A leaking dump valve on the secondary separator would not be obvious at normal working pressure until its condition became severe. The flow and venting restrictions created by the characteristics of the construction of the storage tank as described in the Coast Guard report would also contribute to overpressure.

Continental Oil Company has advised that all of the platform equipment, with the exception of two water tanks and the heliport were so badly damaged by the fire that it was classified as junk and sold as such. The fire destroyed the physical evidence pertinent to the cause of the accident. Visual examination of the damaged equipment by Continental personnel did not shed any light on the cause of the casualty.

PROBABLE CAUSE

The Safety Board concludes that the investigative record in this case does not contain sufficient information to provide a determination of the cause of this casualty. However, based on the most likely hypothesis, the Board concludes that the most probable cause was faulty operation of two of the four dump valves of the separators in a chain of events combined with a malfunction of the primary dump valve controller during the pipe cleaning operation which allowed a large volume of high pressure gas to enter the storage tank, rupturing it.

RECOMMENDATIONS

The Safety Board concurs with the Commandant relative to the recommendations of the Marine Board. In addition, the Board makes the following recommendation :

1. That the Department of Transportation, in conjunction
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with the Department of the Interior, study the need for safety regulations or the revision of regulations for fixed and mobile drilling and production units operating on the outer continental shelf, including the operating equipment, the methods and operations used in drilling for and the production of oil, gas, or other subsoil minerals, and the transportation thereof by pipeline.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

Adopted this 21st day of May, 1969:

[Redacted]
[Redacted] Chairman

[Redacted]
[Redacted] Member

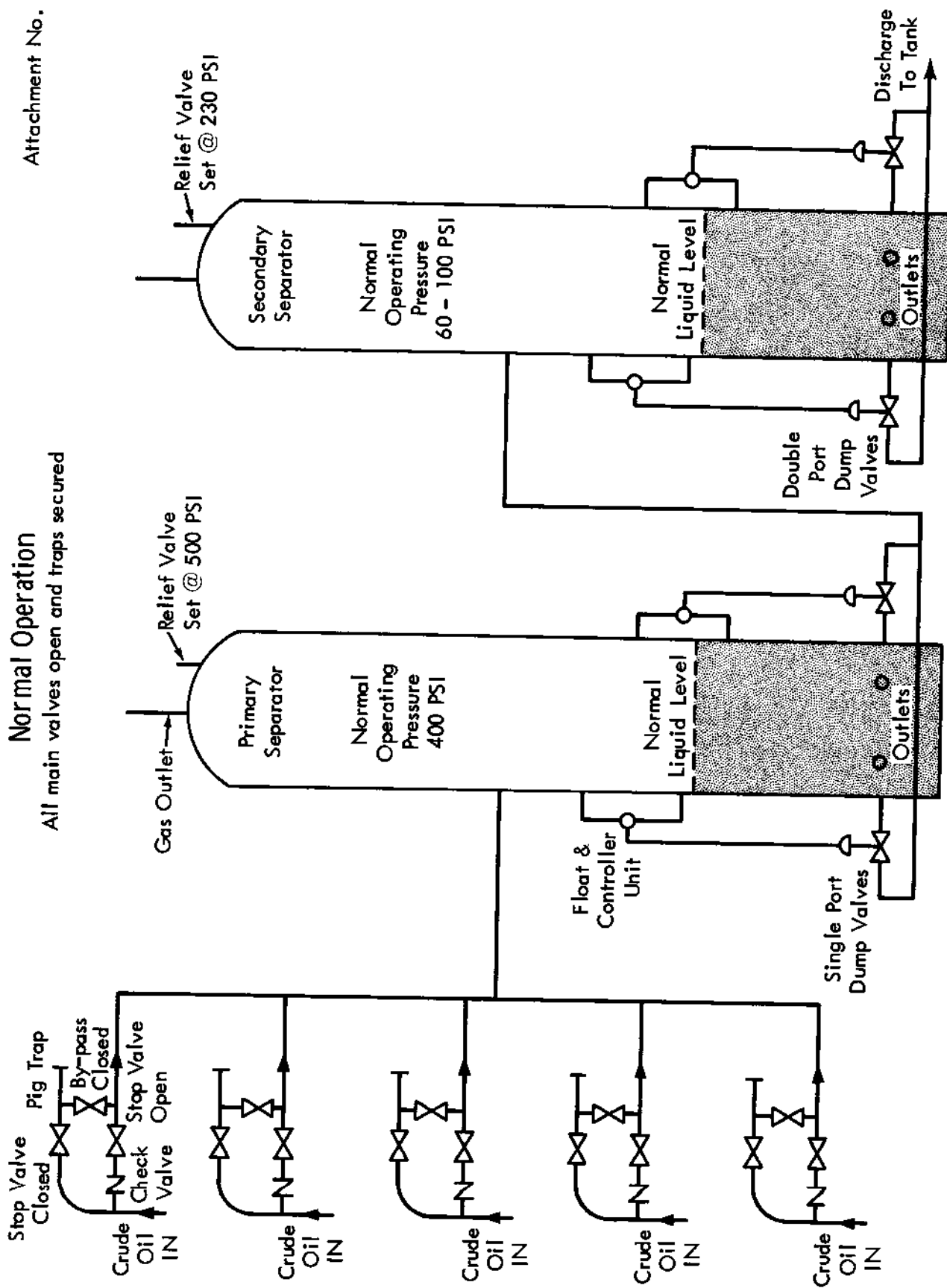
[Redacted], Member

[Redacted]
[Redacted] Member

[Redacted]
[Redacted] Member

Normal Operation

All main valves open and traps secured



Situation at Time of Casualty

Stop Pig arrived in trap.
 Closed Trap Inlet & By-pass were closed
 Main flow valve was being opened
 when Storage Tank ruptured.

