

GERALD S.

OCS Report
MMS 86-0100



**Investigation of the December 1985 Blowout and Fire,
Lease OCS-G 4268,
West Cameron Block 648,
Gulf of Mexico,
Off the Louisiana Coast**

SCANNED

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West Cameron Block 648,
Gulf of Mexico,
Off the Louisiana Coast**

October 1986

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Table of Contents

	Page
I. Investigation and Report	
A. Authority	1
B. Procedures	1
II. Introduction	
A. Background	2
B. Description of Incident	4
III. Findings	
A. Preliminary Activities	6
B. Loss of Well Control	8
C. Abandonment of Rig and Platform	9
D. Ignition and Fire	10
E. Subsequent Activities	11
F. Killing of Well A-1	13
G. Injuries and Damages	14
IV. Conclusions	
A. Probable Cause of Incident	15
B. Possible Causes of Underbalanced Situation	15
C. Probable Cause of Ignition	15
D. Contributing Causes of Incident	15
E. Probable Cause of Injuries	16

V. Recommendations

A. Safety Alerts	16
B. OCS Order No. 6	17

Appendix

Attachment 1 — Photographs of Fire	18
Attachment 2 — Location of Lease OCS-G 4268, Gulf of Mexico	19
Attachment 3 — West Cameron Block 648, Location of Platform A on Lease OCS-G 4268	20
Attachment 4 — Schematic of Well A-1	21
Attachment 5 — Photographs of Fireboats and Tap-in	22
Attachment 6 — Photographs of Workstring Valve with Crossover Subs and Production Side of Platform	23
Glossary	24

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I. Investigation and Report

A. *Authority*

A serious blowout occurred on Sun Exploration and Production Company's (Sun) Platform A, West Cameron Block 648, Lease OCS-G 4268, in the Gulf of Mexico (GOM), offshore the State of Louisiana, at approximately 11:55 p.m. on December 3, 1985, and ignited on December 7, 1985. 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 19, 1985, the following MMS personnel were named to the Investigative Panel:

J. L. Guidry, Metairie, Louisiana
D. Lueck, Lake Charles, Louisiana
C. J. Schoennagel, Metairie, Louisiana

B. *Procedures*

Members of the Investigative Panel made several visits to facilities located in proximity to Platform A, West Cameron Block 648. During these visits, the Panel informally questioned Sun personnel to obtain information concerning the blowout and subsequent fire and to monitor Sun's efforts to extinguish the blaze and kill the well. (For photographs of fire, see appendix, attachment 1.)

The Investigative Panel convened on February 18, 1986, to formally question personnel knowledgeable about the blowout and fire. The meeting was held at the MMS GOM Regional Office in Metairie, Louisiana. The following is a list of the personnel from whom testimony was taken:

Charles LaCombe	Sun
Daniel E. Myers	Dowell Schlumberger, Inc.
Charles R. Quinn	Service Equipment and Engineering (S.E.E.)
Jim L. Waller	S.E.E.
Richard L. Werline	Sun

II. Introduction

A. Background

Lease OCS-G 4268 covers approximately 5,000 acres and is located in West Cameron Block 648, Gulf of Mexico, off the western Louisiana coast. (For lease location, see appendix, attachment 2.) The lease was issued effective December 1, 1979, for a cash bonus of \$22,265,000 with a 1/6 fixed royalty rate. The original lessees were as follows:

Sun Oil Company (Delaware) — 61.66 percent
Diamond Shamrock Corporation — 38.34 percent

Sun Oil was designated as operator of the lease with its issuance. Effective October 29, 1981, Sun Oil Company's name was changed to Sun Exploration and Production Company. Presently the lessees are as follows:

Sun Exploration and Production Company — 61.66 percent
Diamond Shamrock Offshore Partners Limited Partnership —
38.34 percent

By letter dated September 9, 1980, the MMS approved Sun's Plan of Development/Production for drilling 18 wells in Lease OCS-G 4268, West

Cameron Block 648. On September 15, 1980, the design, plan of installation, and surface location were approved for Platform A in West Cameron Block 648.

Development drilling commenced from Platform A on November 30, 1980, with the spudding of Well A-1. A total of 16 wells were drilled from Platform A with 13 completed as gas wells. (For platform and well location, see appendix, attachment 3.) On December 5, 1983, wells drilled and completed from Platform A were placed on continuous production.

Before the blowout and fire, the last annual inspection of the production operations of Platform A was completed by an MMS Petroleum Engineering Technician (PET) on July 3, 1985. The results of this inspection indicated that there were no violations of MMS regulatory requirements.

The S.E.E. Rig No. 14 was moved onto Platform A on November 13, 1985, to conduct workover operations. No inspection was conducted of the S.E.E. Rig No. 14 or the workover by an MMS PET before the blowout and fire.

Before the accident, there were 12 gas-producing wells on Lease OCS-G 4268. Daily production rates averaged approximately 330 barrels (bbls) of condensate, 970 bbls of water, and 71,200,00 cubic feet of gas.

B. Description of Incident

On December 3, 1985, the S.E.E. Rig No. 14, a platform-type rig, was being used to perform workover operations on Well A-1, Lease OCS-G 4268, West Cameron Block 648. (For schematic of Well A-1, see appendix, attachment 4.)

At approximately 10:45 p.m. the Dowell Schlumberger unit started to pump fluid down the A-1 workstring to set a cement plug below the existing perforations. By 11:35 p.m. the fluid had been pumped and the Dowell unit was disconnected from the well.

Two stands of the workstring were then pulled out of the well. At this time, approximately 11:55 p.m., a considerable amount of fluid was flowing out of the workstring. Attempts were made to stab a workstring valve into the workstring. After these attempts failed, the annular preventer and then the pipe rams were closed.

As gas started to flow out of the workstring, personnel aboard the rig and the platform were told to report to their abandon-ship stations. The platform Emergency Shutdown (ESD) System was activated, shutting in all wells and associated production equipment. At about 12:30 a.m., December 4, 1985, the rig and platform were abandoned via the escape capsules, except for three personnel who remained aboard the platform. All personnel who had abandoned the platform and the three who had remained were picked up by the motor vessel *Mary Lynn II* and were transported to Sun's West Cameron Block 639, Platform A. Three S.E.E. employees that had been slightly injured during the blowout were picked

up at West Cameron Block 639 at approximately 2:35 a.m. and transported via helicopter to St. Mary's Hospital in Port Arthur, Texas.

Several personnel reboarded the platform at about 9:30 a.m. on December 4, 1985, to survey the results of the blowout. The generators were shut down and the diesel tanks for the fire pumps were refueled. At this time the well was blowing gas and some sand. By 1:30 p.m. on December 4, 1985, two boats were on the scene spraying water on the rig to try to prevent the well from catching fire. Personnel were on and off the platform between December 4 and 7, 1985, attempting to kill the well and remove equipment from the facility. Additional fireboats and a derrick barge also arrived on the scene during this time period.

On December 7, 1985, at approximately noon, the traveling block fell to the drill floor, igniting the gas. Within minutes the drill floor was engulfed in flames, with the derrick collapsing by 12:30 p.m.

On December 10, 1985, the semisubmersible rig *Penrod 70* spudded Relief Well No. 1, while the jack-up rig *Gorilla III* spudded Relief Well No. 2 on December 25, 1985. After the gas ignited, fireboats continued to spray the rig and platform in an attempt to put out the fire. (For photograph of fireboats, see appendix, attachment 5.) Sun also tapped into the structural casing of Well A-1 and pumped water into the annulus in an attempt to put out the fire. (For photograph of tap in, see appendix, attachment 5.)

The fire was extinguished on December 31, 1985, at approximately 3:45 a.m., but a grey mist was still being blown out of the well. The well was

killed on January 20, 1986, after approximately 40 bbls of cement were pumped into the well.

Pollution that resulted from the blowout and fire was minimal. The only injuries reported were minor burns that occurred to three of the rig personnel during the initial stages of the incident. The S.E.E. Rig No. 14 was completely destroyed and Sun's Platform A received extensive damage to the wellbay area.

III. Findings

A. *Preliminary Activities*

Installation of the S.E.E. Rig No. 14 on Sun's Platform A in West Cameron Block 648 began on November 13, 1985. Workover operations on Well A-1 commenced on November 19, 1985, with the well being circulated with a 13.0 pound-per-gallon (ppg) calcium chloride (CaCl_2) and calcium bromide (CaBr_2) brine solution. The blowout preventer (BOP) stack and associated surface equipment were hooked up on November 21, 1985, and tested on November 22, 1985. Workover operations continued on Well A-1 through November 29, 1985, when the BOP stack and associated surface equipment were again tested.

On December 3, 1985, Well A-1 was circulated with 13.1 ppg CaCl_2 and CaBr_2 in preparation for the setting of a balanced cement plug. C.R.C. Wireline ran a CCL-gamma-ray tool so that a correlation of workstring

measurements with perforation location could be obtained. After the gamma-ray log was run, the Dowell Schlumberger (DS) unit was hooked up to circulate fluid to the workstring.

The DS unit and associated lines were pressure tested to 4,000 pounds per square inch (psi). At approximately 10:45 p.m. the job of setting the cement plug began with the pumping of an 11-barrel freshwater buffer. This was followed by 5 bbls (25 sacks) of 16.4 ppg Class H cement to be set as the balanced plug at a depth of 10,390 to 10,165 feet. The cement was followed by a 3-bbls freshwater buffer and displaced down the workstring with 73 bbls of CaCl_2 and CaBr_2 . Testimony obtained at the meeting indicated that (1) the volume of brine solution necessary to displace the cement to the depth required was calculated to be 74.4 bbls but was cut short at 73 bbls, and (2) there was a several-minute delay in the pumping of the brine solution because it could not be obtained at the DS unit.

After displacement was completed, the DS unit was shut down. At this time, the pressure on the unit was approximately 100 psi. Between 1 and 2 bbls of fluid were bled back from the workstring at the DS unit, and the pressure then read 200 psi. No serious back pressure was observed, and the associated flowback was thought to be a U-tube effect from the heavier cement in the wellbore. Therefore, the DS unit was rigged down and operations were turned over to the drill floor.

B. Loss of Well Control

A workstring valve on top of the workstring was opened and some flow was observed. This valve was then removed. The first stand of the workstring was pulled out of the hole, the connection broken, and the stand racked back. The flow from the workstring was observed to have slightly increased.

The second stand of the workstring was pulled out of the hole, the connection broken, and the stand racked back. The flow was observed to have increased considerably from the previous stand. A decision was made to shut in the well. Several unsuccessful attempts were made at stabbing the workstring valve. Information obtained at the February 18 meeting suggests that there was a time delay from when the decision was made to when the first attempt was made to stab the valve, with the result being an increase in flow out of the workstring. Testimony indicated that the delay was the result of the following factors: (1) the workstring valve and crossover subs were too heavy and cumbersome to be picked up by the drill crew and stabbed directly onto the workstring and therefore had to be hooked up on a sling and moved with the air hoist (for photograph of workstring valve with crossover subs, see appendix, attachment 6); (2) the drill crew was in the middle of a shift change when the decision was made to stab the valve, and therefore, before they could attempt to stab the valve, the crew had to put on protective clothing and equipment (slicker suits, goggles, gloves, etc.) to protect themselves from the CaCl_2 and CaBr_2 being blown out of the well.

While the attempts were being made to stab the valve onto the workstring, the flow was increasing out of the workstring and starting to come out of the annulus. Testimony indicated that the valve was stabbed on the workstring but, because the threads were difficult to make up, flow from the workstring continued. At approximately 12:00 midnight the annular preventer and pipe rams were closed to secure the annulus of the well. As flow from the workstring continued to increase, the decision was made to evacuate the drill floor and assemble personnel at the abandonment stations.

C. Abandonment of Rig and Platform

During the evacuation of the drill floor, cement and gas were observed to be coming from the well. The blind rams, which were not the shear type, were closed, with the results being a brief period of reduced flow.

Personnel aboard the rig attempted to notify both Platform A and shore personnel of the incident as they prepared to abandon the rig. Testimony obtained at the meeting indicated that no abandon-ship alarm was sounded during the evacuation. However, Platform A personnel had noticed the accident and activated the ESD system which shut in the other wells and associated production equipment on the platform.

The escape capsule for the rig was not launched immediately after all personnel had assembled at their abandon-ship station. There was concern for launching the capsule because its engine would not start, and the capsule would then be powerless in the water. Also, there were discussions as to whether or not the capsule needed to be launched, considering it was

reasonably clear of and below the escaping gas. The production personnel that had assembled at the escape capsule for Platform A did not launch immediately, as they were farther from the blowout than those by the rig capsule and were waiting on that capsule to launch.

But, at approximately 12:30 a.m., December 4, 1985, the escape capsules for the rig and the platform were launched. Three production personnel that were assembled at the platform escape capsule remained aboard the platform. They felt that there was no immediate danger, and that if flow from the well subsided, they might be able to stab the workstring valve and shut in the well.

While in the water, the platform escape capsule experienced engine problems also, and both capsules drifted without power. The personnel aboard the escape capsules and those that remained aboard the platform were picked up by the *M. V. Mary Lynn II*; they were transported to Sun's West Cameron Block 639 Platform A at approximately 2:30 a.m.

D. Ignition and Fire

Personnel reboarded the platform and rig at approximately 9:30 a.m., December 4, 1985. The well had ceased blowing sand, and well fluids were observed to be hitting the top of the derrick, some 84 feet above the drill floor. The spray system on the platform was kept in operation with the refueling of the diesel tanks for the fire pumps. Two boats were on the scene spraying water on the platform and rig by 1:30 p.m. on December 4,

1985. The spraying operations were an attempt to prevent ignition of the escaping gases. At the same time, Sun was making plans to kill with fluid the remaining wells on the platform.

By December 6, 1985, Sun had four boats and a derrick barge on location. Spraying of the platform and rig continued, and methods of killing the wells and removing platform and rig equipment from the platform were evaluated. The well was observed to be flowing some gas and sand, with two feet of sand having accumulated on the drill floor.

On December 7, 1985, a 2-inch line was hooked up from the derrick barge to the Well A-1 tubing head. Pumping of kill mud began at approximately 11:45 a.m.

At approximately 12:00 noon, December 7, 1985, the traveling block in the derrick fell, immediately igniting the gas. By 12:30 p.m. the derrick had collapsed, and by 6:30 p.m. the quarters for the drilling rig had toppled overboard and sunk.

E. Subsequent Activities

In an attempt to extinguish the blaze, additional boats equipped with fire monitors arrived on location. At one time 58,000 gallons of water were being sprayed on the fire per minute. The fire was extinguished several times on December 9, 1985, and thereafter, but it continued to reignite.

Headquarters for the personnel responsible for extinguishing the fire and killing the well was established aboard the derrick barge. These personnel

periodically boarded the platform to monitor how the other wellheads were holding up and to maintain the fire pumps on the platform. In addition, they used the crane on the derrick barge to clear debris from the rig and platform.

On December 10, 1985, the semisubmersible drilling rig *Penrod 70* spudded Relief Well No. 1.

On December 17, 1985, hot-tapping of two 2 1/2-inch holes in the 26-inch casing of the A-1 well began at the 14-foot level. By December 18, 1985, the holes were completed, hoses were hooked up, and water was pumped into the 26-inch by 16-inch annular space of Well A-1. This resulted in a significant reduction in the noise level of the blowout but no apparent change in the intensity of the fire. A total of six holes were drilled into the annulus of Well A-1, hoses were connected, and more water was pumped into the annular space. It was reported that the additional pumping caused a further reduction in the noise level of the blowout and a reduction in the intensity and height of the fire.

By December 24, 1985, 67,000 gallons of water were being pumped per minute onto the fire. The fire was extinguished several times but would always reignite shortly thereafter.

The jack-up drilling rig *Gorilla III* spudded Relief Well No. 2 on December 25, 1985. At this time, Relief Well No. 1 was drilling below 5,000 feet with no major problems encountered.

On December 31, 1985, at approximately 3:45 a.m., the fire was extinguished and did not reignite. However the well was still flowing gas, condensate, and sand.

A crane was installed aboard Platform A, and the 26-, 16-, and 10 3/4-inch casings were removed at the 14-foot level on January 2, 1986. A casinghead was then welded onto the 7 5/8-inch casing. A BOP was installed on the well, but the attempt at shutting in the well resulted in the rupture of a burst plate.

A diverter system was then installed on the well. Flare lines were hooked up to the diverter, and controlled flaring of Well A-1 began by January 13, 1986.

F. Killing of Well A-1

A work deck was constructed above Well A-1 and a snubbing unit was installed on the work deck. The snubbing unit was rigged up to the BOP, and snubbing operations were begun on Well A-1. During these operations the tubing pressure was observed at 3,900 psi. One hundred bbls of salt water were pumped into the well on January 18, 1986. After the operation the tubing pressure was observed to be 1,125 psi.

On January 20, 1986, Well A-1 was killed when 40 bbls of 16.4 ppg cement were displaced into the well with 58 bbls of sea water. Well A-1 was plugged on January 23, 1986, by cementing to the mudline the annulus between the 7 5/8- and 10 3/4-inch casings and the 3 1/2-inch workstring and 7 5/8-inch casing.

After Well A-1 was killed, operations on Relief Wells Nos. 1 and 2 were suspended. Relief Well No. 1 was plugged and abandoned on January 29, 1986, and Relief Well No. 2 was plugged and abandoned on February 1, 1986.

G. Injuries and Damages

Three S.E.E. employees were slightly injured during the course of the blowout and fire. All injuries occurred while personnel were attempting to stab a workstring valve onto the workstring.

The three injured S.E.E. employees — Parker Dixon and Danny Shephard, roughnecks, and Steve Pistole, derrickman — were transported via helicopter from Sun's Platform A in West Cameron Block 639 to St. Mary's Hospital in Port Arthur, Texas. All were treated for burns received from the CaCl_2 and CaBr_2 fluid being blown out of the well, and all were released the same day.

The wellbay area of the West Cameron Block 648 Platform A was completely destroyed. All wellheads and flowlines in the area were replaced. The firewall separating the wellbay area from the rest of the platform prevented the fire from spreading to and destroying the production equipment, living quarters, and heliport. (For photograph of production side of platform, see appendix, attachment 6.) The platform was restored to production on August 20, 1986. The S.E.E. Rig No. 14 was completely destroyed.

IV. Conclusion

A. *Probable Cause of Incident*

The probable cause of the incident was that the fluid in the workstring was underbalanced and did not exert enough hydrostatic pressure to counteract the downhole pressures.

B. *Possible Causes of Underbalanced Situation*

1. The fluid pumped into the workstring to displace the cement plug was too light.
2. The fluid pumped into the workstring overdisplaced the cement plug into the annulus of the well.

C. *Probable Cause of Ignition*

The falling of the traveling block onto the drill floor was the probable cause of the ignition of the escaping gas.

D. *Contributing Causes of Incident*

1. The absence of a workstring "safety" valve on the drill floor to fit the workstring being used. The valve on the drill floor that fit the workstring was being used as a work valve with crossover subs attached and, as such, could not be easily stabbed onto the workstring.
2. The delay in attempting to stab the workstring valve because of the personnel crew change. When the decision was made to stab the workstring valve, there were no personnel with proper protective

clothing and equipment. The crew going off duty had already removed theirs and the crew coming on had not yet put theirs on.

3. The type of thread in the workstring was difficult to make up. This difficulty was compounded by the fluid flowing out of the workstring.

E. Probable Cause of Injuries

Personnel not having proper protective clothing and equipment to work with the fluid being used was the probable cause of the injuries.

V. Recommendations

A. Safety Alerts

The Gulf of Mexico Region should issue Safety Alerts concerning the following:

1. Lessees and contractors should consider the installation of a full-opening workstring valve or a back-pressure valve at a predetermined location in the workstring when conducting cementing operations, thus allowing for better control of well fluids during critical operations.
2. Lessees and contractors should consider establishing detailed procedures for tool changes during critical well-control operations including the possibility of delaying the tool change.

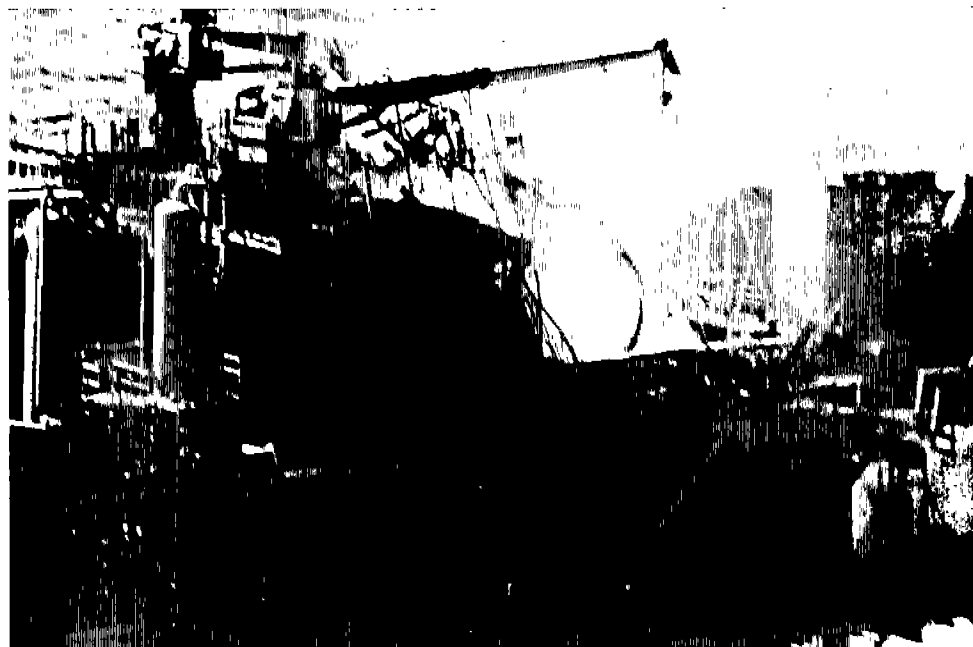
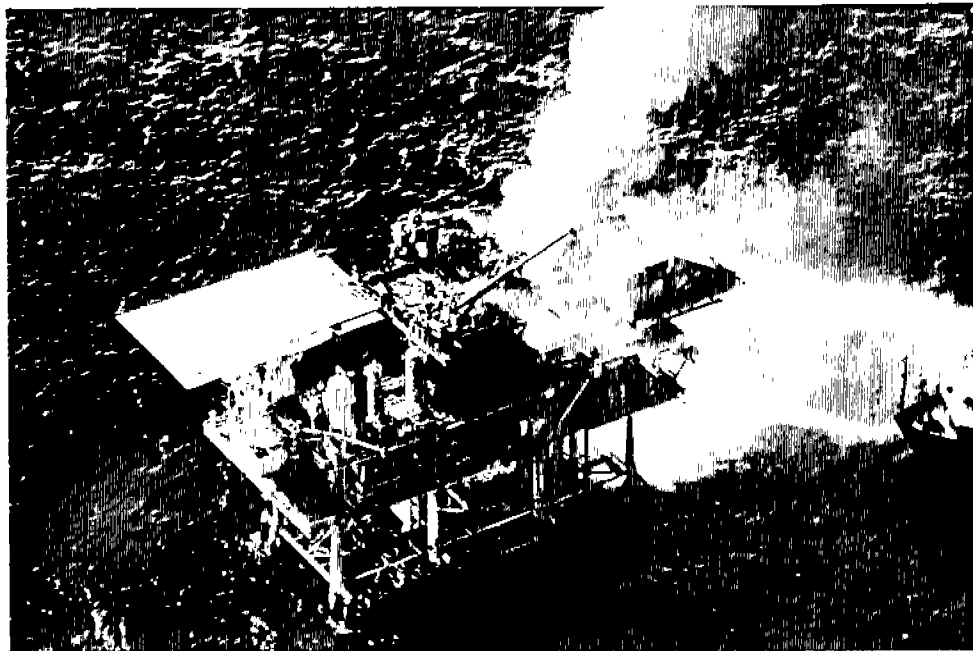
3. Lessees and contractors should consider the difficulty that could occur in making up a workstring safety valve into a fine-threaded workstring .

B. OCS Order No. 6

OCS Order No. 6 should be revised to include the following requirements:

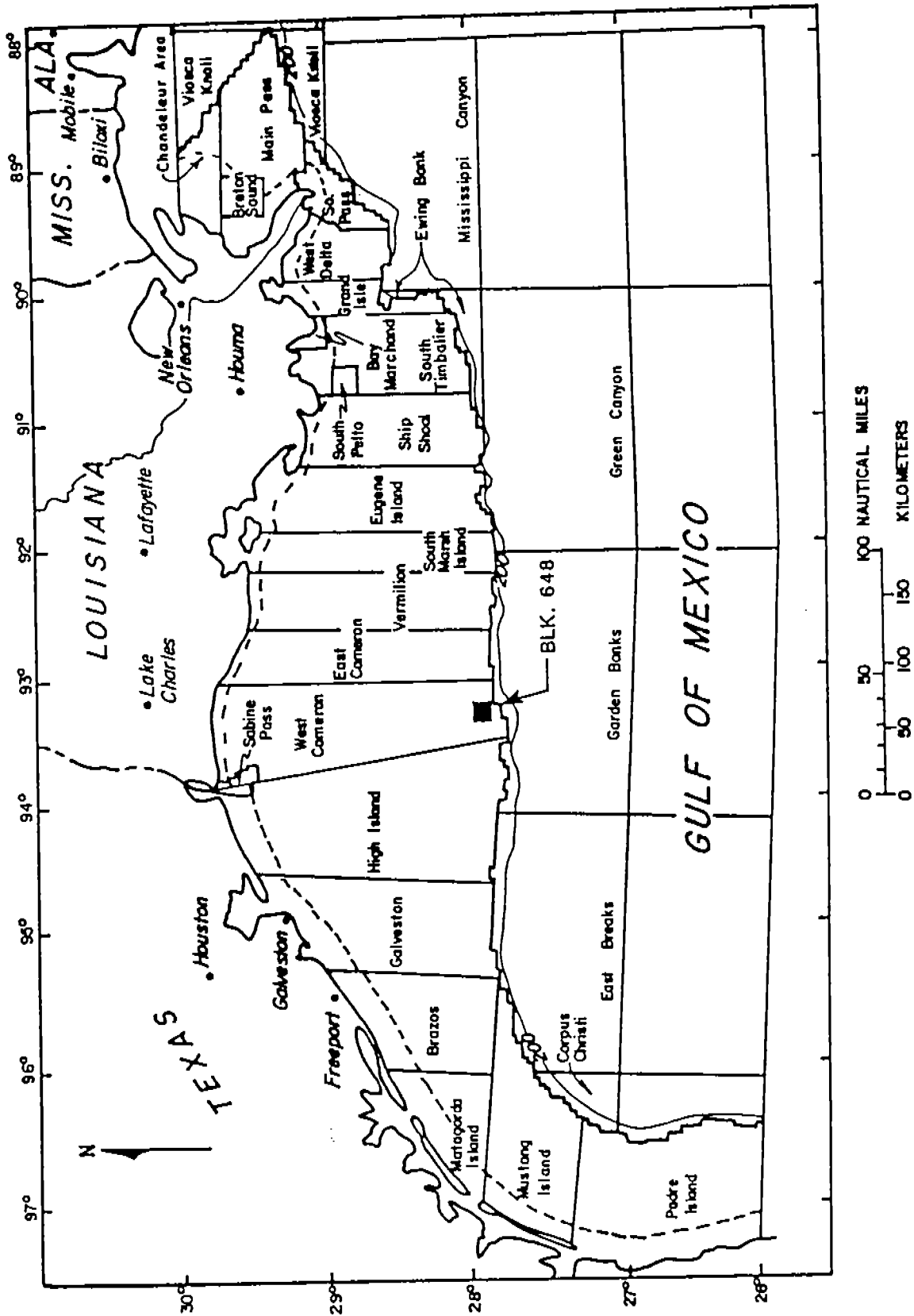
1. At all times during workover operations, a workstring safety valve shall be available on the drill floor to fit the workstring being used.
2. During workover operations, when fluids that can cause severe skin burns are being used in the well, proper protective clothing and equipment (slicker suits, goggles, gloves, etc.) shall be worn by the drill floor crew.
3. During workover operations, blind shear rams shall be provided in the BOP stack.

Finally, OCS Order No. 6 shall be completely revised, so that more stringent regulations are required for both workover and completion operations.



Photographs of Fire

BEST AVAILABLE COPY



Location of Lease OCS-G 4268, Gulf of Mexico. Dashed lines indicate boundary between State and Federal waters; solid line indicates 200-meter water depth.

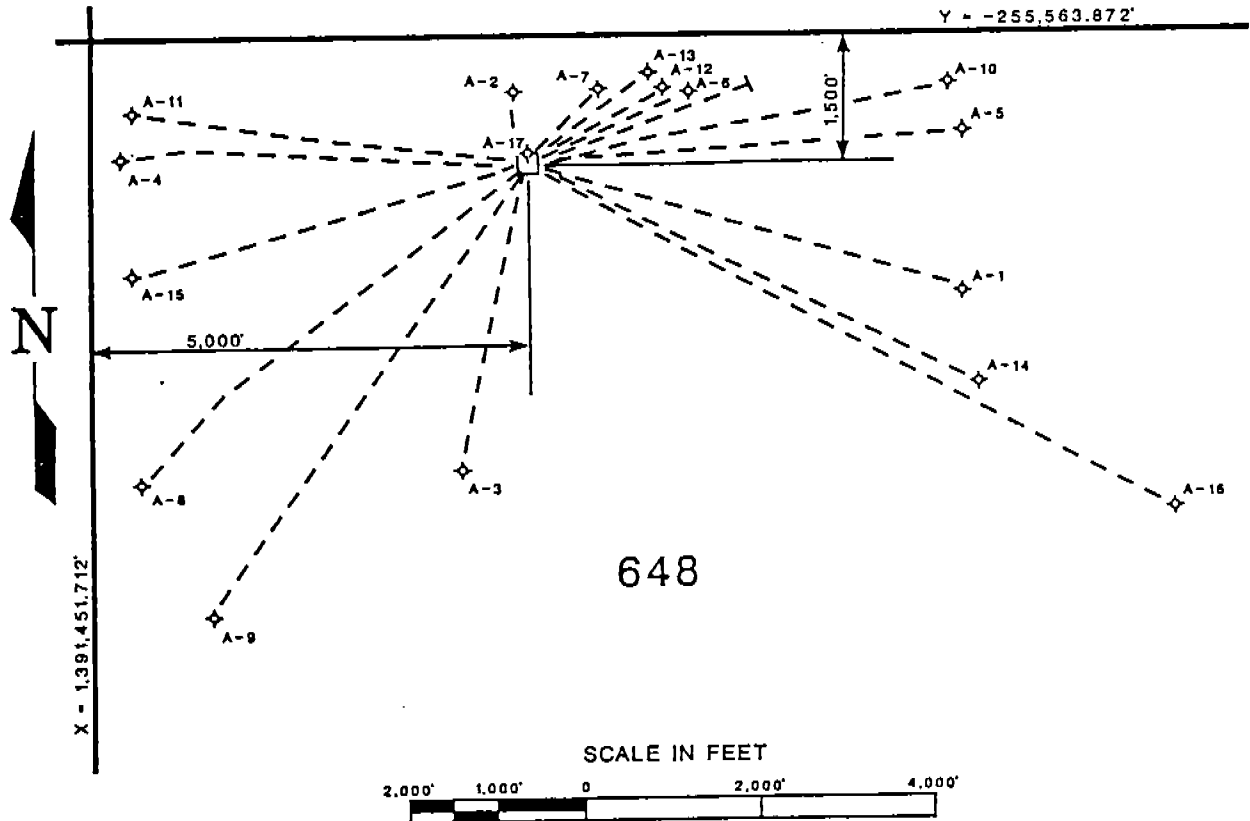
WEST CAMERON BLOCK 648
LOCATION OF PLATFORM A
ON LEASE OCS G-4268

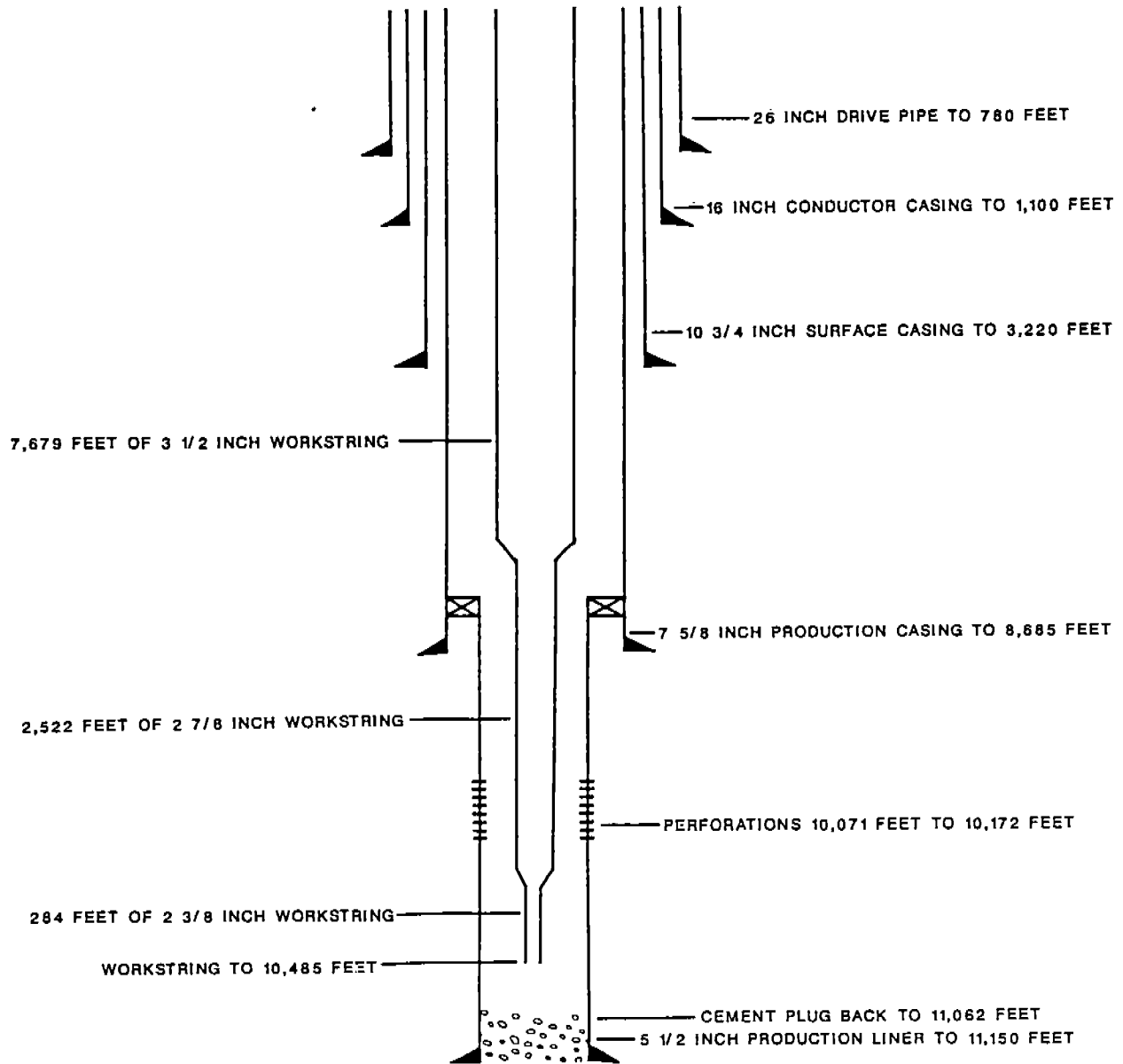
SUN G-4268

PLATFORM A

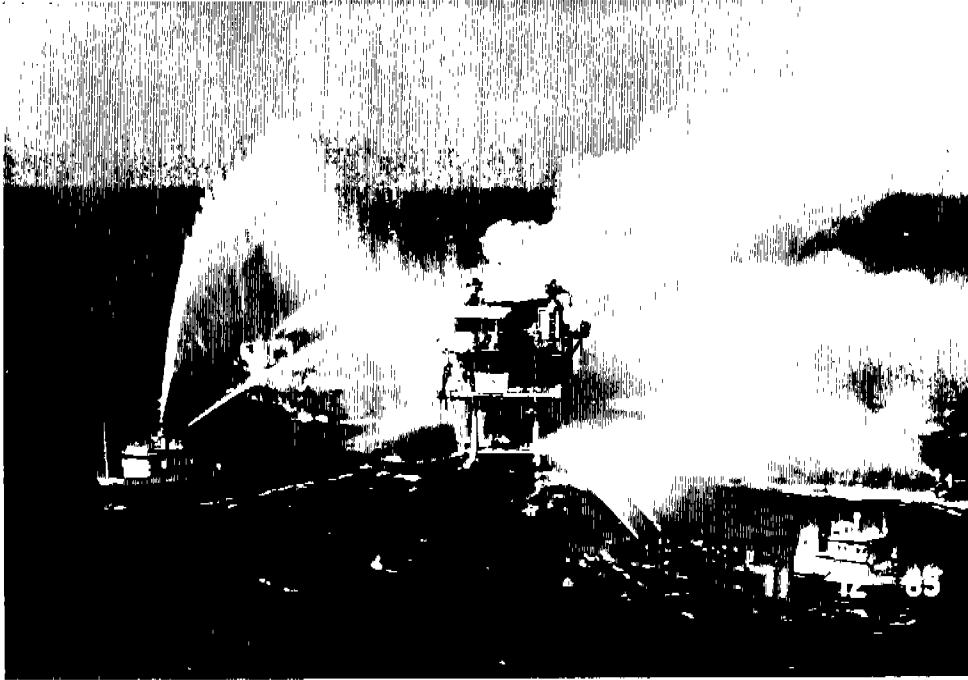
X = 1,396,451.71'
Y = -257,083.87'

LAT. 27° 56' 47"
LONG. 93° 12' .06"





SCHEMATIC OF WELL A-1

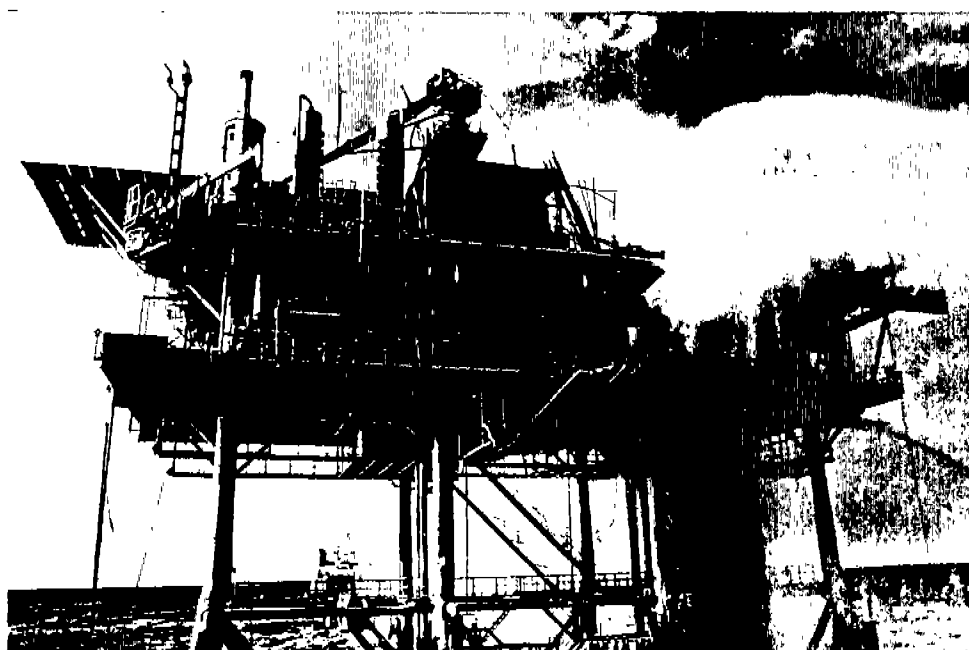
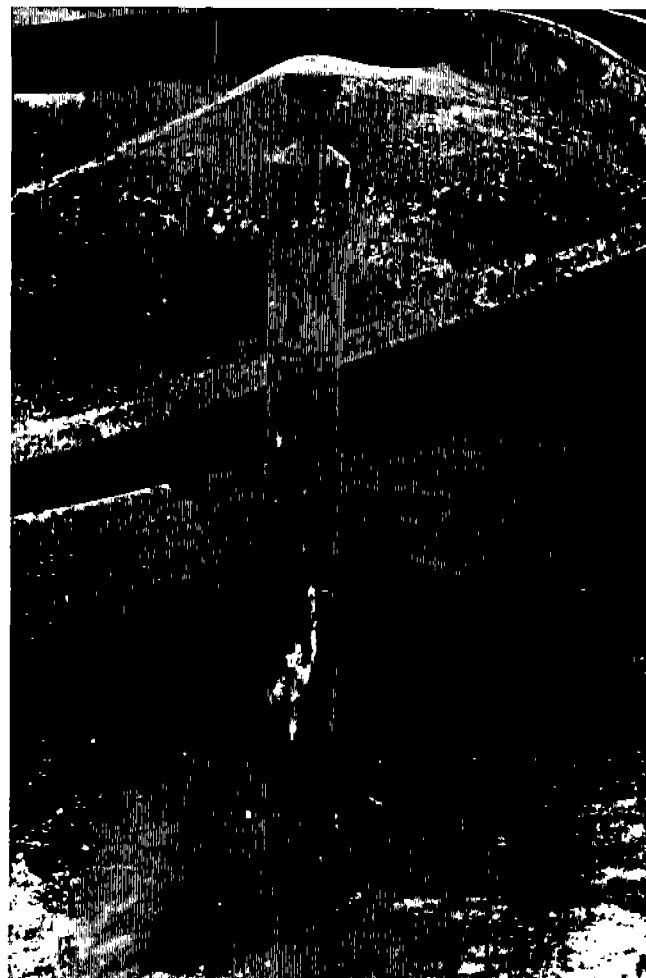


Fireboats



Tap-in

Right: Workstring valve with crossover subs.
Below: Production side of platform.



Glossary

Annular Preventer — A large valve that is used to form a seal in the annular space between a workstring or drill pipe and casing.

Annulus — The space around a pipe in a wellbore, the outer wall of which may be the wall of either the bore hole or the casing.

Blind Rams — A large closure mechanism that is installed as part of a blowout-preventer stack, and that will seal off the wellbore in the event of a gas kick or blowout when the workstring or drill pipe is out of the well.

Blind-Shear Rams — A large closure mechanism that is installed as part of a blowout-preventer stack and that will cut or shear the workstring or drill pipe if they are present in the well, thus sealing off the well in the event of a gas kick or blowout.

Blowout Preventer (BOP) Stack — An assembly of heavy-duty valves or rams attached to the top of casing to control well pressure.

Burst Plate — A safety device designed to burst at a predetermined pressure that is less than the maximum working pressure of the unit it is protecting.

Casing — Steel pipe used in wells to seal off fluids from the borehole and to prevent the walls of the well from sloughing off or caving. There may be several strings of casing in a well, one inside the other.

Circulate — To pump a drilling or workover fluid into the borehole through the drill pipe or workstring and back up the annulus.

Crossover Subs — A usually short section of steel pipe designed to make up to other sections of pipe having different thread types or sizes.

Drill Floor — The area where the driller and his crew work.

Emergency Shutdown (ESD) System — A designed system of safety equipment that initiates shutdown of all wells and product-process equipment when a station is activated during an abnormal condition.

Escape Capsule — A device used for evacuating personnel from a platform or rig.

Flaring — The controlled releasing of a gas to the atmosphere.

Hot Tapping — Making repairs or modifications on a tank, pipeline, or other installations without shutting down operations.

Kill the Well — To overcome downhole pressure in a well by the use of a drilling or workover fluid.

Make up — The joining or putting together of a male and female thread to start a connection and achieve a seal joint.

Pipe Rams — A large closure mechanism that is installed as part of a blowout-preventer stack and that will seal off the wellbore in the event of a gas kick or blowout when the drill pipe or workstring is in the annulus.

Snubbing Unit — A piece of equipment or device used for servicing wells under pressure.

Stand — A section of workstring or drill pipe, usually made up of two or three joints, unscrewed from the string as a unit and racked in the derrick.

Traveling Block — A large heavy-duty block hanging in the derrick which supports the drill pipe or workstring when these are going in and out of the wellbore.

Wellbay Area — Area on a production platform where the wellheads are located.

Wellhead — An assembly of valves mounted on the casinghead through which the well is produced.

Workstring — A string of pipe used in working over a well.

Workstring Safety Valve — A valve kept on the drill floor to fit the size and type of workstring in the well and used solely for emergency situations.

Workstring Valve — A valve and, if necessary, associated equipment kept on the drill floor and used on the top of a workstring as a shutoff mechanism when rigging up on a well for wirelining, pumping, or other remedial work.