

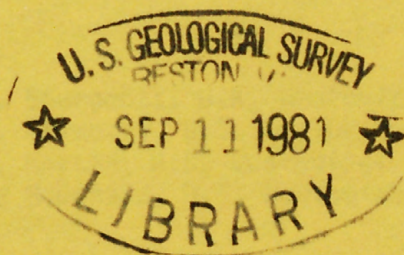
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INVESTIGATION OF AUGUST 1980
BLOWOUT AND FIRE, LEASE OCS-G 4065
MATAGORDA ISLAND BLOCK 669, GULF OF MEXICO
OFF THE TEXAS COAST



U.S. Geological Survey
Open File Report 81-706



Investigation of August 1980
Blowout and Fire, Lease OCS-G 4065
Matagorda Island Block 669, Gulf of Mexico
Off the Texas Coast

By

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Geological Survey**

Open File Report 81-706

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I. INVESTIGATION AND REPORT

A. Authority

By memorandum dated October 21, 1980, pursuant to Section 208 (Subsection 22 d, e, and f) of the OCS Lands Act Amendments of 1978, and Department of the Interior Regulation 30 CFR Part 250, the following U.S. Geological Survey Conservation Division personnel were named to serve as an Investigative Panel:

D. J. Bourgeois
R. J. Melancon
W. H. Martin
Price McDonald

In addition, L. Poe Leggette, Staff Attorney, Solicitor's Office, Division of Energy and Resources, Department of the Interior, was designated as legal advisor to the Panel.

The Panel was assigned to conduct an investigation and to prepare a public report of the blowout and fire which occurred on August 30, 1980, on the jackup mobile drilling rig, Ocean King. Drilling operations were being conducted on the Cities Service Company's Well No. 1, Lease OCS-G 4065, Matagorda Island Block 669, Gulf of Mexico, offshore the State of Texas. The Panel was granted subpoena authority, and by consensus of the Panel, Cities Service Company and Getty Oil Company as co-lessees, and Ocean Drilling and Exploration Company as drilling contractor, were designated parties-in-interest to the investigation. Getty Oil Company was subsequently dismissed as a party-in-interest to the investigation.

B. Procedures

Formal public hearings were convened in Metairie, Louisiana, on December 8, 9, 10, and 11, 1980, and January 22, 1981. As parties-in-interest, Cities Service Company and Ocean Drilling and Exploration Company were represented by counsel at the hearing and were privileged to cross-examine all witnesses. Testimony was taken from 22 witnesses at the sessions in Metairie, Louisiana: 13 Ocean Drilling and Exploration Company employees, 5 Cities Service Company employees, 1 employee of The Analysts, Inc., 1 employee of Halliburton Offshore Services, 1 Schlumberger employee, and 1 employee of Burns Directional Drilling Company. In addition to the sessions in Metairie, Louisiana, testimony was taken on January 23, 1981, from the mud engineer, employed by Dresser-Magcobar, at his residence, 9206 Benning Street, Houston, Texas. All members of the Panel were present for the complete conduct of the hearing.

In all, testimony was taken from 23 witnesses (see Appendix, List No. 1). These witnesses were selected to participate in the hearing in order to have a complete representation of personnel who were on the rig and involved in the well-control operations and also with separate times and methods of evacuation. Their recollections and actual eyewitness accounts of the activities leading up to the blowout and the events that took place on the evening

of August 29 and the early morning hours of August 30, 1980, were of primary consideration. Six of the witnesses were only involved in telephone communications with the rig personnel from the respective Cities Service Company office in Houston, Texas, or Ocean Drilling and Exploration Company office in New Orleans, Louisiana. The witnesses represent all companies which had personnel on the rig except ARA Company, the catering subcontractor. The Panel utilized numerous documents and other information including records submitted by both Cities Service Company and Ocean Drilling and Exploration Company; data from Gulf of Mexico Region lease and well files; and other relevant regulatory, administrative, and procedural documents. Both Cities Service Company and Ocean Drilling and Exploration Company cooperated fully with the Panel in the scheduling of witnesses, in providing requested information and in conducting the hearing.

All testimony was taken under oath, and the verbatim record of the entire proceedings was made by the same certified court reporter, Bay State Reporting Company. The verbatim record consists of 938 pages of testimony, plus 6 exhibits, and is included in this report by reference only. Copies of the transcript and exhibits are available for review in the case file at the U.S. Geological Survey's office at 3301 North Causeway Boulevard, Metairie, Louisiana, and in the office of the Chief, Conservation Division, 12201 Sunrise Valley Drive, Reston, Virginia.

II. INTRODUCTION

A. Background

Lease OCS-G 4065 covers 5,760 acres described as Block 669 of the Matagorda Island Area, Gulf of Mexico, off the Texas Coast (see Figure No. 1). The lease was initially issued effective October 1, 1979, to Cities Service Company (50 percent) and Getty Oil Co. (50 percent) for a cash bonus of \$14,659,200 with a fixed sliding-scale royalty rate and annual rental of \$3 per acre. Cities Service Company was designated operator by Getty Oil Company on October 1, 1979. Cities Service Company had contracted with Ocean Drilling and Exploration Company to conduct the drilling operations on lease OCS-G 4065.

The initial Exploration Plan for lease OCS-G 4065 was submitted by Cities Service Company on December 18, 1979. The plan proposed the drilling of six wells to determine the hydrocarbon potential of the lease and was approved by the Oil and Gas Supervisor, Operations Support, on January 30, 1980. The Application for Permit to Drill (Form 9-331C) was submitted to the Freeport District Office on February 13, 1980, and was approved by the District Supervisor on February 22, 1980. The well was to be drilled from a surface location described as 1600' from the north line (FNL) and 1400' from the west line (FWL) of Matagorda Island Block 669 to a bottom hole location of 1600' FNL and 6250' FWL at a proposed total depth of 15,479' measured depth (MD) (see Figure No. 2).

B. Description of Incident

On June 1, 1980, the jackup mobile drilling rig, Ocean King, arrived on location in Matagorda Island Block 669, and Well No. 1 was spudded on June 3, 1980. Thirty-inch drive pipe was driven to 414' MD (216' below the mudline), 20" conductor casing was set and cemented at 1133' MD, 13 3/8" casing was set and cemented at 4479' MD, 9 5/8" intermediate casing was set and cemented at 10,337' MD, and the well was drilled to a total depth of 13,794' MD as of August 24, 1980.

On June 16, 1980, at a depth of approximately 4610' MD, directional drilling operations commenced. From August 24 to August 29, 1980, after completing the hole, operations on Well No. 1 involved logging, fishing, and circulating and conditioning the drilling fluid, with at least two incidents of gas cut mud being reported. A hydrocarbon-bearing sand section was encountered at a depth of 12,030' MD. Mud weight was maintained at 16.8 pounds per gallon (ppg).

At approximately 5:30 p.m. on August 29, 1980, after removal of 25 stands (90'/stand) of drill pipe, the rig crew realized that the well bore was not taking the proper volume of drilling fluid for fill-up. The Ocean Drilling and Exploration Company driller stopped the trip out of the hole, and notified the Cities Service Company representative on the rig of the situation. Apparently both agreed that swabbing of reservoir fluid into the wellbore had occurred and that the drill pipe should be returned to the bottom of the hole for circulating and conditioning of the mud system. This was reported by telephone by the Cities Service Company representative to the drilling superintendent in Houston, Texas, who concurred in this procedure. Based upon testimony of witnesses at the hearing, this procedure involved direct circulation of the mud system with returns over the shale shaker and not through the choke manifold.

At about 8:00 p.m., after the drill pipe was returned to bottom and while circulation continued, the Ocean Drilling and Exploration Company floor-hand, assigned to observe the mud returns across the shale shaker, informed the driller that the mud flow had increased significantly. The Analysts, Inc. (mud monitoring service company) representative also reported to the driller an increase of gas content in the mud system of up to 800 units. By 8:30 p.m., gas and mud were spurting out of the bell nipple and through the rotary, 5' to 10' over the drill floor every 10 to 15 seconds. This was shown to the Magcobar mud engineer who reported the situation to the Cities Service Company representative and the Ocean Drilling and Exploration Company toolpusher. They immediately left the recreation room in the living quarters for the drill floor to discuss the matter with the driller.

The annular preventer was closed at approximately 8:45 p.m. with initial shut-in pressures reported as 2000 pounds per square inch (psi) on the casing and 0 psi on the drill pipe. The Cities Service Company representative again reported by telephone to the drilling superintendent, and they decided to pump the now-surfaced gas bubble out of the well bore. Circulation was resumed with returns through the choke manifold. At about 9:15 p.m., the casing pressure rose to approximately 3700 psi at which point the annular preventer failed, and mud spurting out of the wellbore, up the derrick, covering the drill floor. Very shortly thereafter, the Ocean Drilling and

Exploration Company derrickman reported that the mud pits were overflowing and estimated a gain of 80 barrels (bbl) within 4 to 5 minutes. The lower pipe rams were closed immediately by the Ocean Drilling and Exploration Company driller. So that circulation could be attempted through the choke manifold, the upper pipe rams were closed, pressure between the rams was equalized, and the lower rams were reopened (see attachment No. 1). Essential well control apparently was lost by this time, due to the continued influx of reservoir fluids into the wellbore, expansion of the gas bubble displacing drilling fluid from the casing annulus, and the sharp rise in casing pressure from 2000 psi to 3700 psi in approximately 30 minutes.

The casing pressure continued to rise, and the Ocean Drilling and Exploration Company derrickman had revised the mud pit gain estimates to be as much as 250 bbl. This indicated that approximately half of the drilling fluid had been displaced from the casing-drill pipe annulus.

By 10:00 p.m., the casing pressure had risen to 4800 psi; by 11:00 p.m., to 5400 psi; and at 11:15 p.m., to 5520 psi, still with 0 psi on the drill pipe. During these time frames, attempts were made to lower the well pressures by alternately bleeding gas through the choke manifold and pumping with the Halliburton pumps, a few strokes at a time, a total of 3 3/4 bbl of mud into the casing-drill pipe annulus. Following this effort, gas from the casing was vented while pumping approximately 80 bbl of 16.8-ppg mud down the drill pipe.

A total of 39 persons was aboard the rig, Ocean King, on August 29, 1980, (see Appendix, List No. 2). At about midnight, the off-duty and nonessential personnel, who had been standing by since about 9:30 p.m. preparing to evacuate the rig, were lowered onto the standby boat, MV Gulf Fleet 32. Twenty-two personnel were safely evacuated, leaving 17 crewmen aboard to attempt to regain control of Well No. 1. The Ocean Drilling and Exploration Company toolpusher and both drillers were on the rig floor monitoring pressures and directing the other crew members in the pumping operations. The Cities Service Company representative remained in the office maintaining communication with the rig floor by intercom, the standby boat by radio, and the Cities Service Company Houston office by telephone. The Magcobar mud engineer and a few Ocean Drilling and Exploration Company personnel were in and out of the same office during this time.

At about 12:45 a.m., August 30, 1980, the casing pressure reached 7300 psi. Rig personnel heard a dull explosion, felt the rig vibrate, and noted a sudden drop in the casing pressure to 4900 psi. Six additional crewmen climbed down the escape net or stairway to the standby boat at this time, leaving 11 personnel aboard the rig. Apparently, the 9 5/8" casing had ruptured just below the blowout preventers and casingheads (see attachments No. 2 and 3).

At about 2:00 a.m., August 30, 1980, a radio request was made to the nearby rig, Loffland 75, to mix and deliver 400-500 bbl of heavy liquid mud. The Loffland rig was operating about 9 miles to the southwest on another Cities Service Company lease at Matagorda Island Block 686. For the next

2 hours or so, the casing pressure fluctuated between 4900 and 5500 psi, as various attempts were made to pump mud into the drill pipe and choke the returns or to pump mud into the casing and periodically bleed gas through the choke manifold.

At about 4:30 a.m., the Cities Service Company representative and the Ocean Drilling and Exploration Company toolpusher attempted to install a pressure gauge at the casinghead below the rig floor to determine the pressure on the 13 3/8" casing. The gas flow between the 9 5/8" and the 13 3/8" casings could be heard, so the gauge was not installed. The attempts to kill the well were thereafter limited to pumping down the drill pipe using the rig pumps. With continued pumping, the casing pressure declined to as low as 4200 psi.

At about 6:15 a.m., the 13 3/8", 20", and 30" casing strings failed just below the casingheads and blowout-preventer stack. Gas was suddenly released to the atmosphere, and in just a few seconds a fire ignited, an explosion occurred, and flames engulfed the rig (see Photos No. 1 and 2). Of the 11 men aboard the rig at the time of the explosion and fire, 2 were picked up from the water by the MV Mr. David, 6 were picked up from the water by the MV Gulf Fleet 32, and 3 were noted to be missing and presumed dead. Of the eight recovered, two died of asphyxia due to drowning, and six sustained injuries ranging from severe body burns to slight facial and arm burns to broken ribs.

The fire burned until extinguished at 5:00 p.m. on September 1, 1980. The well had bridged at 12:00 noon. The rig was heavily damaged on the main and machinery decks with the loss estimated at \$30,000,000 (see Photo No. 3).

III. FINDINGS

A. Preliminary Activities

The 9 5/8" casing string was run on July 14, 1980, so actual operations had been conducted in the casing for 41 days prior to the blowout, considering a short shutdown due to Hurricane Allen. OCS Order No. 2, Section 3.6 requires, "In the event of prolonged drill pipe operations which could cause damage to the casing, the casing shall be pressure-tested, calipered, or otherwise evaluated, as approved by the District Supervisor." The 9 5/8" casing had not been pressure-tested or calipered during the 41-day period after July 14, 1980.

Directional drilling operations in the 9 5/8" casing began on July 16, 1980, and continued through August 24, 1980. The normal problems for directional drilling were encountered, such as stuck pipe, fishing for wire-line tools, numerous surveys, building the angle, the pipe moving laterally while drilling, numerous trips in and out of the hole, and torque problems with the pipe assembly. The directional driller indicated that the problems encountered in the drilling of Well No. 1 were normal for such a high-angle well.

A packoff was installed in the 9 5/8" casinghead to serve as a wear bushing

to protect the casing from undue wear by drill pipe action in the upper portion of the hole. When the packoff was eventually retrieved, Cities Service Company personnel noted that it was well worn. Further examination of a piece of the 9 5/8" casing removed from just below the casinghead indicated that one side was worn to a 1/8" (0.125 inch) thickness (see Photo No. 4). In comparison, manufacturer's specifications on the same 9 5/8", 47#/ft., S-95 grade casing, which was used in Well No. 1, indicate a new pipe wall thickness of 0.472 inch and a corresponding internal yield pressure rating of 8150 psi.

On August 28, 1980, fishing operations for logging tools were completed. On August 29, 1980, the mud was circulated and conditioned for 5 or 6 hours in preparation for a logging run through the drill pipe. The drill crew began pulling the drill string about 5:00 p.m. After removing approximately 15 stands, the drill crew suspected that the hole was not taking the correct amount of mud from the fill-up tank to fill the hole properly.

B. Loss of Well Control

After pulling 10 more stands (a total of 25 stands or 2250' of drill pipe) and assuring that the hole was not filling properly, the driller stopped pulling the drill pipe and discussed the condition with the Ocean Drilling and Exploration Company toolpusher and the Cities Service Company representative. Apparently, all agreed to return the drill assembly to bottom and to circulate and condition the hole in order to pump the gas bubble from the system. This decision to circulate bottoms up was discussed by telephone with the Cities Service Company drilling superintendent, who agreed with this procedure. While circulating the well, the driller took no action to shut in the well and check for flow. Such action is basic in response to a well kick in order to maintain well control. Cities Service Company personnel revealed in testimony that they normally utilize the Driller's Method for controlling a kick. Thus, well-control procedures, as described in the Cities Service Company's Well Control Operational Manual, were not followed.

At approximately 8:00 p.m., after 30 minutes of circulation, The Analysts, Inc. representative reported to the driller that 800 units of gas were detected at the surface. Also, the Ocean Drilling and Exploration Company floor hand at the shale shaker reported to the driller signs of gas and increased flow at the shaker. Shortly thereafter, with the loss of mud over the shaker, the pumps were slowed. Eventually, a valve was partially opened upstream of the shaker to divert the flow and minimize the loss of mud.

At approximately 8:30 p.m., gas and mud began spurting above the rotary bushing about 5 to 10 feet in the air. This occurred approximately 1 hour after circulation began. The Cities Service Company geologist noticed the flow and reported it to the Magcobar mud engineer, who reported to the Cities Service Company representative. The company representative and the Ocean Drilling and Exploration Company toolpusher were playing cards with others in the rig recreation room at the time the flow was first observed.

All four men walked to the drill floor; and in a short period of time, the driller was instructed to shut the well in with the annular preventer and

to circulate the well on the choke. When the annular preventer was closed at approximately 8:45 p.m., the drill pipe and casing pressures were reported to be 0 psi and 2,000 psi, respectively.

During these operations, the mud monitoring system was not working correctly. The pit level indicator could not operate properly because the mud level in the pits was so high that the alarm could not be actuated if a mud gain occurred. The arms and floats in the active pits were jammed against pit beams such that the alarm for the mud pit level at the drill floor was inoperable (see Photo No. 5).

While walking to the drill floor about 9:00 p.m., the derrickman noticed that the annular preventer was closed and spoke to the driller concerning the well condition. When he returned to the mud room afterwards, he noticed that the mud pits were overflowing. He reported a gain of 45 bbl initially, but this was soon changed to 80 bbl, and then to approximately 180 bbl. His final estimate was 250 bbl gained. Although presumably in the mud room area for nearly 2 hours prior to these happenings, the derrickman gave no indication of a pit level increase during this time.

At approximately 9:15 p.m., the annular preventer, which was rated for 5,000 psi and normally tested to 3,500 psi, failed when the casing pressure reached 3,700 psi. The lower pipe rams were immediately activated. With regard to the annular preventer, numerous trips were made with the drill pipe, and numerous pressure tests were made on the preventer during some 74 days of operations following its installation.

During the period of time from returning the drilling assembly to bottom and commencing circulation until the annular preventer failed, communication between the toolpusher, the driller, the derrickman, and the floor hand at the shale shaker was definitely lacking. Too much time elapsed from the time the flow was detected until the annular preventer was closed. A determination was not possible as to whether or not the driller reported the kick to the Cities Service Company representative prior to the time the geologist observed drilling mud spurting up through the rotary.

C. Attempts at Restoring Well Control

The lower pipe rams were immediately activated after the annular preventer failed, and then the upper pipe rams were closed. After equalizing pressure between the upper and lower rams, the lower rams were opened. At this point the annular pressure was approximately 4,800 psi.

Shortly after 10:00 p.m., the Halliburton pumps were utilized to lubricate mud into the annulus. At 11:00 p.m., the casing pressure had reached 5,400 psi. Attempts to maintain or perhaps lower the casing pressure by bleeding gas through the choke manifold and later to do so by pumping mud down the drill pipe were unsuccessful.

With the rising casing pressures, Cities Service Company representatives in the Houston office discussed with the company representative on the rig the possibility of venting the well to the atmosphere. This option was not

exercised even though the limiting pressure of 6500 psi on the 9 5/8" casing, as determined by 80 percent of the internal yield pressure, was exceeded. Testimony during the hearing indicated that Cities Service Company personnel were not overly concerned with the 3450 psi internal yield pressure rating of the 13 3/8" casing, even though the 13 3/8" casing was exposed for several hours to the higher pressures on the 9 5/8" casing. The actual pressure on the 13 3/8" casing was never established.

With the casing pressure at 7200 psi, at approximately 12:45 a.m. on August 30, 1980, another attempt was made to bleed gas and reduce the casing pressure, but this was halted by the toolpusher's action to close the choke when condensate and mud began flowing through the choke manifold instead of gas. At this time, the 9 5/8" casing ruptured just below the blowout-preventer stack (see attachment No. 3). The casing pressure had been allowed to reach 7300 psi without the well being vented.

Additional supplies of heavy liquid mud were ordered from shore and from the Loffland 75 rig. After the 9 5/8" casing failure, additional mud was pumped down the drill pipe and also bullheaded down the annulus. At approximately 4:30 a.m. on August 30, 1980, after determining that the well flow could be heard inside the 13 3/8" casing and not being able to install a pressure guage, Cities Service Company decided to pump the mud remaining in the pits down the drill pipe.

D. Explosion and Fire

The sudden release of gas at high pressure from the casing strings just below the blowout-preventer stack was described as a heavy white cloud which ignited in a few seconds. The flames spread rapidly with a blowtorch effect. The source of ignition was not determined. Sometime later, fire on the water developed. The gas feeding the fire on the water was flowing from holes in the casing strings about 20 feet below the mud line.

E. Emergency Warning and Evacuation

After the annular preventer failed at approximately 9:15 p.m., all personnel not directly involved in the operations were instructed to go to their abandon ship stations near the two Whittaker capsules. The Cities Service Company representative and the crane operator alerted all off-duty personnel. The crane operator made additional checks in the quarters to assure that all nonessential personnel were awakened and aware of the situation. The general alarm was not sounded. Twenty-two nonessential personnel were safely evacuated shortly after midnight on August 30, 1980; 17 people remained on board. At approximately 12:45 a.m., six other personnel evacuated when the 9 5/8" casing failed. Again, the general alarm was not sounded, but the men were told to leave the rig. Eleven people remained on the rig to continue efforts to regain control of the well. In spite of discussions to vent the well while within the 80 percent internal yield pressure limits of the 9 5/8" casing in the interest of personnel safety, a decision was not made for all personnel to evacuate the rig even when flow was known to exist in the 13 3/8" casing at approximately 4:30 a.m.

F. Deaths and Damage

The explosion and fire resulted in Ocean Drilling and Exploration Company employees Bessonnette, Snelling, and Smith being declared missing and presumed dead. Ocean Drilling and Exploration Company employee Blanco and Cities Service Company employee Bailey died in abandoning the platform during the fire. The bodies of Messrs. Blanco and Bailey were recovered from the water by the crew on the MV Gulf Fleet 32 on August 30, 1980. Copies of the State of Texas certificates of death are included as attachments No. 4 and 5. The six survivors who were on the rig when the fire occurred sustained injuries of varying degrees.

The rig, Ocean King, was extensively damaged, including three bent legs, a number of structural cross members severed, and numerous holes in the barge. The living quarters, drill floor, and machinery room were heavily damaged by the fire (see Photo No. 3).

IV. CONCLUSIONS

A. The Proximate Cause of Incident

1. The evidence at hand indicates that the well was swabbed while tripping out of the hole to prepare for a through-drill-pipe logging run.
2. The loss of well control resulted from:
 - a. a swabbing action while hoisting drill pipe through a hydrocarbon-bearing sand allowing formation gas to enter the wellbore.
 - b. the continued removal of at least 10 stands of drill pipe after the wellbore no longer accepted the calculated volume of drilling mud for proper fill up.
 - c. the failure to take note of early increased mud flow warnings and to shut in the well for a flow check.
 - d. the apparent unloading of a large amount of mud due to the circulation and natural rise of formation gas up to a level where rapid near-surface expansion took place, which allowed continued influx of formation fluids.
 - e. the failure on the part of the driller to immediately close the annular preventer upon first indication of mud flow from the hole through the rotary.
 - f. the failure of the annular preventer as a result of its continued use during prolonged drilling operations. These operations caused wear on the preventer rubbers which eventually affected the pressure-holding capacity of the equipment.

B. The Proximate Cause of Explosion and Fire

The proximate cause of the explosion and fire was the failure of the 9 5/8" casing under pressure just below the blowout-preventer stack and casinghead. This failure resulted in the release of drilling mud and formation gas under high pressure into the 13 3/8" surface casing. With release of the well flow into the 13 3/8" casing, the casing shoe broke down and the surface pressure dropped considerably. Several hours later, the 13 3/8" surface casing ruptured, resulting in (1) the release of well fluids into the 20" conductor casing at a pressure in excess of the 20" casing and the 30" drive pipe internal yield pressure; (2) the failure of both the 20" and 30" casings shortly thereafter; and (3) the release of well fluids into the atmosphere. In a matter of seconds, ignition of the gaseous hydrocarbons by an unknown source occurred resulting in:

1. An explosion and fire which engulfed the drilling rig.
2. Deaths, presumptive deaths, injuries, and extensive damage to the well and drilling rig.

The precise cause of ignition of the escaping gases has not been identified. However, the following are likely causes:

1. Spark created by metal or debris striking metal.
2. Spark or heat from the exhaust system of the generator's prime mover, from the generator, or from some other source in the rig's electrical system.

Sometime after ignition, the 13 3/8", 20", and 30" casings burst below the mud line allowing total release of the well. These holes were located by divers soon after the incident.

C. The Proximate Cause of Deaths and Presumptive Deaths

1. Deaths in evacuating the drilling rig

Messrs. Bailey and Blanco, although wearing life jackets, died of asphyxia due to drowning. Both suffered injuries while on the rig from the explosion and fire, and these injuries are presumed to have contributed to the drownings.

2. Presumptive deaths on the drilling rig

Messrs. Bessonette and Smith were last seen on the drill floor, are still missing, and are presumed to have died of injuries at the site of the explosion and fire. Mr. Snelling was last seen near the living quarters, is still missing, and is presumed to have died of injuries sustained at the site of the explosion and fire.

D. The Contributing Causes

1. Loss of well control

- a. The excessive mud level in the mud tanks prior to the incident was sufficient to render the mud pit level monitor and warning alarm inoperative.
- b. With the existence of the condition described in (a.) above, procedures were not established to assure that any pit level rise, while circulating out the formation fluids intrusion, would be promptly noted.

2. Explosion and fire

- a. Directional drilling operations in the 9 5/8" casing had been conducted over some 41 days, a sufficient time for the casing wall to be worn, thereby reducing casing integrity (see Photo No. 4). Apparently, when high pressures were encountered, no particular consideration was given to determining a lesser internal yield pressure as a result of the probable wear.
- b. Failure to investigate possible communication between the 9 5/8" and 13 3/8" casings on the part of Ocean Drilling and Exploration Company and Cities Service Company personnel when the pressure on the 9 5/8" casing dropped from 7,300 psi to 4,900 psi approximately 5 hours prior to the explosion and fire. If a check had been made on the existence of flow in the 13 3/8" casing, decisions on venting the well and evacuating all personnel may have been different.

3. Deaths

Failure of responsible personnel to consider the worst situation, that communication between the 9 5/8" and 13 3/8" casings had occurred, and to take appropriate action to vent the well and evacuate all personnel from the rig.

V. RECOMMENDATIONS

A. That OCS Order No. 2 be revised to require the following:

1. A mud monitoring system which will activate both audio and visual alarms at two or more stations when mud levels of active pits change more than 5 bbl, and which alarms cannot be pegged out of service.
2. A limit of 30 days to conduct actual drilling or completion operations in a casing string without evaluating the integrity by: (1) determining by survey that the casing retains at least 87.5 percent wall thickness, or (2) pressure testing the casing to 70 percent of the original internal yield pressure. If the casing integrity is not confirmed, operations shall not commence until an additional casing string or liner tieback is run.

3. Venting the well and evacuating the rig when the flow is essentially gas and when well pressure exceeds 80 percent of the original or recalculated internal yield pressure of the affected casing string.
 4. The installation of a wear bushing or casing packoff for drill pipe operations below surface casing.
 5. A statement in the Application for Permit to Drill (Form 9-331c) where mudline casing hangars are planned to be used, giving information as to type and depth of installation.
 6. Directional drilling specialist personnel be trained and qualified in accordance with USGS OCS Standard No. TI (GSS-OCS-TI). These specialists in the normal course of their duties often relieve or replace the driller and are directly involved in recommendations and/or decisions affecting a critical segment of the drilling operations.
 7. The installation of a pressure gauge to monitor surface casing annular pressure after setting intermediate casing.
- B. That the Director's designee assign the following apparent violations to a Reviewing Officer for further action pursuant to 30 CFR 250.80:
1. OCS Order No. 2 Section 6.2 requires a recording mud pit level indicator with a visual and audio warning device to determine pit volume gains and losses (see Conclusion D.1.a.).
 2. The approved casing program for Well No. 1 included the setting of 7" casing at a depth of 13041' MD. In fact, Well No. 1 was drilled to a depth of 13794' MD for the installation of a 7" liner or full casing string. The approved plan was neither modified nor was approval obtained from the Freeport District Supervisor to drill deeper before setting the 7" casing (see 30 CFR 250.92(a)).

List No. 1
Witnesses at Hearing

Cities Services Company

Kenneth A. Shorck
James M. Eagan
Donald Oliver
William W. Langford
Robert S. Hutton, Jr.

Ocean Drilling and Exploration Company

Carl L. Snelling
Otis M. Roy
Freddie W. Halbrook
Glen E. Mitchell
Elton Randall Stokes
James L. Chatham
Norman G. Hobbs
Alfred E. Sykes
Joe D. Pope
Palmer Smith
Warren S. Hahn
Clarence O Bourne
James D. Adams

Schlumberger Offshore Services

Jeffrey M. West

The Analysts, Inc.

Kahn S. Abrar

Burns Directional Drilling Company

Johnny G. Soileau

Halliburton Offshore Services

Clarence Bone

Dresser-Magcobar

Arthur Sims

List No. 2Personnel on Drilling Rig, Ocean King

There were 39 persons aboard the Ocean King on August 29, 1980, when the well control problem began, of which 22 were safely evacuated shortly after midnight, and 6 more evacuated at about 12:45 p.m. on August 30, 1980. Of the 11 who remained aboard the rig, 2 are known dead, 3 are missing and presumed dead, 2 suffered severe burns, and 4 sustained minor injuries and slight burns.

The 39 persons who were on the drilling rig are identified as follows:

A. Cities Service Company

1. *Parvin N. Bailey, Drilling Specialist.
2. Kenneth A. Shorck, Senior Engineer
3. James M. Eagan, Senior Geologist

B. Ocean Drilling and Exploration Company

1. **Lonnie D. Bessonette, Toolpusher
2. **Gary W. Snelling, Driller
3. **Samuel L. Smith, Jr., Driller
4. *William J. Blanco, Mechanic
5. ***Clarence O. Bourne, Derrickman
6. ***Otis M. Roy, Motorman
7. ***Joe D. Pope, Electrician
8. Jeff Lewis, Floorman
9. Norman G. Hobbs, Floorman
10. Marty Evans, Floorman
11. Freddie W. Halbrook, Derrickman
12. Alfred E. Sykes, Floorman
13. Morgan Perry, Floorman
14. James L. Chatham, Floorman
15. Clarence Singleton, Welder
16. Daniel Boothe, Motorman
17. Elton R. Stokes, Roustabout Pusher
18. Eldon Price, Roustabout Pusher
19. Carsie Barnes, Roustabout
20. Deborah Ryder, Roustabout
21. James Ward, Roustabout
22. Carl Snelling, Roustabout
23. Michael Brown, Roustabout
24. Donald Walker, Roustabout
25. Glen E. Mitchell, Industrial Relations Representative

C. The Analysts, Inc.

1. Khan S. Abrar, Unit Manager

D. Dresser-Magcobar

1. ***Arthur E. Sims, III, Mud Engineer

E. Halliburton Offshore Services

1. ***Clarence W. Bone, Cementer
2. ***Wilson W. Vowell, Cement Equipment Operator

F. Schlumberger Offshore Services

1. Jeffrey M. West, General Field Engineer
2. Wayman Teamer, Operator
3. Paul Tipton, Operator

G. ARA Company

1. James Godrich, Utilityman
2. Joseph H. Hunt, Head Cook
3. Al Germaine, Night Cook
4. Harold Gribble, Utilityman

* Deceased

** Missing and presumed dead

*** Injured

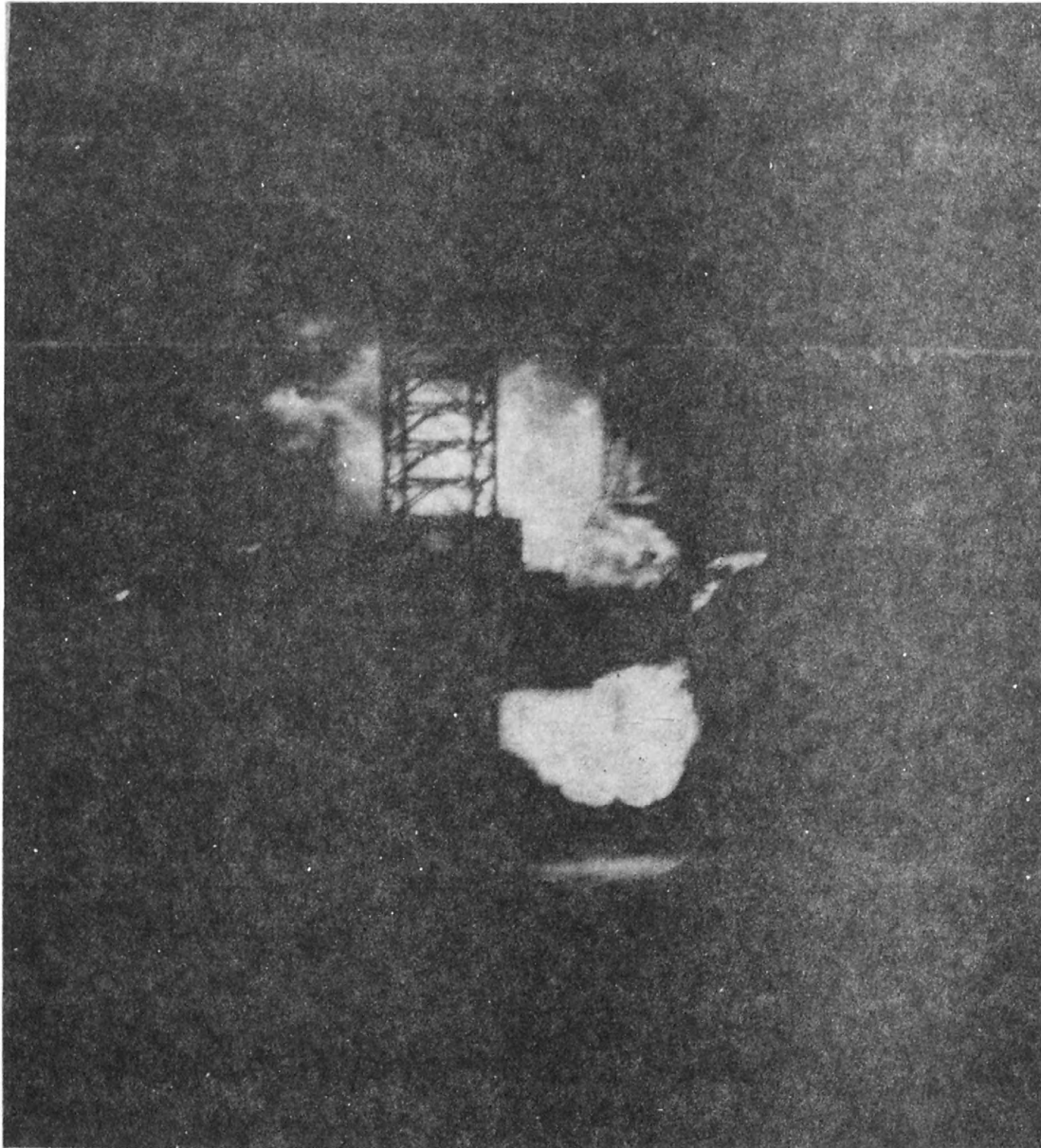
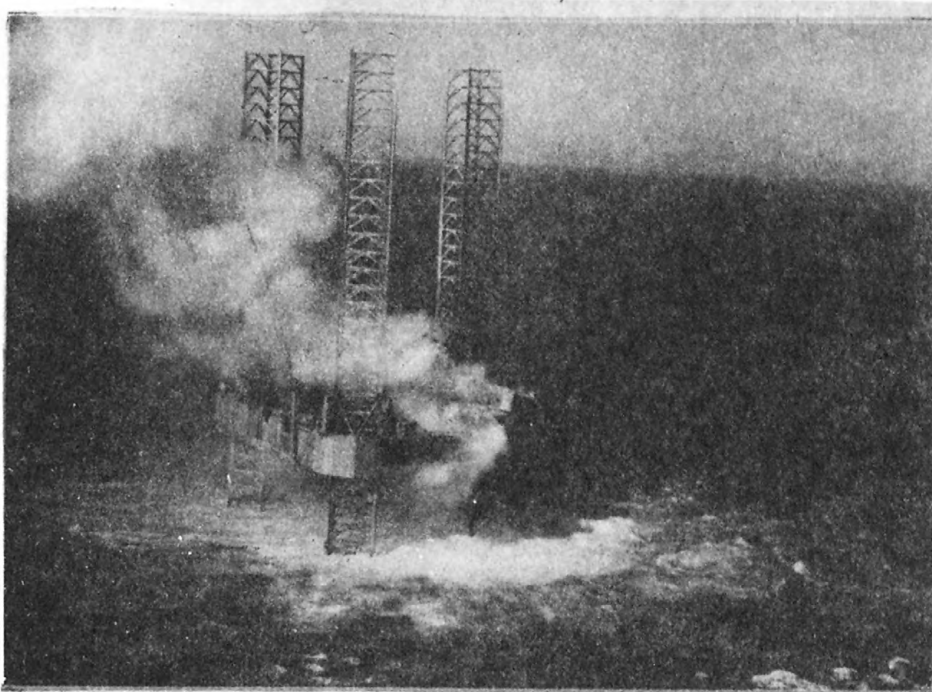


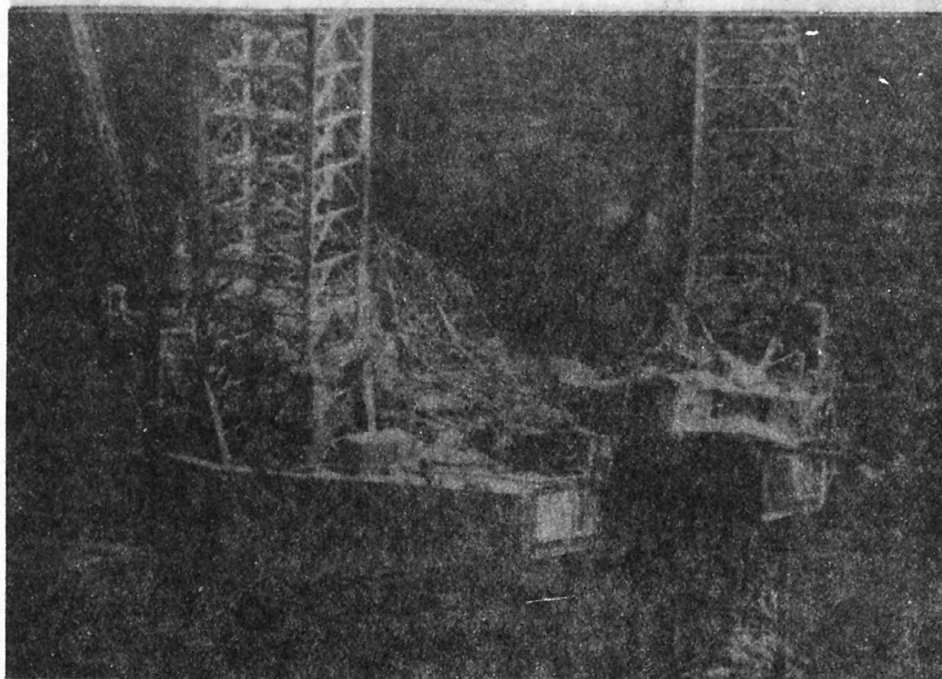
Photo No. 1
Date: August 30, 1980, 6:30 a.m.
Location: Matagorda Island Block 669
Gulf of Mexico, off Texas coast
DESC: View of fire on rig, Ocean King
from MV Gulf Fleet 32



Date: August 30, 1980, a.m. Location: Matagorda Island
Block 669, Gulf of Mexico
off Texas coast

DESC: View of fire on rig, Ocean King, from helicopter

Photo No. 3

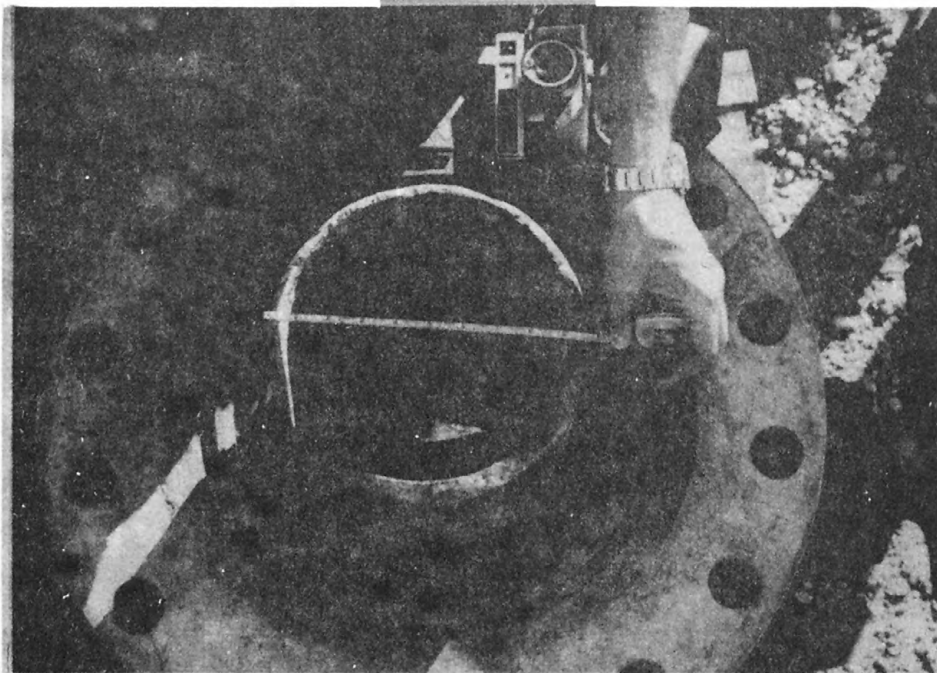


Date: September 1, 1980, p.m. Location: Matagorda Island
Block 669, Gulf of Mexico

DESC: View of damage to rig, Ocean King, from helicopter

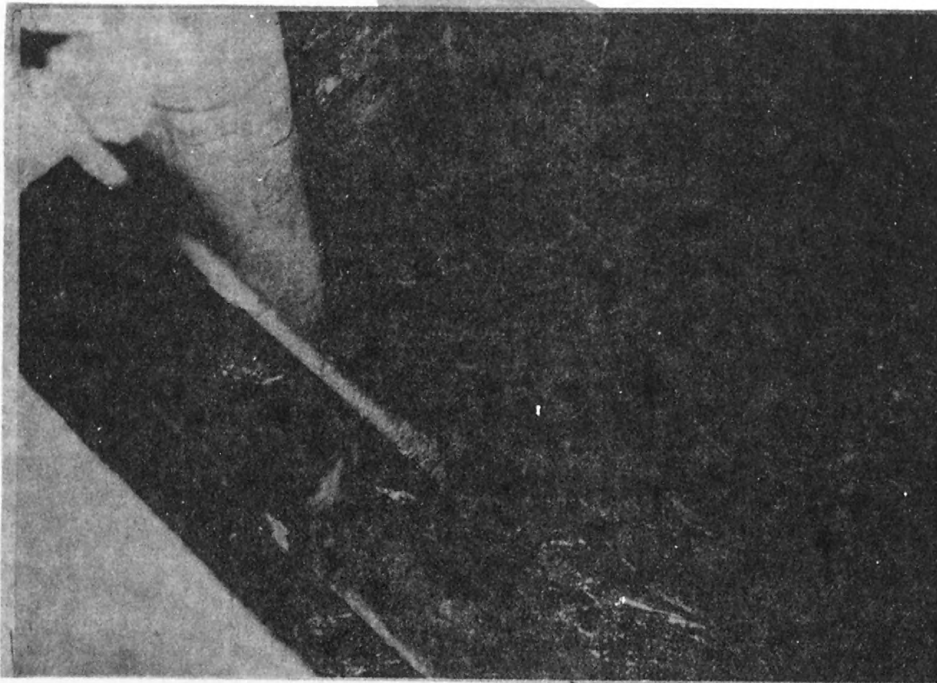
Photo No. 4

18



Date: September 10, 1980 Location: Cities Service Co.
Pelican Island Yard, Galveston, Texas
DESC: View of piece of 9 5/8" casing retrieved from
Well No. 1 OCS-G 4065

Photo No. 5

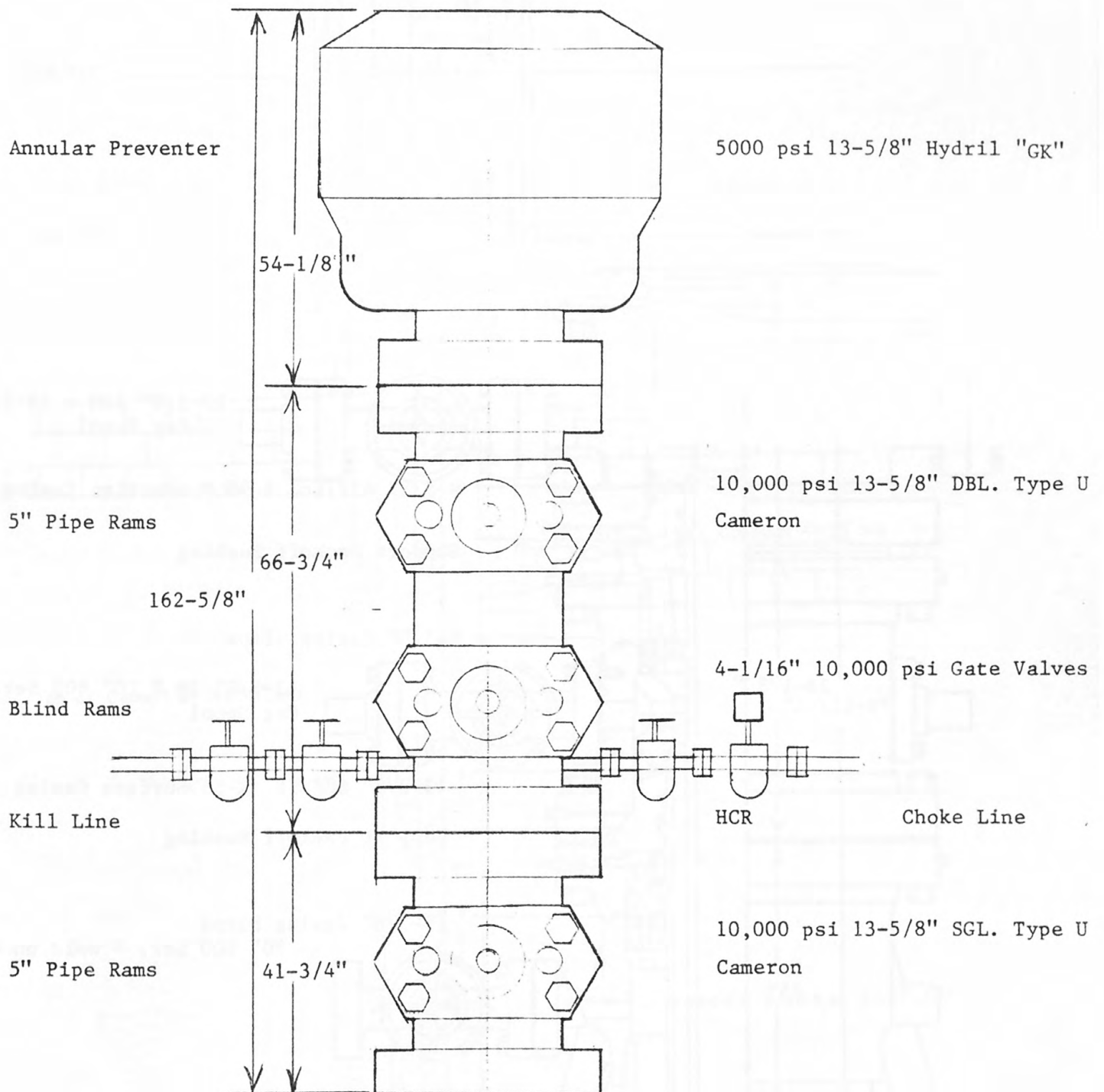


Date: September 3, 1980 Location: Matagorda Island
Block 669, Gulf of Mexico
DESC: View of float control in mud pit aboard rig, Ocean King

BLOWOUT PREVENTER STACK

OCS - G - 4065

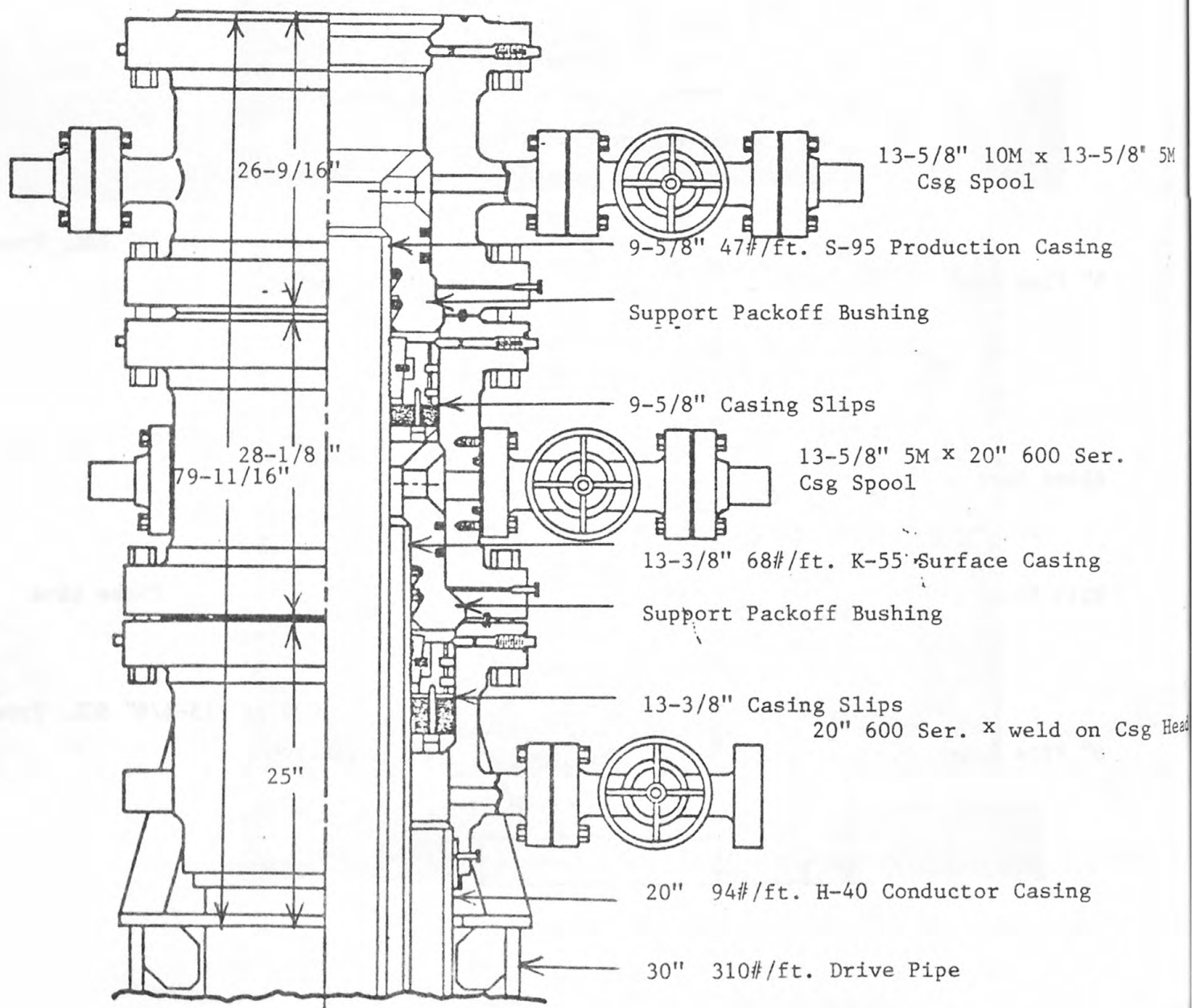
Well No. 2



CASING HEAD ASSEMBLY

OCS - G 4065

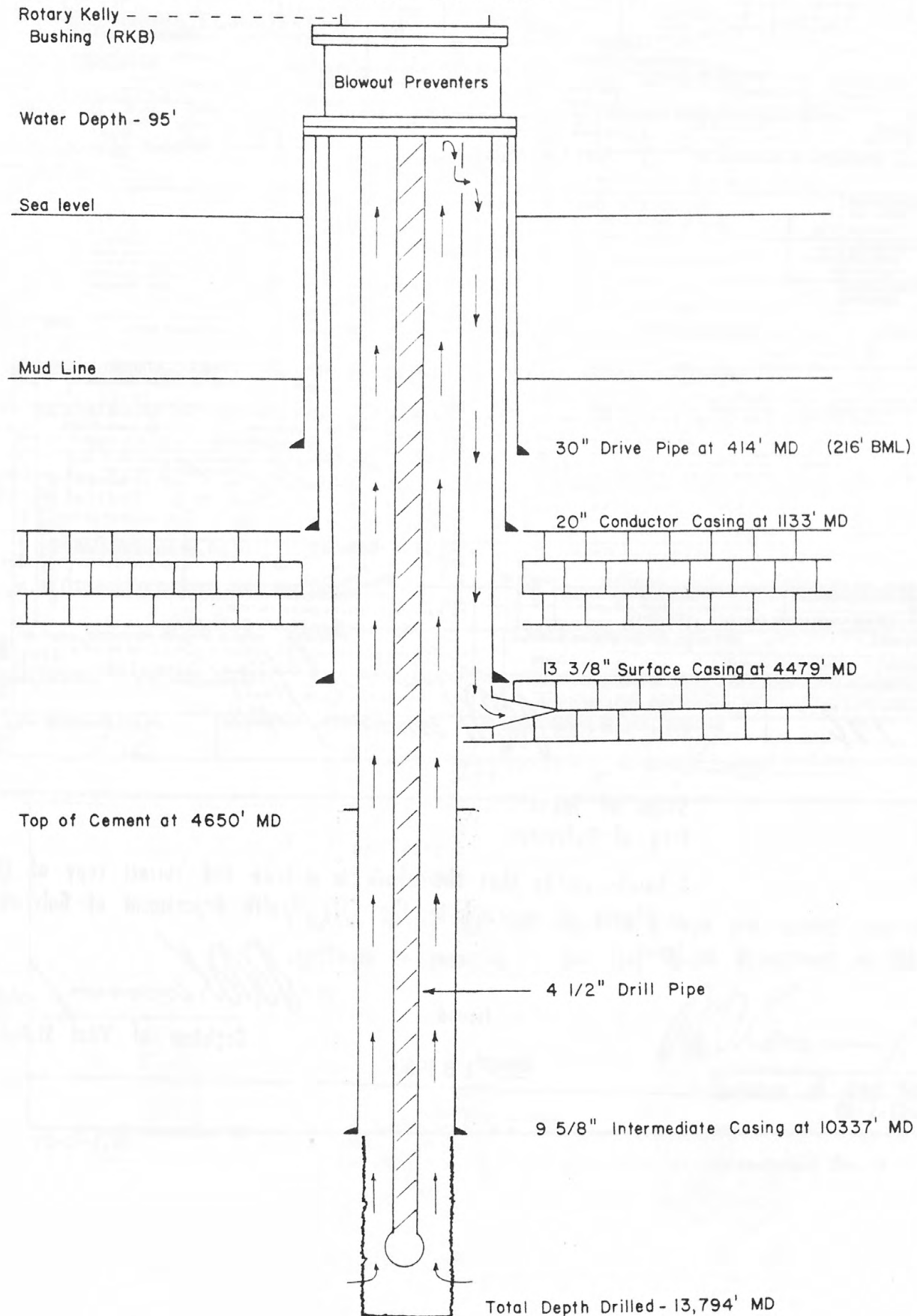
Well No. 1



Rupture of 9 5/8" Casing
and
Breakdown of 13 3/8" Casing Shoe
OCS G 4065 Well No. 1

21

Attachment No. 3



1 NAME OF DECEASED [Type or print] [a] First William [b] Middle J. [c] Last Blanco, Sr.			2 SEX Male	3 DATE OF DEATH Aug. 30, 1980			
4 RACE White	5a WAS THE DECEDENT OF SPANISH ORIGIN? No	5b IF YES, SPECIFY MEXICAN, CUBAN, PUERTO RICAN, ETC.	6 DATE OF BIRTH 3/16/1925	7 AGE [In years and last birthday] 55	8 IF UNDER 1 YEAR Months Days Hours Minutes	9 IF UNDER 24 HRS Hours Minutes	
8a PLACE OF DEATH - COUNTY Galveston	8b CITY OR TOWN [If outside city limits, give precinct no.] Galveston	8c NAME OF [If not in hospital, give street address] John Sealy Hospital	8d INCLUDE CITY LIMITS? Yes				
9 MARRIED NEVER MARRIED, WIDOWED DIVORCED [Specify] Married	10 BIRTHPLACE [State or foreign country] Cuba	11 CITIZEN OF WHAT COUNTRY? USA	12 WAS DECEDENT EVER IN U.S. ARMED FORCES? No	13 SURVIVING SPOUSE [If wife, give maiden name] Hattie Kinard			
14 SOCIAL SECURITY NO. 462-40-8686	15a USUAL OCCUPATION [Give kind of work done during most of working life, even if retired] Mechanic	15b KIND OF BUSINESS OR INDUSTRY ODECO					
16a RESIDENCE - STATE Alabama	16b COUNTY Baldwin	16c CITY OR TOWN [If outside city limits, show rural] Daphne	16d STREET ADDRESS [If rural, give location] Rt. 2, Box 428	16e INCLUDE CITY LIMITS? No			
17 FATHER'S NAME Jesus Blanco	18 MOTHER'S MAIDEN NAME Josefina Souto	19 SIGNATURE OF INFORMANT Mrs. Hattie Blanco					
20 PART I IMMEDIATE CAUSE [Enter only one cause per line for (a), (b), (c)] (a) Asphyxia due to drowning. DUE TO, OR AS A CONSEQUENCE OF: (b) DUE TO, OR AS A CONSEQUENCE OF: (c) DUE TO, OR AS A CONSEQUENCE OF:							Interval between onset and death Interval between onset and death Interval between onset and death
21 PART II OTHER SIGNIFICANT CONDITIONS - CONDITIONS CONTRIBUTING TO DEATH BUT NOT RELATED TO CAUSE GIVEN IN PART I (a) Yes							
22a AGE, SUICIDE, HOW, UNDET., OR PENDING INVEST [Specify] Accident		22b DATE OF INJURY 8/30/80	22c HOUR OF INJURY 6:10 a. m.	22d DESCRIBE HOW INJURY OCCURRED Decedent was on oil rig which blew up.			
22e INJURY AT WORK [Specify yes or no] Yes		22f PLACE OF INJURY - At home, farm, street, factory, office building, etc. [Specify] 50 miles offshore in Gulf		22g LOCATION STREET OR RFD NO. CITY OR TOWN STATE 50 miles offshore in Gulf Galveston Texas			
23a To the best of my knowledge, death occurred at the time, date, and place and due to the cause(s) stated [Signature and Title] [Signature]		24a On the basis of examination and/or investigation, in my opinion, death occurred at the time, date, and place and due to the cause(s) stated [Signature and Title] [Signature]					
23b DATE SIGNED [Mo., Day, Yr.]		23c HOUR OF DEATH		24b DATE SIGNED [Mo., Day, Yr.]			
23d NAME OF ATTENDING PHYSICIAN [Type or print]				24c HOUR OF DEATH			
				24d PRONOUNCED DEAD [Mo., Day, Year] ON 8/30/80			
				24e PRONOUNCED DEAD [hour] AT 6:10 a.m. M			
25a BURIAL, CREMATION, REMOVAL [Specify] Removal		25b DATE Aug. 31, 1980		25c NAME OF CEMETERY OR CREMATORY Daphne Baptist Cemetery			
25d LOCATION [City, town, or county] Daphne		(State) Alabama		25e SIGNATURE OF FUNERAL HOME OR FIRM ACTING AS SUCH J. Levy & Bro., Inc.			
27a REGISTRAR'S FILE NO. 776		27b DATE REC'D BY LOCAL REGISTRAR SEP 18 1980		27c SIGNATURE OF LOCAL REGISTRAR [Signature]			

State of Texas
City of Galveston

I hereby certify that the above is a true and correct copy of the certificate as recorded in the City Health Department of Galveston, Texas.

Issued

SEP 18 1980

Registrar of Vital Statistics

Texas Department of Health — BUREAU OF VITAL STATISTICS
CAUSE OF DEATH
VS-112, REV. 1/80

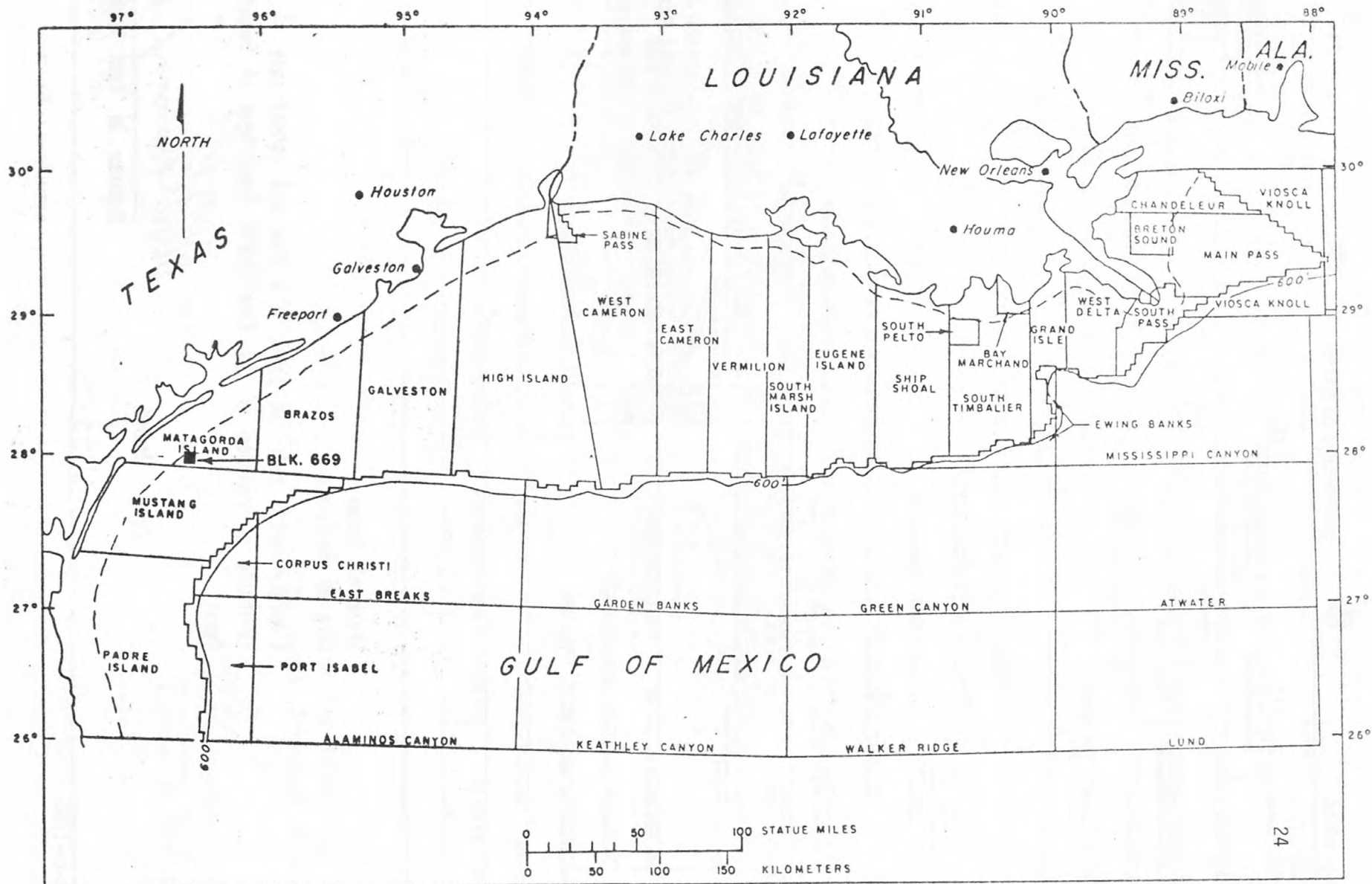
1. NAME OF DECEASED (Type or print) [a] First [b] Middle [c] Last JOHN VINCENT MULLY			2. SEX MALE		3. DATE OF DEATH AUG. 30, 1980										
4. RACE WHITE		5a. WAS THE DECEDENT OF SPANISH ORIGIN? NO		5b. IF YES, SPECIFY MEXICAN, CUBAN, PUERTO RICAN, ETC.		6. DATE OF BIRTH 7-11-38		7. AGE [In years last birthday] 42		IF UNDER 1 YEAR Months Days Hours Minutes		IF UNDER 24 HRS. Hours Minutes			
8a. PLACE OF DEATH — COUNTY GALVESTON			8b. CITY OR TOWN [If outside city limits, give precinct no.] GALVESTON			8c. NAME OF [If not in hospital, give street address] HOSPITAL OR INSTITUTION D.O.A. JOHN MULLY			8d. INSIDE CITY LIMITS? YES						
9. MARRIED, NEVER MARRIED, WIDOWED, DIVORCED [Specify] MARRIED		10. BIRTHPLACE [State or foreign country] LOUISIANA		11. CITIZEN OF WHAT COUNTRY? U.S.A.		12. WAS DECEDENT EVER IN U.S. ARMED FORCES? NO		13. SURVIVING SPOUSE [If wife, give maiden name] LOTTIE DARGNE							
14. SOCIAL SECURITY NO. 136-02-7783			15a. USUAL OCCUPATION [Give kind of work done during most of working life, even if retired] DRILLING CONTRACTOR			15b. KIND OF BUSINESS OR INDUSTRY OIL & GAS PRODUCTION									
16a. RESIDENCE — STATE Louisiana		16b. COUNTY CALCASIEU		16c. CITY OR TOWN [If outside city limits, show rural] DEIDLER		16d. STREET ADDRESS [If rural, give location] RT. 2 BOX 173			16e. INSIDE CITY LIMITS? NO						
17. FATHER'S NAME LARRY ELLIOTT SR.				18. MOTHER'S MAIDEN NAME TERESA L...				19. SIGNATURE OF INFORMANT J. J. LAIRD							
20. PART I Conditions, if any, which gave rise to immediate cause stating the underlying cause last		IMMEDIATE CAUSE [Enter only one cause per line for (a), (b), (c)] (a) Asphyxia due to drowning. DUE TO, OR AS A CONSEQUENCE OF: (b) DUE TO, OR AS A CONSEQUENCE OF: (c)								Interval between onset and death					
PART II OTHER SIGNIFICANT CONDITIONS — CONDITIONS CONTRIBUTING TO DEATH BUT NOT RELATED TO CAUSE GIVEN IN PART I (a)										21. AUTOPSY? YES					
22a. ACC., SUICIDE, HOM., UNDET., OR PENDING INVEST. [Specify] Accident		22b. DATE OF INJURY [Mo., Day, Yr.] 8/30/80		22c. HOUR OF INJURY 6:10 a. M.		22d. DESCRIBE HOW INJURY OCCURRED Decedent was in an oil rig explosion.									
22e. INJURY AT WORK [Specify yes or no] Yes		22f. PLACE OF INJURY — At home, farm, street, factory, office building, etc. [Specify] 50 miles offshore in Gulf of Mexico		22g. LOCATION STREET OR R.F.D. NO. CITY OR TOWN STATE 50 miles offshore in Gulf Galveston Texas											
23a. To the best of my knowledge, death occurred at the time, date, and place and due to the cause(s) stated [Signature and Title] [Signature]		23b. DATE SIGNED [Mo., Day, Yr.]		23c. HOUR OF DEATH M.		24a. On the basis of examination and/or investigation, in my opinion death occurred at the time, date, and place and due to the cause(s) stated [Signature and Title] [Signature] Galveston County W.E. Korndorffer, M.D. Medical Examiner		24b. DATE SIGNED [Mo., Day, Yr.] 9/5/80		24c. HOUR OF DEATH 6:10 a.m. M.		24d. PRONOUNCED DEAD [Mo., Day, Year] ON 8/30/80		24e. PRONOUNCED DEAD [Hour] AT 6:10 a.m. M.	
25a. BURIAL, CREMATION, REMOVAL [Specify] REMOVAL		25b. DATE 9-1-80		25c. NAME OF CEMETERY OR CREMATORY HUNTER CEMETERY											
25d. LOCATION [City, town, or county] [State] GALVESTON TEXAS		26. SIGNATURE OF FUNERAL DIRECTOR OR PERSON ACTING AS SUCH [Signature]													
27a. REGISTRAR'S FILE NO. 752		27b. DATE REC'D BY LOCAL REGISTRAR SEP 05 1980		27c. SIGNATURE OF LOCAL REGISTRAR [Signature]											

State of Texas
City of Galveston

I hereby certify that the above is a true and correct copy of the certificate as recorded in the City Health Department of Galveston, Texas.

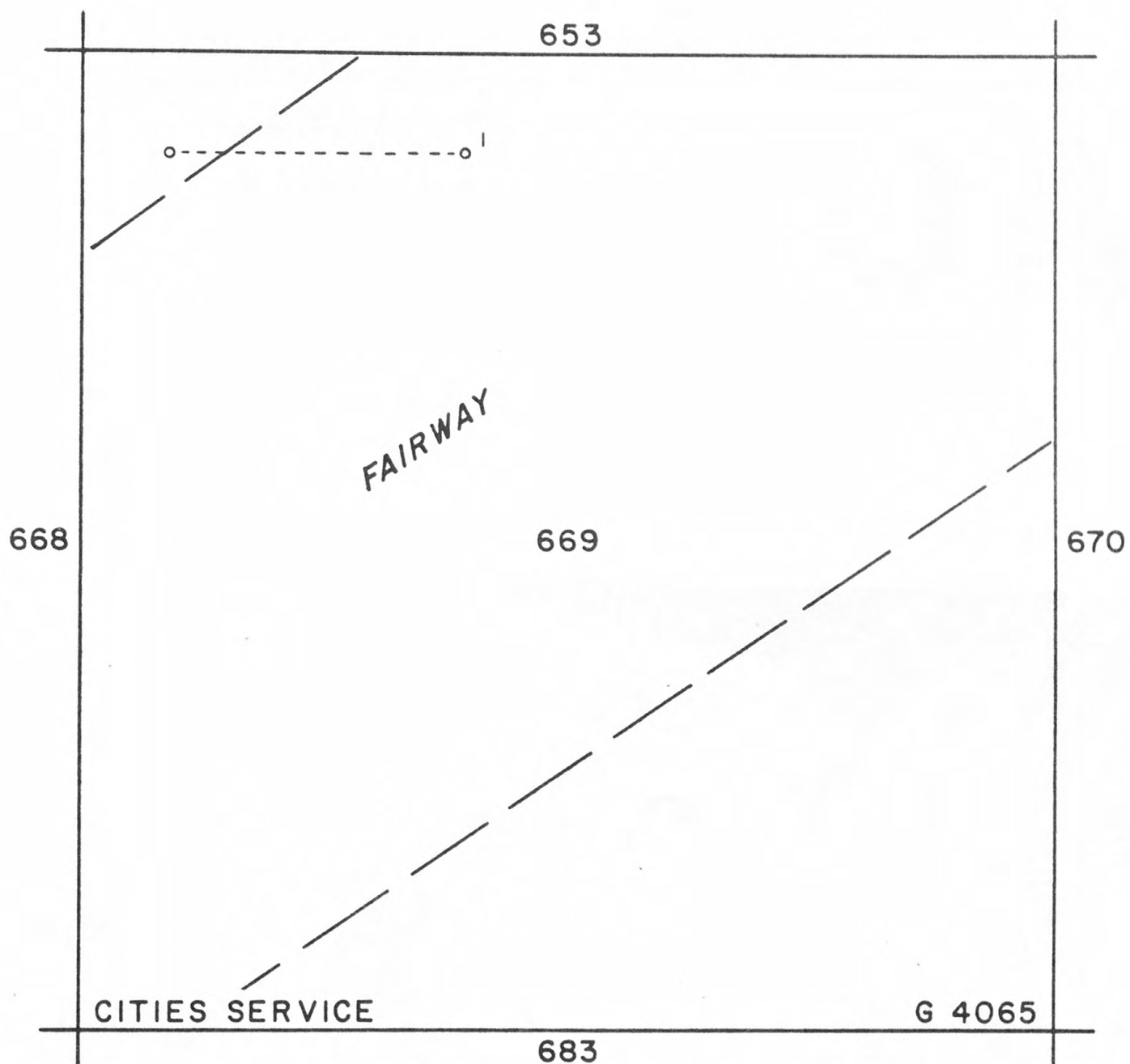
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Registrar of Vital Statistics



INDEX MAP SHOWING OUTER CONTINENTAL SHELF LEASING AREAS OFF TEXAS AND LOUISIANA. DASHED LINES, SHOWN AT 3 MARINE LEAGUES (9 NAUTICAL MILES) FROM THE TEXAS COAST AND 3 NAUTICAL MILES FROM THE LOUISIANA COAST, INDICATE BOUNDARY BETWEEN STATE AND FEDERAL WATERS. SOLID LINE INDICATES 600-FOOT WATER DEPTH.

FIGURE NO. 1



MATAGORDA ISLAND AREA
OFFSHORE TEXAS

Figure No. 2 - - Well & Rig Location

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