VUF-1022
FINAL REPORT

VELA UNIFORM PROGRAM

PROJECT DRIBBLE

SALMON EVENT

TATUM SALT DOME, MISSISSIPPI

22 OCTOBER 1964

part of an experiment in seismic decoupling at the nuclear level

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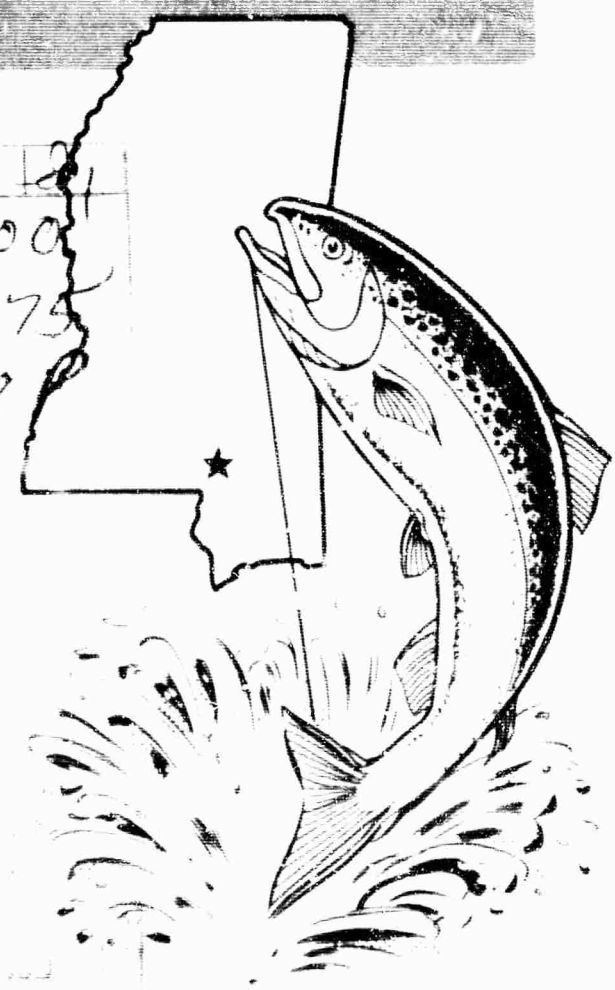

Preshot and Postshot Safety Survey of Oil and Gas Facilities—Baxterville Field, Mississippi

DON C. WARD
U. S. BUREAU OF MINES

Issued: 5 August 1965

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VUF-1022

NUCLEAR EXPLOSIONS—PEACEFUL APPLICATIONS
(TID-4500, 43rd Ed.)

PROJECT DRIBBLE
SALMON EVENT

PRESHOT AND POSTSHOT SAFETY SURVEY OF OIL AND GAS FACILITIES - BAXTERVILLE FIELD, MISSISSIPPI (Final Report)

Don C. Ward
U. S. Bureau of Mines
Bartlesville Petroleum Research Center
Bartlesville, Oklahoma

January 1965

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PRESHOT AND POSTSHOT SAFETY SURVEY OF OIL AND GAS FACILITIES - BAXTERVILLE FIELD, MISSISSIPPI

PROJECT DRIBBLE - SALMON EVENT

I. INTRODUCTION

1.1 Authority

The survey was conducted in accordance with the Operational Safety Plan for Project Dribble - Salmon Event, dated July 1964.

1.2 Purpose and Scope

Oil and gas wells and related facilities of the Baxterville field were surveyed to document any physical changes resulting from the Salmon Event. All such structures within a 5-mile radius of Ground Zero (GZ) were examined and photographed in detail. In addition, all wells and major facilities between the 5- and 6-mile radii, as well as other selected wells and facilities within a 10-mile radius of GZ, were examined and photographed.

1.3 Summary

No damage was observed at any of the oil or gas wells or related facilities. Notes and photographic documentation are contained in the appendixes.

1.4 Background

Previous investigation (references 1 and 2) by the U. S. Bureau of Mines (USBM) included a preliminary survey of oil and gas wells and associated facilities of the industry that lie within 10 miles of the proposed test site at the Tatum Dome, Lamar County, Mississippi. Figure 1 of Appendix A shows locations of such wells and facilities within 5- and 10-mile radii of GZ.

Many test wells were drilled within this area, but only in the Baxterville field have oil and gas been produced in commercial quantities. Figure 2 of Appendix A shows location, status, and ownership of all wells within the Baxterville field. Gulf Oil Corporation is the major operator of the field. On the shot date (October 22), 149 wells were producing oil from the Lower Tuscaloosa formation at depths ranging from 8,600 to 8,900 feet. Thirty-three wells were producing gas, three from the Wilcox formation at a depth of about 5,100 feet and thirty from the Upper Tuscaloosa formation at depths between 7,614 and 7,970 feet. Daily production from the Baxterville field is approximately 15,000 barrels of oil and 25,000 Mcf of gas.

Five gas pipelines, three oil pipelines, and one liquified petroleum products line cross the area (see Appendix A). A dehydration plant (6 miles from GZ), operated by the United Gas Company of Shreveport, Louisiana, and having a daily capacity of about 200 million cubic feet

of gas, delivers dry gas to three of the company's pipelines.

The nearest productive well is 4.7 miles from Salmon GZ. The nearest petroleum facility is a 16-inch gas pipeline that passes within 2.8 miles of GZ. Based on predicted peak ground motions and experience from previous nuclear tests, the USBM concluded that no damage to these facilities could be expected.

II. SURVEY

2.1 Preshot

Because of the many and varied structures and facilities (derricks, pumping units, wellhead connections, tank batteries, gathering lines, etc.) within the Baxterville field and in view of the remote possibility of only minor damage, a detailed survey of the entire field was deemed impractical.

All oil and gas structures within a 5-mile radius of GZ were examined and photographed in detail. All major facilities and installations within a 6-mile radius of GZ were surveyed along with other potentially critical structures within a 10-mile radius of GZ.

The preshot survey was initiated on September 11, 1964, 11 days before the originally scheduled date for detonation. The above-mentioned facilities were inspected, and photographs were taken to provide documentation of any physical changes.

Arrangements were made to place, on the day of the shot, a down-hole pressure bomb in Gulf Oil Corporation's Bass-Bilbo Well No. G-2 (4.8 miles from GZ).

Representatives of the producing and pipeline companies of the Baxterville area were contacted and advised of the scheduled date for detonation and the degree of ground shock that was expected. These companies were kept informed throughout the postponement interval.

2.2 Postshot

The postshot survey began immediately after the detonation at 10:00 a.m., October 22, 1964. The same facilities as documented in the preshot survey were examined and photographed. Also, inquiry was made to the oil companies concerning possible damage resulting from the Salmon Event.

Representative samples of the photographs appear in the appendix. Additional photographs (a total of 360 were taken) are on file at the USBM Bartlesville Petroleum Research Center, Bartlesville, Oklahoma.

The preshot and postshot surveys were performed by personnel of the USBM: Don C. Ward, petroleum research engineer, and Duel J. Sears, photographic technician.

III. OBSERVATIONS

No damage was observed either by on-the-spot inspection or examination of photographs.

No damage was reported by the producing or pipeline companies.

Seismic measurements taken by the U. S. Coast and Geodetic Survey at a point within the Baxterville field and 6 miles from GZ recorded a maximum acceleration of 0.049 g's and a maximum displacement of 0.1 centimeter.

The down-hole pressure bomb recorded no change in bottom-hole pressure, and surface measurements of wellhead pressures throughout the field also registered no change in pressures subsequent to the detonation.

IV. CONCLUSIONS

The preshot and postshot survey indicated that no damage occurred to any oil or gas well or related facility. Maximum values of ground shock recorded in the Baxterville field were well below those values at which structural damage to oilfield construction would be anticipated.

It is concluded that, for future projects, no damage should result to similar structures from comparable yields at comparable ranges. Also, it is concluded that the survey procedures were adequate to accomplish the survey objectives.

REFERENCES

1. Riggs, C. H., and Don C. Ward; Oil and Gas Wells and Associated Facilities in the Tatum Dome Area, Lamar County, Mississippi; U.S. Bureau of Mines--Special Report to AEC, January 1963.

2. Ward, Don C., and C. H. Atkinson; Report of Initial Review of Possible Damage to Petroleum Reservoirs in the Vicinity of the Salmon Nuclear Test Event, Project Dribble; U.S. Bureau of Mines--Special Report to AEC, June 12, 1963.

APPENDIX A

Maps

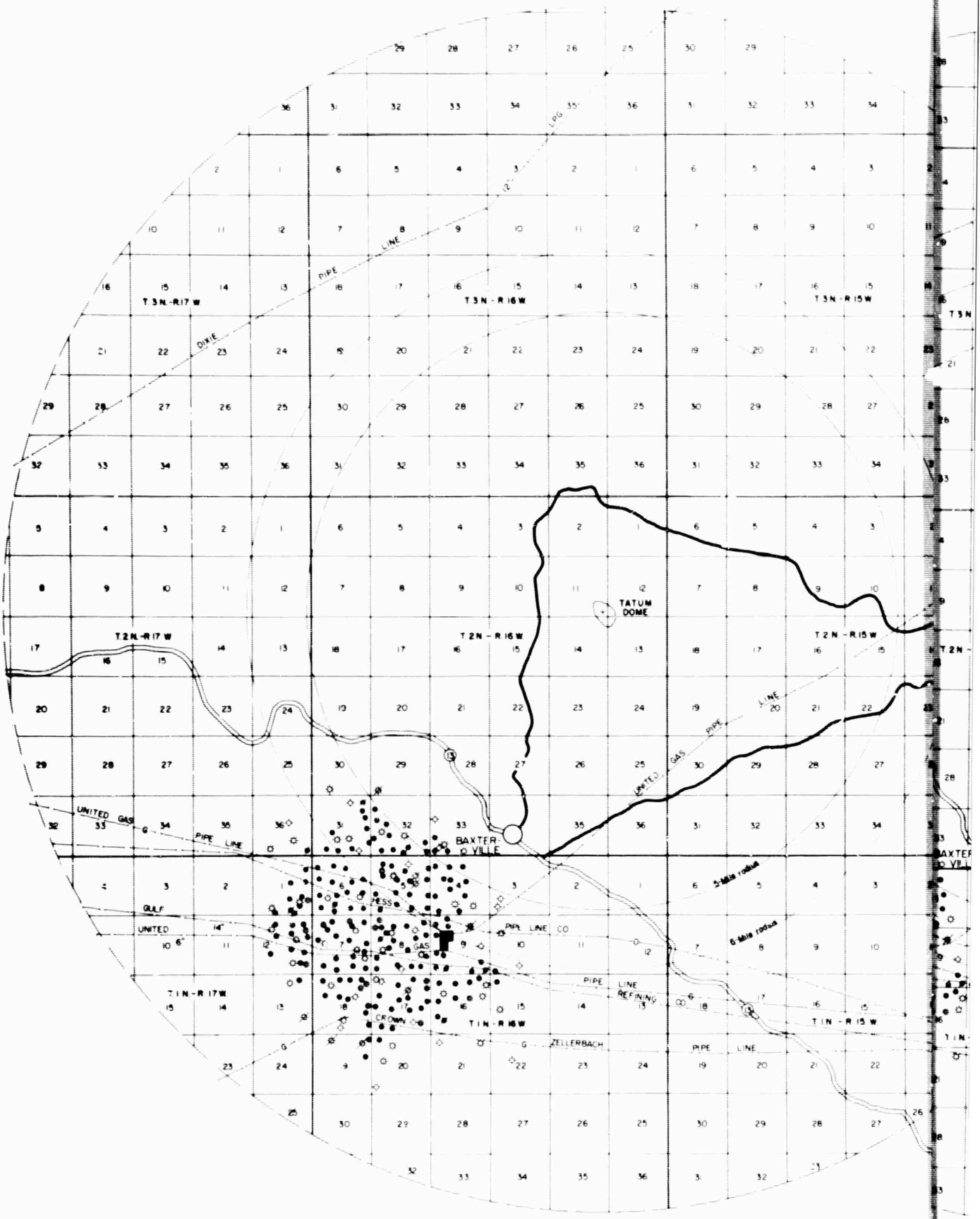
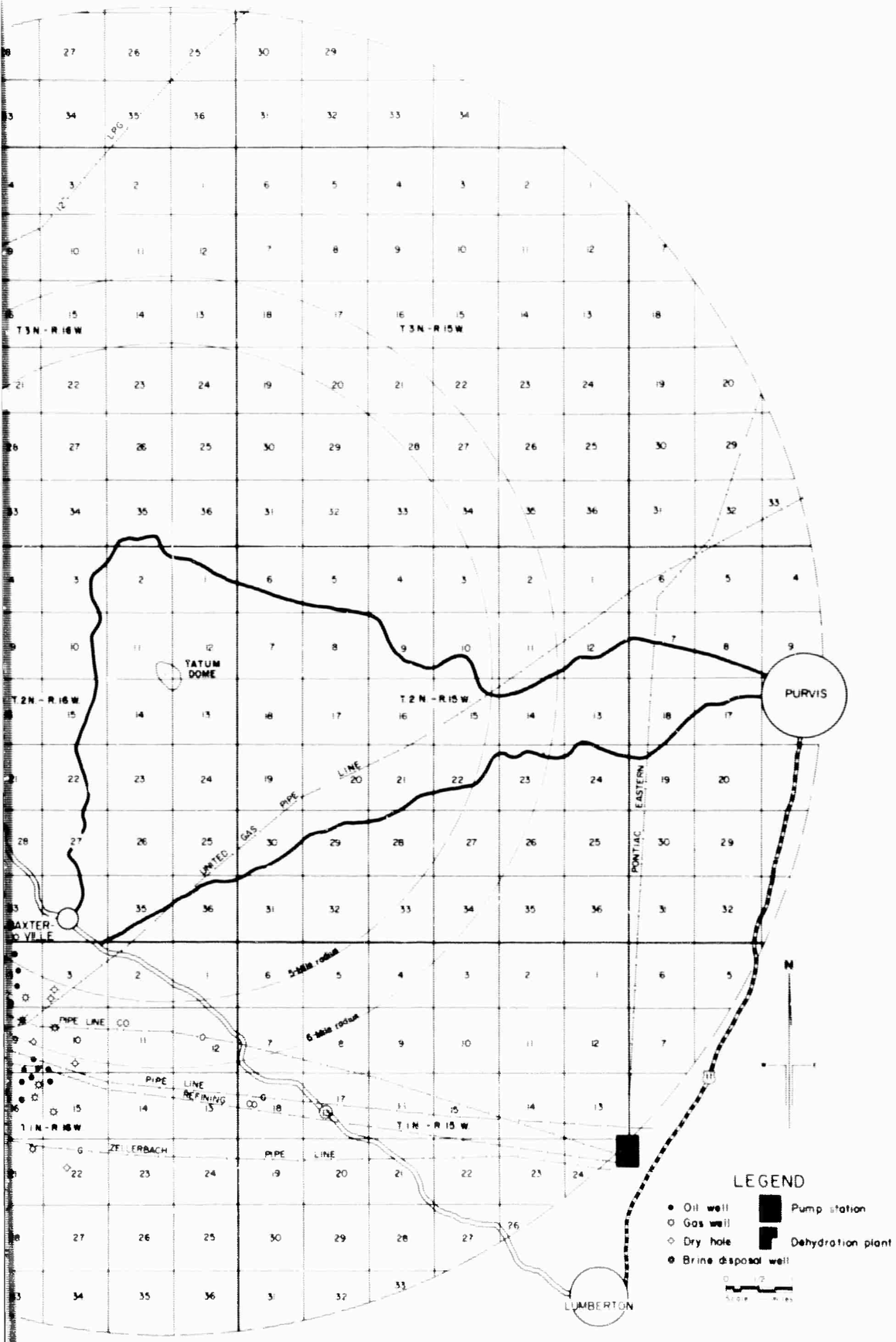


FIGURE 1 - Oil and Gas Facilities Within 10 Miles of Salmon Event — Project Dr as

A



Gas Facilities Within 10 Miles of Salmon Event – Project Dribble.

B

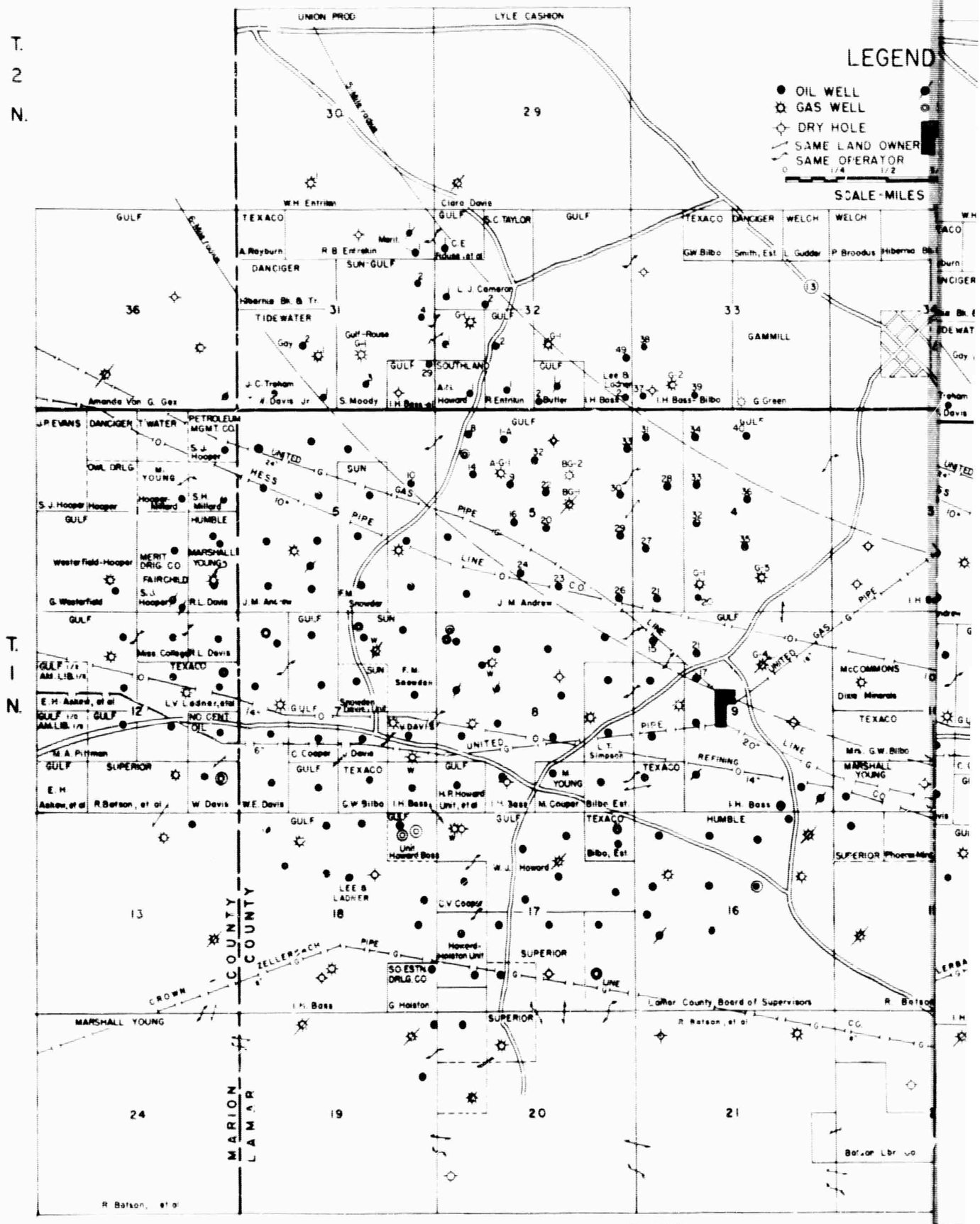
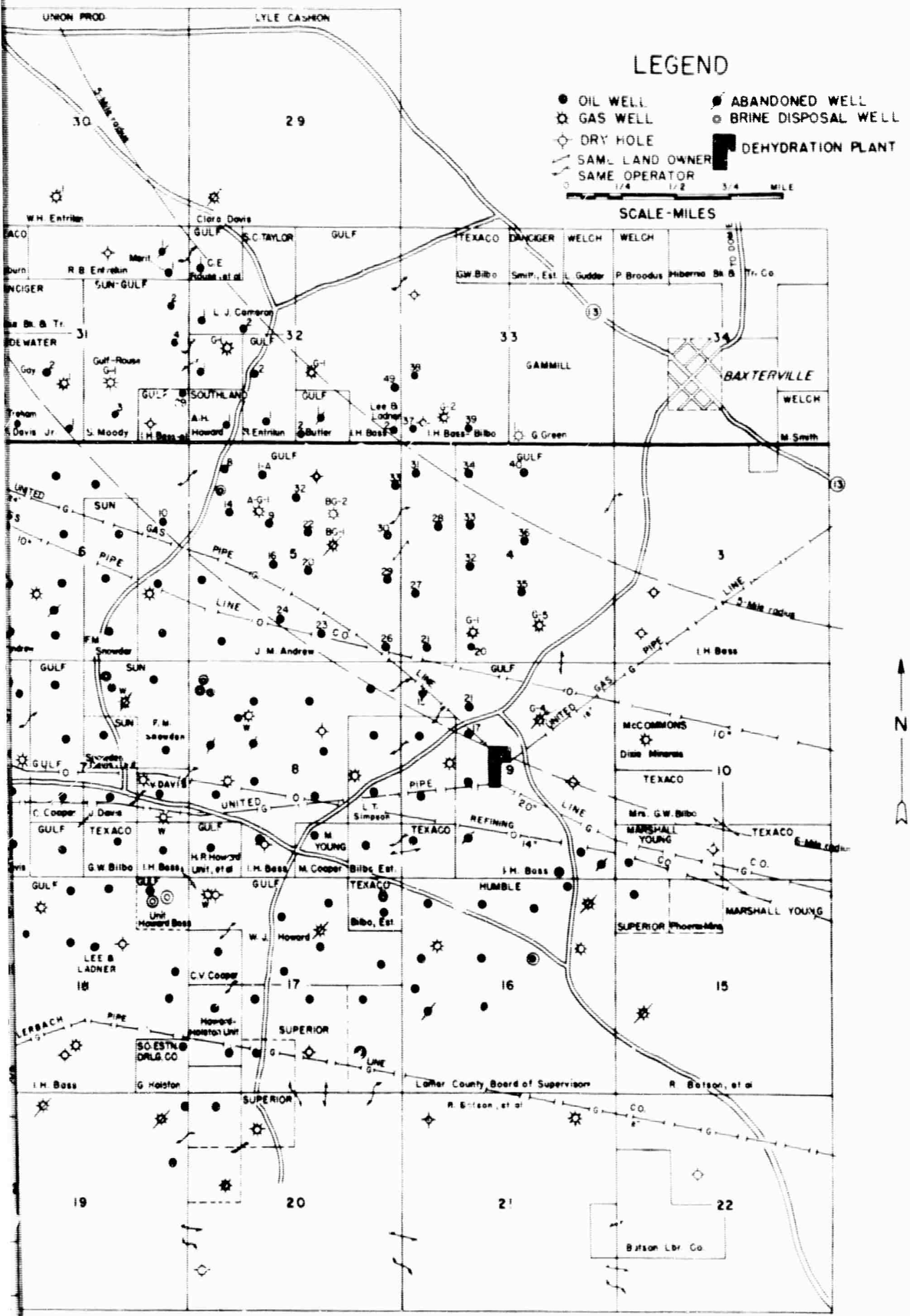


FIGURE 2- Baxterville Oilfield, Lamar and Marion Counties Mississippi.

A



Baxterville Oilfield, Lamar and Marion Counties Mississippi.

B

APPENDIX B

General Notes

APPENDIX B

General Notes

Equipment and construction associated with the Baxterville field were designed for permanent usage and contain safety factors in excess of 2. The function of these heavy-duty installations is the transportation and confinement under pressure of produced fluids. Thorough maintenance is provided to assure that all facilities remain in good working condition.

Empirical threshold values of shock wave acceleration or velocity for damage to residential-type construction are far less than those which would cause structural damage to oil and gas wells or associated facilities.

Oil Wells

Oil wells in the Baxterville field were completed with 600-1,600 feet of surface casing (predominantly 10-3/4-inch) cemented to the surface, 5-1/2-inch or 7-inch production casing cemented to a minimum of 2,000 feet above the base of the casing, and 2-1/2-inch or 2-7/8-inch tubing suspended from the wellhead. These wells (except a few that flow naturally) are pumped by individually powered 320,000-pound beam units set on concrete foundation piers, the bases of which extend a minimum of 14 inches below ground surface. Ninety-six-foot service derricks stand over approximately 50 of these wells. The corners of the derricks are set on 5-foot-square cement blocks that extend 24 inches into solid earth.

Gas Wells

Gas wells were completed with a minimum of 500 feet of surface casing cemented to the surface and either a 4-1/2-inch, 5-1/2-inch, or 7-inch production casing cemented to at least 1,700 feet above the base of the casing. In many wells, production packers were run on the tubing. Wellhead equipment consists of a casinghead, a master-gate, and a composite manifold.

Brine Disposal Systems

The brine disposal systems include settling tanks, pumps, line pipe, and disposal wells. Most disposal wells were completed with from 200 to 300 feet of surface casing and about 2,500 feet of 5-1/2-inch casing. Cement-lined pipes, 4 to 8 inches in diameter, are buried near the surface and connect the settling and brine-storage tanks to the disposal wells.

Lease Batteries

Each oil lease is equipped with from one to eight heater-treaters and has from two to ten stock tanks that range in capacity from to 1,000 barrels each. Tanks, heaters, separators, etc. are of welded-steel construction set on either concrete or steel-ring foundations. Gathering lines from wells to tank batteries range in size from 2-1/2 to 4 inches in diameter; 90 percent of these lines are covered. Feeder pipelines from tank batteries to the main pipeline are 6 inches in diameter and are buried at a depth of about 18 inches. Associated with each gas lease are a separator, compressor, and distillate tanks.

Pipelines

The nine oil and gas transmission lines in the area range in diameter from 6 to 24 inches. These lines are buried 2 to 3 feet below the ground surface and are exposed only at terminal or booster stations. Normal operating pressures are from 500 to 1,000 psi.

APPENDIX C

Photograph Notes

APPENDIX C

Photograph Notes

Preshot and postshot photographs shown in Appendix D are a representative sampling of all photographs taken. No damage was detected either by visual observation or by photographic documentation. Locations of photographed wells and facilities may be determined from the field map in Appendix A.

Photo 1-1 through 2-4 (4.8 miles from GZ--adjacent to Gulf Bass 49--SE NE SE of Section 32)

Photo 1-1 and 1-2: After the shock waves had passed, one bottle was overturned; the other remained standing.

Photo 2-1 through 2-4: Reflections of trees on the water surface show movement seconds after detonation. Concentric ripples were caused by twigs falling from the trees.

Photo 3-1 (4.8 miles from GZ--Bass-Bilbo G2--E½ SW SW of Section 33)

Subsurface pressure bomb was placed in this well at a depth of 7,690 feet. Pressures were recorded during the interval D-2 hours to D+3 hours. No change in pressure.

Photo 4-1 through 8-2 (4.7 miles from GZ--Gammill Green 1--SW SW SE of Section 33--nearest gas well to GZ)

Photo 4-1 and 4-2: No evidence of movement. Notice the undisturbed sand in and around the bottom valve in photo 4-2.

Photo 5-1 and 5-2: Bleeder line from tanks shown in foreground. Photo 5-2 shows slight cracks in loose soil where line goes underground. Cracks may have been formed by motion of pipe resulting from ground tremor. This was the only observed change that could be related to the Salmon Event.

Photo 6-1 and 6-2: Concrete blocks supporting flow line. No change.

Photo 7-1 and 7-2: Indirect heater and piping. No change.

Photo 8-1 and 8-2: Footing and base for condensate separator. Chalk marks indicated no movement.

Photo 9-1 through 13-2 (4.7 miles from GZ--Gulf Bass 38--SW NW SW of Section 33--nearest oil well to GZ)

No change.

Photo 9-1 and 9-2: Standing service derrick and oil well pumping unit.

Photo 10-1 and 10-2: Individually powered beam pumping unit.

Photo 11-1 and 11-2: Wellhead of pumping oil well.

Photo 12-1 and 12-2: Foundation pier and left-front leg of derrick.

Photo 13-1 and 13-2: Crack in left-rear foundation pier of derrick.

Photo 14-1 through 19-2 (4.9 miles from GZ--adjacent to Gulf Bass 37--SW SW ¼ of Section 33--large oil and gas battery)

No change.

Photo 14-1 and 14-2: Heater-treaters.

Photo 15-1 and 15-2: Oil-storage tanks.

Photo 16-1 and 16-2: Pipeline connections.

Photo 17-1 and 17-2: Distillate tanks and separators.

Photo 18-1 and 18-2: Brine storage tank and bleeder manifold.

Photo 19-1 and 19-2: Suction end of pipeline oil pump.

Photo 20-1 through 27-2 (6 miles from GZ--United Gas Company Dehydration Plant--center of Section 9)

No change.

Photo 20-1 and 20-2 Compressor plant.

Photo 21-1 and 21-2: Two 1,500-horsepower Ingersoll-Rand compressors.

Photo 22-1 and 22-2: Crack in foundation of compressor plant.

Photo 23-1 through 24-2: Dehydration towers.

Photo 25-1 and 25-2: Subsurface inlet and outlet valves from gas pipelines to dehydration plant.

Photo 26-1 and 26-2: Gauge glass on fuel tank.

Photo 27-1 and 27-2: Forty five-foot, 100-barrel water tank.

Photo 28-1 and 28-2 (5.0 miles from GZ--Gulf Bass-Butler G1--SW NW SF of Section 32)

Top half of wellhead of gas well. No change.

Photo 29-1 through 30-2 (4.8 miles from GZ--Gulf Bass 39--SW SE SW of Section 33)

No change.

Photo 29-1 and 29-2: Oil well pumping unit.

Photo 30-1 and 30-2: Motor skids and bracket.

Photo 31-1 and 31-2 (4.8 miles from GZ--Gulf Bass 40--NW NW NE of Section 44)

Motor bracket and skids. Chalk lines indicate no slippage.

Photo 32-1 and 32-2 (4.9 miles from GZ--Gulf Bass 37--SW SW SW of Section 33)

Pumping unit foundation and base plate for motor skids. No change.

Photo 33-1 through 35-2 (5.7 miles from GZ--Gulf Andrew 2 and up Battery--adjacent to Gulf Bass 8--c NW NW of Section 5)

No change.

Photo 33-1 and 33-2: Heater-treaters and indirect heaters.

Photo 34-1 and 34-2: Distillate tanks.

Photo 35-1 and 35-2: Brine tank and disposal well.

Photo 36-1 and 36-2 (5.? miles from GZ--Gulf Cameron-Entrikin G1--NE NW SW of Section 32)

Wellhead of gas well. No change.

Photo 37-1 through 38-2 (5.2 miles from GZ--Gulf Entrikin 2--SW NE SW of Section 32)

Photo 37-1 and 37-2: Service derrick. No change.

Photo 38-1 and 38-2: Oil well pumping unit. No change.

Photo 39-1 and 39-2 (5.3 miles from GZ--Sun Moody Battery A--adjacent to Sun Moody 4--SE SE NE of Section 31)

Storage tanks, separators, and pipeline pump. No change.

Photo 40-1 and 40-2 (5.4 miles from GZ--Sun Moody 1--SW NW SW of Section 32)

Base of derrick and oil well pumping unit. No change.

Photo 41-1 and 41-2 (5.6 miles from GZ--Gulf Andrew BG2--SE SW NE of Section 5)

Compressor at gas well. No change.

Photo 42-1 and 42-2 (5.6 miles from GZ--Gulf Bass-Andrew G1--W½ SE SW of Section 4)

Wellhead of gas well. No change.

Photo 43-1 and 43-2 (6.0 miles from GZ--Gulf Andrew 10--c SE NE of Section 6)

Formerly a pumping well--now flowing. No change.

Photo 44-1 and 44-2 (5.4 miles from GZ--Gulf Bass 32--NW NE SW of Section 4)

Oil well pumping unit. No change.

APPENDIX D

Photographs

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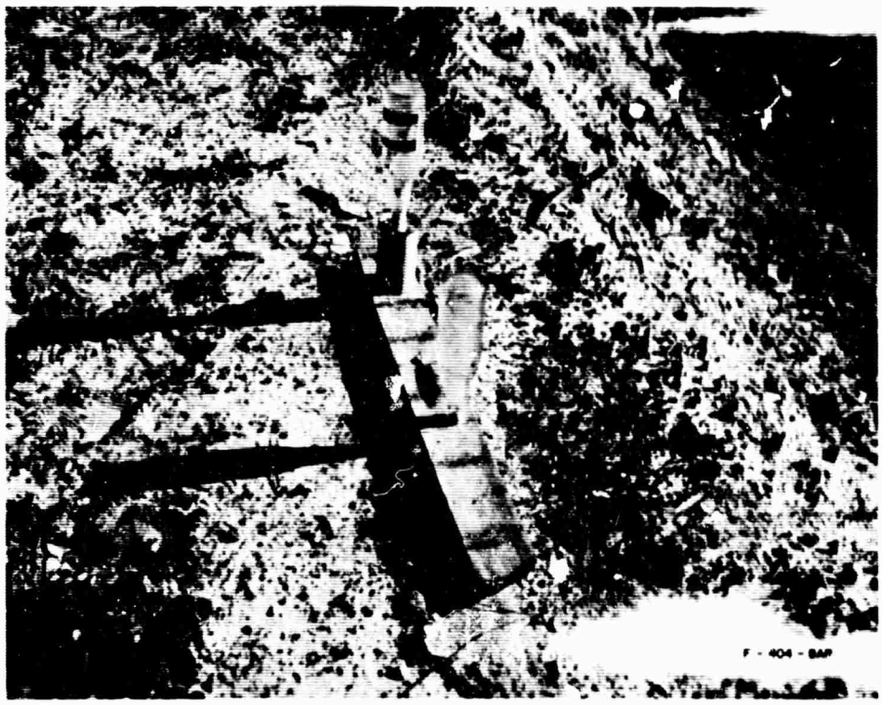


Photo 1-1 Preshot

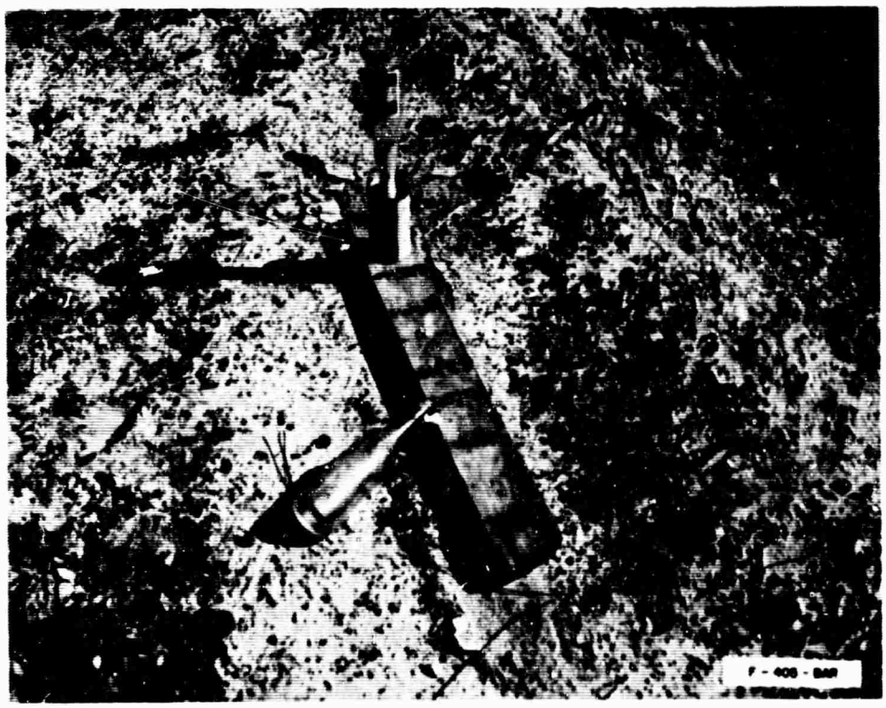


Photo 1-2 Postshot

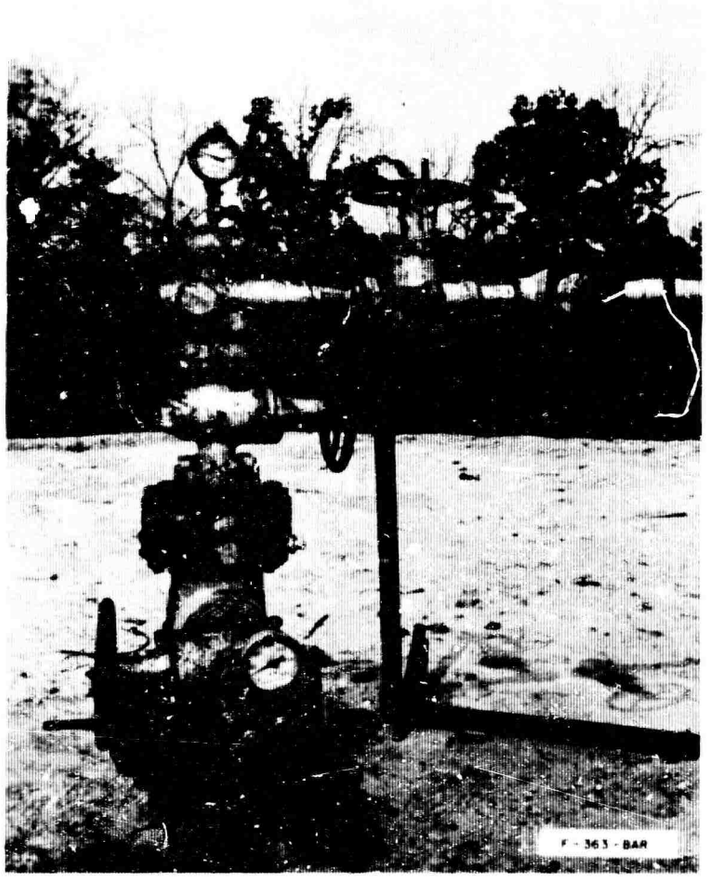
Photo 2-1 Preshot

Photo 2-2 Postshot

Photo 2-3 Postshot

Photo 2-4 Postshot

Photo 3-1 Postshot



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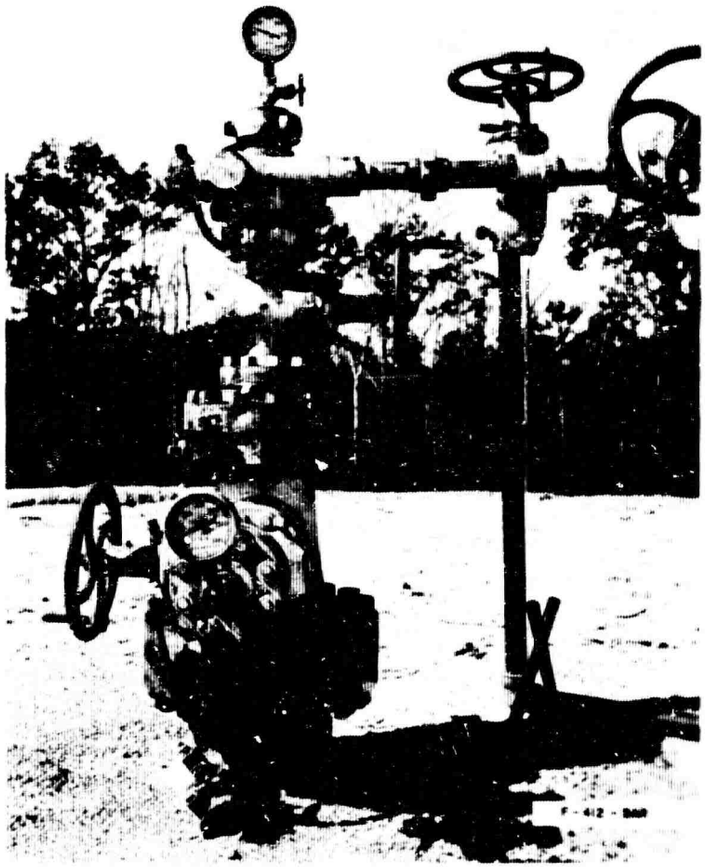
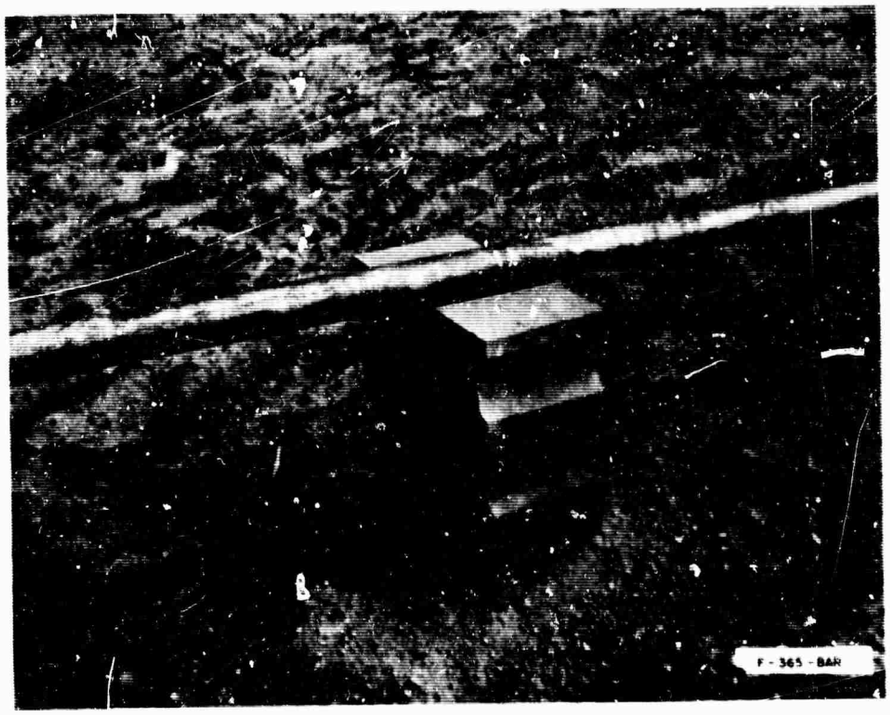


Photo 4-2 Postshot

Photo 5-1 Preshot

Photo 5-2 Postshot



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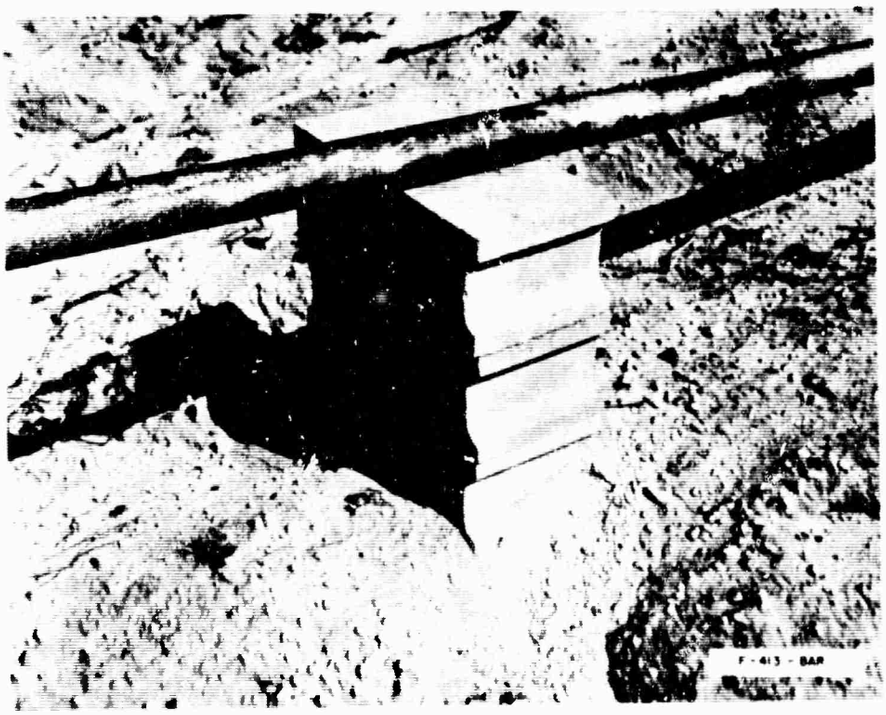

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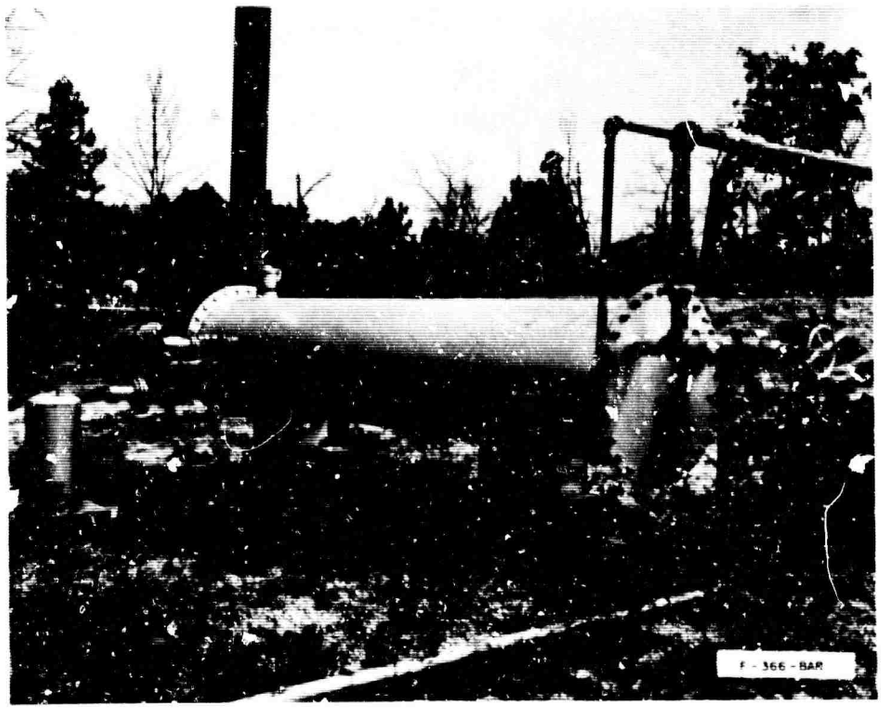

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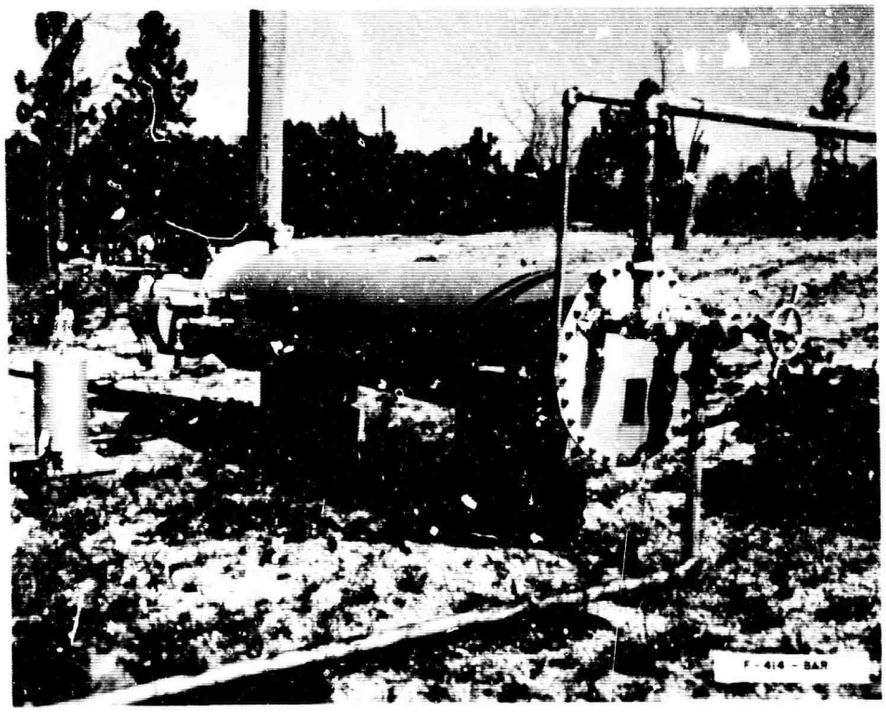
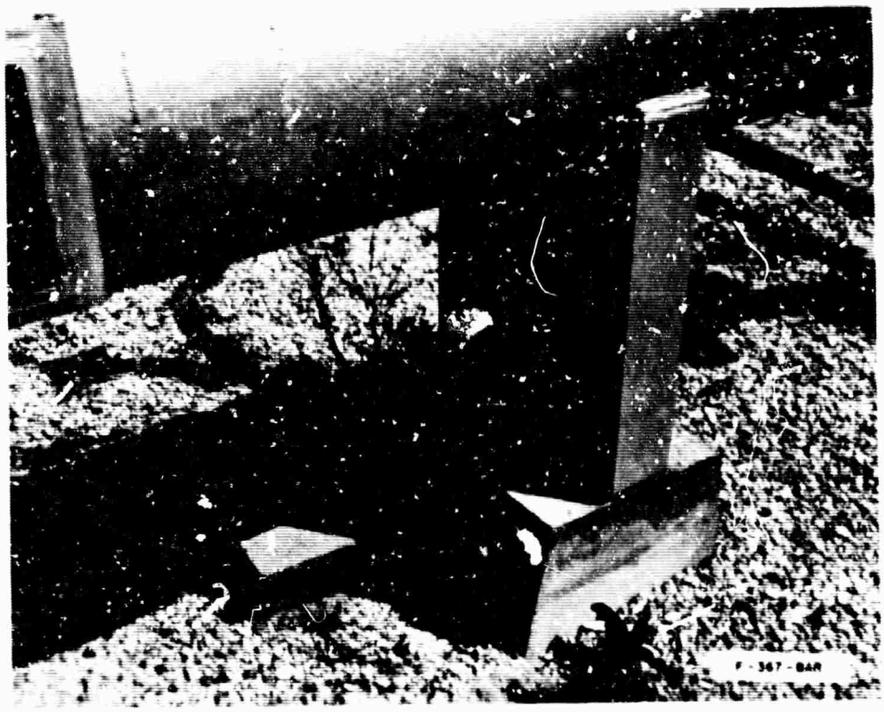


Photo 7-2 Postshot



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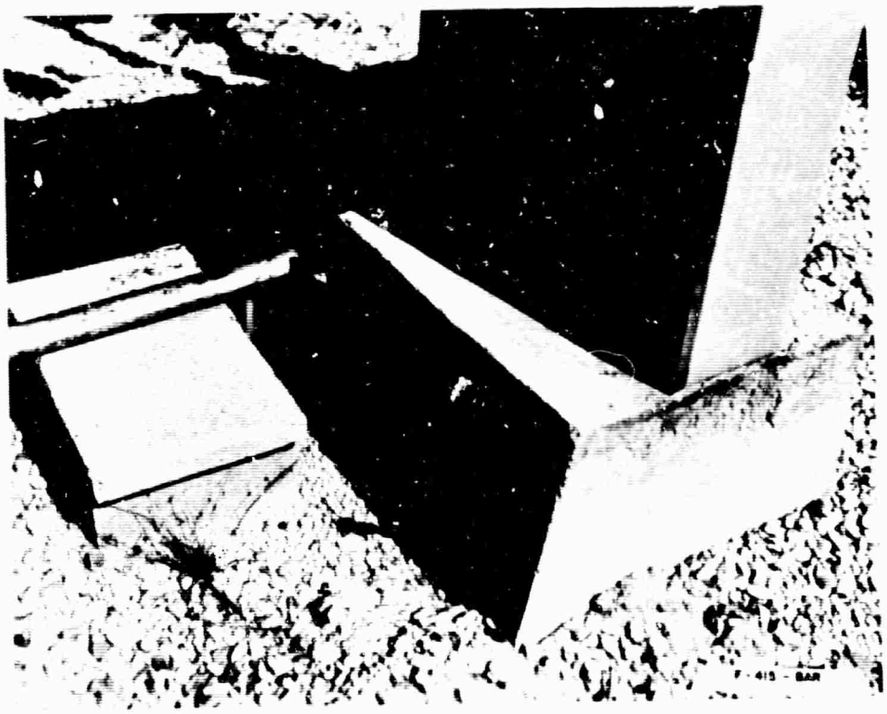

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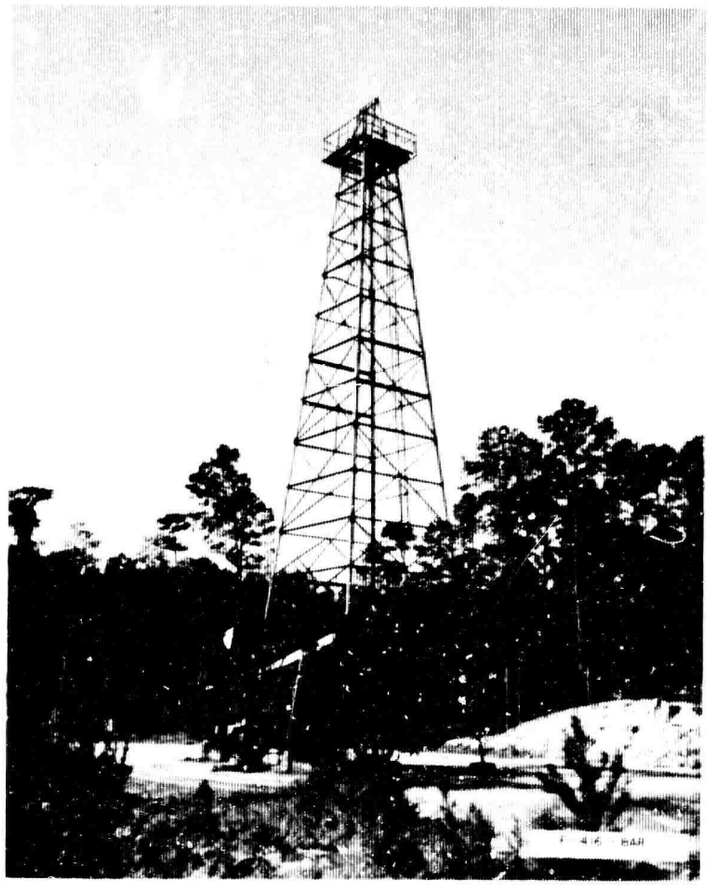

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Photo 10-2 Preshot

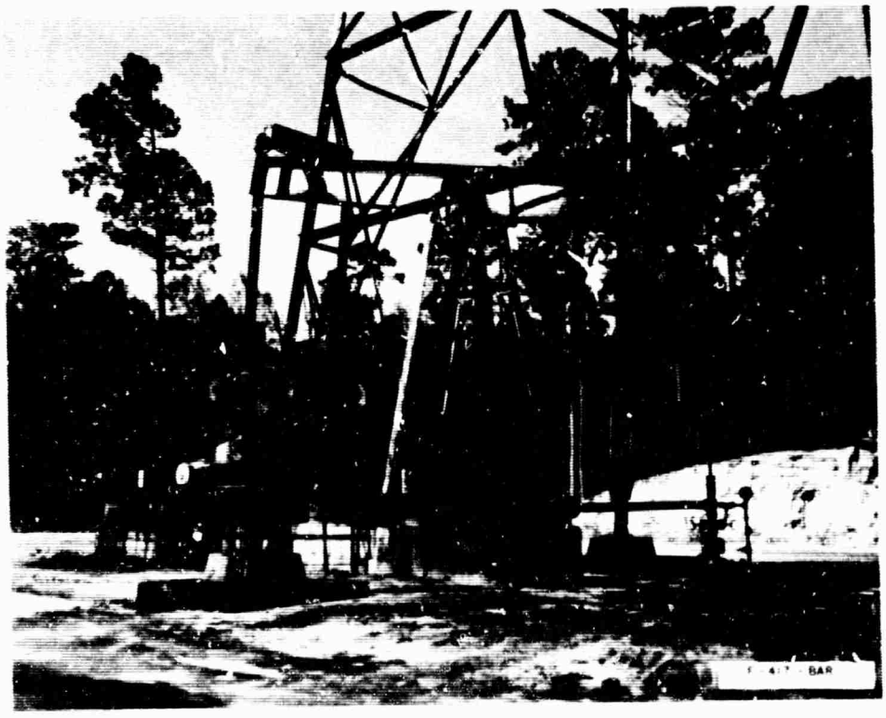

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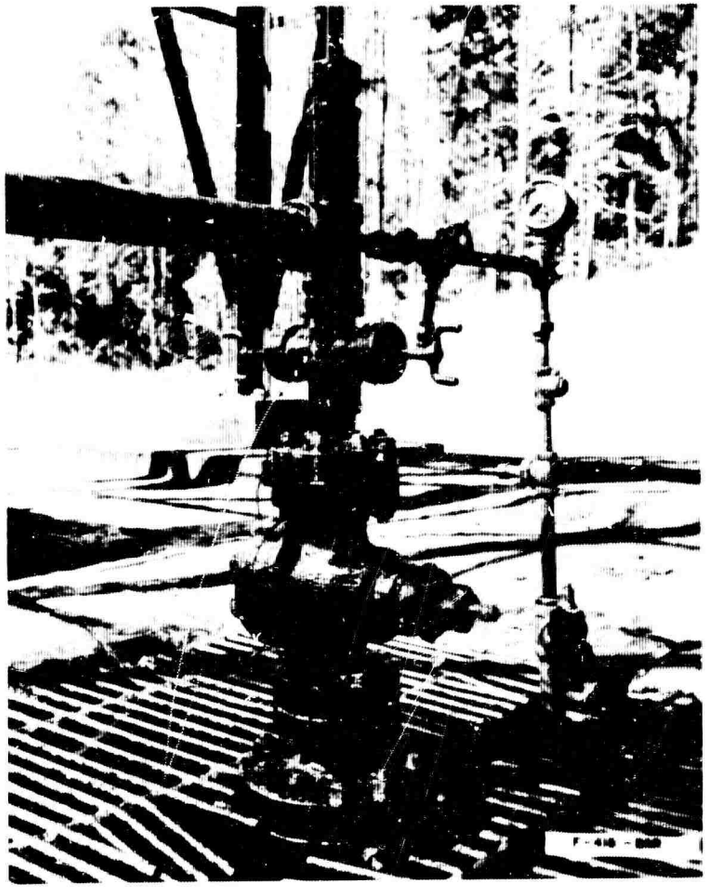
Photo 11-1 Pr shot



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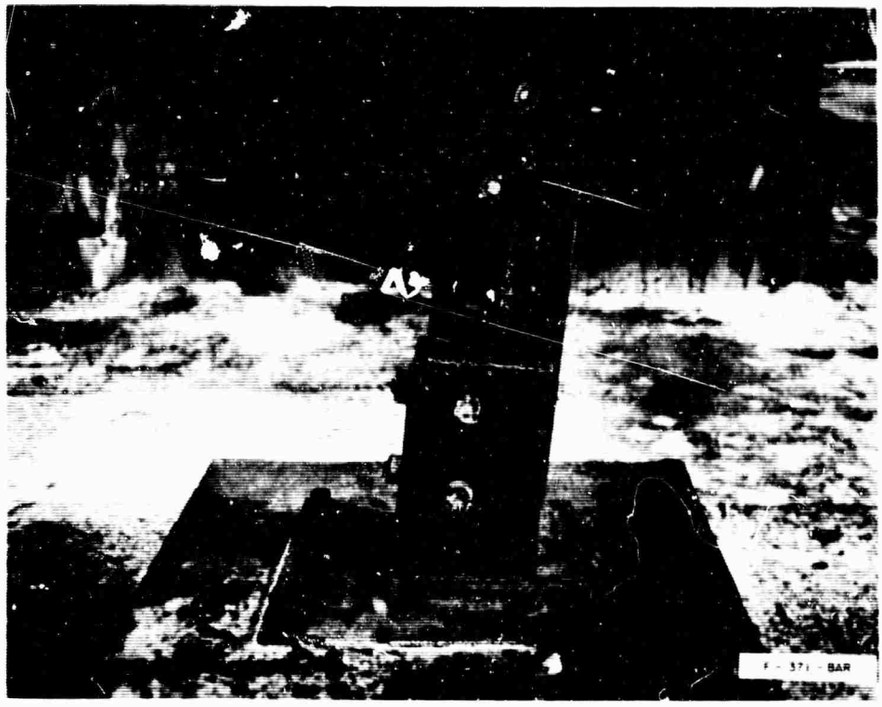

Photo 12-1 Preshot

Photo 12-2 Postshot

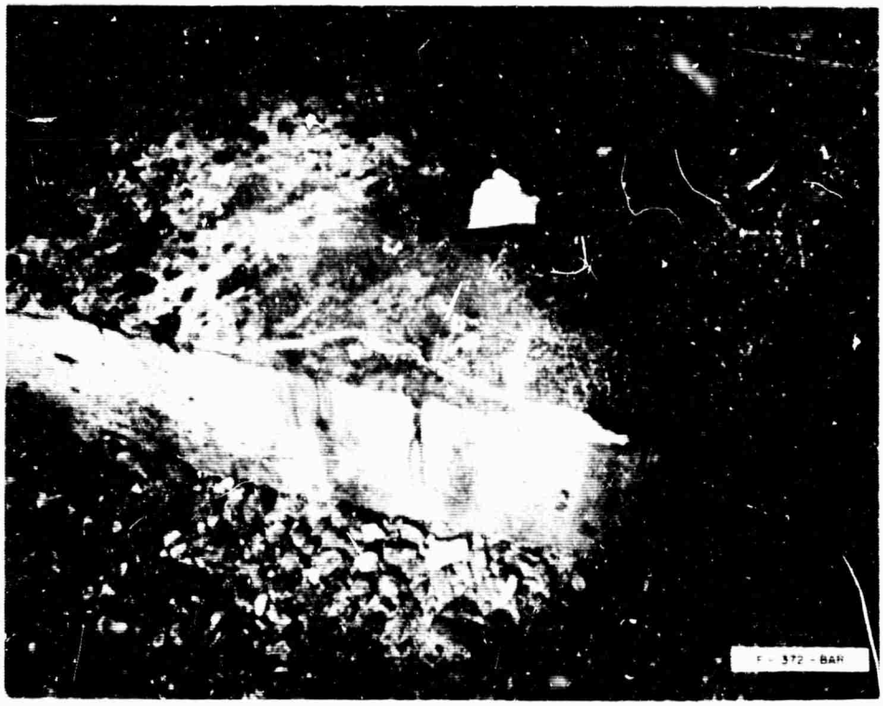

Photo 13-1 Preshot

Photo 13-2 Postshot

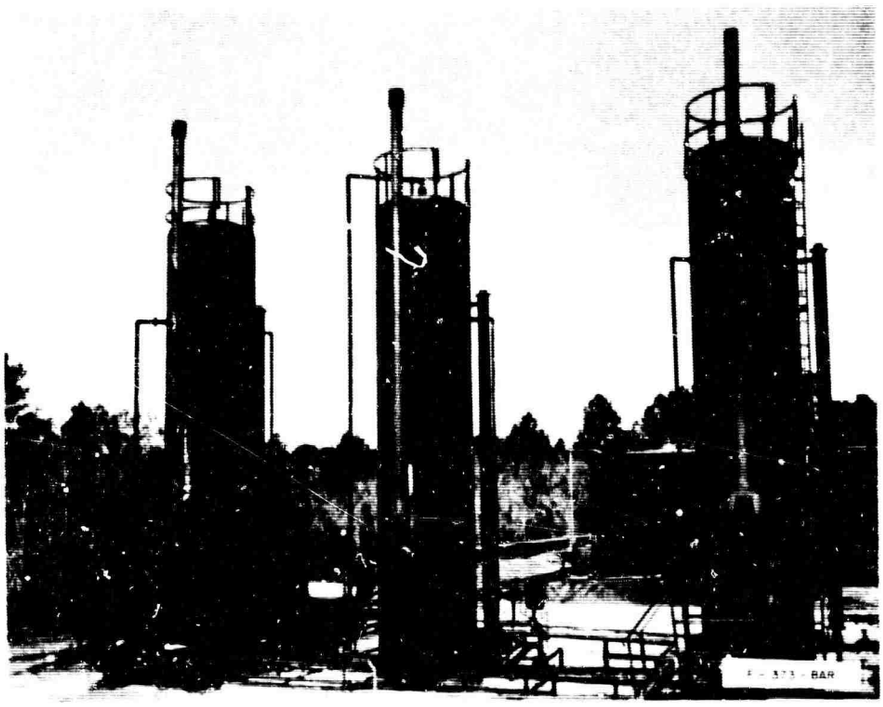

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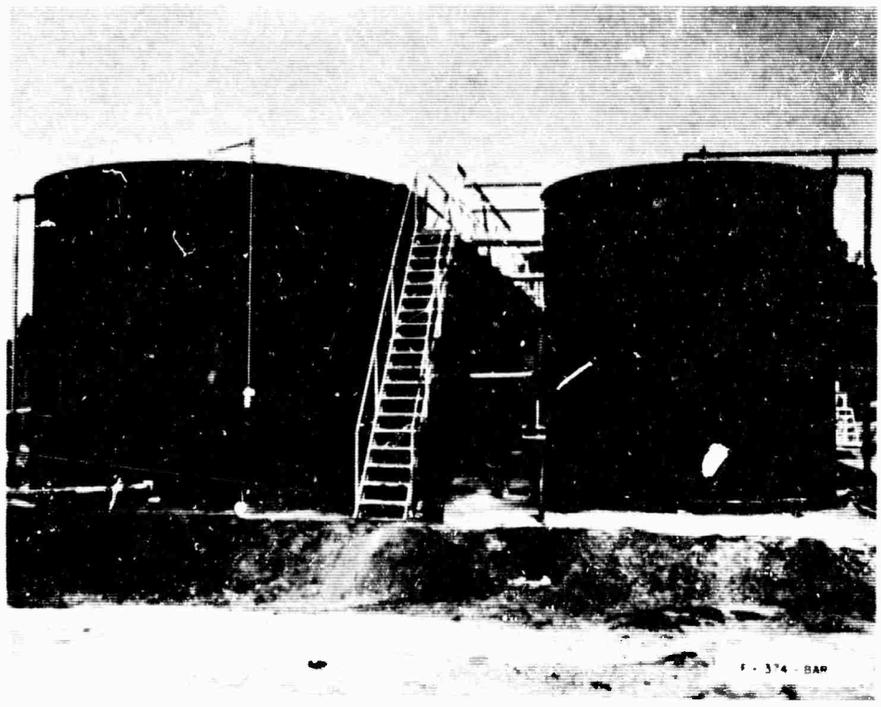
Photo 14-2 Postshot



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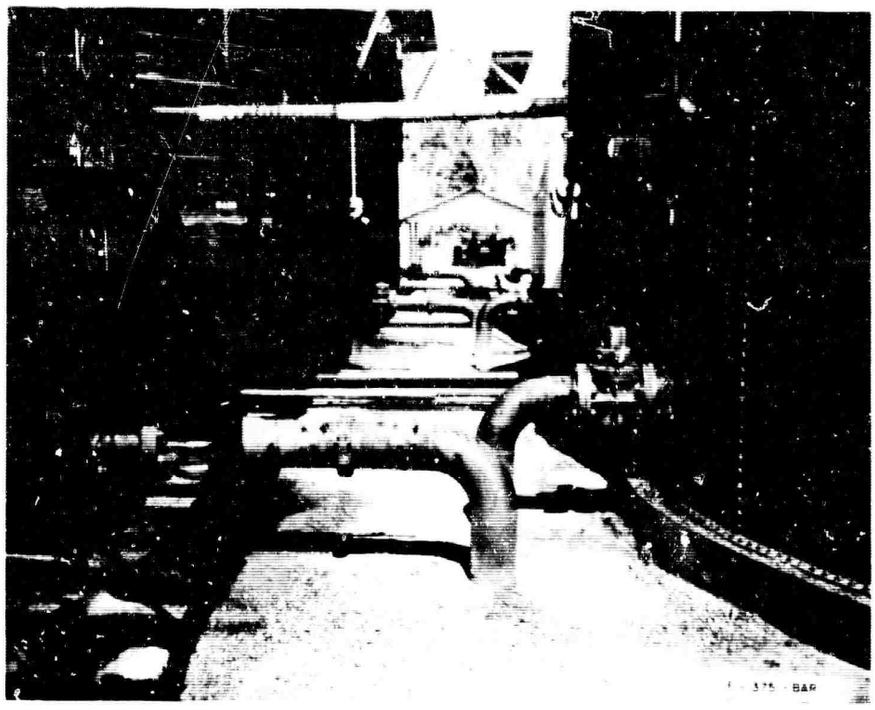

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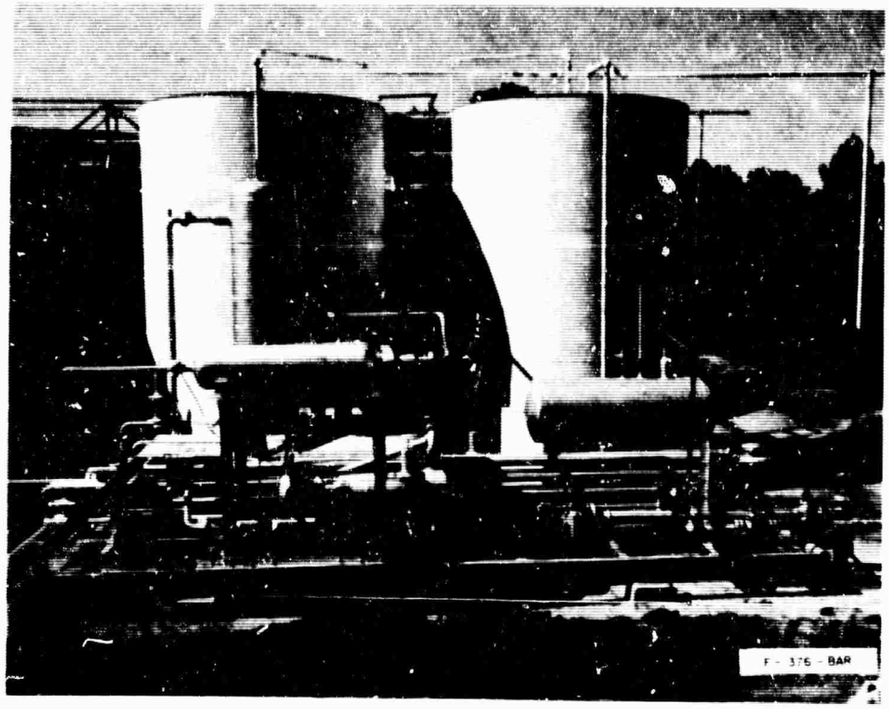
Photo 16-2 Postshot



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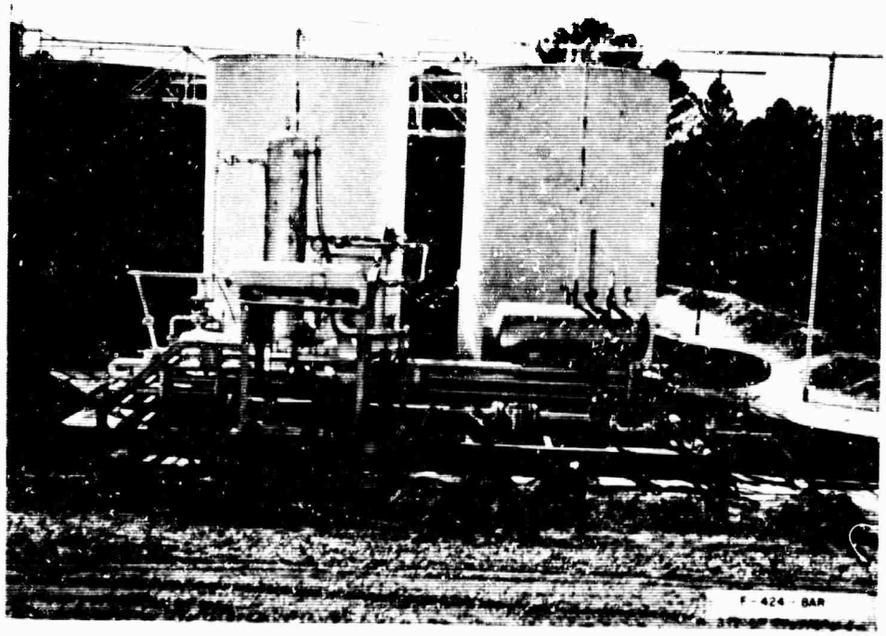

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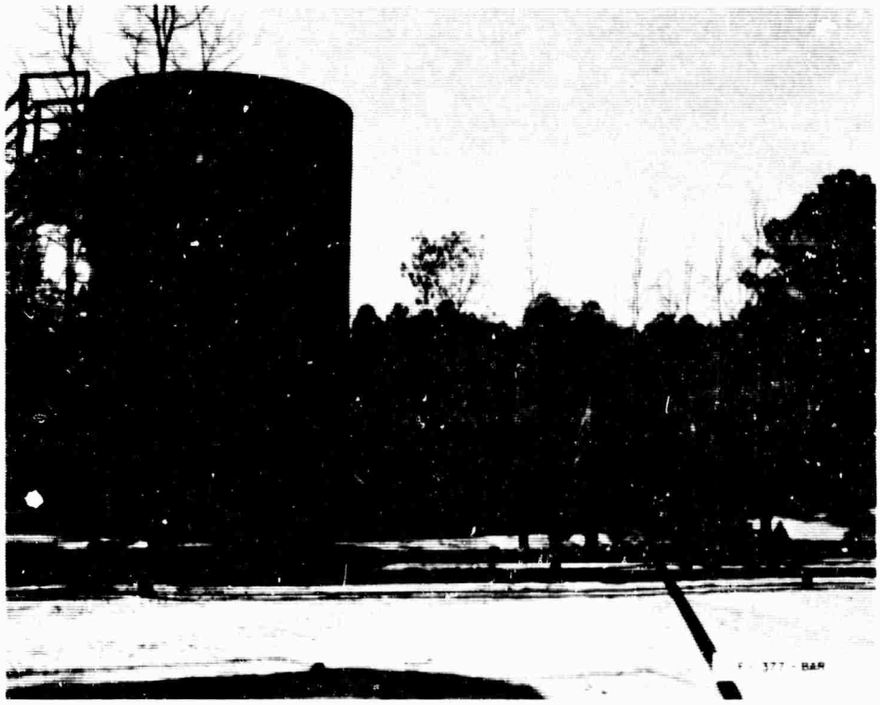

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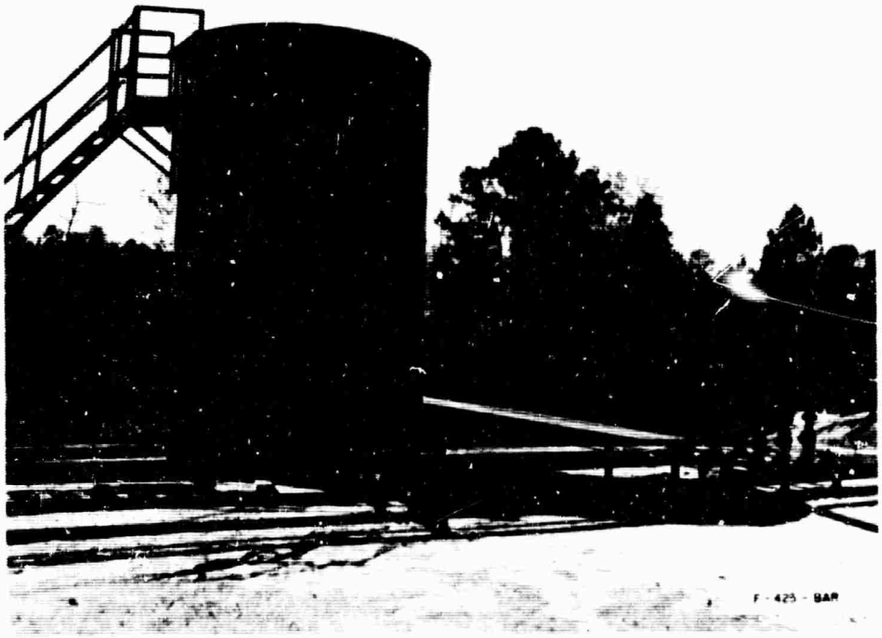


Phot 18-2 Postshot

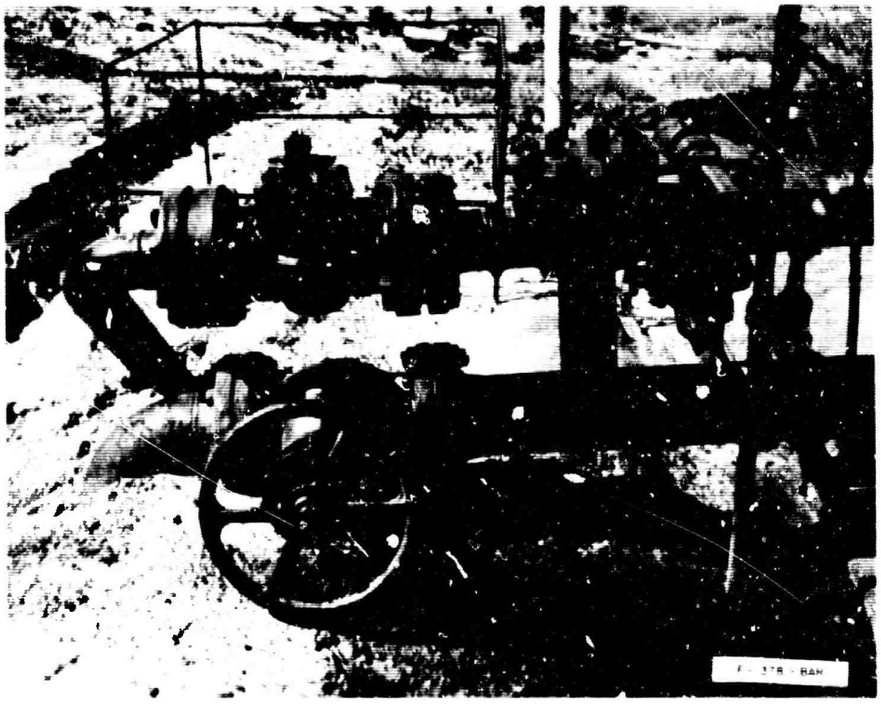


Photo 19-1 Preshot

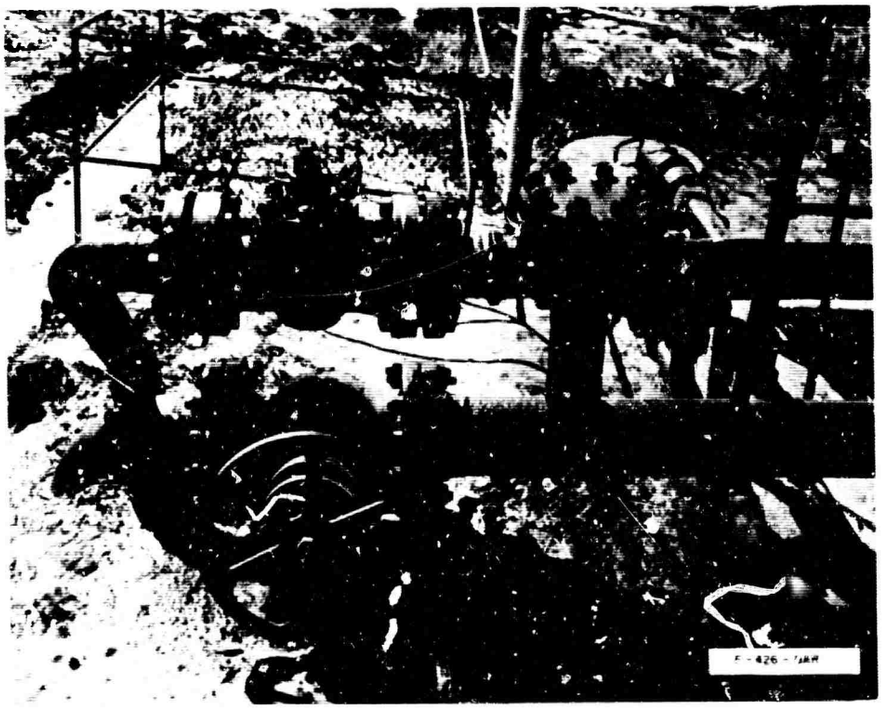


Photo 19-2 Postshot

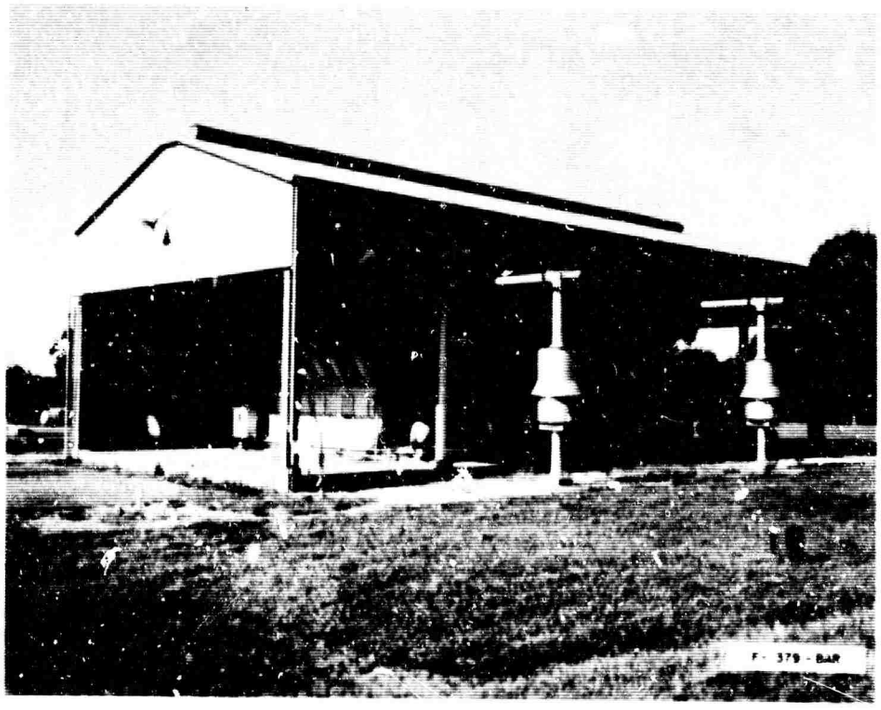


Photo 20-1 Preshot

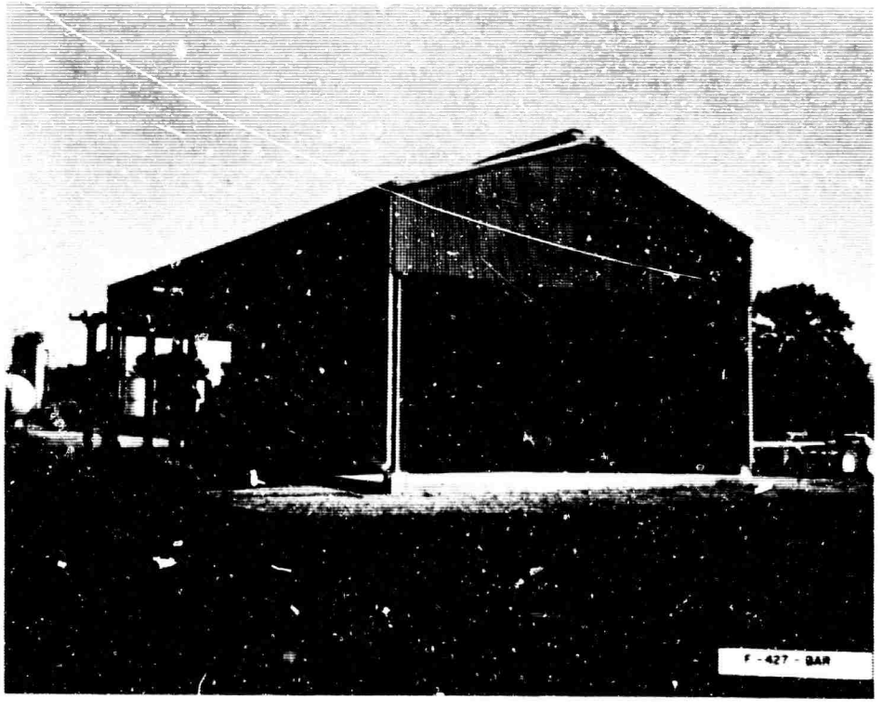


Photo 20-2 Postshot

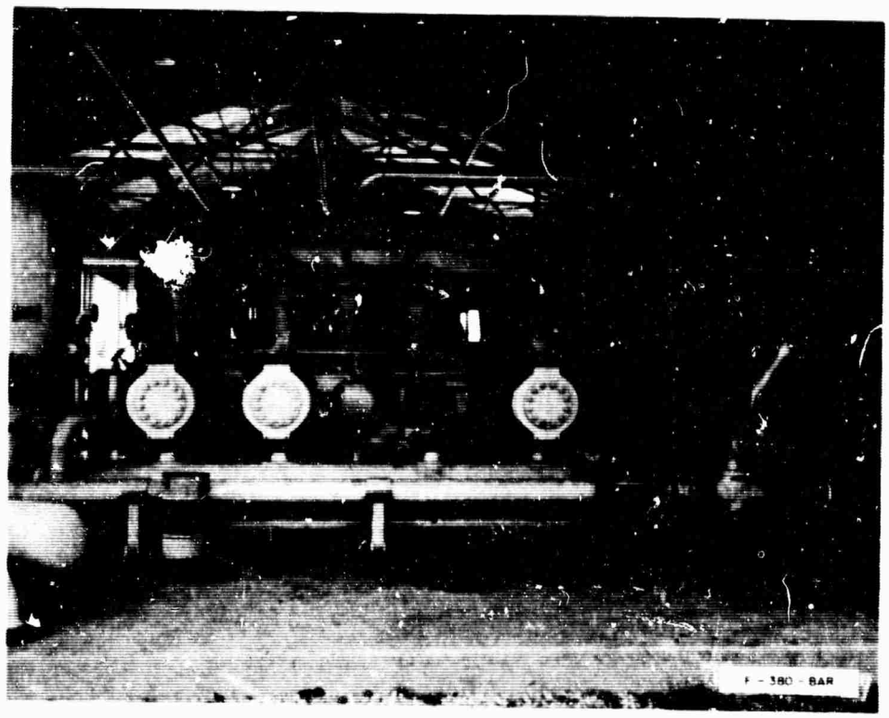


Photo 21-1 Preshot

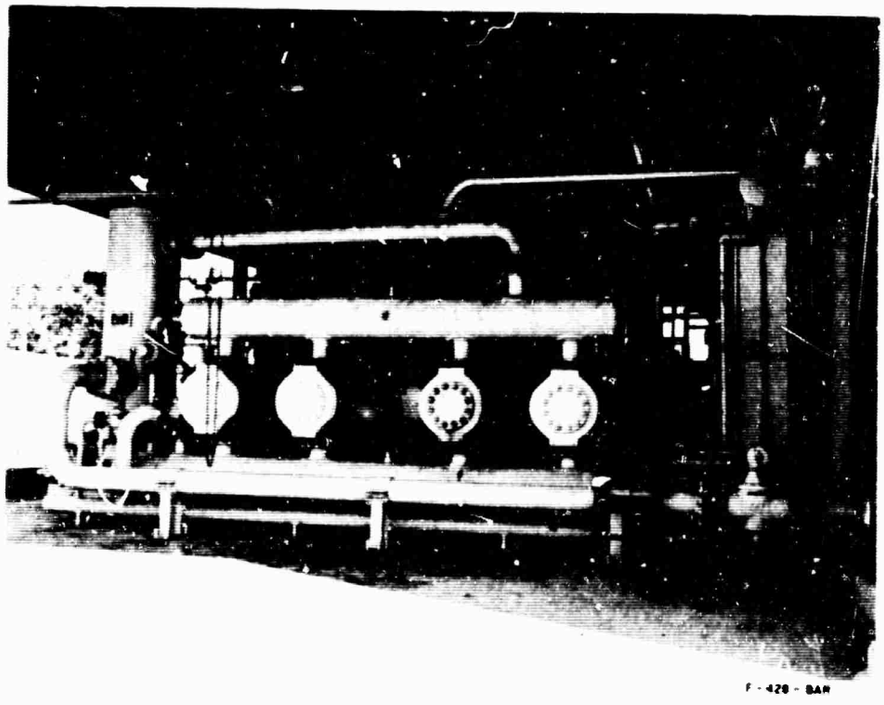
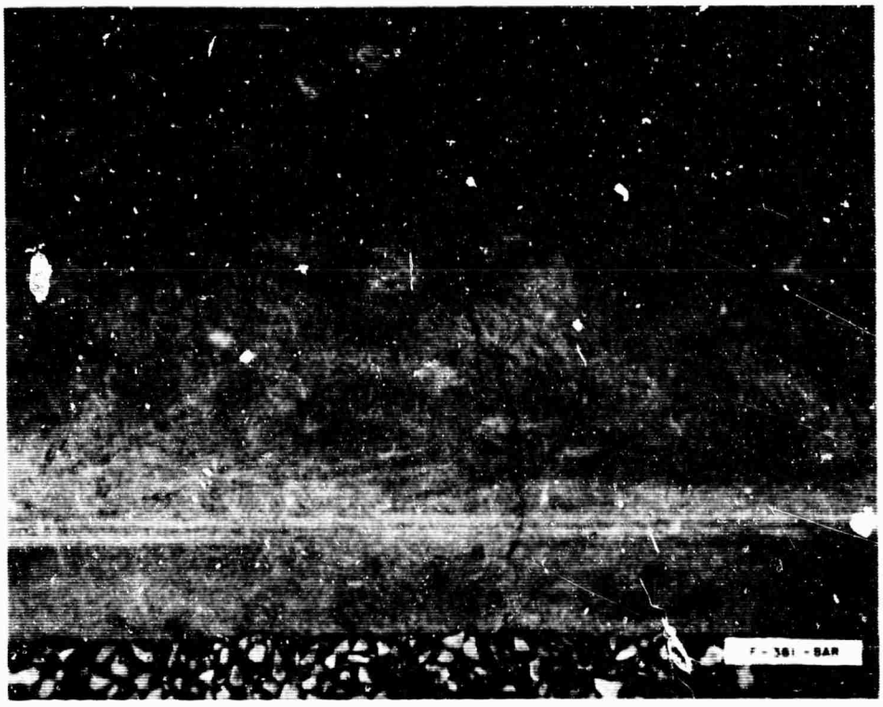


Photo 21-2 Postshot



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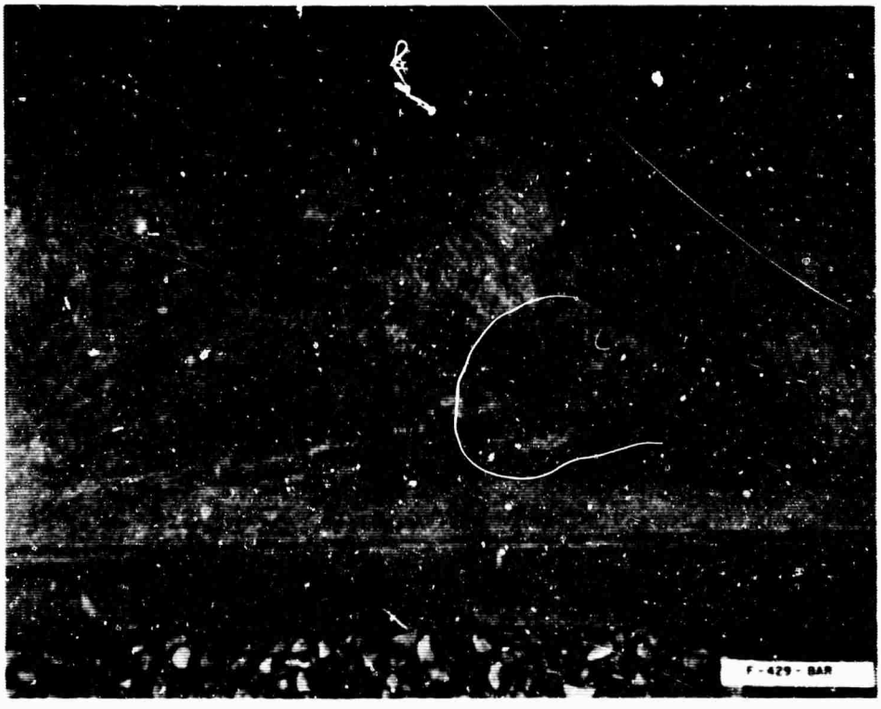


Photo 22-2 Postshot

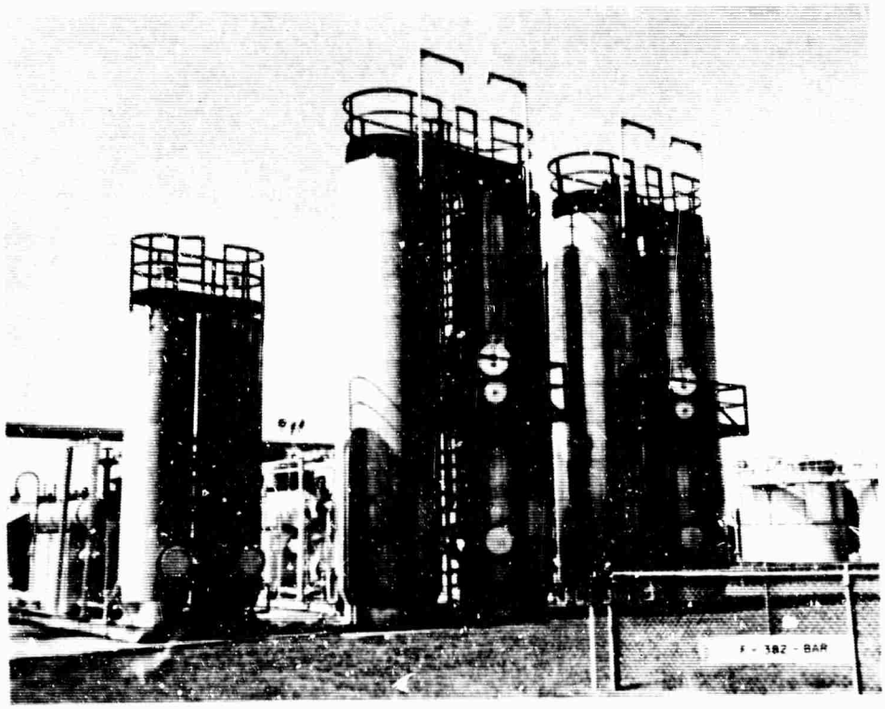
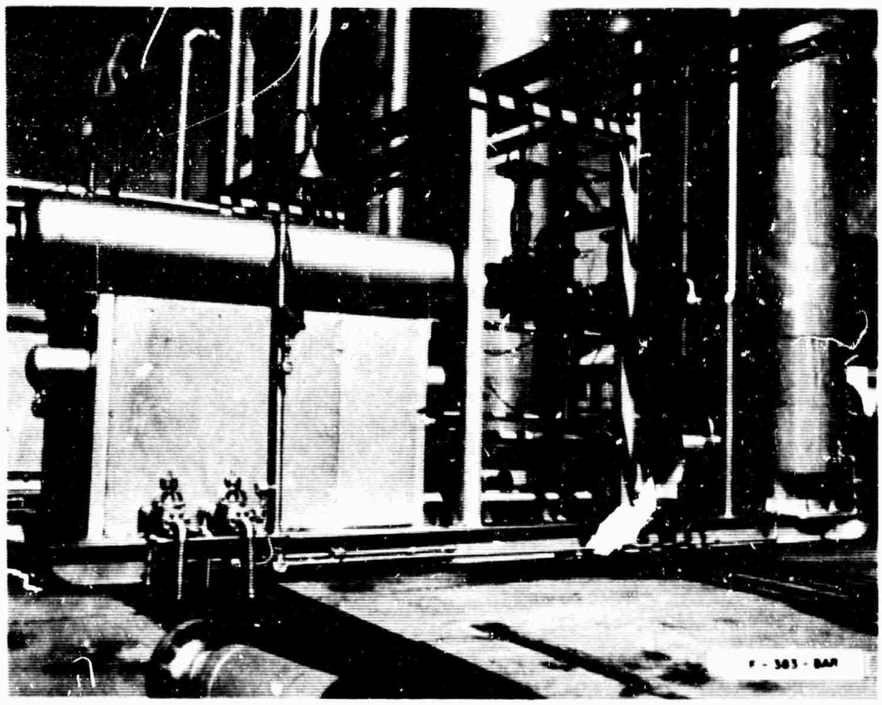


Photo 23-1 Preshot

Photo 23-2 Postshot



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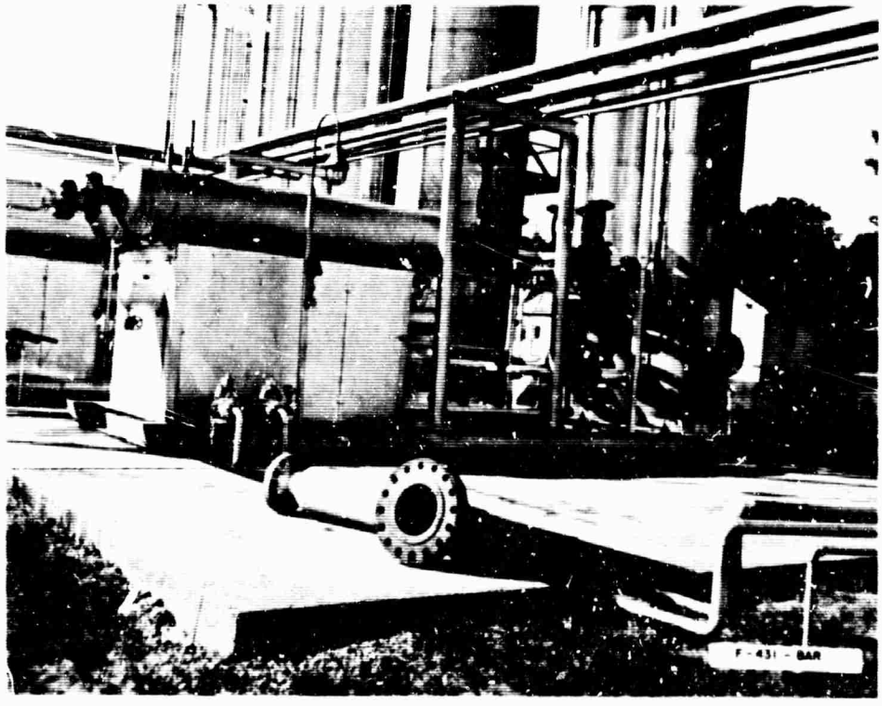

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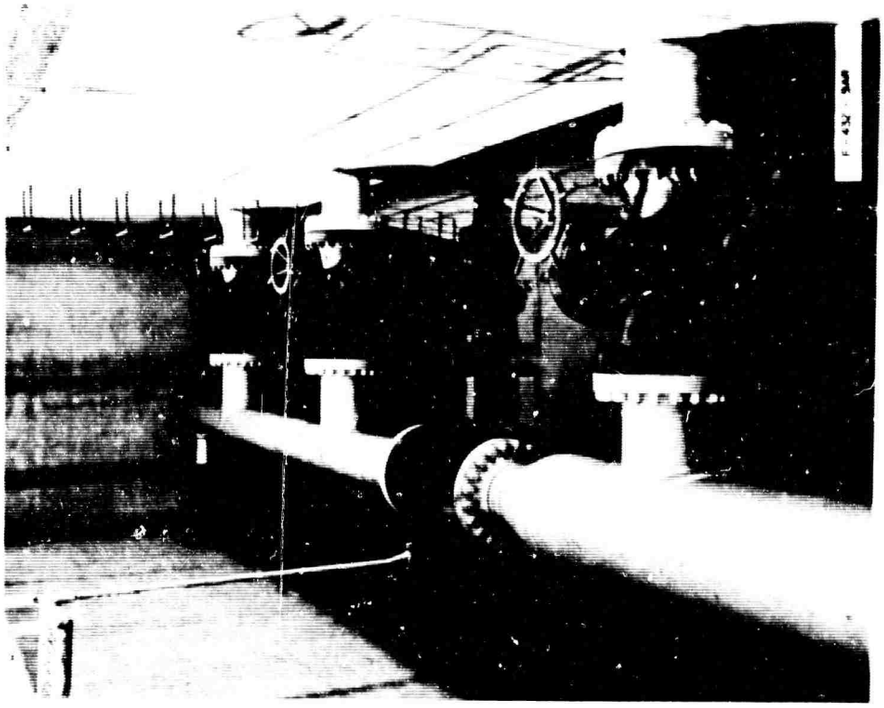

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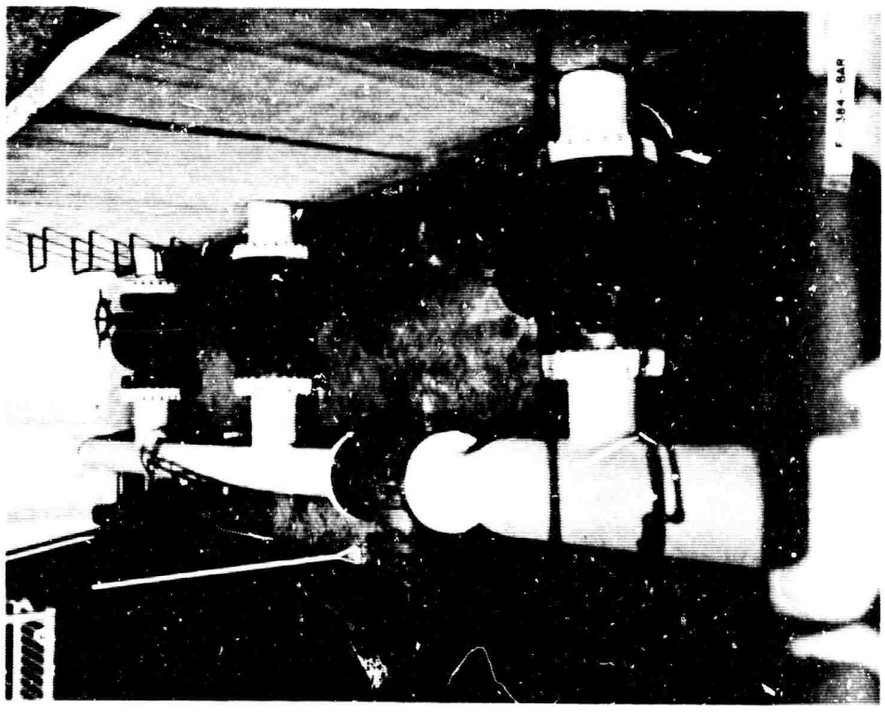

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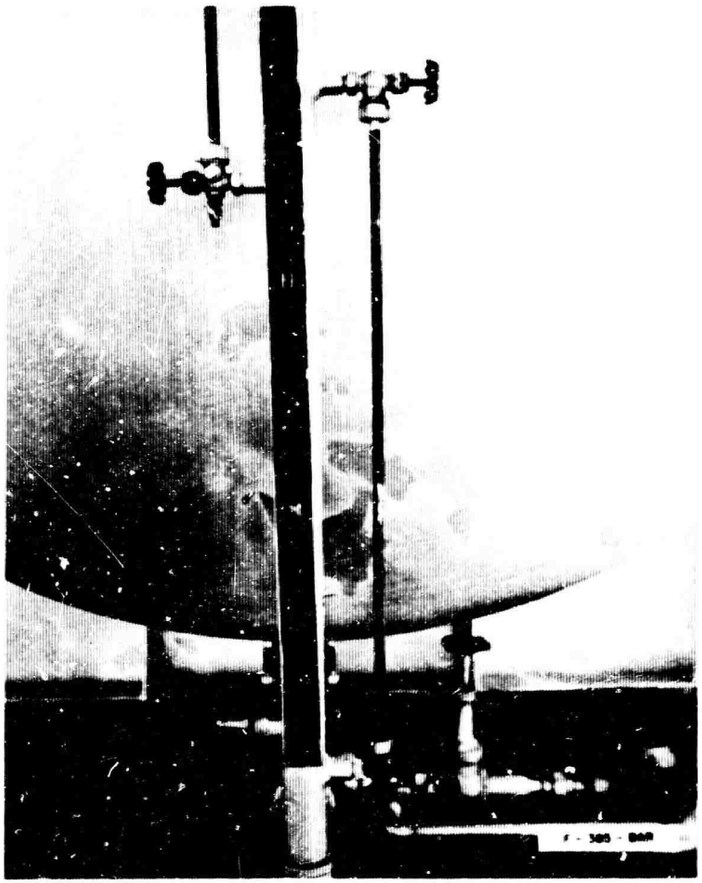


Photo 26-1 Preshot

Photo 26-2 Postshot

Photo 27-1 Preshot

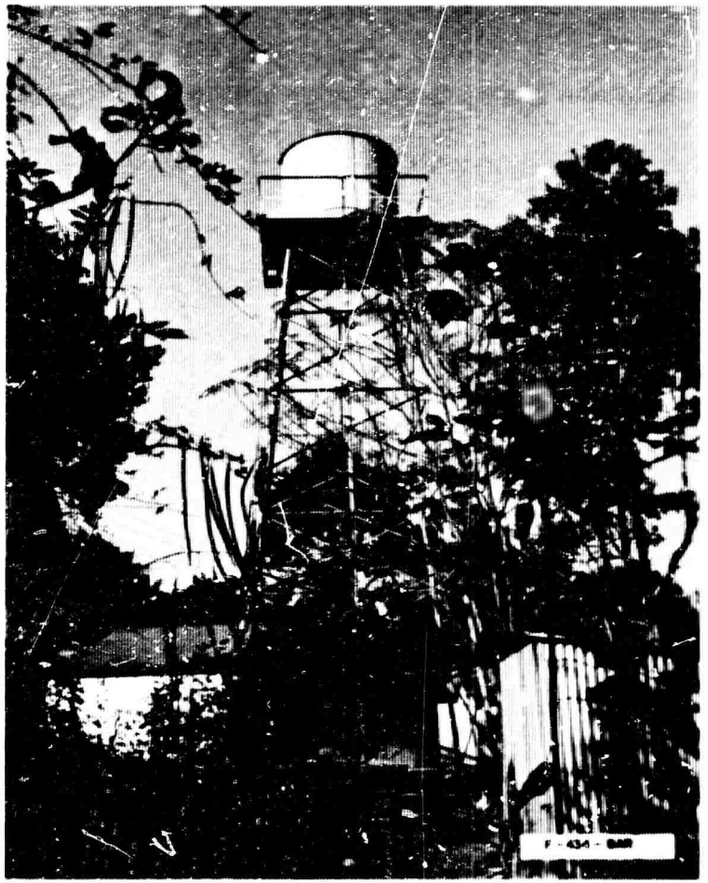


Photo 27-2 Postshot

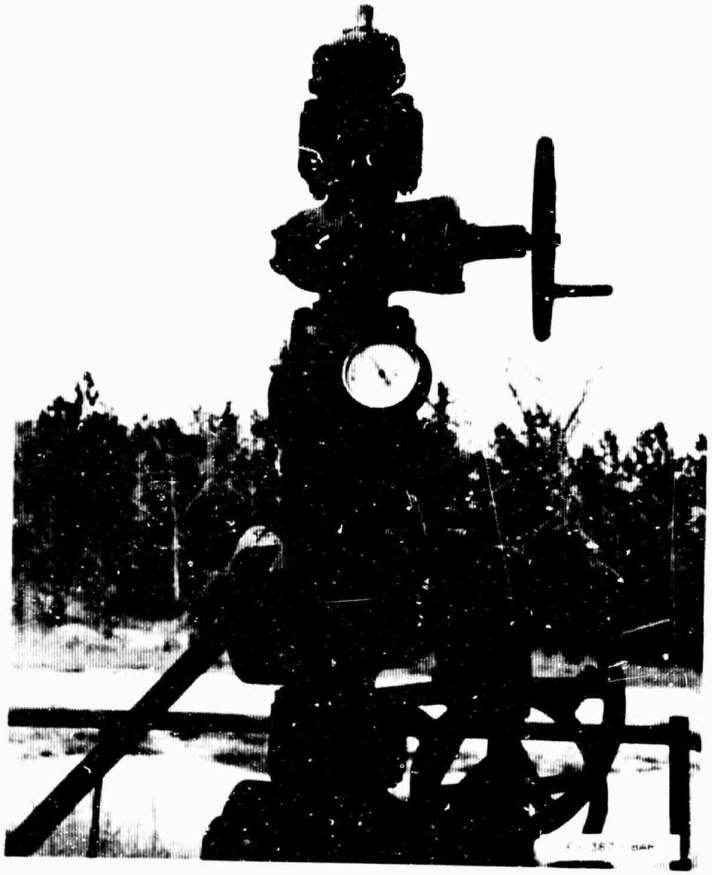
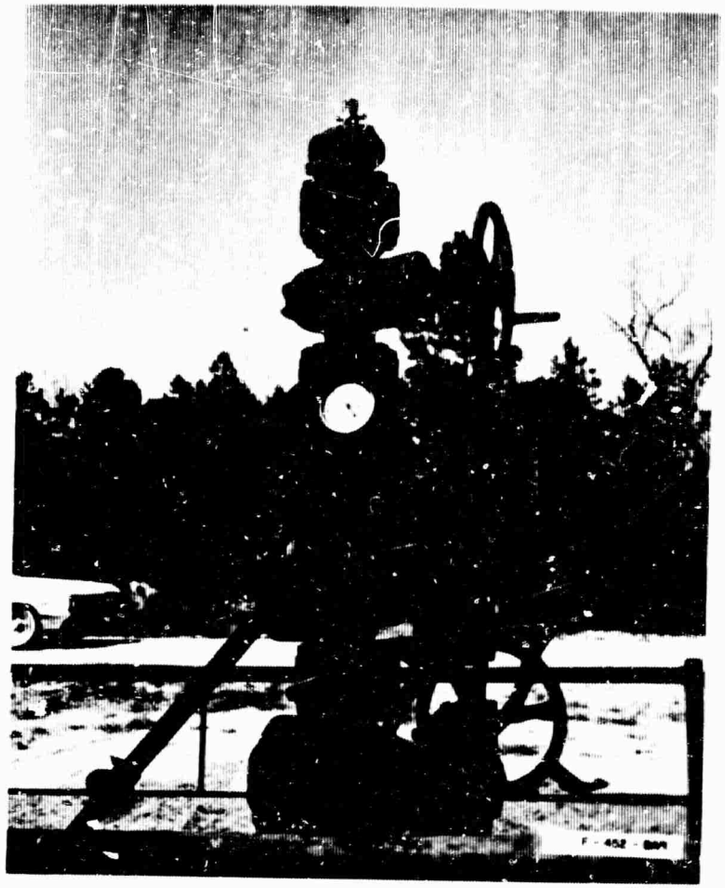


Photo 28-1 Preshot



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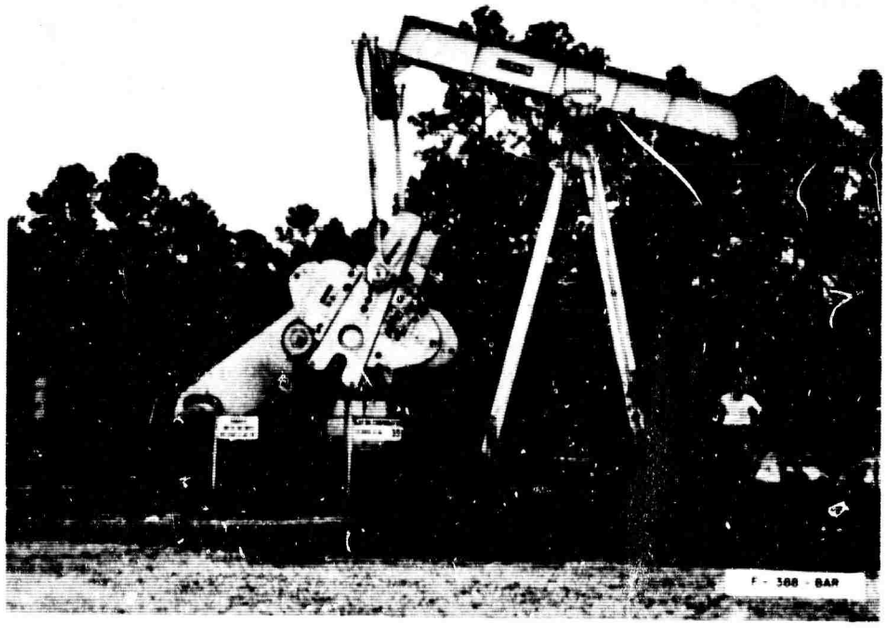

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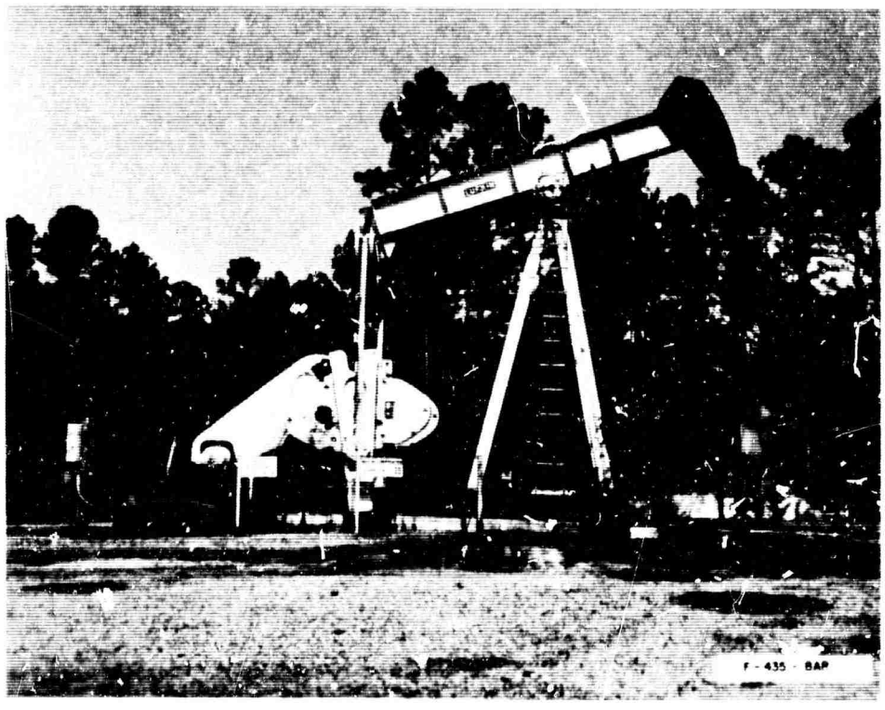

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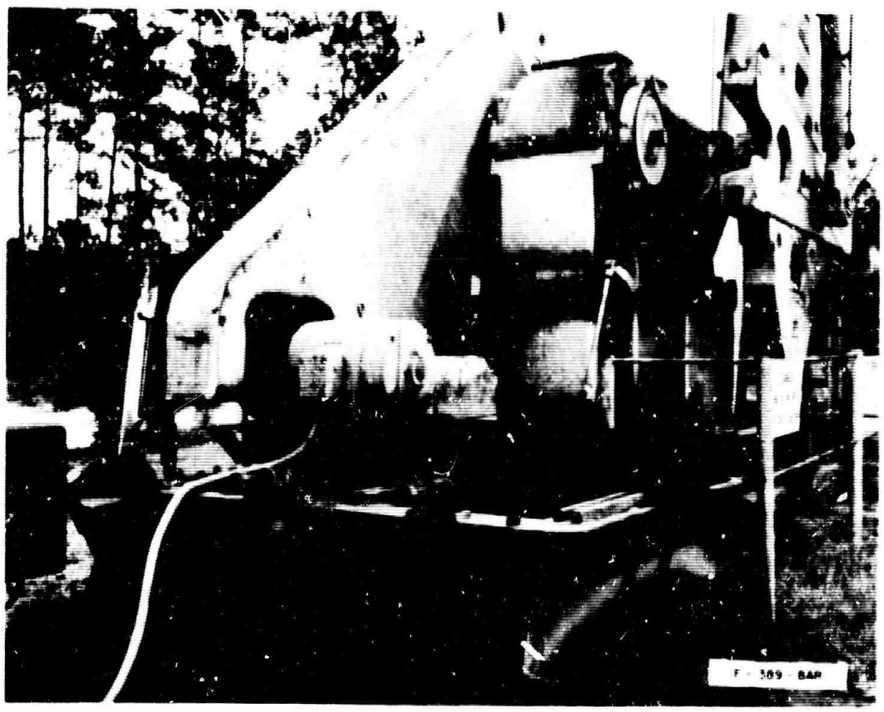

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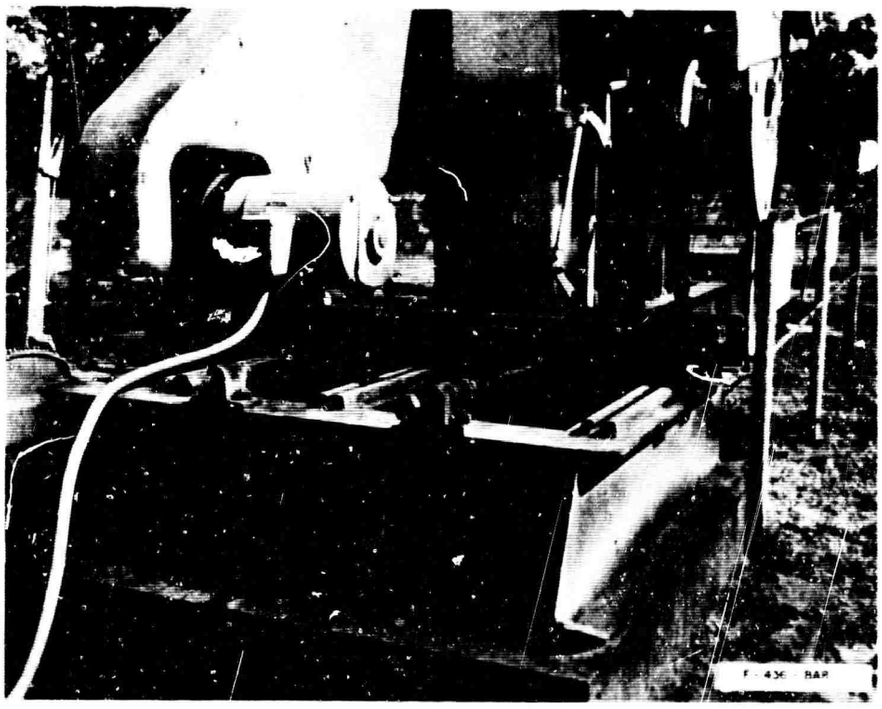

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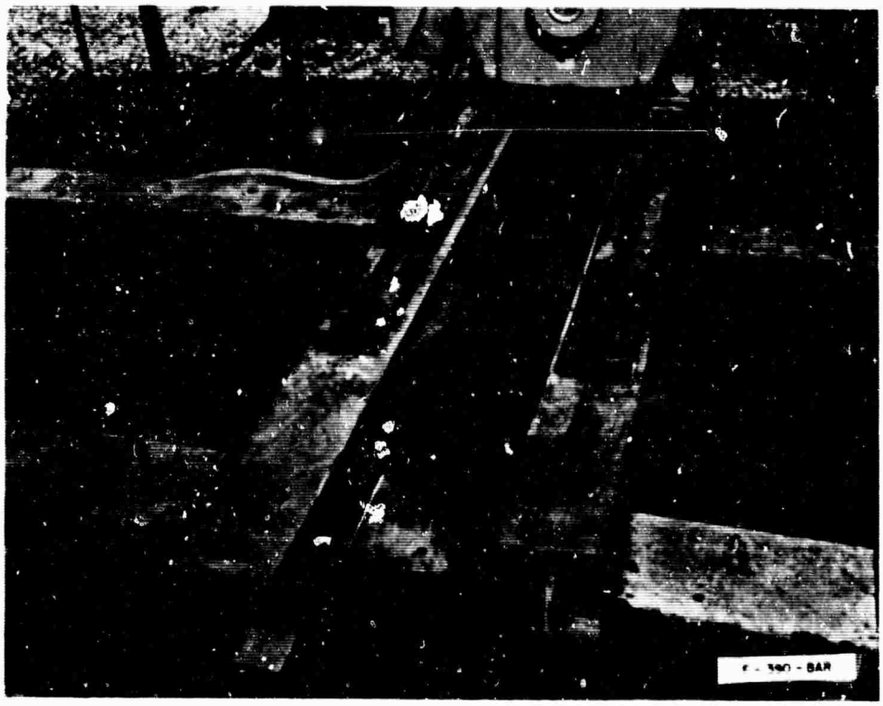


Photo 31-1 Preshot

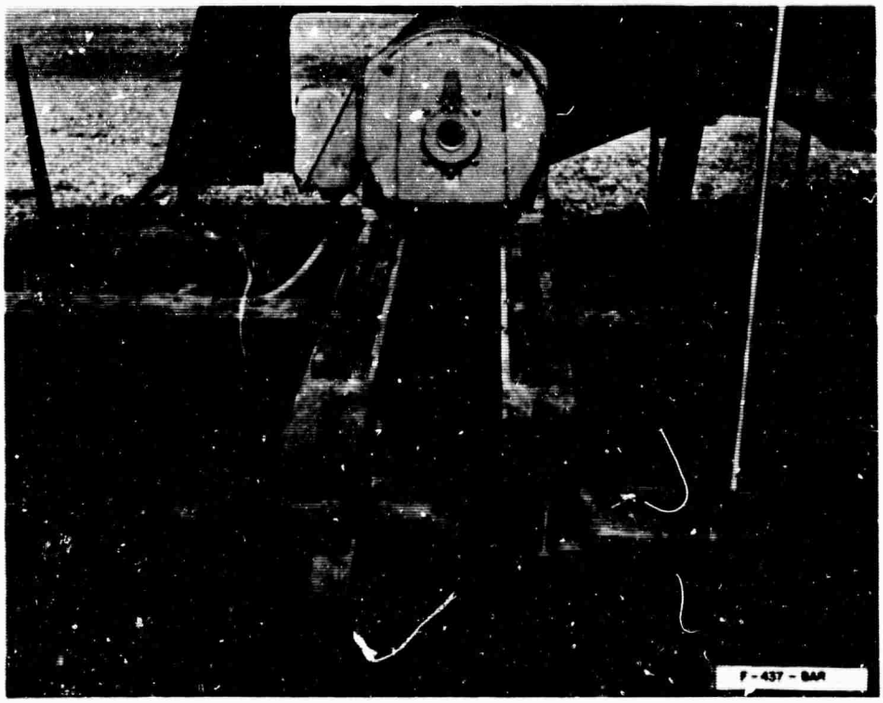


Photo 31-2 Postshot

Photo 32-1 Preshot

Photo 32-2 Postshot

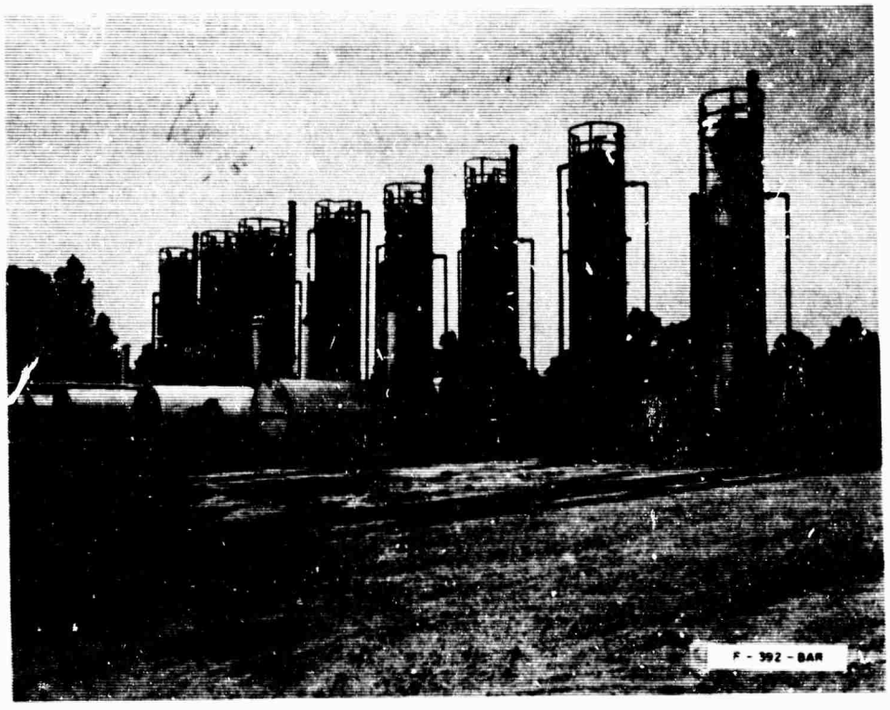
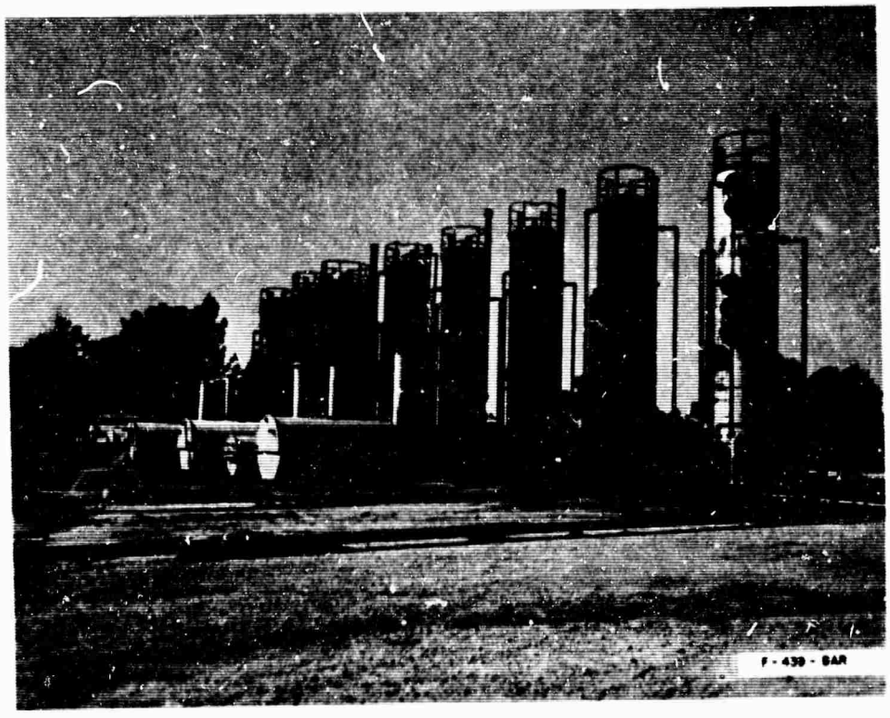


Photo 33-1 Preshot



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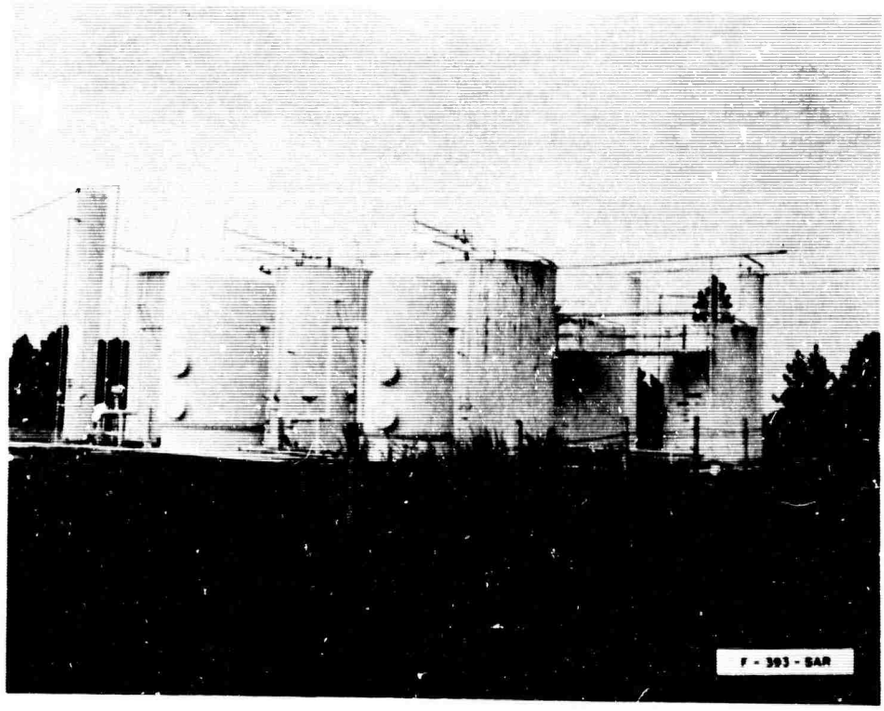

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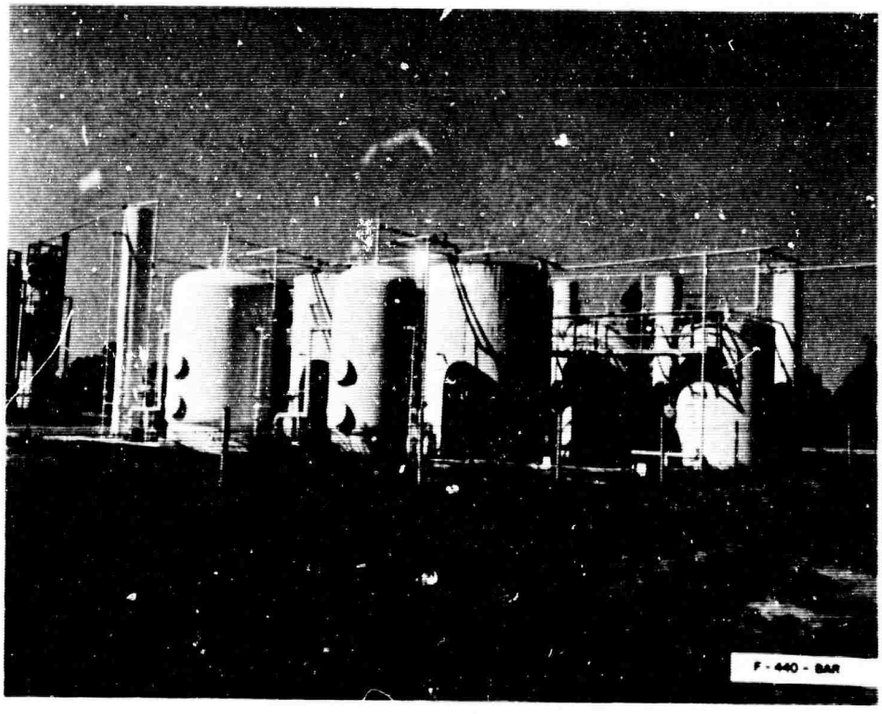

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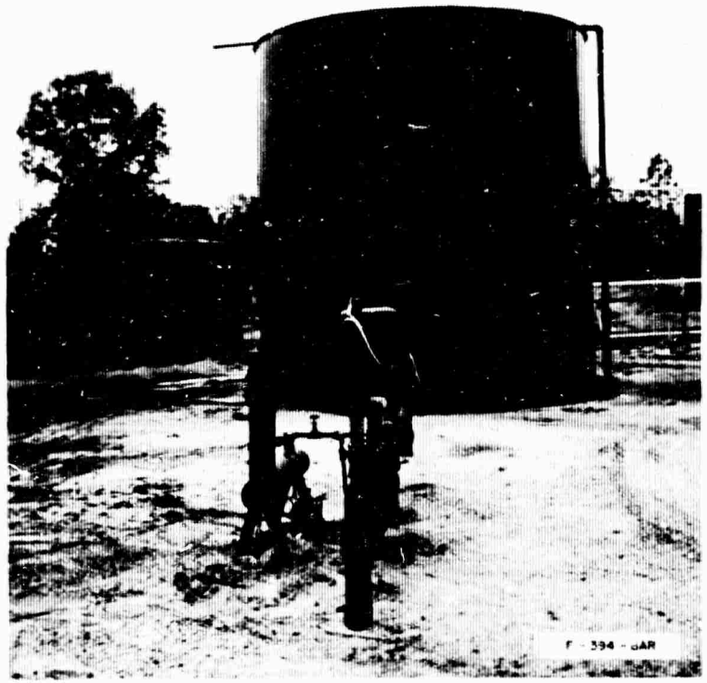

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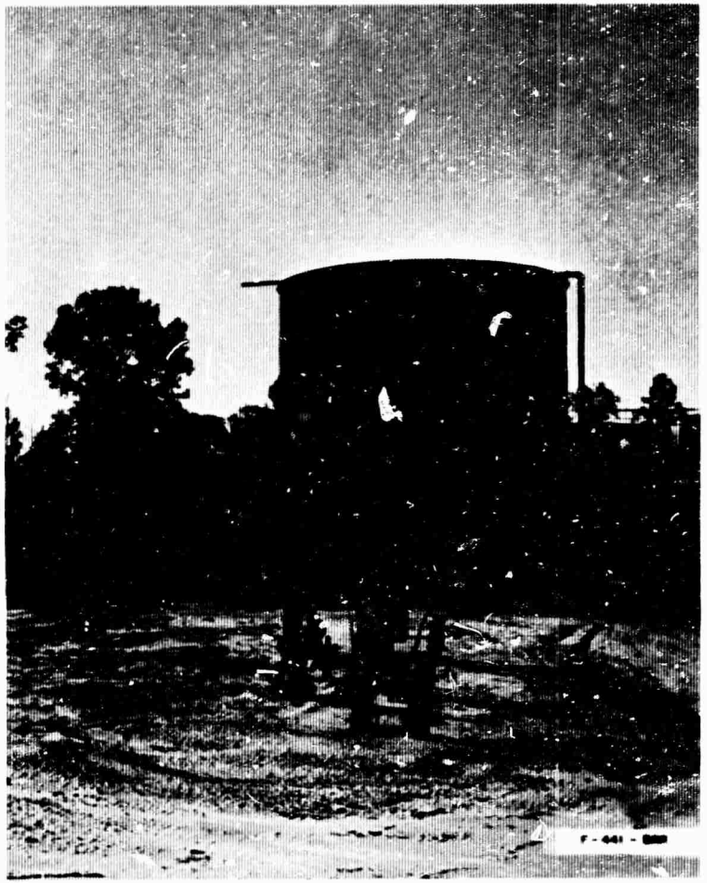

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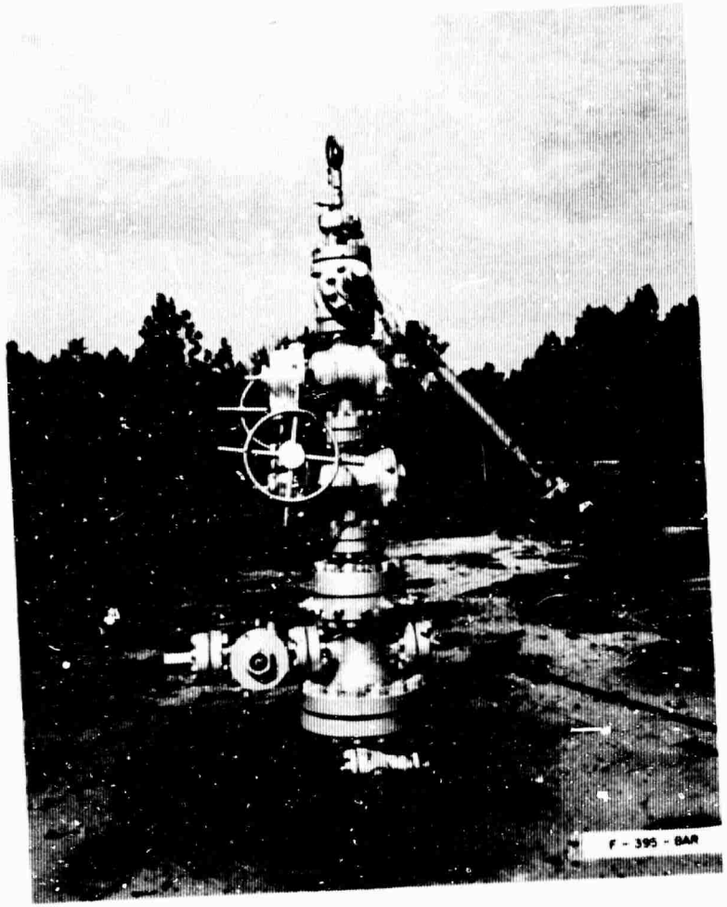

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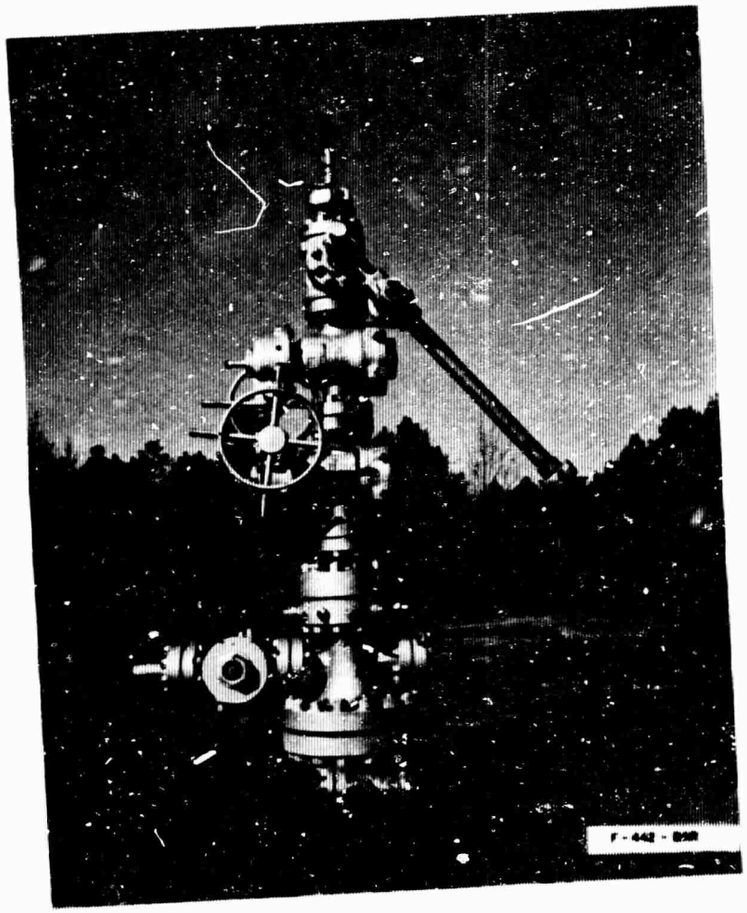

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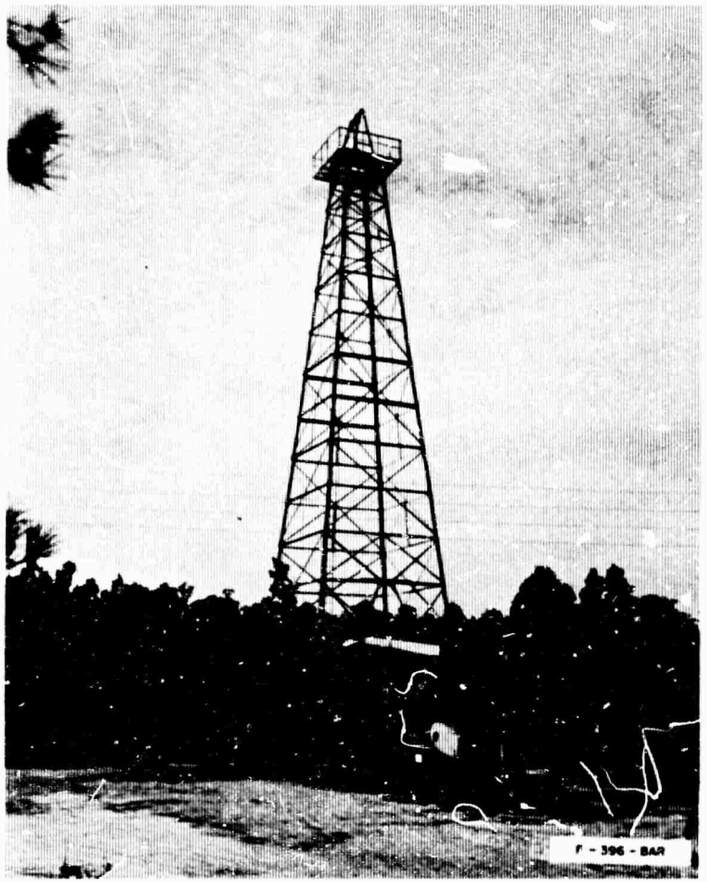

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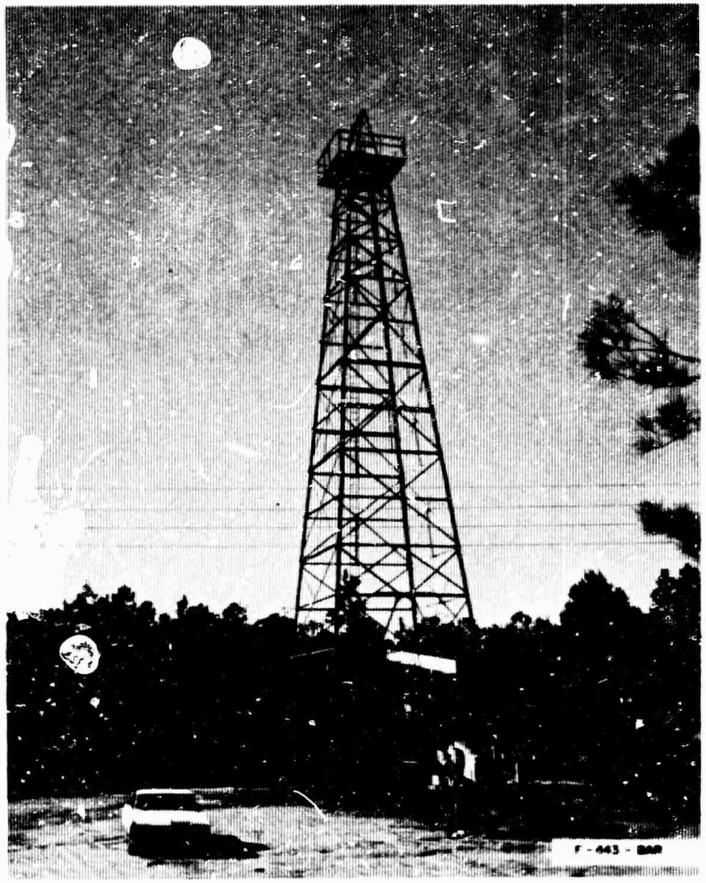

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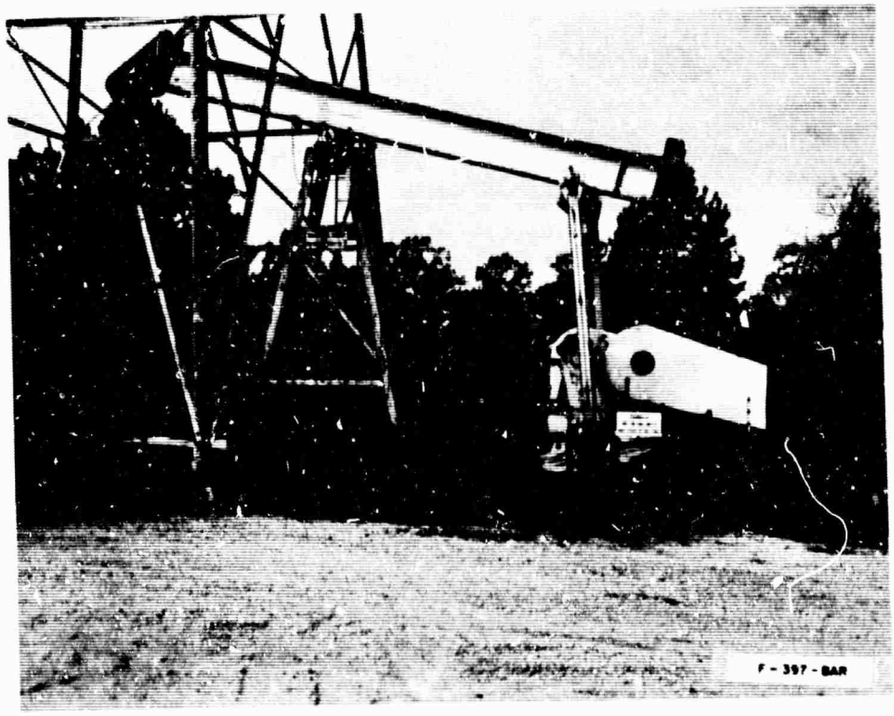

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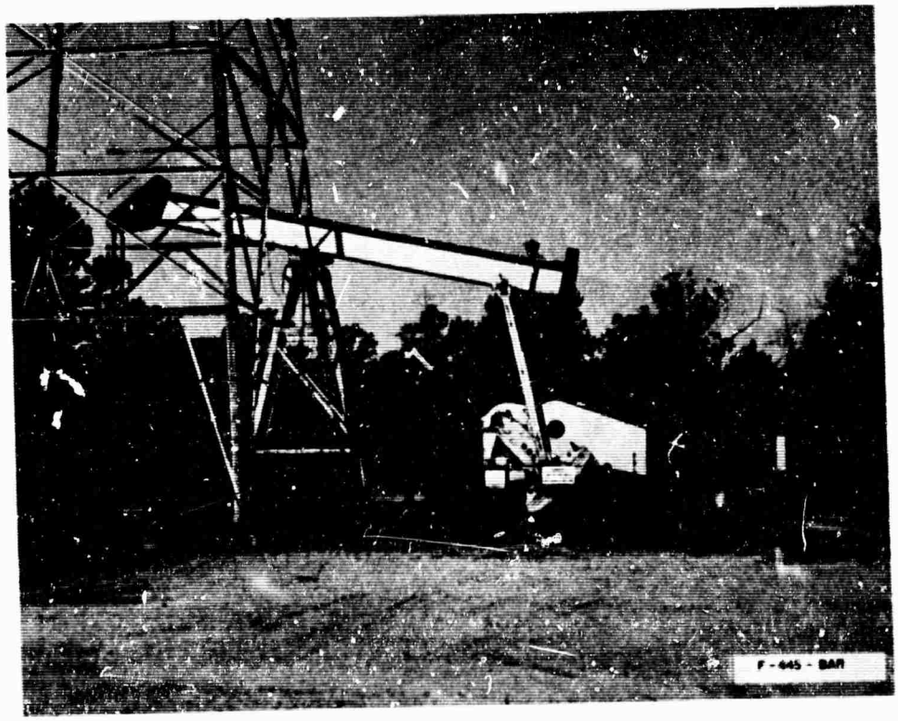


Photo 38-2 Postshot

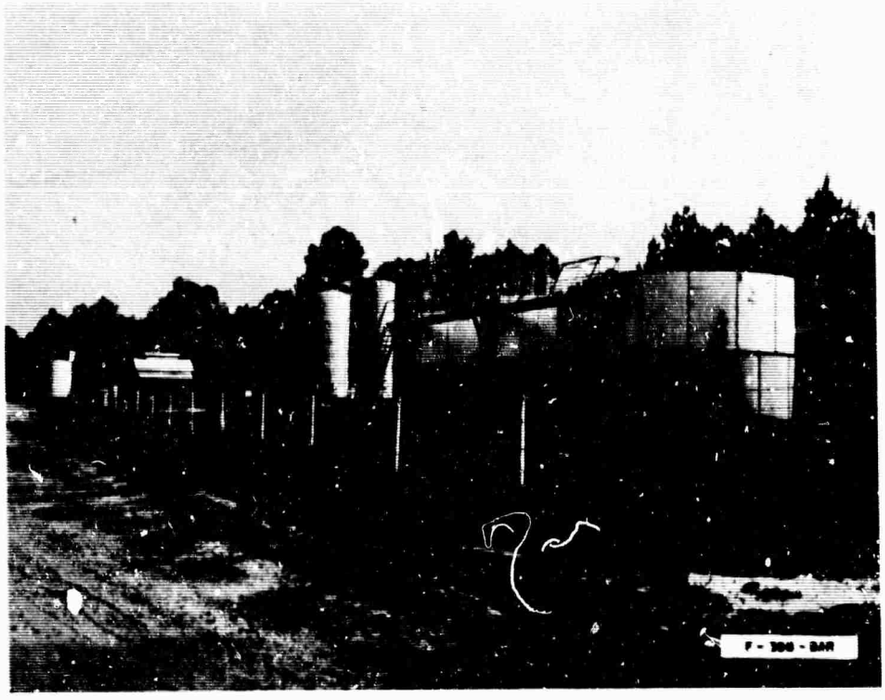


Photo 39-1 Preshot

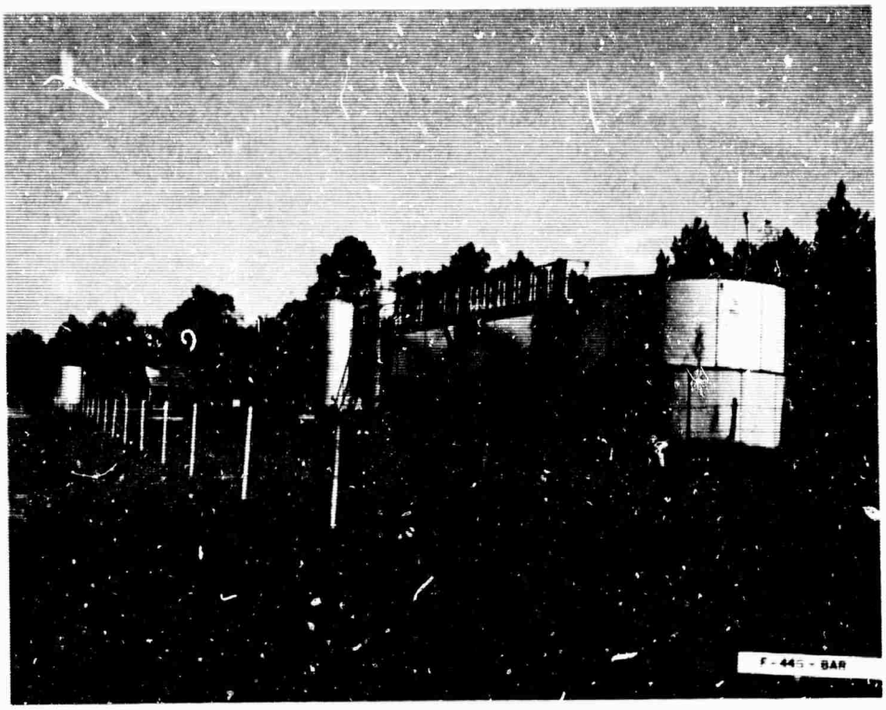


Photo 39-2 Postshot

Photo 40-1 Preshot

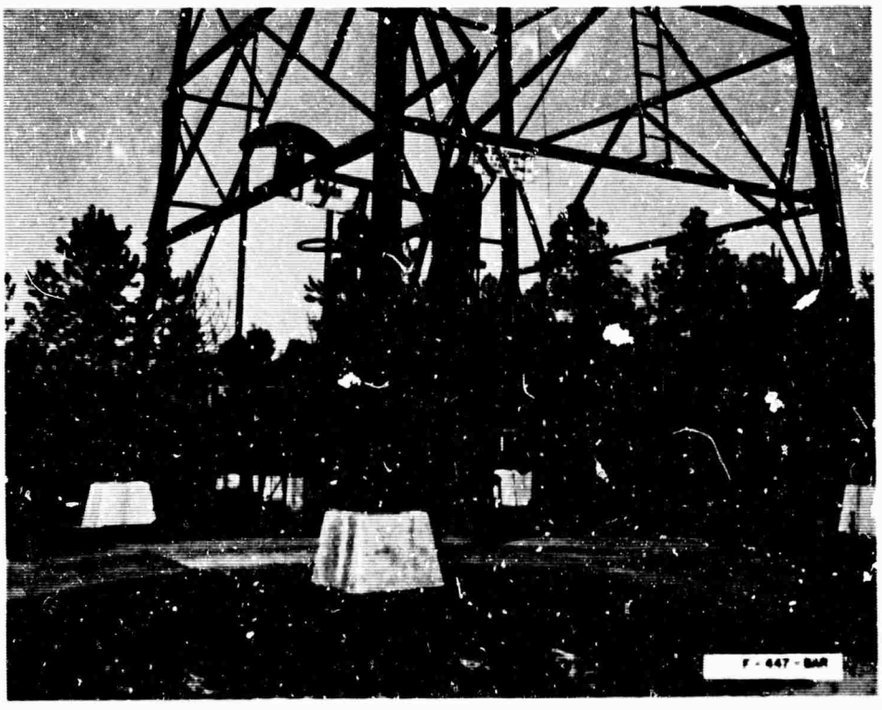


Photo 40-2 Postshot

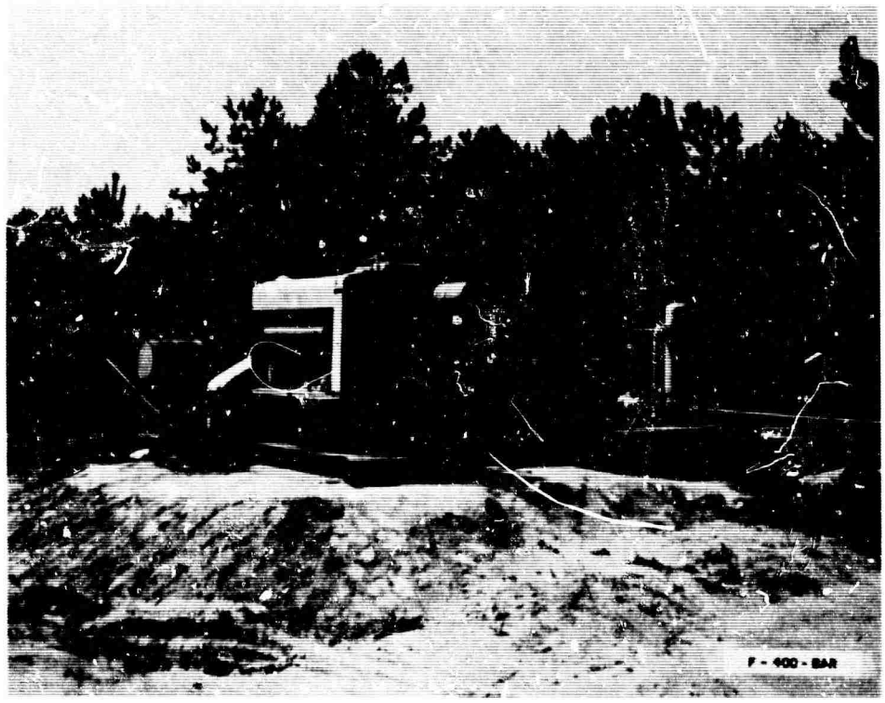


Photo 41-1 Preshot

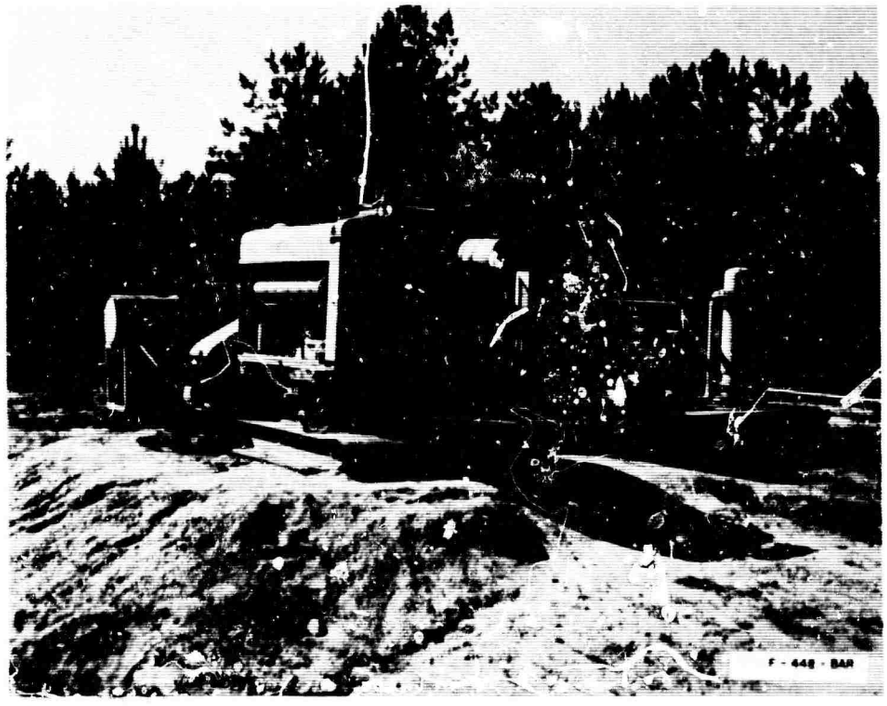


Photo 41-2 Postshot

Photo 42-1 Preshot

Photo 42-2 Postshot

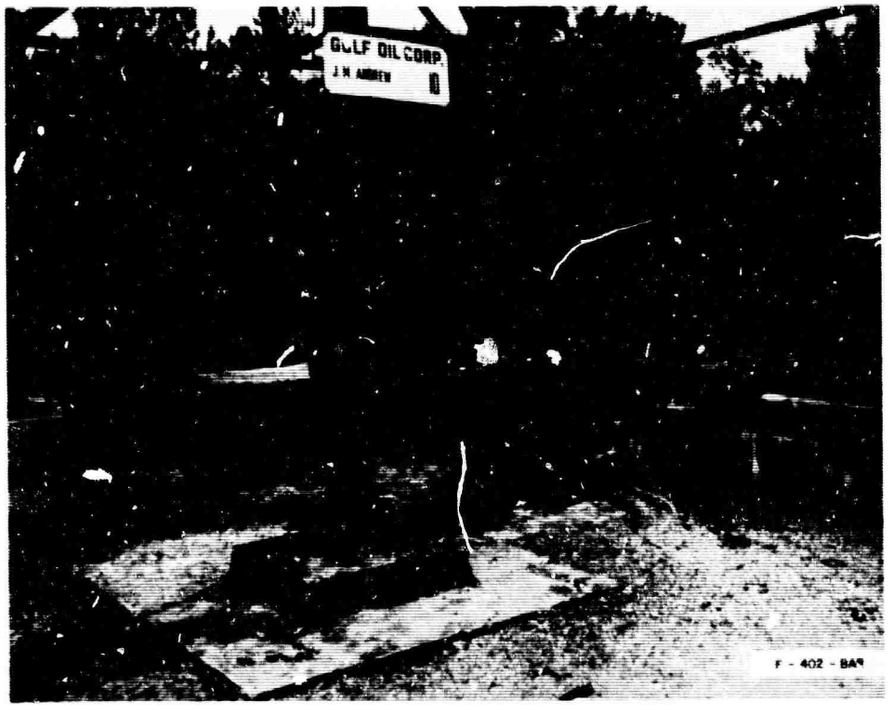
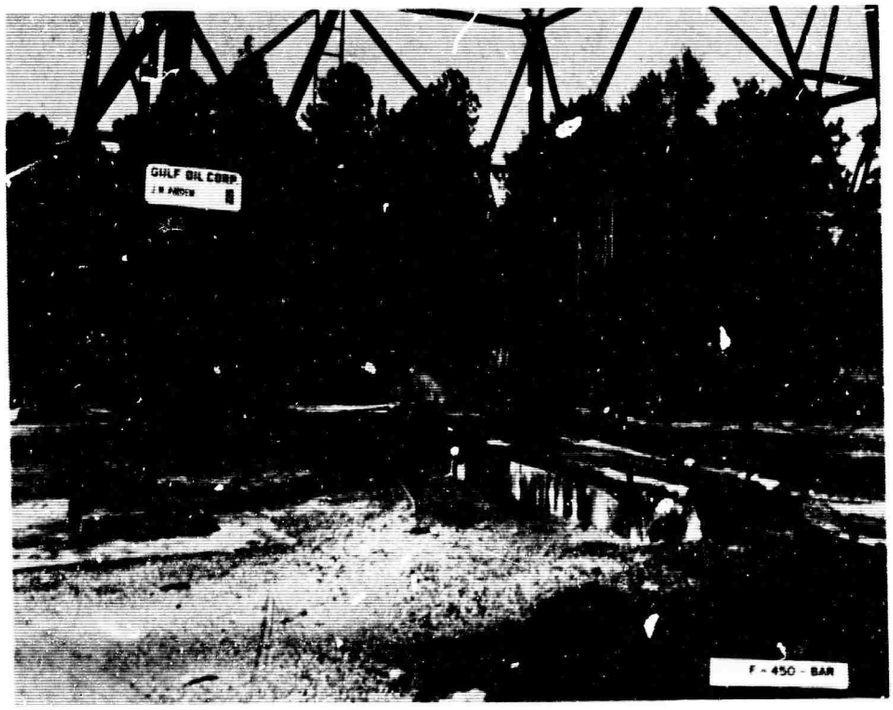


Photo 43-1 Preshot



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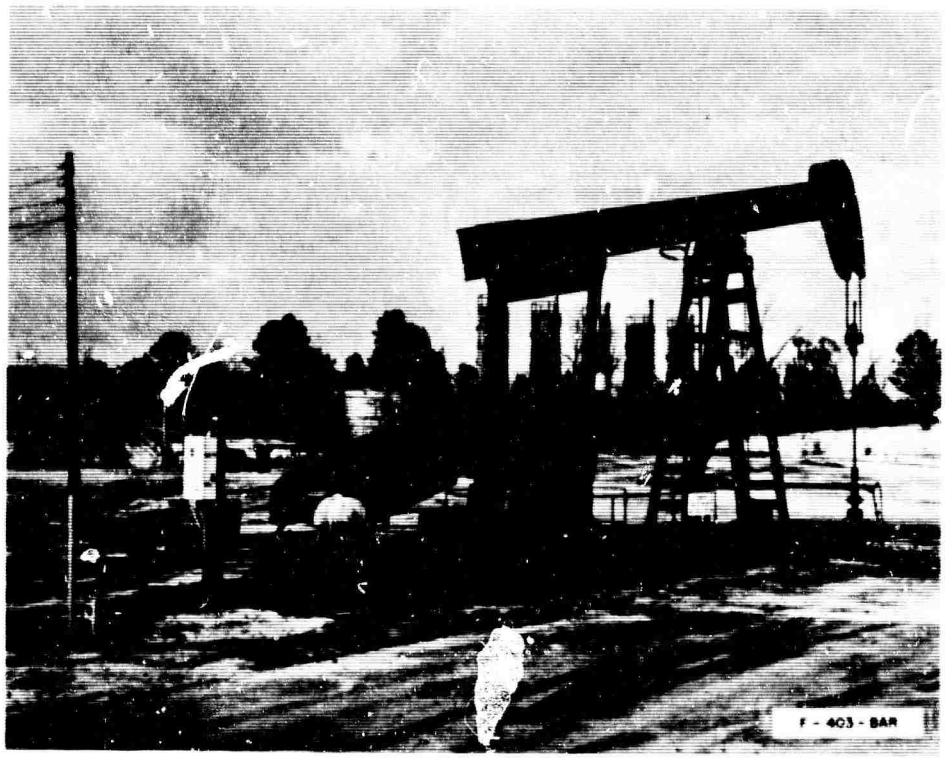

Photo 44-1 Preshot

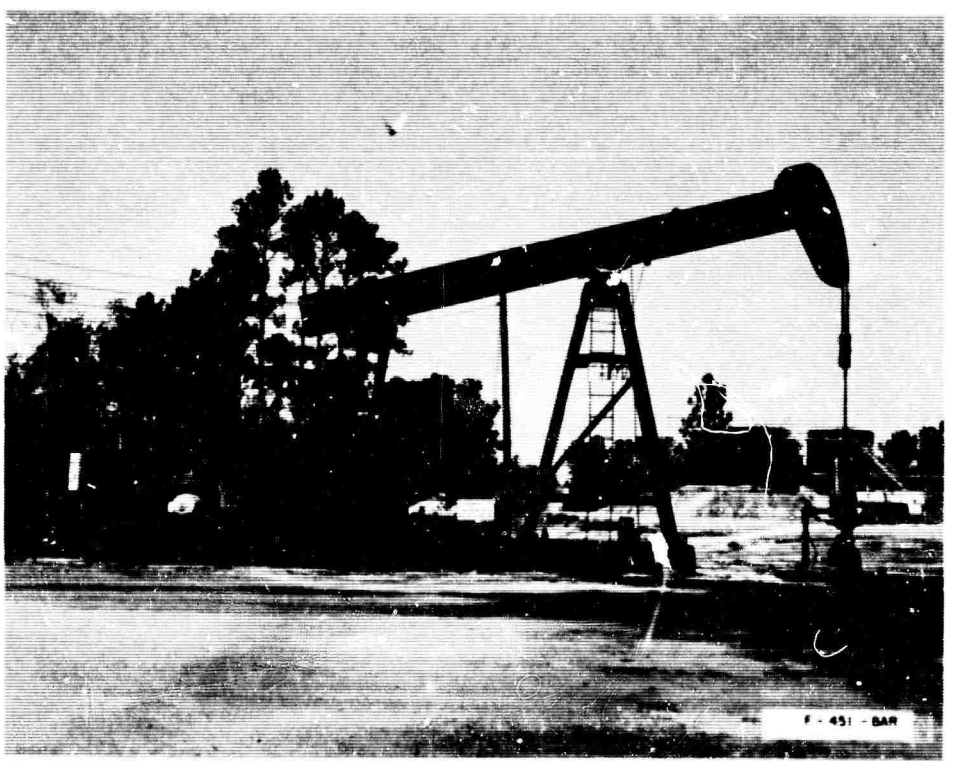

Photo 44-2 Postshot