

# **Investigation of Blowout Lease OCS-G 7871 Viosca Knoll Block 32 December 17, 1987**

**Gulf of Mexico  
Outer Continental Shelf**

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## Contents

<b>Investigation and Report</b>	
Authority	1
Procedures	1
<b>Introduction</b>	
Background	3
Description of Incident	4
<b>Findings</b>	
Preliminary Activities	6
Loss of Well Control	7
Blowout	8
Emergency Warning and Evacuation	9
Subsequent Activities	11
Damages	12
<b>Conclusions</b>	
Probable Cause of Incident	14
Contributing Causes of Incident	14
<b>Recommendations</b>	
Safety Alert	15
Drilling Requirements	15
<b>Attachments</b>	
1 Photographs of Blowout	16
2 Photographs of Recovered Equipment	17
3 Location of Lease OCS-G 7871, Gulf of Mexico	18
4 Schematic of BOP Stack	19

## Investigation and Report

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### Authority

A serious blowout occurred aboard Western Oceanic's jack-up drilling rig *Triton III* at approximately 1:40 p.m. on December 17, 1987, while drilling operations were being conducted for Santa Fe Minerals, Inc. (Santa Fe), in Viosca Knoll Block 32, Lease OCS-G 7871, in the Gulf of Mexico (GOM), offshore the State of Alabama. Pursuant to Section 208, Subsection 22 (d), (e), and (f), of the Outer Continental Shelf (OCS) Lands Act amendments of 1978 and Department of the Interior Regulation 30 CFR Part 250, the Minerals Management Service (MMS) is required to investigate and prepare a public report of this accident. By memorandum dated December 22, 1987, the following MMS personnel were named to the investigative panel:

J. Chong, Metairie, Louisiana  
J. Hennessey, Metairie, Louisiana  
R. Lanza, Metairie, Louisiana  
C. J. Schoennagel, Metairie, Louisiana

### Procedures

Inspection personnel from MMS flew to the Viosca Knoll Block 32 blowout on December 18, 1987, but were unable to land on the *Triton III*, which had been abandoned, because the blowout was still in progress.

Investigative panel members flew to the blowout location on December 19, 1987, took pictures of the incident from the air, and at Santa Fe's shore base in Pascagoula, Mississippi, obtained preliminary information from personnel familiar with the accident. (For photographs of blowout, see appendix, attachment 1.) On December 28, 1987, the

accident investigative panel landed on the *Triton III*, and obtained information about the blowout and subsequent activities. They also photographed the damage incurred to the rig and associated equipment, including the blowout preventer (BOP) stack that was recovered after falling into the Gulf of Mexico during the blowout. (For photographs of recovered equipment, see appendix, attachment 2.)

The investigative panel convened on March 22, 1988, at the Hampton Inn in Pascagoula, Mississippi. The following individuals were questioned about the blowout and subsequent activities:

John Miller, Jr., Western Oceanic  
Charlie Lloyd Wiley, Western Oceanic  
Robert Frederick Smith, Western Oceanic  
Cletus A. Meadors, Milpark Drilling Fluids  
Arnold E. McDowell, Western Oceanic  
Lee Dalco Turner, Western Oceanic  
Jack D. Ramsey, Francis Brown and Associates  
John Michael Neubauer, Santa Fe Minerals

## Introduction

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### Background

Lease OCS-G 7871 covers approximately 5,760 acres and is located in Viosca Knoll Block 32, GOM, off the Alabama coast. (For lease location, see appendix, attachment 3.) The lease was issued effective September 1, 1985, for a cash bonus of \$4,111,000, with a 1/6 fixed royalty rate. The original lessees were as follows:

Santa Fe International Corporation	50.00%
HNG Oil Company	50.00%

Santa Fe Minerals, Inc., was designated as operator of the lease with its issuance. Effective December 31, 1986, HNG Oil Company was merged with and into Enron Oil and Gas Company. In January 1987, Santa Fe International Corporation was designated as operator of the lease. At present the lessees are as follows:

Santa Fe International Corporation	50.00%
Enron Oil and Gas Company	50.00%

On September 18, 1986, MMS received Santa Fe's plan of exploration and environmental report for Lease OCS-G 7871. By letter dated October 31, 1986, MMS approved Santa Fe's exploration plan.

An application for permit to drill Well No. 1 was approved February 24, 1987. With 30-inch structural casing driven to 350 feet, 153 feet of penetration, Well No. 1 was spudded on March 28, 1987, by the jack-up rig *Rowan Juneau*. A string of 10 3/4-inch casing was set and cemented at 1,363 feet. Total depth of 2,702 feet was reached on

March 31, 1987, with the use of a 9.5 pound-per-gallon (ppg) polymer mud, and the 7 5/8-inch production casing was set and cemented. The well was temporarily abandoned on April 5, 1987.

Well No. 2 was approved by the MMS on December 11, 1987, based on an application for permit to drill. The proposed casing program for the well consisted of 48-inch structural casing driven to 351 feet, 155 feet of penetration, 10 3/4-inch casing set at 1,300 feet, and 7 5/8-inch production casing set at the planned total depth of 2,900 feet. The proposed mud system to be used to drill to total depth was a 9.5-ppg polymer mud. The rig selected to drill the well was Western Oceanic's jack-up rig *Triton III*.

**Description of Incident**

During the drilling of Well No. 2 on December 17, 1987, a drilling break was incurred from 2,762 feet to 2,812 feet. A maximum of 800 gas units was observed while the mud was being circulated out of the well. Drilling continued from 2,812 feet to 2,900 feet.

At approximately 12:30 p.m., a wiper trip was begun. The hole took mud properly until the fifth stand of pipe was pulled. The five stands were run back into the hole, and circulation was begun at approximately 1:30 p.m.

Approximately 10 minutes after breaking circulation, the flow rate increased. The well was shut in at the 21 1/4-inch annular preventer, the downwind (starboard) diverter line opened, and the well flowed. All nonessential personnel were offloaded by crane onto the workboat MV *Canary Island*.

As well fluids and gas started to flow under the rig floor, all remaining personnel were evacuated by escape capsule to the MV *Canary Island*. No hydrocarbon pollution of the gulf waters was observed and no injuries were sustained.

## Findings

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### Preliminary Activities

The *Triton III* arrived on location in Viosca Knoll Block 32 on December 10, 1987. Water depth at the location was 96 feet. Structural casing of 48 inches was driven to 320 feet, and Well No. 2 was spudded on December 10, 1987. The diverter system was installed, pressured up, and function-tested on December 13, 1987. On December 14, leaks at the bell nipple and flowline were repaired. Conductor casing of 10 3/4 inches was set and cemented at 1,300 feet on December 15, 1987. The proposed total depth of the well was 2,900 feet.

On December 16, 1987, the drill string, including a 9 7/8-inch bit, drill collars, and a J-slot, nonlocking wear bushing, was picked up and tripped in the hole where cement was tagged at 1,208 feet. The 10 3/4-inch casing was then tested against the lower pipe rams to 250 pounds per square inch (psi) for 30 minutes.

After the cement float collar and shoe were drilled out, a pressure integrity test was performed at a depth of 1,310 feet using 8.9-ppg seawater. A 14-ppg equivalent mud weight was obtained. The slick assembly was pulled out of the hole, a new bottomhole assembly consisting of a 9 7/8-inch bit, a float sub, two 8-inch drill collars, one 9 13/16-inch stabilizer, three 8-inch drill collars, one 9 13/16-inch stabilizer, one 8-inch drill collar, a crossover sub, and 15 joints of 5-inch heavyweight drill pipe was picked up, and drilling resumed. A controlled drilling program was



initiated whereby wireline surveys were periodically run during drilling from 1,310 feet to 2,812 feet.

Drilling was being conducted with a 9.5-ppg polymer mud. Because of the nonreactive nature of polymer muds, one result of their use is a hole size that is extremely close to bit size, a "gauge hole." Santa Fe chose this mud system to reduce the cement volume required for production casing and still be assured of a quality cement job.

A drilling break occurred on December 17, 1987, during drilling between 2,762 feet and 2,812 feet. The gas was circulated out of the well with a maximum gas count of 800 units observed during circulation. The mud weight was gas cut from 9.5 ppg to 7.6 ppg. This gas zone was the well's targeted production interval. There was no observed increase in chlorides during this period.

#### **Loss of Well Control**

After the gas was circulated out and a flow check indicated no flow, drilling operations continued in the well. The well was drilled from 2,812 feet to 2,900 feet, the planned total depth, with a maximum of 10-12 units of background gas observed during this period. At 2,900 feet the well was twice circulated bottoms up with no indication of gas flowing or the mud being gas-cut from the 9.5-ppg mud weight. A wireline survey was run in the well, and then a 10 barrel (bbl) slug of 10.5-ppg mud was pumped to help drain the drill pipe.

A wiper trip was begun at 12:30 p.m. The mud level, as observed at the bell nipple, dropped properly as the first four stands of drill pipe were pulled from the well. After the fifth stand of drill pipe was pulled from the well, the mud level was observed not to drop, indicating the well was swabbed-in.

Since there was an indication of swabbing, the fifth stand was not broken out, and the five stands were run back into the well. For a short period of time the drill pipe was rotated in an attempt to knock off any gumbo that had accumulated on the stabilizer or drill bit. Next, the drill pipe was pulled up very slowly to see if the mud level would drop at the bell nipple. Since the mud level did not drop, circulation was begun with an initial background gas reading of six units. After approximately 10 minutes of circulation, gas was observed at the surface as the flow rate from the well increased at the shaker. The well was shut-in with the annular preventer. The starboard diverter valve was opened, and well flow was observed out the starboard diverter line. Although the annular preventer was not leaking, as an extra precaution the upper pipe rams were closed. (For schematic of BOP stack, see appendix, attachment 4.)

### **Blowout**

The active mud pit containing 400 bbl of 9.5-ppg mud was lined up to be pumped into the well in an attempt to outrun the kick. At the same time, preparations were made to add barite to the active pit. Pumping of 9.5-ppg mud into the well was initiated, but adding barite to the active pit did not take place because pressure to transfer barite was not high enough.

Another compressor was put on line to increase pressure, but when the pressure increased enough to get barite to the active pit, the hopper plugged up for a short period of time, further delaying the addition of the barite to the active pit.

As the active pit was nearly empty before barite could be added, plans to add barite to a pit containing 400 bbl of 9.2-ppg mud were made. After the active pit was emptied, 9.2-ppg mud, plus whatever barite had been added, was pumped into the well. When all of the 9.2-ppg mud was pumped, a pit containing 100 bbl of 9.0-ppg polymer mud was lined up, and pumping into the well started. The well continued to flow during the entire pumping operation.

### **Emergency Warning and Evacuation**

Sometime after the initial well flow, the rig personnel were notified of the emergency, and all nonessential personnel were assembled at the starboard escape capsule. At the same time, the workboat *MV Canary Island* was alerted and told to stand by for further action. It could not be determined if an emergency alarm was sounded to notify rig personnel.

When the well began flowing out the starboard diverter line, the order was given to evacuate all nonessential personnel. Thirty-two persons were then evacuated using the crane to lower them via the personnel basket to the *MV Canary Island*.

The remaining personnel continued in their attempt to kill the well and secure the rig. Before the remaining personnel abandoned the platform, the mud pumps were shut down. In a final effort to control the well, the remote BOP control panel was used to close the lower pipe rams, which had been installed below the diverter spool. This procedure, though considered earlier, was not attempted because of concern that this would have caused the sudden stoppage of the well flow and might have resulted in the breakdown of the formation at the 10 3/4-inch casing shoe, with a subsequent uncontrolled underground flow. Additionally, although a full BOP stack was installed on the well, the planned action in the event of a kick was to divert. Consequently, a diverter system (spool, valves, and flowlines) was installed in the BOP stack where choke and kill lines are normally located.

An almost immediate signal of closure and no observed decrease in well flow were an indication that the rams had not closed. The rams normally take a longer period of time to seal around the drill pipe than the signal indicated. The BOP system was then activated to open the lower rams and reactivated to close the rams. The results were the same as observed in the initial closure sequence.

Subsequent investigation of the BOP stack showed that the lower rams had in fact closed. It is possible that the wear bushing had been pushed up the well and that the lower rams had, in fact, sealed with this bushing between the drill pipe and the ram sealing elements. This would explain both the early closure signal and the lack of decrease in well flow.

Sometime after the well was shut in and the diverter opened, the well flow started to cut out the starboard diverter line.

As gas began to accumulate around the rig floor from the damaged diverter line, the remaining eight rig personnel abandoned the *Triton III* via an escape capsule. Some short time thereafter, the personnel in the capsule were picked up by the MV *Canary Island*.

### Subsequent Activities

The MV *Canary Island* transported all personnel who abandoned the rig to Santa Fe's shore base in Pascagoula, Mississippi. Santa Fe had personnel monitor the blowout from a workboat during the night. Santa Fe also contacted well-control specialists and began to contract for additional equipment, vessels, and a rig to drill a relief well.

On Friday, December 18, 1987, the derrick barge *Tonkawa* arrived on location. Well-control specialists boarded the rig and monitored the situation. At daylight on Saturday, December 19, 1987, the bell nipple and BOP stack were observed to be missing from the caisson. The rig was again boarded by the well control personnel, and a detailed inspection of the rig was conducted.

Several times during the day on December 20, 1987, the well would stop flowing but then resume flowing shortly thereafter. At approximately 6:00 p.m. on December 20, 1987, the well bridged and stopped flowing permanently.

Over the next few days, work was conducted for Santa Fe aboard the *Triton III* during daylight hours. Tasks included assessment of damages, removal of drill pipe and other debris, and the skidding of the rig away from the well.

On December 25, 1987, a bridge plug was set in the well at 1,150 feet. The next day 25 feet of sand were dumped on top of the plug, and an unsuccessful attempt was made to run a second bridge plug. The second plug could not be run below 267 feet.

Several unsuccessful attempts were then made to determine what was causing the second bridge plug to hang up. On December 27, 1987, a 300-ft balanced plug of 16.2-ppg cement was set from 1,125 feet to 825 feet. That same day, divers were jumped, and the bell nipple, annular preventer, BOP (top two rams), diverter spool with port diverter valve and line, and BOP (bottom ram) were recovered from the seafloor.

Finally, on December 28, 1987, the well was secured with the setting of a second balanced plug with 16.2-ppg cement from 825 feet to 158 feet.

## Damages

The bell nipple and entire BOP stack were sheared by abrasive sand particles flowing from the well and fell into the Gulf of Mexico. All of this equipment was recovered except the starboard diverter valve and line.

Some of the 5-inch drill pipe was blown out of the well and struck the rotary table and the underside of the rig floor. Very little of the 5-inch pipe has been recovered, indicating it has either been cemented in the well or buried beneath the seafloor. Because of the blowout, the 10 3/4-inch casing was very worn as indicated by a casing inspection log.

Water and sand were found throughout the rig. The rig floor and derrick received minor damage. There was no damage to the engine room and the hull of the rig.

## Conclusions

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### Probable Cause of Incident

The probable cause of the incident was the swabbing in of the well as the drill pipe was being pulled out of the hole. This allowed formation gas to enter the well bore and reduce the hydrostatic pressure of the drilling mud in the hole to a point where the well could flow.

### Contributing Causes of Incident

The following were contributing causes:

1. The last string of casing set prior to the blowout was set shallowly as planned and was not intended to withstand shut-in pressures at the casing seat. For this reason the lower pipe rams were only activated as a last resort.
2. The drilling of a gauged hole created a tight fit between the well bore and the drill string. This enhanced the chance of swabbing in the well during trips.
3. The chances of controlling the well after it started to flow were lessened by a lack of weighted mud. This was the result of the unavailability of a kill mud and the delays encountered in getting barite to the active mud pit.



## Recommendations

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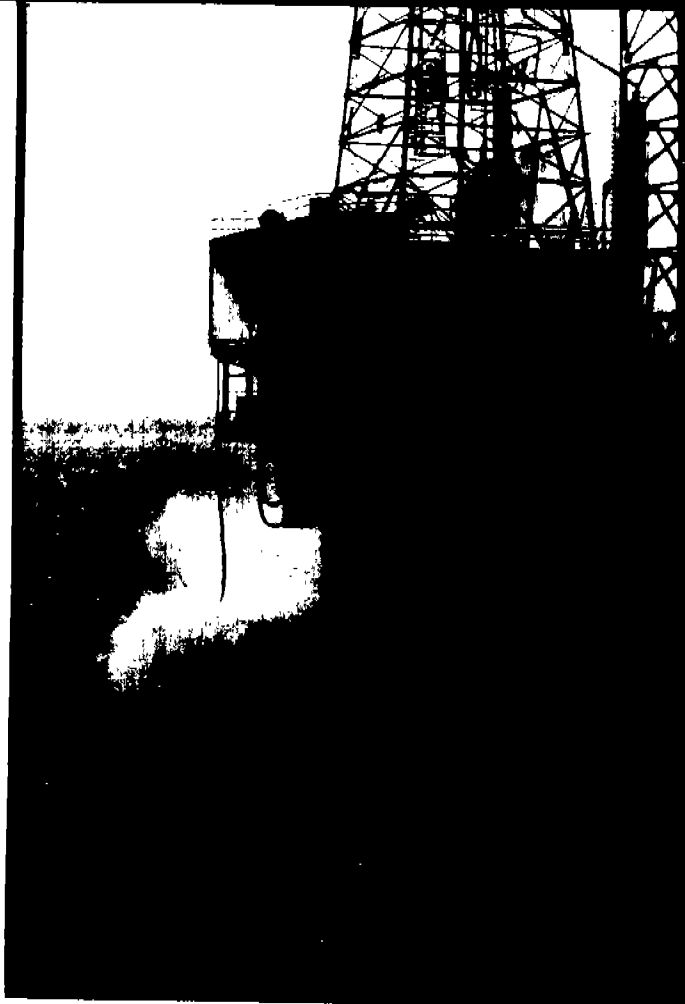
### Safety Alert

The Gulf of Mexico Region should issue a Safety Alert concerning the drilling of shallow, gauged holes as producing wells, including the potential effects of drilling into and the encountering of high permeability gas sands.

### Drilling Requirements

The Gulf of Mexico Region should consider requiring the following when shallow gas sands are the drilling objective:

1. A full BOP system, including a choke line and a kill line, be installed, thus allowing for better control of well fluids during critical operations.
2. An additional string of casing be set as close to a producing zone as is safely feasible, thus allowing for better control of formation pressures and fluids.



Photographs of Blowout



Photographs of Recovered Equipment



### SCHEMATIC OF BOP STACK

