OCS Report
MMS 96-0054

Investigation of Explosion and Fire, Platform A, Mustang Island Block 831, Lease OCS-G 3043, November 20, 1994

Gulf of Mexico,
Off the Texas Coast

MMS
U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Regional Office

OCS Report
MMS 96-0054

Investigation of Explosion and Fire, Platform A, Mustang Island Block 831, Lease OCS-G 3043, November 20, 1994

Gulf of Mexico, Off the Texas Coast

C.B. Kirkpatrick
R.K. Michelsen
C.J. Schoennagel
J.E. Scholzen

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Regional Office

New Orleans
October 1996

Contents

Introduction

Authority

A serious explosion and fire occurred on Seagull Energy E&P Inc's. Platform A, Mustang Island Block 831, Lease OCS-G 3043 in the Gulf of Mexico, offshore the State of Texas, at approximately 6:00 p.m. on November 20, 1994. Pursuant to Section 208, Subsections 22(d), (e), and (f) of the Outer Continental Shelf (OCS) Lands Act Amendments of 1978, and the Department of the Interior Regulations 30 CFR Part 250, the Minerals Management Service (MMS) is required to investigate and prepare a public report of this accident. By memorandum dated January 23, 1995, the following personnel were named to the Investigative Panel:

C. B. Kirkpatrick	Lake Jackson, Texas
R. K. Michelsen	Corpus Christi, Texas
C. J. Schoennagel	New Orleans, Louisiana
J. E. Scholzen	New Orleans, Louisiana

Procedures

On November 21, 1994, an Investigative Panel member flew to Mustang Island Block 831, Platform A, and photographed the scene from a helicopter. On November 22, 1994, an Investigative Panel member flew to Mustang Island Block 831, Platform A, initiated an onsite investigation into the incident, and photographed the scene. (For photographs of the scene, see attachment No. 1.) The panel member obtained preliminary information from personnel familiar with platform operations.

Investigative Panel members flew to the accident location on December 6 and 7, 1994, and landed at Mustang Island Block 828, Platform B. They obtained additional preliminary information from personnel familiar with the Platform A operations. On December 7, 1994, they proceeded by workboat to Platform A to investigate the incident site and to note the damage to the platform and associated equipment.

The Investigative Panel convened on March 23, 1995, at the MMS Regional Office in New Orleans, Louisiana. The following individuals were questioned about the accident, including prior and subsequent activities:

Wesley Ardoin	Baker/MO
Greg Weber	Baker/MO
Kirk Kelley	Baker/MO
Bruce Wallace	Seagull
Gary Schwintz	Seagull
Mark Lindsey	Baker/MO

On July 26, 1995, MMS personnel revisited Mustang Island Block 831, Platform A, to obtain additional information about the accident and to trace piping.

Investigation and Report

Background

Lease OCS-G 3043 covers approximately 5,760 acres and is located in Mustang Island Block 831, Gulf of Mexico (GOM), off the Texas coast. (For lease location, see attachment No. 2.) The lease was issued effective April 1, 1975, for a cash bonus of $3,390,000. The original lessees were The Superior Oil Company (25%), Ashland Oil, Inc. (10%), Gulf Oil Corporation (35%), Canadian Superior Oil Ltd. (15%), PanCanadian Petroleum Company (10%), and Alminex U.S.A., Inc. (5%). The lessees at the time of the accident were Columbia Gas Development Corporation (23.6%), Rowan Petroleum, Inc. (9.4%), Seagull Energy E&P Inc. (49.6%), Columbus Mills, Inc. (2.5%), Marine Exploration Company (4.8%), Ed A. Smith (4.8%), Walter A. Stockard (2.4%), Johnson & Lindley, Inc. (0.6%), James E. Froelich, Jr. (0.3%), Willis W. Thames (0.3%), and Jackson J. Campau (1.7%).

On October 7, 1983, Seagull received approval to install a four-pile, nine-well-slot platform, Platform A, in Mustang Island Block 831. Subsequent to approval, Platform A was installed in December 1983, and seven wells were drilled.

At the time of the accident there were three producing gas wells, B-6, B-6d, and A-6. The A-6 well was the only well produced from Mustang Island Block 831, Platform A. The B-6 and B-6d wells were produced and separated at Mustang Island Block 828, Platform B. The gas production from Platform B flowed to Mustang Island Block 831, Platform A, and entered the high-pressure

separator. The gas from the high-pressure separator was commingled with compressed gas from the A-6 well and sold at Platform A.

Description of Accident

On November 20, 1994, there were three Baker MO employees located on Mustang Island Block 831, Platform A. These men were a production superintendent, an A-gauger, and a B-operator.

At approximately 4:00 p.m. the platform had shut in due to the A-6 well shutting in. When the platform was brought back on-line, it was discovered the A-6 well had loaded up with water. In an effort to unload the well, personnel on Platform A aligned the flow of the well to the vent system while hydrocarbon production from Platform B, Mustang Island Block 828, continued to be processed through the high-pressure separator on Platform A. At approximately 6:00 p.m., while the well was venting, the three men were in the living quarters when an explosion occurred.

The three men, injured in the blast, exited from the living quarters and made their way down to the second level by crawling down flare boom piping. To escape the initial area of the explosion and fire, they then proceeded down to lower deck levels, where they spent the night.

The three men were rescued on the morning of November 21, 1994, by United States Coast Guard (USCG) personnel. They were transported via USCG helicopter to Memorial Medical Center in Corpus Christi, Texas.

Three injuries resulted from this accident and the living quarters were completely destroyed.

Findings

Basic Platform Design

When drilling operations were completed on Platform A, the drilling rig was removed and living quarters and production equipment were installed. The living quarters were set on the drill deck, which had an open trough to drain the deck. The trough ran underneath the length of the living quarters and was piped to the sump tank.

The initial design of the living quarters included the installation of a fire and gas detection system. Three gas sensor heads were to be located inside the living quarters, two were to be located outside on the roof at the air conditioning units, and two were to be located for exterior use. (For schematic of the living quarters, see attachment No. 3.) Subsequent investigation revealed that four gas sensor heads were located in the living quarters, one in the meter shack, and no record of any located at the air conditioning units.

The platform production equipment was initially designed to handle high-pressure gas well production. Several modifications had been made to the production system since first production, including the addition of a compressor to handle intermediate-pressure gas production.

When Well A-6 was being produced prior to the accident, production flowed to the test separator. From there, gas was piped to the compressor before going to sales. Liquids from the test separator were piped to the water skimmer. Condensate from the water skimmer was piped to sales, while produced water was piped to the overboard waste water line coming from the living quarters.

When Well A-6 was being vented prior to the accident, production flowed to the test separator. From there, gas was piped to the low-pressure vent scrubber before being piped to the vent boom. Liquids from the test separator were piped the same as during the production of Well A-6. Liquids from the low-pressure vent scrubber were piped to the sump tank.

In addition, the piping for the liquids from the low-pressure vent scrubber and the drill deck trough tied together prior to entering the sump tank. (For a simplified schematic of basic platform piping during flaring, see attachment No. 4.)

Preliminary Activities

Baker/MO had been contracted by Seagull to provide personnel to operate their Mustang Island Block 831, Platform A; Mustang Island Block 828, Platform B; and North Padre Island Block A-72, Platform A. Sometime in September or October 1994, Seagull reduced the number of personnel operating these facilities from four to three.

Prosafe had been contracted by Seagull to provide for quarterly testing of fire and gas detection and alarm systems at Mustang Island Block 831, Platform A. Prosafe's testing records indicate that on May 22, 1994, five detector heads were tested, four in the living quarters and one in the meter shack. The transmitter and sensor for the meter shack were replaced. In September 1994, Seagull replaced Prosafe with TEST.

TEST tested the fire and gas detection and alarm systems on September 1, 1994. Records indicate that five gas detector heads were tested, four in the living quarters and one in the meter shack. (Records and testimony indicate that no testing was done for gas detector heads by the air conditioning units on the roof of the living quarters.) All of the detector heads were tested with a known concentration of 50 percent lower explosive limit (LEL) applied to the sensing head. The gas detection system span dials at the monitor were adjusted to read 50 percent LEL when the known 50 percent LEL concentration was applied to the detector heads. The 25 percent LEL alarm for the detector head by the galley exit tested out of range and was adjusted. The only defective equipment found during the September 1994 testing was a smoke detector base, which was replaced and retested.

Subsequent to the testing of the fire and gas detection system in September 1994, testimony indicates that the gas detector alarm was going off at the 25 percent LEL but that the monitor was registering a higher gas percentage LEL. There was differing testimony as to when and how many times the alarms sounded, whether the alarms were set at a 20 or 25 percent LEL, and as to whether or not a gaseous odor was present in the living quarters. Records indicate Prosafe tested the alarms at 20 percent LEL while TEST tested the alarms at 25 percent LEL. Testimony indicates that the gas detector sensing heads that registered the 25 percent LEL or higher were either the head at the galley exit door and/or the head at the first floor east exit door. Testimony also indicates that on several occasions personnel aboard the platform used a portable gas sniffer in an attempt to locate the source of the

gas. The only places where gas readings were detected with the sniffer were by the galley exit door and the first floor east exit door.

At some time during this period, personnel aboard the platform siliconed the windows in the living quarters in an attempt to alleviate the problem of the 25 percent LEL gas detector alarm going off. However, testimony indicates that the first floor east exit door was in poor condition and would allow for an external gas source to enter the living quarters. Also, subsequent investigation revealed that a pipe chase, which would allow for an external gas source to enter the living quarters, existed at the bottom of the living quarters.

In addition, the gas detection system alarms only sounded when platform personnel were in the process of venting Well A-6. This well was consistently loading up with water and was being vented on a daily basis for at least one week prior to the explosion and fire.

On November 18, 1994, the Baker/MO production superintendent aboard the platform called a TEST representative to discuss a 25 percent LEL alarm that had sounded with a 35 percent reading showing on the monitor.

Venting Well A-6

While there were minor differences in the platform personnel testimonies as to the procedure for venting Well A-6, there was agreement on the basic means on how the well was vented the day of the explosion. Personnel were stationed at the compressor and the test separator.

Personnel at the compressor shut down the compressor and blew it down. There was differing testimony as to where the compressor was blown down, but subsequent investigation revealed that it would have had to have been blown down to the high-pressure vent line, which flowed to the vent boom.

Personnel at the test separator shut off flow to the compressor and opened a manual block valve, which allowed flow to the low-pressure vent scrubber. Examination of this block valve, while vessels were being purged after the explosion, revealed that the valve had been cut out and was always open. Using the back-pressure valve, personnel decreased the pressure on the test separator, which allowed the well to flow.

This procedure would allow flow from the well to be routed to the low-pressure vent scrubber prior to the gas going to the vent boom. Subsequent investigation revealed that the automatic liquid dump valve was out of service and stuck in the closed position, and the manual liquid dump valve was open on the low-pressure vent scrubber. (For photograph of the manual liquid dump valve, see attachment No. 5.) Another post-accident discovery on the low-pressure vent scrubber was that the pressure safety element (PSE) had burst and the pressure relief line had a blind flange in it. This blind flange would have prohibited any gas flow out the relief line.

Testimony indicates new range charts had been run for the test separator for venting conditions, so that no devices on the test separator would have to be in the bypass mode while the well was vented. Investigation of the main panel

conducted after the explosion showed that the test separator's pressure safety high/low (PSHL) and the level safety low-2 (LSL-2) were in service. However, their "winkies" were red. A red "winkie" indicates that a signal was sent to the main panel and appropriate devices should have been automatically activated. For these sensors, an alarm should have sounded, a shutdown valve should have shut off flow to the vessel, and the venting should have ceased. Testimony does not indicate that this occurred. (For photograph of PSHL main panel controls, see attachment No. 6.)

Explosion and Fire

After the well was routed to vent, all three men went to the living quarters. They were inside the living quarters on the first floor, one in the office area and the other two in the living area, when an alarm sounded that they testified to as being the 25 percent LEL alarm for the gas detectors.

When they had experienced the previous 25 percent LEL alarms, the procedure was to open doors, windows, and turn the air-conditioner on to air out the living quarters. At the same time, someone would immediately change Well A-6 from the venting process to producing.

However, on the day of the explosion, within seconds of the alarm sounding, the three men were hit with a fireball that testimony indicates originated in the galley area. Immediately an explosion occurred that blew out the walls of the living quarters. When they realized what had happened, they were surrounded

by fire. They were able to escape out of the living quarters and onto the vent boom.

From the vent boom they could see the entire living quarters were on fire, and the walkways and stairs from the top deck had been destroyed. The only way to get down to another deck was to shimmy down the piping that goes from the vent boom to the production deck. Testimony indicates that once on the second level, they started hitting emergency shutdown (ESD) stations.

Subsequent investigation revealed that both the ESD "winkie" and the quarters and fire and gas detection "winkie" were red on the main control panel. (For photograph of ESD and quarters fire and gas main panel controls, see attachment No. 7.) It should be noted that this is a first-out indicator panel, which means that when one platform shutdown system is activated and shuts down the platform, the other systems cannot be activated. There are three platform shutdown systems on this platform. They are the ESD system, the fire and gas detection system (for 60% LEL), and the fusible loop system. The ESD and the fusible loop systems have no bypass switches. In addition, the fire and gas detection system sends an almost instantaneous electronic signal to the main panel, while the ESD and fusible loop systems send a pneumatic signal to the main panel.

The crew, hoping to spot a passing boat, made their way to the boat landing . Communication was impossible as all radios and telephones had been destroyed in the explosion and fire. They stayed on the boat deck until the weather and

water spray from the waves caused them to go up to the sump deck and stay in the gas meter shack. One man's eyes became swollen shut and he stayed in the meter shack the remainder of the night. The other two men went up to the production deck and stayed in the tool shed for the night, as this provided better protection from the elements.

The production foreman knew he had a helicopter coming in the morning for a crew change and a boat scheduled for the afternoon; therefore, no attempt was made to abandon the platform. If they had to abandon the platform it would have been done via life raft, as the survival capsule normally kept on the platform had been sent in for repairs.

Rescue

On the morning of November 21, 1994, the crew-change helicopter arrived at Platform A, observed that an accident had occurred, and notified the United States Coast Guard (USCG). Helicopters arrived with USCG personnel who provided immediate medical attention to the men on the platform. Coast Guard personnel then hoisted two of the men into the helicopter. The third man remained on the platform with USCG personnel while the helicopters were refueled. When the helicopter returned, USCG personnel lifted the third man into the helicopter. The men were brought to Memorial Medical Center in Corpus Christi, Texas, where they received medical treatment.

Subsequent Activities

Currently, the A-6 well's status is shut in. Gas production from Mustang Island Block 828, Platform B, still flows to the Mustang Island Block 831 Platform A; however, a jumper line has been installed from the incoming pipeline directly to the departing sales line.

Injuries

Kirk Kelley, Greg Weber, and Wesley Ardoin suffered severe burns in the explosion and fire.

Damages

The living quarters were destroyed in the explosion and fire, along with the heliport. The production deck and sump deck were intact after the explosion with only debris scattered about.

Conclusions

Probable Cause of Incident

The probable cause of the explosion and fire was the ignition of gas that had accumulated in the living quarters.

Probable Source of Gas

The living quarters were placed over an open trough that served as a deck drain whose contents were piped to the sump tank. The piping from this trough tied into the liquid dump line from the low-pressure vent scrubber before entering the sump tank. Since the manual liquid dump valve on the low-pressure vent scrubber was found in the open position, there would be no fluids in that vessel to prevent gas blowby to the sump tank. When the well was vented to the low-pressure vent scrubber, the pressure could have been great enough to displace the fluid in the P-trap in the piping for the deck drains. Gas could then rise through the deck drains to the trough area and migrate into the living area through openings in the building.

Probable Cause of Ignition

No evidence was available to determine the initial source of ignition. Numerous potential sources of ignition existed in the living quarters including an oven and electrical appliances and equipment.

Other Possible Sources of Gas

Two other possible sources of gas existed:

1. Gas could have accumulated in the living quarters through a fresh air intake for the air conditioning system. It could not be substantiated

whether or not the air conditioning system had a fresh air intake. Even if it had a fresh air intake, the closest source of gas was the pressure relief line for the low-pressure vent scrubber, which had a blind flange in it. This would leave only the flare boom as the principal source of gas for entry into the air conditioning system.

2. Gas could have accumulated in the living quarters from the overboard waste water line. If the water skimmer had no liquid level in it, gas blowby could have occurred. Since the water from the skimmer was piped to the overboard waste water line coming from the living quarters, any gas blowby could migrate up this line into the living quarters. However, subsequent investigation has given no indication that a water level was not maintained in the water skimmer.

Contributing Causes The following were probable contributing causes:

1. The failure to determine why gas alarms were going off in the living quarters. If the platform had been shut-in until the source of gas were found, the explosion and fire might not have occurred.

2. The failure to maintain the automatic liquid dump valve on the low-pressure vent scrubber in an operating condition. If this valve were operating properly and the manual liquid dump valve were closed, gas blowby would probably not have occurred.

3. The failure to maintain a properly operating PSE and blind flanging of the pressure relief line for the low-pressure vent scrubber. If the PSE and pressure relief line were operating properly, any overpressure on the low-pressure vent scrubber should have been detected.

4. The bypassing of the fire/gas detection platform shutdown system at the main panel. If this system had been operational, the platform may have been shut in before the explosion occurred.

5. The failure to monitor safety devices that were placed in bypass. Personnel in attendance at the main panel could have immediately activated the ESD when "winkies" on the main panel turned red.

6. The venting of Well A-6. Without the venting of the well, gas probably would not have accumulated in the living quarters.

Recommendations

Safety Alerts

The Gulf of Mexico OCS Region should issue a Safety Alert concerning the following points:

1. When gas sensor heads detect a 25 percent LEL in the living quarters, lessees and operators should consider shutting down operations until they establish the reason for the alarm, whether it be by locating and eliminating the source of the gas or by identifying and correcting a problem with the gas detection system.

2. Lessees and operators should repair malfunctioning equipment in lieu of using alternative methods such as opening a manual liquid dump valve when the automatic liquid dump valve fails or blind flanging off a pressure relief line when a PSE ruptures.

3. Lessees and operators should review platform piping to ensure that deck drains have an adequate trap mechanism to prevent gases from migrating through them, that deck drains are not piped to a pressure line before entering a sump tank, and that piping for produced water does not tie into the piping for the waste water from the living quarters.

4. Lessees and operators should review their gas detection system to ensure that the locations of gas detector sensing heads provide adequate protection and that all heads are tested.

5. Lessees and operators should review flare boom lines to ensure that they are designed of proper length and height and oriented in the proper position according to prevailing winds to minimize the migration of gas back to the living quarters.

6. Lessees and operators should consider equipping manned platforms with some type of emergency position-indicating radio beacon.

Additional Consideration

1. The Gulf of Mexico OCS Region should develop a civil penalty case file for apparent violations of bypassing equipment without the bypassed equipment being monitored by platform personnel.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.