

PTL - HOUSTON
SOUTH TEXAS PROJECT



**Pittsburgh
Testing
Laboratory**

FORM NO. ST-4
REV. NO. 1
DATE: 6-7-82

REPORT OF LIQUID AND PLASTIC LIMIT

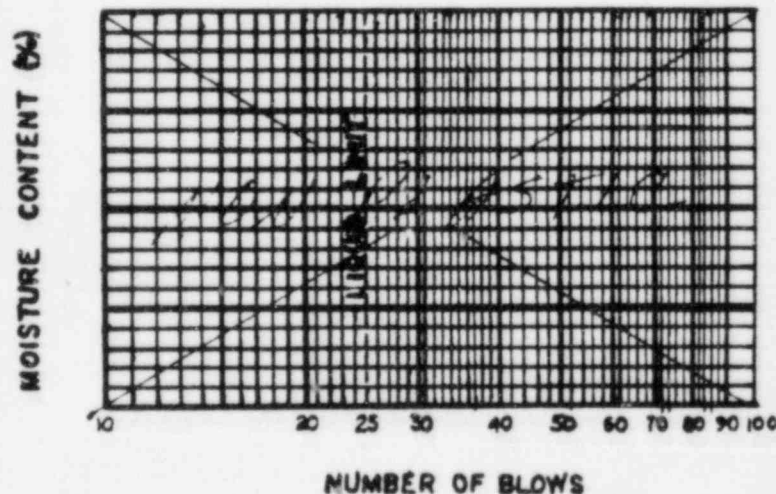
ORDER NO. HO-4471
CLIENT HOUSTON LIGHTING & POWER
PROJECT SOUTH TEXAS PROJECT

LAB NO. 5-9128
D. C. NO. _____
TEST METHOD ASTM D-423-66 &
ASTM D-424-59

Date of Sample 5-30-85 Date Tested 6-6-85
Sample Description S.P. 211 Silty
Sample Identification NES DIKE, S.P. 211, Dep. 27.5 to 29, L-4

SUMMARY

LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
<u>NO. - PLASTIC</u>		



PLASTIC LIMIT			
DETERMINATION N ^o	1	2	3
CONTAINER N ^o			
CONTAINER + WET SOIL			
CONTAINER + DRY SOIL			
WEIGHT OF WATER			
CONTAINER + DRY SOIL			
WEIGHT OF CONTAINER			
WEIGHT OF DRY SOIL			
PERCENT OF WATER			
LIQUID LIMIT			
DETERMINATION N ^o	1	2	3
NUMBER OF BLOWS			
CONTAINER N ^o			
CONTAINER + WET SOIL			
CONTAINER + DRY SOIL			
WEIGHT OF WATER			
CONTAINER + DRY SOIL			
WEIGHT OF CONTAINER			
WEIGHT OF DRY SOIL			
PERCENT OF WATER			

Acceptance Criteria 100

Test Equipment Serial No's 100, 100, 100, 100

REMARKS: 100

Tested By: David Mullins Level I

Reviewed By: Joe Balneck Level II

Requested By: S. PULLEY / JR. Company: HARZA

8510010464 850924
PDR ADOCK 05000498
A PDR

Attachment C
An Assessment of the Potential
Likelihood of Economically Producing
Hydrocarbons Located Beneath the
South Texas Project

AN ASSESSMENT OF THE POTENTIAL
LIKELIHOOD OF ECONOMICALLY
PRODUCIBLE HYDROCARBONS LOCATED
BENEATH THE SOUTH TEXAS PROJECT SITE

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FIGURES

Figure Number

- 1 INDEX MAP
- 2 STRUCTURAL CONTOUR MAP TOP FRIO MARKER
- 3 STRUCTURAL CONTOUR MAP MIDDLE FRIO MARKER "A"
- 4 NW - SE STRATIGRAPHIC CROSS SECTION
- 5 SCHEMATIC CROSS SECTION ILLUSTRATING POTENTIAL TRAP TYPES

EXECUTIVE SUMMARY

Miller and Lents, Ltd., has been asked to investigate the likelihood of economically producible hydrocarbons located beneath the South Texas Project Site. In the event that any significant likelihood is found that economically producible hydrocarbons do exist, then we were further requested to identify the location, depths, quantity and physical properties of such potential resources.

In completing this investigation, we have utilized a more than adequate amount of information. Some of the information was supplied by Houston Lighting & Power Company and some was obtained from public sources by us. The data included subsurface well data such as logs, seismic data, paleontological data and gravity data.

As a result of these studies, we conclude that there is very little likelihood of the presence of economically producible hydrocarbons located beneath the South Texas Project Site.

PURPOSE

This study of the South Texas Project Site was made to determine the following:

1. The potential likelihood of economically producible hydrocarbons located beneath the South Texas Project Site.
2. Identify the location and depths of potential mineral resources, i.e., hydrocarbons.
3. Identify the nature of these potential mineral resources, i.e., the possible quantity and the various physical properties of these potential resources.

INTRODUCTION AND AUTHORITY

The South Texas Project Site is located approximately 16 miles south-southwest of Bay City and approximately 12 miles east-northeast of Palacios, Texas. The site is located geographically in Matagorda County near the Texas Gulf Coast (Figure No. 1). More specifically, the site is located just west of the Colorado River on the John Raney, A-80, the C. H. Vanderveer, A-95, and the Abram Sheppard, A-383 surveys. Geologically, the site is located near the southeastern edge of the geological trend in which the Frio is the primary objective of oil and gas exploration.

This study was authorized by Houston Lighting & Power Company. The scope of the work included a review of geological, geophysical and engineering data furnished by Houston Lighting & Power Company and other public information obtained by Miller and Lents, Ltd. All the above geological, geophysical and engineering data were evaluated in order to arrive at our conclusions. All these data were deemed adequate and necessary for us to form an independent judgment and evaluation of the objectives stated in the Purpose.

CONCLUSION

As a result of this investigation we conclude that the prospects for commercial production of hydrocarbons from the South Texas Project Site appear to be most unlikely.

DISCUSSION

GEOLOGY

The geological structure in the subsurface of the Project site has been defined by the use of all available data including subsurface well data, seismic data, gravity data, and paleontological data. Two structure maps are included with this report. Figure No. 2 is a structure contour map on the Top Frio Marker. Figure No. 3 is a structure contour map on a Middle Frio Marker. These two maps were constructed from data acquired in studying well logs in the area (logs used are shown with numbered circles beside the well location on Figures No. 2 and No. 3). The available seismic data (seismic lines are indicated on the map base across and near the Project site) were interpreted and incorporated along with the well data to construct these structure maps. The gravity data confirms our structural interpretations.

Some of the major features shown on these maps should be pointed out. A major down-to-the-coast (south) fault (labeled Fault A) occurs along the north line of the Project site. This fault strikes in an essentially east-west direction. Also, minor relief faulting to this major fault can be seen (labeled Faults B and C). At these two Frio levels, one must note the strong north dip into the major fault. This north dip is counter to the regional trend in this area which is to the south. From this one can infer the possible presence of an anticline whose crest would be located somewhere south of the Project site and out of the study area. On the Project site itself, other

minor faulting has been observed in several dry holes located on the site. These are labeled Faults D and E. The dip and strike of these faults can only be inferred because they have been observed in only one place. Also, the presence of these minor faults cannot be detected on the seismic sections.

On the structure contour map of the Middle Frio Marker, it can be seen that there is apparently north dip on the upthrown side of the major fault (Fault A) seen striking east-west along the northern boundary of the Project site.

On the basis of this investigation, it does not seem possible for there to be any other unobserved major faulting in the Project site area.

Deep seated salt movement is suspected as the underlying cause of the structural features observed on and near the Project site.

STRATIGRAPHY

Miocene sands and shales occur essentially from the surface to a depth of 6,000 to 6,500 feet over the Project site. No structures have been observed for traps in the Miocene. These sands are not located in the proper geologic environment to provide attractive objectives for hydrocarbon exploration.

Underlying the Miocene is the Frio formation of Oligocene age to as deep a depth as has been drilled on the Project site or about 16,510 feet.

Prospects for oil or gas production deeper than the Frio in the Vicksburg or older rocks is purely speculative. In this area of Matagorda County, Frio age rocks would ordinarily be considered the

primary objectives. The Upper and Middle Frio sands have been the primary objectives in this area to date. On the Project site these objective horizons have been condemned by six dry holes.

It is questionable whether the Lower Frio section has been fully penetrated at a depth of 16,510 feet in the Magnolia No. 1 W. W. Rugeley. Little porous and permeable sand appears to be present in the 10,000 plus feet of Frio section penetrated on the Project site. This tends to condemn the Lower Frio prospects in this area basically due to the absence of porous and permeable sands. This is exactly what would be expected based on the location of the Project site regionally (Figure No. 4). Figure No. 4 is a stratigraphic section crossing the Project site from northwest to southeast. The line of section is shown on Figures No. 2 and No. 3. This stratigraphic section illustrates the thinning of Frio sands from northwest to southeast and their very poor development across the Project site.

GEOPHYSICS

Seismic

Six Petty-Ray seismic lines were in the data provided by Houston Lighting & Power Company. These lines are shown on Figures No. 2 and No. 3. They are deep reflection seismic lines. Several seismic lines shot by CONOCO and GUS DIGITECH also were available and evaluated. These lines are much older vintage seismic and are not shown on Figures No. 2 and No. 3.

Petty-Ray Line 4 was reprocessed to see if any significant improvement in quality could be made. Although some minor improvement could be observed, it was not deemed necessary to have the remaining

five lines reprocessed. Reprocessing would not improve our stratigraphic knowledge of the area. Also, the reprocessing of the one seismic line did not enhance our ability to see small faults.

Using all the available seismic data, a seismic interpretation was made and was incorporated into the geological evaluation.

Gravity

After our seismic interpretation and subsurface studies were completed, a gravity study was recommended in order to gain a better understanding of the tectonics of the area, especially to see if salt movement might be an important factor. Houston Lighting & Power Company authorized the purchase of gravity data including a Bouguer Anomaly Map and a Grid Residual Map covering the Project site and surrounding area. These data were studied. Strong evidence in the area south of the Project site indicates a salt ridge trending east-west. This evidence also lends to the conclusion that deep seated salt movement may be the underlying cause of the structural features observed on and near the Project site. Also, the location of the major faulting is indicated by the gravity data.

PROSPECTS

No prospects of commercial importance are present on the Project site. There are five typical types of traps that might occur in the area:

1. Anticlinal trap
2. Upthrown side of major fault
3. Upthrown side of minor fault

4. Downthrown side of minor fault

5. Stratigraphic

These five possible types of traps which might occur in the general area are illustrated schematically by Figure 5 and each type is numerically coded at the general structural position where it might be expected to occur on the schematic cross section. The first three of these trap types are known to provide attractive targets for exploration in this trend. However, experience has shown that Types 4 and 5 have not provided attractive exploratory objectives in this area.

The anticlinal feature (Type 1) has either been tested or is located just south of the Project site. The upthrown side of the major fault (Fault A) (Type 2) has produced off the Project site. Underlying the Project site, it has been condemned by wells. The upthrown side of any minor faults (Type 3) have been condemned by wells. Only two minor faults have been identified on the Project site. The downthrown side of minor faults (Type 4) does not show any structural closure to complete the trapping mechanism anywhere on the Project site. It is not considered an attractive target in this area in any event. Stratigraphic traps (Type 5) are not readily located by seismic investigation in thin sand zones. Regionally, the Frio sands are becoming very thin and sparse and increasingly thinner across the Project site toward the Gulf of Mexico and are not expected to thicken appreciably at any position underlying the Project site. Even in the remote event the sands should thicken on the downthrown side of major Fault A and pinch out to the south, this is not considered to be an attractive target for exploration in this area.

Several intervals in the Middle Frio were sidewall cored in the Brazos No. 1 W. W. Rugeley in the depth interval 10,005 feet to 12,157 feet. All zones are indicated to be very thin and either tight or water-bearing. All zones penetrated are indicated to be non-commercial even if they should prove to contain hydrocarbons because they are very thin and are indicated to have low permeability. In our opinion, no economic importance should be attached to the minor shows of hydrocarbons observed in the sidewall cores obtained from this well.

DRILLING ACTIVITY

We were asked to investigate recent drilling activities in the vicinity of the Project site to see if there were any indications of a trend of production developing moving in a direction toward the Project site. Such is not indicated to be the case.

Drilling activity near to the Project site within the past two years has occurred in two areas. The first is approximately three miles northwest of the Project site in a field named Duncan Slough-South located just east of Pheasant Field and East Blessing Field. Here, two gas wells have recently been completed in Upper Frio zones. These wells have no bearing on possible oil or gas production on the Project site since they are located on a structure entirely separate from the Project site. Immediately south of the Project site on the John T. Criswell Survey, A-20, a dry hole has been drilled to a total depth of 6,025 feet. Another well location, J-3 Oil Co. No. 1 Mercer, has just recently been announced in this same survey. It is

approximately 2,500 feet south of the southern boundary of the Project site and is a proposed 6,500-foot Miocene test. In 1980 approximately fifteen miles east of the Project site, Inexco drilled a Frio test to 16,938 feet. This well was a dry hole.

The zones penetrated by all these recent wells, that is, the Miocene and the Frio zones, have been penetrated by the various wells drilled on the Project site. All have been plugged and abandoned since no economically producible hydrocarbons were encountered.


SUMMARY

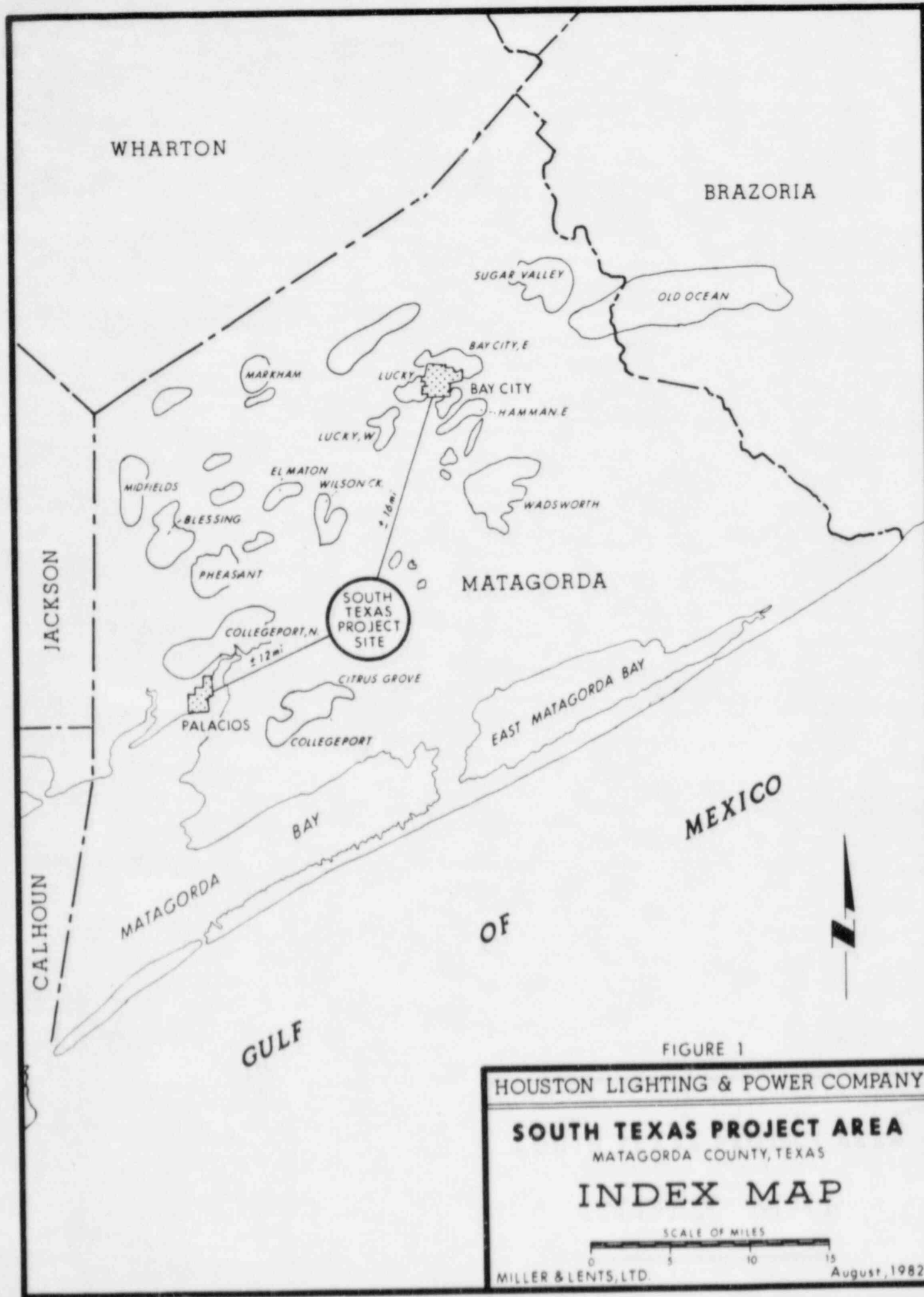
In view of (1) the absence of any identifiable, undrilled traps underlying the Project site and (2) the extremely poor development of potential reservoir rocks (sands) underlying the Project site, in our opinion, the prospects for commercial production of hydrocarbons from the South Texas Project Site appear to be most unlikely.

Respectfully submitted,

MILLER AND LENTS, LTD.

By

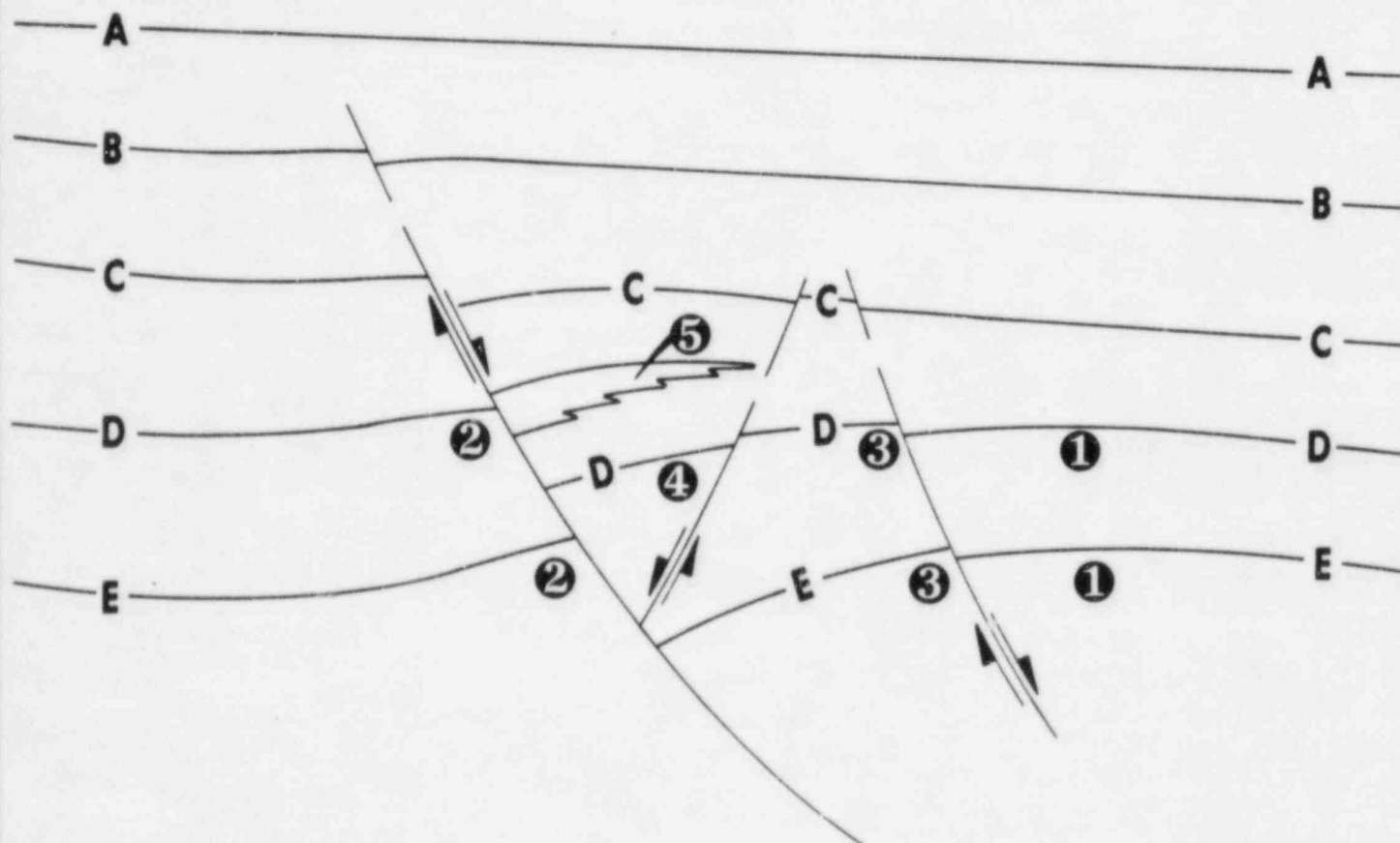

P. G. Von Tungeln
Vice President



North

South

GROUND LEVEL



TRAP TYPES

- ① Anticlinal
- ② U/T Side of Major Fault
- ③ U/T Side of Minor Fault
- ④ D/T Side of Minor Fault
- ⑤ Stratigraphic

FIGURE 5

HOUSTON LIGHTING & POWER COMPANY

SOUTH TEXAS PROJECT AREA

MATAGORDA COUNTY, TEXAS

SCHMATIC
CROSS SECTION
ILLUSTRATING POTENTIAL
TRAP TYPES

MILLER & LENTS, LTD.

August, 1982