CASE 5193: Application of BELCO PETROLEUM FOR A DRILLING PERMIT IN THE POTASH-OIL AREA, LEA COUNTY

CASE No. 5193

Application,

Transcripts,

Small Exhibits

ETC.

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

April 2, 1974

Re: CASE NO. 5193
ORDER NO. R-4759
Applicant:
BELCO PETROLEUM CORP.

Mr. Jason Kellahin
Kellahin & Fox
Attorneys at Law
Post Office Box 1769
Santa Fe, New Mexico

Dear Sir:

Enclosed herewith are two copies of the above-referenced Commission order recently entered in the subject case.

Very truly yours,

A. L. Porter, Jr.

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

Copy of order also sent to:

Hobbs OCC X
Artesia OCC
Aztec OCC

Other Mr. John Robb, Mr. Joe Peacock, Phillips Petroleum, Odessa,
Mr. C. E. Childers, International Minerals

WILLIAM A. SLOAN
JACKSON G. AKIN
JOHN D. ROBB
CHARLES B. LARRABEE
JAMES C. RITCHIE
JOHN P. EASTHAM
WILLIAM C. SCHAAB
WILLIAM C. BRIGGS
RAY H. RODEY
ROBERT D. TAICHERT
ROBERT M. ST. JOHN
JOSEPH J. MULLINS
DUANE C. GILKEY
MARK R. ADAMS
ROBERT G. McCORKLE
PETER G. PRINA
BRUCE D. HALL

JOHN P. SALAZAR
WILLIAM S. DIXON
JOHN P. BURTON
REX D. THROCKMORTON
ROBERTA COOPER RAMO
JONATHAN W. HEWES
JAY B. GENTRY ORTIZ
GENE C. WALTON

RODEY, DICKASON, SLOAN, AKIN & ROBB, P.A.
COUNSELLORS AND ATTORNEYS AT LAW
FIRST NATIONAL BANK BUILDING-WEST
WEST CENTRAL AVENUE AT THIRD
P. O. BOX 1888
ALBUQUERQUE, NEW MEXICO 87103

OF COUNSEL
DON L. DICKASON

PEARCE C. RODEY
1889-1958

TELEPHONE 243-1301
AREA CODE 505

April 8, 1974

New Mexico Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Attention: Mr. A. L. Porter, Jr., Secretary

File

Dear Mr. Porter:

Re: Case No. 5193 - Belco-Kerr-McGee

You are requested to return to Kerr-McGee at your earliest convenience the thirteen core hole logs which were turned over to Belco by Kerr-McGee under the compulsion of the subpoena issued by the Commission. We previously advised George Warnock, Consulting Engineer to Belco, that these logs contained privileged information; that he was not to reproduce or use information therefrom for any purpose other than the hearing before the Commission, and that they were to be returned to us as soon as the hearing was completed. Instead, Mr. Warnock turned these logs over to Mr. Kellahin, attorney for Belco who had advised him that the logs should be filed with the Commission.

These logs are not a part of the record and therefore we request that they be returned to us.

Sincerely yours,

RODEY, DICKASON, SLOAN, AKIN & ROBB, P.A.

By: John D. Robb
John D. Robb

JDR/sa

Called Jason Kellahin 9:30 am 4/9/74 He advises that the logs have already been sent to Kerr-McGee in Carlsbad w/ a copy of the cover letter sent to John Robb
JLE

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5193
Order No. R-4759

APPLICATION OF BELCO PETROLEUM
CORPORATION FOR A DRILLING PERMIT
IN THE POTASH-OIL AREA, LEA COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on March 15, 1974, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission".

NOW, on this 2nd day of April, 1974, the Commission, a quorum being present, having considered the testimony presented and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Belco Petroleum Corporation, seeks authority to drill its proposed Bass-Federal Well No. 2 to test the Pennsylvanian formation at an unorthodox location 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, NMPM, South Salt Lake-Morrow Gas Pool, Lea County, New Mexico, said location being within the boundaries of the Potash-Oil Area as defined by Commission Order R-111-A, and having been objected to by the owner of potash leases in the Area. This unorthodox location was previously approved by the Commission by Order No. R-4699.

(3) That the entire S/2 of said Section 30 may reasonably be presumed to be productive of gas from the Morrow formation.

(4) That a well drilled at the proposed location would not be in sufficient proximity to commercial deposits of potash to impose a hazard to the mining of such deposits.

(5) That approval of the application is necessary to prevent waste and protect correlative rights.

IT IS THEREFORE ORDERED:

(1) That Belco Petroleum Corporation is hereby authorized to drill its proposed Bass-Federal Well No. 2 in the Potash Oil Area at an unorthodox location 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, NMPM, South Salt Lake-Morrow Gas Pool, Lea County, New Mexico.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

I. R. TRUJILLO, Chairman

ALEX J. ARMIJO, Member

A. L. PORTER, JR., Member & Secretary

S E A L

jr/

Ken-McGee
Ex's - Completed -

Case 5193
Land March 15 & 16
1974

OIL CONSERVATION COMMISSION
OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF BELCO PETROLEUM COMPANY FOR A DRILLING PERMIT IN THE POTASH AREA, SECTION 30, TOWNSHIP 20 SOUTH, RANGE 33 EAST, LEA COUNTY, NEW MEXICO

Case No. _____

STATEMENT BY KERR-McGEE CORPORATION

HISTORY

(a) Kerr-McGee and Other Operations

Kerr-McGee Corporation is one of the major potash operators in the Carlsbad Potash Basin with a capital investment in mining and milling plant and equipment exceeding $35,000,000. It employs approximately four hundred employees in this operation. Its annual payroll has increased from 2.2 million dollars in 1966 to approximately 5 million dollars in 1973. Kerr-McGee and its predecessors have conducted exploration, development and mining in the Carlsbad Potash Basin starting in 1952. Large scale mining and milling operations have been continuously conducted there by Kerr-McGee and its predecessors since 1965.

Major potash mining has been conducted in the Basin since 1932 and has continued to the present time. The Basin is the only major source of potash in the United States. For many years it has been well known that subsidence has been a normal and inevitable result of the only economically feasible mining method in the district.

(b) New Mexico and Federal Restrictions on Drilling

Oil and gas drilling in this area have either been prevented or restricted since 1939 when the Secretary of the Interior reserved the potash deposits from oil and gas leasing. In 1951 the Secretary enlarged the potash area but permitted oil and gas leasing where it would not result in undue waste of or hazard to the potash.

In the same year this Commission issued its Order R-111 which permitted oil and gas operations under certain conditions. This order has been amended a number of times. On May 11, 1965, the Secretary of the Interior issued an order further enlarging the potash area and permitting potash and oil and gas operations where no waste of or hazard to mineral deposits existed. Furthermore, the United States Geological Service (USGS) has established, outlined and maintained an area where potash is known to exist which has been aptly described as the "known potash area".

(c) Events Leading Up To Present Controversy

In 1973, following increasing controversies between potash and oil and gas operators, the New Mexico Oil and Gas Association applied to the Secretary of the Interior for modification of his 1965 order. In August 1973 both Kerr-McGee and the other potash companies responded separately to this application by submitting memoranda to the Secretary, copies of which are also attached to this statement as Exhibits I and II respectively.

In its presentation Kerr-McGee took the position that potash mining should be accorded a priority because:

1. There is risk both of losing large quantities of valuable potash and of recurring hazards to the men and the mining operation if oil and gas drilling should precede mining operations, whereas there is no such danger to the oil and gas deposits if potash mining should precede oil and gas drilling operations.

2. The relatively small area involved contains the major source of potash in the United States and is thus of enormous importance to the nation as well as to the potash industry.

3. Within this area the economic values of the potash, and of large stable mining and milling payrolls, coupled with the huge investment in mining and milling plants, outweigh the potential for oil and gas in this area.

In supporting these contentions, Kerr-McGee stated in Exhibit I:

> "The risk of losing large quantities of valuable potash and the potential hazards to mine employees and mining operations from prior oil and gas drilling result primarily from subsidence of overlying beds above areas where potash has been extracted. Subsidence is a well known occurrence in the Carlsbad mining area. Stresses result from subsidence, posing a serious threat of damaging or collapsing well casings and releasing hydrocarbons into adjacent potash beds and into active mine workings. The consequent hazards to miners working in such areas would be great. Apart from possible death or injuries to miners, it would not be economically feasible to convert potash mining equipment to operate under gaseous conditions. In order to avoid the risk of subsidence, it would be necessary to leave large pillars of unmined ore around oil and gas wells to provide support. The diameter of such a pillar in the eastern portion of Kerr-McGee's reserves is estimated at approximately 4,000 feet or a large portion of an entire section of land. The amount of ore left in such a pillar would vary between 3 and 6 million tons, depending upon whether or not first mining could be economically conducted. This is equal to approximately one to two years of Kerr-McGee's present annual production. The economics might well prevent keeping access available to these pillars after other mining operations in the area had ceased thus making it likely that a large portion of the ore in these pillars would be lost forever.

"There is no corresponding risk involved to the oil and gas deposits, if any, should potash exploration, development and mining operations precede oil and gas operations. Oil and gas operations would simply be deferred until potash operations have been completed in the particular area. Experience has shown that all but insignificant amounts of subsidence occur within five years after the termination of mining operations.

"The economics of potash versus oil and gas in this limited area finds the balance weighted heavily in favor of potash. The potash industry is a stable and important one. Large scale potash operations have been conducted in the Carlsbad Basin since the early 1930's. . .

"The Bureau of Business Research of the University of New Mexico has compiled data on the economics of the potash industry, attached to this memorandum as Appendix A. This shows that for 1970 (the last year for which official statistics are available) the potash industry accounted for approximately 2,600 jobs and generated an annual payroll of about $21,000,000. The Bureau applied its own income and employment multipliers to produce a real value of approximately $32,000,000 annually, or approximately 28.6% of the total earnings and 34.6% of the entire employment in Eddy County, New Mexico for that year.

"Further, the employment provided by the mining of such an ore pillar, if not required to support an oil or gas well casing, would amount to approximately 95,000 man days as compared to the employment provided by the drilling of a deep oil or gas well of approximately 6,000 man days, a ratio of approximately sixteen to one in favor of potash payrolls. Employment afforded by oil and gas operations tends to be confined to the exploration and development stages over a relatively short time. Producing wells in a field can be serviced by relatively few employees.

"Likewise the retail value of the potash product in the pillar of ore necessary to support an oil or gas well casing amounts to approximately $15,000,000, (assuming first mining can be conducted).

"The investment in plant and equipment by the major potash companies in the Carlsbad mining area is conservatively estimated to exceed $200,000,000, of which $35,000,000 is represented by the capital investment of Kerr-McGee alone. The major portion of the capital investment by the oil and gas operators in or directly relating to the Secretarial Order area is the aggregate amount paid to acquire their leases. Moreover these oil and gas leases were acquired with knowledge by the lessees of existing potash deposits and of the conditions in the leases limiting the rights to drill for oil and gas in the event of conflict with potash deposits.

"The foregoing payrolls, valuable potash deposits and capital investment all could be seriously jeopardized were oil and gas drilling permitted in this area without restrictions suggested below."

The Secretary of the Interior has just issued a decision in this matter which will prohibit drilling through potash reserves except under extraordinary circumstances, a copy is attached hereto.

STATEMENT OF POSITION AND CONTENTIONS

Position

Kerr-McGee's position is that the application of Belco should be denied; that drilling at its proposed location would result in undue waste of commercial potash deposits, unduly reduce the total quantity of such deposits which may reasonably be recovered in commercial quantities, would constitute a hazard to other Kerr-McGee deposits and its miners and would seriously interfere with

the commercial development of ore deposits; further that these effects are wholly unnecessary in that Belco could drill directionally under the deposits from adjacent locations at modest increase in cost.

Statutes

Section 65-3-5 of the 1953 N.M.S.A. gives the Commission jurisdiction and authority over all matters relating to "the prevention of waste of potash as the result of oil or gas operations in this state". Sections 65-3-3F and 65-3-11(17) provide that drilling or producing operations for oil and gas in areas containing commercial deposits of potash constitute waste and are to be regulated or if necessary prohibited by this Commission where the effect of such operations would "unduly reduce the total quantity of such commercial deposits of potash which may reasonably be recovered in commercial quantities or where such operations would interfere unduly with the orderly commercial development of such potash deposits". This Commission's Order No. R-111-A is designed to implement the provisions of these governing New Mexico Statutes..

Contentions

1. Belco Proposal Constitutes Undue Waste of Commercial Potash Deposits and Undue Reduction Thereof

(a) Commercial Ore Deposits

The location proposed to be drilled contains commercial deposits of potash ore. It is within the "known potash area" designated by the USGS. Furthermore, it is an integral part of the potash ore body which Kerr-McGee is presently mining. Although Kerr-McGee's operations are presently several miles away it is advancing to this area. The ore deposit which it is presently mining together with the ore in the vicinity of the proposed Belco drill site constitutes approximately 80 per cent of Kerr-McGee's overall potash reserves in the Carlsbad Potash Basin.

Kerr-McGee estimates that there is probably ore of 6.48 feet in thickness with a grade of 14.7 per cent. This is within the range of ore grades now being mined by Kerr-McGee.

If the proposed well is drilled, Kerr-McGee could do no second mining of any kind within a 4,200 foot diameter circle of the drill site and no mining of any kind within 150 feet. Indeed, it might not even be economic to conduct first mining at all. This enormous pillar, comprising the better part of an entire section, contains enough ore to sustain Kerr-McGee's entire mining operation for a period of one to two years. This ore would have to be left in place and wasted in order to prevent subsidence with the consequent risk of escape of methane gas from the well into the potash formation. The waste involved involves a total of approximately 472,000 final product potash tons at the posted price of $33.89 a ton or a total

retail value in excess of $15,000,000. These dangers of subsidence are real. They are analyzed and described in the report of John Boyd, an extremely well qualified mining engineer whose findings and report are attached as Exhibit H to the potash companies' report (Exhibit II) attached hereto and also Exhibits B, C, D, E, F and G (Exhibit II).

In addition, this potash pillar would have to left because escaping methane gas might impregnate not only the portion of the ore deposits immediately surrounding the well but also adjacent portions of the ore body located within Kerr-McGee's present federal leases. Such impregnation would also impose a serious hazard of explosion and fire to the men working in Kerr-McGee's mine (see John Boyd report, supra).

(b) Loss and Reduction of Ore Deposits Are Unnecessary

Directional drilling could be undertaken by Belco from adjacent sites. For example, its Bass federal #1 site is approximately 3,800 feet away. Directional drilling is feasible up to at least 5,000 feet. The additional costs of directional drilling in this vicinity are approximately 22% according to the studies and experience of Mr. Roy Williamson of Sipes, Williamson, Runyan and Aycock, Consulting Engineers (who have testified frequently before this Commission),

These studies are Appendix C to Exhibit I attached hereto. On a deep well costing approximately $750,000 this adds only

$165,000 to the expense. This is less than 1-1/2% of the $15,000,000 worth of potash ore which would be preserved by directional drilling. Thus the damage and destruction of the ore deposit contemplated by Belco's application is wholly unnecessary.

2. Belco Application Would Unduly Interfere With the Orderly Development of Potash Deposits

The proposed Belco drill site is less than a mile from Kerr-McGee's existing federal potash leases. Kerr-McGee presently has no lease on the area covered by the drill site. However, it has an orderly plan for development of its existing lease areas and for that portion of its ore body beyond the limits of its present leases to the northeast including the area in question. Kerr-McGee has filed a proposed five year mining plan with this Commission showing that it anticipates being within approximately a mile and a half of the proposed drill site within that period of time. Kerr-McGee holds the only federal potash leases in this immediate vicinity and the proposed Belco location is a logical and natural extension of its present lease. Kerr-McGee expects in the normal course of its operations to apply for federal leases on this area. Because of its existing operations in the area, Kerr-McGee would appear to be the only company which could economically develop and mine the ore. Complete mining of this area of course would require some arrangement with Teledyne which owns a small state potash lease.

Assuming we obtain the federal lease, it is Kerr-McGee's present intention and plan to mine this area within ten years. Thus Belco's proposed location would not only unduly interfere with the orderly development of the potash deposits in this vicinity; it would obliterate them.

Respectfully submitted,

KERR-McGEE CORPORATION

By John S. Cobb
Attorney

STATEMENT OF TELEDYNE POTASH COMPANY

Teledyne Potash Company holds a State of New Mexico mining lease which includes all of Sec. 36, all of Sec. 32, the north half of the north half of Sec. 31, the southeast quarter of the northeast quarter of Sec. 31 and the west half of the east half of Sec. 30 in Township 20, South Range 33 East, Lea County, New Mexico.

Jim Walls, General Manager of Teledyne has authorized John D. Robb, Jr., attorney, to advise the New Mexico Oil Conservation Commission that Teledyne is opposed to any intrusion of or any well location that would penetrate a commercially valuable potash deposit and particularly to the intrusion of its above leased area including the present Belco application to drill a gas well in Sec. 30 immediately adjoining its holdings.

Teledyne has granted Kerr-McGee a sub-lease to mine other potash properties in this area; and it is willing to enter into negotiations with Kerr-McGee for a sub-lease to mine potash under the above state leases.

Dated this 14th day of March, 1974.

TELEDYNE POTASH COMPANY

KERR-McGEE CORPORATION
KERR MCGEE BUILDING • OKLAHOMA CITY, OKLAHOMA 73102

JAMES J. KELLY
PRESIDENT

August 7, 1973

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. I
Submitted by Kerr-McGee
Hearing Date 3-15-74

Hon. Stephen A. Wakefield
Assistant Secretary of the Interior
for Energy and Minerals
Washington, 26, D. C.

Re: Potash Area - Eddy & Lea Counties, New Mexico

Dear Mr. Wakefield:

This letter has been prepared for presentation to you in conjunction with the August 7th meeting at which you have invited the potash companies to submit their recommendations pertaining to oil and gas drilling in the potash area of Southeastern New Mexico recognized in the Secretary's 1951 and 1965 Orders. We have been informed that certain potash companies have jointly prepared for you a similar letter and supporting data. We prefer however to present our own statement of position that potash mining be accorded priority in this area.

Kerr-McGee Corporation urges you to take two steps:

1. To accord potash mining priority over oil and gas drilling in this area; and

2. To provide the potash companies with an opportunity to select sites where oil and gas drilling will not damage or prevent extraction of these valuable potash deposits and will result in the least interference with the orderly exploration, development and extraction of potash.

Within the relatively small area previously designated in the Secretary's Orders, potash mining should be accorded a priority because:

1. There is risk both of losing large quantities of valuable potash and of recurring hazards to the men and the mining operation if oil and gas drilling should precede mining operations, whereas there is no such danger to the oil and gas deposits if potash mining should precede oil and gas drilling operations.

2. The relatively small area involved contains the major source of potash in the United States and is thus of enormous importance to the nation as well as to the potash industry.

Exhibit I not admitted

3. Within this area the economic values of the potash, and of large stable mining and milling payrolls, coupled with the huge investment in mining and milling plants, outweigh the potential for oil and gas in this area.

Attached hereto is a brief memorandum supporting and amplifying the reasons listed above.

We recommend and urge that if action by the Secretary is contemplated at the present time, any guidelines or order recognize the integrity of the potash deposits and include the following:

1. That persons holding Federal and State potassium leases on lands within the potash area recognized in the Secretary's Orders be required to designate to the Secretary in writing within 180 days after a date set by the Secretary all land within the area where drilling for oil and gas could be conducted without significantly interfering with present or future potash exploration, development and mining. Oil and gas drilling could be freely conducted thereafter in the designated areas but no oil and gas drilling could be conducted outside of said areas except through a showing by clear and convincing evidence that such activities would not damage potash ore deposits or interfere with the development and mining of such deposits or pose a risk of injury to persons employed in potash operations.

2. In the event a showing is made to justify oil and gas drilling in undesignated areas, that the widest possible spacing be required and that the sites be selected to permit directional drilling from the approved sites.

3. To the extent feasible, unitization of oil and gas leases be required.

Sincerely,

James J. Kelly
President

MEMORANDUM OF KERR-McGEE CORPORATION IN SUPPORT OF RECOMMENDATIONS FOR LIMITING OIL AND GAS DRILLING IN POTASH AREA

This memorandum is submitted in support of a letter dated August 7, 1973 from Kerr-McGee Corporation to Stephen A. Wakefield, Assistant Secretary of the Interior for Energy and Minerals.

Potash Should Be Accorded Priority

The risk of losing large quantities of valuable potash and the potential hazards to mine employees and mining operations from prior oil and gas drilling result primarily from subsidence of overlying beds above areas where potash has been extracted. Subsidence is a well known occurrence in the Carlsbad mining area. Stresses result from subsidence, posing a serious threat of damaging or collapsing well casings and releasing hydrocarbons into adjacent potash beds and into active mine workings. The consequent hazards to miners working in such areas would be great. Apart from possible death or injuries to miners, it would not be economically feasible to convert potash mining equipment to operate under gaseous conditions. In order to avoid the risk of subsidence, it would be necessary to leave large pillars of unmined ore around oil and gas wells to provide support. The diameter of such a pillar in the eastern portion of Kerr-McGee's reserves is estimated at approximately 4,000 feet or a large portion of an entire section of land. The amount of ore left in such a pillar would vary between 3 and 6 million tons, depending upon whether or not first mining could be economically conducted. This is equal to approximately one to two years of Kerr-McGee's present annual production. The economics might well prevent keeping access available to these pillars after other mining operations in the area had ceased thus making it likely that a large portion of the ore in these pillars would be lost forever.

There is no corresponding risk involved to the oil and gas deposits, if any, should potash exploration, development and mining operations precede oil and gas operations. Oil and gas operations would simply be deferred until potash operations have been completed in the particular area. Experience has shown that all but insignificant amounts of subsidence occur within five years after the termination of mining operations.

The economics of potash versus oil and gas in this limited area finds the balance weighted heavily in favor of potash. The potash industry is a stable and important one. Large scale potash operations have been conducted in the Carlsbad Basin since the early

1930's. The annual payroll for Kerr-McGee employees has increased from 2.2 million dollars in 1966 to 3.8 million dollars in 1972, with utilities and local purchases by Kerr-McGee exceeding these figures for each year.

The Bureau of Business Research of the University of New Mexico has compiled data on the economics of the potash industry, attached to this memorandum as Appendix A. This shows that for 1970 (the last year for which official statistics are available) the potash industry accounted for approximately 2,600 jobs and generated an annual payroll of about $21,000,000. The Bureau applied its own income and employment multipliers to produce a real value of approximately $32,000,000 annually, or approximately 28.6% of the total earnings and 34.6% of the entire employment in Eddy County, New Mexico for that year.

Further, the employment provided by the mining of such an ore pillar, if not required to support an oil or gas well casing, would amount to approximately 95,000 man days as compared to the employment provided by the drilling of a deep oil or gas well of approximately 6,000 man days*, a ratio of approximately sixteen to one in favor of potash payrolls. Employment afforded by oil and gas operations tends to be confined to the exploration and development stages over a relatively short time. Producing wells in a field can be serviced by relatively few employees.

Likewise the retail value of the potash product in the pillar of ore necessary to support an oil or gas well casing amounts to approximately $15,000,000, (assuming first mining can be conducted).

The investment in plant and equipment by the major potash companies in the Carlsbad mining area is conservatively estimated to exceed $200,000,000, of which $35,000,000 is represented by the capital investment of Kerr-McGee alone. The major portion of the capital investment by the oil and gas operators in or directly relating to the Secretarial Order area is the aggregate amount paid to acquire their leases. Moreover these oil and gas leases were acquired with knowledge by the lessees of existing potash deposits and of the conditions in the leases limiting the rights to drill for oil and gas in the event of conflict with potash deposits.

The foregoing payrolls, valuable potash deposits and capital investment all could be seriously jeopardized were oil and gas drilling permitted in this area without restrictions suggested below.

Selection of Drill Sites by Potash Companies

The New Mexico Oil and Gas Association has suggested that the potash area be redefined to eliminate portions which may

---

* based upon calculations and letter dated July 26, 1973 from Sipes, Williamson, Runyan & Aycock, Inc. Consulting Engineers, attached as Appendix B.

contain only marginal mineralization of potash. This proposal would create problems. In the first place substantial portions of the potash area have never been drilled adequately to rule out the presence of commercial ore. Secondly, an adequate drilling program must be conducted in an economic and orderly fashion over a period of time. At present, the New Mexico Oil Conservation Commission and the Department of Interior occasionally permit oil and gas operations unless mining operations are planned to be conducted within a period of five to ten years. This time standard fails to meet the needs of adequate planning and conservation. The large capital investment in the mining equipment and milling plant cause many companies to base their initial plans on an ore supply of twenty-five to thirty years in order to produce an economic operation. Kerr-McGee, for example, erected its plant commencing in 1965 based upon projections of a thirty-year supply or ore. That supply should be protected for the planned life of the facilities and not be limited or disrupted by an arbitrary five or ten year rule. furthermore, mining plans tend to change from time to time based upon economics, occasional erratic occurrences of the ore and other factors.

An alternative to this arbitrary five to ten year time standard is available. To preserve the integrity of the valuable ore deposits and to prevent unnecessary interference with mining plans each mining company could be required to designate areas in which drilling would not involve a hazard to either. This would diminish potential conflicts between the potash and the oil and gas operators. It would lighten the burden on the New Mexico Oil Conservation Commission and upon the Secretary to resolve them. If necessary, additional designations could be requested by the Secretary, perhaps at five to ten year intervals as the mining operations progressed and the potash companies acquired additonal information which would make possible additional designations.

Where feasible, oil and gas operators would be required to unitize their lease holdings to embrace both designated and undesignated areas. Drilling in undesignated places would be permitted only after a clear showing by the oil or gas applicant of no substantial likelihood of damage to the ore deposit, interference with development or mining operations or hazard to potash employees. Where such exceptions are made, the widest possible spacing should be observed and directional drilling employed.

NEW MEXICO OIL AND GAS PRESENTATION

It would serve no useful purpose to make a point-by-point refutation of the arguments of the New Mexico Oil and Gas Association or in the report of Mr. Warnock submitted in connection therewith. For example, the economics of potash mining, which occupied a large portion of the Association's presentation, is not here involved. Irrespective of future industry profits, the potash companies have invested a large amount of capital in plant and equipment and are actively pursuing exploration, development and mining operations on a major scale.

A proposal to permit wide-spread oil and gas drilling in the potash area without regard to the potash reserves is unreasonable, unwise and potentially devastating in the development and mining of the potash. The claim that the effect of subsidence upon well casings poses no threat to the potash reserves, mines and operations has not been substantiated. The claim that directional drilling is not feasible has not been supported and is directly refuted by the opinion of Sipes, Williamson, Runyan & Aycock, Inc. attached hereto as Appendix C. Its only disadvantage is increased cost. The interpretation of the prior orders of the Secretary and the Oil Conservation Commission by the U.S.G.S. and by the OCC, although failing to give sufficient protection to the potash reserves, clearly demonstrate that both have recognized the need to protect the integrity of the potash reserves.

The elaborate and unsubstantiated presentation by the New Mexico Oil and Gas Association on the question of the economics of potash mining is wholly irrelevant to the issues here presented. What is clear, however, is that adoption of the oil and gas position would lead inevitably to economic distress not only for the potash industry but likewise to communities whose welfare depends upon that industry.

TABLE 1

EDDY COUNTY

Income
(thousands of dollars)

	1966	1967	1968	1969	1970
Total Earnings	$102,789	$102,303	$98,770	$105,474	$112,384
*Farm	10,805	9,866	11,044	11,925	12,352
*Government	14,216	13,749	16,059	17,242	19,213
*Manufacturing	4,399	4,304	4,496	5,122	5,384
*Mining	34,952	34,994	27,049	28,378	31,237
*Contract Construction	4,132	4,135	5,106	5,495	5,547
Trade, Wholesale & Retail	13,429	13,488	13,382	13,624	13,690
Finance, Insurance & Real Estate	3,185	3,399	3,434	3,248	3,242
Services	12,529	13,186	14,085	16,258	17,417
Other	589	399	397	443	442

Employment

Total Employment	NA**	16,342	15,140	15,279	15,144
Number of Proprietors		1,798	1,802	1,821	1,807
Farm		520	509	502	495
Nonfarm		1,278	1,293	1,319	1,312
Wage & Salary Employment		14,544	13,338	13,458	13,337
*Farm		727	664	666	589
*Government		2,256	2,218	2,143	2,086
*Manufacturing		615	603	656	644
*Mining		3,934	3,032	3,189	3,237
*Construction		562	484	412	417
Transportation, Communication, & Public Utilities		756	752	749	695
Trade		2,623	2,497	2,396	2,349
Finance, Insurance & Real Estate		462	436	416	397
Services.		2,540	2,589	2,763	2,853
Other		69	63	68	70

*Basic or export sectors
**Not Available
Source: Unpublished data, Bureau of Economic Analysis, U. S. Department of Commerce, March 8, 1973.

TABLE 2

INCOME AND EMPLOYMENT MULTIPLIERS

	1966	1967	1968	1969	1970	Income and Employment Multipliers
Total Earnings / Basic Earnings	1.500	1.526	1.549	1.547	1.524	1.529[a]
Total Employment / Basic Employment		1.905	2.016	2.019	2.028	1.992[b]

Potash Payroll, 1970 — $21,000,000[c] x 1.529 = $32,109,000 or 28.6% of 1970 Total Earnings

Potash Employment, 1970 — 2630[d] x 1.992 = 5239 or 34.6% of 1970 Total Employment

---

a 5-year average
b 4-year average
c Carlsbad Chamber of Commerce statistical data
d Annual average of covered employment in nonmetalic mining, Employment Security Commission of New Mexico.

TABLE 3

ECONOMIC IMPACT OF OIL WELL DRILLING IN POTASH AREA

Deep Well:

6 months drilling time, 5,965.5 man days required to drill & complete[1]

Shallow Well:

30 days drilling time, 1,009 man days required to drill & complete[1]

Mine 1400-foot Circle (area around well in which mining would be restricted):

380 workers, 1 year to complete[2]/approximately 95,000 man days[3]

Net "Base" Loss (assuming a deep well):

95,000 - 5,965.5 = 89,034.5 man days

Gross Loss (assuming a deep well):

89,034.5 x 1.992[4] = 177,356.7 man days or approximately 709 man years[3] of employment

---

[1]Roy C. Williamson, correspondence April 19, 1973
[2]Kerr McGee
[3]Assumes 250 man days per year per worker
[4]Employment multiplier from Table 2

TABLE 4

ECONOMIC IMPACT OF OIL WELL DRILLING IN POTASH AREA

Net "Base" Loss (assuming a deep well):

95,000 - 5,965.5 = 89,034.5 man days or 356 man years[1]

Using 1972 Average Wage Figures:

$\frac{\$21,500,000}{2579}$ = 8337, the net dollar loss is $2,967,972

The Gross Dollar Loss (assuming a deep well):

$2,967,972 x 1.529^2 = $4,538,029

[1]Assumes 250 man days per year per worker
[2]Income multiplier from Table 2

APPENDIX D

SIPES, WILLIAMSON, RUNYAN & AYCOCK, INC.
CONSULTING ENGINEERS
Midland, Texas

600 OILS TOWER WEST
MIDLAND, TEXAS 79701
915 683-1841

800 MAIN BUILDING
HOUSTON, TEXAS 77002
713 228-8146

July 26, 1973

Rodey, Dickason, Sloan, Akin & Robb, P. A.
First National Bank Building - West
West Central Avenue at Third
P. O. Box 1888
Albuquerque, New Mexico 87103

Attention: Mr. John D. Robb

Dear Mr. Robb:

Subject: Kerr-McGee Versus Belco
Economic Impact of Oil and Gas
Industry on the State of New Mexico
Kerr-McGee Potash Area
Lea and Eddy Counties, New Mexico

I have prepared the attached Table No. 1 for the purpose of examining the service and people requirements for drilling both a deep and a shallow well in the subject area. These data provide a qualitative look at the economic impact that drilling a well of either type described would have on the State of New Mexico. In addition to estimating the various costs involved in drilling both a deep and shallow well, an attempt was made to define the number of people and the number of days that they would be employed as a result of this drilling activity. As can be seen on the table, a deep well will cost over $750,000 and a shallow well will cost over $100,000. The costs are broken down between intangible and tangible items. The intangible items are service-oriented whereas the tangible items are equipment or pipe. Most of the intangible items will be provided by local service companies and it is hard to determine exactly how many wells would be required to maintain any one particular service office. These offices are often rather transient and when a local area becomes dormant as to drilling activities, some service locations will be shut down and services provided from a more centrally located office.

The majority of the drilling contractors having rigs capable of drilling deep holes are in Texas. There are some in New Mexico and, of course, their utilization would provide additional economic support to New Mexico.

Considerable expense is involved in the casing and tank battery equipment, but the majority of this equipment, even though ordered locally, is manufactured outside the state. Here, again, ordering this equipment helps to maintain various supply outlets, but at the same time, this service could be provided from a remote office by means of a traveling salesman, etc.

A deep hole is estimated to require approximately six months to drill and, as shown on Table No. 1, would require approximately 5,965.5 man days for drilling and completing. A shallow well is estimated to take approximately thirty days to drill and would require 1,009 man days for drilling and completing.

It is obvious that the potential oil and gas industry effort in this area will create a very minor economic impact as far as goods and personnel are concerned. Please let me know if you need any expansion of the above comments.

Yours very truly,

SIPES, WILLIAMSON, RUNYAN & AYCOCK, INC.

Roy C. Williamson, Jr., P. E.

/lm

attachment

TABLE NO. 1

ESTIMATE OF COSTS FOR DRILLING AND NUMBER OF PEOPLE INVOLVED
LEA AND EDDY COUNTIES, NEW MEXICO

	Deep Well 10,000 psig Equipment - $	People Involved	Number People	Days Employed	Man Days	Shallow Well Costs - $	Number People	Days Employed	Man Days
INTANGIBLES									
Location and Roads	10,000	Local Contractor	2	3	6	5,000	2	3	6
Damages	1,000	Land Owner	1	-	-	1,000	1	-	-
Drilling - Footage Basis	163,350	Drilling Contractor - Outside N. M.*	-	-	-	** -	-	-	-
Drilling - Day Work	100,800	Drilling Contractor - Outside N. M.*	-	-	-	** -	-	-	-
Cementing Operations	23,000	Local Service Company	7	1	7	7,000	4	1	4
Mud and Chemicals	50,000	Local Service Company	1	180	180	5,000	1	30	30
Logging	11,200	Local Service Company	4	2	6	2,500	3	1	3
Drill Stem Tests	4,500	Local Service Company	2	4	8	-	-	-	-
Water	5,000	Local Supplier	3	3	9	1,000	3	3	9
Trucking	2,500	Local Company	5	5	25	1,000	2	2	4
Mud Logger	5,600	Local Company	1	90	90	-	-	-	-
Bits and Reamers on Day Work	25,000	Local Supply Company	-	-	-	-	-	-	-
Perforating	2,200	Local Service Company	3	1	3	1,000	3	0.5	1.5
Roustabouts	1,000	Local Company	5	10	50	500	5	4	20
Rental Equipment	10,000	Local Company	-	-	-	1,000	-	-	-
Treatment (acid)	3,500	Local Service Company	3	0.5	1.5	1,000	3	0.5	1.5
Supervision	10,000	Drilling Contractor Employee - Outside N. M.*	1	180	180	1,500	1	30	30
SUBTOTAL INTANGIBLES	428,650					50,000			
20% Contingencies	87,500	--	-	-	-	10,000	-	-	-
TOTAL INTANGIBLES	516,150					60,000			
TANGIBLES									
Casing	173,000		-	-	-	32,250	-	-	-
Tubing	32,000		-	-	-	6,000	-	-	-
Wellhead & Tree	25,000		-	-	-	1,000	-	-	-
Liner Hanger	3,000		-	-	-	-	-	-	-
Tank Battery & Installation	10,000		-	-	-	7,500	-	-	-
TOTAL TANGIBLES	243,000					46,750			
Drilling Crews			30	180	5,400		30	30	900
GRAND TOTAL	759,150				5,965.5	106,750			1,009

* Most deep rigs come from Texas
** More shallow rigs available in New Mexico

TABLE NO.

SIPES, WILLIAMSON, RUNYAN & AYCOCK, INC.
1100 GIHLS TOWER WEST MIDLAND, TEXAS 79701
ROY C. WILLIAMSON, JR., P. E./lm JULY 26, 1973

7.

Appendix "C"

SIPES, WILLIAMSON, RUNYAN & AYCOCK, INC.
CONSULTING ENGINEERS
Midland, Texas

1100 GIHLS TOWER WEST
MIDLAND, TEXAS 79701
915 683-1841

600 MAIN BUILDING
HOUSTON, TEXAS 77002
713 228-8146

July 31, 1973

Rodey, Dickason, Sloan, Akin & Robb, P. A.
First National Bank Building - West
West Central Avenue at Third
P. O. Box 1888
Albuquerque, New Mexico

Attention: Mr. John D. Robb

Dear Mr. Robb:

Subject: Feasibility and Additional Cost of Drilling a Whipstock Hole to a Vertical Depth of 13,500' Lea and Eddy Counties, New Mexico

In accordance with your request, we have investigated the feasibility and cost for drilling a deviated hole to a vertical depth of 13,500' with a directionally controlled horizontal displacement of one mile between the top and bottom of the drilled hole.

Mr. Foy W. Boyd, a drilling consultant here in Midland with considerable experience in drilling deep holes in Southeast New Mexico, and Mr. H. G. Pruett, District Manager of Eastman Whipstock, Inc., have assured me that a deviated hole such as described above presents no serious technical problems. Below is an estimate of the increased cost required to achieve the required deviation.

Tangible and Intangible Costs to Vertically Drill and Complete a Well at a T. D. of 13,500', $		710,000
Incremental Tangible and Intangible Costs for Achieving a One Mile Directionally Controlled Horizontal Displacement of the Bottom of the Hole, $	87,000	
Cost of Special Equipment and Services From Eastman Whipstock for 4 Hole Direction Corrections, $	64,871	
Cost of Increase, $	151,871	

Percentage Cost Increase = $151,871/$710,000 = 21.39%

Mr. Pruett assures me that this proposed deviation would be considerably less than the maximum angle of deviation that Eastman has achieved. Attached is an estimate of costs from Eastman. There is a "no hole correction" estimate and a "4 correction" estimate. The "4 correction" estimate was chosen as a reasonable estimate of additional cost in this situation. Also shown is a cost breakdown for each additional hole correction that might be required. Such corrections may be necessary to keep the bottom hole location within the preset limits as the hole deviation angle is built. As can be seen from the Eastman proposal, the maximum deviation angle required is 41°14'. Eastman's maximum deviation achieved in hard rock was 68° in Holland where a horizontal displacement of 9,251' was achieved in a vertical depth of 7,000'.

A deviated hole such as described in this letter should present no serious technical problems and the increased cost is modest when compared with the potential hazard that a vertical hole drilled through the potash deposit would create.

Please let me know if you need elaboration on any part of this discussion.

Yours very truly,

SIPES, WILLIAMSON, RUNYAN & AYCOCK, INC.

Roy C. Williamson, Jr., P. E.

/cr

attachments

SIPES, WILLIAMSON & AYCOCK, INC.
CONSULTING ENGINEERS
Midland, Texas

1100 GIHLS TOWER WEST
MIDLAND, TEXAS 79701
915 683-1841

800 MAIN BUILDING
HOUSTON, TEXAS 77002
713 [illegible]

July 31, 1973

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. I-A
Submitted by Kerr-McGee
Hearing Date 3-15-74

Rodey, Dickason, Sloan, Akin & Robb, P. A.
First National Bank Building - West
West Central Avenue at Third
P. O. Box 1888
Albuquerque, New Mexico

Attention: Mr. John D. Robb

Dear Mr. Kobb:

Subject: Feasibility and Additional Cost of Drilling a Directionally Controlled Hole to a Vertical Depth of 13,500', Lea and Eddy Counties, New Mexico

In accordance with your request, we have investigated the feasibility and cost for drilling a directionally controlled hole to a vertical depth of 13,500' with a horizontal displacement of one mile between the top and bottom of the hole.

Discussions with technical personnel knowledgeable in directional drilling techniques indicate that drilling this type of hole presents no serious technical problems. Below is an estimate of the cost for a nondirectional well and the increased cost required to achieve the required deviation assuming no serious difficulties are encountered.

Tangible and Intangible Costs to Vertically Drill and Complete a Well at a T. D. of 13,500', $	710,000
Incremental Tangible and Intangible Costs for Achieving a One Mile Directionally Controlled Horizontal Displacement of the Bottom of the Hole, $	87,000
Cost of Special Equipment and Services that Would be Required for 4 Hole Direction Corrections, $	64,871
Cost of Increase, $	151,871

Percentage Cost Increase = $151,871/$710,000 = 21.39%

I-A not admitted

Directional drilling experts assure me that the herein required proposed deviation would be considerably less than the maximum angle of deviation that has been achieved. The directional control cost is based on a "4 correction" estimate (i.e., 4 changes in the direction of drilling). The "4 correction" estimate was chosen as a reasonable estimate of additional cost in the current situation. Additional corrections may be necessary to keep the bottom hole location within the preset limits as the hole deviation angle is built. Additional cost would be incurred based on the number of additional corrections required. The maximum deviation angle required in this case is 41°14'. A deviation of 68° is on record in hard rock in Holland where a horizontal displacement of 9,251' was achieved in a vertical depth of 7,000'.

Directional drilling can present the opportunity for increased drilling costs and such contingencies should be considered in the planning stages. If no serious problems are encountered, the additional cost of directional drilling where needed could be modest as compared to alternatives such as delayed drilling or prevention of drilling.

Please let me know if you need elaboration on any part of this discussion.

Yours very truly,

SIPES, WILLIAMSON & AYCOCK, INC.

Roy C. Williamson, Jr., P. E.

/lm

SIPES, WILLIAMSON & AYCOCK, INC.
CONSULTING ENGINEERS
Midland, Texas

1100 GIHLS TOWER WEST
MIDLAND, TEXAS 79701
915 683-1841

600 MAIN BUILDING
HOUSTON, TEXAS 77002
713 228-8146

March 9, 1974

Rodey, Dickason, Sloan, Akin & Robb, P. A.
First National Bank Building - West
P. O. Box 1888
Albuquerque, New Mexico

Attention: Mr. John D. Robb

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. I-B
Submitted by Kerr-McGee
Hearing Date 3-15-74

Dear Mr. Robb:

Subject: Proposed Location
Belco Bass Federal No. 2
Section 30-20S-33E, 660' FSL
and 1,320' FEL
Lea County, New Mexico

In accordance with your request, we have calculated reserves, producing life and product value for mature producing wells in the vicinity of the proposed location and have discussed various questions concerning this area as posed in your letter dated March 15, 1973.

The attached Exhibit No. 1 is an area plat showing the subject proposed location circled in red. The well in Section 25 shown as "Proposed Location" is a previously announced location by Belco. Also shown on this plat is the trace of a cross section, A - A'. Exhibit No. 2 is a portion of the log from the Texaco Audie Richards No. 1 covering the interval in the geologic section from the top of the Strawn to the top of the Barnett shale. The included zones are the Strawn, Atoka, and the Morrow. Exhibit No. 3 is a cross section A - A' from the Phillips No. 1 well in Section 15-20S-32E, through the Belco No. 1 Bass Federal, the Texaco No. 1 State "CM", the Texaco No. 1 State "CM", and ending with the Phillips No. 1 Hat Mesa in Section 11-21S-32E. The correlated intervals on this cross section are the Strawn, Atoka, and Morrow zones. Shown alongside each log are drill stem tests and completion data. Shown alongside the depth measurements on the log are the perforated intervals as obtained from the public record. The cross section points out that general geologic sections are correlable, but that individual zones of porosity cannot easily be traced from well to well. This indicates that the producing intervals are stratigraphic in nature having the porous, permeable zones randomly distributed throughout the gross section.

not admitted

I-B

Recent completions in the area further point out the random distribution of reservoir quality and producing interval:

Operator	Lease and Well	Location	Zone and Perforations	AOF, MCF/D
Amini Oil Co.	New Mexico Federal No. 1	4-21S-32E	Morrow, 13,640-671	16,200
Amini Oil Co.	New Mexico "SL" State No. 1	32-20S-33E	Strawn, 13,106-116	6,248
Amini Oil Co.	Aztec-State No. 1	33-20S-33E	Morrow, 13,808-898	517

Belco's proposed location is in the SE/4 of Section 30-20S-33E, and is located 660' from the south line and 1,320' from the east line of the section. Since the Atoka - Morrow zones are stratigraphic in nature, a volumetric determination of reserves from a pore volume study is very hazardous, therefore, no attempt was made to determine the reserves to be expected from Belco's Bass Federal No. 1 in Section 30-20S-33E, Amini's wells in Section 32 and 33-20S-33E and Section 4-21S-32E, or from Phillips' Hat Mesa No. 1 in Section 11-21S-32E, which is the right hand well on the cross section A - A'. Production performance has been analyzed, however, for Texaco's Audie Richards No. 1 in Section 25, State "CH" No. 1 in Section 36, and State "CM" No. 1 in Section 31. Three types of performance curves were prepared for each of these wells: 1) a plot of bottom hole pressure divided by the compressibility factor versus cumulative gas production, 2) a plot of gas producing rates versus time, and 3) a plot of gas producing rates versus cumulative gas production. By analyzing the three performance curves for each well, the estimated ultimate recovery and remaining primary were determined as outlined below:

	Texaco - Audie Richards No. 1	Texaco - State "CH" No. 1	Texaco - State "CM" No. 1
Ultimate Recovery, MMCF	2,192	2,913	7,340
Cumulative as of 1-1-74, MMCF	1,811	2,461	5,610
Reserves as of 1-1-74, MMCF	381	452	1,730
Average Expected Life, Years	23	21	26
Cumulative Condensate Yield, BBLS/MMCF	18.5	11.8	23.7

As can be seen by the above figures, a large percentage of the expected ultimate gas recovery from these wells has already been produced, thus establishing sufficient production history from which to make an extrapolation of expected remaining reserves. It can be assumed that a projected well in the southeast quarter of Section 30 would have an ultimate gas recovery equal to the average expected ultimate from the above three wells, or 4,150 MMCF. The average producing life would be 23 years with an average condensate yield of 18 barrels per MMCF. "Old" gas in southeastern New Mexico generally sells for $0.20 to $0.27 per MCF. For purposes of this evaluation, we have estimated that the maximum price for "new" gas in this area would be $0.55 per MCF. This could be an optimistic number but certainly gives the upper limit of the gas price. Estimated operating costs for this well are $600 per month. Using the above parameters, 4,150 MMCF of gas at $550 per MMCF less severance and ad valorem taxes of 5.6 percent, and assuming a 1/8 royalty, future net income would be $1,885,345. The value of the condensate is calculated by 4,150 MMCF times 18 barrels per MMCF at $10 per barrel (which could be rolled back) less severance and ad valorem taxes of 5.6 percent, and assumption of a 1/8 royalty. The calculated value is $617,022. The operating costs for a 23-year life utilizing a constant cost of $600 per well per month, provides total operating costs of $165,600. Therefore, the sum of the value from the gas and the condensate less the operating costs yields undiscounted future net revenue of $2,336,767. If rather than taking an average of the three wells, we looked at the individual wells, percentages would indicate that recovery from this proposed well would be nearer the two to three billion cubic feet of gas range than the 4.15 billion cubic feet that we have estimated. If this were the case, of course, the undiscounted future net profit would be proportionately reduced.

If drilling is deferred in an area that is mined for potash until after the mining is completed and subsidence of the overburden has occurred, it should be possible to drill through the subsided area. Considerable care and preparation would be needed in order to overcome the severe loss circulation problem that would surely occur in the mined-out area. Successful drilling operations have been conducted through severe loss circulation zones and through cavernous formations unexpectedly encountered while drilling. With proper planning, it is reasonable to assume that the mined-out area could be successfully penetrated without excessive costs.

It would appear to be technically and economically feasible to directionally drill the subject location from Belco's Bass Federal No. 1 location in the northwest quarter of Section 30. Directionally drilled holes have been successfully completed in the southeastern New Mexico area. The main considerations of such a contemplated operation are the technical feasibility and the additional costs incurred for directionally drilling a well. The increased AFE cost can be calculated by the additional footage that must be drilled in the directionally controlled hole, plus the cost of the equipment required to make the necessary hole direction corrections. The increased cost for directionally drilling a 13,500' hole with the bottom of the hole horizontally displaced one mile, including little contingency costs for unexpected trouble, is estimated to be $170,000, or approximately 22 percent of the estimated straight hole cost of $781,000. It must be considered, however, that a directionally controlled hole can potentially cause more trouble and thus more costs than an attempted straight hole. This is certainly not always the situation since a directional hole could be drilled with no trouble, whereas, conversely, a straight hole could have considerable trouble. The most prudent approach would be to provide more contingency money for unexpected problems while drilling a directionally controlled hole than would be provided for drilling a nondirectionally controlled hole.

Please advise me if you need additional elaboration on any points covered in this report.

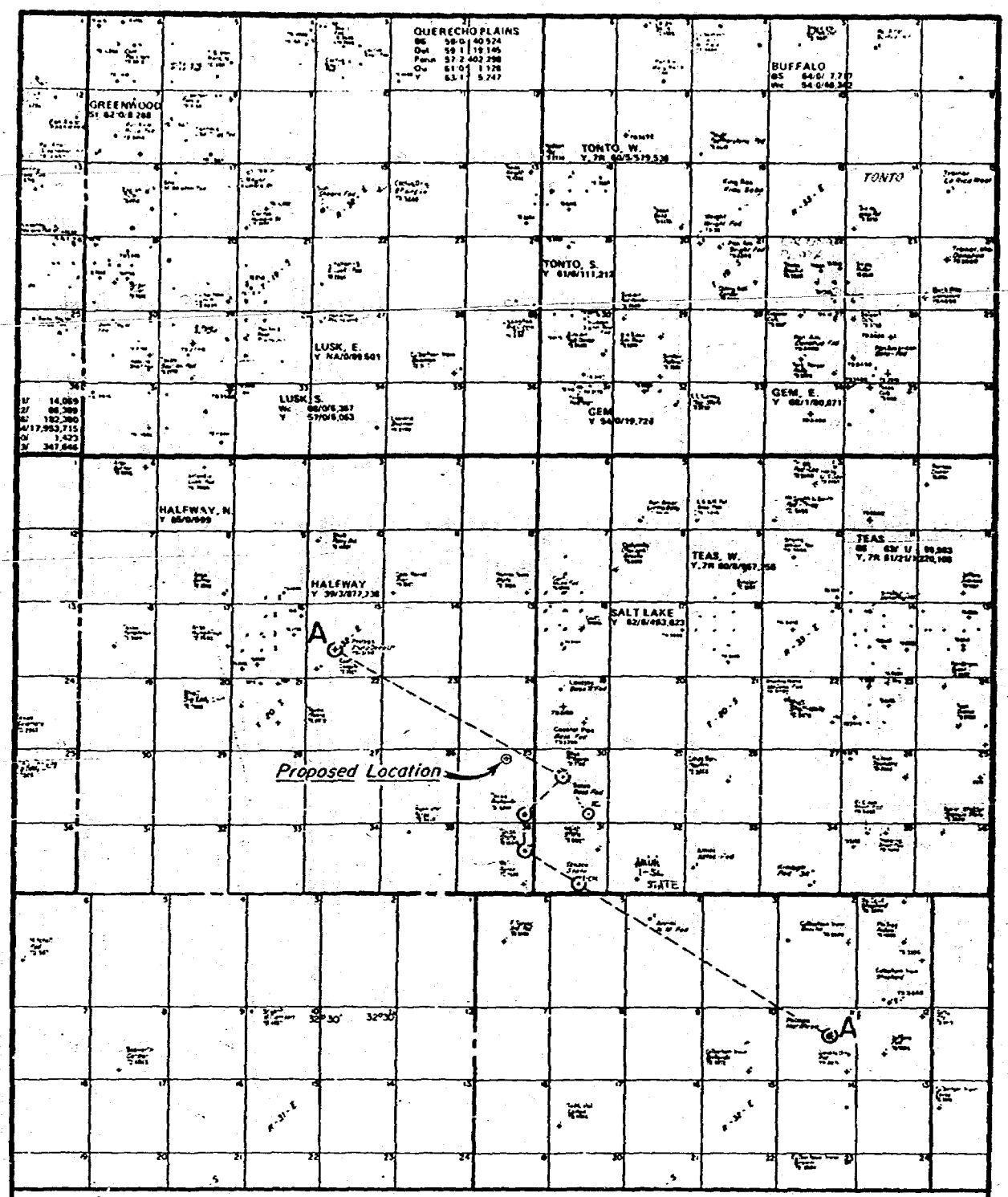
Yours very truly,

SIPES, WILLIAMSON & AYCOCK, INC.

Roy C. Williamson, Jr., P. E.

/lm

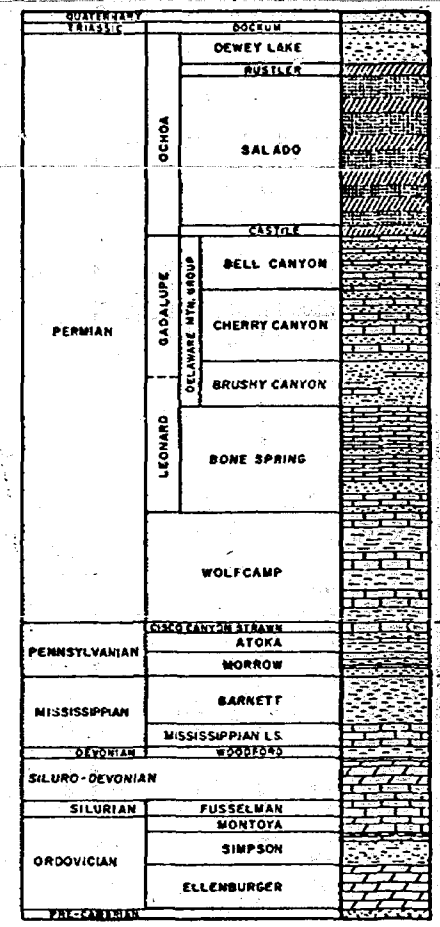
Attachments



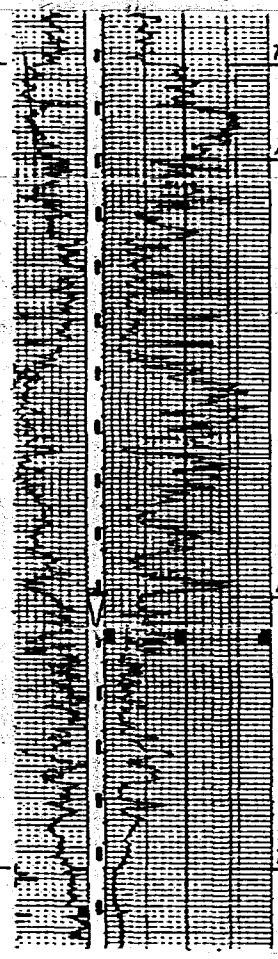
AREA PLAT

FIELD SALT LAKE (Morrow & Atoka)		County LEA	State NEW MEXICO
Engineer J. J. K.	Drwn. By Del	Date 3-12-74	File SALT LAKE
SIPES, WILLIAMSON & AYCOCK, INC. Consulting Engineers Midland - Houston, Texas		Ref. No. 3.606	EXHIBIT NO. 1

GENERALIZED SECTION - DELAWARE BASIN



Texaco, Inc.
Audie Richards — No. 1



TYPE LOG

FIELD SALT LAKE (Morrow & Atoka)		County LEA	State NEW MEXICO
Engineer J. J. K.	Drwn. By Del	Date 3-12-74	File SALT LAKE
SIPES, WILLIAMSON & AYCOCK, INC.		Ref. No. 3.606	EXHIBIT NO. 2
Consulting Engineers	Midland - Houston, Texas		

POTASH COMPANY OF AMERICA
A DIVISION OF IDEAL BASIC INDUSTRIES, INC.
MINE AND REFINERY: P. O. BOX 31 • CARLSBAD, NEW MEXICO 88220 • AREA CODE 505 • 887-2044

R. H. BLACKMAN
RESIDENT COUNSEL

August 7, 1973

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. II
Submitted by Lea-McGee
Hearing Date 3-15-74

not admitted although several pages were admitted as Exhibits 11, 12

Hon. Stephen A. Wakefield
Assistant Secretary, Energy and Minerals
United States Department of the Interior
Washington, D. C. 20240

Your Reference: ECS

Dear Mr. Secretary:

We are grateful for the opportunity to present to you the position paper of the New Mexico potash industry relating to whether oil and gas drilling should be permitted through known potash ore bodies in the Secretary's potash area.

Ex B to this Ex II was admitted as K-McG Ex 11

The paper is divided into three sections: (1) the Outline which briefly states each principal proposition treated, (2) the Report which enlarges upon each proposition with our reasoning and proof and (3) supporting Exhibits. Should you wish any further information will you please advise us.

(6) not admitted (Ex F) not admitted

Ex 13 denied
Ex 14 denied (Boyd Co. Report)

3rd page (photographs of Ex F of this Ex II was admitted as K-McG Ex 12

For your convenience we enclose two additional copies.

Respectfully submitted

On Behalf of the Potash Committee
of the New Mexico Mining Association
and
the New Mexico Potash Industry

By _____
R. H. Blackman

RHB/jm

II

OUTLINE

1. Subject

   Waste of potash resulting from drilling through known potash deposits.

2. Issues

   Will drilling through known potash deposits cause damage and waste of potash?

   Can any waste of potash be justified to accelerate the production of gas or oil in the Carlsbad basin?

3. Extent of the Problem

   If absolutely no drilling were permitted through known potash deposits which the New Mexico Oil and Gas Association desires to open to drilling, the area denied to drilling would not exceed four or five townships.

   The value of an average grade and thickness sylvinite ore body one township in area is about $1.5 billion.

4. (a) Drilling through a potash deposit will cause waste since protective pillars of potash ore will be left in place to insure that an oil or gas well which passes through the deposit will not be ruptured which would create an enormous safety hazard.

   (1) If second mining operations were conducted, subsidence would occur causing both lateral and vertical movements of enormous power in the strata above the ore removal zone.
   (2) The vertical and lateral movements would probably rupture or severely damage the casing and production string of a well.
   (3) The damage could result in the escape of gas into the potash mine since the salt section has sufficient permeability and porosity to transmit oil and gas. Oil seeps, probably from leaking wells, have been exposed in the potash zone in two mines in the Carlsbad area. However, no dangerous gas leaks have occurred in any New Mexico potash mine.
   (4) Gas escaping into a mine would expose employees to unreasonably dangerous conditions since the vast open areas of each mine are interconnected.
   (5) Because of this danger no prudent potash mining executive will perform second mining (total mining) operations in the protective pillar surrounding an active producing well.

(6) Protective pillars will therefore be left to protect the well and thus insure that no gas escapes into the mine. If second mining is not possible the value of protective pillars lost under average conditions is about $2.1 million. It can be much higher in deeper than average ore bodies and in ore bodies having adverse strength-weakness characteristics.
(7) A well having any residual pressure is potentially as dangerous as a producing well.

(b) The protective pillars will not be recovered unless the physical condition of the mine has not changed adversely and mining operations are still economically feasible when the well is depleted and assuredly adequately plugged.

(c) Certainly a large percentage will not be recoverable and will, in fact, be lost forever.

5. (a) Such waste is preventable since if the potash is fully produced before oil and gas operations penetrate the ore body, no waste will occur. The oil and gas operations will be postponed temporarily.

(1) Oil and gas exploration can be conducted elsewhere, whereas the potash industry cannot be moved. There will be no appreciable reduction in exploration drilling operations, since there is certainly no dearth of good gas prospects at present prices.

(b) Future generations will still require gas and oil.

6. (a) The best interests of the United States would certainly not be served by waste of potash because:

(1) Increased cost can result in export of more of the potash industry to Canada.
(2) We should not be dependent on a foreign source (even Canada) for any necessary resource.
(3) Mining to remove protective pillars after a period of time has passed is more hazardous than removal contemporaneous with first mining.
(4) No natural resource should be wasted.

7. (a) Value of the potash industry.

(1) The value of the industry is estimated at about one-third of the Eddy County, New Mexico business output.
(2) Royalties, taxes, salaries and wages.
(3) Comparison with gas production industry.

8. History and Applicable Regulations

9. Miscellaneous Items

10. Conclusion

August 7, 1973

Hon. Stephen A. Wakefield
Assistant Secretary, Energy and Minerals
United States Department of the Interior
Washington, D. C. 20240

Re: Multiple Use - Waste of Potash
Resulting from Drilling through
Known Potash Deposits

The following report is presented on behalf of the potash producing companies in the Carlsbad basin in Eddy and Lea Counties, New Mexico, by the Potash Committee of the New Mexico Mining Association.

1. Subject

This report presents the position of the New Mexico potash industry concerning the problems associated with oil and gas drilling in the Secretary's potash area. It urges that rules be promulgated prohibiting either exploratory or development drilling through any known potash deposit.

2. Issues

Will drilling through known potash deposits cause damage and waste of potash?

The answer is an absolute unqualified yes. It is only a matter of degree.

Can any waste of potash be justified to accelerate the production of gas or oil in the Secretary's potash area?

We think not.

3. Extent of the Problem

The presentation by the New Mexico Oil and Gas Association recognizes that drilling into and through open mine workings would not be feasible at least until all operations have ceased and the mine has been abandoned.

If the recognized potash deposits of currently mineable grade, thickness and depth were gathered together into one solid body, the area would not exceed about four or five townships. This includes known potash deposits held under federal lease by operating companies and others.

The value of an average grade and thickness sylvinite potash ore body one township in area is about $1.5 billion. Areas having dual deposits have much higher values.

4. (a) Drilling through a known potash deposit will cause waste since protective pillars of potash ore will be left in place to insure that an active oil or gas well or any well not assuredly adequately plugged which passes through the deposit will not be ruptured which would create an enormous safety hazard.

It is the considered unanimous position of the New Mexico potash industry members that first mining will not be conducted in the primary protective pillar and second mining will not be conducted in the secondary protective pillar surrounding an active oil or gas well.

The Primary Protective Pillar is a pillar of solid potash ore having a radius of at least 100 feet left in place surrounding the

well. This allows for surveying and operational errors in the mine and well.

The Secondary Protective Pillar is an area surrounding the well having a radius equal to the depth of the potash deposit from the surface. First mining only will be conducted in the Secondary Protective Pillar by mining out rooms leaving pillars for support to prevent subsidence. (Second mining would remove the pillars permitting subsidence.)

The amount of potash left in these two pillars will range from about 25% to about 40% of the total depending on mining methods used and underground conditions encountered. The value of lost potash is about $2.1 million for each drill hole under average conditions for sylvinite ore. It can be much higher in ore bodies of greater than average depth and with weaker strength characteristics, such as carnallite which requires much larger pillars to support the overlying strata, and in areas having more than one ore zone.

> Exhibit A attached presents value calculations in several assumed conditions.

(1) If second mining operations were conducted, subsidence would occur causing both lateral and vertical movements of enormous power in the strata above the ore removal zone.

> Exhibit B attached by Earl S. Miller and Frank Pierson reports on the horizontal and vertical subsidence movements at the U. S. Potash mine. Limiting angles up to 51° from the vertical were noted. In some instances surface stations were observed to rise and fall during overall descent in a pattern resembling a corkscrew. The horizontal and vertical forces inferred from the movements observed are obviously enormous.

Exhibit C attached is a map showing the area of total mining at the U. S. Potash mine on which is superimposed the area of surface deformation.

Exhibit D attached is a graph of the movement of a survey station at the old U. S. Potash mine which illustrates the corkscrew movement of the survey point actually observed on the surface.

(2) The vertical and lateral movements would probably rupture or severely damage the casing and production string of a well.

Exhibit E attached is a report of subsidence action at the Duval sulphur property in Culbertson County, Texas.

(3) The damage could result in the escape of gas into the potash mine since the salt section has sufficient permeability and porosity to transmit oil and gas. Oil seeps, probably from leaking wells, have been exposed in the potash zone in two mines in the Carlsbad area; however, no dangerous gas leaks have occurred in any New Mexico potash mine.

It seems obvious that if there were any oil or gas in the well it would be released into the strata by any rupture of the well casing. The section overlying the potash zone is laminated. It consists of several different materials, principally salt, clay, polyhalite and anhydrite, some of which are permeable to oil and gas. This stratification and its attendant permeability also exists in the Salado formation which includes the potash zone.

In the Potash Company of America mine, oil seeps or showings have been encountered four times in the potash zone itself, one of

which is in a vertical crack. A similar oil seep was encountered in the Eddy mine of National Potash Company.

> Exhibit F is a report which details the several instances including color reproductions from photographs taken in the south tunnel area of the Potash Company of America mine which show the oil stains in the anhydrite layer just above the potash zone.
>
> Exhibit G is a report which details an instance where oil seepage was encountered in the National Potash Company mine in Eddy County, New Mexico.

Small pockets of dead air under pressure have been encountered in all of the mines. Extensive sampling of the escaping gas reveal it to be mostly nitrogen and carbon dioxide. No significant amounts of methane or other explosive or flammable gases have ever been detected.

Case No. 862 before the New Mexico Oil Conservation Commission contains the testimony of Mr. S. J. Stanley, staff engineer for the Commission, at a hearing April 20, 1955, that:

> "It has been definitely proven in the oil business that the salt section is charged in the Monument and Hobbs Pool and charged with gas. The charging of oil and gas in these pools was probably man made by casing leaks. The point I am trying to make is that I feel that porosity and permeability exists in the salt section throughout Lea County, that the extent of charging the zone, and that is the salt zone, from one well would depend on the amount of gas present, and, of course, the pressure of that particular gas."

(4) Gas escaping into a mine would expose employees to new and unreasonably dangerous conditions since the vast open areas of each mine are interconnected.

As an example, the Potash Company of America mine contains over 1,200 miles of interconnected tunnels about 28 feet wide and 6 feet high on the average. Other mines are both larger and smaller. All are similarly structured.

Most of the gas produced near the potash area is odorless. Gas leaking into a potash mine would produce a huge bomb. Employees could be smothered or poisoned if a major leak occurred although the principal hazard is the possibility of explosive mixtures accumulating undetected.

(5) Because of this danger no prudent potash mining executive will perform second mining (total mining) operations in the protective pillar surrounding an active producing well.

(6) Protective pillars will therefore be left to protect the well and thus insure that no gas escapes into the mine.

> Exhibit H is a report by the John T. Boyd Company, a mining engineering firm of international repute, of Pittsburgh, Pennsylvania, which approves and elaborates on the statements and conclusions set forth herein.

(b) The protective pillars can only be removed by mining after the well has been abandoned and plugged in such manner that it can be absolutely assured that no gas can ever escape into the mine.

This may not occur until it is too late for economically profitable mining. It is obviously more expensive to remove mining and transportation machinery out of an area after first mining and then move it back in again for second mining.

After passage of a period of time the mining conditions may have changed to such a degree that a lesser overall percentage of ore can be removed than would have been possible had second mining been conducted coincidentally with first mining. Under such conditions hazards to employees will be increased.

The amount of ore so wasted is difficult to estimate, but it is surely substantial.

> Exhibit I attached is an internal memorandum from Amax Corporation which furnishes some information on the character and extent of such losses. The memorandum is supported by photocopies of monthly reports in 1968 and 1969 in which the Amax mine superintendent points out the difficulties encountered and comments on the increased costs incurred and the pillars left in place to minimize hazards to employees and therefore, unavoidably at that time, wasted.

If the changed conditions are sufficiently hazardous, the second mining operation may not be conducted at all. This waste would be substantial.

At some point in time when either changed mining conditions interdict second mining, second mining will not yield a profit, or mining operations in the mine have ceased, all protective pillar ore will be lost.

The elements of delay and uncertainty introduced by the well will cause some losses. Depending on the length of the delay and the degree of uncertainty, the waste can range up to all ore in the protective pillar system.

Even if a well is located outside the subsidence area it cannot be

guaranteed that no damage will occur since if a blow-out occurs or if the well is improperly plugged when it reaches the uneconomic state, the gas could penetrate the mine through permeable strata. Wells which contain so little gas that they will not produce against gathering line pressure still contain sufficient pressure and volume to contaminate a mine.

Wells in the Getty field which is in the Potash Company of America west ore body have been plugged and abandoned under U.S.G.S. supervision, but because of the condition of the wells after many years of production, it cannot be assured that the plugging was successful. The potash ore in the protective pillars around those wells has probably been permanently lost.

Even if wells could be properly plugged, primary protective pillars would be left. Attempting to mine around these pillars would seriously affect efficiency and the normal mining cycle and make mining of the ore in that area uneconomical.

The possibility of ultimate recovery of some of the potash by solution mining is too remote for consideration. Solution mining in the thin potash beds in the United States has thus far been unsuccessful. However, one company in Canada appears to have a sustainable operation. They are producing from ore beds from 80 to 100 feet thick with average grade over 20% K_2O, reserves totally unlike those in the Carlsbad area which would average less than 8 feet in thickness and less than 20% K_2O.

In a study comparing solution with conventional potash mining prepared by W. H. W. Husband, head of the Engineering Division, and Selim Ozsahin, Associate Research Officer, both of the Saskatchewan Research Council, for presentation at the March 1967 annual general meeting of the Canadian Institute of Mining in Ottawa, the authors reached the following conclusions:

> "The results indicate that solution mining and refining of potash is economically feasible in Saskatchewan at current market prices if reasonable production rates are maintained and a suitable deposit is used. Ore grade has to average at least 20% K_2O over a thickness of 50 feet.
>
> The cost of the potash produced by the solution mining and refining method is greater than the cost of potash produced from the conventional method. This is due mainly to costlier surface recovery installations and operations. Great quantities of water have to be evaporated in the refining stage and this requires complex equipment and large amounts of fuel."

(c) Certainly, a large proportion of the ore in protective pillars will not be recoverable and will, in fact, be wasted.

(d) As illustrated by the Boyd report, Exhibit H, whether second mining can or cannot be performed can mean the difference between profit and loss operations.

5. (a) The waste described is preventable since if the potash is fully produced before oil and gas operations penetrate the ore body, no waste will occur. The oil and gas operations will be postponed temporarily.

(1) Oil and gas exploration can be conducted elsewhere, whereas the potash industry cannot be moved. There will be no appreciable

reduction in exploratory drilling operations, since there is certainly no dearth of good gas prospects at present prices.

(b) Future generations will still require gas and oil.

6. (a) The best interests of the United States would certainly not be served by waste of potash because:

(1) Increased cost can result in export of more of the potash industry to Canada.

(2) We should not be dependent on a foreign source (even Canada) for any necessary resource.

(3) Mining to remove protective pillars after a period of time has passed is more hazardous than removal contemporaneous with first mining.

(4) No natural resource should be wasted.

7. (a) Value of the potash industry.

(1) The value of industrial output and related and supported industries of the potash industry is estimated at about one-third of the Eddy County, New Mexico business output.

(2) Royalties, taxes, salaries and wages - During the 15 year period from 1958 through 1972, the potash industry has paid out over $440 million in salaries and wages to their employees; over $50 million in ad valorem, severance and other taxes to the State of New Mexico; and approximately $55 million in State and Federal royalties. The turnover of these dollars

in wages and salaries as well as the support businesses that supply the potash industry has made and will continue to make a very significant contribution to the economy of southeastern New Mexico.

(3) Wages and salaries generated from potash production exceed wages and salaries from gas production by a ratio of about 17.5 to 1. Production of potash values of $10 million would generate about $3.5 million in salaries and wages. As per the following calculation, production of $10 million of gas would generate about $200,000.

Reserve:
20 billion cubic feet at $0.50 - $10 million

Production:
10 million cubic feet per day average for 2,000 days, 5-1/2 years

$0.01 per MCF for labor cost - $100 per day for 2,000 days - $200,000

One of the best wells in the potash area is about one mile from Potash Company of America's ore body. This well originally estimated at a production of 6 billion cubic feet has already produced about that amount and probably will produce an additional 6 billion cubic feet over a period of 12-18 years. Using today's prices, at $0.50 per MCF, it would have a gross value of $6 million. Were that well drilled through an average potash deposit, the value of the protective pillars, almost certainly lost because of its lengthy production period, would be $2.1 million.

If we take into consideration the average productive well in the

area (we estimate 2-5 billion cubic feet for the average good producer), the lost potash would probably exceed in value the gas produced.

How can this be said to best serve the interests of the United States?

A schedule prepared by the New Mexico Bureau of Business Research of the University of New Mexico for Kerr-McGee Corp., tables 1-4, is attached as Exhibit J.

8. History and Applicable Regulations

From time to time beginning in the 1920's, substantial federal acreage in New Mexico was withdrawn from oil and gas leasing. Secretary's order dated October 16, 1951, 16 F.R. 10669 revoked previous withdrawals and established regulations concerning drilling in the newly released area. That order was superseded by the Secretary's order of May 11, 1965, 30 F.R. 6692 which contains the currently applicable drilling regulations.

1951 ushered in a period of intense controversy between the two industries over the serious questions of safety and conservation created by reopening the area to oil and gas activity.

Representatives of the potash and oil and gas industries held many meetings and many problems were aired. However, the only significant accord reached is embodied in New Mexico Oil Conservation Commission Order R-111-A, October 13, 1955, providing for notification to the potash lessee of notice of intention to drill by the oil and gas lessee and if objection is made, for a full record hearing before the New Mexico Oil Conservation Commission. Other provisions of Order R-111-A

were more or less imposed on both industries by the Commission.

A more complete paper prepared by International Minerals & Chemical Corporation for the potash group is attached as Exhibit K.

9. Miscellaneous Items

Sylvinite ore is a mechanical mixture of KCl and NaCl. Langbeinite ore is a similar structure but it is a double salt of potassium and magnesium.

These ores lie in bedded deposits. It is mined like coal with coal machinery but there the similarity ends.

Potash ore is non-toxic, non-explosive, non-flammable, has no inherent vices; the dust is harmless - potash miners have breathed it for over thirty years with no ill effects. The mines are clean and dry. About 95% of the finished product is used as fertilizer.

Before World War I, we were dependent on Germany for our potash and during that war, prices of potash rose to $500 per ton.

The present prices are about $21 per ton for both KCl and Sulphate of Potash Magnesia, less than before World War II. We know of no other commodity that can match that price record.

Almost complete automation of mining and processing is the reason. At its peak, the New Mexico industry produced about 5 million tons of finished product annually having a value in excess of $105 million. Current production is about 4 million tons having a value of about $78 million.

The potash industry has a substantial effect on the economy of Lea County, New Mexico and also supports a salt industry of about $1.4 million annually.

About 800 wells have been drilled in the Secretary's area - about 200 of them since 1950 without objection from the potash industry. There have been six contested cases which went to hearing before the New Mexico Oil Conservation Commission. In four, the potash industry position prevailed and drilling was denied. In one there was failure of proof of the existence of potash ore, and in the other drilling was permitted in the old Getty field which was discovered and drilled out before the potash industry was established in New Mexico, on the theory that the potash there was already lost due to the presence of the old oil wells. Later plugging operations on those wells were not successful.

10. Conclusion

The potash industry has not objected to drilling in the Secretary's area arbitrarily or capriciously, and respectfully urges that the current system of proceeding through objection to hearing and decision under New Mexico Oil Conservation Commission Order R-111-A be continued and recognized. Drilling through known potash deposits with its resultant waste of potash must continue to be prevented.

To the extent that the statements of fact made in this report are in conflict with statements made in the New Mexico Oil and Gas Association presentation, we respectfully urge that the evidence produced herein substantiates the validity of our position.

We shall be pleased to submit additional evidence or conduct studies and surveys on any matter herein treated concerning which you may desire additional information.

Respectfully submitted

On Behalf of the Potash Committee
of the New Mexico Mining Association
and
the New Mexico Potash Industry

By _____

5.5 ft. of 16% K_2O Sylvinite Potash Ore

43,560	
5.5	
15/239,580	cu. ft.
15,972	tons
.9	extraction
14,374.8	
.82	recovery
11,787.34	
11,787	
16%	
188,592	units
.35	per unit
$ 66,000	per acre
640	
$42,240,000	per section
36	
$1,520,640,000	

At 1,250 ft. depth the value of the protective pillar would be about $2,100,000.

Value of Protective Pillars - Sylvinite

Value of 16% potash ore at 82% refinery recovery and $0.35 per unit assuming that thickness is 5.5 feet:

Value per ton = Grade x Recovery x Unit Price x 100
= .16 x .82 x 0.35 x 100
=$4.592

I. If well were not drilled, 90% of the ore within a 1,250 ft. radius circle would be mined, or:

$$\text{Tons} = \frac{3.1416 \times 1250 \times 1250 \times 5.5}{15}$$
$$= \frac{4,908,750 \times 5.5}{15}$$
$$= 1,799,875^{(1)} \times .90 = 1,619,887$$

Value of ore that could be mined, no well:

1,619,887 x $4.592 = $7,438,521

II. If well were drilled, the ore in a solid 100 ft. radius barrier would be lost, and the remainder of the ore outside the 100 ft. radius circle and a circle 1,250 ft. in radius would be only 65% extracted.

Tons in 100 ft. radius barrier:

$$T = \frac{3.1416 \times 100 \times 100 \times 5.5}{15}$$
$$= 11,519 \text{ tons}$$

Total tons in 1,250 ft. radius circle = 1,799,875
- 11,519
1,788,356 tons, of which only 65% could be mined or:

1,788,356 x .65 = 1,162,431 tons, the value of which is:

1,162,431 x $4.592 = $5,337,883

Value if no well	$7,438,521
Value, if well	5,337,883
Lost, due to well	$2,100,638

7/31/73

Exhibit B
PRELIMINARY NO. 5019

SOCIETY OF MINING ENGINEERS OF A.I.M.E.

UNDERGROUND MOVEMENT AND SUBSIDENCE OVER UNITED STATES POTASH COMPANY MINE

E. H. Miller
Resident Manager

F. L. Pierson
Senior Geologist

U.S. Potash Company
Carlsbad, New Mexico

Ex B p1 admitted as Kerr McGee Ex 11

This paper is to be presented at the Annual Meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers, New York, February 16-20, 1958. Permission is hereby given to publish with appropriate acknowledgements, excerpts or summaries not to exceed one-fourth of the entire text of the paper. Permission to print in more extended form subsequent to publication by the Institute must be obtained from the Secretary of the Society of Mining Engineers of A.I.M.E.

If and when this paper is published by the Institute, it may be subject to certain changes made by agreement between the Technical Publications Committee and the author, so that the form in which it appears here is not necessarily that in which it may be published later.

UNDERGROUND MOVEMENT AND SUBSIDENCE OVER UNITED STATES POTASH COMPANY MINE

By

Earl H. Miller, Resident Manager
and
Francis L. Pierson, Senior Geologist

53:929

The United States Potash Company was the original discoverer and first producer of underground mined potash ore in North America and commenced active production of potash in 1931. In July 1952, the company merged with United States Borax & Chemical Corporation and is now a Division of that corporation.

The mine is located twenty-two miles east of the city of Carlsbad and the refinery is located eighteen miles south of the mine. The mine was placed where the ore was found and the refinery placed where there was sufficient water for a dissolving and re-crystallization plant.

For twenty-three of the last twenty-six years, the potash ore was mined with the room and pillar method, which approximately sixty percent extraction and leaving forty percent in pillars. These pillars are generally fifty-eight feet by fifty-eight feet square. Three years ago, it was decided that removal of as large an extraction as possible from these pillars should be continued.

The first visible evidence of subsidence on the surface is by small hairline cracks which rapidly develop into openings measuring up to approximately one inch wide and one hundred feet long. In the first instance mentioned, where tension cracks disappear. About the boundaries of the final mined area which have been undisturbed for any length of time, these cracks appear and become larger. With continued strain and occasional shocks, some of the cracks develop into measurable openings measuring six inches to two feet wide and with an unknown depth. With continued erosion, the walls of the cracks fall into the bottom, thus widening and filling the openings.

In the present stage after two years, some of the openings appear as slump holes measuring some six to eight feet across, ten to thirty feet long, and five to fifteen feet deep. The geologic structure through which these forces are transmitted is rather typical of tilted salt deposits in the area. The buff dolomite section at approximately four hundred feet below the surface is a water zone of considerable magnitude over quite an extensive area. The fact that both the salt and potash are highly soluble makes it imperative that the section between this buff dolomite and the underground salt and potash beds below must not be ruptured. The potash bed, which varies from five to fifteen feet in height and lies more or less horizontal, is approximately one thousand feet below the surface and is normally overlain by a salt section some five hundred feet thick. The shale and clay strata below the water zone and above the salt section form the impervious layer which protects the salt section from the water above.

The effects of subsidence over the surface area are much larger than the actual final mined area underground. In those places where final mining has been carried to the limits of the orebody, subsidence effects have been observed some seven hundred feet beyond the limits on the surface. In those places where final mining stopped in a first mined area, subsidence has been noted for distances as great as one thousand two hundred feet beyond the limits of final mining. Principally for this reason, a large zone about the hoisting shafts has been prohibited to final mining activities until all other mining is completed.

In present operations, there are two types of mining in use. The first is known as conventional mining which utilizes undercutters, drills and blasting, after which the ore is moved from the face with loaders and shuttle cars. The other method is with continuous mining machines, using extensible and mainline haulage belts. In both of these operations, final mining is being carried on. The conventional final mining system is used generally in high ore in which it would be uneconomical to use a continuous mining machine.

In cases where a mud seam or zone of weakness occurs in a pillar, it will, of course, crush and fail at this point. Frequently when the mud seam is just above the back or just under the floor, the pillar will punch through into the work zone. Additional effects caused by the mud seam just above or just below an entry are frequent sags and falls of roof slabs and heaving of the floor.

Ex B P 2

Even in the event that roof slabs begin to fall over haulage ways, an attempt is made to control their subsidence until the haulage way is abandoned. In controlling roof slabs, cribbing, stulls and roof bolts are often used. These measures usually suffice to keep the haulage ways

open but occasionally it is necessary to blast down a slab and remove it.

It is thought that roof sloughing and floor swelling are caused by the vertical pressure and probably secondary forces. The vertical pressure is caused by a gradual action which tends to cause the floor to rise in the entry and the back to sag. The other resulting forces are thought to be the movement of clay in the strata coming from above and below the pillars out into the floor and back in the entries. It is also thought that "end pressure" exerted on the floor ahead of slabs from the bounding pillars helps to cause the initial separation of the slabs.

The second type of mining in our operations is in the continuous miner sections. Mine five years ago discontinued the use of continuous miners, and in this operation a different type pillar was necessary due to the limitations of the machine. The general mining pattern with this method leaves pillars one hundred feet long and thirty-five feet wide after first mining. In final mining, these pillars are reduced to such size that from ninety-five to ninety-eight percent extraction is being obtained. The back stands well immediately after mining but with such a large percentage of extraction, subsidence is relatively rapid.

In graphically plotting subsidence, the mean amount of movement underground is estimated to be approximately twelve feet, while the mean subsidence on the surface is approximately eight and one-half feet. This would appear to indicate that very little breaking is taking place in the strata above the mined-out area and that the overlying beds are more or less sagging uniformly.

In plotting the movement of one particular station on the surface and underground in the final mined out, it was found that for approximately thirty days subsidence was extremely rapid. The total height of the mined-out area was originally 12.75 feet. For the first thirty days after final mining, there was apparently little movement, but between thirty and sixty days, the underground workings at this point had subsided 3.25 feet, while the point above on the surface had dropped 2.75 feet. At the end of one hundred days, the back had come down a total of six feet, while subsidence on the surface measured 2.25 feet. After one hundred and forty days, the station underground had dropped a total of seven and one-half feet, while the point on the surface had moved down three and one-half feet. Due to the bad conditions of the back underground at this time, observations were discontinued. On the surface, however, the point continued downward, maturing six feet total drop after two hundred days. It was at approximately this point that the sharp rate of subsidence changed abruptly. At the end of one thousand days, the surface station had subsided a total of 7.50 feet, an increase of 1.50 feet in the last eight hundred days.

In graphing the movement of this station, it was found that the line was not continuously downward but indicated that subsidence, both underground and on the surface, came in waves or intervals, and in some cases the ground actually rose from the previous month's reading. From our closest observation in a single instance, it appeared that surface subsidence became measurable approximately thirty-five days after subsidence was noted underground.

In the first study of subsidence movement, a grid was set over the area to be mined with stations on five-hundred foot spacing, both east-west and north-south. These stations were triangulated in each month and a record of their movement was noted. From this date an approximate limiting angle of 51 degrees - 30 degrees has been calculated, the limiting angle, of course, being measured from a line drawn vertically up from the edge of advance and a second line drawn upward from the edge of advance to the outermost point where subsidence was observed on the surface. This limiting angle is important in determining where surface structures will be affected by subsidence. There are many factors which contribute to the degree of the angle. Those principally responsible are:

(1) The overlying strata through which subsidence takes place, this angle being relatively small for strong rocks and relatively large for weaker members, the total limiting angle, of course, being the sum of the various limiting angles up through the differentstrata.

Ex E P3

(2) It has been observed that the limiting angle is greater in areas where final mining operations are bordered by first mining operations. Strictly speaking, this is not a true limiting angle because extraction outside the area effects an increase of the angle. However, from the practical point of view, it is quite necessary to take this influence under consideration. We have observed in some cases a limiting angle as large as 51 to 30 degrees. It may be when the

ground completely stabilizes that this angle will become somewhat greater.

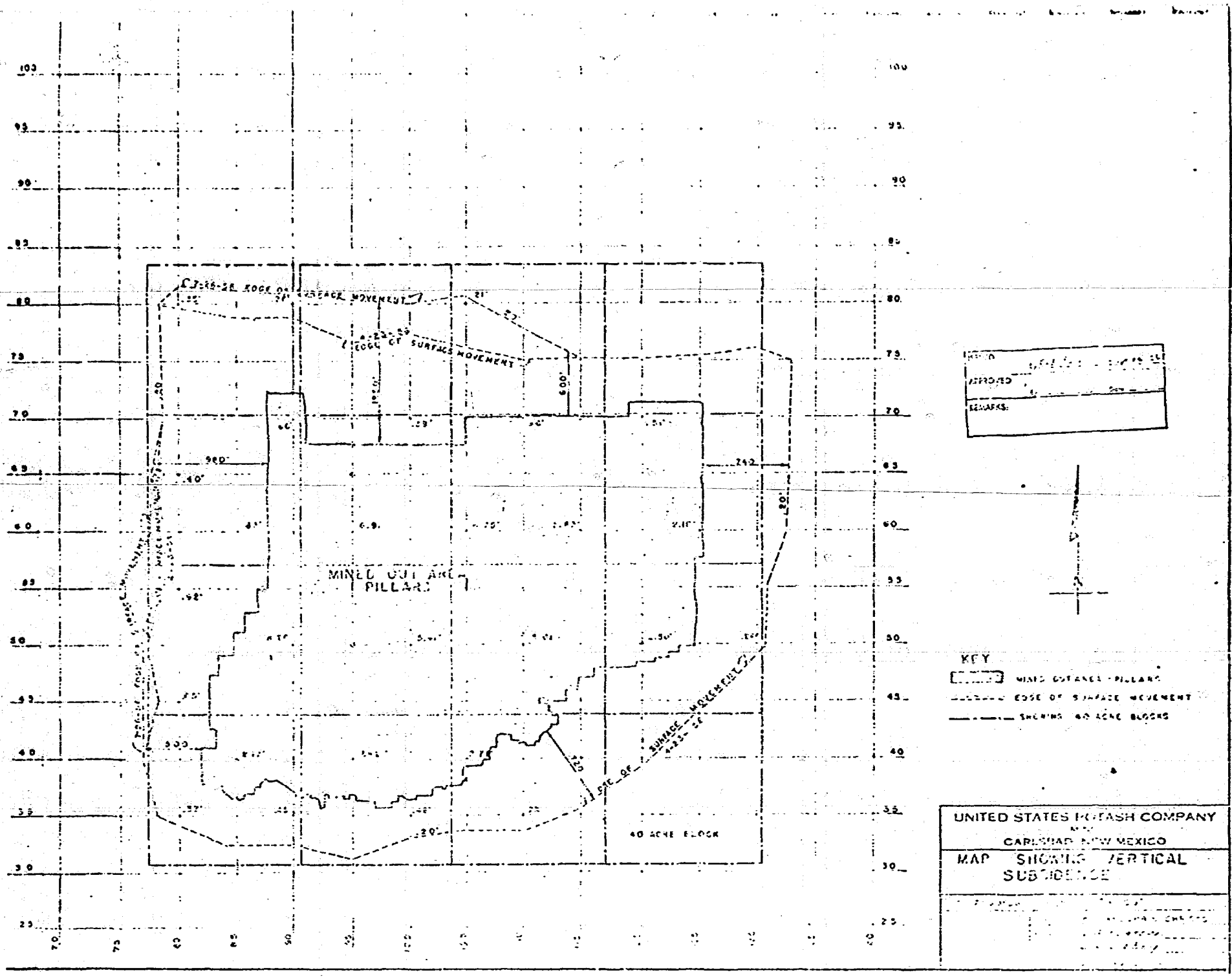
The [illegible] angle, of course, can only be measured well after final mining has been completed and the ground has more or less become stabilized. Up until that point there is a definite lag of subsidence behind final mining operations.

Presently a line of stations on the [illegible] foot contour was placed over the center of an area which will be final mined. In addition to giving much closer control on subsidence data, [illegible] the amount of strain (elongation and compression) between these points. This method of acquiring will give a more accurate limiting angle and an angle of break which is the supplement of the limiting angle, and the angle of break is of considerable interest as it is the line through which the greatest force of shear is exerted. This [illegible] from the vertical to a line which is drawn from the edge of extent of the subsidence area which ground up to a point of maximum tension strain, as plotted from the field data.

It is expected that with continued study, more detailed information on the characteristics of ground movement, as applies to salt-bedded deposits in the Carlsbad district, will become available.

ILLEGIBLE

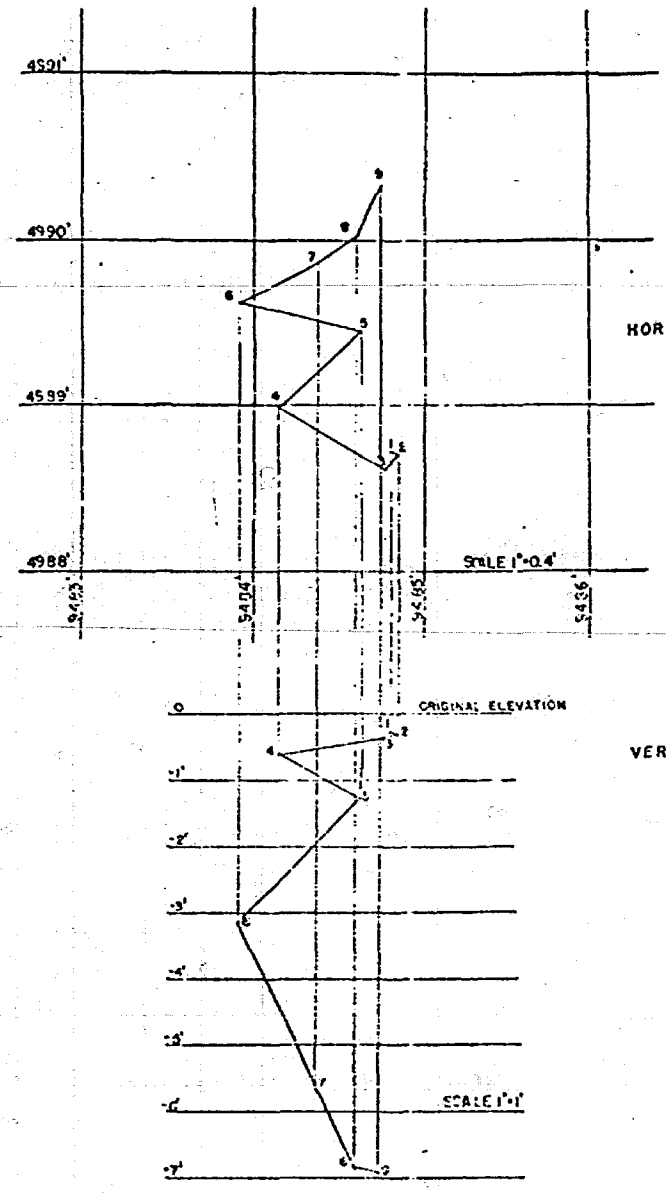
Ex B
p4


EDGE OF SURFACE MOVEMENT
EDGE OF SURFACE MOVEMENT
MINED OUT AREA
PILLARS
40 ACRE BLOCK
EDGE OF SURFACE MOVEMENT
APPROVED
REMARKS:
KEY
MINED OUT AREA - PILLARS
EDGE OF SURFACE MOVEMENT
SHOWING 40 ACRE BLOCKS
UNITED STATES POTASH COMPANY
CARLSBAD, NEW MEXICO
MAP SHOWING VERTICAL SUBSIDENCE

STATION 50N-95E

DATE

1. 9-15-55
2. 11-29-55
3. 12-21-55
4. 1-25-56
5. 2-24-56
6. 3-24-56
7. 4-25-56
8. 9-29-56
9. 6-20-56



HORIZONTAL DISPLACEMENT

VERTICAL SUBSIDENCE

UNITED STATES POTASH COMPANY

MAP SHOWING HORIZONTAL DISPLACEMENT & VERTICAL SUBSIDENCE OF STATION 50N-95E

Sa-C9

POST OFFICE BOX 511 CARLSBAD NEW MEXICO 88220

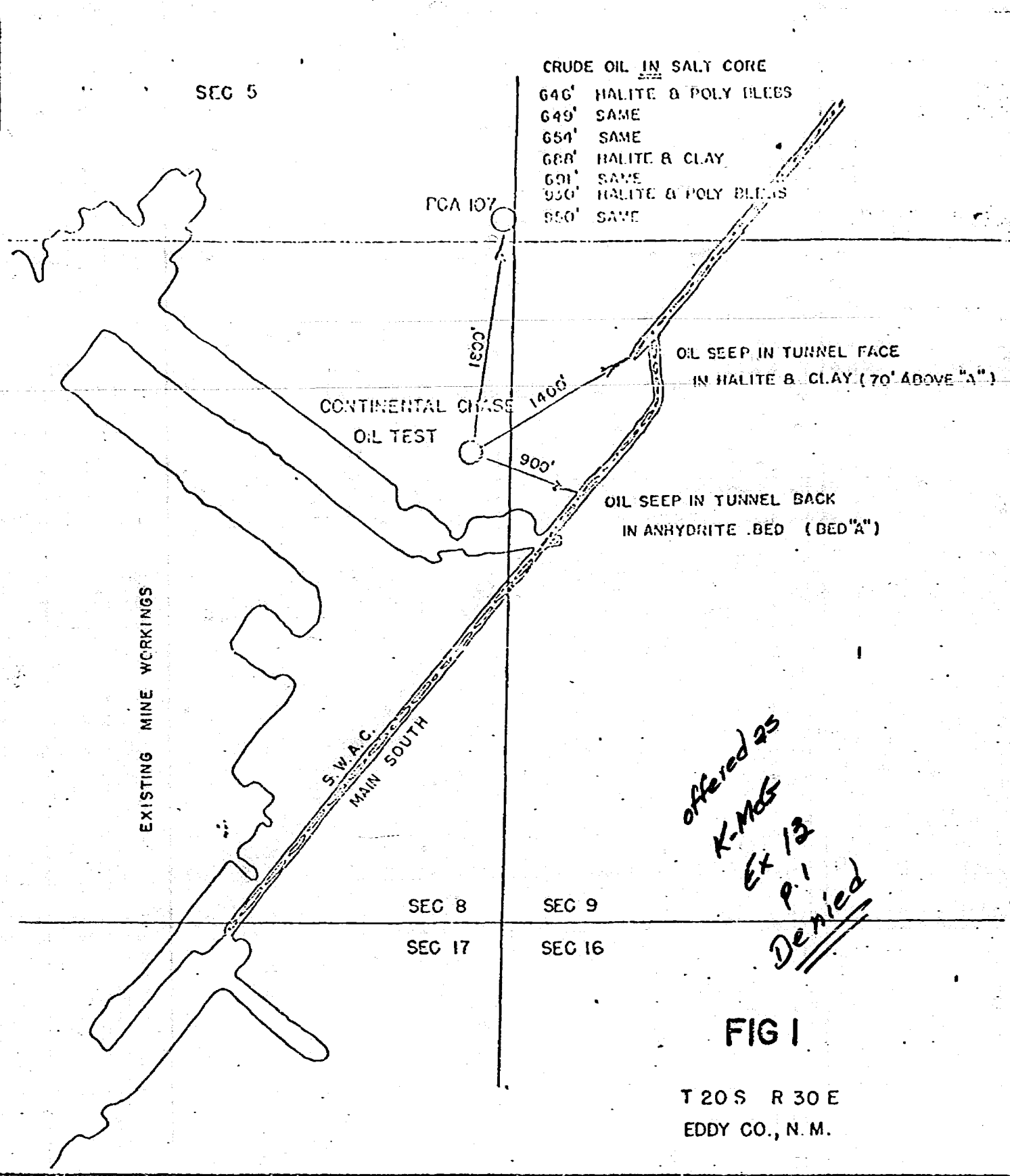
CORPORATION

Exhibit E

Duval Corporation is currently producing sulphur by the Frasch Process in Culberson County, Texas. The plant was originally designed to produce 2.5 million tons annually. However, sulphur supply conditions at the time of startup limited production to 1.5 million tons annually. Initial production plans called for producing sulphur from three contiguous areas, but such good results were achieved that only one area was steamed for about the first year. As a result of the subsidence due to sulphur production, previously drilled and equipped adjacent wells were damaged beyond use and/or casing recovery. This damage was discovered when attempts to inject superheated water into fully equipped wells failed and when three inch tubing would not pass through seven inch casing in the installation of the final production equipment. Failure to recover 7 inch uncemented casing and uncemented 3 inch tubing accured in over 45 wells.

The sulphur bearing limestone host rock, up to 400 feet thick, occurs at a depth of approximately 300 feet and is of Permian age: The Castile and Rustler formations of the Ochoa Series.

J. W. Magraw
Mine Superintendent



offered as K-MCS Ex 13 p. 1 Denied

FIG 1

T 20 S R 30 E
EDDY CO., N. M.

APPROVED BY	SHOWING CONTINENTAL CHASE OIL TEST AND THE AREAS WHERE CRUDE OIL HAS BEEN ENCOUNTERED IN SALT.	POTASH COMPANY OF AMERICA CARLSBAD, NEW MEXICO
		DRAWN BY LFC — DRAWING NO.
		CHECKED BY
	SCALE- 1" = 1000' — DATE- MARCH 64	DIRECTED BY JBC

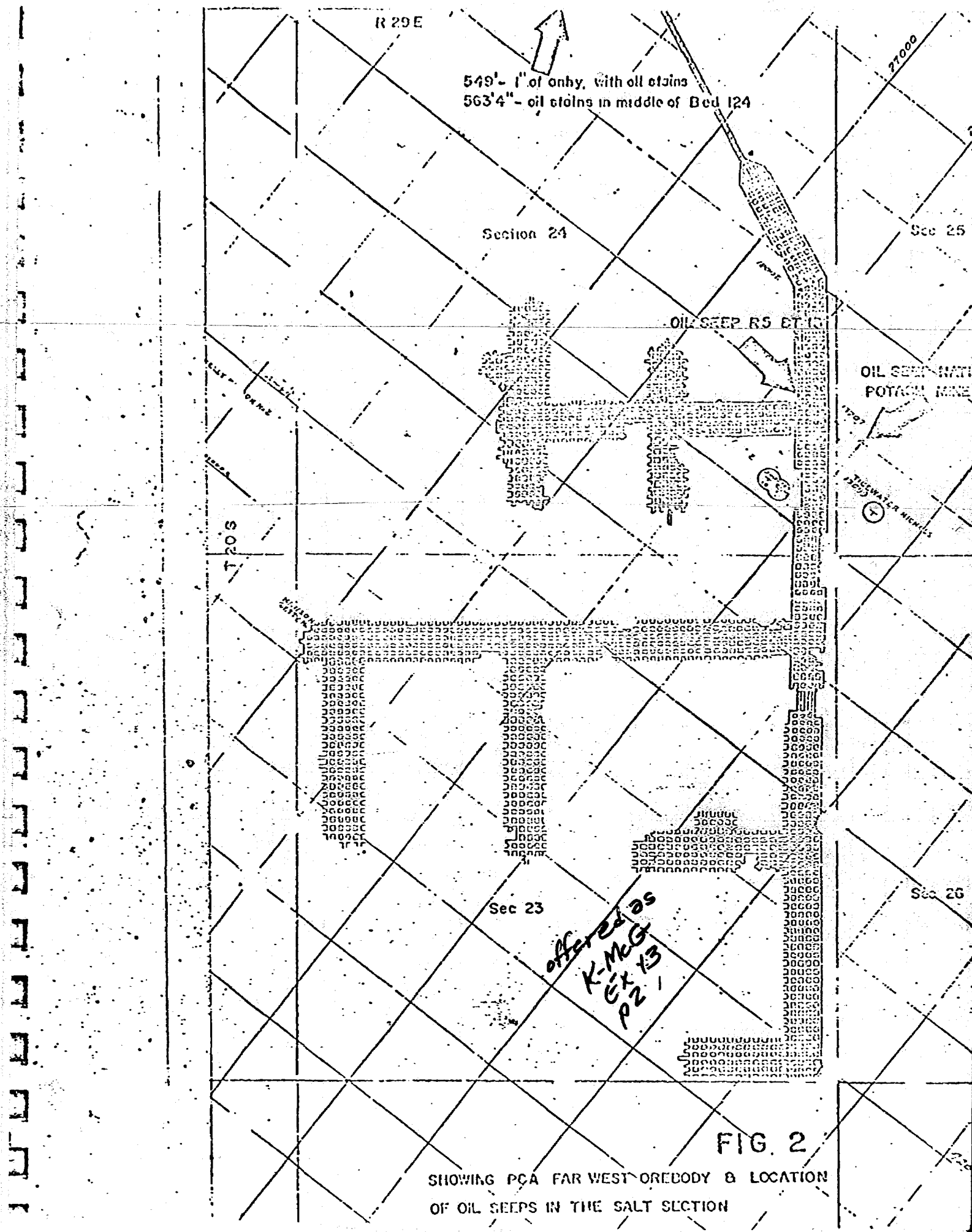


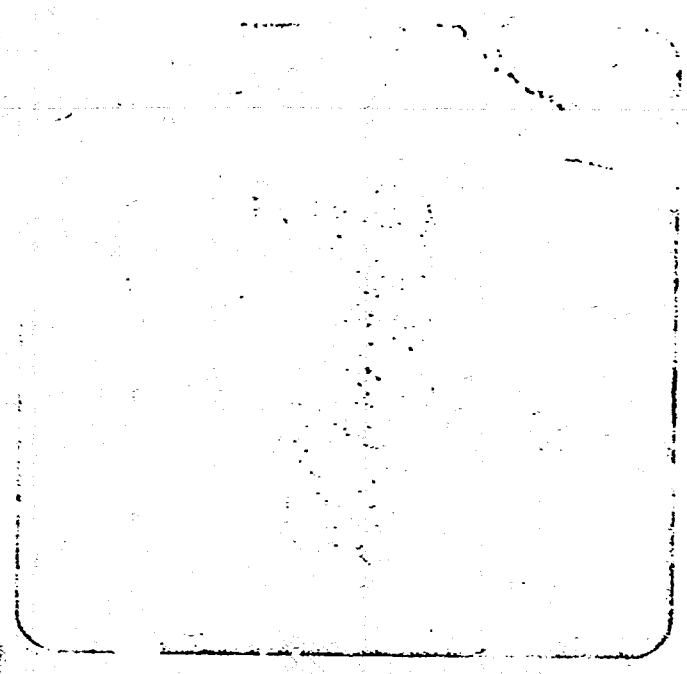
FIG. 2

SHOWING PCA FAR WEST OREBODY & LOCATION OF OIL SEEPS IN THE SALT SECTION

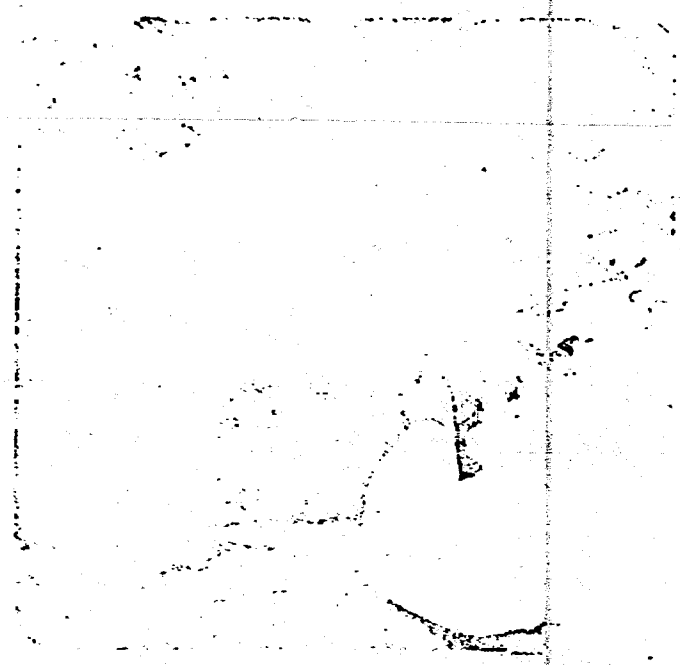
POTASH COMPANY OF AMERICA

Photographs of Main South Entries Showing Oil Seep Near Abandoned Oil Well

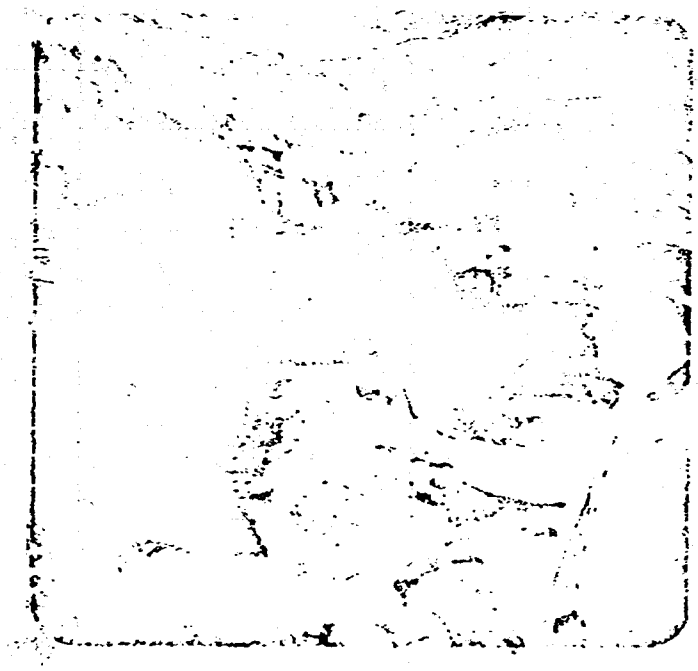
January 18, 1962



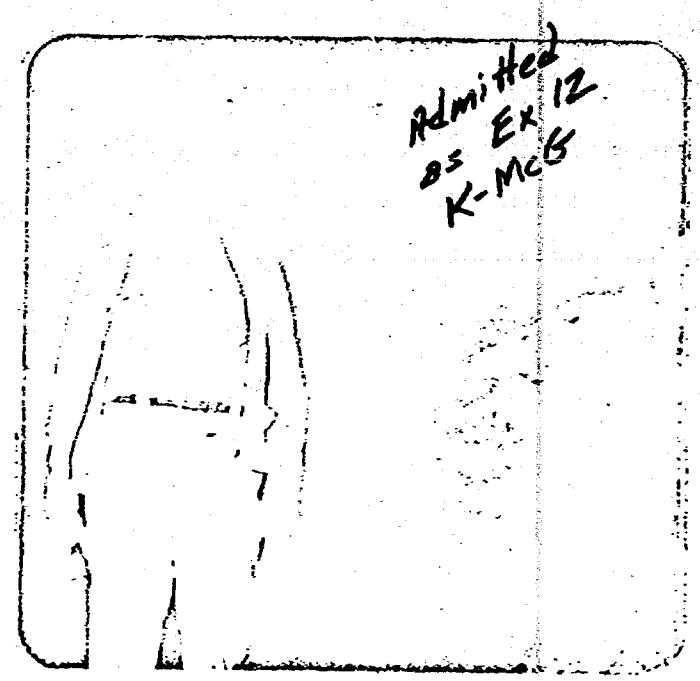
Tension crack in anhydrite filled with salt showing oil seep in Main South.



Anhydrite bed - Main South showing oil seep.



Oil seep in rib of Main South Entry.



Face of Main South. Red is polyhalite and salt. Oil covers most of face.

G

NATIONAL POTASH COMPANY

P. O. BOX 731
CARLSBAD, NEW MEXICO

August 1, 1975

Mr. Roy H. Blackman
Resident Counsel
Potash Company of America
P. O. Box 31
Carlsbad, New Mexico 88220

Dear Mr. Blackman:

This pertains to an incident in the spring of 1965 in which we encountered evidence of oil seepage in operations at our Eddy Mine. The location where this occurred was approximately 1,000 feet from the west line and 100 feet from the north line of the NW-1/4, Sec. 25, T. 20 S., R. 29 E. Altogether there were some three or four oil stains present, and two separate entries in the panel were affected.

The material involved at the site was horizontally bedded and consisted of 5 feet of sylvinite overlaid by 1 to 1-1/2 feet of clay. No particularly unusual physical conditions were present other than the fact that it was a salt dome area in which the seeps were encountered.

Mining operations in the area were discontinued immediately in order that the seep conditions could be investigated. This, of course, necessitated transfer of operations, including removal of all equipment by the production crews involved, to another area of the mine.

Since the nearest well was the Getty No. 1, which was approximately 700 feet from the location of the seeps, it was suspected as their source. The U. S. G. S. investigated and determined that this well had not been properly and adequately sealed. So the owner was required to reseal it in an approved manner. It is my understanding that this led further to a check of several other wells in the Getty pool in which the findings of such inadequacy were essentially the same and in which similar corrective action was also taken.

If, for any reason, additional information in regard to this matter is needed, I am sure it can readily be obtained from the U. S. G. S. office in Roswell, New Mexico, as personnel from there were involved in the incident.

Very truly yours,

Orland Foster
Industrial Relations Manager

OF:ca

H

JOHN T. BOYD COMPANY

MINING ENGINEERS AND GEOLOGISTS

PITTSBURGH, PENNSYLVANIA
DENVER, COLORADO

John T. Boyd
Chairman and
Chief Executive Officer
Robert L. Frantz
President
Lawrence D. Gent
Executive Vice President
James W. Boyd
Assistant to the President
Marjorie C. Rist
Administrative Assistant

Alfred G. Gilbert
Vice President
Lawrence M. Thomas
Vice President
Richard W. Brummett
Vice President

July 27, 1973

Potash Committee
New Mexico Mining Association
Post Office Box 31
Carlsbad, New Mexico 88220

Attention: R. H. Blackman, Esquire
Resident Counsel, Potash Company of America

Dear Sirs:

Herewith are our findings on the effects oil or gas wells drilled in potash reserve areas would have on the actual mining operation.

The safety of the underground physical property and personnel operating the mine have been taken into consideration.

I have a working knowledge of the Carlsbad Potash Basin dating back to 1952. Included in this report is Exhibit 1 showing my professional background and specific consulting work in potash mining.

Very truly yours,

John T. Boyd

Offered as
K-McG Ex 1-H
Denied
not admitted

PLEASE REPLY TO: ☒ 430 Oliver Building
Pittsburgh, Pennsylvania 15222

☐ 1028 Lincoln Tower
Denver, Colorado 80203

GENERAL

The Potash Basin of Lee and Eddy Counties, New Mexico, covers approximately 270,000 acres of land; a high percentage has been mined over. There are seven active operations in the basin, namely,

Amax Corporation
Duval Corporation
International Minerals and Chemical Corporation
Kerr McGee Corporation
National Potash Company
Potash Company of America
Teledyne Potash Company

Refer to Exhibit 2 for general location of the operations.

The general geology of the Carlsbad Potash District is similar over the general area. The surface is covered with sand, caliche and gypsite for several feet then the Rustler Formation of the late Permian Age lies unconformably on the Salada (salt) Formation. The Rustler Formation consists of limestones, anhydrites, water-bearing dolomites, clays and shales.

The Salada Formation is approximately 1600 ft. thick with beds of potash ore (sylvite) within a 150 ft. to 250 ft. zone approximately in the center of the formation. In the western half of the Potash Basin, No. 4 (or 28) Bed is mined and is approximately 1000 ft. below the surface.

In the eastern portion of the Potash Basin the mineable potash ore is known as the 10th Ore Zone and ranges from 1600 to 2100 ft. below the surface, or 650 to 750 ft. into the Salada Formation. The Salada Formation consists principally of beds of halite with bands of anhydrite, polyhalite, thin layers of clay and beds of potash ore (sylvite).

With the underground mining of potash ore or halite (salt), stresses originally distributed throughout a large area are concentrated in the pillars. These stresses are relieved as the pillars undergo continuous permanent deformation without fracture; a process commonly called "plastic flow". As mining continues, pressure on the pillars increases and plastic flow continues indefinitely or until the pillar crushes. A salt grain in an aggregate surrounded on all sides by other salt grains cannot change its shape in an arbitrary manner as the single salt crystal tends to act like the aggregate as a whole with plastic flowage the result.

Potash ore is a combination of halite and sylvite with the same characteristics. The higher the percentage of sylvite, the weaker the potash ore becomes. A second factor which tends to weaken the potash ore is the amount of clay within the ore zone.

The bedded potash ore in the Carlsbad Basin with a 15 to 20 percent K_2O content and the roof salt have the following characteristics when a force is applied perpendicular to the planes of stratification:

	Potash Ore 15 to 20% K_2O	Salt
Compressive Tests (PSI)	3,300	4,400
Yield Strength (PSI)	2,000	2,500

The mineable ore zones in the Carlsbad Potash Basin range from 1000 to 2100 ft. below the surface.

Following is a tabulated comparison of pillar loads for different percentages of recovery.

Mining Recovery %	Overburden Thickness 1,000 ft. PSI	1,600 ft. PSI	2,100 ft. PSI
30	1,430	2,285	3,000
40	1,667	2,670	3,500
50	2,000	3,200	4,200
60	2,500	4,000	5,250
70	3,333	5,330	7,000
80	5,000	8,000	10,500
85	6,600	10,670	14,000
92	12,500	20,000	26,250

Experience at the Amax operation shows that it requires 92% recovery for the remaining ore pillars to crush out and the salt back to bend down and meet the buckled floor. Exhibit 3 shows a generalized section of the manner in which the Salada Formation flows and bends while the shales, clays, limestone and dolomite strata above in the Rustler Formation shear. This is substantiated by the visible surface cracks above an underground pillared area.

The salt back starts to flow and bend when 60% mining recovery is reached with 1000 ft. of cover and 20% mining recovery at 2100 ft. of cover. The potash ore pillars start compressing with 50% mining recovery at 1000 ft. of cover and when first mining starts at 2100 ft. of cover.

Experience has shown that the first layer of salt roof does not always break as represented on Exhibit 3; the breaking depends on the location of the clay seams. In many cases the immediate salt roof will bend or break off in large slabs.

With pillar mining in potash, the surface will subside 65% of the mining height underground directly above the mined out areas and taper off to 0 at the edge of the 45 to 50 degree angle of draw (see Exhibit 3).

With a normal pillar recovery system in mining a 10 ft. seam, the salt back will move as much as 12 to 14 ft. The salt becomes plastic and flows as a mass. The forces that would build up against any oil or gas well casing in a subsidence area would be uncontrollable.

EFFECTS OF OIL AND GAS WELLS IN POTASH MINING AREAS

1. The mine operators in the Carlsbad Potash Basin have definite proof that the angle of draw or area affected by pillar mining ranges from 45 to 51 degrees from the edge of the caved area at the ore level (see Exhibit 3).

2. With pillars removed, the 400 to 600 ft. of salt back above the potash ore zone becomes plastic and flows. This is substantiated as the dolomites in the Rustler Formation above the salt are water-bearing and would enter the mine in large quantities if the salt would fracture.

3. The limestone, clays, dolomites and shales above the Salada (salt) Formation fracture and subside when pillars are removed. This has been proven by visual evidence and surveys by the potash mine operators.

4. Any oil or gas well drilled in the Carlsbad Potash Basin would require the mine operator to first mine only in an area around the well with the diameter of the area equal to twice the depth of the surface to the ore zone. The amount of first mining permitted would depend on the

4. (continued)

depth of the ore zone from the surface and could range from 35 to 50 percent mining recovery. The ore lost due to first mining only could range from 460,000 to 3,400,000 tons per well.

5. In the Carlsbad Potash Basin two mine operators, namely, PCA and National, have witnessed oil seeps. Gas has been known to migrate through salt strata and could readily migrate along the mud seams in the Salada Formation.

6. Pillar mining within a minimum of a 45 degree angle of draw area of any oil or gas well (see Exhibit 3) could result in the shearing of the casing. Methane gas entering the mine could cause a violent explosion which would damage equipment and take the lives of the miners. The explosive range of methane gas is 5 to 15 percent mixture with air.

7. If methane gas is detected in any operating mine, the United States Bureau of Mines would classify the mine as "gaseous". This would require the mine to operate under different mining conditions. The main changes would be,

   (a) Mining equipment would become obsolete and would be replaced with permissible electrics.

   (b) Each operating section would operate on a separate ventilating split of air.

7. (continued)

(c) Ammonia nitrate explosives would be replaced with permissible explosives.

(d) Total capital cost would depend on the size of the mine, but operating costs could increase 25 percent.

8. The oil and gas reserves would not be wasted as it is my opinion that 5 years after pillar mining is completed complete subsidence would occur and the areas could be penetrated with wells.

9. Comparing a pillar mining versus first mining only operation in the Carlsbad Potash Basin, the net profit per ton of product drops from $3.20 before taxes to a net loss of $0.12. Thus, a mining system limited to first mining only would result in an uneconomical operation. See Schedule 1 following this text for detail.

Respectfully submitted,

JOHN T. BOYD COMPANY
By:

John T. Boyd

SCHEDULE 1

CARLSBAD POTASH INDUSTRY

Example of Effect of Restricted Mining Recovery on Production Costs

By
John T. Boyd Company
Mining Engineers
July 1973

Basic Assumptions:

Total Reserves, Ore in Place, net tons (000's)	135,000
Average Mining Depth	2,000 ft.
Mine Production per Year, net tons (000's)	3,600
K_2O Grade	15%
Product Grade, Percent K_2O	62%
Mill Recovery	82%
Total Recovery - Millfeed to Product, $\frac{0.15 \times 0.82}{0.62} \times 3{,}600{,}000$	714,000 tons
Sales Value per Ton Product	$21.70

	Case 1	Case 2
Mining Plan	Pillar Mining	Partial Mining
Mining Recovery	80%	35%
Recoverable Ore to Mill, net tons (000's)	108,000	47,250
Total Recoverable Product, net tons (000's)	21,400	9,400
Annual Product, net tons (000's)	714	714
Life of Mine, years	30.0	13.2
Investment per Annual Ton Product	$72.00	$72.00
Depreciation per Ton Product		
Mining	$ 2.50	$ 2.75
Milling and Processing	2.35	3.55
Total	$ 4.85	$ 6.30
Depreciation per Year $(000's)	$3,463	$4,498
Increase in Depreciation Charges	-	$1,035
Depreciation per Unit K_2O Equivalent	$ .078	$ .102
Cash Cost per Unit K_2O Equivalent	.220	.250
Total Cost per Unit K_2O Equivalent	$ .298	$ .352
Total Cost per Ton Product, Before Taxes and Return on Investment	$18.50	$21.82
Estimated Sales Price	21.70	21.70
Profit Before Taxes per Ton of Product	$ 3.20	$ (0.12)
Estimated Mine and Mill Investment per Annual Ton of Product	$72.00	$72.00

PROFESSIONAL BACKGROUND AND EXPERIENCE

John Thomas Boyd
Mining Engineer

Born: Elyria, Ohio, January 14, 1913.

Education: The Ohio State University, B.E.M. – 1935

Memberships: American Institute of Mining, Metallurgical and Petroleum Engineers; American Mining Congress; Coal Mining Institute of America; Ohio Society of Professional Engineers; National Society of Professional Engineers; etc.

Registration: Registered Professional Engineer in Kentucky, Ohio, Pennsylvania and West Virginia.

Experience:

(1) John T. Boyd Company, Consulting Mining Engineers, Oliver Building, Pittsburgh, Pennsylvania. Chairman and Chief Executive Officer. (1968 to date)

(2) John T. Boyd & Associates, Consulting Mining Engineers, Oliver Building, Pittsburgh, Pennsylvania. Owner. (1964 – 1968)

(3) J. W. Woomer & Associates, Consulting Mining Engineers, Oliver Building, Pittsburgh, Pennsylvania. Partner. (1944 – 1963)

(4) From engineer trainee to production engineer. (1935 – 1943)

Nature of Consulting Work:

Geological work on coal (deep and strip), potash, limestone, clays, sand and gravel, copper and iron ore.
Proved mining properties, both metallic and non-metallic.
Designed modern plants and modern mining systems.
Installed modern machinery in underground and opencast operations.
Presented forecasts of costs, production and financial returns.
Designed rock tunnels and supervised their installation.
Made many specific project studies on drainage, hoisting, maintenance, etc.
Made valuations and appraisals for banks, railroads, utilities, and various companies.
Represented utility companies on coal combustion matters.
Appeared as expert witness in legal controversies.

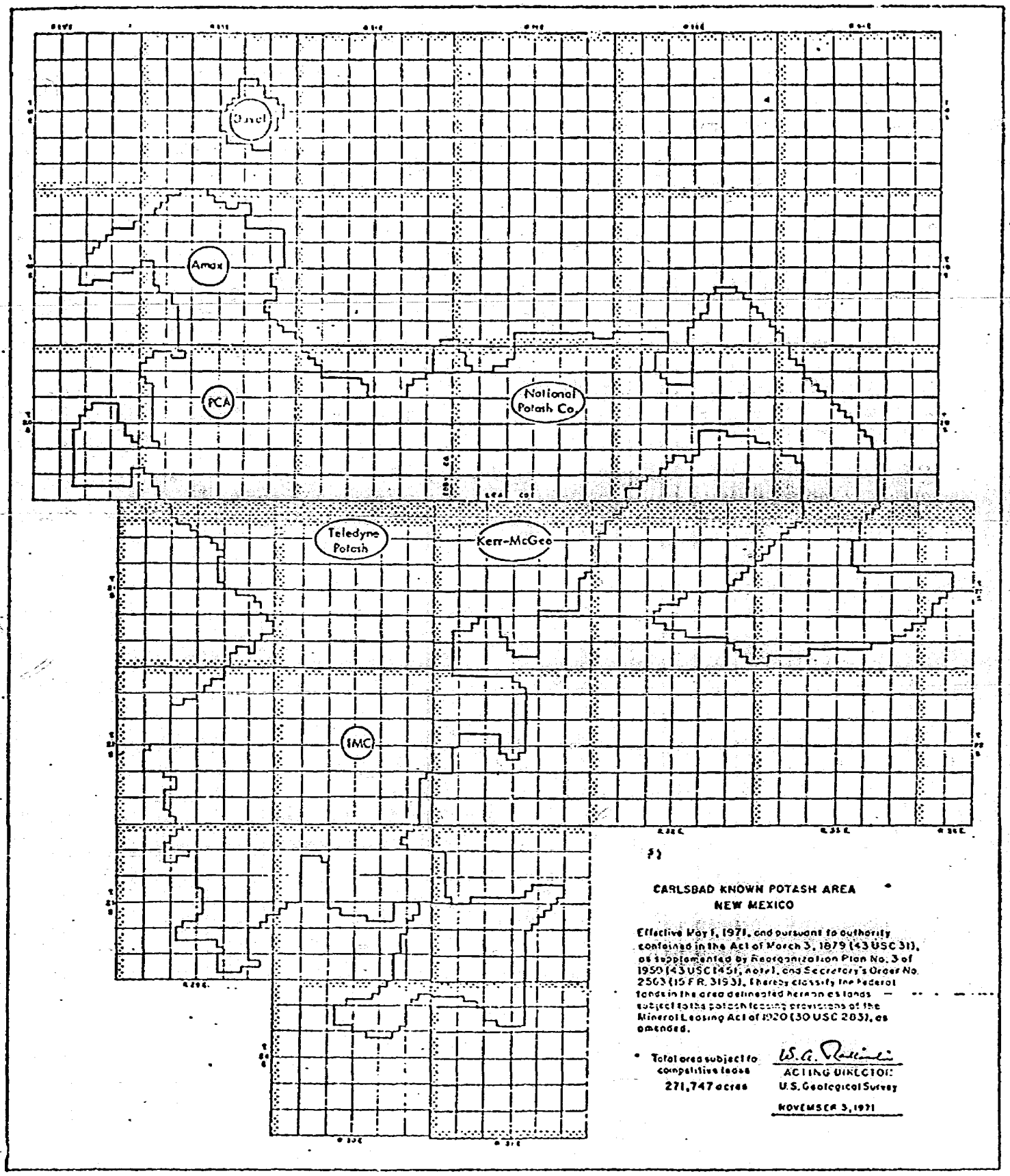
Foreign Mining Experience:

Australia	Ethiopia	Israel
Canada	France	Mexico
Chile	Greece	Philippines
Dominican Republic	Japan	United Kingdom

Consulting Work In Potash:

Southwest Potash Corporation
  Carlsbad, New Mexico
  Bredenbury Potash Reserve, Saskatchewan, Canada
  Musley Sylvite Study, Danakil, Ethiopia
Superior Oil Limited
  Canberra Potash Study, Saskatchewan, Canada
Consolidated Mining & Smelting Company of Canada Limited
  Vanscoy Potash Study, Saskatchewan
Noranda Mines Limited
  Noranda Potash Study, Saskatchewan
Scurry-Rainbow Oil Limited
  Potash Mining Study, Saskatchewan
United States Steel Corporation
  Holle Potash Study, African Congo
National Potash Company
  Potash Studies in Lee and Eddy Counties
Continental Minerals Inc.
  IMC Reserve Study, Saskatchewan
Potash Company of America
  Carlsbad, New Mexico
IMC
  Carlsbad, New Mexico

Exhibit 1



F)

CARLSBAD KNOWN POTASH AREA
NEW MEXICO

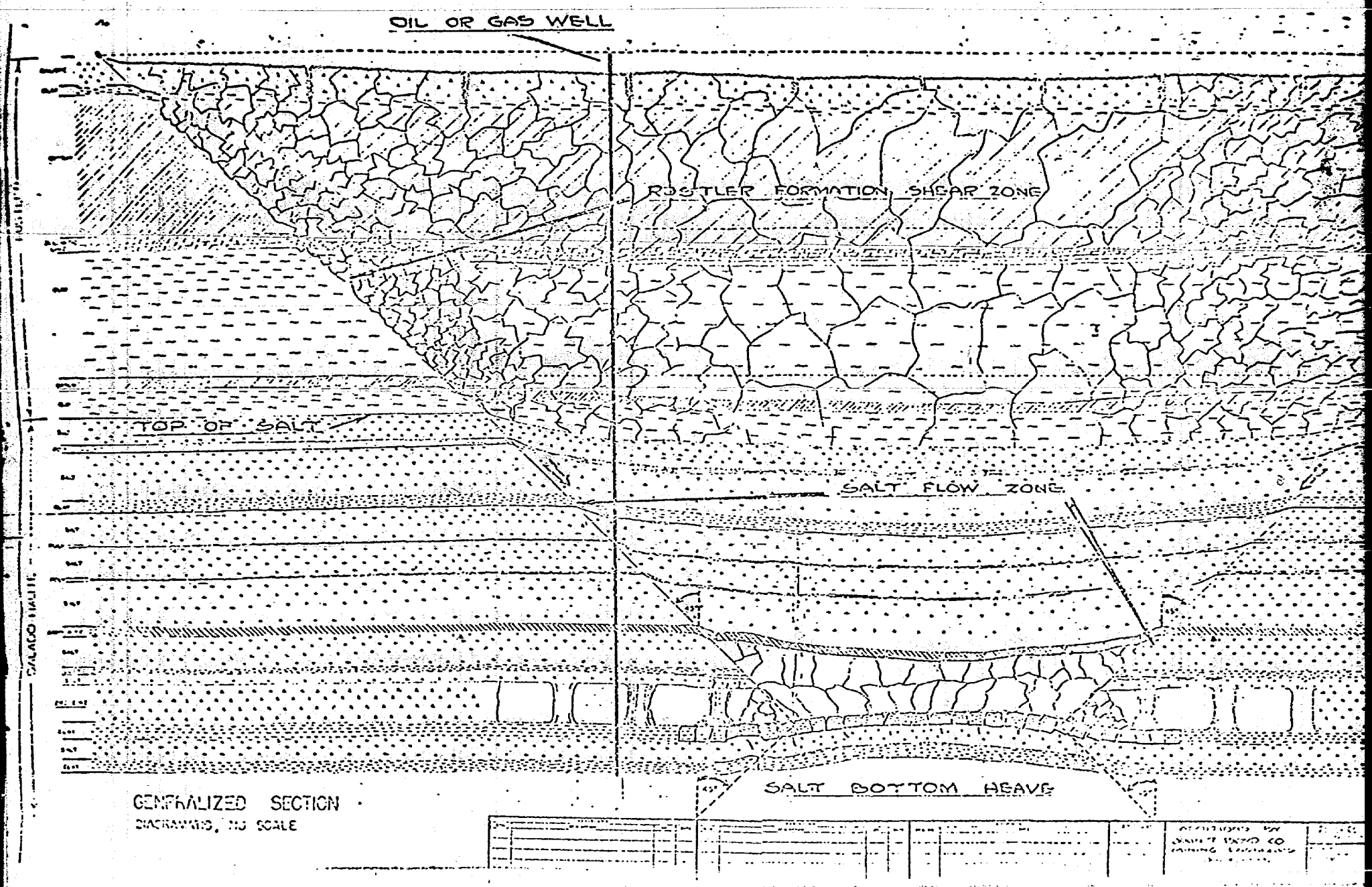
Effective May 1, 1971, and pursuant to authority contained in the Act of March 3, 1879 (43 USC 31), as supplemented by Reorganization Plan No. 3 of 1950 (43 USC 1451, note), and Secretary's Order No. 2563 (15 F.R. 3193), I hereby classify the federal lands in the area delineated hereon as lands subject to the potash leasing provisions of the Mineral Leasing Act of 1920 (30 USC 283), as amended.

* Total area subject to competitive lease
271,747 acres

W. A. Radlinski
ACTING DIRECTOR
U.S. Geological Survey

NOVEMBER 3, 1971

Exhibit 2



GENERALIZED SECTION
DIAGRAMMATIC, NO SCALE

Form 102:

I

MEMORANDUM

AMAX Chemical Corporation
A SUBSIDIARY OF AMERICAN METAL CLIMAX, INC.
P.O. BOX 279, CARLSBAD, NEW MEXICO 88220 (505) 885-3157

July 6, 1973

To: Mr. R. D. Brown

From: C. C. Curry

Subject: Increased Cost of Second Mining After Passage of Time

During the period February 1968 through May 1970, we reentered several sections of our mine in which first mining had been completed for periods of from four to sixteen years.

Attached are excerpts from reports of the Mine Superintendent to the General Manager during that period in which pertinent comments have been underlined in red. In each instance where an item is so identified, the area identified was a reentered area as explained above.

From the attached report and our accounting records, the following conclusions are presented:

1. Productivity in reentered sections was approximately 22% lower than if the second mining had been performed contemporaneously with first mining.

2. The additional cost per ton of product produced from a reentered area is estimated at $0.35.

3. Ore which could not be removed on delayed second mining which probably could have been produced contemporaneously with first mining was substantial. In 59-West that extraction was only 76.5% compared with our current extraction rate of 91%.

C. C. Curry

West Mains - The ore bed remains regular and good grade. Some localized rolling of the bed was encountered on the northern portion of the section.

2 South-West - The ore bed is slightly improved as to thickness and grade.

East Region

59 West - Second mining was completed with a total extraction of 76.5%. The lower extraction was due to necessity of leaving three rows of partially crushed pillars along the old 59 West second mined area.

10 South - Men and equipment were moved from 59 West and second mining operations started in fringe ore.

2 South-East - Second mining is progressing satisfactorily in thick, good grade ore.

6 East - Production from the continuous miner was 3,238 tons, with the remaining 516 tons from ore left in section from previous mining. The ore bed is thick, good grade, with some sharp rolling.

Continuous Miner

The machine operated 16 shifts and produced 3,238 tons with the following evaluation:

Effective machine utilization = 18.5%
Effective cutting rate = 128 tons/hr.

The remaining lost time of 81.5% is distributed as follows:

Miner	
Mechanical, electrical, etc.	18.5%
Service & change bits	8.6%
Moving, position, trimming	14.1%
Total	41.2%

Other	
Ventilation	2.2%
Back-up equipment	32.6%
Travel and lunch	24.0%
Total	58.8%

The higher mechanical down time was mainly due to considerable trouble with hydraulic jacks.

Safety

There were a total of 3 lost time accidents consisting of electrical burns, sprained shoulder and bruises to arm and leg.

Production from State and Federal Leases

	July		Year-to-Date	
	Tons	% K_2O	Tons	% K_2O
Federal	77,309	17.4	1,063,056	18.1
State	63,197	18.0	648,709	19.4

Efficiency Rate (Based on Tons Hoisted)

	Man-Shifts		Tons per Man-Shift		
	July	June	July	June	Year-to-Date
Production Crews - Hourly	1577.81	2058.19	89.05	95.31	89.56
Total Hourly	3662.09	4209.81	38.37	46.60	45.72
Salary	769.00	807.00	182.72	243.09	248.44
Total	4431.09	5061.81	31.71	39.10	38.62

Ineffective manpower for July was 5.56% as compared with 5.13% for June.

General Comments

The mine grade of 17.7% K_2O fell below the plan grade of 18.2% K_2O. This low grade can be attributed to the following:

1. Excessive heights in the two 1st mining sections caused unnecessary dilution of the potential ore grade.

2. Degradation of the ore bed in a localized area of 2 Southwest.

3. Extremely heavy ground conditions in the 2 Southeast and 45 West 2nd mining sections which, among other things, contributed additional dilution.

The degradation in 2 Southwest is showing a natural improvement and steps are being taken to improve grade control in the other areas.

Production efficiency dropped from 95.31 tons per man-shift in June to 89.05 in July. This in part explains the 12.2c per ton increase of mining costs over the projected standard costs. There are existing conditions in 45 West which are not conducive to high production efficiency. Back conditions are causing excessive rehandling of material and the original low mining height plus the fact that this section has been dormant for 6-1/2 years causes numerous additional problems. As a result, this section produced 8.9% of the total ore and required 13.4% of the total production manpower for an efficiency rate of 58.9 tons per man-shift compared with the overall average of 89.05.

West Region

3 North - 2nd mining operations continue under satisfactorily controlled conditions in very low grade ore.

2 Southwest - 1st mining intersected a localized area of salt inclusions which affected the overall grade. This condition appears to have improved and the section is back to normal.

5 South - Some of the gauges installed at the 14 and 17 Breaks to record convergence are no longer visible. It is assumed that, at these points, convergence has exceeded the 2-1/2 ft. range of the gauge.

West Mains - Ore grade and thickness continue to be satisfactory.

East Region

45 West - This section is operating under adverse conditions in respect to low height, back conditions and maneuverability with the section which have resulted in low grade and low tonnage. Steps have been taken to improve this condition by selectively mining the more accessible pillars, thereby sacrificing overall percent extraction in favor of higher grade and efficiency.

2 Southeast - Conditions are similar to 45 West and warrant the same approach.

Cost Analysis

1. Unfavorable variance of $7,846 in salaries and fringes reflects the difference in manpower for the planned production level and the actual production level achieved, also increased cost of fringe benefits granted after the plan was formulated.

2. Unfavorable variance of $7,645 in hourly labor is due to the low production efficiency and increased maintenance employees.

3. Favorable variance of $3,627 in production bonus reflects the low tonnage levels.

4. Unfavorable variance of $11,651 in hourly fringe benefits results from unfavorable labor variance.

5. Favorable variance of $7,949 in ordinary and lubricating supplies was offset by overexpeditures of $7,413 in repair supplies. This overexpenditure is due chiefly to overhauling major mine equipment as a preventive measure.

George Carrico
Mine Superintendent

AUGUST, 1968

Production from State and Federal Leases

	August		Year-to-Date	
	Tons	% K_2O	Tons	% K_2O
Federal	128,255	18.6	1,191,311	18.2
State	124,183	18.6	772,892	19.3

Efficiency Rate (Based on Tons Hoisted)

	Man-Shifts		Tons per Man-Shift		
	August	July	August	July	Year-to-Date
Production Crews - Hourly	2940.00	1577.81	85.86	89.05	89.06
Total Hourly	5746.59	3662.09	43.93	38.37	45.48
Salary	1046.00	769.00	241.34	182.72	247.51
Total	6792.59	4431.09	37.16	31.71	38.42

Ineffective manpower for August was 4.73% compared with 5.56% during July.

General Comments

The average grade of 18.6% K_2O for August exceeded the plan grade at 18.4% K_2O. The year-to-date average is 0.5% K_2O below the planned average. It is doubtful that the four remaining months will average the required 19.5% K_2O needed to meet the year end planned average of 18.9%.

Production efficiency dropped from the previous month to 85.86 tons per man-shift. Overall efficiency also dropped when compared to the last full month (May) of operation. This loss in production is primarily attributed to the following:

1. Completion of 5 South and 3 North second mining during the month and the resulting preparation of two new working sections.

2. Adverse ground conditions and restricting mining conditions in 2 Southeast and 45 West.

3. Extraordinary loss on mainline haulage due to derailments.

4. Equipment breakdowns.

The mining cost of $1.485 per ton was $0.165 over the standard of $1.320.

West Region

3 North - Second mining operations were completed for the present. Extraction was 92.6% under satisfactory ground conditions. Crews were moved to 80 West.

80 West - A new first mining belt section was set up off the 3 North Main immediately south of 89 West. Experimental innovations with respect to work cycle, equipment combinations, shooting patterns, and height-grade control are being set up and evaluated on this section.

5 South - Second mining operations were completed during the month and the crews are being moved to 14 South, a new first mining section on the east side immediately north of 23 West. Extraction in 5 South, from 19 to 4 break, averaged 92.0% with good second mining conditions. It has been recommended that the second mining pattern adopted in this section after the last major fall should be continued on future second mining operations.

West Mains - Ore grade and thickness continue satisfactory in this first mining section.

2 Southwest - The salt horse reported last month was a localized condition as predicted and all entries returned to good ore. However, this condition was only temporary and during the latter part of the month, the entries again intercepted what appears to be a major salt horse. As of the end of the month, 5 of the 11 entries were in salt. All entries have been narrowed down and it may become necessary to probe through with a minimum number of entries to sustain haulage and ventilation.

East Region

45 West - This section continues to operate in very low constricting height and heavy ground conditions. The southern end of the adjacent 1 South Main is being prepared for operation and will hopefully alleviate these conditions to some extent.

2 Southeast - Ground conditions and maneuverability continue to plague this section. The low production from this section is somewhat counteracted by the high grade.

Cost Analysis

Ore Grade Variance - Unfavorable variance of $8,055 due to the year-to-date averaging 0.48% below the plan.

Production Volume - Unfavorable variance of $2,861 due to low level of ore mined.

Mining Cost - Unfavorable variance of $41,480 due to the following:

1. Unfavorable variance of $8,383 in salaries and fringes continue to reflect increased personnel over planned estimate as well as increased cost of fringe benefits granted after standard costs were formulated.

2. Unfavorable variance of $30,002 in hourly labor due to low average daily tonnage with the manpower projected to achieve a higher level. Also, increased maintenance employees over planned estimate.

3. Favorable variance of $5,676 in production bonus reflects the 85.86 versus 97.0 tons per man-shift projection.

SOUTHWEST POTASH CORPORATION
REPORT OF OPERATIONS
Month of October, 1968

To: Mr. C. A. Arend, Jr., Vice President By: J. S. Mitchell, General Manager

General Summary

The mine hoisted 258,708 tons of ore as compared with the forecast of 283,650 tons. A fatal accident in the mine on October 24th resulted in a twenty-four hour production delay, thus accounting for 9,000 tons of the 25,000-ton shortage.

Muriate production amounted to 65,558 tons as compared with the anticipated 77,000 tons. The shortage of 11,500 tons is attributable to general failure to produce mine tonnage and the average ore grade of 18.1% K_2O as compared with 19.5% in the forecast. The grade problem resulted primarily from encountering a "salt horse" of unknown size in the 2 South-West section. Efforts to probe this area also adversely affected production. Productivity index for mine production crews averaged 89.7 tons per man-shift which is the same as the previous month. Productivity in the three West sections of the mine averaged 98.5 tons per man-shift versus 80.8 TPMS for the three sections in the East.

Mill recovery averaged 85.8 percent which reflects an improvement of 0.5% over September's performance. Carnallite content of the feed ore averaged 3.90% for the second straight month. This material is coming from the West Mains in the mine. Tailings losses averaged 4.4% of the mill feed K_2O values. The CCD complex losses averaged 6.1% reflecting the high carnallite content of the feed ore.

Muriate production was 65,558 tons with a product mix of 29% Standard, 42% Coarse, 26% Granular, and 3% Unscreen. Total product inventory decreased approximately 11,400 tons to a month-end value of 87,000 tons.

Muriate shipments totalled 77,003 tons. Export shipments amounted to 10,900 tons or 14.2% of the total. Sales estimates indicated 56,000 tons for domestic and 13,000 tons of export for a total of 69,000 tons.

Cost Analysis

Total expenditures for the month were $828,237 for an average of $12.63 per ton of product. Overall variance exceeded plan by approximately $7,500. This is the result of an unfavorable variance of $31,630 for production costs that were nearly offset by favorable variances of $2,564 for storage and shipping and $21,584 for plant administrative costs.

Mining costs averaged $1.485 per ton of ore, thus exceeding standard costs by $.167 per ton. Salary, hourly labor and fringes exceeded standard costs by $40,943. Mine repair supply costs exceeded standard costs by $12,612. This supply account for the year to date exceeds standard by $109,443. Of this amount, some $46,224 or 1.9¢ per ton represents non-recurring items such as Nordberg hoist gear, rotary car dump repair, Goodman loader conversions, etc.

West Region

38 East - First mining in this new section continues in high grade ore without intersecting any additional salt horses. Productivity levels were low due to equipment failures.

West Main - Productivity from this section remains high despite the unnatural rolling of the ore body. Grade dropped drastically during the month as a result of excessive heights and displacement of sylvite with carnallite in the ore body. The higher carnallite concentrations are becoming a problem to recovery in the mill.

80 West - The ore in the section continued to thin and finally dropped below the economic cut-off. Development was stopped and second mining operation initiated on November 27, 1968. This section was stopped even with the adjacent section, 89 West.

East Region

1 South - Second mining in this section is experiencing adverse roof conditions. The nature of the roof coupled with the time lapse between first and second mining have created conditions that restrict production and lower efficiency.

2 South-East - Mining conditions and productivity showed some improvement during the month in this second mining section. The grade of the ore continues to be exceptionally good.

14 South - First mining continued to be hampered by dipping of the ore body. Grade improved during the month.

Cost Analysis

Mining Costs - Unfavorable Variance of $40,652

1. Unfavorable variance of $2,517 in salaries and fringes continues to reflect increased personnel and increased fringe costs not anticipated when the plan was formulated.

2. Unfavorable variance of $30,316 in hourly labor, bonus and fringes is due to lower efficiency of the production crews and total manpower levels keyed to 9,400 tons per day and a resulting 8,675 tons per day.

3. Unfavorable variance of $13,520 in repair supplies continues to reflect condition of the mining equipment.

4. Favorable variance of $5,386 in blasting supplies results from an increased efficiency of materials used and a reduction in cost of materials.

George Carrico
Mine Superintendent

East Region

1 South - Second mining in this section continues at a very slow rate. Deteriorating roof conditions have not improved.

2 South-East - Ground conditions have improved now that one side of the section is adjacent to solid ground. Second mining production is still a problem in this area. The present mining and haulage systems being used are not compatible with the methods that were used to develop this area years ago.

14 South - The ore grade has continued good with less rolling of the ore bed.

Cost Analysis

Mining Costs - Unfavorable Variance of $16,023

1. Unfavorable variance of $2,653 in salaries and fringes continues to reflect increased personnel and fringe benefit costs not anticipated when the plan was formulated.

2. Unfavorable variance of $25,622 in hourly labor, bonus and fringes is partially due to low production efficiency and manpower levels set up for 9,450 TPD with a resulting production of 9,139 TPD. Two Saturday midnight shifts on overtime rates also contributed to this variance.

3. Favorable variance of $8,507 in ordinary and lubricating supplies reflects a $2,224 credit refund on lubricating taxes.

4. Unfavorable variance of $7,248 in repair supplies continues to reflect condition of the mining equipment.

5. Favorable variance of $10,553 in blasting supplies is due to reduction in price of ammonium nitrate and more efficient use of materials.

George Carrico
Mine Superintendent

3 North - Four rows of blocks were skipped in the 3 North Mains due to low grade. Four ows were second mined and completed February 25th. Production in this area will resume after the new mainline belt set-up is completed.

East Region

1 South - Second mining operations are experiencing very heavy ground conditions. The ore grade continues good and uniform. Production efficiency failed to improve.

2 South-East - Second mining in very good grade was increased during the month, however, the production efficiency dropped.

14 South - This first mining section is now heading east, attempting to complete development of the very irregular shaped area. Limited working places dictates the use of half crews. Ore of very good grade was diluted due to difficulties in following the rolling ore body.

Cost Analysis

The unfavorable mining cost of $1.501 was due to the overall low efficiency causing a variance of $36,323 in salaries and labor. Favorable variances mainly in supplies, fringes and bonuses defrayed $16,019 of these costs.

The low production efficiency combined with increased back-up labor continue to escalate mining costs.

Blasting supplies showed a small increase during the month due to the following:

1. The last two sections, 14 South and 2 South-East, were converted to the new blasting pattern.

2. This required the removal of approximately 15,000 8-ft. leg wires already charged to the mine, and their replacement with higher priced 12-ft. leg wires.

A credit for these caps will be reflected in the March cost. An overall 3.5% price increase of caps from the supplier went into effect March 1st. Due to the changes taking place with respect to blasting, it will be April before a stabilized cost is available and the savings effects of this change can be evaluated.

George Carrico
Mine Superintendent

West Region

38 East - Production from this first mining section was increased during the month due to absence of 3 North production. The ore bed continues regular and uniform but at a lower grade.

West Mains - Carnallite content dropped some from 12.4% to 11.4% with a slight overall grade improvement. Hole #37 was intersected during the month. This hole penetrated an irregular ore body with respect to grade and carnallite content at a location which produced erroneous results. A regular mine sample, 13 feet away was cut in ore of completely different ore averaging 19% K_2O and 25% carnallite. In addition to ore grade, the dip of the ore body continues to be a problem for rail haulage.

3 North - Conversion of the haulage system was completed and ready for operation March 31st. The first production panel will drive east to old 2 North and be designated 70 East.

East Region

2 Southeast - Second mining operations were completed in this section on March 30th. Production crews from this section will move into 6 East first mining operations.

1 South - Heavy ground conditions and restricted haulage facilities which contribute to low production in only average grade ore present some question as to the economics of continuing this section.

14 South - First mining operations were completed and second mining initiated on the 24th of March.

Cost Analysis

The unfavorable mining cost of $1.508 was composed of a variance in salaries, labor and fringes of $56,759. Low production from the total mine force sized for a much higher production level produced this discrepancy. All other expense accounts showed a favorable variance of $21,947 which defrayed the labor cost and resulted in a total unfavorable variance of $34,812.

George Carrico
Mine Superintendent

April 1, 1969

Production from State and Federal Leases

	April		Year-to-Date	
	Tons	% K_2O	Tons	% K_2O
Federal	131,360	21.0	498,195	20.5
State	136,396	15.8	577,895	16.5

577,495

Efficiency Rate (Based on Tons Hoisted)

	Manshifts		Tons per Manshift		
	April	March	April	March	Year-to-Date
Production Crews - Hourly	3239.63	3072.94	82.65	84.92	83.80
Total Hourly	6369.53	6434.80	42.04	40.55	42.37
Salary	1000.00	1065.00	267.76	245.03	265.21
Total	7369.53	7499.80	36.33	34.79	36.53

Ineffective manpower for April was 5.3% compared with 4.2% during March.

General Comments

The mine operated a total of 90 production shifts during the month which included four (4) Saturday night shifts. Production efficiency dropped to 82.65 tons. However there was an improvement shown in overall efficiency for the month. Mainline haulage problems, particularly in the 6 East section, drastically affected production.

The average mine grade dropped from 18.6% to 18.3% K_2O. This drop in grade reflects the degradation in the West Mains and resumption of mining in the 3 North area.

West Region

38 East & 9 South - This first mining section had advanced eastward to the 1 South workings. The production crews are now in the process of turning south from this point and working the 9 South section. The ore continues to be regular and good grade.

70 East - This belt section was turned east off the 3 North Mains at 70 break. The ore is relatively flat lying and reasonably uniform. Mine samples indicate that the overbreak is excessive in this belt section. Height control to 64" could yield a +19% grade.

West Mains - This section continues to produce high tonnage at very low grade. The carnallite content continues to be relatively stable, averaging 11.8% for the month, however the sylvite content appears to be weakening.

East Region

1 South - Second mining conditions have improved some during the month. This section is now operating with first mined ground to the west and a sizable barrier pillar to the east. The average ore grade has also improved considerably.

14 South - Second mining operations are being affected by severe rolling of the ore. This is in an area that created difficulty during first mining. These severe rolls cause numerous problems including excessive overbreak which reflects this month's drop in grade.

6 East - First mining operations were resumed in 6 East. Except for minimum production from the continuous miner, this section has been dormant since April, 1965. The ore is thick and good grade but extremely irregular. Adverse haulage grades from the loading points are seriously affecting production.

Cost Analysis

Mining Costs - Unfavorable Variance of $30,368.

Major unfavorable variances were as follows:

1. Unfavorable variance of $4,092 in salaries was due to $1,303 payments to mine foremen working their vacation, $1,350 to foremen working extra Saturday shifts, $396 to temporary foreman upgraded, and $1,878 severance pay to a foreman who was terminated.

2. Unfavorable variance of $1,160 in salary fringes was due to increase in salaries over standard estimates.

3. Unfavorable variance of $31,107 in hourly labor, bonus and fringes is due to low production efficiency. The production efficiency averaged 82.65 tons per manshift and total hourly averaged 42.04 tons per manshift versus 97.00 and 47.26 respectively estimated in the plan for standard costs.

4. Unfavorable variance of $4,700 in supplies reflects overexpenditures in these categories as compared to the production level.

The only significant favorable variance this month was $11,680 in blasting supplies and this reflects a variance in deliveries to the mine.

George Carrico
Mine Superintendent

West Mains - The challenge of pitching ore versus rail haulage continues. A slight improvement in grade and reduction in carnallite from 11.8 to 10.5% occurred during the month. This put the year-to-date average at 417,042 tons - 15.1% K_2O - 11.7% carnallite.

East Region

1 South - At month's end this section was working in No. 13, the last row to be mined from this section. Equipment and crews will move to 6 South off the West Mains.

14 South - Extremely heavy ground is seriously affecting extraction, production, and grade. The engular attack of weight from the completed 2 South-East section is exerting extraordinary force on the remaining pillar in this section.

6 East - During the month it was necessary to change the rail haulage layout from the conventional mainline and stub-track to an independent track to each loading point in order to maintain grades that could be negotiated by the haulage motors. These severe grades are also drastically affecting production and ore quality.

Cost Analysis

Mining Cost - Unfavorable Variance of $20,301.

Major variances were as follows:

1. Unfavorable variance of $25,112 in hourly labor, bonus and fringes continues to reflect lower than planned average tonnage and decreased efficiency of the total work force when compared to the standard estimates.

2. Unfavorable variance of $4,491 in ordinary and lubricating supplies was due mainly to advance purchases of lumber in the amount of $4,186 for use in ventilation.

3. A favorable variance of $10,364 in blasting supplies continues to reflect implementation of new blasting techniques.

The overall improvement from an unfavorable variance of $30,368 last month to the current variance of $20,301 can be fully attributed to the increased production efficiency during the month.

George Carrico

October, 1969

9 South - The anticipated return of good ore reported at the end of last month was shorted. Conditions reverted and worsened during October. The ore bed is very erratic with sudden facies changes from ore to salt with no apparent relief in sight.

East Region - Second mining operations are progressing satisfactorily with the exception of a severe haulage problem. Revision of the haulage has been considered and dismissed on a basis of the work entailed for little or no improvement and the short life of the section remaining.

Cost Anolysis

The unfavorable mining cost of $1.487 per ton of ore was $0.100 over the standard cost. Gross unfavorable variances of $42,454, comprised principally of labor, fringes and supplies, was partially offset by favorable variances of $15,193 in salaries, blasting materials and bonuses.

The net unfavorable variance of $27,261 represents the difference in planned production efficiency of 97 TPMS and the actual production efficiency of 89 TPMS.

George Carrico
Mine Superintendent

6 South - First mining operations continue satisfactorily in good ore. The ore grade, although showing some gradual decline, is agreeable with estimates derived from the adjacent 5 South section.

9 South - During the month, the ore in this section has displayed more stability than it has during the two previous months. As a result, the grade improved to 16.1% K_2O. Development is approximately 400 feet from the southern lease boundary of State Section 16.

East Region - Second mining operations are being conducted under heavy ground conditions. Converging weight from three directions dictates extreme caution and in some cases sacrificing a small percent of extraction in the interest of safety.

Cost Analysis

Mining Cost - Favorable Variance of $3,153

This is the first monthly mining cost in 34 consecutive months that has come within the estimated standard costs. Reasons for this favorable mining cost are as follows:

1. Unfavorable variance of $20,319 in hourly labor was substantially decreased from the previous months and reflects the increased production efficiency.

2. Favorable variance of $2,273 in production bonus was due to an efficiency rate lower than the 1969 projected standards.

3. Favorable variance of $15,809 in hourly fringe benefits was due to not expensing the hourly pension plan for the month of November and crediting this expense from overaccruals in earlier months. The net effect on mine costs amounted to $13,991.

4. Unfavorable variance of $4,465 in ordinary and lubricating supplies was due primarily to expensing $7,200 of belt hardware for the West Mains.

5. Favorable variance of $11,375 in blasting supplies reflects modifications to the blasting operations.

6. Unfavorable variance of $1,765 in power purchased coincides with a production level lower than 1969 estimates.

George Carrico
Mine Superintendent

3. 30.7% more places cut per grinding with Carboloy bits.

4. 33.4% more footage cut per grinding with Carboloy bits.

5. 36.2% less broken bits per 1,000' cut with Carboloy bits.

6. 18.8% reduction in bit cost per foot cut with Carboloy bits.

The cutting operation, which is a bottleneck in the production cycle, is affected by more than the type of bits being used. Results of this test are limited to data taken from one production crew and limited to the cutability on one section and therefore does not present conclusive evidence to support a sudden or radical change in cutter bits. The test does however suggest that improvements are possible and continuation of this project will be continued if and when time allows.

A capital expenditure progress chart is attached depicting the anticipated arrival and installation of major mining equipment included in the 1970 Capital Program. This chart will be updated and included in ensuing reports.

West Region

West Mains - Ore grade dropped during the month to 19.0% K_2O. This was caused by a rapid degradation which occurred during the last week. The ore bed which is satisfactory grade and relatively clean, averaging 6.2% carnallite, has suddenly thinned out. Current advance is approximately 1,000' from the projected ore limits.

71 West - Average ore grade improved as second mining retreats. Ground conditions remain satisfactory.

70 East - Second mining operations are progressing satisfactorily. Convergence of approximately 20" has been recorded 4 rows behind the working row.

6 South - First mining continues in good grade ore. Production efficiency dropped during the month by a factor of 4.2 TPMS.

9 South - During the month the ore has again become very spotty and inconsistent. The average grade dropped to 14.4% K_2O. Back conditions resembling the adjacent 1 South area are presenting problems. Production efficiency dropped 7.5 TPMS during the month.

East Region

Row 7 was completed on the 23rd, crew and equipment were moved to an area immediately north to recover a small block of pillars originally mined in 1953. Production was resumed December 29th. Production from this area will be limited to one loading point set ups.

Cost Analysis

An unfavorable mining cost of $1.489 per ton of ore before adjustment was $0.094 over the standard cost. A gross unfavorable variance of $46,390, comprised principally of labor,

May, 1970

Production from State and Federal Leases

	May		Year-to-Date	
	Tons	% K_2O	Tons	% K_2O
Federal	236,340	18.86	1,021,493	19.77
State	85,645	18.43	408,918	16.88

General Comments

The mine operated a total of 89 shifts during May. Production averaged 10,387 tons per day or 3,618 tons per shift, an increase of 101 tons per shift over April.

The efficiency of the mine production crews averaged 100.82 tons per manshift with the total mine efficiency including salaried personnel averaging 45.19 tons per manshift.

The average mine grade dropped from 19.66% K_2O in April to 18.75% K_2O in May. This was as expected and was caused primarily by the completion of 6 East section and starting 62 South at a lower grade. There was also a general decline in grade in all sections, the greatest change being in 17 West which dropped 1.4% K_2O.

The East hoist rope on the #1 shaft was replaced on May 21, with the West rope scheduled for replacement the second week in June. This is a planned replacement when each rope has hoisted 4 million tons of ore.

Surface hole No. 85 was completed on May 22. Core analysis showed 9.9% K_2O at a 5.6' mining height. Hole #86 is now being drilled and core analysis should be completed by June 8th.

Installation of the new 6,000-ft. belt conveyor in the West Mains is for all practical purposes completed. The second panel belt in the West area is being installed in 272 break for the 272 North section. This section will be worked with equipment and crews from the 62 South section following the four-day shutdown in July.

Mining Regions

6 East - Second mining was completed on May 10, 1970, and equipment and crews were moved to the new 62 South section.

17 West - First mining continued in poor to fair grade ore. The ore bed is of good thickness but varies in grade from poor to only fair. The average ore grade dropped from 16.0% K_2O in April to 14.7% in May.

6 South - First mining continued in good ore. The average grade dropped from 18.0% in April to 17.9% K_2O in May. However, some weakening of the ore grade was apparent on the Nos. 1 and 2 entries adjacent to 5 South section at month's end. Continued deterioration of the ore bed is expected as we are 150 feet beyond the 5 South extremity. Better control of mining heights is still needed in this section.

TABLE 1

EDDY COUNTY

Income
(thousands of dollars)

	1966	1967	1968	1969	1970
Total Earnings	$102,789	$102,303	$98,770	$105,474	$112,384
*Farm	10,805	9,866	11,044	11,925	12,352
*Government	14,216	13,749	16,059	17,242	19,213
*Manufacturing	4,399	4,304	4,496	5,122	5,384
*Mining	34,952	34,994	27,049	28,378	31,237
*Contract Construction	4,132	4,135	5,106	5,495	5,547
Trade, Wholesale & Retail	13,429	13,488	13,382	13,624	13,690
Finance, Insurance & Real Estate	3,185	3,399	3,434	3,248	3,242
Services	12,529	13,186	14,085	16,[illegible]56	17,417
Other	589	399	397	443	442

Employment

Total Employment	NA**	16,342	15,140	15,279	15,144
Number of Proprietors		1,798	1,802	1,821	1,807
Farm		520	509	502	495
Nonfarm		1,278	1,293	1,319	1,312
Wage & Salary Employment		14,544	13,338	13,458	13,337
*Farm		727	664	666	589
*Government		2,256	2,218	2,143	2,086
*Manufacturing		615	603	656	644
*Mining		3,934	3,032	3,189	3,237
*Construction		562	484	412	417
Transportation, Communication, & Public Utilities		756	752	749	695
Trade		2,623	2,497	2,396	2,349
Finance, Insurance & Real Estate		462	436	416	397
Services		2,540	2,589	2,763	2,853
Other		69	63	68	70

*Basic or export sectors
**Not Available
Source: Unpublished data, Bureau of Economic Analysis, U. S. Department of Commerce, March 8, 1973.

TABLE 2

INCOME AND EMPLOYMENT MULTIPLIERS

	1966	1967	1968	1969	1970	Income and Employment Multipliers
Total Earnings / Basic Earnings	1.500	1.526	1.549	1.547	1.524	1.529[a]
Total Employment / Basic Employment		1.905	2.016	2.019	2.028	1.992[b]
Potash Payroll, 1970		$21,000,000[c] x 1.529 = $32,109,000 or 28.6% of 1970 Total Earnings				
Potash Employment, 1970		2630[d] x 1.992 = 5239 or 34.6% of 1970 Total Employment				

[a] 5-year average
[b] 4-year average
[c] Carlsbad Chamber of Commerce statistical data
[d] Annual average of covered employment in nonmetalic mining, Employment Security Commission of New Mexico.

TABLE 3

ECONOMIC IMPACT OF OIL WELL DRILLING IN POTASH AREA

Deep Well:

6 months drilling time, 5,965.5 man days required to drill & complete[1]

Shallow Well:

30 days drilling time, 1,009 man days required to drill & complete[1]

Mine 1400-foot Circle (area around well in which mining would be restricted):

380 workers, 1 year to complete[2]/approximately 95,000 man days[3]

Net "Base" Loss (assuming a deep well):

95,000 - 5,965.5 = 89,034.5 man days

Gross Loss (assuming a deep well):

89,034.5 x 1.992[4] = 177,356.7 man days or approximately 709 man years[3] of employment

---

[1]Roy C. Williamson, correspondence April 19, 1973
[2]Kerr McGee
[3]Assumes 250 man days per year per worker
[4]Employment multiplier from Table 2

TABLE 4

ECONOMIC IMPACT OF OIL WELL DRILLING IN POTASH AREA

Net "Base" Loss (assuming a deep well):

95,000 - 5,965.5 = 89,034.5 man days or 356 man years[1]

Using 1972 Average Wage Figures:

$\frac{\$21,500,000}{2579}$ = 8337, the net dollar loss is $2,967,972

The Gross Dollar Loss (assuming a deep well):

$\$2,967,972 \times 1.529^{2} = \$4,538,029$

[1]Assumes 250 man days per year per worker
[2]Income multiplier from Table 2

EXHIBIT K

REPORT TO POTASH COMMITTEE

CONCERNING

PROSPECTING FOR OIL & GAS

IN THE POTASH AREA

JULY 1973

EXHIBIT K

TABLE OF CONTENTS

	Page
ISSUE	1
SUMMARY	1
RECOMMENDATIONS	2
APPLICABLE REGULATIONS & HISTORY OF REGULATIONS	3
RULES REGARDING LEASING OF FEDERAL LANDS	5
HISTORY OF POTASH IN NEW MEXICO	6
REVIEW OF CASES HEARD BY THE OIL CONSERVATION COMMISSION	9
CURRENT CONTROVERSY BETWEEN POTASH AND OIL & GAS INDUSTRIES	14
POTASH DISTRICT - SOUTHEASTERN NEW MEXICO (MAP)	19

ISSUE:

Should prospecting for oil and gas be conducted in or through potash-bearing land without satisfactorily establishing that such drilling would not interfere with the mining and recovery of potash deposits or cause undue waste of potash or constitute a hazard.

SUMMARY:

The Potash Area, as designated by the Secretary of the Interior, is an area of land in the southeastern part of the State of New Mexico covering 420,212 acres. Within this approximate same area, the United States Geological Survey has described an area covering 271,747 acres that is known as the Known Potash Area. The Potash Area is a multiple-use land. A study of the area shows that within the Secretary's area as it is now designated, there are over 800 oil and/or gas wells, and approximately 30,000 acres of open mine workings. See attached map.

Potash, as well as oil and gas activity, in this area is governed by the Secretary's Order dated May 11, 1965. Parts of this area are also governed by New Mexico Oil Conservation Commission Order R-111-A. It is the feeling of International Minerals & Chemical Corporation that the present regulations have proven to be adequate.

Carlsbad area potash reserves are the only significant potash reserves in the United States that have been economically mined. In the southern portion of the Potash Area, the only langbeinite potash reserves known in the Western Hemisphere exist. The United States government in 1911 appropriated funds to explore for possible potash sources in the United States. The New Mexico deposits were located in 1925. Mining of this ore began in the early 1930's. These valuable

deposits have been protected by the laws and regulations of the United States government. The capital investment and future planning of any mining operation is contingent upon ore reserves. After an investment in a plant and mine and the capital expenditures in locating and delineating an ore body, a mining company must have adequate protection of those reserves in order to properly protect their investment.

There is no way oil and gas wells can be drilled through valuable potash deposits without resulting in a possible hazard or causing undue waste of these deposits. It seems unreasonable to approve a wildcat location for oil and gas exploration through a delineated, proven potash deposit. A wildcat location cannot be considered development or production when it is not even known if oil and/or gas is present at that location. There are many millions of acres of land where oil and gas exploration can be conducted while potash is being mined. Some of those acres are within the Secretary's Area where valuable deposits of potash are not known to exist. On the other hand there are no other places to mine potash in these United States.

Proper conservation procedures call for the mining of potash and then the recovery of oil and gas.

RECOMMENDATIONS:

1. Present regulations should remain in effect.
2. Allow wildcat locations in the Secretary's Area when the well will not penetrate a valuable potash deposit.
3. Disallow any wildcat location that would penetrate a delineated, proven potash ore reserve.
4. Solve any disputes between oil and gas operators and potash producers by following the procedures set forth in the New Mexico Oil Conservation Commission Order R-111-A.

APPLICABLE REGULATIONS & HISTORY OF REGULATIONS:.

The current applicable regulations are the Order signed by the Secretary of the Interior, Stewart L. Udall, dated May 11, 1965, and the New Mexico Oil Conservation Commission Order R-111-A. The Secretary's Order of 1965 superseded an Order of 1951 which superseded an Order of 1939. In 1939, 42,245 acres were reserved from oil and gas leasing to protect the then-known potash deposits. In 1951 the area was increased to 298,345 acres with new rules which did not reserve any areas but put stipulations on the leases so that there would be no waste and no hazards would result from oil and gas activity. In 1965 the Secretary's Area was again enlarged; this time to 420,212 acres and the rules were modified somewhat, but the concept of no waste, no hazard, remained.

In 1951 the New Mexico Oil Conservation Commission issued Order R-111, which dealt with the rules concerning the area referred to by the Order as the Potash-Oil Area. This Order was revised as R-111-A in 1955. Extensions of the Area described in R-111-A have been made in Orders R-111-B through R-111-H. The main difference between the Federal Order and the State Order is the State established a procedure which requires the oil and gas operators to notify all potash lease holders within one mile of the proposed location of the intent to drill. If a potash lease holder within one mile of the proposed location has an objection to the location, an arbitration meeting is held to discuss the location. If agreement is not reached in the arbitration meeting, a full hearing is conducted before the Commission.

The Secretary of the Interior Order places the responsibility for the decision as to whether an oil or gas well will be approved upon the Regional Oil & Gas Supervisor of the Geological Survey. The Order calls for the Regional Oil & Gas Supervisor to take into consideration recommendations of the Regional Mining Supervisor of the Geological Survey and the applicable

conservation rules and regulations of the Oil Conservation Commission of the State of New Mexico. The Order states "no wells will be drilled for oil or gas except on the approval of the Regional Oil & Gas Supervisor of the Geological Survey, it being understood that drilling will be permitted only in the event that it is satisfactorily established that such drilling will not interfere with the mining and recovery of potash deposits or the best interests of the United States would best be subserved thereby." It further states "no wells will be drilled for oil or gas at a location which in the opinion of the Regional Oil & Gas Supervisor of the Geological Survey would result in undue waste of potash deposits or constitute a hazard to or unduly interfere with mining operations being conducted for the extraction of potash deposits." The Order places the responsibility for mining activities upon the Regional Mining Supervisor of the Geological Survey. The requirements are that no mining or exploratory operations will be conducted that in the opinion of the Regional Mining Supervisor of the Geological Survey would constitute a hazard to oil or gas production or that would unreasonably interfere with the orderly development and production under any oil or gas lease issued for the same land.

RULES REGARDING LEASING OF FEDERAL LANDS:

Potash leases may be obtained by one of two methods. If the land is in the Known Potash Area as described by the USGS, the land is available for competitive leases. Land outside the USGS Known Potash Area may be taken as a prospecting permit. These permits are issued for two years and if at least one test hole is drilled on the permit land, the prospecting permit may be extended for a period of two years. A permittee who discovers potash on a prospecting permit is entitled to a preference right lease. Leases are issued for an indeterminant period subject to readjustment at the end of the first 20 years.

There are two types of oil and gas leases. The first is known as a competitive lease. This is a lease covering land that is included within the known geologic structure and these leases can be obtained by competitive bidding in units of not more than 640 acres. Non-competitive leases are for areas that are not within a known geologic structure and are issued to the first qualified offerer, and may not exceed 2,560 acres. A maximum of 246,080 acres may be held by one company. A non-competitive oil and gas lease compares to a prospecting permit for potash. One of the main differences between an oil and gas lease and a potash lease is that potash must be proven or known to exist before a potash lease will be issued, whereas non-competitive oil and gas leases are issued whether oil and/or gas is known to exist or not. Another important difference is that potosh lease holders are restricted to a maximum of 25,600 acres, while oil and gas leasees may hold a maximum of 246,080 acres.

HISTORY OF POTASH IN NEW MEXICO:

The German potash industry was the major source of potash for American agriculture and industry until the outbreak of World War I. Loss of this essential commodity during the war and escalating potash prices by the German cartel emphasized the absolute necessity of discovering low-cost American reserves of this ore. After several years of exploration by both the USGS and by private industry, potash was identified in drill cutting from a well being drilled by Snowden & McSweeney Company near Carlsbad, New Mexico. Following the initial discovery in 1925, subsequent core drilling operation over a great many years has established the only significant potash reserve in the United States.

Seven companies are now in operation in the Carlsbad potash basin:

	Initial Production
Teledyne Potash Company (formerly United States Potash)	1932
Potash Company of America	1935
International Minerals & Chemical Corporation	1940
Duval Corporation	1952
Amax Chemical Corporation (formerly Southwest Potash)	1952
National Potash Company	1957
Kermac Potash Company	1965

Two types of potash ore are mined in the Carlsbad basin. The primary potash ore contains the potassium chloride mineral called sylvite. This mineral is mined by all producers in the basin and is also being mined from the vast Canadian ore deposits. In addition to sylvite, a double salt of potassium magnesium sulphate, called langbeinite, is being mined by two companies,

Duval and IMC, in the southern portion of the Secretary's area, to supply the rapidly increasing market demands for animal feed ingredients and for chloride-free fertilizers containing the essential ions of both magnesium and sulphur. The langbeinite deposits, covering a small section of the Secretary's Area, are the only known commercial reserves in the Western Hemisphere, and possibly the only commercial reserves in the world.

The Secretary of the Interior issued an Order in 1939 which reserved the known potash deposits from oil and gas leases. The successful exploration for potash in the late 1940's made it quite clear that the area reserved by the Secretary's Order of 1939 was not large enough to protect the potash deposits. As a consequence and after some controversy between the two industries, the Secretary issued an Order in 1951 which increased the area of the 1939 Order seven-fold. However, a new approach was taken that would allow oil and gas leasing in the area with stipulations that drilling would not be permitted if it would result in undue waste or result in a hazard to any of the potash deposits. This same year, the New Mexico Oil Conservation Commission issued its Order R-111, which was designed to allow for both potash and oil and gas production from the area described in that Order, yet giving the Commission the power to determine which wells would be drilled as to best conserve both minerals. It seems quite clear, in both the Federal Order and the State Order, that deposits of oil and gas, as well as deposits of potash, should be protected and not interferred with by exploration for the other. Both Orders refer to the orderly development and production of oil and gas and not the exploration for oil and gas. It seems clear that potash deposits as well as mines should be protected from exploratory wells for gas and oil. The potash deposits which the US government was attempting to protect from undue waste remain to be the only potash deposits in the United States to be successfully and economically mined.

In 1955 the Oil Conservation Commission of the State of New Mexico issued Order R-111-A as an Order revising Order R-111. Since that time various Orders, R-111-B through R-111-H, have amended the area described in R-111-A. The objectives of those rules and regulations were to prevent waste, assure maximum conservation of the oil, gas, and potash resources and permit the economic recovery of said minerals within the defined area.

Cooperation between the potash and petroleum industries has been extremely good until recent months. Since 1955, 122 oil and/or gas wells have been drilled within the R-111-A area without protest from the potash operators. Similarly, the petroleum industry has accepted suspension of some 64 Federal oil and gas leases totaling 19,380 acres where well locations would have constituted a hazard to mining operations or potash deposits.

Only in six cases have the potash lease holders and the oil and gas lease holders been unable to reach an agreement, thereby resulting in hearings before the New Mexico Oil Conservation Commission. On five of these occasions the disputed location was on Federal lands. There has been an unwritten agreement between Federal and State officials that the procedures set forth in Order R-111-A would be followed since it called for a hearing where both sides could present their testimony. Although conducted by the chairman of the OCC, the USGS officials have always played a large part in making the decisions by offering advice and, in earlier cases, testimony.

Although profits have been reduced and increased efficiencies have been necessary to remain in operation, the New Mexico potash industry is a viable part of the economy and will remain so for many years if offered adequate protection for its reserves.

REVIEW OF CASES HEARD BY THE OIL CONSERVATION COMMISSION:

In the New Mexico Oil & Gas Association report presented to the Secretary, many assumptions were made to support the contention that oil and gas wells would pose no interference or hazard to the potash industry. Expert testimony by both potash industry engineers with many years of actual experience and by eminent consulting engineers and USGS officials, such as Don Libbey and Bob Fulton from the USGS, Daniel M. Bass, Jr., Petroleum Department Head at the Colorado School of Mines, Mr. J. W. Woomer, recipient of the AIME Man of the Year Award, Lewis C. Raymond with Ford, Bacon & Davis, and John Boyd, an independent consultant, tend to discount many of these assumptions. In the six cases heard before the OCC, these witnesses have established the following facts that must be given careful consideration:

1. An oil and/or gas well presents a hazard, in that no guarantee can be given that gas or oil will not escape and leak into the potash deposits. Even an abandoned or non-commercial gas well could have enough pressure to result in a leak. There can be no question of the danger that results from methane gas in a mining atmosphere. Any student of mine disasters is well aware of the many catastrophes caused by methane explosions. Although most of these disasters have occurred in coal mines, a methane explosion in the Texas Gulf & Sulphur Cane Creek potash mine resulted in several deaths and the subsequent gassy-mine classification. High production costs materially increased by gassy-mine classification eventually resulted in termination of underground operations. No gas or oil operator will agree to guaranteeing that gas will not escape from one of their wells, thereby resulting in extreme hazards to anyone mining through those deposits. Potassium deposits in Carlsbad are methane free and the potash producers and their employees are emphatic in maintaining that condition. In addition to the unwarranted hazards, the high capital requirement for conversion to gassy mine conditions and high operating costs would result in the closure of some of the potash mines.

2. When such a well exists and mining is carried on around it, the mine operator must leave protective pillars around the well. This consists of a solid pillar around the well of a minimum radius of 100 feet. In some cases, operators have indicated a larger radius would be required. Secondary mining cannot be completed for a distance from the well equal to the depth of the potash deposit. This results in a waste of potash ore. The resultant waste will vary with the depth of the deposit and the strength of the ore; that is to say, whether the ore is primarily a sylvinite or langbeinite ore. In the recent IMC-Phillips Petroleum case, testimony showed that the potash which would have to be left because of a gas well would have the value of approximately $9,000,000.

3. State and Federal lands must be treated in a like manner as they adjoin each other and the efficient recovery of any ore deposit or oil and gas reservoir will, at times, require development of both State and Federal lands.

4. The salt section containing the potash reserves contains permeable members that can be charged with gas leaking from ruptured or perforated casings.

The information leading to the establishment of the above facts has been attested to by many prominent mining people throughout the history of the OCC hearings. In 1956, in the OCC hearing concerning Case #1130, testimony was given relating to the pillar-pulling experience at the US Potash mine and of the extensive records that had been kept of the measurements, both underground and on the surface, to delineate subsidence. Information from US Potash, who at that time had more pillar-pulling experience than any of the other potash operators, proved the subsidence angle to be 45°. In addition, the USGS testified as to the government requirements of 100-foot solid pillar with no pillar pulling or secondary mining within a radius of 750 feet. At the requested location, the potash depth was 750 feet.

In April 1957, OCC Cases #1233 and #1234 concerned locations requested by Yates and Carver on land owned by Southwest Potash. Southwest Potash engineers testified to the effect of subsidence at the Southwest Potash mine. Pictures taken in a timed sequence of pillars underground gave pictorial proof of the massive forces at work when pillars left were squeezed down showing the effect of subsidence in an area where second mining had taken place. Pictures of large surface cracks as a result of secondary mining were shown indicating the subsidence line as it appeared and the results of this subsidence on the surface.

In 1964 Case #3029, when Pan American Petroleum Corporation had requested a location in a deposit owned by PCA, expert testimony substantiated the danger of gas wells in potash deposits and the 45° subsidence line. Lewis C. Raymond, a consultant with the firm of Ford, Bacon & Davis, testifying for Pan American, also stated that pillar pulling would not be allowed around an operating well. Lowell Page, Senior Geologist for United States Potash, testified that the Washington office of the USGS would not allow pillar pulling within 1,250 feet of the US Potash #1 & #2 shafts, where the deposit was 1,000 feet deep.

In February of this year, John Boyd, an independent consulting mine engineer of the John Boyd firm, testified in the IMC-Phillips case as to the danger of a gas well located in a potash deposit and testified from his firm's own studies that subsidence would result in failure of casing and that the subsidence would be in effect for an angle of 45° and that prudent mining procedures would call for protective pillars around any oil or gas well.

Although conducted by the New Mexico Oil Conservation Commission, cooperation between State officials and the USGS officials has been noted in each of the cases. John Anderson, former Regional Supervisor for Oil & Gas for the USGS, in 1961 suggested at the end of the hearing on Case #2432 an unorthodox location which would move the proposed location further

from PCA's projected ore line. The decision by the OCC followed Mr. Anderson's suggestion. In the 1964 hearing between Pan American and PCA, Mr. Fulton of the USGS made a statement at the conclusion of the hearing that the well, in his opinion, should not be allowed. Mr. John Anderson stated that although the proposed location was on State land, proper development would require locations on Federal lands. He urged the Commission to disallow the location. The decision of the Commission followed the request of Mr. Fulton and Mr. Anderson.

In the years of successful potash mining in the Carlsbad basin, many records have been kept and many facts have been established. The complete mining of a potash deposit requires secondary mining. The proper conservation of such deposits requires secondary mining. It is a policy of the USGS in carrying out their responsibilities of conservation of this valuable ore to require efficient and complete mining as safely as possible. The subsidence that is a result of secondary mining cannot be questioned. The records and measurements that have been kept and studied by competent mining engineers at the potash properties have shown the subsidence angle to be 45°. The effects of the subsidence not only underground but also on the surface are a documented matter of record. Independent, nationally-known consulting mining engineering firms have made studies and have found and have so testified in hearings before the OCC that subsidence does take place and does result in a subsidence angle of 45°.

There has been much said about the possibilities of gas escaping from an oil or gas well. There is ample proof that this can and has happened. In Case #862 before the New Mexico Oil Conservation Commission, Mr. S. J. Stanley, an engineer for the Commission, stated:

> "It has been definitely proven in the oil business that the salt section is charged in the Monument and Hobbs pool and charged with gas. The charging of oil and gas in these pools was probably man-made by casing leaks. The point I am trying to make is that I feel porosity and permeability

exist in the salt section throughout Lea County, that the extent of charging the zone, and that is the salt zone, from one well would depend on the amount of gas present and, of course, the pressure of that particular gas."

To assume gas leaking from a casing would follow the hole to the surface and escape by that route as opposed to permeating a potash deposit is pure speculation. It is well known that although casing schedules may be improved, procedures for cementing and plugging may be improved, and elaborate testing valves may be installed, things often happen that are not planned. The business of Mr. Red Adair is based on accidents. Blow-outs can and do occur. Contention that pressure monitors on production wells will detect casing leaks and thereby offer protection to the potash deposits is valid only for major breaks that could well saturate the deposit before preventive measures could be taken. Equally or possibly even more hazardous conditions could be created by small casing leaks, undetectable by pressure monitors, which could saturate an unmined reserve over a period of time. If a gas or oil well exists, there is the possibility that gas could escape from such well, resulting in the extreme hazard of methane in a mine atmosphere. The industry and its employees are unwilling to take this risk.

It seems ironic that in the face of the multitude of new and restrictive Federal Mine Safety Laws initiated by catastrophes resulting from methane explosions, the potash industry is now called upon to defend its contention that gas and oil exploration through methane-free reserves constitutes an unwarranted hazard to both the life and economic well-being of the potash industry and its employees.

CURRENT CONTROVERSY BETWEEN POTASH AND OIL & GAS INDUSTRIES:

In September 1972, El Paso Natural Gas Company requested a location in Section 29, T23S, R31E. The location was protested by Teledyne Potash. An arbitration meeting was conducted in the offices of the USGS in Roswell, New Mexico, by Mr. Pete Porter, Chairman of the New Mexico Oil Conservation Commission. Although agreement was not reached, and a hearing should then have been held before the Oil Conservation Commission, the location was approved by the USGS. This was in variance with past accepted procedures and was a matter of great concern to the potash producers.

Following the decision on the El Paso Natural Gas Company well, Phillips Petroleum Company immediately requested a location in Section 13, T23S, R30E. The location was protested by International Minerals & Chemical Corporation since it would have penetrated the heart of a high grade langbeinite reserve. An arbitration meeting was conducted and as with the El Paso well, no agreement was reached. This time, however, the past accepted practice of following the procedure set forth in R-111-A was followed and a hearing was held before the OCC on February 21, 1973. The evidence presented at that hearing resulted in a decision by the OCC to disallow the location. This decision was in keeping with past decisions of the OCC in cases held in the 1950's and early 1960's. Phillips has now filed suit in District Court to overrule this decision.

Immediately following the OCC decision on the Phillips well, the Oil & Gas Association of New Mexico initiated a hearing before the Department of the Interior protesting recent OCC rulings. Apparently the Oil & Gas Association felt as though the past policies of the OCC, that have successfully governed the operation of both potash and oil for many years, have been modified to favor the potash industry. In their resolution submitted to the Department of the

Interior they state:

> "Whereas not withstanding such intent it now appears that a policy or practice has been formulated and put into effect whereby the development of potash deposits are being given preferential treatment over oil and gas deposits and the owners of oil and gas leases within the potash area are being denied approval of many well locations projected to test and develop oil and gas deposits lying at depths greatly in excess of the formation in which potash deposits occur..."

The potash industry does not object to oil and gas exploration in the potash area. We object only to those wells that would penetrate an established ore reserve or wells that are drilled in such close proximity to a reserve so as to constitute a hazard to the recovery of an established potash reserve. As stated previously, 122 oil and gas wells have been drilled since 1955 in the R-111-A areas without protest from the potash industry.

Concurrent operations in the Secretary's Area to the potash producers means that within the Secretary's Area there will be potash mining and oil and gas wells. The potash producers and the decisions handed down in the few cases where agreement could not be reached have shown that concurrent operations has never meant oil and gas wells and mining for potash could be conducted at the same time in the very same area.

The Oil & Gas Association, when being denied a location for a wildcat well on a non-competitive lease that is not within a known geologic structure, but is within a proven potash deposit, would point to the Secretary's order and claim that they were being unreasonably prevented from orderly development and production of their lease. A wildcat well cannot be considered orderly development and production.

The Oil & Gas Association has pointed to the closing of four potash mines as an indication that economic conditions are very poor and the potash producers are going out of business. The Wills-Weaver and the Saunders mine of the Duval Corporation were closed because the ore deposit was mined out. This is the same as shutting down a well after all the oil or gas has been recovered. Because Phillips Petroleum has completed the recovery of a particular reservoir does not mean that Phillips Petroleum is going out of business. In fact, the Duval Corporation has sunk two new shafts and is recovering ore from their Nash Draw mine. The Lea mine of National Potash was temporarily shut down to concentrate on recovering the ore from the Eddy mine. Teledyne #3 mine was shut down for the same reason as the Duval mines: the deposit of ore for which the #3 shaft was sunk to recover has been recovered. National Potash plans to reopen the Lea mine in the near future and IMC will be required to sink a new shaft for future recovery of high grade langbeinite ore.

The Oil & Gas Association has stated that the rules of the Commission are strict with respect to running and cementing of casing and testing when wells are drilled in the potash area through the salt or potash formation. They have stated this method of completion of wells has so far proven very satisfactory and has never been questioned by the potash companies. The fact is, in each of the cases heard before the Oil Conservation Commission, one of the prime concerns of the potash company has been the ability of the oil and gas operators to guarantee that the cementing and casing of wells would not result in oil or methane migrating to the potash beds.

The Oil & Gas Association has stated that it would appear that the only limitation on drilling wells for oil and gas under the regulations is where such drilling would interfere with mining operations being conducted. It would appear to them that there is no limitation on drilling when it will not interfere with actual mining operations being carried on. When in fact, the

regulations state no wells will be drilled for oil and gas except upon approval of the Regional Oil & Gas Supervisor of the Geological Survey, it being understood that drilling will be permitted only in the event that it is satisfactorily established that such drilling will not interfere with the mining and recovery of potash deposits. A gas well which produces for ten years can result in interference with mining and recovery of potash deposits that do not start in that area for a period of five to eight years from the time the well was first drilled. The regulations further state no wells will be drilled for oil or gas that would result in undue waste of potash deposits or constitute a hazard to mining operations. It does include interference with mining operations being conducted. If, however, the restrictions for oil or gas wells were held to areas presently being mined, potash deposits that are to be mined in the near future would have no protection whatsoever. Certainly mining through an area where an oil or gas well is located will result in undue waste and interfere with the mining and recovery of said potash deposits and could result in a hazard to the operation of the mine and to the miners who work the mine.

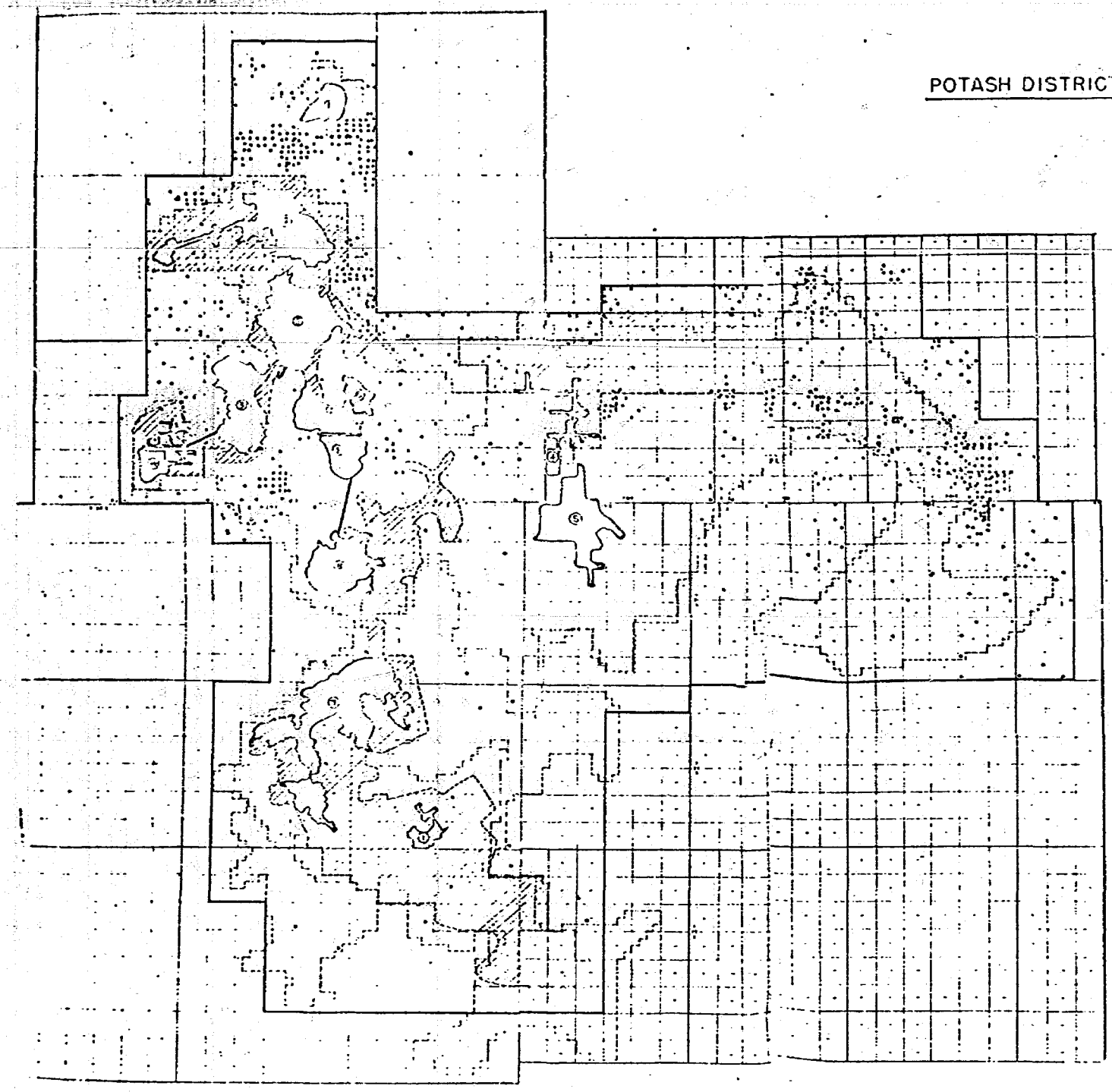
Federal regulations allow for suspension of oil and gas leases when drilling is denied. This is an important consideration to the oil and gas lease holders. Non-competitive gas leases may be held for a period of ten years with no exploration and no expense whatsoever to the oil and gas leasee. If after ten years oil or gas is not being produced from the lease, the lease must be given up by the lease holder. If this lease is suspended, the lease holder does not lose his lease after ten years and he is allowed to retain the lease at no rental costs whatsoever. The Oil & Gas Association has stated the potash companies can obtain suspension of their leases when the drilling of wells for oil and gas would interfere with projected development of the potash area. This is not quite the same, however, as potash leases are not for ten years and are not even issued unless it has already been proven that the area contains a potash deposit. The potash lease holder is limited to 25,000 acres and cannot afford to have much of this area held in suspension. Whereas

the oil and gas lease holders are allowed by the government to hold almost ten times this amount and, therefore, a suspension would not materially affect the area in which they have to explore.

Potash mines and refineries cannot be moved around like an oil well rig. The initial investment required by a potash operation is in the neighborhood of 50-70 million dollars before production can begin. He must have sufficient, protected reserves to earn a return on his capital. Once ore is bypassed the extreme cost of returning (if physically possible) to a bypassed area could very well prevent the recovery of that ore.

The Oil & Gas Association has suggested that American potash is not important because of high grade deposits in Canada. Although a similar rationalization could be drawn with the vast oil and gas reserves in the Near East, it is sufficient to say that past experience emphasizes the danger in this concept.

POTASH DISTRICT - SOUTHEASTERN NEW MEXICO



LEGEND

- OIL OR GAS WELL LOCATION

- OPEN MINE WORKINGS:
  1. DUVAL
  2. AMAX
  3. PCA
  4. NATIONAL
  5. KERMAC
  6. TELEDYNE
  7. IMC

- APPROXIMATE ORE RESERVES, WITHIN LEASED AREAS *

- SECRETARY OF INTERIOR - POTASH AREA

- U.S.G.S. KNOWN POTASH AREA

- H.M.O.C.C. R-111-A AREA

* DATA SUPPLIED BY 5 OPERATING COMPANIES. ESTIMATED ORE RESERVES FOR TELEDYNE, RESERVES FOR KERMAC & NON-OPERATING COMPANIES ARE NOT SHOWN.

United States Department of the Interior

GEOLOGICAL SURVEY
12201 SUNRISE VALLEY DRIVE
RESTON, VIRGINIA 22092

FEB 15 1974

Memorandum

To: Secretary of the Interior
Through: Assistant Secretary - Energy & Minerals
Acting

From: Director, Geological Survey

Subject: Drilling of oil and gas tests in the Secretary's Potash Area, New Mexico

As you will recall, several recent controversies as to whether to permit the drilling of certain oil and gas tests in the Secretary's Potash Area precipitated a review of Departmental policy with respect to operations in this multiple use area.

The Conservation Division has now completed its study of the situation. Items such as (1) the stated position of the potash and oil and gas industries; (2) past approval actions; (3) the need to maintain a harmonious relationship with the State of New Mexico; (4) the Nation's requirements for additional energy sources; and, (5) the conservation of our most important domestic potash supply have been considered. Based on this study, the Chief, Conservation Division believes that action is required if we are to avoid similar conflicts in the future, and the Division has made certain recommendations as set forth in the enclosed memorandum.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. III
Submitted by Kerr-McGee
Hearing Date 3-15-74

III not admitted

If you concur in these recommendations, please indicate in the space provided, and the Conservation Division will prepare the necessary implementation papers.

Acting Director

Determination is hereby made that adoption of the recommendations contained in Chief, Conservation Division's memorandum of February 14, 1974, would be in the public interest and authority to proceed as recommended is hereby granted.

Date MAR 1 1974

SIGNED, JOHN C. WHITAKER

Acting Secretary of the Interior

Enclosure

4

200643

United States Department of the Interior
GEOLOGICAL SURVEY
12201 SUNRISE VALLEY DRIVE
RESTON, VIRGINIA 22092

FEB 14 1974

Memorandum

To: Director, Geological Survey

From: Chief, Conservation Division

Subject: Drilling of oil and gas tests in the Secretary's Potash Area, southeastern New Mexico

By order of October 16, 1951, the Secretary of the Interior delineated an area embracing 298,345 acres in southeastern New Mexico as a designated potash area. This order revoked the Secretary's Order of February 6, 1939, thereby eliminating the ban on oil and gas leasing which had been in effect on 42,235 acres of these same lands. Since that time, there have been periodic differences of opinion between the potash mining companies and the oil industry as to whether a particular oil and gas well should be drilled in the Area. Secretarial Order of May 11, 1965, expanded the Secretary's Potash Area to include 420,212 acres and eased some of the restrictions previously imposed on oil and gas drilling in the Area. The discovery and development of extensive and very valuable langbeinite potash deposits, and the currently escalating price of oil and gas which has given impetus to exploratory activity in the Area by the oil and gas industry have resulted in a situation where conflicts of interest between the two industries are inevitable. In each of the several recent controversies, neither side has seemed willing to compromise, and each new confrontation appears to magnify the differences of opinion.

As to Federal lands in the Secretary's Potash Area, the Area Oil and Gas Supervisor, in consultation with the Area Mining Supervisor, is charged with the responsibility of deciding which proposed oil and gas tests may be drilled. These have never been easy decisions, but with today's energy shortage and the need to protect our most important source of domestic potash, these decisions have become more difficult.

Accordingly, a complete policy review was initiated in April of 1973. As a part of this study, Assistant Secretary Wakefield and other Departmental representatives met with delegations from the New Mexico Oil and Gas Association and the seven potash operating companies in

Washington, D.C., on May 8 and August 7, 1973, respectively. The Area Oil and Gas Supervisor and the Area Mining Supervisor reviewed the position documents presented by both industries and submitted a joint report dated August 24, a copy of which is enclosed. The Conservation Manager, Central Region, supplied his comments and recommendations in a memorandum of September 6, a copy of which is also enclosed.

The results of this study indicated that action should be taken to assure that the decisions of our Supervisors reflect Departmental policy, are made as fairly as possible, result in proper conservation of both of these important mineral resources, and do not unduly impede the development of either resource. It was concluded (1) that certain facets of Departmental policy affecting operations in the Secretary's Potash Area should be reaffirmed; (2) that more clear-cut procedures to assist the two Supervisors in their decision-making processes should be adopted; and (3) that guidelines to implement the new procedures should be developed. Based on these conclusions, certain proposed recommendations were submitted for your consideration by our memorandum of December 7, 1973, and, upon your concurrence, those recommendations were forwarded by memorandum of December 10 to the Office of the Assistant Secretary - Energy and Minerals for further consideration. Subsequently, copies of the December 7 memorandum were furnished to representatives of the New Mexico oil and gas and potash industries for their review. On January 31, Deputy Assistant Secretary Rigg and other Departmental personnel conducted a meeting in Albuquerque, New Mexico, to discuss the proposed new procedures. Approximately 50 people attended the meeting, of which 35 were representatives of the two industries. A copy of the attendance list is enclosed. The discussions at that meeting were very productive. They not only disclosed the need for revision of some segments of the proposed procedures but also seemed to promote a spirit of cooperation between the two industries. As a result of this further review, we now recommend that:

Part 1. The Department reaffirm its position that the Secretarial Order of May, 1965, adequately protects the rights of the oil and gas and potash industries. However, the Area Mining Supervisor is to initiate action to bring about the expansion of Secretary's Potash Area to include those known potash deposits in T. 22 S., R. 31 E., T. 23 S., Rs. 29 and 31 E., and T. 24 S., Rs. 30 and 31 E., N.M.P.M., presently outside the designated Area.

Part 2. Each potash lessee will be required by April 15, 1974, to file with the Mining Supervisor a map or maps on which has been delineated the following information with respect to the Federal potash leases which it then holds:

a. The areas where active mining operations are now in progress on one or more ore zones.

b. The areas where mining operations have been completed on one or more ore zones.

c. The presently unmined areas which are considered to contain a minable reserve in one or more ore zones, i.e., those areas (enclaves) where potash ore is known to exist in sufficient thickness and quality to be minable under present day technology and economics.

d. The areas within these enclaves which are believed to be barren of commercial ore.

These maps are to be updated effective January 1, 1975, and thereafter on an annual basis. The Area Geologist, in consultation with the Mining Supervisor, will prepare the data required in subparts c. and d. above for unleased Federal lands in the Secretary's Potash Area.

The potash lessee will be responsible for submitting sufficient data to justify any area which is proposed as a minable reserve. The Area Geologist, in consultation with the Mining Supervisor, will review the information furnished in this regard and make any revision in the boundary of a proposed minable reserve (potash enclave) which is considered to be consistent with the data available at the time of each such analysis. All maps which are developed pursuant to this Part will be updated between the required revision dates whenever new information becomes available.

The Area Geologist and the Area Mining Supervisor will complete the analysis of the initial data supplied by the potash lessees and commit their total findings to a map or maps of suitable scale by June 1, 1974. These maps will be revised as necessary to reflect the latest available information. Copies of such map(s) will be available to all interested parties through map reproduction companies located in Roswell, New Mexico.

Part 3. After April 15, 1974, it will be Departmental policy to deny approval of most applications for permits to drill oil and gas tests from surface locations within the potash enclaves established in accordance with Part 2 hereof. Two exceptions to this policy will be permitted under the following conditions:

a. Drilling of vertical or directional holes will be allowed to take place from barren areas within the potash enclaves when the Mining Supervisor determines that such operations will not adversely affect active or planned mining operations in the immediate vicinity of the proposed drillsite.

b. Drilling of vertical or directional holes will be permitted to take place from a drilling island located within a potash enclave when: (1) there are no barren areas within the enclave or drilling is not permitted on the established barren area(s) within the enclave because of interference with mining operations; and, (2) the objective oil and gas formation beneath the lease cannot be reached by a well which is vertically or directionally drilled from any permitted location within the barren area(s); or, (3) in the opinion of the Oil and Gas Supervisor, the target formation beneath a remote interior lease cannot be reached by a well directionally drilled from a surface location outside the potash enclave. Under these circumstances, the Mining Supervisor will, in consultation with the Oil and Gas Supervisor, establish an island within the potash enclave from which the drilling of that well and subsequent wells will be permitted. The Mining Supervisor in establishing any such island will, consistent with the data supplied by the Oil and Gas Supervisor regarding present directional drilling capabilities, select a site which will minimize the loss of potash ore. No island will be established within one mile of any area where approved mining operations will be conducted within three years. To assist the Mining Supervisor in this regard, he may require potash mining operators to furnish a three-year mining plan.

Part 4. In order to protect the equities between oil and gas lessees while at the same time reducing the number of oil and gas wells which operators propose to drill in the Potash Area, the Oil and Gas Supervisor will make greater use of his prerogative to require unitization. Unitization will be mandatory in those cases where completion of the proposed well as a producer would result in the drainage of oil and gas from beneath other Federal lands within a potash enclave. In other words, unitization will be a prerequisite to the approval of any well which is (1) located adjacent to an enclave (within a quarter of a mile if an oil test or one-half mile if a gas test) and which is to be drilled vertically to the prospective formation; (2) to be directionally drilled from an adjacent surface location to bottom in a formation beneath an enclave; or (3) to be vertically or directionally drilled from a barren area or island within an enclave.

Part 5. The Department reaffirm its intent to cooperate with the New Mexico Oil Conservation Commission (NMOCC) in the implementation of that agency's rules and regulations. In that regard, the potash lessees shall continue to have the right to protest to the NMOCC the drilling of a proposed oil and gas test on Federal lands provided that the location of said well is within the State of New Mexico's "Oil-Potash Area" as that Area is delineated by NMOCC Order No. 111, as amended.

Part 6. The Department reassert its prerogative to make the final decision of whether to approve the drilling of any proposed well on Federal oil and gas leases within the Secretary's Potash Area.

Part 7. Applications for permits to drill vertical tests for oil and gas at locations that are in the Secretary's Potash Area but outside the State of New Mexico's Oil-Potash Area and which do not directly offset an enclave (within a quarter mile if an oil test or within one-half mile if a gas test) will be routinely approved by the Oil and Gas Supervisor after review by the Mining Supervisor.

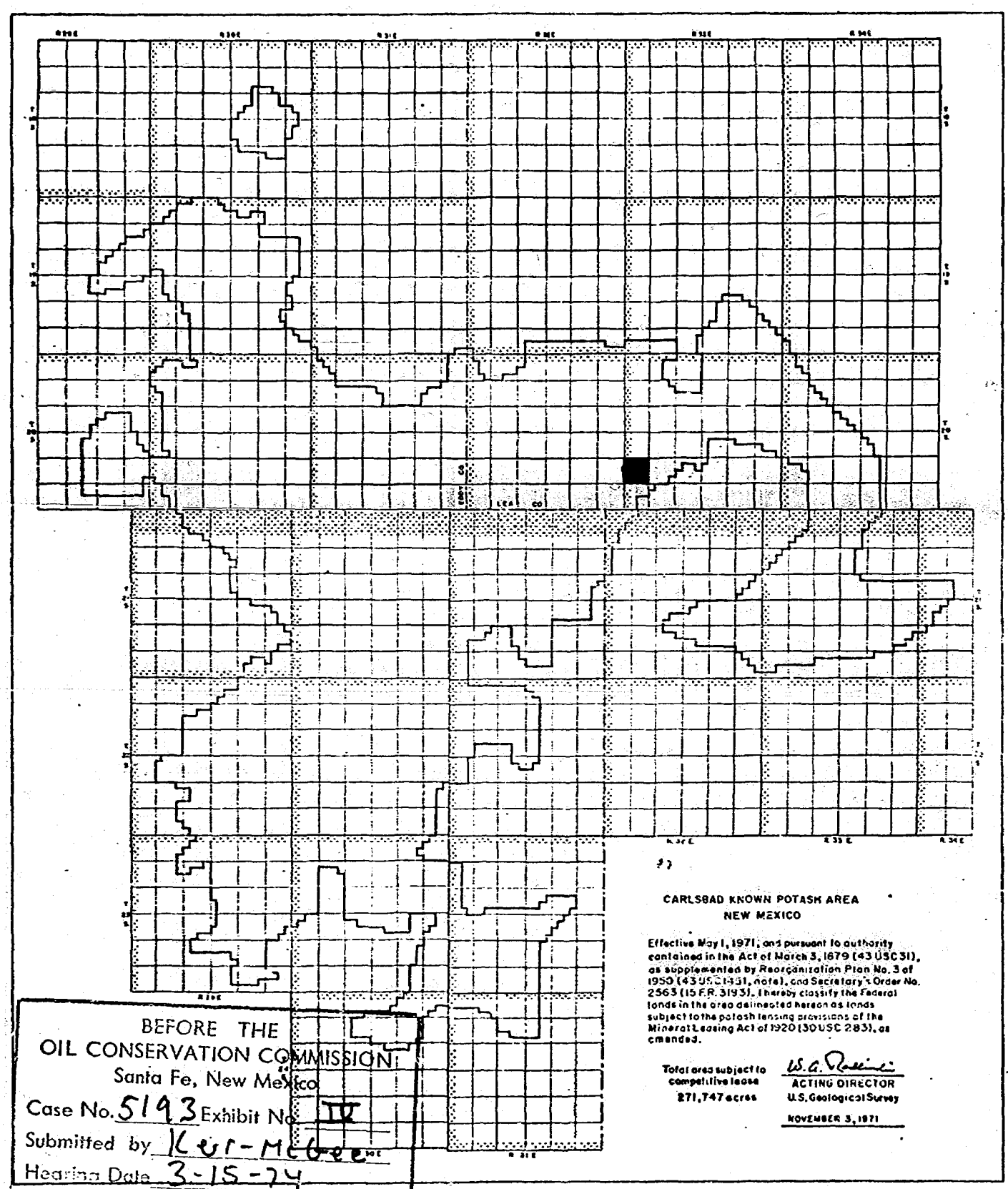
Part 8. Future controversies as to whether to permit the drilling of an oil and gas test in the Secretary's Potash Area which cannot be resolved in the field are to be referred to the Chief, Conservation Division, with a recommendation from the Regional Conservation Manager.

If these recommendations meet with your approval, we suggest that this memorandum be sent to the Assistant Secretary - Energy & Minerals for review and the subsequent authorization of the Secretary of the Interior to proceed as recommended.

Russell G. Wayland

Chief, Conservation Division

Enclosures



CARLSBAD KNOWN POTASH AREA
NEW MEXICO

Effective May 1, 1971, and pursuant to authority contained in the Act of March 3, 1879 (43 USC 31), as supplemented by Reorganization Plan No. 3 of 1950 (43 USC 1451, note), and Secretary's Order No. 2563 (15 F.R. 3193), I hereby classify the Federal lands in the area delineated hereon as lands subject to the potash leasing provisions of the Mineral Leasing Act of 1920 (30 USC 283), as amended.

Total area subject to competitive lease
271,747 acres

W. A. Radinovich
ACTING DIRECTOR
U.S. Geological Survey

NOVEMBER 3, 1971

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. IV
Submitted by Kerr-McGee
Hearing Date 3-15-74

EXHIBIT IV

file

KERR-McGEE

P. O. BOX 610 • HOBBS, NEW MEXICO 88240

January 22, 1974

Chief Engineer
Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico 87501

Re: Oil Conservation Commission, Order No. R-111 A, Map of Potash Lease Holdings and Five-Year Development Plan

Dear Sir:

Attached are two copies of a map showing the outline of our Federal and State Potash Leases in Lea and Eddy Counties. In addition, you are being furnished with two copies of a map showing lands that will be developed by Kerr-McGee Corporation during the next five years.

Yours very truly,

KERR-McGEE CORPORATION

By: R. H. Lane

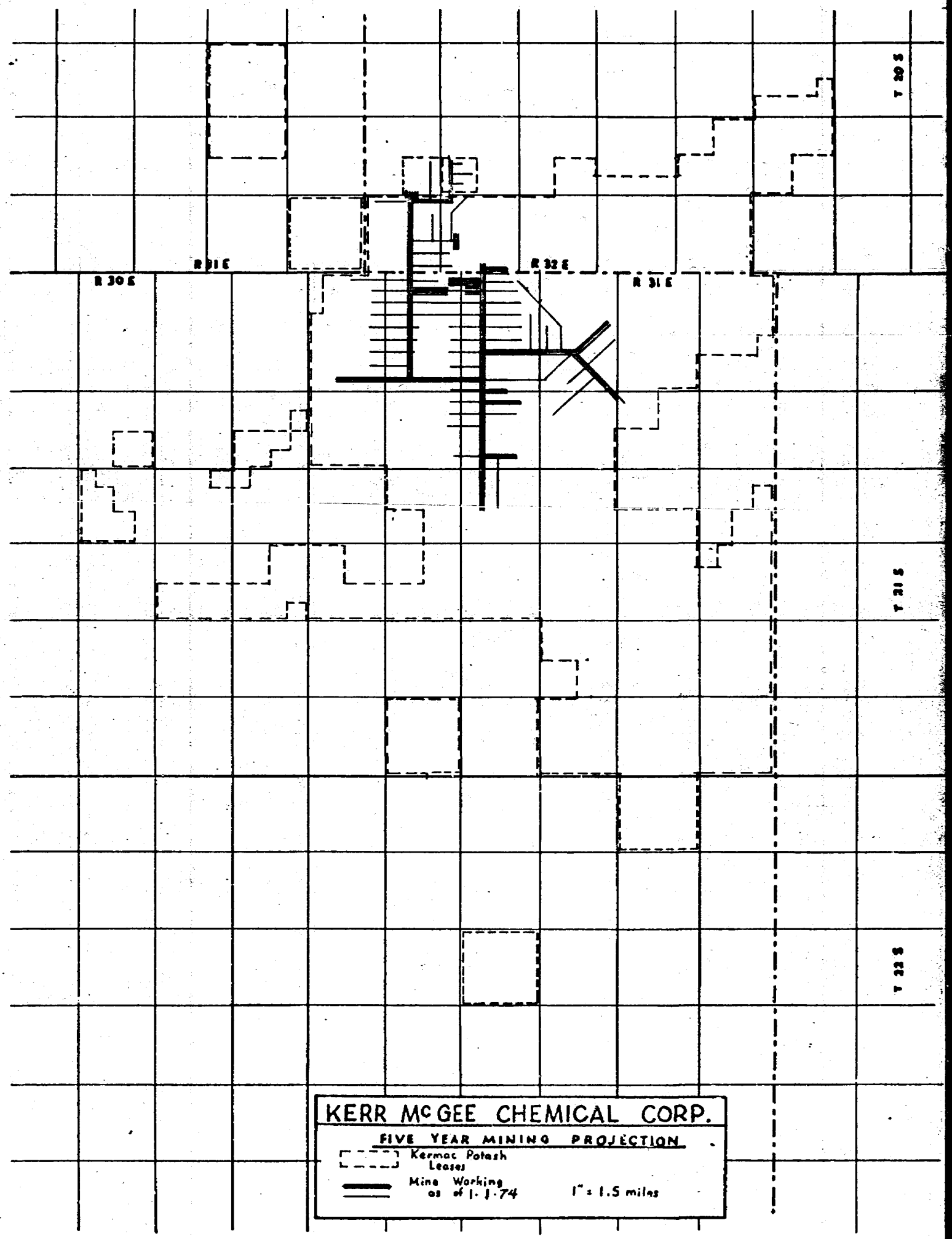
R. H. Lane

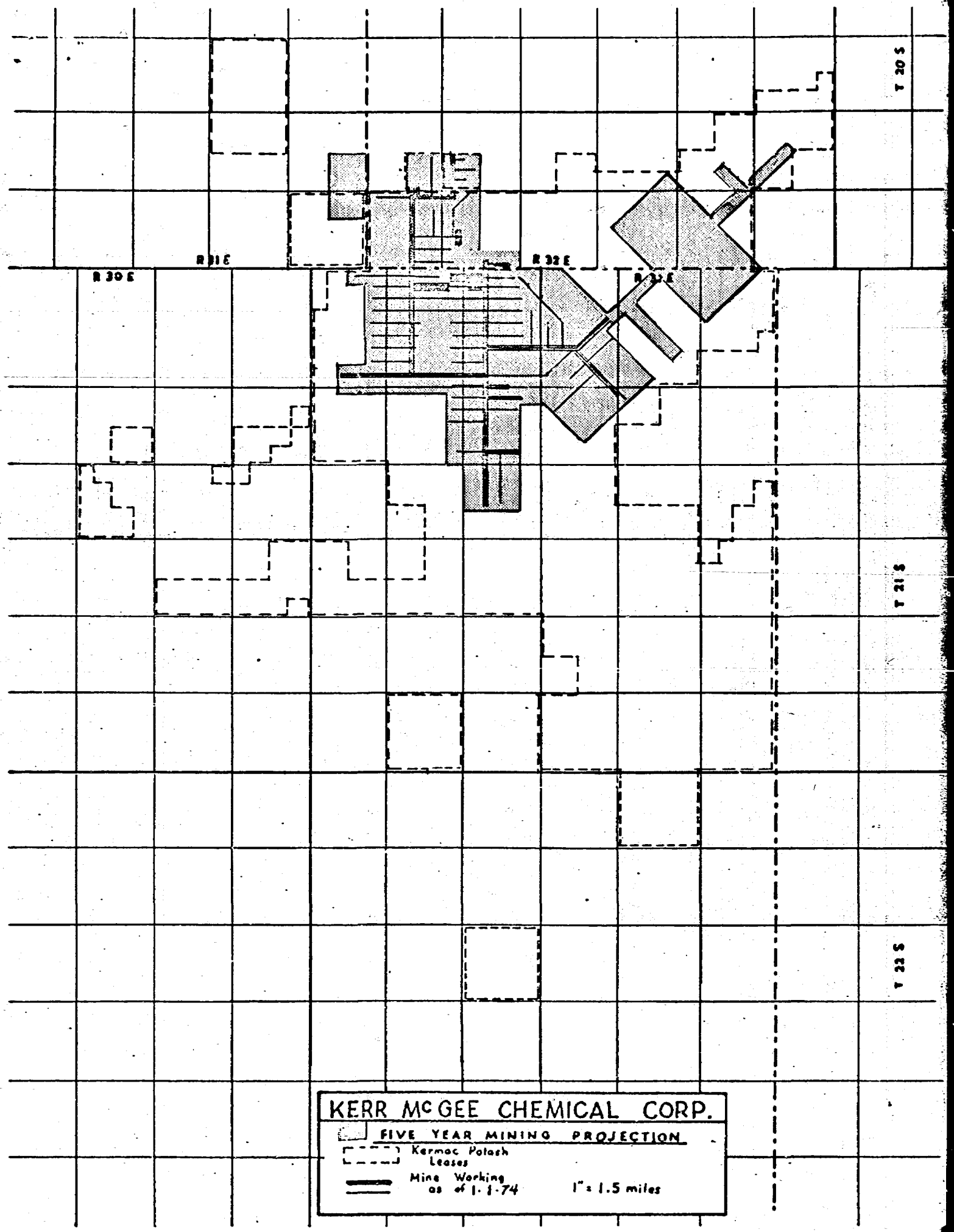
RHL:bd

cc: G. R. Cochran - Oklahoma City
L. E. Craig - Oklahoma City
w/Attachment

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. VI
Submitted by Kerr-McGee
Hearing Date 3-15-74

EXHIBIT VI


R 30 E
R 31 E
R 32 E
R 31 E
T 20 S
T 21 S
T 22 S
KERR McGEE CHEMICAL CORP.
FIVE YEAR MINING PROJECTION
Kermac Potash Leases
Mine Working as of 1-1-74
1" = 1.5 miles


R 30 E
R 31 E
R 32 E
R 33 E
T 20 S
T 21 S
T 22 S
KERR McGEE CHEMICAL CORP.
FIVE YEAR MINING PROJECTION
Kermac Potash Leases
Mine Working as of 1-1-74
1" = 1.5 miles

DATA SHEET

U.S.P. Hyl Core Test

Well:	USP No. 141, Permit N.M. 0482
Location	2523 ft. from north line 2933 ft. from east line Section 29, T20S, R33E, N.M.P.M., N.M. Lea County
Elevation:	3584 ft. above sea level
Total Depth:	2503 ft.
Type Well:	Rotary Rock bit : 0' to 1532' Cored : 1532' to 2503'
Size Hole:	6" hole surface to 1532 ft. 4" hole 1532' to 2503 ft.
Drilling Contractor:	Joy Manufacturing Co.
Casing Record:	4" casing set to 1532' and all casing recovered
Drilling Record:	Began September 1, 1954 Completed October 8, 1954

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. VIII-A
Submitted by Kerr-McGee
Hearing Date 3-15-74

VIII-A

REPORT ON DRILLING

USP 141 CORE TEST

USP 141 core test is located in the southwest quarter of the northeast quarter of Section 25, Township 20 south, Range 33 east, Lea County, N.M.P.M., N.M. This test was located on Permit III 0432 which was required from the National Potash Union. This eastern potash core test is 2.32 miles south of USP 139 core test, 2.21 miles southeast of USP 127 core test, and 1.02 miles west of U.S.G.S. 17 core test. The primary prospecting objective of USP 141 core test was to explore the bed No. 1 ore potential which was found to be present in commercial grade and thickness.

Bed No. 4 was cut from 2429'10" to 2436'9" and carries no sylvite. This 6'11" interval averages 0.36% K_2O

Scattered sylvite, carnallite and kieserite mineralization was found between the upper carnallite stray zone down to Anhydrite "A". Langbeinite was found below Anhydrite "A".

The better showings are enumerated below:

Upper carnallite stray zone 1640'10" - 1650'10", 2'0" This 2'0" zone averages 25.0% kieserite, 21.2% carnallite, 3.92% sylvite and 1.60% anhydrite.

Upper stray sylvite bed 2122'4" - 2127'5", 5'1" This 5'1" bed averages 4.35% K_2O and 5.05% water insolubles. This bed can be broken down to 2122'4" - 2124'10", 1'6" 7.2% K_2O and 15.41% water insolubles and 2124'10" - 2127'5", 1'5" = 62.46% K_2O and 0.00% water insolubles.

Bed No.1 sylvite 2190'2" - 2195'5", 5'3". This 5'3" bed averages 17.2% K_2O and 1.9% water insolubles. This is the best consistent ore showing in USP 141 core test.

Bed No. 1A 2235'11" - 2238'3", 2'4". This 2'4" bed averages 10.21% kieserite, 17.1% carnallite, and 5.23% sylvite.

Bed No. 2 2291'0" - 2292'5", 1'5". This 1'5" bed averages 13.44% K_2O or 21.2% sylvite and 4.0% water insolubles.

Bed No. 2A 2310'3" - 2312'11", 2'8". This 2'8" bed averages 16.00% K_2O or 25.32% sylvite

Bed No. 3 2333'2" - 2335'6", 2'4". This 2'4" bed averages 56.5% langbeinite.

Respectfully submitted

Joe P. Smith

CORE SAMPLE ANALYSIS

USP 141 CORE TEST

From	To	Thick	$\%CaO$	$\%MgO$	$\%SO_4$	% Water Insolubles
1648'10"	1650'10"	2'0"	6.05	6.27	28.61	
1650'10"	1651'10"	1'0"	4.00	2.42		
1651'10"	1654'2"	2'4"	6.70	4.25	3.45	
1654'2"	1655'6"	1'4"	1.42	1.09	1.05	
2120'0"	2122'4"	1'4"	2.16			
2122'4"	2124'0"	1'8"	7.24			15.41
2124'0"	2127'5"	3'5"	62.46			
2127'5"	2128'3"	0'10"	2.37			0.66
2143'8"	2144'9"	1'1"	3.66			
2179'10"	2180'3"	0'5"	10.58	4.82	20.82	
2187'4"	2190'2"	2'10"	2.64			
2190'2"	2195'5"	5'3"	17.54			1.94
2195'5"	2196'4"	0'11"	4.88			10.24
2205'3"	2209'5"	4'2"	6.57			1.95
2228'9"	2232'9"	4'0"	2.77	1.12		
2232'9"	2234'4"	1'7"	1.71	0.83		
2234'4"	2235'11"	1'7"	5.27	1.94		0.87
2235'11"	2238'3"	2'4"	6.19	4.71	12.65	3.56
2238'3"	2239'10"	1'7"	1.95	1.06		8.90
2239'10"	2240'8"	0'10"	4.06	0.71		10.01
2240'8"	2245'4"	4'8"	3.08	1.33		6.73
2275'10"	2279'6"	3'8"	2.34	0.82		
2280'1"	2281'8"	1'7"	2.24			
2291'0"	2292'5"	1'5"	13.44			4.05

CORE SAMPLE ANALYSIS

USP 141 CORE TEST

From	To	Thick	$\%Fe_2O$	$\%SiO$	$\%SO_4$	% Water Insolubles
1648'10"	1650'10"	2'0"	6.05	6.27	18.61	
1650'10"	1651'10"	1'0"	4.00	2.42		
1651'10"	1654'2"	2'4"	6.70	4.35	3.45	
1654'2"	1655'6"	1'4"	1.42	1.09	1.05	
2120'0"	2122'4"	1'4"	2.16			
2122'4"	2124'0"	1'8"	7.24			15.41
2124'0"	2127'5"	3'5"	62.46			
2127'5"	2128'3"	0'10"	2.37			0.66
2143'8"	2144'9"	1'1"	3.66			
2179'10"	2180'3"	0'5"	10.58	4.82	20.82	
2187'4"	2190'2"	2'10"	2.64			
2190'2"	2195'5"	5'3"	17.54			1.94
2195'5"	2196'4"	0'11"	4.88			10.24
2205'3"	2209'5"	4'2"	6.57			1.95
2220'9"	2232'9"	4'0"	2.77	1.12		
2232'9"	2234'4"	1'7"	1.71	0.83		
2234'4"	2235'11"	1'7"	5.27	1.94		0.87
2235'11"	2238'3"	2'4"	6.19	4.71	12.65	3.56
2238'3"	2239'10"	1'7"	1.95	3.06		8.90
2239'10"	2240'8"	0'10"	4.06	0.71		10.01
2240'8"	2245'4"	4'8"	3.03	1.33		6.73
2275'10"	2279'6"	3'8"	2.34	0.82		
2280'1"	2281'8"	1'7"	2.24			
2291'10"	2293'5"	1'5"	13.44			4.05

Budget Bureau 42-R358.2.
Approval expires 12-31-53.

(SUBMIT IN TRIPLICATE)

Land Office New Mexico

Permit Serial No. 0402

Unit

RECEIVED
JUN 22 1953
U. S. Geological Survey

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL		SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	X
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

June 17, 1953

Well No. F-29 is located 1320 ft. ~~from~~ {N/S} ~~line~~ and 1320 ft. ~~from~~ {E/W} ~~line~~ of sec. 31 S. W. corner

SW¼ Sec. 31 (¼ Sec. and Sec. No.) 20 South (Twp.) 33 East (Range) N.M.P.M. (Meridian)

Potash (Field) Lea (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3616 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Cement 2120' to 1450'
Mud 1450' to 10'
Cement 10' to surface and set 4" pipe 4' above surface BEFORE THE
Started drilling 5-8-53
Stopped drilling 6-3-53
T. S. 1400'
T. D. 2244'
Culebra 1450' - 1460'
"A" Bed Did not drill

OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. VIII-B
Submitted by Ker-McGee
Hearing Date 3-15-74

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company Farmers Educational & Cooperative Union of America

Address 3501 E. 46th Avenue
Denver, Colorado

By: [signature]

APPROVED: JUN 22 1953
U. S. Geological Survey

By [signature]

Title REGIONAL MINING SUPERVISOR U.S.G.S.

U. S. GOVERNMENT PRINTING OFFICE 16—64377-4

VIII-B

Recapitulation F-27

Company: Farmers Educational & Cooperative Union of America

Location: 1320' North of South Line
1320' East of West Line
Section 31, T 20 S, R 33 E

Elevation: 3616'

Type of Well: Potash core test. Used a rock bit from the surface to 1515' 0" and cored from 1515' 0" to 2244' 0". Began drilling 5-8-53 and finished drilling 6-3-53.

Casing Record: Set 1394' of 4½" O.D. casing.

Cement Record: Cemented from 2120' to 1450'.

Drilling Contractor: Olen F. Featherstone.

Limestone: 1450' to 1460' (culebra)

Beds Analyzed:

10th ore zone

2127' 10" to 2132' 0"	4' 2"	13.5% K_2O sylvite 4.9% insoluble	

From	To	Interval	Description	K_2O	Ks	Sol.	Ins.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2129' 0"	2130' 7"	1' 7"	Sylvinite	19.92	0.30	1.15	6.00
2130' 7"	2132' 0"	1' 5"	Sylvite, halite	12.90	0.35	0.49	6.26

Hayward No. 28

RECAPITULATION B&CC NO. 155

Lessee	International Minerals & Chemical Corporation
Location	1320' South of North Line 1320' East of West Line Section 25, T. 20 S., R. 32 E.
Elevation	~~3550~~ 3565.10'
Total Depth	2135'
Type of Well	Potash core test. A rotary rig was used from the surface to the bottom.
Drilling Contractor	Joy Manufacturing Company
Size of Hole	The hole is 6¼" from the surface to 1365'. From 1365' to the bottom the hole was cored with a 3⅞" O.D. core bit.
Water Horizon	No water horizons determined.
Casing Record	Set 1365' of 4" casing.
Drilling Record	Began drilling with a rock bit 3-31-52 and stopped 4-19-52 at a depth of 1365'. Began core drilling 4-21-52 at 1365' and stopped 4-20-52 at a depth of 2135'.
Rustler Limestone	1370' to 1394' (Culebra)
Top of Salt	1400'
Beds Analyzed:	

Carnallite Bed	1506'- 1" to 1503'- 0"	1'-11"	3.88% K_2O as carnallite, 8.50% kieserite
No. 1 Bed	2039'-11" to 2049'-11"	10'- 0"	12.93% K_2O as sylvite, .95% K_2O as carnallite, 1.77% Kieserite and 2.99% insolubles
Sylvite Bed	2085'- 0" to 2089'- 2"	4'- 2"	10.72% K_2O as sylvite, and 4.0% insolubles

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. VIII-C
Submitted by Kerr-McGee
Hearing Date 3-15-74

VIII-C

IMCC NO. 155 CORE TEST

From	To	Interval	Description	K_2O	Mg	SO_4	Insol.
Carnallite Bed:							
1506'- 1"	1507'- 0"	0'-11"	Carnallite and halite	5.4	4.0	3.89	37.0
1507'- 0"	1508'- 0"	1'- 0"	Carnallite and halite	2.5	4.13	7.94	34.7
1508'- 0"	1509'- 0"	1'- 0"	Halite, trace of carnallite	.99	1.45	3.37	5.52
No. 1 Bed:							
2039'-11"	2040'- 7"	0'- 8"	Sylvinite	31.9	.15	.53	.73
2040'- 7"	2041'- 7"	1'- 0"	Halite and sylvite, trace of carnallite	13.86	.22	.53	2.67
2041'- 7"	2042'- 1"	0'- 6"	Halite and sylvite, trace of carnallite	12.9	1.05	2.14	4.19
2042'- 1"	2044'-11"	2'-10"	Halite, little carnallite	2.52	1.40	1.93	.41
2044'-11"	2045'-11"	1'- 0"	Halite and sylvite, trace of carnallite	15.65	.50	.58	2.63
2045'-11"	2047'- 4"	1'- 5"	Halite and sylvite, trace of carnallite	25.5	.60	1.77	6.99
2047'- 4"	2048'- 9"	1'- 5"	Halite and sylvite, trace of carnallite	14.0	.62	.66	4.14
2048'- 9"	2049'-11"	1'- 2"	Halite and sylvite, trace of carnallite	15.8	.92	1.11	4.40
2049'-11"	2050'-11"	1'- 0"	Halite, blebs of sylvite and carnallite	5.5	.87	1.85	4.10
Sylvite Bed:							
2083'- 0"	2084'- 0"	1'- 0"	Halite, trace of sylvite	2.8	.25	2.76	.20
2084'- 0"	2085'- 0"	1'- 0"	Halite, little sylvite	7.14	.52	4.28	3.26
2085'- 0"	2086'- 1"	1'- 1"	Halite, little sylvite	8.16	.25	2.10	.20
2086'- 1"	2087'- 0"	0'-11"	Sylvinite	21.2	.35	1.11	4.72
2087'- 0"	2088'- 6"	1'- 6"	Halite, little sylvite	3.03	.52	.74	6.03
2088'- 6"	2089'- 2"	0'- 8"	Sylvinite	18.4	.35	.66	4.90
2089'- 2"	2090'- 6"	1'- 4"	Halite, little sylvite	4.38	.35	1.40	5.10
2090'- 6"	2091'- 6"	1'- 0"	Halite and sylvite	9.79	.62	1.73	10.25
2091'- 6"	2092'- 6"	1'- 0"	Halite, trace of sylvite	2.57	.50	3.46	6.03

Kerr-McGee Chemical Corp.
Hobbs Potash Facility

K_2O Feet Method

K_2O Tons in the 2100' Radius Area Around the Proposed Well

Calculation of Values

Area No.	Planimeter Reading (P.R.)	K_2O Feet	Factor*	K_2O Tons
1	0.185	1.0375	113,882.35	21,858
2	0.575	1.0125		66,301
3	0.750	.9875		84,344
4	0.889	.9625		97,445
5	0.940	.9375		100,359
6	0.900	.9125		93,526
7	0.715	.8875		72,265
8	0.635	.8625		62,372
9	0.635	.8375		60,564
10	0.510	.8125		47,190
11	0.465	.7875		41,702
12	0.165	.7625		14,328
	7.364			762,254

* Factor $\dfrac{(1{,}320\ \text{ft})^2 \times 1\ \text{Ft}}{15.3\ \text{Ft}^3/\text{ton}}$

K_2O Tons = $\dfrac{(\text{P.R.})(1{,}742{,}400\ \text{sq. ft.})(K_2O\ \text{Feet})}{15.3\ \text{Ft}^3/\text{ton}}$ = K_2O Tons

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. VIII-D
Submitted by Kerr-McGee
Hearing Date 3-15-74

VIII-D

RHL
3-11-74

Calculations of Value
Bass Federal No. 2
660 FS - 1300 FE
Section 30 T20S R33E

Value of ore loss in 2100' radius area around the proposed well east of Kerr-McGee potash leases by using K_2O Feet Method (see attached).

Normal Mine Plan:

K_2O Tons in Place	=	762,254
K_2O Tons to Mill @ 80% Extraction	=	609,803
Tons of Product @ 82% Mill Recovery x 62% K_2O Grade	=	806,513

Mine Plans With No Second Mining:

K_2O Tons to Mill @ 35% Extraction and No Mining within 150' of Well	=	266,789
Tons of Product @ 82% Mill Recovery x 62% K_2O Grade	=	352,850

Product Tons Lost to Well:

Normal Mine Plan	=	806,513
Mine Plan with No Second Mining	=	352,850
Total		453,663
Sales Value @ $33.89/Ton	=	$15,374,639

RHL
3-12-74

PROPOSED
BASS FEDERAL No2

STATE

I 155
10.0—13.9

US 141
5.25—17.2

29

25

30

FEE

150'R

2100'R

T
20
S

31

32

36

F29
4.2—13.9

4" = 1 Mile

R 32 E

R 33 E

STATE

STATE

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5143 Exhibit No. VIII-E
Submitted by Kellahin & Kellahin
Hearing Date 3-15-74

EXHIBIT VIII E

Calculations of Value

Bass Fed No. 2
660' FS, 1300' FE
Sec. 30 T20S R33E

Value of ore lost in the 2100' radius area around the proposed well east of Kerr-McGee's potash leases.

Area of 2100' radius circle	=	13,854,456 sq. ft.
Less area lost to Bass Fed # 1	=	1,151,853 sq. ft.
		12,702,603 sq. ft.

△	Area ÷ 15.3	Height (Ft.)	Tons in place	K_2O Grade	K_2O Tons
4_a	830,236	6.48	5,379,926	14.70	790,849

Normal Mine Plan:

Tons in Place	=	5,379,926
Tons to Mill @ 80% extraction	=	4,303,941
Tons of Product @ 82% Mill Recovery x 62% K_2O Grade	=	836,769

Mine Plans with No Second Mining:

Tons to Mill @ 35% extraction and No Mining Within 150' of Well	=	1,872,496
Tons of Product @ 82% Mill Recovery x 62% K_2O Grade	=	364,050

Product Tons Lost to Well:

State Lands	=	265,058
Federal Lands	=	157,330
Fee Lands	=	50,331
Total		472,719

Sales Value @ $33.89/Ton = $16,020,447

2-26-74 Rev. (Ownership)
R.H.L.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. IX
Submitted by Kerr-McGee
Hearing Date 3-15-74

MURIATE OF POTASH

AGRICULTURAL GRADES 62% K_2O

BULLETIN 102P

PRICE SCHEDULE

EFFECTIVE January 1, 1974
(Subject to change without notice)

Subject to our written confirmation and in accordance with the terms and conditions of our Standard Contract and this Price List, we are pleased to offer agricultural grades of Muriate of Potash on an F.O.B. car, Carlsbad, New Mexico basis, in minimum carloads of 40 tons, priced in U.S. dollars per unit of K_2O.

BULK OR BAGGED

F.O.B. CARS HOBBS, NEW MEXICO, ... IN BULK PER UNIT OF K_2O:

	Jan. 1, 1974 June 30, 1974
Standard	52¢
Coarse	55¢
Granular	57¢

BAGGING: All muriate grades are available in 100 lb multiwall bags at a cost of $9.00 per ton for bags and bagging.

MANURE SALTS, 20% Minimum, Run of Mine = 17.65¢ per Unit of K_2O.

TERMS OF SALE

Net cash in United States funds 30 days from date of Bill of Lading. A service charge of 1% per month will be assessed and billed on all overdue accounts.

1. Shipments will be made as follows:

   Muriate of Potash, from Seller's Mine, Hobbs, New Mexico, freight collect. The total delivered cost of the product will be the above F.O.B. Mine Basis, plus the lowest applicable published single carload rail freight to Buyer's destination. We reserve the right to equalize against the delivered price of potash shipped by other producers from other producing points.

2. Trucks will be loaded at our plant only by prearrangement and provided that trucker has written authorization from a contract customer at a truck loading charge of $2.00 per net ton.

3. Billing price will be governed by railroad bill of lading date.

4. Seller reserves the right to decline acceptance of orders received after the 20th of any month for shipment during that month, if physically unable to make shipment. Seller further reserves the right to refuse or accept orders for shipment of any grade of muriate of potash in any given month in excess of the fraction of 1/12th of the contract tonnage.

5. Registration, under applicable state and local laws where necessary, is the responsibility of the buyer.

6. Any present or future sales, production, manufacturer's excise or similar tax, and any increase therein, imposed by any governmental authority affecting the production, sale or delivery of product hereunder shall be added to the prices herein quoted and borne by buyer.

12-31-73

IX

KERR-McGEE CHEMICAL CORP.
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73102

POTASH COMPANY OF AMERICA

Photographs of Main South Entries Showing Oil Seep Near Abandoned Oil Well

January 18, 1962



Tension crack in anhydrite filled with salt showing oil seep in Main South.



Anhydrite bed - Main South showing oil seep.



Oil seep in rib of Main South Entry.



Face of Main South. Red is polyhalite and salt. Oil covers most of face.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico

Case No. 5193 Exhibit No. 12

Submitted by KERR-McGEE

Hearing Date 3/16/74

Kellahin -

Intro - South Salt Lake Morrow Gas Pool - Old rules 160 - Special rules enacted for 320 - approved unorthodox location. On Federal land - Teledyne owner of only potash lease under proposed unit. Teledyne did not protest application.

Brown - Landman - Belco -

Exhibit 1 - shows comparable sales by companies in NM

Exhibit 2 - map showing S/2 NMGP

Exhibit 3 - ownership map. S/2 Section 40 dedicated. Belco has right to drill - communitized

Exhibit 4 - farmout agreement. Extended to April 1, 1974

Belco drilled well in N/2 with no protest.

Exhibit 5 - Federal permit to drill well in N/2

Exhibit 6 - Waiver of objection to well in N/2

Exhibit 7 - K with ERNG for gas from well in N/2. Commitment to take gas from subject well.

Exhibit 8 - State application to drill

Exhibit 9 - Potash ownership map - well not on lease - very close to Teledyne lease

Exhibit 10 - abstract supporting potash map.

Robb objections:
(1) Robb well contrary development proposal
(2) No objection to well drilled in N/2
(3) well do not located or leave

Robb stipulations:
(1) well in potash area.

Bill Henry - Consulting pet. geo - stipulated qualified.

Exhibit #1 - structure map 5SL Lower Morrow - - good development prospect.
Exhibit #2 - Stratigraphic X-section - good dev. pros. - if well not drilled, gas would
Exhibit #3 - Production history of well in N/2

GLENN COPE - Consulting Engineer -

Exhibit #4 - monthly production history of No. 1 well Cumulative - 5.2 billion.
Exhibit #5 - Press decline v. cumulative prod. table for Texaco well
Exhibit - 16 - projected performance of No. Rurell.
#7. Drilling Program - Surface pipe to salt section, intermediate to 3650 feet.
Cross - Robb wants guarantee of no damage - question disallowed.
Adequacy of Completion & plugging -
E.M. Exhibit NO. 2 - testimony & report of expert in Phillips case re Effects of

Offe questions on potash mining. Asks Cope if he agrees with statements. Agrees that potash is at depth of 2100 feet. Asks he has no knowledge to disagree with other question. Admission of KN exhibits 1-A, 1-B + 2 refused - not appropriate in connection with X-exam of Cope.

Mc Peters - Moranco - drilling contractor problems of directional drilling.

Lowman Drilling Co. - Gy - Hubbert problems of directional drilling.

George Warnock - mining geologist -
Exhibit 18 - ore reserves map - polygonal
Exhibit 19 - up dated maps
" 20 - Map utilizing foot-per-cent method
21 - Kerr Mc Gee's out-line of probable ore deposits.
20-A - update of 20. Moves trend further west of well.
22 - map of current + projected KN mining operations.

The following exhibits were offered by Ken McGee

I — denied
I-A — denied
I-B — denied
II — denied
III — denied
IV — admitted
V — admitted
VI — admitted
VII — admitted
VIII — admitted
VIII-A — admitted
VIII-B — admitted
VIII-C — admitted
VIII-D — admitted
VIII-E — admitted
IX — admitted
X — admitted
XI — admitted <subsidence report — 4 pages> *
XII — admitted <pictures> *
XIII — denied * <FIG 1 + 2>
XIV — denied * <w/ ltr of II above> Boyd Report

*from exhibit II.

GENERAL OFFICES - FORT WORTH

PERRY R. BASS
DIVISION LAND & GEOLOGICAL OFFICE
POST OFFICE BOX 171
MIDLAND, TEXAS 79701

March 11, 1974

New Mexico Oil
Conservation Commission
Santa Fe, New Mexico 87501

Re: Belco #2 Bass-Federal
S½ of Section 30,
T-20-S, R-33-E, Lea
County, New Mexico.

Gentlemen:

Perry R. Bass and Bass Enterprises Production Co. have a working interest in the above proposed test and we concur and support the position of Belco Petroleum Corporation.

We strongly feel if this test well is not allowed to be drilled, that our correlative rights will be violated and valuable gas reserves will not be recovered.

We sincerely request the New Mexico Oil Conservation Commission to approve the permit and location requested by Belco, and allow Belco to orderly develop the property in the spirit set forth under the R-111-A regulation without further delay.

Yours very truly,

BASS ENTERPRISES PRODUCTION CO.

BY: Bill Seetzer

PERRY R. BASS

BY: Bill Seetzer

BS/sbc

Telegram

1974MAR 14 PM 4:17

IPMFEKA SANA
2-034131E073 03/14/74
ICS IPMDMGZ CSP
3062929920 TDBN DENVER CO 33 03-14 0607P EDT
PMS OMAR L BROWN, DLR
HILTON INN
SANTA FE, NM
REFERENCE BASS FEDERAL NUMBER TWO 600 FSL AND 1300 FEL SECTION 30 TOWNSHIP 20 SOUTH RANGE 33 EAST LEA COUNTY NEW MEXICO
TENNECO OIL COMPANY SUPPORTS BELCOS POSITION IN DRILLING OF SUBJECT WELL
D D MYERS DENVER DIVISION PRODUCTION MANAGER

1808 EDT

IPMFEKA SANA

PHILLIPS PETROLEUM COMPANY
ODESSA, TEXAS 79760
PHILLIPS BUILDING, FOURTH & WASHINGTON

LEGAL DEPARTMENT

March 13, 1974

New Mexico Oil Conservation Commission
State Land Office Building
Santa Fe, New Mexico 87501

Re: Case No. 5193 - Application of Belco Petroleum Company For Drilling Permit in Potash-Oil Area, Lea County, New Mexico

Gentlemen:

Phillips Petroleum Company is the owner of an interest in the unit behind the proposed well and requests that the Commission now approve Belco's application for a permit to drill.

Yours truly,

PHILLIPS PETROLEUM COMPANY

BY Joe V. Peacock
Joe V. Peacock
Division Chief Attorney

JVP:nc

TEXACO

PETROLEUM PRODUCTS

PRODUCING DEPARTMENT
CENTRAL UNITED STATES
MIDLAND DIVISION

TEXACO INC.
P. O. BOX 3109
MIDLAND, TEXAS 79701

RECEIVED
MAR 15 1974
OIL CONSERVATION COMM.
Santa Fe

March 12, 1974

177447 - AUDIE RICHARDS LEASE
LEA COUNTY, NEW MEXICO
Belco Petroleum Corporation
Bass-Federal No. 2
660' FSL and 1300' FEL
Section 30 - 20S-33E

Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Gentlemen:

Texaco Inc., as a non-operator interest owner, files this letter of support in favor of Belco Petroleum Corporation's application to drill the captioned test. An objection to approval of Belco's application has been entered, and the matter will come before the Commission for hearing on March 15, 1974.

The captioned test is to develop known gas reserves. Texaco believes that denying Belco's application would prevent the orderly development and production of oil and gas from the South Salt Lake Field. We urge the Commission to approve Belco's application in order that correlative rights of the mineral owners will be protected.

Yours very truly,

Darrell Smith
Division Manager

By G. F. Clarke
G. F. Clarke
Assistant Division Manager

BEH-JM

cc: Belco Petroleum Corporation
2000 Wilco Building
Midland, Texas 79701

Case 5193

203 W. Aven., N
Lovington, New Mexico
March 11, 1974

MAR 14 1974
OIL CONSERVATION COM...
Santa Fe

Oil Conservation Commission
Santa Fe, New Mexico

Gentlemen:

With reference to drilling of No. 2 Bass Federal well on E½SE¼ Section 30, Township 20 South, Range 33 East, N.M.P.M., Lea County, New Mexico, as a mineral owner under the SW¼ of this section I urge the entire S½ of this section be unitized as requested by Belco Petroleum Corporation.

Very truly yours

Audie Richards

Audie Richards

Case 5193

March 8, 1974

MAR 14 1974

OIL CONSERVATION COMM.
Santa Fe

Henry Monteith
Artesia Hotel
Artesia, New Mexico

New Mexico Oil Conservation Commission
Post Office Box 2088
Santa Fe, New Mexico

RE: Belco Petroleum Corporation's
Application to Drill the
#2 Bass Federal Well
S/2 Section 30, T20S, R33E,
Lea County, New Mexico

Gentlemen:

I and my sister, Vera Briggs, own royalty interests in the SW/4 Section 30, T-20-S, R-33-E, Lea County, New Mexico. These royalty interests are presently being drained by offsetting production and, consequently, we urge your approval of Belco Petroleum Corporation's Application to Drill the above test. If this test is not drilled, our correlative rights will be violated.

Very truly yours,

Henry Monteith
Henry Monteith

Vera Briggs
Vera Briggs

HM:OB:dp

Telegram

western union

1974 MAR 13

WU MGR SANA
AYB038(1242)(2-015238E072)PD 03/13/74 1242
ICS IPMBNGZ CSP
9156828631 TDBN MIDLAND TX 90 03-13 1242P EDT
PMS NEW MEXICO OIL CONSERVATION COMMISSIONSTATE LAND OFFICE BLDG,FONE

SANTE FE NM 87501
ATLANTIC RICHFIELD COMPANY UNABLE TO BE PRESENT AT HEARING MARCH 15TH 9AM PROTESTING BELLCOS APPLICATION TO DRILL NUMBER 2 BASS FEDERAL SOUTH HALF SECTION 30 TOWNSHIP 20 SOUTH RANGE 33 EAST LEA COUNTY NEW MEXICO,AS A 25 PERCENT MINERAL INTEREST OWNER IN SOUTHWEST QUARTER SECTION 30 TOWNSHIP 20 SOUTH RANGE 33 EAST AND A WORKING INTEREST OWNER IN OTHER TRACKS CORRELATED RIGHTS WILL BE VIOLATED UNLESS NUMBER 2 BASS FEDERAL IS DRILLEDATLANTIC RICHFIELD SUPPORTS BELLCOS POSITION IN THAT SECTION 30 TOWNSHIP 20 SOUTH RANGE 33 EAST SUFFERING DRAINAGE FROM OTHER WELLS IN AREA

RECEIVED
MAR 14 1974
OIL CONSERVATION COMM.
Santa Fe

TELEPHONED
TIME 11:00 A
TO Amsden
BY J
TO BE M.L.

A J BROWN JOINT INTEREST SUPERINTENDENT
NNNN

Case 5-193

Docket No. 7-74

DOCKET: COMMISSION HEARING - FRIDAY - MARCH 15, 1974

OIL CONSERVATION COMMISSION - 9 A.M. - MORGAN HALL, STATE LAND OFFICE BUILDING, SANTA FE, NEW MEXICO

CASE 5193: Application of Belco Petroleum Corporation for a drilling permit in the Potash-Oil Area, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to drill its proposed Bass-Federal Well No. 2 to test the Pennsylvanian formation at an unorthodox location 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, South Salt Lake Field, Lea County, New Mexico, said location being within the boundaries of the Potash-Oil Area as defined by Commission Order No. R-111-A, and having been objected by the owner of potash leases in the area. This unorthodox location was previously approved by the Commission by Order No. R-4699.

WILLIAM A. SLOAN
JACKSON G. AKIN
JOHN D. ROBB
CHARLES R. LARRABEE
JAMES C. RITCHIE
JOHN P. EASTHAM
WILLIAM C. SCHAAB
WILLIAM C. BRIGGS
RAY H. RODEY
ROBERT D. TAICHERT
ROBERT M. ST. JOHN
JOSEPH J. MULLINS
DUANE C. GILKEY
MARK K. ADAMS
ROBERT G. McCORKLE
PETER G. PRINA
BRUCE D. HALL

JOHN P. SALAZAR
WILLIAM S. DIXON
JOHN P. BURTON
REX D. THROCKMORTON
ROBERTA COOPER RAMO
JONATHAN W. HEWES
JAY R. GENTRY ORTIZ
GENE C. WALTON

RODEY, DICKASON, SLOAN, AKIN & ROBB, P.A.
COUNSELLORS AND ATTORNEYS AT LAW
FIRST NATIONAL BANK BUILDING-WEST
WEST CENTRAL AVENUE AT THIRD
P. O. BOX 1888
ALBUQUERQUE, NEW MEXICO 87103

OF COUNSEL
DON L. DICKASON

PEARCE C. RODEY
1889-1958

TELEPHONE 243-1301
AREA CODE 505

OIL CONSERVATION COMM
Santa Fe

February 22, 1974

Oil Conservation Commission
Land Office Building
Santa Fe, New Mexico 87501

Attention: Mr. A. L. Porter

Re: Belco Petroleum Corporation - Bass-Federal No. 2

Dear Mr. Porter:

This letter will confirm the fact that Kerr-McGee waives arbitration in this matter. We understand that the hearing will probably be set for March 15th.

Sincerely yours,

RODEY, DICKASON, SLOAN, AKIN & ROBB, P.A.

By: John D. Robb
John D. Robb
JDR/sa

cc: Mr. Jason Kellahin

DOCKET MAILED
Date 3-1-74

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY – DIRECTOR

February 22, 1974

Mr. Jason Kellahin
Kellahin & Fox
Attorneys at Law
Post Office Box 1769
Santa Fe, New Mexico

DOCKET MAILED
Date 3-1-74

Mr. John D. Robb
Attorney at Law
Post Office Box 1888
Albuquerque, New Mexico 87103

Gentlemen:

With further reference to the Belco application to drill a gas well in Section 30, Township 20 South, Range 33 East, Lea County, New Mexico, I appreciate your notification that you are willing to waive an arbitration meeting. We are therefore advertising the matter for hearing at 9 a.m. on March 15, 1974 at Morgan Hall, State Land Office Building, Santa Fe, New Mexico. This matter will be heard by a quorum of the Commission.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir
cc: Commissioners Trujillo and Armijo
Mr. Orvis Frederick, U. S. G. S. - Roswell, N.M.
Mr. R. S. Fulton, U.S.G.S. - Carlsbad, New Mexico

DOCKET MAILED
Date 3-1-74

KERR-McGEE CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73102

February 18, 1974

JAMES J. KELLY
PRESIDENT

RECEIVED
FEB
OIL CONSERVATION COMM
Santa Fe

Mr. R. S. Fulton
Regional Mining Supervisor
United States Geological Survey
Carlsbad, New Mexico 88220

Dear Mr. Fulton:

As you know, Kerr-McGee has objected to the drilling of the natural gas test by Belco in Section 30, Township 20 South, Range 33 East, Lea County, New Mexico. Although Kerr-McGee does not presently hold a federal potash lease on Section 30, it appears that it would be the logical lessee to mine this resource from its existing facilities.

We are furnishing the attached map to support our belief that commercial potash deposits exist in this Section. Appreciable loss of recoverable potash reserves will occur if a gas test is drilled. Consequently, we have made the attached calculations from such data as is available to us from the areas shown on the accompanying map.

We are writing this letter in an effort to clarify Kerr-McGee's position with respect to this matter.

Sincerely yours,

James J. Kelly
President

JJK:mj
Attach. Map

cc: Andrew V. Bailey, USGS, Reston, Virginia 22070
A. L. Porter, Jr., USGS, Santa Fe, New Mexico 87501
D. M. Van Sickle, USGS, Roswell, New Mexico 88201

Calculations of Value

Bass Fed #2
660' S, 1320' E
Sec. 30 T20S R33E

Value of ore lost in the 2100' radius area around the proposed well east of Kerr-McGee's potash leases.

Area of 2100' radius circle	=	13,854,456 sq. ft.
Less area lost to Bass Fed # 1	=	1,151,853 sq. ft.
		12,702,603 sq. ft.

△	Area ÷ 15.3	Height (Ft.)	Tons	K_2O Grade	K_2O Tons
4a	830,236	6.48	5,379,926	14.70	790,849

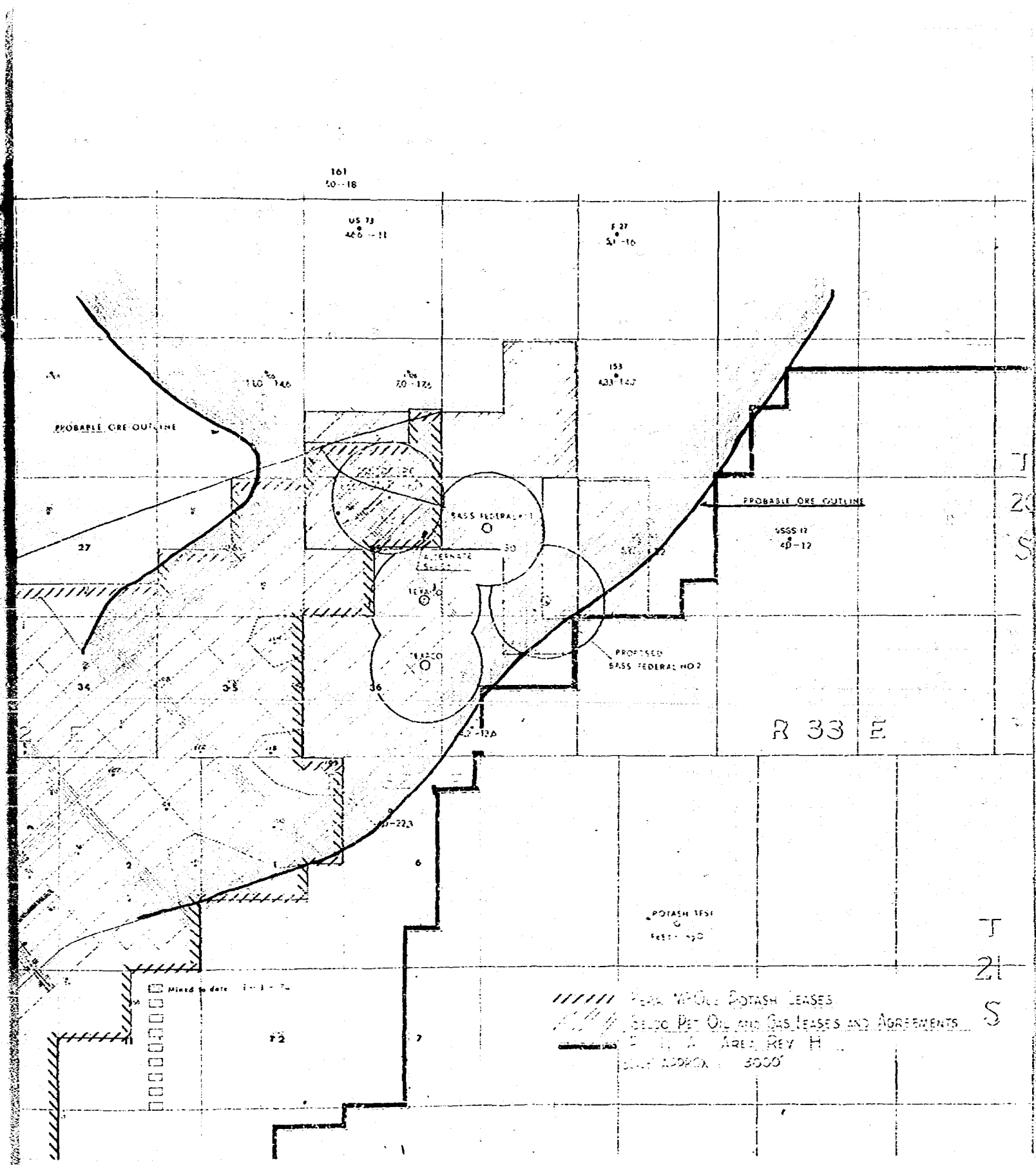
Normal Mine Plan:

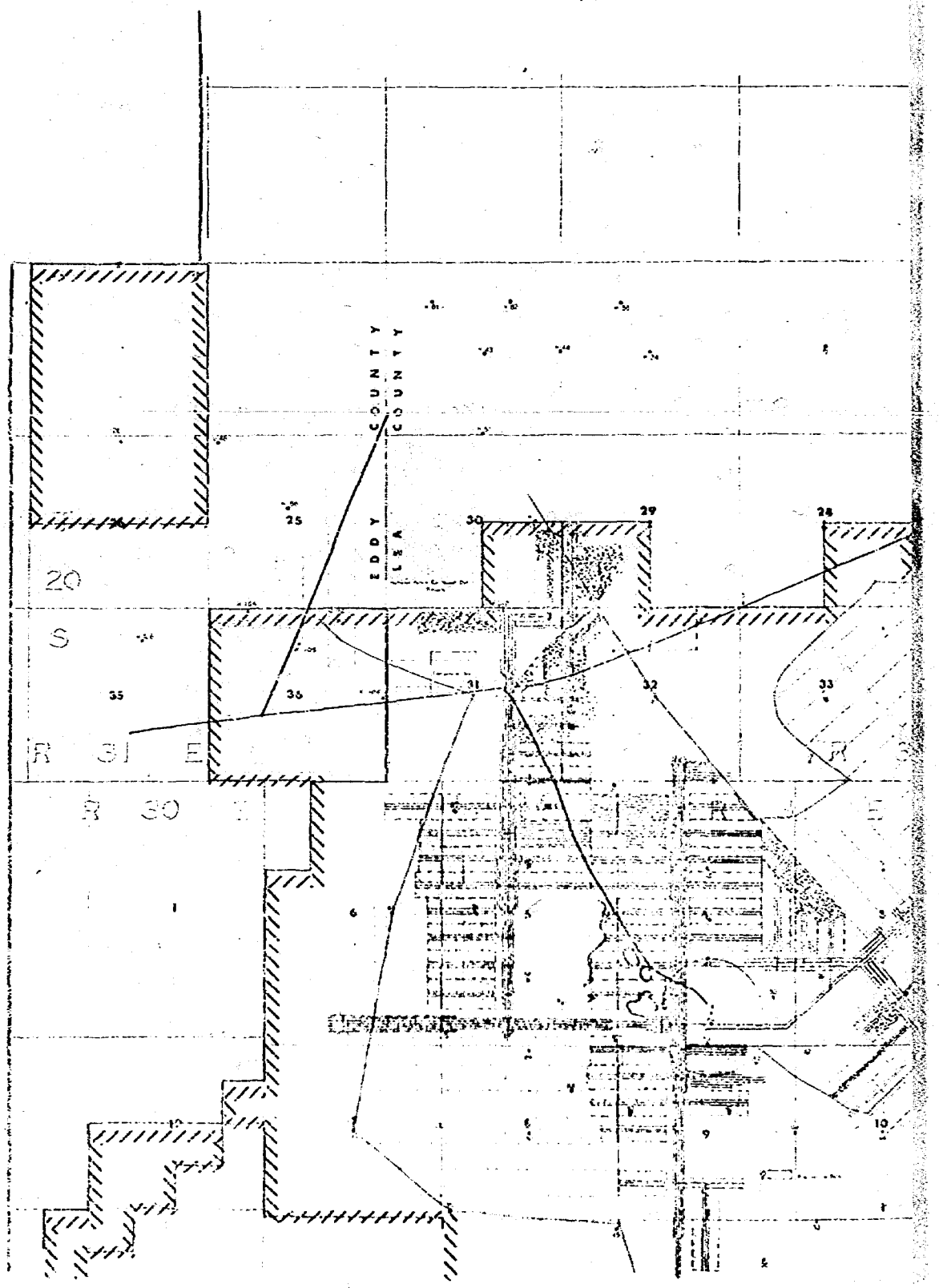
Tons in place	=	5,379,926
Tons to Mill @ 80% extraction	=	4,303,941
Tons of Product @ 82% Mill recovery x 62% K_2O grade	=	836,769

Mine Plans with No Second Mining:

Tons to Mill @ 35% extraction and no mining within 150' of well	=	1,872,496
Tons of Product @ 82% Mill Recovery x 62% K_2O grade	=	364,050
Product Tons Lost to Well	=	472,719
Sales Value @ $24.35/Ton	=	$ 11,510,708

RHL
2-14-74


PROBABLE ORE OUTLINE
PROBABLE ORE OUTLINE
PROPOSED
BASS FEDERAL NO 2
R 33 E
T 21 S
POTASH TEST
Mined to date
PEPL YPOCA POTASH LEASES
DELCO PET OIL AND GAS LEASES AND AGREEMENTS
AREA REV H
5000'


EDDY COUNTY
LEA COUNTY
20
S
R 31 E
R 30 E
25
30
29
28
35
36
31
32
33
1
6
5
4
3
2
7
8
9
10
11
12

JASON W. KELLAHIN
ROBERT E. FOX
W. THOMAS KELLAHIN

KELLAHIN AND FOX
ATTORNEYS AT LAW
500 DON GASPAR AVENUE
POST OFFICE BOX 1769
SANTA FE, NEW MEXICO 87501

TELEPHONE 982-4315
AREA CODE 505

Feb. 19, 1974

Mr. A. L. Porter, Secretary-Director
Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Re: Belco Petroleum Corporation Application for Permit to Drill its Bass-Federal No. 2 Well, Potash Area

Dear Mr. Porter:

Belco Petroleum Corporation is in agreement that there would be no purpose served in holding the secheduled arbitration meeting on the above application in Roswell unless Kerr-McGee Corporation indicates that an agreement is possible. For that reason, and in response to your letter of February 13, 1974, Belco Petroleum Corporation will waive any requirement for the arbitration hearing under the provisions of Commission Order No. R-111-A, and request that a hearing on this application be set before the Commission at the earliest possible date.

We request a hearing before a quorum of the Commission, rather than before a Commission examiner in order to avoid any further delay in disposing of this application.

Your consideration of this will be appreciated.

Sincerely,

Jason W. Kellahin

Jason W. Kellahin

JWK:ss
cc: Mr. Orvis Frederick, U.S.G.S., Roswell
Mr. R. S. Fulton, U.S.G.S., Carlsbad
Mr. Charles Savage, Belco Petroleum Corp., New York
Mr. Lee Nering, Belco Petroleum Corp., Houston
Mr. John D. Robb, Attorney at Law, Albuquerque

Date 3-1-74

United States Department of the Interior

GEOLOGICAL SURVEY
P. O. Box 1157
Hobbs, New Mexico 88240

October 23, 1973

OIL CONSERVATION COMM.

Mr. A. L. Porter, Jr.
New Mexico Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Dear Mr. Porter:

Attached is an information copy of an Application for Permit to Drill a well to a depth of 13,600 feet to test the Pennsylvanian in the SE¼SE¼ sec. 30, T. 20 S., R. 33 E., Lea County, New Mexico, filed by Belco Petroleum Corporation, 2000 Wilco Building, Midland, Texas.

The well location is in the Oil-Potash area on land included in Federal oil and gas lease New Mexico 03023-A.

Sincerely yours,

Arthur R. Brown
District Engineer

Attachment

KERR-McGEE CORPORATION
KERR-McGEE BUILDING • OKLAHOMA CITY, OKLAHOMA 73102

October 26, 1973

RECEIVED
OCT 29 1973
OIL CONSERVATION COMM.
Santa Fe

Oil Conservation Commission
State Land Office Building
Santa Fe, New Mexico 87501

Re: Belco Petroleum Corporation
Bass-Federal No. 2
600' FSL and 1300' FEL
Section 30-T20S-R33E
Lea County, New Mexico

Gentlemen:

Kerr-McGee Corporation is the lessee of United States Potassium Lease NM 0554862, which lands including, among other lands, lands in Section 25-T20S-R32E, N.M.P.M., Lea County, New Mexico, are within one mile of the proposed drill site. Kerr-McGee hereby enters its objection to the approval of the application of Belco Petroleum Corporation.

Commercial deposits of potash are located in Section 25-T20S-R32E and potash core tests to the southwest, east and northeast of the proposed drill site indicate a commercial deposit exists throughout this area. Permitting the well to be drilled would constitute waste, in that production of gas would have the effect of reducing the total quantity of commercial deposits of potash that may be reasonably recovered in commercial quantities, would unduly interfere with the orderly development of the potash deposits and would create hazards to mining.

Very truly yours,

KERR-McGEE CORPORATION

Harold J. Kleen

Harold J. Kleen
Vice President
Minerals Exploration

HJK-ew

cc: R. S. Fulton
Regional Mining Supervisor
U.S.G.S.
Federal Building
Carlsbad, New Mexico 88220

Belco Petroleum Corporation

TELEGRAM

October 29, 1973

OIL CONSERVATION COMMISSION

OKLAHOMA CITY

BELCO

PLEASE REFER TO OUR LETTER OF OCTOBER 26, 1973 RE PETROLEUM CORPORATION FED. NO. 2 - 600' FSL AND 1300' FEL, SECTION 30, TOWNSHIP 20 SOUTH, RANGE 33 EAST, LEA COUNTY, NEW MEXICO. THE FIRST SENTENCE SHOULD READ "KERR McGEE CORPORATION IS THE LESSEE OF UNITED STATES POTASSIUM LEASE N M 0554862 INCLUDING AMONG OTHER LANDS, LANDS IN SECTION 25, TOWNSHIP 20 SOUTH, RANGE 32 EAST, NMPM, LEA COUNTY, NEW MEXICO WHICH LANDS ARE WITHIN ONE MILE OF THE PROPOSED DRILL SITE".

HAROLD J. KLEEN
KERR McGEE CORPORATION
OKLAHOMA CITY

Telegram will be mailed in.

og

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

January 30, 1974

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

Mr. Harold J. Kleen
Vice President
Kerr-McGee Corporation
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

Dear Sir:

With reference to your letter of October 26, 1973 which stated an objection by Kerr-McGee Corporation to the drilling of the Belco Petroleum Corporation Bass-Federal No. 2 Well 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, Lea County, New Mexico, I am hereby giving notice of an arbitration meeting to be held in the U. S. Geological Survey Office in the Federal Building in Roswell, New Mexico, at 10 o'clock a.m. on February 8, 1974. This meeting is in accordance with the provisions of Commission Order No. R-111-A, and by copies of this letter the other interested parties are being notified.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

cc: Belco Petroleum Corporation, 2000 Wilco Bldg., Midland
Mr. Orvis Frederick, U.S.G.S., Roswell, New Mexico
Mr. R. S. Fulton, U.S.G.S., Carlsbad, New Mexico
Mr. Jason Kellahin, Kellahin & Fox, Santa Fe, New Mexico

OIL CONSERVATION COMMISSION
P. O. BOX 2088
SANTA FE, NEW MEXICO 87501

March 8, 1974

CASE 5193

COPY

Sheriff
Eddy County Court House
Carlsbad, New Mexico 88220

Dear Sir:

Enclosed are Subpoenas which need to be served as soon as possible.

Any charges will be paid by the Commission.

Very truly yours,

WILLIAM F. CARR
General Counsel

WFC/dr

enclosure

OIL CONSERVATION COMMISSION
P. O. BOX 2088
SANTA FE, NEW MEXICO 87501

March 8, 1974

COPY

Mrs. Hawthorne
Eddy County Sheriff's Office
Eddy County Court House
Carlsbad, New Mexico 88220

Dear Mrs. Hawthorne:

This confirms my request made this date by telephone of you to have the Subpoena issued by the New Mexico Oil Conservation Commission against Kerr-McGee Corporation served on Mr. R. C. Green instead of Mr. John M. Swales.

Your assistance in this matter is appreciated.

Very truly yours,

WILLIAM F. CARR
Special Assistant Attorney General

WFC/dr

SUBPOENA DUCE TECUM

THE STATE OF NEW MEXICO

TO: Mr. John M. Swales, General Manager, Kerr-McGee Corporation, Greeting:

We command you to be and appear on or before March 14, 1974, before the Oil Conservation Commission of the State of New Mexico, in the Land Office Building, in the City of Santa Fe, in Oil Conservation Commission Case No. 5193, application of Belco Petroleum Corporation for a drilling permit in the Potash-Oil Area, Lea County, New Mexico, and that you bring with you and produce at the time and place aforesaid Potash Core Hole Logs with complete analysis on the following cores:

IMC	105	- NE	Sec. 23	- T20S R32E
IMC	128	- NE	Sec. 24	- T20S R32E
IMC	153	- NW	Sec. 20	- T20S R32E
F	27	- NW_2	Sec. 17	- T20S R33E
K	108	- E^2_2	Sec. 34	- T20S R32E
K	110	- E^2_2	Sec. 35	- T20S R32E
K	112	- S^2_2	Sec. 35	- T20S R32E
K	107	- N^2_2	Sec. 2	- T21S R32E
K	109	- NE^4	Sec. 1	- T21S R32E
K	111	- W^2_2	Sec. 1	- T21S R32E
D	165	- NW^4	Sec. 6	- T21S R33E

And this do you under penalty of the law.

WITNESS A. L. Porter, Jr., Secretary-Director of the Oil Conservation Commission of the State of New Mexico, and the seal of said Commission, this _____ day of _____, A.D. 1974

_____

KERR-McGEE CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73102

February 19, 1974

JAMES J. KELLY
PRESIDENT

RECEIVED
FEB 21 1974
OIL CONSERVATION COMM
Santa Fe

Mr. A. L. Porter, Jr.
New Mexico Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Dear Mr. Porter:

Enclosed is a copy of a letter that was sent to you yesterday erroneously directed to the United States Geological Survey, as we were misinformed that you were with that agency, rather than the Oil Conservation Commission. We trust this will clarify the matter, in the event you receive the duplicate mailing.

Sincerely yours,

James J. Kelly

James J. Kelly
President

JJK:mj
Enc.

KERR-McGEE CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73102

February 18, 1974

JAMES J. KELLY
PRESIDENT

Mr. R. S. Fulton
Regional Mining Supervisor
United States Geological Survey
Carlsbad, New Mexico 88220

Dear Mr. Fulton:

As you know, Kerr-McGee has objected to the drilling of the natural gas test by Belco in Section 30, Township 20 South, Range 33 East, Lea County, New Mexico. Although Kerr-McGee does not presently hold a federal potash lease on Section 30, it appears that it would be the logical lessee to mine this resource from its existing facilities.

We are furnishing the attached map to support our belief that commercial potash deposits exist in this Section. Appreciable loss of recoverable potash reserves will occur if a gas test is drilled. Consequently, we have made the attached calculations from such data as is available to us from the areas shown on the accompanying map.

We are writing this letter in an effort to clarify Kerr-McGee's position with respect to this matter.

Sincerely yours,

James J. Kelly
President

JJK:mj
Attach. Map

cc: Andrew V. Bailey, USGS, Reston, Virginia 22070)
A. L. Porter, Jr., USGS, Santa Fe, New Mexico 87501) w/att.
D. M. Van Sickle, USGS, Roswell, New Mexico 88201)

Memo

2-21-74

From

A. L. PORTER, JR.
SECRETARY–DIRECTOR

To

Talked with Mr. George Cochran of Kerr Mc. gee this A.M. He said Mr. Rabb of Alb. would call me today or tomorrow.

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY – DIRECTOR

February 13, 1974

Mr. Harold J. Kleen, Vice President
Kerr-McGee Corporation
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

Belco Petroleum Corporation
2000 Wilco Building
Midland, Texas 79701

Gentlemen:

Enclosed is an official notice of an arbitration meeting to be held on March 1, 1974.

Our Commission would like for Kerr-McGee and Belco to make every effort to reach an agreement and let this office know not later than February 25 as to the success of your efforts. In the event that you are unable to reach an agreement and you feel that the arbitration meeting would not result in an agreement, please notify this office by February 25 of your willingness to waive the arbitration meeting and we will proceed to advertise the matter for hearing before the Commission.

I am sure that all parties realize that there would seem to be no point in holding the arbitration meeting unless there is a good possibility of reaching an agreement.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir
cc: Mr. Orvis Frederick, U.S.G.S., Roswell, New Mexico
Mr. R. S. Fulton, U.S.G.S., Carlsbad, New Mexico
Mr. Jason Kellahin, Kellahin & Fox, Santa Fe, N.M.
Mr. John Robb, Attorney at Law, Albuquerque, N.M.
Mr. Joe D. Ramey, Oil Conservation Commission, Hobbs, N.M.

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

February 13, 1974

Mr. Harold J. Kleen, Vice President
Kerr-McGee Corporation
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

Belco Petroleum Corporation
2000 Wilco Building
Midland, Texas 79701

Gentlemen:

Enclosed is an official notice of an arbitration meeting to be held on March 1, 1974.

Our Commission would like for Kerr-McGee and Belco to make every effort to reach an agreement and let this office know not later than February 25 as to the success of your efforts. In the event that you are unable to reach an agreement and you feel that the arbitration meeting would not result in an agreement, please notify this office by February 25 of your willingness to waive the arbitration meeting and we will proceed to advertise the matter for hearing before the Commission.

I am sure that all parties realize that there would seem to be no point in holding the arbitration meeting unless there is a good possibility of reaching an agreement.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir
cc: Mr. Orvis Frederick, U.S.G.S., Roswell, New Mexico
Mr. R. S. Fulton, U.S.G.S., Carlsbad, New Mexico
Mr. Jason Kellahin, Kellahin & Fox, Santa Fe, N.M.
Mr. John Robb, Attorney at Law, Albuquerque, N.M.
Mr. Joe D. Ramey, Oil Conservation Commission, Hobbs, N.M.

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

February 13, 1974

Mr. Harold J. Kleen
Vice President
Kerr-McGee Corporation
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

Dear Sir:

With reference to your letter of October 26, 1973 which stated an objection by Kerr-McGee Corporation to the drilling of the Belco Petroleum Corporation Bass-Federal No. 2 Well 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, Lea County, New Mexico, I am hereby giving notice of an arbitration meeting to be held in the U. S. Geological Survey Office in the Federal Building in Roswell, New Mexico, at 10 o'clock a.m. on March 1, 1974. This meeting is in accordance with the provisions of Commission Order No. R-111-A, and by copies of this letter the other interested parties are being notified.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir
cc: Belco Petroleum Corporation, 2000 Wilco Bldg., Midland
Mr. Orvis Frederick, U.S.G.S., Roswell, New Mexico
Mr. R. S. Fulton, U.S.G.S., Carlsbad, New Mexico
Mr. Jason Kellahin, Kellahin & Fox, Santa Fe, New Mexico
Mr. John Robb, Attorney at Law, Albuquerque, New Mexico

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY – DIRECTOR

February 13, 1974

Mr. Harold J. Kleen
Vice President
Kerr-McGee Corporation
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

Dear Sir:

With reference to your letter of October 26, 1973 which stated an objection by Kerr-McGee Corporation to the drilling of the Belco Petroleum Corporation Bass-Federal No. 2 Well 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, Lea County, New Mexico, I am hereby giving notice of an arbitration meeting to be held in the U. S. Geological Survey Office in the Federal Building in Roswell, New Mexico, at 10 o'clock a.m. on March 1, 1974. This meeting is in accordance with the provisions of Commission Order No. R-111-A, and by copies of this letter the other interested parties are being notified.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir
cc: Belco Petroleum Corporation, 2000 Wilco Bldg., Midland
Mr. Orvis Frederick, U.S.G.S., Roswell, New Mexico
Mr. R. S. Fulton, U.S.G.S., Carlsbad, New Mexico
Mr. Jason Kellahin, Kellahin & Fox, Santa Fe, New Mexico
Mr. John Robb, Attorney at Law, Albuquerque, New Mexico

Also a copy to Mr.
John Robb

March 14

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

January 30, 1974

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

Mr. Harold J. Kleen
Vice President
Kerr-McGee Corporation
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

Dear Sir:

With reference to your letter of October 26, 1973 which stated an objection by Kerr-McGee Corporation to the drilling of the Belco Petroleum Corporation Bass-Federal No. 2 Well 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, Lea County, New Mexico, I am hereby giving notice of an arbitration meeting to be held in the U. S. Geological Survey Office in the Federal Building in Roswell, New Mexico, at 10 o'clock a.m. on February 8, 1974. This meeting is in accordance with the provisions of Commission Order No. R-111-A, and by copies of this letter the other interested parties are being notified.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

cc: Belco Petroleum Corporation, 2000 Wilco Bldg., Midland
Mr. Orvis Frederick, U.S.G.S., Roswell, New Mexico
Mr. R. S. Fulton, U.S.G.S., Carlsbad, New Mexico
Mr. Jason Kellahin, Kellahin & Fox, Santa Fe, New Mexico

2-7-74 Robb -
At suggestion of John Robb - meeting was postponed. will give written notice later
Called Frederick
Called Kellahin.

MATKINS AND MARTIN
ATTORNEYS AT LAW
501 NORTH CANAL STREET
P. O. DRAWER N
CARLSBAD, NEW MEXICO 88220

JEROME D. MATKINS
W. T. MARTIN, JR.

AREA CODE 505
885-2445
885-2312

October 24, 1973

RECEIVED
OCT 25 1973
OIL CONSERVATION COMM
Santa Fe

Mr. A. L. Porter, Jr., Secretary
New Mexico Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Re: Belco Petroleum Corporation
Bass Federal No. 2
660' FSL & 1300' FEL
Section 30, T-20-S, R-33-E
Lea County, New Mexico

Dear Mr. Porter:

This is to advise that Harroun and Haworth, a partnership composed of D. S. Harroun and Russell Haworth, object to the application for permit to drill filed by Belco Petroleum Corporation on the referenced property.

Yours very truly,

MATKINS AND MARTIN

Jerome D. Matkins
Attorneys for Harroun and Haworth

ln
cc: D. S. Harroun
Belco Petroleum Corporation
Regional Oil and Gas Supervisor, USGS
Mr. R. S. Fulton, USGS
Kerr-McGee Chemical Corporation, Attn: John M. Swales

Form 9-331 C
(May 1963)

SUBMIT IN TRIPLICATE*
(Other instructions on reverse side)

Form approved.
Budget Bureau No. 42 R1425.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. TYPE OF WORK: DRILL [XX] DEEPEN [ ] PLUG BACK [ ]

b. TYPE OF WELL: OIL WELL [ ] GAS WELL [XX] OTHER — SINGLE ZONE [XX] MULTIPLE ZONE [ ]

2. NAME OF OPERATOR: Belco Petroleum Corporation

3. ADDRESS OF OPERATOR: 2000 Wilco Building, Midland, Texas 79701

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements.*)
At surface: 660' FSL & 1300' FEL Section 30, T-20-S, R-33-E Lea County
At proposed prod. zone: Same

RECEIVED
OCT 22 1973
U.S. GEOLOGICAL SURVEY
HOBBS, NEW MEXICO

5. LEASE DESIGNATION AND SERIAL NO.: NM-03023A
6. IF INDIAN, ALLOTTEE OR TRIBE NAME: None
7. UNIT AGREEMENT NAME: None
8. FARM OR LEASE NAME: Bass-Federal
9. WELL NO.: 2
10. FIELD AND POOL, OR WILDCAT: South Salt Lake
11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA: Sec. 30, T-20-S, R-33-E
12. COUNTY OR PARISH: Lea
13. STATE: New Mexico

14. DISTANCE IN MILES AND DIRECTION FROM NEAREST TOWN OR POST OFFICE*: 33 Miles East of Carlsbad, New Mexico

15. DISTANCE FROM PROPOSED* LOCATION TO NEAREST PROPERTY OR LEASE LINE, FT. (Also to nearest drlg. unit line, if any)	16. NO. OF ACRES IN LEASE	17. NO. OF ACRES ASSIGNED TO THIS WELL
660'	320	320
18. DISTANCE FROM PROPOSED LOCATION* TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR, ON THIS LEASE, FT.	**19. PROPOSED DEPTH**	**20. ROTARY OR CABLE TOOLS**
None	13,600'	Rotary

21. ELEVATIONS (Show whether DF, RT, GR, etc.): 3598.9 GR
22. APPROX. DATE WORK WILL START*: 11-15-73

23. PROPOSED CASING AND CEMENTING PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	QUANTITY OF CEMENT
16'	13 3/8"	48#	1,000'	350sx (To Circulate)
12 ¼	10 3/4"	40.50#	3,100'	650sx (To Circulate)
9 ½	7 5/8"	26.40 & 29.70#	10,300'	3000sx
6 ½	5 1/2"	17#	13,600'	750sx

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: If proposal is to deepen or plug back, give data on present productive zone and proposed new productive zone. If proposal is to drill or deepen directionally, give pertinent data on subsurface locations and measured and true vertical depths. Give blowout preventer program, if any.

24.

SIGNED [signature] TITLE District Engineer DATE 10-18-73

(This space for Federal or State office use)

PERMIT NO. _____ APPROVAL DATE _____

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

*See Instructions On Reverse Side

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section.

Operator	Lease	Well No.
BELCO PETROLEUM CORP.	BASS FEDERAL	2

Unit Letter	Section	Township	Range	County
P	30	20 South	33 East	Lea

Actual Footage Location of Well: 660 feet from the South line and 1300 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3598.9			Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

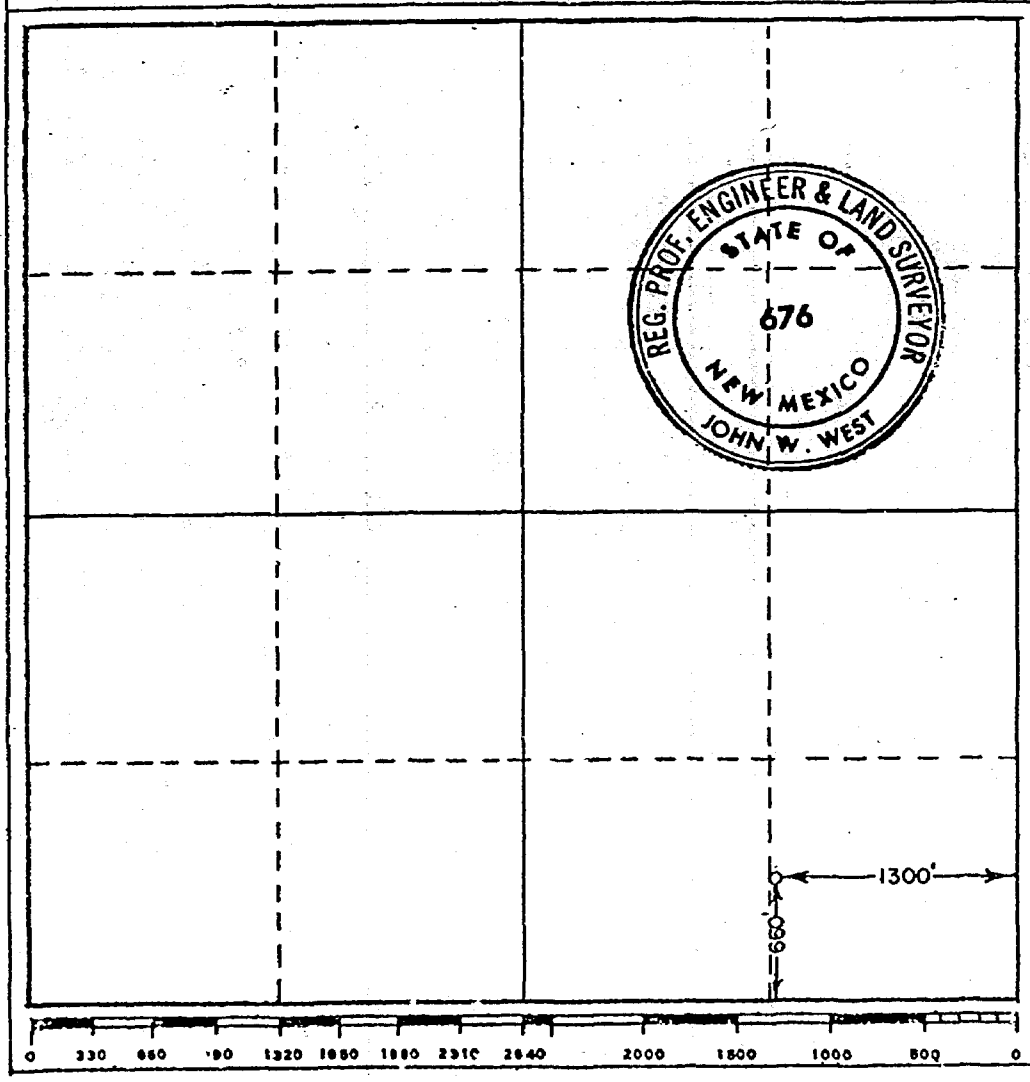
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling. etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name

Position
District Engineer

Company
Belco Petroleum Corporation

Date
10/18/73

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed
October 10, 1973

Registered Professional Engineer and/or Land Surveyor

John W West

Certificate No. 676

Western Union Telegram

1973 OCT 29 AM 11:11

IPMFEKA SANA
1-028127A302 10/29/73
TLX KERRMCGEE OKC B
 001 PD OKLA CITY OKLA 10-29-73
PMS OIL CONSERVATION COMMISSION
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501

GENTLEMEN:
PLEASE REFER TO OUR LETTER OF OCTOBER 26, 1973, RE BELCO PETROLEUM CORPORATION [illegible]-FEDERAL NO. 2 600' FSL AND 1300' FEL SECTION 30-T20S-R35E LEA COUNTY, NEW MEXICO. FIRST SENTENCE SHOULD READ "KERR-MCGEE CORPORATION IS THE LESSEE OF UNITED STATES POTASSIUM LEASE NM 0554662, INCLUDING, AMONG OTHER LANDS, LANDS IN SECTION 25-T20S-R35E, N.M.P.M., LEA COUNTY, NEW MEXICO, WHICH LANDS ARE WITHIN ONE MILE OF THE PROPOSED DRILL SITE."

HAROLD J. KLEEN
KERR MCGEE CORP
OKLA CITY OKLA

1306 EST

IPMFEKA SANA

TELETYPED
TIME 1077
TO OCC
BY
[illegible]

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY – DIRECTOR

October 29, 1973

Mr. Jerome D. Matkins
Matkins and Martin
Attorneys at Law
Post Office Drawer N
Carlsbad, New Mexico 88220

Dear Mr. Matkins:

In response to your letter of October 24 objecting to the application for a permit to drill filed by Belco Petroleum Corporation, I am quoting below Section VII of Commission Order No. R-111-A.

"Before commencing drilling operations for oil or gas on any lands within the Potash Area, the well operator shall prepare a map or plat showing the location of the proposed well, said map or plat to accompany each copy of the Notice of Intention to Drill. In addition to the number of copies required by the Commission, the well operator shall send one copy by registered mail to all potash operators holding potash leases within a radius of one mile of the proposed well, as reflected by the plats submitted under paragraph IX (2).

The well operator shall furnish proof of the fact that said potash operators were notified by registered mail of his intent by attaching return receipt to the copies of the Notice of Intention to Drill and plats furnished the Commission.

The Commission, or its authorized representative, may approved such Notice of Intention to Drill if no objection to the location of the proposed well is made by a potash operator within ten days after receipt. If the location of the proposed well is objected to by the potash operator, the matter shall be referred to the Secretary-Director of the Commission for arbitration. If a satisfactory settlement cannot be reached, the Secretary-Director of the Commission shall refer the matter to a hearing before the Commission after due notice and a decision either approving or denying the operator's plans to drill shall be entered by the Commission."

Mr. Jerome D. Matkins
Matkins and Martin
Attorneys at Law
Post Office Drawer N
Carlsbad, New Mexico 88220

In view of the foregoing, it does not appear that your clients have established that they have the standing to object to the well location since they are not potash operators.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

cc: Belco Petroleum Corporation, 2000 Wilco Building, Midland, Texas 79701
Kerr McGee Corporation, Kerr McGee Building, Oklahoma City, Oklahoma 73102
Mr. R. S. Fulton, Regional Mining Supervisor, U. S. G. S., Federal Building, Carlsbad, New Mexico 88220

SHARP DRILLING CO., INC.
FIRST NATIONAL BANK BUILDING
P. O. BOX 1271 TELEPHONE 683-3384
MIDLAND, TEXAS 79701

March 12, 1974

Belco Petroleum Corporation
2000 Wilco Building
Midland, Texas 79701

Attention: Mr. Al Owings

Gentlemen:

We have considered your solicitation for a footage bid to drill your 13,300' Morrow well to be located in Section 30, T-20-S, R-33-E, Lea County, New Mexico, to be drilled as a directional hole with the surface location to be approximately 4,000' East in Section 29. We regret that we can not submit a bid on this well for the following reasons:

(1) We are unable to determine the number of days required to drill a well of this nature.

(2) We can not estimate the number or types of bits required for this project.

(3) We are unable to determine the cost of directional drilling services required for drilling this well.

(4) We are reluctant to furnish our drillstem to drill this directional well because we are presently receiving estimates of two years as a delivery date to replace drill pipe. We recognize that this project will cause excessive wear to our drillstring, and we do not know at this point just what our replacement cost of this pie might be.

If we can furnish further information regarding this well, please advise.

Yours very truly,

SHARP DRILLING CO., INC.

R. E. Throckmorton

R. E. Throckmorton
Vice President

RET/pb

WILLIAM A. SLOAN
JACKSON G. AKIN
JOHN D. ROBB
CHARLES B. LARRABEE
JAMES C. RITCHIE
JOHN P. EASTHAM
WILLIAM C. SCHAAB
WILLIAM C. BRIGGS
RAY H. RODEY
ROBERT D. TAICHERT
ROBERT M. ST. JOHN
JOSEPH J. MULLINS
DUANE C. GILKEY
MARK K. ADAMS
ROBERT G. McCORKLE
PETER G. PRINA
BRUCE D. HALL
JOHN P. SALAZAR
WILLIAM S. DIXON
JOHN P. BURTON
REX D. THROCKMORTON
ROBERTA COOPER RAMO
JONATHAN W. HEWES
JAY R. GENTRY ORTIZ
GENE C. WALTON

RODEY, DICKASON, SLOAN, AKIN & ROBB, P.A.
COUNSELLORS AND ATTORNEYS AT LAW
FIRST NATIONAL BANK BUILDING-WEST
WEST CENTRAL AVENUE AT THIRD
P. O. BOX 1888
ALBUQUERQUE, NEW MEXICO 87103

OF COUNSEL
DON L. DICKASON

PEARCE C. RODEY
1889-1958

TELEPHONE 243-1301
AREA CODE 505

March 20, 1974

MAR 21 1974
OIL CONSERVATION COMM.
SANTA FE

New Mexico Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Attention: Ida Rodriguez

Re: Case No. 5193

Dear Ida:

Enclosed are four legible copies of Exhibit XI of Kerr-McGee Corporation in the referenced Case. Please place the Commission's Stamp upon at least two copies of the Exhibit and fill in the blanks indicating that it is Exhibit XI of Kerr-McGee Corporation submitted in connection with the referenced case on March 15, 1974. Please telephone me if you have any questions.

Yours very truly,

RODEY, DICKASON, SLOAN, AKIN & ROBB, P.A.

Mark

By:
Mark K. Adams

MKA/sa
Encl.
cc: Bob Lane

EXHIBIT B

(I L L E G I B L E)

MAR

UNDERGROUND MOVEMENT AND SUBSIDENCE OVER UNITED STATES POTASH COMPANY MINE

E. H. Miller
Resident Manager

F. L. Pierson
Senior Geologist

U. S. Potash Company
Carlsbad, New Mexico

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. XI
Submitted by KERR-McGEE
Hearing Date 3-16-74

[Presented at Annual Meeting of American Institute of Mining, Metallurgical, and Petroleum Engineers, New York, February 16-22, 1958].

UNDERGROUND MOVEMENT AND SUBSIDENCE OVER UNITED STATES POTASH COMPANY MINE

581929

By

Earl H. Miller, Resident Manager
and
Francis L. Pierson, Senior Geologist

The United States Potash Company was the original discoverer and first producer of underground mined potash ore in North America and commenced active production of potash in 1931. In July 1936, the company merged with United States Borax & Chemical Corporation and is now a Division of that corporation.

The mine is located twenty-two miles east of the city of Carlsbad and the refinery is located sixteen miles south of the mine. The mine was placed where the ore was found and the refinery placed where there was sufficient water for a dissolving and re-crystallization plant.

For twenty-three of the last twenty-six years, the potash ore was mined with the room and pillar method, taking approximately sixty percent extraction and leaving forty percent in pillars. These pillars are generally fifty-eight feet by fifty-eight feet square. Three years ago, it was decided that removal of as large an extraction as possible from these pillars should be commenced.

The first visible evidence of subsidence on the surface is by small hairline cracks which rapidly develop into openings measuring up to approximately one inch wide and one hundred feet long. As the face retreats underground, these tension cracks disappear. About the boundaries of the final mined area which have been unworked for any length of time, these cracks appear and become larger. With continual strain and erosional effects, some of the cracks develop into sizeable openings measuring six inches to two feet wide and with an unknown depth. With continued erosion, the walls of the cracks fall into the bottom, thus widening and filling the openings.

In the present stage after two years, some of the openings appear as slump holes measuring some six to eight feet across, ten to thirty feet long, and five to fifteen feet deep. The geologic structure through which these forces are transmitted is rather typical of bedded salt deposits in the area. The buff dolomite section at approximately four hundred feet below the surface is a

water zone of considerable magnitude over quite an extensive area. The fact that both the salt and potash are highly soluble makes it imperative that the section between this buff dolemite and the underground salt and potash beds below must not be ruptured. The potash bed, which varies from five to fifteen feet in height and lies more or less horizontal, is approximately one thousand feet below the surface and is normally overlain by a salt section some five hundred feet thick. The shale and clay strata below the water zone and above the salt section form the impervious layer which protects the salt section from the water above.

The effects of subsidence over the surface area are much larger than the actual final mined area underground. In those places where final mining has been carried to the limits of the ore-body, subsidence effects have been observed some seven hundred feet beyond the limits on the surface. In those places where final mining stopped in a first mined area, subsidence has been noted for distances as great as one thousand two hundred feet beyond the limits of final mining. Principally for this reason, a large zone about the hoisting shafts has been prohibited to final mining activities until all other mining is completed.

In present operations, there are two types of mining in use. The first is known as conventional mining which utilizes undercutters, drills and blasting, after which the ore is moved from the face with loaders and shuttle cars. The other method is with continuous mining machines, using extensible and mainline haulage belts. In both of these operations, final mining is being carried on. The conventional final mining system is used generally in high ore in which it would be uneconomical to use a continuous mining machine.

In cases where a mud seam or zone of weakness occurs in a pillar, it will, of course, crush and fail at this point. Frequently when the mud seam is just above the back or just under the floor, the pillar will punch through into the weak zone. Additional effects caused by the mud seam just above or just below an entry are frequent sags and falls of roof slabs and heaving of the floor.

Even in the event that roof slabs begin to fail over haulage ways, an attempt is made to control their subsidence until the haulage way is abandoned. In controlling roof slabs, cribbing, stulls and roof bolts are often used. These measures usually suffice to keep the haulage ways open but occasionally it is necessary to blast down a slab and remove it.

It is thought that roof slabbing and floor heaving are caused by the vertical pressure and certain resulting forces. The vertical pressure through a punching action causes the tendency for the floor to rise in the entry and the back to sag. The other resulting forces are thought to be the movement of clay in the clay seams from above and below the pillars out into the floor and back in the entries. It is also thought that "end pressure" exerted on the floor and roof slabs from the expanding pillars helps to cause the initial separation of the slabs.

The second type of mining in our operations is in the continuous miner sections. About five years ago we commenced the use of continuous miners, and in this operation a different type pillar was necessary due to the limitations of the machine. The general mining pattern with this method leaves pillars one hundred feet long and thirty-five feet wide after first mining. In final mining, these pillars are reduced to such size that from ninety-five to ninety-eight percent extraction is being obtained. The back stands well immediately after mining but with such a large percentage of extraction, subsidence is relatively rapid.

In technically plotting subsidence, the major amount of movement underground is estimated to be approximately twelve feet, while the major subsidence on the surface is approximately eight and one-half feet. This would appear to indicate that very little breaking in to the place in the strata above the mined-out area and that the overlying beds are more or less subsiding uniformly.

In plotting the movement of one particular station on the surface and underground in the final mined area, it was found that for approximately thirty days subsidence was extremely rapid. The total height of the mined-out area was originally 12.75 feet. For the first thirty days after final mining, there was apparently little movement; that between thirty and sixty days, the underground workings at this point had subsided 3.25 feet, while the point above on the surface had dropped 0.75 feet. At the end of one hundred days, the back had come down a total of six feet, while subsidence on the surface measured 2.20 feet. After one hundred and forty days, the station underground had dropped a total of seven and one-half feet, while the point on the surface had moved down three and one-half feet. Due to the bad conditions of the back underground at this time, observations were discontinued. On the surface, however, the point continued downward, measuring six feet total drop after two hundred days. It was at approximately this point that the sharp rate of subsidence changed abruptly. At the end of one thousand days, the surface station had subsided a total of 7.50 feet, an increase of 1.50 feet in the last eight hundred days.

In graphing the movement of this station, it was found that the line was not continuously downward but indicated that subsidence, both underground and on the surface, came in waves or intervals, and in some cases the ground actually rose from the previous month's reading. From our closest observation in a single instance, it appeared that surface subsidence became measurable approximately thirty--five days after subsidence was noted underground.

In the first study of subsidence movement, a grid was set over the area to be mined with stations on five-hundred foot spacing, both east-west and north--south. These stations were triangulated in each month and a record of their movement was noted. From this date an approximate limiting angle of 51 degrees - 30 degrees has been calculated, the limiting angle, of course, being measured from a line drawn vertically up from the edge of advance and a second line drawn upward from the edge of advance to the outermost point where subsidence was observed on the surface. This limiting angle is important in determining where surface structures will be affected by subsidence. There are many factors which contribute to the degree of the angle. Those principally responsible are:

(1) The overlying strata through which subsidence takes place, this angle being relatively small for strong rocks and relatively large for weaker members, the total limiting angle, of course, being the sum of the various limiting angles up through the different strata.

(2) It has been observed that the limiting angle is greater in areas where final mining operations are bordered by first mining operations. Strictly speaking, this is not a true limiting angle because extraction outside the area affects an increase of the angle. However, from the practical point of view, it is quite necessary to take this influence under consideration. We have observed in some cases a limiting angle as large as 51 to 30 degrees. It may be when the ground completely stabilizes that this angle will become somewhat greater.

The limiting angle, of course, can only be measured well after final mining has been completed and the ground has more or less become stabilized. Up until that point there is a definite lag of subsidence behind final mining operations.

Recently a line of stations on one-hundred feet centers was placed over the center of an area which was to be final mined. In addition to giving much closer control on subsidence date, we can determine the amount of strain (elongation and compression)

between these points. This method of computing will give a more accurate limiting angle and an angle of repose which is the complement of the limiting angle, and the angle of break. The angle of break is of considerable interest as it is the line through which the greatest force of shear is exerted. This angle is measured from the horizontal to a line which is drawn from the edge of advance of the remaining face underground up to a point of maximum tension strain, as plotted from the field data.

It is expected that with continued study, more detailed information on the characteristics of ground movement, as applied to salt-bedded deposits in the Carlsbad district, will become available.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5193
Order No. R-4759

APPLICATION OF BELCO PETROLEUM
CORPORATION FOR A DRILLING PERMIT
IN THE POTASH-OIL AREA, LEA COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on March 15, 1974, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission".

NOW, on this _____ day of March, 1974, the Commission, a quorum being present, having considered the testimony presented and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Belco Petroleum Corporation, seeks authority to drill its proposed Bass-Federal Well No. 2 to test the Pennsylvanian formation at an unorthodox location 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, NMPM, South Salt Lake-Morrow Gas Pool, Lea County, New Mexico, said location being within the boundaries of the Potash-Oil Area as defined by Commission Order R-111-A, and having been objected to by the owner of potash leases in the Area. This unorthodox location was previously approved by the Commission by Order No. R-4699.

(3) That the entire S/2 of said Section 30 may reasonably be presumed to be productive of gas from the Morrow formation.

(4) That a well drilled at the proposed location would not be in sufficient proximity to commercial deposits of potash to impose a hazard to the mining of such deposits.

~~(5) That the proposed unorthodox location has previously been approved by the Commission by Order No. R-4699.~~

(5) That approval of the application is necessary to prevent waste and protect correlative rights.

IT IS THEREFORE ORDERED:

(1) That Belco Petroleum Corporation is hereby authorized to drill its proposed Bass-Federal Well No. 2 in the Potash Oil Area at an unorthodox location 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, NMPM, South Salt Lake Morrow Gas Pool, Lea County, New Mexico.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year herein-above designated.

LGN

RECEIVED

FEB 4 1974

INVOICE

PRODUCING OPERATORS
STATE OF NEW MEXICO

INVOICE

Below is statement of pipeline oil runs and dry gas marketed (25 MCF representing one barrel) for month of December, 1973 and proration of New Mexico Oil and Gas Engineering Committee expense for January, 1974. In accordance with the adopted By-Laws of the Committee, the minimum billing is $15.00 per month. Please report changes in names and addresses of operators and make remittance to the New Mexico Oil & Gas Engineering Committee, P.O. Box 127, Hobbs, New Mexico 88240.

Operators	Bbls. of Oil	Bbls. 25 MCF to 1 Bbl.	Bbls. Run All Fields	Proration of Expense
Adobe Oil Company	723	2,793	3,516	$ 15.00
Agua, Inc.	1,825		1,825	15.00
Alamo Petroleum Company		151	151	15.00
Amerada Hess Corporation	251,949	44,313	296,262	79.41
American Trading & Production Co.	948		948	15.00
Amini Oil Corporation	14,198	3,082	17,280	15.00
Amoco Production Company	306,719	319,160	625,879	167.75
Anadarko Production Company	108,562	1,468	110,030	29.50
Anderson Oil & Gas Company, Inc.	8,870	21	8,891	15.00
Antweil, Morris R.	3,730	13,848	17,578	15.00
APCO Oil Corporation		1,000	1,000	15.00
Apexco, Inc.	36,160		36,160	15.00
Apollo Oil Company	400		400	15.00
Armer Oil Company	7,110		7,110	15.00
Ashland Oil & Refining Co.	477		477	15.00
Ashmun & Hilliard Oil Company	1,433		1,433	15.00
Atlantic Richfield Company	1,189,812	90,447	1,280,259	343.14
Aztec Oil & Gas Company	20,978	117,566	138,544	37.13
Barber Oil Inc.	4,185	350	4,535	15.00
Barnhill, Wm. B.	650		650	15.00
Bass, Perry R.	5,573	5,732	11,305	15.00
Baxter, Murphy H.	9,362		9,362	15.00
BCO, Inc.	6,175	195	6,370	15.00
BTA Oil Producers	30,750		30,750	15.00
Beard, J. G.	3,928		3,928	15.00
Belco Petroleum Corp.	14,469	21,036	35,505	15.00
Bell Petroleum Company	11,162		11,162	15.00
Benson-Montin-Greer Drlg. Co.	59,040	590	59,630	15.98
Black, W. H. & Dan-Partnership	545		545	15.00
Blue Danube Oil Company, Inc.		955	955	15.00
Bonanza Oil Corporation	715		715	15.00
Bridwell Oil Company	2,728		2,728	15.00
Bright & Schiff	525		525	15.00
Brookhaven Oil Company		3,519	3,519	15.00

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. 1
Submitted by Belco
Hearing Date 3-12-74

1500 Wilco Building
Midland, Texas 79701
Telephone (915) 683-6366

Belco Petroleum Corporation

November 6, 1973

LAND SECTION
PHILLIPS PETROLEUM CO.

Belco

Perry R. Bass
P. O. Box 171
Midland, Texas 79701
Attention: Bill Seltzer

Bass Enterprises Production Co.
P. O. Box No. 171
Midland, Texas 79701
Attention: Bill Seltzer

Atlantic Richfield Company
P. O. Box 1610
Midland, Texas 79701
Attention: Jim Walker

Phillips Petroleum Company
Phillips Building
Odessa, Texas
Attention: E. M. Gorence

Frank O. Elliott, Tr.
Clarence E. Hinkle, Tr. and
Edna Ione Hall, Tr.
P. O. Box 1355
Roswell, New Mexico

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. 4
Submitted by Belco
Hearing Date 3-15-74

Extended to Apr 1 74 and all Rch extended to 7/1/74

Re: Teas Prospect
Belco #2-Bass Federal
Section 30, T20S, R33E
Eddy County, New Mexico

Gentlemen:

Under the terms of Farmout Agreement dated August 8, 1972, as amended by letter dated June 18, 1973, Belco must commence a second test on the captioned prospect on or before January 1, 1974.

By letter dated August 31, 1973, Belco proposed to drill the captioned test with the S/2 Section 30 dedicated thereto. Perry R. Bass subsequently objected to the inclusion of the W/2 SW/4 of Section 30 in this proration unit and suggested that a non-standard unit covering the SE/4, E/2 SW/4 Section 30 and the N/2 NE/4 Section 31 be formed. In deference to this request, we went before the Oil Conservation Commission for hearing on October 3, 1973 requesting such a non-standard unit. Texaco, Inc. objected to the formation of this non-standard unit. Due to a technical error in the advertising, this hearing was re-advertised and rescheduled for October 31, 1973 at which time both Texaco and Belco entered additional testimony into the record. The thrust of Texaco's testimony was that no decision should be made by the commission until such time as the exact amount of acreage to be dedicated to their #1-Audie Richards well located SE/4 Section 25 had been settled. We, of course, requested that the commission approve our request for a

non-standard unit. It is our opinion that the commission will probably not make a ruling in our application until after the hearing on Texaco's application for a non-standard proration unit comprised of the SE/4 of Section 25 has been heard. This item will come before the commission on November 28, 1973.

On October 18, 1973, Belco made application to the regulatory bodies to drill the captioned well at a location 1300' FEL and 660' FSL of Section 30. Inasmuch as this location is within the boundaries of the New Mexico Oil Conservation Commission Potash-Oil Area as defined by Order #R-111, Belco was obligated to notify offset potash operators. As of the date of this writing, two operators have objected to drilling this well. They are Kerr McGee and Harroun and Haworth. The Oil Conservation Commission has dismissed the protest of Harroun and Haworth. We have had a lengthy conversation with Mr. Pete Porter of the Oil Conservation Commission and he refuses to dismiss the Kerr McGee protest and feels that it must be handled in the normal procedure i.e. arbitration and hearing before the commission.

Belco is considering another visit with Kerr McGee in an effort to solicit their withdrawal of this protest; however, we are not optimistic that this can be accomplished. In all likelihood, it will be necessary to bring this matter before the commission by hearing.

The consequence of the above problems are that no definitive proration unit will be approved until some time late in December; and unless the Kerr McGee protest can be removed, the chances are that the issuance of a permit to drill this well will be delayed at least until early 1974. Consequently, we herein request an extension of time to April 1, 1974 in which to commence the second well called for under the terms of the Farmout Agreement dated August 8, 1972. Please so indicate your approval of this extension by signing in the space provided below and returning one copy of this letter at your earliest convenience.

If you should have any additional questions, please do not hesitate to contact me.

Yours very truly,

BELCO PETROLEUM CORPORATION

Omar L. Brown
District Landman

OLB/MW

AGREED TO AND ACCEPTED THIS
21st day of November, 1973.
PHILLIPS PETROLEUM COMPANY
BY _____

RECEIVED
NOV 1 1973
MIDLAND OFFICE

non-standard unit. It is our opinion that the commission will probably not make a ruling in our application until after the hearing on Texaco's application for a non-standard proration unit comprised of the SE/4 of Section 25 has been heard. This item will come before the commission on November 28, 1973.

On October 18, 1973, Belco made application to the regulatory bodies to drill the captioned well at a location 1300' FEL and 660' FSL of Section 30. Inasmuch as this location is within the boundaries of the New Mexico Oil Conservation Commission Potash-Oil Area as defined by Order #R-111, Belco was obligated to notify offset potash operators. As of the date of this writing, two operators have objected to drilling this well. They are Kerr McGee and Harroun and Haworth. The Oil Conservation Commission has dismissed the protest of Harroun and Haworth. We have had a lengthy conversation with Mr. Pete Porter of the Oil Conservation Commission and he refuses to dismiss the Kerr McGee protest and feels that it must be handled in the normal procedure i.e. arbitration and hearing before the commission.

Belco is considering another visit with Kerr McGee in an effort to solicit their withdrawal of this protest; however, we are not optimistic that this can be accomplished. In all likelihood, it will be necessary to bring this matter before the commission by hearing.

The consequence of the above problems are that no definitive proration unit will be approved until some time late in December; and unless the Kerr McGee protest can be removed, the chances are that the issuance of a permit to drill this well will be delayed at least until early 1974. Consequently, we herein request an extension of time to April 1, 1974 in which to commence the second well called for under the terms of the Farmout Agreement dated August 8, 1972. Please so indicate your approval of this extension by signing in the space provided below and returning one copy of this letter at your earliest convenience.

If you should have any additional questions, please do not hesitate to contact me.

Yours very truly,

BELCO PETROLEUM CORPORATION

Omar L. Brown
District Landman

OLB/MW

AGREED TO AND ACCEPTED THIS
30 day of November, 1973.
PERRY R. BASS
BY

non-standard unit. It is our opinion that the commission will probably not make a ruling in our application until after the hearing on Texaco's application for a non-standard proration unit comprised of the SE/4 of Section 25 has been heard. This item will come before the commission on November 28, 1973.

On October 18, 1973, Belco made application to the regulatory bodies to drill the captioned well at a location 1300' FEL and 660' FSL of Section 30. Inasmuch as this location is within the boundaries of the New Mexico Oil Conservation Commission Potash-Oil Area as defined by Order #R-111, Belco was obligated to notify offset potash operators. As of the date of this writing, two operators have objected to drilling this well. They are Kerr McGee and Harroun and Haworth. The Oil Conservation Commission has dismissed the protest of Harroun and Haworth. We have had a lengthy conversation with Mr. Pete Porter of the Oil Conservation Commission and he refuses to dismiss the Kerr McGee protest and feels that it must be handled in the normal procedure i.e. arbitration and hearing before the commission.

Belco is considering another visit with Kerr McGee in an effort to solicit their withdrawal of this protest; however, we are not optimistic that this can be accomplished. In all likelihood, it will be necessary to bring this matter before the commission by hearing.

The consequence of the above problems are that no definitive proration unit will be approved until some time late in December; and unless the Kerr McGee protest can be removed, the chances are that the issuance of a permit to drill this well will be delayed at least until early 1974. Consequently, we herein request an extension of time to April 1, 1974 in which to commence the second well called for under the terms of the Farmout Agreement dated August 8, 1972. Please so indicate your approval of this extension by signing in the space provided below and returning one copy of this letter at your earliest convenience.

If you should have any additional questions, please do not hesitate to contact me.

Yours very truly,

BELCO PETROLEUM CORPORATION

Omar L. Brown
District Landman

OLB/MW

AGREED TO AND ACCEPTED THIS
30 day of November, 1973.

BASS ENTERPRISES PRODUCTION CO.

BY B. P. Thompson

non-standard unit. It is our opinion that the commission will probably not make a ruling in our application until after the hearing on Texaco's application for a non-standard proration unit comprised of the SE/4 of Section 25 has been heard. This item will come before the commission on November 28, 1973.

On October 18, 1973, Belco made application to the regulatory bodies to drill the captioned well at a location 1300' FEL and 660' FSL of Section 30. Inasmuch as this location is within the boundaries of the New Mexico Oil Conservation Commission Potash-Oil Area as defined by Order #R-111, Belco was obligated to notify offset potash operators. As of the date of this writing, two operators have objected to drilling this well. They are Kerr McGee and Harroun and Haworth. The Oil Conservation Commission has dismissed the protest of Harroun and Haworth. We have had a lengthy conversation with Mr. Pete Porter of the Oil Conservation Commission and he refuses to dismiss the Kerr McGee protest and feels that it must be handled in the normal procedure i.e. arbitration and hearing before the commission.

Belco is considering another visit with Kerr McGee in an effort to solicit their withdrawal of this protest; however, we are not optimistic that this can be accomplished. In all likelihood, it will be necessary to bring this matter before the commission by hearing.

The consequence of the above problems are that no definitive proration unit will be approved until some time late in December; and unless the Kerr McGee protest can be removed, the chances are that the issuance of a permit to drill this well will be delayed at least until early 1974. Consequently, we herein request an extension of time to April 1, 1974 in which to commence the second well called for under the terms of the Farmout Agreement dated August 8, 1972. Please so indicate your approval of this extension by signing in the space provided below and returning one copy of this letter at your earliest convenience.

If you should have any additional questions, please do not hesitate to contact me.

Yours very truly,

BELCO PETROLEUM CORPORATION

Omar L. Brown
District Landman

OLB/MW

AGREED TO AND ACCEPTED THIS
____day of November, 1973.

_____
Edna Ione Hall, Trustee

non-standard unit. It is our opinion that the commission will probably not make a ruling in our application until after the hearing on Texaco's application for a non-standard proration unit comprised of the SE/4 of Section 25 has been heard. This item will come before the commission on November 28, 1973.

On October 18, 1973, Belco made application to the regulatory bodies to drill the captioned well at a location 1300' FEL and 660' FSL of Section 30. Inasmuch as this location is within the boundaries of the New Mexico Oil Conservation Commission Potash-Oil Area as defined by Order #R-111, Belco was obligated to notify offset potash operators. As of the date of this writing, two operators have objected to drilling this well. They are Kerr McGee and Harroun and Haworth. The Oil Conservation Commission has dismissed the protest of Harroun and Haworth. We have had a lengthy conversation with Mr. Pete Porter of the Oil Conservation Commission and he refuses to dismiss the Kerr McGee protest and feels that it must be handled in the normal procedure i.e. arbitration and hearing before the commission.

Belco is considering another visit with Kerr McGee in an effort to solicit their withdrawal of this protest; however, we are not optimistic that this can be accomplished. In all likelihood, it will be necessary to bring this matter before the commission by hearing.

The consequence of the above problems are that no definitive proration unit will be approved until some time late in December; and unless the Kerr McGee protest can be removed, the chances are that the issuance of a permit to drill this well will be delayed at least until early 1974. Consequently, we herein request an extension of time to April 1, 1974 in which to commence the second well called for under the terms of the Farmout Agreement dated August 8, 1972. Please so indicate your approval of this extension by signing in the space provided below and returning one copy of this letter at your earliest convenience.

If you should have any additional questions, please do not hesitate to contact me.

Yours very truly,

BELCO PETROLEUM CORPORATION

Omar L. Brown
District Landman

OLB/MW

AGREED TO AND ACCEPTED THIS
11th day of November, 1973.

Frank O. Elliott, Trustee

non-standard unit. It is our opinion that the commission will probably not make a ruling in our application until after the hearing on Texaco's application for a non-standard proration unit comprised of the SE/4 of Section 25 has been heard. This item will come before the commission on November 28, 1973.

On October 18, 1973, Belco made application to the regulatory bodies to drill the captioned well at a location 1300' FEL and 660' FSL of Section 30. Inasmuch as this location is within the boundaries of the New Mexico Oil Conservation Commission Potash-Oil Area as defined by Order #R-111, Belco was obligated to notify offset potash operators. As of the date of this writing, two operators have objected to drilling this well. They are Kerr McGee and Harroun and Haworth. The Oil Conservation Commission has dismissed the protest of Harroun and Haworth. We have had a lengthy conversation with Mr. Pete Porter of the Oil Conservation Commission and he refuses to dismiss the Kerr McGee protest and feels that it must be handled in the normal procedure i.e. arbitration and hearing before the commission.

Belco is considering another visit with Kerr McGee in an effort to solicit their withdrawal of this protest; however, we are not optimistic that this can be accomplished. In all likelihood, it will be necessary to bring this matter before the commission by hearing.

The consequence of the above problems are that no definitive proration unit will be approved until some time late in December; and unless the Kerr McGee protest can be removed, the chances are that the issuance of a permit to drill this well will be delayed at least until early 1974. Consequently, we herein request an extension of time to April 1, 1974 in which to commence the second well called for under the terms of the Farmout Agreement dated August 8, 1972. Please so indicate your approval of this extension by signing in the space provided below and returning one copy of this letter at your earliest convenience.

If you should have any additional questions, please do not hesitate to contact me.

Yours very truly,

BELCO PETROLEUM CORPORATION

Omar L. Brown
District Landman

OLB/MW

AGREED TO AND ACCEPTED THIS
day of November, 1973.

Clarence E. Hinkle, Trustee

AtlanticRichfieldCompany

North American Producing Division
Permian Dist
Post Office Box 1610
Midland, Texas 79701
Telephone 915 682 8631

C. H. McClure
District Land Manager

January 10, 1974

Belco Petroleum Corporation
2000 Wilco Building
Midland, Texas 79701

Attention: Mr. Omar L. Brown

Re: Farmout Agreement
Little Eddy Unit
Lea County, New Mexico
AR-GL-49832; A-NM-11

Gentlemen:

Under date August 8, 1972, you entered into a farmout agreement between Perry R. Bass, et al, covering lands in Lea County, New Mexico, reference being made to said Farmout Agreement herein for all purposes.

You have requested an extension of time in which to commence the drilling of the second test well. An extension to July 1, 1974, is hereby granted, provided, however, in the event that the United States Geological Survey and the New Mexico Oil Conservation Commission issue Belco a permit to drill prior to July 1, 1974, Belco would be obligated to commence the drilling of the second test well within 45 days of issuance of the permit.

Except as expressly provided for herein said Farmout Agreement shall remain as originally written and previously amended.

Very truly yours,

M. James Walker

M. James Walker
Area Landman

MJW:jrb

RECEIVED
JAN 11 1974
MIDLAND OFFICE

RAL OFFICES - FORT WORTH

PERRY R. BASS
DIVISION LAND & GEOLOGICAL OFFICE
POST OFFICE BOX 171
MIDLAND, TEXAS 79701

June 18, 1973

Re: Farmout Agreement dated August 8, 1972, Lea County, New Mexico.

Belco Petroleum Corporation
2000 Wilco Building
Midland, Texas 79701

Gentlemen:

You have requested an extension of time for drilling additional wells as set forth on pages 4 and 5 of the above captioned Farmout Agreement, due to objections and protests from potash companies on potash leases within one mile of your proposed second test, which is located in the NW¼NE¼ of Section 25, T-20-S, R-32-E, Lea County, New Mexico.

We hereby extend the time for commencement of the second well as set forth in the above captioned farmout agreement as follows: Said second well under said Farmout Agreement shall commence operations within thirty (30) days after the completion of the Belco #1 Felmont, located in the NW¼NE¼ of Section 25, T-20-S, R-32-E, Lea County, New Mexico. Said well shall be commenced no later than January 1, 1974.

Other than herein altered, all terms and provisions of our agreement of August 8, 1972, shall remain in full force and effect.

This agreement may be executed by executing the original copy of this letter, a counterpart thereof, or other instrument agreeing to be bound by the provisions hereof, with the same effect as if all parties had executed the same instrument.

Yours very truly,

BASS ENTERPRISES PRODUCTION CO.

BY: Bill Seeger

PERRY R. BASS

BY: Bill Seeger

ATLANTIC RICHFIELD COMPANY

BY: _____

PHILLIPS PETROLEUM COMPANY

BY: _____

_____
Frank O. Elliott, Trustee under
the Frank O. Elliott Living Trust

_____
Clarence E. Hinkle, Trustee under
the Frank O. Elliott Living Trust

This agreement may be executed by executing the original copy of this letter, a counterpart thereof, or other instrument agreeing to be bound by the provisions hereof, with the same effect as if all parties had executed the same instrument.

Yours very truly,

BASS ENTERPRISES PRODUCTION CO.

BY: Bill Seeger

PERRY R. BASS

BY: Bill Seeger

ATLANTIC RICHFIELD COMPANY

BY: _____

PHILLIPS PETROLEUM COMPANY

BY: _____

Frank O. Elliott, Trustee under
the Frank O. Elliott Living Trust

Clarence E. Hinkle, Trustee under
the Frank O. Elliott Living Trust

This agreement may be executed by executing the original copy of this letter, a counterpart thereof, or other instrument agreeing to be bound by the provisions hereof, with the same effect as if all parties had executed the same instrument.

Yours very truly,

BASS ENTERPRISES PRODUCTION CO.

BY: Bill Seeger

PERRY R. BASS

BY: Bill Seeger

ATLANTIC RICHFIELD COMPANY

BY: _____

PHILLIPS PETROLEUM COMPANY

BY: _____

_____
Frank O. Elliott, Trustee under
the Frank O. Elliott Living Trust

_____
Clarence E. Hinkle, Trustee under
the Frank O. Elliott Living Trust

This agreement may be executed by executing the original copy of this letter, a counterpart thereof, or other instrument agreeing to be bound by the provisions hereof, with the same effect as if all parties had executed the same instrument.

Yours very truly,

BASS ENTERPRISES PRODUCTION CO.

BY: Bill Seeger

PERRY R. BASS

BY: Bill Seeger

ATLANTIC RICHFIELD COMPANY

BY: W. James Walker

PHILLIPS PETROLEUM COMPANY

BY: _____

_____
Frank O. Elliott, Trustee under
the Frank O. Elliott Living Trust

_____
Clarence E. Hinkle, Trustee under
the Frank O. Elliott Living Trust

Edna Ione Hall

Edna Ione Hall, Trustee under
the Edna Ione Hall Living Trust

Clarence E. Hinkle

Clarence E. Hinkle, Trustee under
the Edna Ione Hall Living Trust

August 8, 1972

Farmout Agreement
Lea County, New Mexico

Belco Petroleum Corporation
2000 Wilco Building
Midland, Texas 79701

Gentlemen:

We claim ownership of the Oil and Gas Leases listed below in Schedule A and Schedule B in the following percentages:

SCHEDULE A

Perry R. Bass	1/4 of 89%
Bass Enterprises Production Co.	3/4 of 89%
Atlantic Richfield Company	2%
Texaco, Inc.	5%
Phillips Petroleum Company	2%
Tenneco Oil Company, successor in title to Leonard Oil Company	1%
Frank O. Elliott and Clarence E. Hinkle, Trustees under the Frank O. Elliott Living Trust, successor in title to Sunshine Royalty Company	1/2 of 1%
Edna Ione Hall and Clarence E. Hinkle, Trustees under the Edna Ione Hall Living Trust, successor in title to Sunshine Royalty Company	1/2 of 1%

#4806-A - Oil and Gas Lease dated April 8, 1952, from Audie Richards, a single man having never been married; Edgar Richards, a married man dealing with his sole and separate property; June Shield, a married woman dealing with her sole and separate property, Hettie Mae Pruit, a married woman dealing with her sole and separate property, to Howard W. Jennings, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-B - Oil and Gas Lease dated April 8, 1952, from Mary Lorena Higgins, Individually and as Trustee, Eula Higgins, a single woman, Flora May Edwards, a single woman, Mary Higgins Smith and J. H. Smith, her husband, Thelma Higgins Kesler and Ralph Kesler, her husband, Samuel O. Higgins and Marie W. Higgins, his wife, W. F. Higgins and Annie Long Higgins, his wife, Earl Curtis Higgins and Hazel G. Higgins, his wife, J. Vernon Higgins and Charles Davis Higgins, his wife, and S. O. Higgins, a single man, to Howard W. Jennings, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-C - Oil and Gas Lease dated April 16, 1956, from Betty M. Dreessen, dealing in her separate property but joined pro forma by her husband E. T. Dreessen, to Sid W. Richardson and Perry R. Bass, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-D - Oil and Gas Lease dated April 16, 1956, from Cecil H. Kyte, Trustee for David Bond Kyte, to Sid W. Richardson and Perry R. Bass, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-E - Oil and Gas Lease dated December 10, 1955, from Maybelle K. Stewart, a widow, to Sunshine Royalty Company, a corporation, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-F - Oil and Gas Lease dated December 10, 1955, from Maybelle K. Stewart, a widow, to Leonard Oil Company, a corporation, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-G - Oil and Gas Lease dated October 16, 1956, from Leonard Oil Company, a corporation, to Richardson & Bass, a partnership composed of S. W. Richardson and Perry R. Bass, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-H - Oil and Gas Lease dated October 16, 1956, from Sunshine Royalty Company, to Richardson & Bass, a partnership composed of S. W. Richardson and Perry R. Bass, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-I - Oil and Gas Lease dated November 6, 1956, from Pearl Monteith, a widow, to The Texas Company, A Delaware Corporation, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-J - Oil and Gas Lease dated November 6, 1956, from Henry Lawson Monteith, dealing in his sole and separate property and Vera Allene Briggs, dealing in her sole and separate property, to The Texas Company, a Delaware Corporation, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4806-K - Oil and Gas Lease dated August 28, 1950, from M. P. Long and T. W. Prentice, Ancillary Executors of the Estate of L. H. Wentz, Deceased in and for the State of New Mexico, to Cities Service Oil Company, a corporation, insofar as it covers the E½/SW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

Atlantic Richfield Company claims ownership to an undivided one-fourth (1/4) unleased mineral interest in the E/2 SW/4 of Section 30, T-20-S, R-33-E, Lea County, New Mexico, which is deemed to be leased on the form of lease marked Exhibit "B" and attached hereto.

#4067 - Oil and Gas Lease dated May 1, 1952, from the United States of America, to Howard W. Jennings, covering among other lands, Lots 3 and 4, the E½/SW¼ and the SE¼ of Section 19; the E½/E½ of Section 30; all in T-20-S, R-33-E, Lea County, New Mexico.

#4067-X - Oil and Gas Lease dated May 1, 1952, from the United States of America, to Howard W. Jennings, covering among other lands, the NW¼ of Section 30, T-20-S, R-33-E, Lea County, New Mexico.

#4148 - Oil and Gas Lease dated May 10, 1951, from the State of New Mexico, to Malco Refineries, Inc., covering among other lands, the N½/NE¼ of Section 31, T-20-S, R-33-E, Lea County, New Mexico.

SCHEDULE B

Bass Enterprises Production Co.	3/4
Perry R. Bass	1/4

#4148 - Oil and Gas Lease dated May 10, 1951, from the State of New Mexico to Malco Refineries, Inc., covering among other lands, the W½/NE¼ of Section 19, T-20-S, R-33-E, Lea County, New Mexico.

#4067 - Oil and Gas Lease dated May 1, 1952, from the United States of America, to Howard W. Jennings, covering among other lands, the E½/NE¼ of Section 19, T-20-S, R-33-E, Lea County, New Mexico.

All of the above described leases and lands are hereinafter referred to as said leases.

It is mutually agreed that ~~on or before November 1, 1973,~~ you will, at your own expense, ~~commence actual drilling~~ of a test well, at a location of your choice, in either the Northeast quarter of the Southwest quarter (NE¼/SW¼) or the Southeast quarter of the Northwest quarter (SE¼/NW¼) of Section 30, T-20-S, R-33-E, Lea County, New Mexico. You agree to prosecute the drilling of said well in a workmanlike manner, to a depth sufficient ~~to test the~~ Morrow formation at approximately 13,400 feet and you shall have the option but not the obligation to drill said test well to a deeper depth to test the Devonian formation at approximately 14,400 feet. Said well to be completed within one hundred eighty (180) days from the date of actual spudding of same.

If in the drilling of said test well the hole is lost due to lost circulation, blowout, high pressure, unusual mechanical problems, or a practically impenetrable substance is encountered which would make further drilling impracticable, then you shall have the right to commence, on or before thirty (30) days after the completion or abandonment of the test well, operations for the drilling of another test well, at a location to be selected by you upon some

portion of said leases. If this alternate test well is commenced, it shall be drilled with due diligence to the same depth as provided for the original test well.

If either of said wells are drilled to a depth sufficient to test the Morrow formation or deeper depth and completed as a commercial producer of oil and/or gas, and if you have complied with the other terms and provisions of this Agreement, we will, within thirty (30) days after being furnished proper evidence that said well has been completed as a commercial producer of oil and/or gas, deliver to you an Assignment of Operating Rights, without warranty of title, all of our right, title and interest in and to acreage and leases approved by the U.S.G.S. and the OCC of the State of New Mexico and approval of the undersigned parties for a proration unit to the producing depth for said well, down to a depth of one hundred (100) feet below the producing perforations.

In this Assignment of Operating Rights, we shall retain a one-eighth of eight-eighths (1/8 of 8/8) overriding royalty and out of this overriding royalty we will assume any overriding royalty or oil payment presently existing on said leases. The above overriding royalty reserved by the undersigned, at our option, may be converted into a 37½% working interest in this well and the leases assigned thereto, after you have recovered all of your costs of drilling, completing and operating said well. The overriding royalty and conversion shall be reduced to accord with each party's interest in the proration unit approved by the U.S.G.S., the OCC of the State of New Mexico and the undersigned parties. In determining the cost of drilling, completing and operating of said well, the Accounting Procedure attached to the Operating Agreement shall apply in determining the payout period to the conversion privilege herein retained by the parties.

By securing commercial production of oil and/or gas from the above test well or substitute well, you shall have earned an option to continuously develop the above described acreage to the producing horizon with the understanding that no more than one hundred eighty (180) days shall elapse between the completion of one well upon our acreage and the commencement of operations for another test well upon some portion of the above described acreage. You shall give Bass et al thirty (30) days written notice prior to the commencement of operation, after you have earned the above option, in which to join you in paying 37½% of the cost of the proposed well reduced proportionately to the acreage each party owns in the proposed prorated unit. Said notice shall designate the location of said well, its depth and the acreage allotted for a prorated unit along with a proposed AFE. In the event the party or parties do not desire to join you in drilling the proposed test, each declining party shall retain a one-eighth of eight-eighths, (1/8 of 8/8) overriding royalty and out of this overriding royalty each declining party shall assume any overriding royalty or oil payment presently existing on said lease reduced proportionately to the acreage contributed to the proposed unit. This option to join or farmout shall be continuous on each subsequent proposed proration unit and well thereafter. Failure to continuously de-

portion of said leases. If this alternate test well is commenced, it shall be drilled with due diligence to the same depth as provided for the original test well.

If either of said wells are drilled to a depth sufficient to test the Morrow formation or deeper depth and completed as a commercial producer of oil and/or gas, and if you have complied with the other terms and provisions of this Agreement, we will, within thirty (30) days after being furnished proper evidence that said well has been completed as a commercial producer of oil and/or gas, deliver to you an Assignment of Operating Rights, without warranty of title, all of our right, title and interest in and to acreage and leases approved by the U.S.G.S. and the OCC of the State of New Mexico and approval of the undersigned parties for a proration unit to the producing depth for said well, down to a depth of one hundred (100) feet below the producing perforations.

In this Assignment of Operating Rights, we shall retain a one-eighth of eight-eighths (1/8 of 8/8) overriding royalty and out of this overriding royalty we will assume any overriding royalty or oil payment presently existing on said leases. The above overriding royalty reserved by the undersigned, at our option, may be converted into a 37½% working interest in this well and the leases assigned thereto, after you have recovered all of your costs of drilling, completing and operating said well. The overriding royalty and conversion shall be reduced to accord with each party's interest in the proration unit approved by the U.S.G.S., the OCC of the State of New Mexico and the undersigned parties. In determining the cost of drilling, completing and operating of said well, the Accounting Procedure attached to the Operating Agreement shall apply in determining the payout period to the conversion privilege herein retained by the parties.

By securing commercial production of oil and/or gas from the above test well or substitute well, you shall have earned an option to continuously develop the above described acreage to the producing horizon with the understanding that no more than one hundred eighty (180) days shall elapse between the completion of one well upon our acreage and the commencement of operations for another test well upon some portion of the above described acreage. You shall give Bass et al thirty (30) days written notice prior to the commencement of operation, after you have earned the above option, in which to join you in paying 37½% of the cost of the proposed well reduced proportionately to the acreage each party owns in the proposed prorated unit. Said notice shall designate the location of said well, its depth and the acreage allotted for a prorated unit along with a proposed AFE. In the event the party or parties do not desire to join you in drilling the proposed test, each declining party shall retain a one-eighth of eight-eighths, (1/8 of 8/8) overriding royalty and out of this overriding royalty each declining party shall assume any overriding royalty or oil payment presently existing on said lease reduced proportionately to the acreage contributed to the proposed unit. This option to join or farmout shall be continuous on each subsequent proposed proration unit and well thereafter. Failure to continuously de-

velop such acreage shall automatically release any interest which you might have in our above described acreage, with the exception of any acreage previously earned.

Each commercial producer completed in accordance with the terms of the continuous drilling program above set out, shall earn an Assignment of Operating Rights as above provided for the covering of the proration unit designated and approved by the U.S.G.S., the OCC of the State of New Mexico and the undersigned parties, down to a depth of one hundred (100) feet below the producing perforations of each subsequent well drilled thereon.

The undersigned parties hereto ~~shall have the right to~~ market their share, whether it be a working interest or an overriding royalty interest of the liquid hydrocarbons (~~crude oil~~ and condensate) ~~and gas~~ (casinghead and gas well gas) produced from any of the lands and leases set out above, subject to the following:

The undersigned parties hereto right to purchase gas and liquid hydrocarbons shall not apply when such hydrocarbons are used by you in your operations.

All sands and formations, in which oil or gas may be encountered, shall be tested to the complete satisfaction of the undersigned. You agree that our representative shall have free and convenient access to the derrick floor at all times for the purpose of witnessing the progress of the drilling of said test well; that Mr. Bill Ford (Residence phone 683-3850, Office phone 682-4329) or Mr. W. J. Parsons (Residence phone 694-2206, Office phone 682-4329) representing Perry R. Bass, of Midland, Texas, and such other person or persons so designated by the undersigned parties, shall be furnished with the following information and notices:

a) notice that the well has been staked and operations are about to begin, together with daily drilling reports on the progress of said test well;

b) any surveys of the hole, however made;

c) samples of the fluid recovered on drillstem and production tests;

d) samples of all cores taken and samples of cuttings from the surface of the soil to the total depth drilled, such cuttings to be furnished at least twice each week in receptacles supplied by us properly labeled, core samples to be furnished or made available to our representative immediately after the same have been taken;

e) notice of your intention to take any drillstem test in sufficient time for us to arrange to have our representative present to witness such test;

f) notice of the completion of said test well in sufficient time for us to arrange to have our representative present to witness the measurement of the depth; and the permission of the undersigned to abandon the well before actual plugging shall take place;

g) one induction electrical survey and gamma ray log and one porosity log;

h) a certified copy of the log upon completion of the well;

i) deliver a complete set of white sacks containing samples of the well to Midland Sample Library;

j) a copy of monthly production reports, together with notification of major workovers, on all wells drilled upon our acreage.

You agree to fully protect us against any and all claims of any and every nature whatsoever by our lessors, their tenants and/or any third parties caused by or arisihg from your operations on the land covered by this Agreement.

~~Neither this letter, nor any rights hereunder, shall be assigned by you without the written consent of the undersigned.~~

If the foregoing outlines your understanding of the conditions under which this Agreement is made, please signify your acceptance in the space provided below and return the duplicate original to us. If this Agreement is not executed and returned before fifteen (15) days from this date, it shall, at the option of the undersigned, become null and void.

This agreement may be executed by executing the original copy of this agreement, a counterpart thereof, or other instrument agreeing to be bound by the provisions hereof, with the same effect as if all parties had executed the same instrument, and the provisions hereof shall be binding upon and shall inure to the benefit of each party executing this agreement and his or its heirs, devisees, legal representatives, successors and assigns, as to all interests of such party in the leases hereinabove described.

This agreement and all of the rights, obligations and conditions hereof shall be binding upon each party executing this instrument and their heirs, devisees, successors and assigns. Should any party named herein fail to execute this agreement or should any party execute this agreement who is not named below, it shall nevertheless be binding upon such party or parties executing the agreement.

Operating Agreement attached hereto and made a part hereof for all purposes.

Notwithstanding anything herein to the contrary, should there be a conflict between this Letter Agreement and the Operating

Agreement, this Letter Agreement shall be superior and controlling in all aspects.

Yours very truly,

BASS ENTERPRISES PRODUCTION CO.

BY: _____

_____
Perry R. Bass

ATLANTIC RICHFIELD COMPANY

BY: _____

TEXACO, INC.

BY: _____

PHILLIPS PETROLEUM COMPANY

BY: _____

TENNECO OIL COMPANY

BY: _____

_____
Frank O. Elliott, Trustee under
the Frank O. Elliott Living Trust

_____
Clarence E. Hinkle, Trustee under
the Frank O. Elliott Living Trust

Agreement, this Letter Agreement shall be superior and controlling in all aspects.

Yours very truly,

BASS ENTERPRISES PRODUCTION CO.

BY: _____

_____
Perry R. Bass

ATLANTIC RICHFIELD COMPANY

BY: _____

TEXACO, INC.

BY: _____

PHILLIPS PETROLEUM COMPANY

BY: _____

TENNECO OIL COMPANY

BY: _____

_____
Frank O. Elliott, Trustee under
the Frank O. Elliott Living Trust

_____
Clarence E. Hinkle, Trustee under
the Frank O. Elliott Living Trust

Agreement, this Letter Agreement shall be superior and controlling in all aspects.

Yours very truly,

BASS ENTERPRISES PRODUCTION CO.

BY: _____

_____
Perry R. Bass

ATLANTIC RICHFIELD COMPANY

BY: _____

TEXACO, INC.

BY: _____

PHILLIPS PETROLEUM COMPANY

APPROVED BY
ATTORNEY

BY: _____
FRED FORWARD, Attorney-in-Fact

TENNECO OIL COMPANY

BY: _____

_____
Frank O. Elliott, Trustee under
the Frank O. Elliott Living Trust

_____
Clarence E. Hinkle, Trustee under
the Frank O. Elliott Living Trust

Agreement, this Letter Agreement shall be superior and controlling in all aspects.

Yours very truly,

BASS ENTERPRISES PRODUCTION CO.

BY: _____

_____
Perry R. Bass

ATLANTIC RICHFIELD COMPANY

BY: _____

TEXACO, INC.

BY: _____

PHILLIPS PETROLEUM COMPANY

BY: _____

TENNECO OIL COMPANY

BY: _____

_____
Frank O. Elliott, Trustee under
the Frank O. Elliott Living Trust

_____
Clarence E. Hinkle, Trustee under
the Frank O. Elliott Living Trust

Edna Ione Hall

Edna Ione Hall, Trustee under the
Edna Ione Hall Living Trust

Clarence E. Hinkle, Trustee under
the Edna Ione Hall Living Trust

ACCEPTED and AGREED TO this the _____ day of _____, 1972.

BELCO PETROLEUM CORPORATION.

Edna Ione Hall, Trustee under the Edna Ione Hall Living Trust

Clarence E. Hinkle, Trustee under the Edna Ione Hall Living Trust

ACCEPTED and AGREED TO this the 14th day of September, 1972.

BELCO PETROLEUM CORPORATION.

BY: John D. Lowe
Vice President

Edna Ione Hall, Trustee under the Edna Ione Hall Living Trust

Clarence E. Hinkle, Trustee under the Edna Ione Hall Living Trust

ACCEPTED and AGREED TO this the _____ day of _____, 1972.

BELCO PETROLEUM CORPORATION.

STATE OF TEXAS)

COUNTY OF ECTOR)

The foregoing instrument was acknowledged before me this 5th day of September, 1972, by FRED FORWARD as attorney-in-fact on behalf of PHILLIPS PETROLEUM COMPANY, A Delaware Corporation.

My Commission Expires:

June 1, 1973

Notary Public in and for Ector County, Texas.

United States Department of the Interior

GEOLOGICAL SURVEY

Drawer 1857
Roswell, New Mexico 88240

October 12, 1972

RECEIVED

OCT 16 1972

MIDLAND OFFICE

Belco Petroleum Corporation
2000 Wilco Building
Midland, Texas 79701

Bass No. 1
in N/2 of 30

Gentlemen:

Your Application for Permit to Drill well No. 1 Bass Federal in the SE¼NW¼ sec. 30, T. 20 S., R. 33 E., Lea County, New Mexico, lease New Mexico 03023-B, to a depth of 14,500 feet to test the Devonian formation in the Potash Area is hereby approved.

One copy of the application is returned herewith. Please notify the District Engineer, Geological Survey, P. O. Box 1157, Hobbs, New Mexico 88240, in sufficient time for a representative to witness all cementing operations.

Sincerely yours,

N. O. FREDERICK
Area Oil and Gas Supervisor

Enclosure

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. 5
Submitted by Belco
Hearing Date 3-15-74

Form 9-331 C
(May 1963)

SUBMIT IN TRIPLICATE*
(Other instructions on reverse side)

Form approved.
Budget Bureau No. 42 R1425.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

5. LEASE DESIGNATION AND SERIAL NO.: NM-03023-B

6. IF INDIAN, ALLOTTEE OR TRIBE NAME:

1a. TYPE OF WORK: DRILL [XX] DEEPEN [ ] PLUG BACK [ ]

b. TYPE OF WELL: OIL WELL [ ] GAS WELL [XX] OTHER — SINGLE ZONE [XX] MULTIPLE ZONE [ ]

7. UNIT AGREEMENT NAME:

8. FARM OR LEASE NAME: Bass Federal

2. NAME OF OPERATOR: Belco Petroleum Corporation

9. WELL NO.: 1

3. ADDRESS OF OPERATOR: 2000 Wilco Building, Midland, Texas 79701

10. FIELD AND POOL, OR WILDCAT: Wildcat

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements.*)
At surface: 1980' FNWL's Section 30, T-20-S, R-33-E, Lea County
At proposed prod. zone: Same

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA: Section 30, T-20-S, R-33E

14. DISTANCE IN MILES AND DIRECTION FROM NEAREST TOWN OR POST OFFICE*: 33 miles east of Carlsbad, New Mexico

12. COUNTY OR PARISH: Lea — 13. STATE: New Mexico

15. DISTANCE FROM PROPOSED* LOCATION TO NEAREST PROPERTY OR LEASE LINE, FT. (Also to nearest drlg. line, if any)	16. NO. OF ACRES IN LEASE	17. NO. OF ACRES ASSIGNED TO THIS WELL
1980'	320	320
18. DISTANCE FROM PROPOSED LOCATION* TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR, ON THIS LEASE, FT.	**19. PROPOSED DEPTH**	**20. ROTARY OR CABLE TOOLS**
None	14,500'	Rotary

21. ELEVATIONS (Show whether DF, RT, GR, etc.): 3580.9' GR

22. APPROX. DATE WORK WILL START*: October 10, 1972

23. PROPOSED CASING AND CEMENTING PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	QUANTITY OF CEMENT
~~20"~~	~~16"~~	~~65#~~	~~1,200'~~	~~1200 sx.~~ CIRCULATE
~~15"~~	~~13-3/8"~~	~~54.5#~~	~~2,800'~~	~~700 sx.~~
12-1/4"	9-5/8"	47#	11,400'	300 sx. CIRCULATE
8-1/2"	5-1/2"	20#	14,300'	400 sx.

Drilling, casing, and cementing programs to be in accordance with OCC Order R-111-A.

Mud Program: Conditioned fresh water 2300 to 11,400 feet. Brine or weighted mud as required 11,400 to 14,300 feet. Light brine 14,300 to 14,500 feet.

BOP Program: As in sketch A above 11,400 feet and as in sketch B below 11,400 feet.

Pit Volume Totalizer to be used below 11,400 feet.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: If proposal is to deepen or plug back, give data on present productive zone and proposed new productive zone. If proposal is to drill or deepen directionally, give pertinent data on subsurface locations and measured and true vertical depths. Give blowout preventer program, if any.

24.

SIGNED Glenn Cope TITLE District Engineer DATE 9-28-72

(This space for Federal or State office use)

PERMIT NO. _____ APPROVAL DATE _____

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

RECEIVED
OCT 16 1972
MIDLAND OFFICE

*See Instructions On Reverse Side

September 28, 1972

Bass No 1
in N/2 of Sec 30

Kerr-McGee Corporation
P. O. Box 610
Hobbs, New Mexico 88240

Re: Belco Petroleum Corporation
Bass Federal No. 1
1980' FNWL's of Section 30
T-20-S, R-33-E
Lea County, New Mexico

Gentlemen:

Belco Petroleum Corporation is planning to drill the subject well at the above location. Attached for your information is the U.S.G.S. Form 9-331-C with our proposed casing and cementing program. You will note that the program is in accordance with the regulations of Order R-111-A.

Belco Petroleum Corporation respectfully requests that if you, as the owner of a potash lease located within one mile of our proposed drillsite, have no objection to this procedure, please execute and return two copies of the attached letter.

Very truly yours,

BELCO PETROLEUM CORPORATION

Glenn Cope
District Engineer

GC/sh
Attachments

Received Sep 29 Kerr McGee Hobbs
By L. Nolan 9/29/72

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5793 Exhibit No. 6
Submitted by Belco
Hearing Date 3-15-74

Sent copy to B. Cope. WF BC

KERR-McGEE CORPORATION
KERR-McGEE BUILDING • OKLAHOMA CITY, OKLAHOMA 73102

1 to Team COPY

October 6, 1972

RECEIVED
OCT 10 1972
MIDLAND OFFICE

United States Geological Survey
Post Office Box 1157
Hobbs, New Mexico

Dear Sirs:

A copy of Belco Petroleum Corporation's Application For Permit To Drill has been received for the following location:

1980' FN&WL's Section 30, T-20-S, R-33-E, Lea County, New Mexico. This test well to be drilled to a proposed depth of 14,500 feet.

As a holder of Potash Leases within one (1) mile of the proposed well, Kerr-McGee Corporation has no objection to the drilling of the above referenced well, provided all drilling is done in accordance with Belco's Permit and with the New Mexico Oil Conservation Commission Order Number R-111-A.

Very truly yours,

Harold J. Kleen

Harold J. Kleen
Vice President
Minerals Exploration

HJK-sw

cc: Belco Petroleum Corporation
2000 Wilco Building
Midland, Texas 79701

Tex. Area

El Paso Natural Gas Company

El Paso, Texas

June 1, 1973

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. 7
Submitted by Belco
Hearing Date 3-15-74

Belco 1972 Oil and Gas Fund, Ltd.
c/o Belco Petroleum Corporation
Belco Petroleum Building
630 Third Avenue
New York, New York 10017

Re: Emergency Limited-Term Gas Purchase Contract--
Belco Operated Bass Federal No. 1 Well
All Section 30, T-20-S, R-33-E
Lea County, New Mexico

Bass No 1
N/2 of Sec 30

Gentlemen:

This Letter Agreement evidences the understanding reached between Belco 1972 Oil and Gas Fund, Ltd., as "Seller," and El Paso Natural Gas Company, as "Buyer," regarding the sale and purchase of gas-well gas (as so classified by the New Mexico Oil Conservation Commission) on an emergency limited-term basis from subject well, attributable to Seller's interest therein, as follows:

1.

Buyer is in need of emergency and limited-term gas supplies to aid it in assuring the maintenance of adequate natural gas service on its pipeline system and to thereby minimize curtailment of service to its customers.

2.

Seller will use its best efforts to deliver and sell and Buyer will use its best efforts to receive and purchase all gas Seller shall have available for delivery hereunder attributable to Seller's interest in subject well. The initial daily volume of gas available hereunder is estimated to be approximately five thousand

(

(5,000) MCF. Buyer represents that it shall at all times during the term hereof maintain sufficient pipeline capacity to receive volumes of gas hereunder which are at least ratable with the production of gas from wells belonging to others completed in the same reservoirs in which subject well is completed, whether such other wells be connected to Buyer's field gathering system or to a field gathering system or another purchaser. Determination of whether or not production is ratable shall be in accordance with the applicable rules and regulations established by duly constituted governmental authorities having jurisdiction thereof, or, in the absence of such rules and regulations, on the basis of gas reserves.

3.

(

The point of delivery of gas delivered hereunder shall be at the inlet of Buyer's gas measurement facilities to be located adjacent to subject well.

4.

Seller will deliver gas hereunder at a pressure sufficient to enter Buyer's gathering system against the working pressure maintained therein from time to time at the point of delivery, provided such working pressure shall not exceed seven hundred (700) psig, and further provided that neither Seller nor Buyer shall be obligated to install compression facilities in order to deliver gas hereunder, but either may do so at its option.

5.

The gas delivered hereunder shall be merchantable natural

(

gas and shall have a total gross heating value of not less than one thousand (1,000) BTU per cubic foot. Such gas shall not contain more than one-quarter (1/4) grain of hydrogen sulphide nor more than five (5) grains total sulphur (mercaptans) per one hundred (100) cubic feet; two per cent (2%) by volume of carbon dioxide nor more than two-tenths (0.2) of one per cent (1%) by volume of oxygen. Seller shall install, at its sole cost and expense, all separators and/or other devices which may be found necessary to prevent hydrocarbons and water in their liquid state from entering Buyer's gathering system at the point of delivery hereunder. If any gas delivered hereunder fails to meet any one of said quality requirements, then Buyer shall have the right, at its option, to refuse to accept such gas.

6.

Buyer shall pay Seller fifty-five cents (55¢) for each one thousand (1,000) cubic feet of gas delivered hereunder from said well, adjusted upward or downward as the total gross heating value of such gas varies from one thousand (1,000) BTU per cubic foot. On or before the tenth (10th) day of each calendar month, Buyer shall render to Seller a statement showing the total volume of gas measured in Buyer's meter station during the preceding calendar month, and on or before the twenty-fifth (25th) day of the calendar month in which such statement is rendered, shall tender its check for payment for all gas purchased hereunder during such calendar month. The statement and check shall be mailed to Seller:

Belco 1972 Oil and Gas Fund, Ltd.
Belco Petroleum Building
630 Third Avenue
New York, New York 10017

Each party hereto shall have the right at all reasonable times to examine the books and records of the other party to the extent necessary to verify the accuracy of any statement or computation made under or pursuant to this Letter Agreement. Any statement shall be final as to all parties unless questioned within one (1) year after payment thereof has been made.

7.

Any expense incurred in connection with the purchase and receipt of gas shall be borne by Buyer, and any expenses incurred in making the delivery and sale shall be borne by Seller, including, without limitation, the payment of any and all taxes levied on such gas prior to the delivery thereof to Buyer.

8.

The sale and purchase of gas hereunder shall begin as soon as practicable after execution hereof as an emergency sale in accordance with Federal Power Commission Order No. 418, issued December 10, 1970, and pursuant to Section 157.29 of the Commission Regulations Under the Natural Gas Act for a period of sixty (60) days from the date of first delivery. In order that the sale and purchase of gas hereunder may be continued for a further period of time upon conclusion of said sixty (60) day period, Seller agrees that it will timely file and prosecute with diligence an application with the Commission for a limited-term certificate with a pre-granted

abandonment provision for a limited-term of twenty-four (24) months from the date of first delivery of gas under said certificate. Such application shall be made by Seller pursuant to the Commission's Order No. 431 and 431-A issued April 15, 1971 and July 31, 1972, respectively. In the event the Commission fails to issue such certificate or fails to issue such certificate in terms satisfactory to Seller prior to sixty (60) days after the date of first delivery of gas hereunder, then sales shall be terminated forthwith and this agreement may be terminated at any time and by written notice to Buyer. Upon issuance by the Commission of a final nonappealable limited-term certificate in terms (including pre-granted abandonment) satisfactory to Seller, the sale and purchase of gas hereunder shall resume or continue, as the case may be, for the limited-term authorized.

9.

Measurement of gas delivered hereunder and related activities will be performed by Buyer in facilities installed by Buyer in accordance with the American Gas Association Gas Measurement Committee Report No. 3, Revised 1969, as amended from time to time.

10.

Except for the determination of the total gross heating value, the unit of volume for purposes of measurement of gas delivered hereunder shall be one (1) cubic foot of gas at a temperature base of sixty degrees (60°) F. and at a pressure base of fourteen and sixty-five hundredths pounds (14.65#) per square inch absolute. Atmospheric pressure shall be assumed to be thirteen and two-tenths

pounds (13.2#) per square inch absolute. Volumes shall be determined in accordance with American Gas Association Gas Measurement Committee Report No. 3, Revised 1969, as amended from time to time. The unit of volume for the determination of the total gross heating value of the gas delivered hereunder shall be the amount of gas, on a dry basis, which would occupy a volume of one (1) cubic foot at a temperature of sixty degrees (60°) F. and under a pressure equivalent to thirty inches (30") of mercury at thirty-two degrees (32°) F. Gas delivered hereunder shall be sampled by Buyer and tested by appropriate laboratory analyses promptly upon first delivery of gas and at three (3) month intervals thereafter during the term hereof for purposes of determining the total gross heating value thereof.

11.

Unless earlier terminated in accordance with paragraph 8 hereof, this Letter Agreement shall continue in full force and effect for a term ending upon the expiration of the twenty-four (24) month delivery period referred to in said paragraph 8. At the end of said term, all obligations of both Buyer and Seller hereunder shall terminate, except as to the payment for any gas delivered during the term hereof.

12.

Seller warrants title to all gas delivered hereunder and its right to sell same and warrants that such gas shall be free and clear of all liens and adverse claims. Title to all gas delivered hereunder shall pass from Seller to Buyer at the point of delivery

hereunder.

13.

Buyer shall be deemed to be in possession of gas sold hereunder and responsible for any loss, damages or injury caused thereby after such gas is delivered to Buyer at the point of delivery. Seller shall be deemed to be in possession of the gas sold hereunder and responsible for any loss, damages or injury caused thereby prior to delivery of same to Buyer at the point of delivery.

14.

Each party hereto shall be excused from performing under this agreement, other than to make payments for gas delivered hereunder, to the extent it is rendered unable to perform by a force majeure situation, but only for the period of time such force majeure situation continues. The term "force majeure" as employed herein shall mean acts of God, strikes, lockouts or other industrial disturbances, acts of the public enemy, wars, blockade, insurrections, riots, epidemics, landslides, lightning, earthquakes, fires, storms, floods, washouts, arrests, breakage or accident to machinery or lines of pipe, freezing of wells or lines of pipe, partial or entire failure of wells or plant operations, breakage of gathering or transmission lines; and other causes, whether of the kind herein enumerated or otherwise, not within the control of the party claiming suspension and which by the exercise of due diligence such party is unable to prevent or overcome.

15.

This agreement shall be subject to all valid applicable state and local laws, rules and regulations. Both Buyer and Seller shall be entitled to treat all laws, orders, rules and regulations issued by any Federal or State regulatory body as valid at such time and may act in accordance therewith until such time as the same may be invalidated by final judgement in a court of competent jurisdiction.

16.

This agreement shall bind and benefit the parties hereto and their respective successors and assigns.

17.

Any notice provided for or permitted in this Letter Agreement shall be deemed sufficiently given and served when and if deposited in the United States mail, postage prepaid and registered, addressed to Seller at the address referred to in paragraph 6 hereof, or to Buyer at P. O. Box 1492, El Paso, Texas 79978, as the case may be, or to such other address as either party shall respectively hereafter designate in writing. Routine communications, including monthly statements and payments, shall be considered as duly delivered when mailed by either registered mail or ordinary first class mail, postage prepaid.

If the foregoing correctly states Seller's understanding concerning the matters covered herein, it is requested that Seller indicate its acceptance hereof and agreement hereto by executing

Belco 1972 Oil and Gas Fund, Ltd. -9-
New York, New York 10017

this letter in the space provided below.

Very truly yours,

EL PASO NATURAL GAS COMPANY

By A. M. Dorrick, Vice President

Accepted and Agreed to this
29th day of May, 1973:

BELCO 1972 OIL AND GAS FUND, LTD.

By _____

Belco Petroleum Corporation,
General Partner

El Paso Natural Gas Company

El Paso, Texas 79978

A. M. DERRICK
VICE PRESIDENT

September 21, 1973

Belco 1972 Oil and Gas Fund, Ltd.
Belco Petroleum Building
630 Third Avenue
New York, New York 10017

Re: Emergency Limited-Term Gas Purchase Contract--Belco Operated Bass Federal No. 1 Well, All Section 30, T 20 S, R 33 E Lea County, New Mexico

Gentlemen:

Reference is made to that certain Letter Agreement between us dated June 1, 1973, captioned as per the above.

In accordance with the provisions thereof, first deliveries of gas from all wells covered thereunder occurred September 12, 1973, and thus establishes the commencement date for the sixty day emergency delivery period referred to in paragraph 8 thereof.

In view of the Federal Power Commission's Order No. 491 issued September 14, 1973, the parties hereto now desire to amend and supplement said Letter Agreement in the following respects:

1.

In accordance with said Order, Belco will file a notice of withdrawal with the Federal Power Commission of its limited-term certificate applicable to said Letter Agreement subject to the refiling thereof as referred to below.

2.

Pursuant to said Order, it is agreed that, upon the conclusion of the said sixty (60) day emergency delivery period, being November 11, 1973, the purchase and sale of gas shall continue for an additional emergency delivery period of one hundred eighty (180) days, which such additional delivery period will conclude May 10, 1974.

3.

It is agreed that Belco shall timely refile its application for a limited-term certificate prior to the conclusion of said additional one hundred eighty (180) day delivery period; however, for a limited term of eighteen (18) months rather than the twenty-four (24) month period now provided.

4.

All other terms and provisions of said Letter Agreement shall remain fully effective insofar as the same are not inconsistent with the foregoing.

If the foregoing correctly states your understanding concerning the matters covered herein, it is requested that you indicate your acceptance hereof and agreement hereto by executing this letter in the space provided below.

Very truly yours,

EL PASO NATURAL GAS COMPANY

By _____
A. M. Derrick, Vice President

Accepted and Agreed to this
24TH day of SEPTEMBER, 1973:

BELCO 1972 OIL AND GAS FUND, LTD.

By _____
Belco Petroleum Corporation,
General Partner

Form 9-331 C
(May 1963)

SUBMIT IN TRIPLICATE*
(Other instructions on reverse side)

Form approved.
Budget Bureau No. 42-R1425.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. TYPE OF WORK: DRILL [XX] DEEPEN [ ] PLUG BACK [ ]

b. TYPE OF WELL: OIL WELL [ ] GAS WELL [XX] OTHER — SINGLE ZONE [XX] MULTIPLE ZONE [ ]

2. NAME OF OPERATOR: Belco Petroleum Corporation

3. ADDRESS OF OPERATOR: 2000 Wilco Building, Midland, Texas 79701

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements.*)
At surface: 660' FSL & 1300' FEL Section 30, T-20-S, R-33-E Lea County
At proposed prod. zone: Same

5. LEASE DESIGNATION AND SERIAL NO.: NM-03023A
6. IF INDIAN, ALLOTTEE OR TRIBE NAME: None
7. UNIT AGREEMENT NAME: None
8. FARM OR LEASE NAME: Bass-Federal
9. WELL NO.: 2
10. FIELD AND POOL, OR WILDCAT: South Salt Lake
11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA: Sec. 30, T-20-S, R-33-E
12. COUNTY OR PARISH: Lea
13. STATE: New Mexico

14. DISTANCE IN MILES AND DIRECTION FROM NEAREST TOWN OR POST OFFICE*: 33 Miles East of Carlsbad, New Mexico

15. DISTANCE FROM PROPOSED* LOCATION TO NEAREST PROPERTY OR LEASE LINE, FT. (Also to nearest drlg. unit line, if any)	660'	16. NO. OF ACRES IN LEASE: 320	17. NO. OF ACRES ASSIGNED TO THIS WELL: 320
18. DISTANCE FROM PROPOSED LOCATION* TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR, ON THIS LEASE, FT.	None	19. PROPOSED DEPTH: 13,600'	20. ROTARY OR CABLE TOOLS: Rotary

21. ELEVATIONS (Show whether DF, RT, GR, etc.): 3539.9 GR
22. APPROX. DATE WORK WILL START*: 11-15-73

23. PROPOSED CASING AND CEMENTING PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	QUANTITY OF CEMENT
16'	13 3/8"	48#	1,000'	350sx (To Circulate)
12 ¼	10 3/4"	40.50#	3,100'	650sx (To Circulate)
9 ½	7 5/8"	26.40 & 29.70#	10,300'	~~2000sx~~ to surf in 2 stages 1st 800sx+200 2nd circ. light weight & follow w/ 300sx neat
6 ½	5 1/2"	17#	13,600'	750sx

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. 8
Submitted by Belco
Hearing Date 3-12-74

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: If proposal is to deepen or plug back, give data on present productive zone and proposed new productive zone. If proposal is to drill or deepen directionally, give pertinent data on subsurface locations and measured and true vertical depths. Give blowout preventer program, if any.

24.

SIGNED [signature] TITLE District Engineer DATE 10-18-73

(This space for Federal or State office use)

PERMIT NO. _____ APPROVAL DATE _____

APPROVED BY _____ TITLE _____ DATE _____
CONDITIONS OF APPROVAL, IF ANY:

*See Instructions On Reverse Side

3000 Wall Building
Midland, Texas 79701
Telephone (915) 683-6366

Belco Petroleum Corporation

Belco

October 18, 1973

United States Geological Survey
Post Office Box 1157
Hobbs, New Mexico 88240

Re: Belco Petroleum Corporation
Bass Federal Well No. 2
660' FSL & 1300' FEL
Section 30, T-20-S, R-33-E
Lea County, New Mexico

Gentlemen:

1. Existing Roads - Highway 128 is the nearest existing road.

2. Planned Access Road - It is planned to extend the caliche road straight south from the Bass-Federal No. 1 to a point directly east of the proposed location and then build a road directly east to the proposed location.

3. Location of Wells - This is the second Belco Petroleum Corporation well in the field, being a southeast offset to the Belco Petroleum Corporation Bass Federal No. 1.

4. Lateral Roads to Well Locations - The roads to the wells are shown on the attached plat.

5. Location of Tank Batteries and Flowlines - In case of production, any tank battery or necessary producing facility would be placed upon the drilling pad.

6. Location and Types of Water Supply - There is no ground water available in the area and water will have to be purchased from a commercial source and trucked to the location.

7. Methods for Handling Waste Disposal - It is planned to build an 8' X 4' X 4' waste pit next to the reserve pit in which to dispose of all waste.

8. Proposed Disposition of Produced Brine Water - Subject well is a gas prospect and no water production is anticipated; however, any produced brine water would be disposed of by hauling to a commercial water disposal well.

9. Disposition of Casinghead Gas - There is a ready market in the area for casinghead gas and the low pressure casinghead gas will be sold.

10. Location Layout - Attached is a diagram of the location showing the position of the various components of the system.

11. Plans for Restoration of the Surface - In case of a dry hole or upon abandonment of the well, all pits and cellars will be filled and leveled. The location will be leveled as nearly as possible to original top ground contour with all dead men removed, all junk and trash disposed.

Very truly yours,

BELCO PETROLEUM CORPORATION

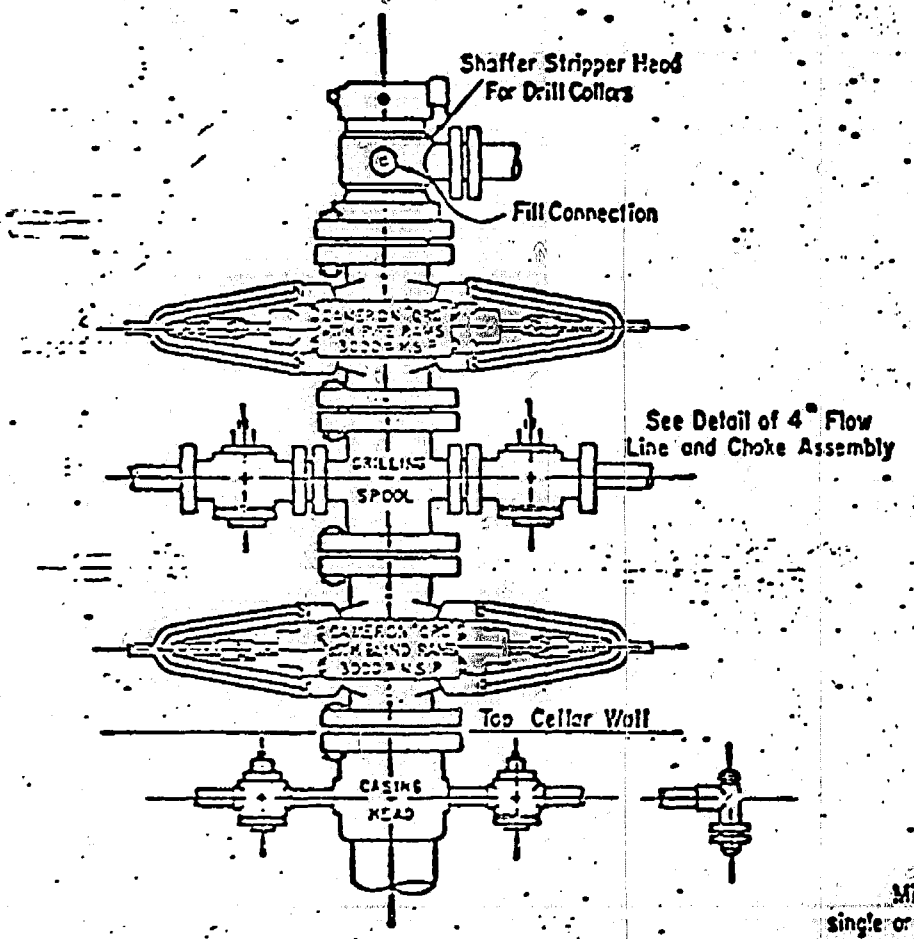
Original Signed
By GLENN COPE

Glenn Cope
District Engineer

GC/sl

Attachments

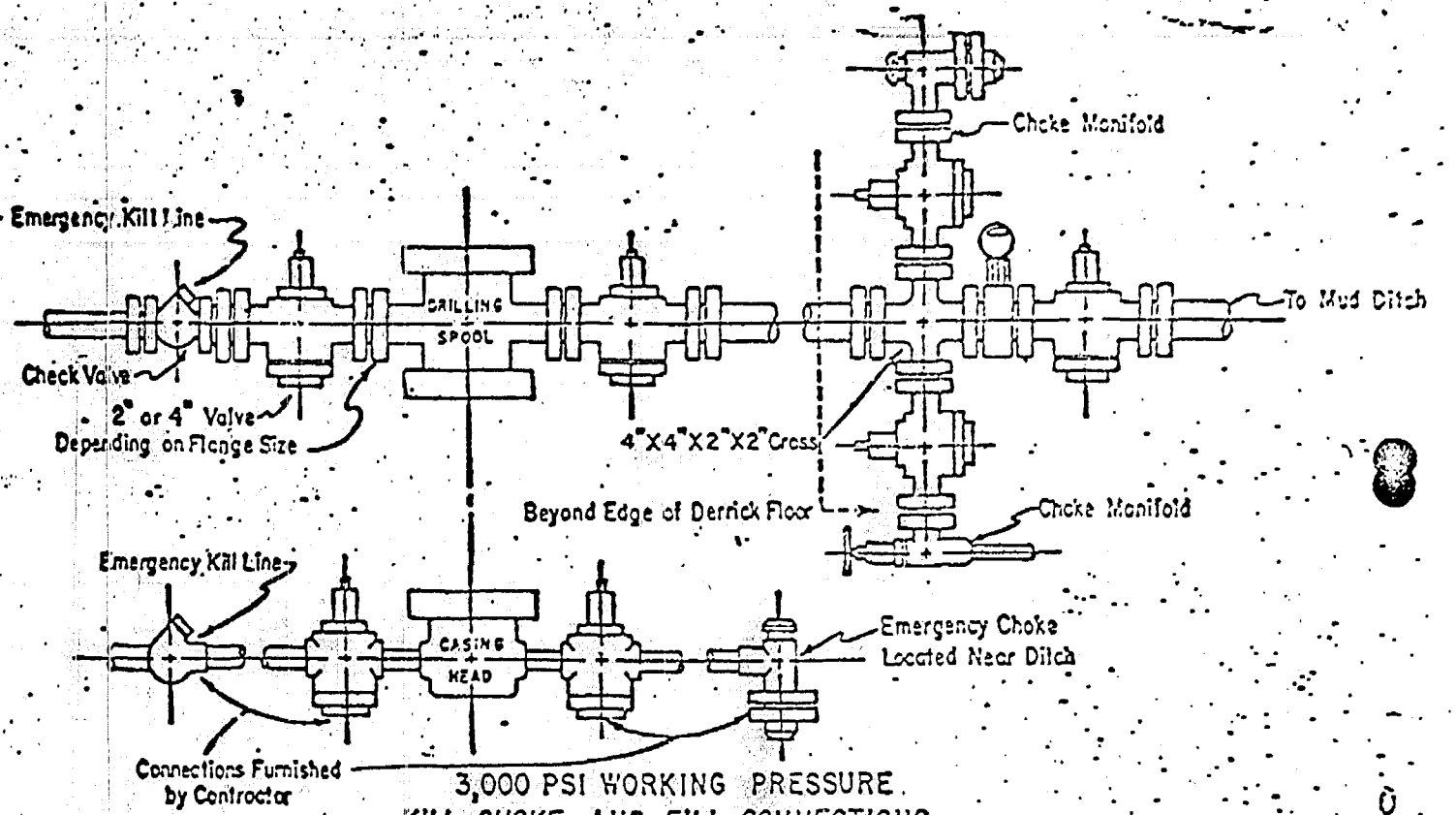
Drawing No. 2
Revised 1-15-59



3,000 PSI WORKING PRESSURE BLOWOUT PREVENTER HOOK-UP

Series 900 Flanges, or Better

SKETCH "A"



3,000 PSI WORKING PRESSURE
KILL, CHOKE, AND FILL CONNECTIONS

API Series 900 Flanges or Better

DETAIL OF 4" FLOW LINE CHOKE ASSEMBLY:

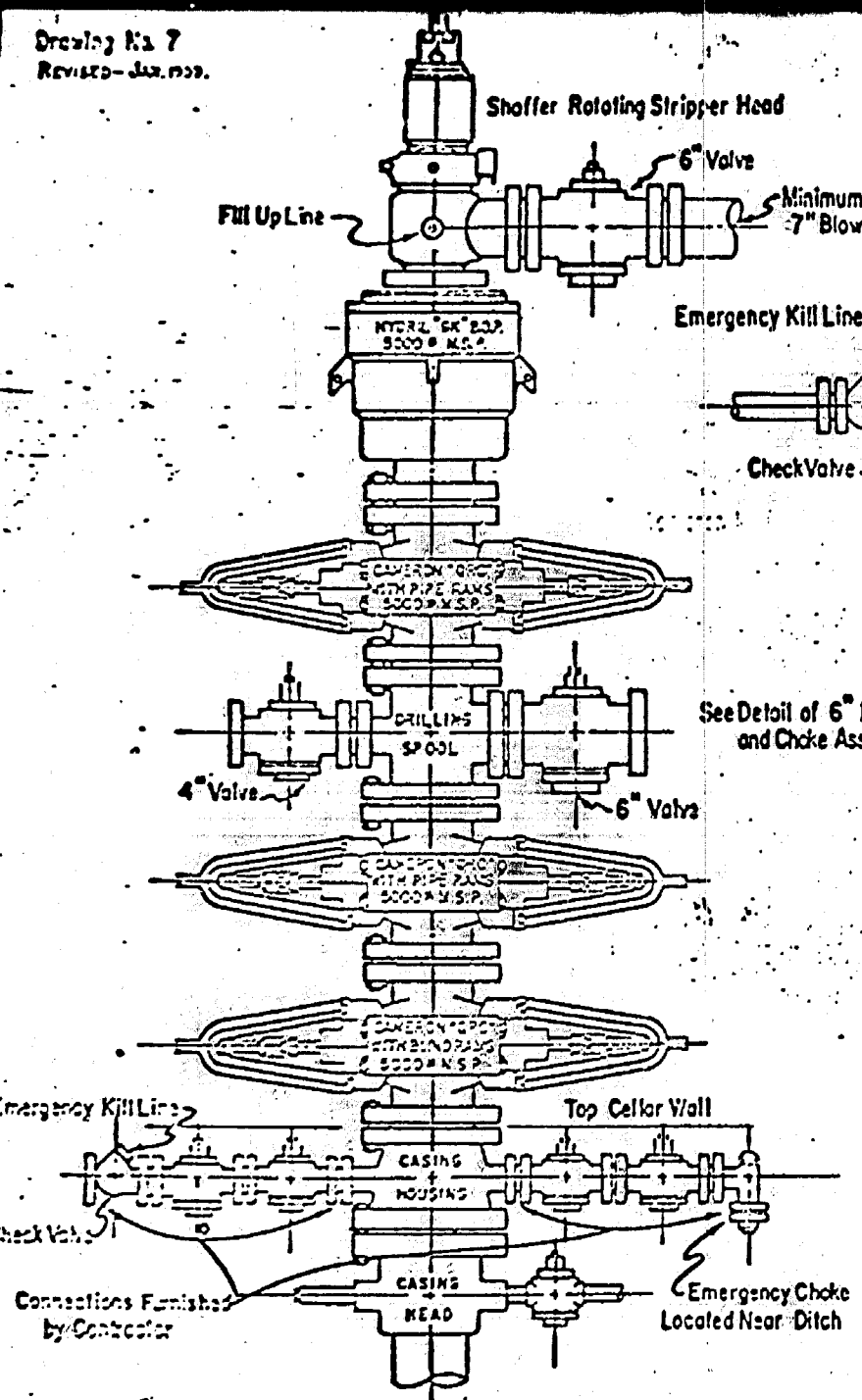
Minimum assembly for 3000 PSI working pressure will consist of two preventers which may be Cameron QRC, Cameron Type F, single or double, Cameron Space-Saver or Shaffer Hydraulic, single or double. If double preventers are provided, the drilling spool shall be placed below the preventers and the blind rams placed in the upper preventer. With this arrangement it will not be necessary to provide a kill and choke line to Gulf's casinghead housing. In lieu of the drilling spool, the flanged outlets of the double Shaffer, the Space-Saver or double F, if they are the correct size, and provided the preventers can be installed to meet Gulf's requirements, may be used for the four-inch flow line and the two-inch kill line.

Size 12-inch preventers may be used for work down through 8-5/8-inch casing. Size 10-inch preventers may be used for work down through 7-5/8-inch casing. Size six-inch preventers are to be used for work through 7-inch and 5-1/2-inch casings.

Minimum operating equipment for the preventers will be: (1) An air operated pump and (2) An accumulator (s) with some means of obtaining a fluid charge. A closed fluid system is recommended. The closing manifold and remote closing manifold will have a separate four-way valve for each pressure operated device. Sufficient fluid capacity in the accumulator (s) shall be available to close all the pressure operated devices at the same time with 25 per cent reserve. Gulf No. 561 hydraulic oil shall be used as the operating fluid.

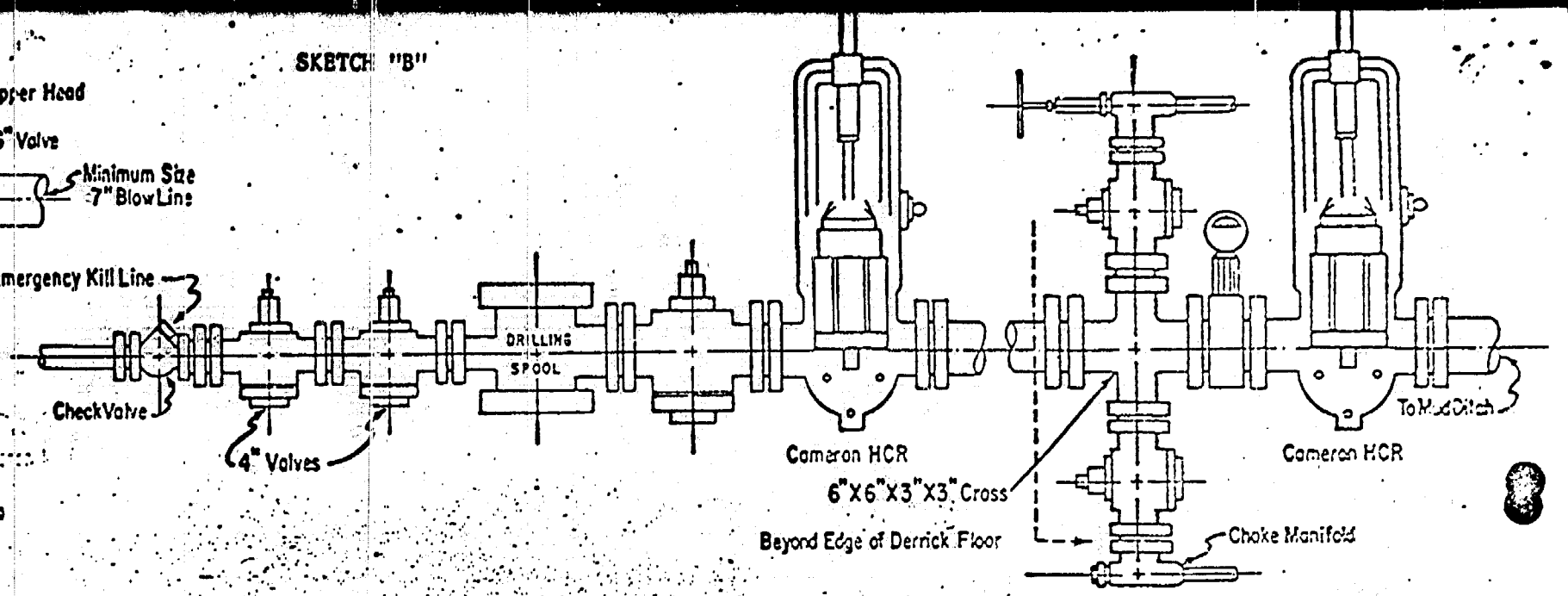
The four-inch flow line from the preventers shall be supported by a metal stand or reinforced concrete. All valves throughout the assembly shall be selected for operation in both gas and fluids. Sufficient substructure height is to be provided in the event Gulf should request installation of a rotating type blow-out preventer. The preventers will be provided with stem extensions, universal joints, if needed, and operating wheels.

Drawing No. 7
Revised-Jan. 1959.



AIR-GAS-MIST DRILLING
5,000 PSI WORKING PRESSURE
BLOWOUT PREVENTER HOOK-UP
Series 1500 Flanges or Better

SKETCH "B"



AIR-GAS-MIST DRILLING
5,000 PSI WORKING PRESSURE
KILL, CHOKE, AND FILL CONNECTIONS
API Series 1500 Flanges or Better

DETAIL OF 6" FLOW LINE CHOKE ASSEMBLY

Minimum assembly for 5000 PSI working pressure will consist of four preventers and a Shaffer Combination Rotating Stripper Head. The two lower preventers may be Cameron QRC, Cameron Type F, single or double, or Shaffer hydraulic, single or double. The preventer above the drilling spool may be Cameron QRC or Cameron Type F and the upper preventer below the Shaffer Rotating Stripper Head will be Hydril GK.

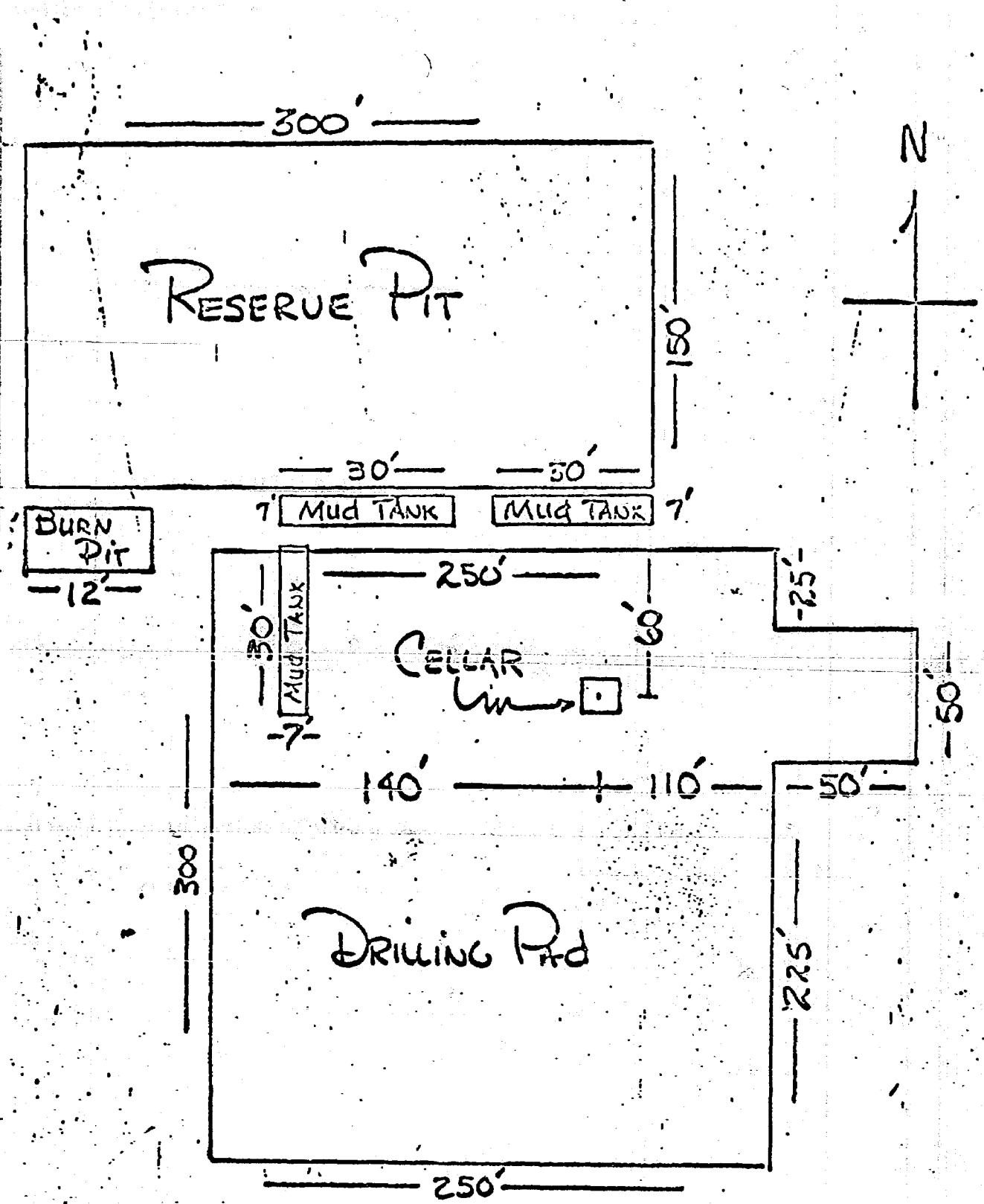
Size 12-inch preventers may be used for work down through 8-5/8-inch casing. Size 10-inch preventers may be used for work down through 7-5/8-inch casing. Size 6-inch preventers, with a 4-inch or larger flow line choke assembly as shown above, are to be used for work through 7-inch and 5-1/2-inch casings.

Minimum operating equipment for the preventers will be: (1) an air operated pump and (2) an accumulator (s) with some means of obtaining a fluid charge. A closed fluid system is recommended. The closing manifold and remote closing manifold will have a separate four-way valve for each pressure operated device and a Hydril regulator will be provided. Sufficient fluid capacity in the accumulator (s) shall be available to close all the pressure operated devices at the same time with 25 per cent reserve. Gulf No. 561 hydraulic oil shall be used as the operating fluid.

The six-inch flow line shall be supported by a metal stand or reinforced concrete. All valves throughout the assembly shall be selected for operation in both gas and fluids.

The ram type preventers and the Cameron HCR valves will be provided with stem extensions, universal joints, if needed, and operating wheels.

14-inch 5000 PSI W.P. Flange



BELCO PET. CO. - NEW DRILLING PAD

BEFORE THE

OIL CONSERVATION COMMISSION OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF BELCO PETROLEUM CORPORATION FOR APPROVAL OF A NON-STANDARD GAS PRORATION UNIT AND UNORTHODOX WELL LOCATION, SOUTH SALT LAKE FIELD, LEA COUNTY, NEW MEXICO

RECEIVED
OCT 22 1973
HOUSTON OFFICE

A P P L I C A T I O N

COMES NOW BELCO PETROLEUM CORPORATION and applies to the Oil Conservation Commission for approval of a non-standard gas proration unit and approval of an unorthodox well location in the South Salt Lake Field, Lea County, New Mexico, and in support thereof would show the Commission:

1. Applicant proposes to drill a well to the Morrow formation in the South Salt Lake Field, the well to be located 660 feet from the South line, and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, N.M.P.M., to be dedicated to a unit composed of the E/2 SW/4 and SE/4 of Section 30, and the N/2 NE/4 of Section 31, all in Township 20 South, Range 33 East.

2. Applicant proposed the non-standard unit for the reason the W/2 SW/4 of Section 30, is within the Little Eddy Unit and within a participating area for Morrow production; all of Section 31 with the exception of the N/2 NE/4 is also within the Little Eddy Unit, and this 80-acre tract will be isolated and without an opportunity to participate in production unless the proposed non-standard unit is approved.

3. Applicant proposes the unorthodox well location in order to avoid drilling on an existing potash lease which, in addition to other lands, covers the W/2 SE/4 of Section 30, and the N/2 NE/4 of Section 31.

WHEREFORE applicant requests that this application be set for hearing before the Commission's duly appointed examiner, and that after notice and hearing as required by law the Commission enter its order approving the non-standard unit and unorthodox well location as prayed for.

Respectfully submitted:

BELCO PETROLEUM CORPORATION

By_____

KELLAHIN & FOX
P. O. Box 1769
Santa Fe, New Mexico 87501

ATTORNEYS FOR APPLICANT

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section.

Operator	Lease	Well No.
BELCO PETROLEUM CORP.	BASS FEDERAL	2

Unit Letter	Section	Township	Range	County
P	30	20 South	33 East	Lea

Actual Footage Location of Well:
660 feet from the South line and 1300 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3595.9			Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

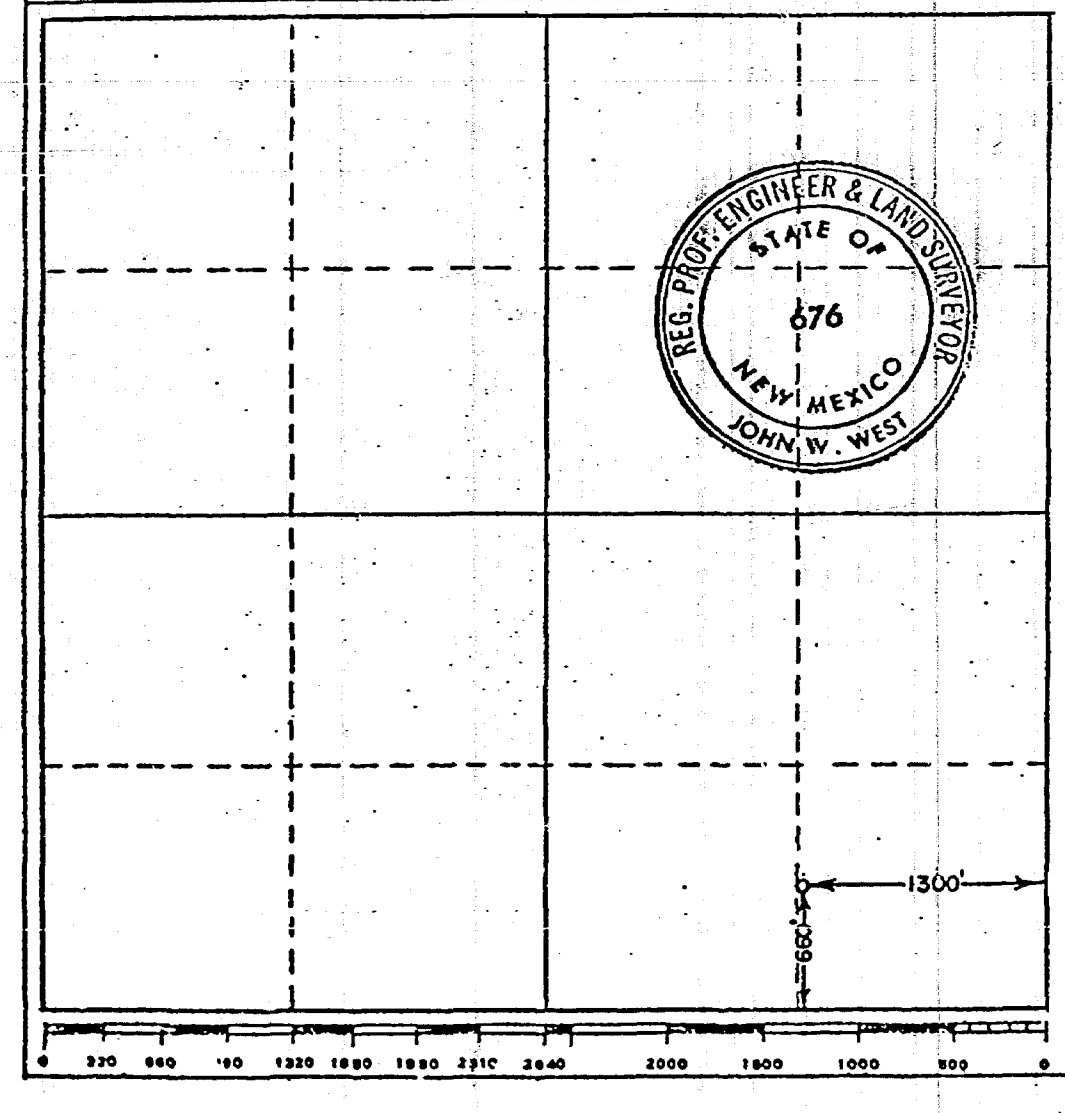
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling. etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, *forced-pooling*, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: Glenn Copp

Position: District Engineer

Company: Belco Petroleum Corporation

Date: 10/18/73

I hemby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed: October 10, 1973

Registered Professional Engineer and/or Land Surveyor

John W West

Certificate No. 676

2000 Wiley Building
Midland, Texas 79701
Telephone (915) 683-6366

Belco Petroleum Corporation

Belco

October 18, 1973

U. S. Potash and Chemical Co.
101 North Halagueno
Carlsbad, New Mexico 88220

Re: Belco Petroleum Corporation
Bass Federal No. 2
660' FSL & 1300' FEL
Section 30, T-20-S, R-33-E
Lea County, New Mexico

Gentlemen:

Belco Petroleum Corporation is planning to drill the subject well at the above location. Attached for your information is the U.S.G.S. Form 9-331-C with our proposed casing and cementing program. You will note that the program is in accordance with the regulations of Order R-111-A.

Belco Petroleum Corporation respectfully requests that if you, as the owner of a potash lease located within one mile of our proposed drillsite, have no objection to this procedure, please execute and return two copies of the attached letter.

Very truly yours,

BELCO PETROLEUM CORPORATION

Glenn Cope
District Engineer

GC/sl

Attachments

2000 Wilco Building
Midland, Texas 79701
Telephone (915) 683-6366

Belco Petroleum Corporation

Belco

October 18, 1973

Mr. E. W. Douglas
1113 Tracy Place
Carlsbad, New Mexico 88220

Re: Belco Petroleum Corporation
Bass Federal No. 2
660' FSL & 1300' FEL
Section 30, T-20-S, R-33-E
Lea County, New Mexico

Gentlemen:

Belco Petroleum Corporation is planning to drill the subject well at the above location. Attached for your information is the U.S.G.S. Form 9-331-C with our proposed casing and cementing program. You will note that the program is in accordance with the regulations of Order R-111-A.

Belco Petroleum Corporation respectfully requests that if you, as the owner of a potash lease located within one mile of our proposed drillsite, have no objection to this procedure, please execute and return two copies of the attached letter.

Very truly yours,

BELCO PETROLEUM CORPORATION

Glenn Cope
District Engineer

GC/sl

Attachments

2000 Wilco Building
Midland, Texas 79701
Telephone (915) 683-6366

Belco Petroleum Corporation

Belco

October 18, 1973

Messrs. D. S. Harroun &
R. Haworth
601 Riverside Drive
Carlsbad, New Mexico 88220

Re: Belco Petroleum Corporation
Bass Federal No. 2
660' FSL & 1300' FEL
Section 30, T-20-S, R-33-E
Lea County, New Mexico

Gentlemen:

Belco Petroleum Corporation is planning to drill the subject well at the above location. Attached for your information is the U.S.G.S. Form 9-331-C with our proposed casing and cementing program. You will note that the program is in accordance with the regulations for Order R-111-A.

Belco Petroleum Corporation respectfully requests that if you, as the owner of a potash lease located within one mile of our proposed drillsite, have no objection to this procedure, please execute and return two copies of the attached letter.

Very truly yours,

BELCO PETROLEUM CORPORATION

Glenn Cope
District Engineer

GC/sl

Attachments

2000 Wilco Building
Midland, Texas 79701
Telephone (915) 683-6366

Belco Petroleum Corporation

Belco

October 18, 1973

Kermac Potash Company
Post Office Box 610
Hobbs, New Mexico 86240

Re: Belco Petroleum Corporation
Bass Federal No. 2
660' FSL & 1300' FEL
Section 30, T-20-S, R-33-E
Lea County, New Mexico

Gentlemen:

Belco Petroleum Corporation is planning to drill the subject well at the above location. Attached for your information is the U.S.G.S. Form 9-331-C with our proposed casing and cementing program. You will note that the program is in accordance with the regulations of Order R-111-A.

Belco Petroleum Corporation respectfully requests that if you, as the owner of a potash lease located within one mile of our proposed drillsite, have no objection to this procedure, please execute and return two copies of the attached letter.

Very truly yours,

BELCO PETROLEUM CORPORATION

By

Glenn Cope
District Engineer

GC/sl

Attachments

Value $ [illegible] | Special Delivery $
Reg. Fee $ [illegible] | Return Receipt $ [illegible]
Handling Charge $ | Restricted Delivery $
Postage $ 16 | ☐ AIRMAIL
POSTMASTER (By) [illegible]

POSTMARK OF [illegible] MIDLAND TEXAS OCT 1969 U.S. POST OFFICE
MAILING OFFICE

FROM
[illegible]

TO E. W. Douglas
1113 Stacy Place
Carlsbad, N. Mex.

REGISTERED NO. 966

Value $ [illegible] | Special Delivery $
Reg. Fee $ 95 | Return Receipt $ 15
Handling Charge $ | Restricted Delivery $
Postage $ 16 | ☐ AIRMAIL
POSTMASTER (By) [illegible]

POSTMARK OF [illegible] MIDLAND TEXAS OCT 1969 U.S. POST OFFICE
MAILING OFFICE

FROM
[illegible]

TO U. S. Grant
107 N. Mahagueno
Carlsbad N. Mex

REGISTERED NO. 965

Value $ [illegible] | Special Delivery $
Reg. Fee $ 95 | Return Receipt $ 15
Handling Charge $ | Restricted Delivery $
Postage $ 16 | ☐ AIRMAIL
POSTMASTER (By) [illegible]

POSTMARK OF [illegible] MIDLAND TEXAS OCT 1969 U.S. POST OFFICE
MAILING OFFICE

FROM
[illegible]

TO Permian Petrol Co.
Box 610
Hobbs N Mex

REGISTERED NO. 964

Value $ [illegible] | Special Delivery $
Reg. Fee $ 95 | Return Receipt $ 15
Handling Charge $ | Restricted Delivery $
Postage $ 16 | ☐ AIRMAIL
POSTMASTER (By) [illegible]

POSTMARK OF [illegible]
MAILING OFFICE

FROM Permian Petrol
2000 Wilco Bldg
Midland Texas

TO D. L. Hannum
601 Riverside Dr
Carlsbad N Mex

Form 9-1123
(Rev. Dec. 1951)

(Submit [illegible]licate to appropriate
Regional Oil an [illegible]as or Mining Supervisor)

(4)

Bass Federal #2
Well File

DESIGNATION OF OPERATOR

The undersigned is, on the records of the Bureau of Land Management, holder of lease

DISTRICT LAND OFFICE: Santa Fe, New Mexico
SERIAL No.: NM-03023-A

and hereby designates

NAME: Belco Petroleum Corporation
ADDRESS: Wilco Building, Midland, Texas 79701

as his operator and local agent, with full authority to act in his behalf in complying with the terms of the lease and regulations applicable thereto and on whom the supervisor or his representative may serve written or oral instructions in securing compliance with the Operating Regulations with respect to (describe acreage to which this designation is applicable):

Township 20 South, Range 33 East, N.M.P.M.
Section 30: E½SE¼
Lea County

It is understood that this designation of operator does not relieve the lessee of responsibility for compliance with the [illegible]rms of the lease and the Operating Regulations. It is also understood that this designation of operator does not constitute an assignment of any interest in the lease.

In case of default on the part of the designated operator, the lessee will make full and prompt compliance with all regulations, lease terms, or orders of the Secretary of the Interior or his representative.

The lessee agrees promptly to notify the supervisor of any change in the designated operator.

Attest:

Marguerite Wright
Secretary

October 19, 1973
(Date)

BASS ENTERPRISES PRODUCTION CO.

By: B. P. Duncan
Vice President

Perry R Bass
PERRY R. BASS

1211 Fort Worth National Bank Bldg.
Fort Worth, Texas 76102

U. S. GOVERNMENT PRINTING OFFICE 16—82836-2

RECEIVED
OCT 23 19[illegible]
MIDLAND OFFICE

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5073
Order No. R-4699

APPLICATION OF BELCO PETROLEUM
CORPORATION FOR A NON-STANDARD GAS
PRORATION UNIT AND UNORTHODOX
LOCATION, LEA COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on October 3, 1973, at Santa Fe, New Mexico, before Examiner Richard L. Stamets.

NOW, on this 15th day of January, 1974, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Belco Petroleum Corporation, seeks approval for a 320-acre non-standard gas proration unit comprising the E/2 SW/4 and SE/4 of Section 30 and the N/2 NE/4 of Section 31, all in Township 20 South, Range 33 East, NMPM, South Salt Lake Field, Lea County, New Mexico, to be dedicated to a well to be drilled at an unorthodox location 660 feet from the South line and 1300 feet from the East line of said Section 30.

(3) That the applicant requests approval of the non-standard unit because it believes that the W/2 SW/4 of Section 30 is already committed to a participating area for Morrow production and may not participate in production from a standard unit consisting of the S/2 of Section 30.

(4) That the applicant seeks approval of the proposed unorthodox location for the purpose of avoiding an existing potash lease underlying Section 30.

(5) That the working interest owner of the W/2 SW/4 of Section 31 is willing and able to participate in a standard unit consisting of the S/2 of Section 31.

(6) That creation of the proposed non-standard gas proration unit would result in the formation of other non-standard units.

(7) That the owner of the W/2 SW/4 of Section 30 has objected to the proposed non-standard unit.

(8) That the application for a non-standard gas proration unit should be denied.

(9) That approval of the application for the proposed unorthodox location will allow the operator to avoid an existing potash lease underlying the W/2 SE/4 of said Section 30, enable the applicant to recover his just and equitable share of the gas in the South Salt Lake Field, and prevent waste and protect correlative rights.

(10) That no offset operator has objected to the proposed unorthodox location.

(11) That the application for an unorthodox gas well location should be approved.

IT IS THEREFORE ORDERED:

(1) That the application for a non-standard gas proration unit is hereby denied.

(2) That the applicant is hereby authorized to drill a gas well at an unorthodox location 660 feet from the South line and 1300 feet from the East line of Section 30, Township 20 South, Range 33 East, NMPM, South Salt Lake Field, Lea County, New Mexico.

(3) That the S/2 of Section 30, Township 20 South, Range 33 East, NMPM, South Salt Lake Field, Lea County, New Mexico, shall be dedicated to said well.

(4) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

I. R. TRUJILLO, Chairman

ALEX J. ARMIJO, Member

A. L. PORTER, Jr., Member & Secretary

S E A L

dr/

Federal Abstract Company

STATE · FEDERAL · INDIAN LANDS

POST OFFICE BOX 2288 - PHONE 982-5537 - SANTA FE, NEW MEXICO 87501

March 14, 1974

Kellahin & Fox, Attorneys
500 Don Gaspar Avenue
Santa Fe, New Mexico 87501

Gentlemen:

This is to certify that the Plat Book Records in the United States Land Office at Santa Fe, New Mexico, affecting the Potash Rights to the E½SE¼ Section 30, T. 20 S., - R. 33 E., N.M.P.M., reflect that this land is Open Public Domain and in a Known Geological Structure. Lots 3, 4, E½SW¼ Section 30, T. 20 S., - R. 33 E., N.M.P.M., is under HE Patent No. 833688 issued November 21, 1921.

That the Records in the Offices of the Commissioner of Public Lands of the State of New Mexico, affecting the Potash Rights to the W½SE¼ Section 30, T. 20 S., - R. 33 E., N.M.P.M., reflect that this land was granted December 14, 1936 to the United States Potash Company under Potash Mining Lease M-651 and is now held by the U. S. Potash & Chemical Company, P. O. Box 101, Carlsbad, New Mexico under Assignment No. 5.

Very truly yours,

FEDERAL ABSTRACT COMPANY

Hoover H. Wright, Secretary

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5193 Exhibit No. 10
Submitted by Bilco
Hearing Date 3-15-74

LEASE NO. M-651 APPLICATION NO. M-651

POTASH MINING LEASE
(Under Act Approved March 12, 1929)

THIS INDENTURE OF LEASE entered into in duplicate this 14th day of December, 1936, by and between the State of New Mexico acting in this behalf by Frank Vesely, its Commissioner of Public Lands, party of the first part and hereinafter called the lessor, and United States Potash Company, (No Stockholders' Liability) a corporation organized and existing under the laws of the State of New Mexico, party of the second part and hereinafter called the lessee, under, pursuant and subject to the terms and provisions of Chapter 140 of the Session Laws of the New Mexico Legislature of 1929 and Chapter 99 of the Session Laws of the New Mexico Legislature of 1923, and hereinafter referred to as the Acts, all of the provisions of said statutes being hereby made a part hereof.

WITNESSETH:

SECTION 1. THAT WHEREAS the said lessee has filed in the office of the Commissioner of Public Lands its application to surrender leases held by it and numbered M-90, M-196, M-197, M-198, M-208, M-224, M-226, M-227, M-228, M-229½, M-305, M-342 and M-435, and has complied with all the provisions of said leases providing for their surrender; and

WHEREAS, the said lessee has filed in said office an application for a new lease for the exploration, development and production of potassium, sodium, phosphorus and other minerals of similar occurrence and their salts and compounds upon the lands hereinafter described, and has tendered the sum of three thousand one hundred sixty-seven dollars and twenty-five cents ($3,167.25) as the first annual rental thereon, together with the sum of $5.00

application fee as evidenced by official receipt No. 20766 ; and

WHEREAS, the said lessee has heretofore explored the lands hereinafter described, by test wells and by the sinking thereon of a shaft at large expense, and has discovered on said land potassium in commercial quantities, and the said lessee has heretofore begun and is now continuing the production on said land of potassium on a commercial basis, and has produced from the lands hereinafter described, and paid royalty on more than forty thousand tons of crude potassium salts in each of the years 1935 and 1936;

NOW, THEREFORE, in consideration of the said above tender, receipt whereof is hereby confessed and acknowledged, and of the rents and royalties to be paid and the covenants to be observed as herein set forth, the lessor does hereby grant, demise, lease and let to the lessee exclusively for the sole and only purpose of exploration, development and production of potassium, sodium, phosphorus and other minerals of similar occurrence and their salts and compounds in, upon and under the following described land situated in the Counties of Eddy and Lea, State of New Mexico, and more particularly described as follows, to wit:

ALL ASSIGNED

Subdivision	Sec.	Twp.	Rge.	Acres
PARCEL "A"				
All	32	21S	29E	612.72
Lot 1, SE¼SW¼	18	"	"	70.36
All	32	20S	30E	640.00
N½	29	"	"	320.00
N½	30	"	"	319.55
SW¼, SW¼NW¼,	11	21S	29E	200.00
N½NW¼, SE¼NW¼, NE¼SW¼	13	"	"	160.00
NW¼, NW¼NE¼, NE¼NE¼, NW¼SE¼	14	"	"	280.00

36,512.50 acres

ALL ASSIGNED

Dated June 23, 1945

Assigned To Continental American Corp.

Address 1241 Fountain Place, Dallas, Texas, 75201

Subdivision	Sec.	Twp.	Rge.	Acres.
	PARCEL "B"			
$S\frac{1}{2}S\frac{1}{2}$	32	20S	32E	160.00
$NE\frac{1}{4}SW\frac{1}{4}$, $W\frac{1}{2}SE\frac{1}{4}$	9	22S	30E	120.00
All	4	22S	30E	641.28
$N\frac{1}{2}$, $SW\frac{1}{4}$	28	21S	"	480.00
$E\frac{1}{2}$	21	"	"	320.00
$N\frac{1}{2}$	27	"	"	320.00
All except $SW\frac{1}{4}SW\frac{1}{4}$	2	22S	"	601.52
$N\frac{1}{2}S\frac{1}{2}$, $SW\frac{1}{4}NW\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$	32	20S	32E	240.00
	PARCEL "C"			
All	5	22S	30E	641.12
All	8	"	"	640.00
$N\frac{1}{2}$, $W\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}SW\frac{1}{4}$	9	"	"	440.00
All	16	"	"	640.00
All	17	"	"	640.00
	PARCEL "D"			
$S\frac{1}{2}NE\frac{1}{4}$, $NE\frac{1}{4}NE\frac{1}{4}$	32	20S	32E	120.00
All	36	"	"	640.00
All	16	"	33E	640.00
$S\frac{1}{2}S\frac{1}{2}$	17	"	"	160.00
$W\frac{1}{2}$, $S\frac{1}{2}SE\frac{1}{4}$	18	"	"	399.88
$W\frac{1}{2}NE\frac{1}{4}$	19	"	"	80.00
All	32	"	"	640.00
$N\frac{1}{2}N\frac{1}{2}$, $SE\frac{1}{4}NE\frac{1}{4}$, $E\frac{1}{2}SE\frac{1}{4}$, $SW\frac{1}{4}SE\frac{1}{4}$	31	"	"	320.26
	PARCEL "E"			
All	2	20S	33E	638.04
Lots 3, 4, $SW\frac{1}{4}NE\frac{1}{4}$, $S\frac{1}{2}NW\frac{1}{4}$, $W\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}SW\frac{1}{4}$, $N\frac{1}{2}SE\frac{1}{4}$	4	"	"	400.92
$W\frac{1}{2}E\frac{1}{2}$	30	"	"	160.00

Subdivision	Sec.	Twp.	Rge.	Acres
PARCEL "E" (Continued)				
SE¼SE¼	27	20S	33E	40.00
All	36	"	"	640.00
SE¼	12	"	32E	160.00
All	13	"	"	640.00
SW¼	36	19S	33E	160.00
W½SE¼, SE¼SE¼	36	"	"	120.00
PARCEL "F"				
All	2	21S	29E	941.44
All	16	"	"	640.00
All	36	"	"	637.12
NW¼NW¼	8	"	30E	40.00
NE¼SE¼	20	"	"	40.00
PARCEL "G"				
NE¼	19	21S	31E	160.00
NW¼	20	"	"	160.00
SW¼NE¼, SW¼	17	"	"	200.00
All	36	"	30E	640.00
All	22	"	"	640.00
N½	23	"	"	320.00
SE¼, S½SW¼	14	"	"	240.00
S½	13	"	"	320.00
S½NW¼	24	"	"	80.00
PARCEL "H"				
All	32	20S	31E	640.00
All	16	21S	"	640.00
E½SE¼, SW¼SE¼,	28	"	30E	120.00
All	32	"	"	640.00
All	16	20S	31E	640.00

Subdivision	Sec.	Twp.	Rge.	Acres
	PARCEL "I"			
All	2	21S	30E	943.80
All	16	"	"	640.00
All (NE¼NW¼ Assigned to Naval Depot)	36	20S	"	640.00
All	36	"	31E	640.00
	PARCEL "J"			
S½SW¼, SW¼SE¼, N½S½	1	21S	33E	280.00
S½	2	"	"	320.00
S½	3	"	"	320.00
S½	4	"	"	320.00
S½	5	"	"	320.00
S½	6	"	"	311.13
Lots 1, 2, 7, 8, 9, 10, 15 and 16	5	"	"	318.08
E½	8	"	"	320.00
E½	17	"	"	320.00
S½SW¼, NW¼SW¼	32	20S	34E	120.00
	PARCEL "K"			
All	16	21S	28E	640.00
All	36	"	"	640.00
	PARCEL "L"			
All	16	23S	29E	640.00
NE¼, E½SE¼, N½NW¼	32	"	"	320.00
	PARCEL "M"			
All	2	22S	29E	640.24
All	18	21S	31E	635.04
S½NW¼, N½SW¼	11	22S	29E	160.00

containing 31,672.50 acres, more or less, together with the right to construct and maintain thereon all works, buildings, plants, waterways or reservoirs necessary to the full enjoyment thereof, including the right to drill, maintain and operate water wells on said lands and to produce and use the water therefrom; provided, that this lease shall extend only to and include any right or interest in the lands or the minerals therein reserved to the State of New Mexico under contract of purchase or deed heretofore or hereafter issued with a reservation of the minerals therein to said State.

TO HAVE AND TO HOLD the said lands and all rights and privileges granted hereunder for a term of ten years and as long thereafter as the said minerals or any of them in paying quantities shall be produced from the leased lands.

SECTION 2. In consideration of the premises, the lessee hereby agrees as follows, to wit:

(a) Unless extension be granted by the Commissioner of Public Lands, to produce from the lands hereinabove described, and to pay the royalty hereinafter specified on at least fifty thousand (50,000) tons of crude potassium salts during each and every year of this lease; provided, that if in any year such production of crude potassium salts falls below the amount herein specified, the lessee shall, within thirty days after the expiration of such year, pay to the Commissioner of Public Lands a sum equal to the number of tons of such shortage below fifty thousand tons, multiplied by the average royalty paid for potassium produced from said lands during the last preceding twelve months in which there was such production, and the making of such payment shall have the same effect as if the full fifty thousand tons were produced during the year for which such payment is made.

(b) If by reason of economic conditions, or of other circumstances beyond the control of the lessee, there is a complete shutdown of its operations of mining and refining potassium on the lands hereinabove described, and all other lands in the vicinity of said lands owned or operated by the lessee, the provisions of the preceding paragraph (a) of this section shall be waived and become inoperative during the period of such shutdown; provided, that the lessee shall not be entitled to the benefits of this paragraph for more than six months at any one time, without the approval of the Commissioner of Public Lands.

(c) To pay to the lessor annually in advance on the successive anniversary dates of this lease the sum of ten cents (10¢) per acre for each and every acre of land as to which the lease may be in force when such payments shall become due, such rental payments to continue so long as this lease shall remain in force. Provided, however, that the annual rental on this lease shall not in any case be less than one hundred dollars ($100.00) to be paid in cash.

(d) To pay to the lessor a royalty of five percent of the value of the minerals produced hereunder, except sodium chloride or common salt, such royalty to be computed upon the value of said minerals delivered at the nearest or most accessible railroad shipping point; and to pay to the lessor a royalty of ten percent of the actual sale price on all sodium chloride or common salt produced hereunder at the place of extraction; all such royalty provided for herein is expressly reserved to the lessor as provided by statute.

(e) Rentals and royalties due the State shall constitute a first lien on any and all improvements on the land leased, prior and superior to any other lien or encumbrance whatsoever whether created with or without notice of the lien for rental or royalties due or to become due.

(f) To furnish monthly sworn statements in detail in such form as may be prescribed by the lessor, of the amount and value of output from the leasehold delivered at the nearest or most accessible railroad shipping point, as a basis for determining the amount of royalties, and to permit at all reasonable times the inspection by the lessor or his duly authorized agent of all books and accounts of the lessee relating thereto, it being a condition of this grant that falsification of any such statements, records, books or accounts by the lessee shall be deemed and taken as sufficient ground for cancellation of this lease.

(g) To furnish the lessor annually a map showing all prospecting and development work on the leased lands and other related information, together with a report showing all buildings, structures and workings placed thereon, and a complete sworn statement of the amount of potassium and other minerals produced and saved by lessee's operations hereunder.

(h) To carry on all mining, reducing, refining and other operations in a good and workmanlike manner in accordance with approved methods and practice, having due regard to the health and safety of employees, the prevention of waste and the preservation and conservation of the property for further productive operations, and to observe all state laws relative to the health and safety of such employees, all mining and related productive operations to be subject to inspection by the lessor or his duly authorized agent and by other duly constituted state authority.

(i) To deliver to the lessor upon the termination of this lease, as a result of forfeiture or otherwise, the lands covered hereby including all fixtures and improvements other than structures, buildings, derricks, machinery, equipment, tools and personal property located and used above ground and other than pumps, engines, air compressors, dynamos, motors, cars and other similar appliances

used underground situated on any of said lands, in good order and condition so as to permit of immediate continued operation to the full extent and capacity of the leased premises. Provided, that upon such termination of the lease the lessee shall have ninety days from such termination to remove such machinery, tools, equipment and personal property from the leased premises if free from a state lien; and all such property shall become the property of the lessor if not so removed within said period of ninety days or within such extension of time as may be granted by the lessor.

(j) To pay when due all taxes lawfully assessed and levied under the laws of the State of New Mexico upon the improvements, output of mines and other rights, property and assets of the lessee.

(k) To comply with all statutory requirements where the surface of the lands embraced herein has been or may be leased, sold or otherwise disposed of under State laws reserving to the State of New Mexico the mineral deposits therein contained.

(l) Not to assign or sublet the premises covered hereby without the written consent and approval of the lessor.

(m) To take and preserve a core of all formations penetrated by any test well containing any of the minerals mentioned in Section 1 hereof, one-quarter of such core to be the property of the lessor, and the lessee further agrees to furnish the lessor promptly copies of any and all analysis made by or for the lessee of cores taken from test wells drilled on the leased premises, and copies of analysis of samples of minerals mined therefrom upon demand of the lessor.

(n) Before commencing operations hereunder to furnish the Commissioner of Public Lands a good and sufficient bond in the penal sum of not to exceed ten thousand dollars ($10,000.00) conditioned upon the faithful performance by the lessee of all and singular, the terms and conditions of this lease, and keep

such bond in force and effect so long as lessee's operations shall continue under the terms hereof.

SECTION 3. The lessor hereby expressly reserves:

(a) The right to permit for joint or several use such easements and rights of way upon, through or in the lands hereby leased as may be necessary or appropriate to the use or disposal of the lands for purposes other than the purpose of this lease, and the right to dispose of the surface of the said lands under the laws of the State of New Mexico now existing or hereafter enacted, insofar as said surface is not necessary or required for use of the lessee in extracting and removing the potash and other mineral deposits therein contained. And the lessor further expressly reserves the right to lease the said lands for minerals other than those described in Section 1 hereof, but the working of said lands under such lease, for such other minerals shall not be permitted where such operations will prevent or materially interfere with the operations of the lessee hereunder.

SECTION 4. The lessee may at any time, by paying to the lessor all amounts then due the lessor as provided herein and the further sum of ten dollars ($10.00) surrender and cancel this lease insofar as the same covers all or any portion of the land herein leased, and be relieved from further obligations or liabilities hereunder as to the lands surrendered. Provided, that all wages or monies due and payable to the workmen employed by the lessee shall have been paid and that a satisfactory showing is made to the lessor that all creditors or others having an interest in or lien or claim against the lessee are fairly and equitably protected, but in no case shall such termination be effective until the lessee shall have made adequate provision for the preservation of any mines, productive works and permanent improvements on the lands covered hereby; and provided further

that this surrender clause and the option herein reserved to the lessee shall cease and become absolutely inoperative immediately and concurrently with the institution of any suit in any court of law or equity by the lessor, lessee or any assignee to enforce this lease or any of its terms, expressed or implied.

SECTION 5. If the lessee shall fail to comply with the provisions of this lease or make default in the performance or observance of any of the terms, covenants and stipulations herein, and such default shall continue for thirty days after service of written notice thereof by the lessor, then the lessor may and he is hereby expressly authorized to declare a forfeiture and cancellation of this lease. A waiver of any particular cause of forfeiture shall not prevent the cancellation and forfeiture of this lease for any other cause of forfeiture or for the same cause occurring at any other time.

SECTION 6. It is expressly understood and agreed that all of the obligations, covenants, agreements, rights and privileges of this lease shall extend to and be binding upon and inure to the benefit of the lawful assigns or successors in interest of the parties hereto.

IN WITNESS WHEREOF: The party of the first part has hereunto signed and caused its name to be signed by its Commissioner of Public Lands, thereunto duly authorized, with the seal of his office affixed, and the lessee has signed this instrument the day and year first above written.

STATE OF NEW MEXICO

By _____
Commissioner of Public Lands.

ATTEST:

_____
Secretary.

UNITED STATES POTASH COMPANY
(No Stockholders Liability).

By _____
Its Vice President

STATE OF New York }
COUNTY OF New York } ss.

On this 19th day of December, 1936, personally appeared Horace M. Albright to me personally known, who being by me duly sworn did say that he is the Vice President of United States Potash Company, (No Stockholders' Liability) and that the seal affixed to the foregoing instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its board of directors and said Horace M. Albright acknowledged said instrument to be the free act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year in the certificate above written.

Gertrude B. Stichler
Notary Public.

NOTARY PUBLIC, Westchester County
Cert. filed in N. Y. Co. No. [illegible], Reg. No. 6-S-157
Commission expires March 30th, 1938

My commission expires:
March 30, 1938

Form M-12 Corporation

RECEIVED
JUL 31 3 04 PM '68
LAND OFFICE
SANTA FE, N. M.

555271

ASSIGNMENT OF MINERAL LEASE

KNOW ALL MEN BY THESE PRESENTS:

That United States Borax and Chemical Corporation a corporation, Los Angeles, California hereinafter sometimes called "Assignor," party of the first part, for and in consideration of the sum of One Dollar, and other good and valuable consideration paid by Continental American Royalty Company, a South Dakota corporation whose postoffice address is 1201 Praetorian Building, Dallas, Texas 75201 hereinafter sometimes called "Assignee," party of the second part, has sold, transferred, set over and assigned, and by these presents does sell, transfer, set over and assign to the Assignee its successors and assigns, all of the assignor's right, title, interest and claim in and to that certain Mineral Lease No. M-651 made by the State of New Mexico to United States Borax and Chemical Corporation

under date of _____, 19____,

and more particularly described as follows:

Lands described on attached Exhibit "A"
which is for all purposes made a part hereof.

TOTAL ACREAGE 30,512.50

The Assignee assumes and agrees to perform all obligations to the State of New Mexico insofar as said described lands are affected, and to pay such rental and royalties, and to do such other acts as are by said lease required as to the above described subdivisions, to the same extent and in the same manner as if the provisions of said lease were fully set out herein.

It is agreed that the Assignee shall succeed to all the rights, benefits and privileges granted the Lessee by the terms of said lease, as to the lands above described.

IN WITNESS WHEREOF, the said party has hereunder caused these presents to be signed and sealed by its proper officers by authority of its Board of Directors this the day of July 10, 19 68.

ATTEST:

_____
Secretary

By _____
President

M-12

CALIFORNIA
STATE OF NEW MEXICO)
County of Los Angeles) ss.

On this 10th day of July, 1968, before me personally appeared Ray J Colemire, Vice President of the to me personally known, who being by me duly sworn did say that the United States Borax and Chemical Corporation and that the seal affixed to the foregoing instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and said Ray J. Colemire acknowledged said instrument to be the free act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal on this, the day and year first above written.

Josephine Johnson

Josephine Johnson
Notary Public
PRINCIPAL OFFICE IN
LOS ANGELES COUNTY

My Commission expires My Commission Expires May 18, 1969

Office of Commissioner of Public Lands
Santa Fe, New Mexico

I hereby certify that the within assignment was filed in my office on the 31st day of July, 1968, and approved by me on August 29, 1968.

Commissioner of Public Lands

INSTRUCTIONS AND INFORMATION

1. All Assignments must be filed in the State Land Office within 100 days from date of issue and accompanied by Cashier's Check, Bank Draft, P. O. or Express Money Order.

2. Recording and approval fees are $10.00 for each Assignment.

3. When assignments are accompanied by personal check, the Commissioner of Public Lands reserves the right to withhold approval of assignment until checks are paid.

4. Assignments will not be approved when assigned to more than two persons.

5. Assignments must show complete postoffice address of assignee.

6. Assignments must be executed before an officer authorized to take acknowledgments of deeds. Corporations must use corporate form of acknowledgment.

7. Assignments must show whether assignors are married or single; if married, both husband and wife must sign the assignment, and certificate of acknowledgment must show marital status of assignors.

8. All official business, letters and communications must be addressed to and sent direct to the Commissioner of Public Lands.

9. Make all payments for annual rental and recording and approval fees, to

COMMISSIONER OF PUBLIC LANDS
SANTA FE, NEW MEXICO

55271

RECEIVED
JUL 31 3 04 PM '68
STATE LAND OFFICE
SANTA FE, N. M.

Eddy T20S, R30E:
- Section 29 - N½ 320.00
- Section 30 - N½ 319.66
- Section 32 - All 640.00
- Section 36 - All except N½ NW¼ 560.00

1,920.00 Lea T20S, R31E:
- Section 16 - All 640.00
- Section 32 - All 640.00
- Section 36 - All 640.00

Eddy T21S, R28E:
- Section 16 - All 640.00
- Section 36 - All 640.00

Eddy T21S, R29E:
- Section 2 - All 941.44
- Section 11 - SW¼, SW¼ NW¼ 200.00
- Section 13 - N½ NW¼, SE¼ NW¼, NE¼ SW¼ 160.00
- Section 14 - NW¼, N½ NE¼, NW¼ SE¼ 280.00
- Section 16 - All 640.00
- Section 18 - Lot 1, SE¼ SW¼ 70.36
- Section 32 - All 612.72
- Section 36 - All (E½ & SW¼ sublease to I.M.C.C.) 637.12

Eddy T21S, R30E:
- Section 2 - All 943.80
- Section 8 - NW¼ NW¼ 40.00
- Section 13 - S½ 320.00
- Section 14 - S½ SW¼, SE¼, SE¼ NE¼ 280.00
- Section 16 - All 640.00
- Section 20 - NE¼ SE¼ 40.00
- Section 21 - E½ 320.00
- Section 22 - All 640.00
- Section 23 - N½ 320.00
- Section 24 - NW¼ 160.00
- Section 27 - N½ 320.00
- Section 28 - N½, SW¼, E½ SE¼, SW¼ SE¼ 600.00
- Section 32 - All (subleased to I.M.C.C.) 640.00
- Section 36 - All 640.00

Eddy T22S, R29E:
- Section 2 - All (subleased to IMCC) 640.24
- Section 11 - S½ NW¼, N½ SW¼ (subleased to IMCC) 160.00

Eddy T22S, R30E:
- Section 2 - N½, SE¼, N½ SW¼, SE¼ SW¼ 601.32
- Section 4 - All (subleased to IMCC) 641.28
- Section 5 - All (W½ subleased to IMCC) 641.12
- Section 8 - All (subleased to IMCC) 640.00
- Section 9 - N½, SW¼, W½ SE¼ (subleased to IMCC) 560.00
- Section 16 - All (subleased to IMCC) 640.00
- Section 32 - All (subleased to IMCC) 640.00

IM-651

"A"

55271

RECEIVED
JUL 31 3 04 PM '68
STATE LAND OFFICE
SANTA FE, N. M.

	Eddy	T23S, R29E:	Section 16 - All	640.00
			Section 32 - NE¼, E½ SE¼, N½ NW¼	320.00
280.00	Lea	T19S, R33E:	Section 36 - SW¼, W½ SE¼, SE¼ SE¼	280.00
1,440.00	Lea	T20S, R32E:	Section 36 - All	640.00
			Section 12 - SE¼	160.00
			Section 13 - All	640.00
4,119.10	Lea	T20S, R33E:	Section 2 - All	638.04
			Section 4 - NW¼, W½ SW¼, SE¼ SW¼, N½ SE¼, SW¼ NE¼	400.92
			Section 16 - All	640.00
			Section 17 - S½ S½	160.00
			Section 18 - W½, S½ SE¼	399.88
			Section 19 - W½ NE¼	80.00
			Section 27 - SE¼ SE¼	40.00
			Section 30 - W½ E½	160.00
			Section 31 - N½ N½, SE¼ NE¼, E½ SE¼, SW¼ SE¼	320.26
			Section 32 - All	640.00
			Section 36 All	640.00
120.00	Lea	T20S, R34E:	Section 32 - S½ SW¼, NW¼ SW¼	120.00
	Eddy	T21S, R31E:	Section 17 - SW¼	160.00
			Section 18 - All	635.04
			Section 19 - NE¼	160.00
			Section 20 - NW¼	160.00
2,827.21	Lea	T21S, R33E:	Section 1 - S½ SW¼, SW¼ SE¼, N½ S½	280.00
			Section 2 - S½	320.00
			Section 3 - S½	320.00
			Section 4 - S½	320.00
			Section 5 - S½, Lots 1, 2, 7, 8, 9, 10, 15 and 16	638.08
			Section 6 - S½	311.13
			Section 8 - E½	320.00
			Section 17- E½	320.00
			Total	30,512.50

Lea 10,7[illegible].21 53.09 [illegible]
Eddy 19,80[illegible].19 64.90 [illegible]
30,[illegible]
All [illegible]
[illegible] Co. M-051 Cont.

RECEIVED
LAND OFFICE
SANTA FE, N.M.

COLLATERAL ASSIGNMENT

The undersigned CONTINENTAL AMERICAN ROYALTY COMPANY of 1201 Praetorian Building, Dallas, Texas, the holder of State Mining Lease No. M-651, does hereby assign, transfer and set over unto UNITED STATES BORAX AND CHEMICAL CORPORATION, P. O. Box 75128, Sanford Station, Los Angeles, California 90005, the aforesaid lease covering the following described lands of the State of New Mexico - to wit:

Property described on attached Exhibit "A"
which is for all purposes made a part hereof.

This assignment is made as collateral security for the payment of indebtedness owing by the undersigned to the assignee herein amounting to $1,000,000.00 and the payment of further advances that may hereafter be made by the assignee herein to the undersigned, now exceeding, however, the sum of $_____.

This assignment is made subject to all the terms and provisions of H.B.205, enacted by the Eleventh Legislature of the State of New Mexico and approved by the Governor of New Mexico on the 14th day of March, 1933, and acts amendatory thereto.

CONTINENTAL AMERICAN ROYALTY COMPANY,
Assignor

ATTEST: _____
Asst Secretary

By _____
President

STATE OF New York)
: ss.
County of New York)

The foregoing instrument was acknowledged before me this 23rd day of July, 1968 by J. William Muller of Continental American Royalty Company, a South Dakota corporation, on behalf of said corporation.

_____
Notary Public

My commission expires:

[illegible] SIKSHIN
Notary Public, State of New York
No. 31-0227515
Qualified in New York County
Certificate filed in [illegible]

The foregoing assignment approved this [illegible] day of August, 1968.

_____

56066

M-651

T20S, R30E:	Section 29 - N½	320.00
	Section 30 - N½	319.55
	Section 32 - All	640.00
	Section 36 - All except N½ NW¼	560.00
T20S, R31E:	Section 16 - All	640.00
	Section 32 - All	640.00
	Section 36 - All	640.00
T21S, R28E:	Section 16 - All	640.00
	Section 36 - All	640.00
T21S, R29E:	Section 2 - All	941.44
	Section 11 - SW¼, SW¼ NW¼	200.00
	Section 13 - N½ NW¼, SE¼ NW¼, NE¼ SW¼	160.00
	Section 14 - NW¼, N½ NE¼, NW¼ SE¼	280.00
	Section 16 - All	640.00
	Section 18 - Lot 1, SE¼ SW¼	70.36
	Section 32 - All	612.72
	Section 36 - All (E½ & SW¼ sublease to I.M.C.C.)	637.12
T21S, R30E:	Section 2 - All	943.80
	Section 8 - NW¼ NW¼	40.00
	Section 13 - S½	320.00
	Section 14 - S½ SW¼, SE¼, SE¼ NE¼	280.00
	Section 16 - All	640.00
	Section 20 - NE¼ SE¼	40.00
	Section 21 - E½	320.00
	Section 22 - All	640.00
	Section 23 - N½	320.00
	Section 24 - NW¼	160.00
	Section 27 - N½	320.00
	Section 28 - N½, SW¼, E½ SE¼, SW¼ SE¼	600.00
	Section 32 - All (subleased to I.M.C.C.)	640.00
	Section 36 - All	640.00
T22S, R29E:	Section 2 - All (subleased to IMCC)	640.24
	Section 11 - S½ NW¼, N½ SW¼ (subleased to IMCC)	160.00
T22S, R30E:	Section 2 - N½, SE¼, N½ SW¼, SE¼ SW¼	601.52
	Section 4 - All (subleased to IMCC)	641.28
	Section 5 - All (W½ subleased to IMCC)	641.12
	Section 8 - All (subleased to IMCC)	640.00
	Section 9 - N½, SW¼, W½ SE¼ (subleased to IMCC)	560.00
	Section 16 - All (subleased to IMCC)	640.00
	Section 17 - All (subleased to IMCC)	640.00

RECEIVED
AUG 12 10 03 AM '68
STATE LAND OFFICE
SANTA FE, N. M.

Exhibit "H"

56060

M-651
Page 2 of 2 pages

T23S, R29E:	Section 16 - All	640.00
	Section 32 - NE¼, E½ SE¼, N½ NW¼	320.00
T19S, R33E:	Section 36 - SW¼, W½ SE¼, SE¼ SE¼	280.00
T20S, R32E:	Section 36 - All	640.00
	Section 12 - SE¼	160.00
	Section 13 - All	640.06
T20S, R33E:	Section 2 - All	638.04
	Section 4 - NW¼, W½ SW¼, SE¼ SW¼, N½ SE¼, SW¼ NE¼	400.92
	Section 16 - All	640.00
	Section 17 - S½ S½	160.00
	Section 18 - W½, S½ SE¼	399.88
	Section 19 - W½ NE¼	80.00
	Section 27 - SE¼ SE¼	40.00
	Section 30 - W½ E½	160.00
	Section 31 - N½ N½, SE¼ NE¼, E½ SE¼, SW¼ SE¼	320.26
	Section 32 - All	640.00
	Section 36 All	640.00
T20S, R34E:	Section 32 - S½ SW¼, NW¼ SW¼	120.00
T21S, R31E:	Section 17 - SW¼	160.00
	Section 18 - All	635.04
	Section 19 - NE¼	160.00
	Section 20 - NW¼	160.00
T21S, R33E:	Section 1 - S½ SW¼, SW¼ SE¼, N½ S½	280.00
	Section 2 - S½	320.00
	Section 3 - S½	320.00
	Section 4 - S½	320.00
	Section 5 - S½, Lots 1, 2, 7, 8, 9, 10, 15 and 16	638.08
	Section 6 - S½	311.13
	Section 8 - E½	320.00
	Section 17- E½	320.00

RECEIVED
AUG 12 10 03 AM '68
STATE LAND OFFICE
SANTA FE, N.M.

74756

ASSIGNMENT OF STATE OF NEW MEXICO MINERAL LEASE

KNOW ALL MEN BY THESE PRESENTS:

That CONTINENTAL AMERICAN ROYALTY COMPANY, a South Dakota corporation of Dallas, Texas hereinafter sometimes called "Assignor", party of the first part, for and in consideration of the sum of One Dollar, and other good and valuable consideration paid by U.S. POTASH & CHEMICAL COMPANY, a Delaware corporation whose post-office address is P. O. Box 101, Carlsbad, New Mexico hereinafter sometimes called "Assignee", party of the second part, has sold, transferred, set over and assigned, and by these presents does sell, transfer, set over and assign to the Assignee, its successors and assigns, all of the Assignor's right, title, interest and claim in and to that certain Mineral Lease No. M 651 made by the State of New Mexico to United States Borax & Chemical Corporation under date of December 14, 1936, covering the following described lands in the State of New Mexico:

T20S, R30E:	Section 29 - N½	Subleased
	Section 30 - N½	Subleased
	Section 32 - All	
	Section 36 - All except N½ NW¼	
T20S, R31E:	Section 16 - All	
	Section 32 - All	
	Section 36 - All	Subleased
T21S, R28E:	Section 16 - All	
	Section 36 - All	
T21S, R29E:	Section 2 - All	
	Section 11 - SW¼, SW¼ NW¼	
	Section 13 - N½ NW¼, SE¼ NW¼, NE¼ SW¼	
	Section 14 - NW¼, N½ NE¼, NW¼ SE¼	
	Section 16 - All	
	Section 18 - Lot 1, SE¼ SW¼	
	Section 32 - All	
	Section 36 - All (E½ & SW¼ sublease to I.M.C.C.)	
T21S, R30E:	Section 2 - All	
	Section 8 - NW¼ NW¼	
	Section 13 - S½	

	Section 14 - S½ SW¼, SE¼, SE¼ NE¼
	Section 16 - All
	Section 20 - NE¼ SE¼
	Section 21 - E½
	Section 22 - All
	Section 23 - N½
	Section 24 - NW¼
	Section 27 - N½
	Section 28 - N½, SW¼, E½ SE¼, SW¼ SE¼
	Section 32 - All (subleased to I.M.C.C.)
	Section 36 - All
T22S, R29E:	Section 2 - All (subleased to IMCC)
	Section 11 - S½ NW¼, N½ SW¼ (subleased to IMCC)
T22S, R30E:	Section 2 - N½, SE¼, N½ SW¼, SE¼ SW¼
	Section 4 - All (subleased to IMCC)
	Section 5 - All (W½ subleased to IMCC)
	Section 8 - All (subleased to IMCC)
	Section 9 - N½, SW¼, W½ SE¼ (subleased to IMCC)
	Section 16 - All (subleased to IMCC)
	Section 17 - All (subleased to IMCC)
T23S, R29E:	Section 16 - All
	Section 32 - NE¼, E½ SE¼, N½ NW¼
T19S, R33E:	Section 36 - SW¼, W½ SE¼, SE¼ SE¼
T20S, R32E:	Section 36 - All
	Section 12 - SE¼
	Section 13 - All
T20S, R33E:	Section 2 - All
	Section 4 - NW¼, W½ SW¼, SE¼ SW¼, N½ SE¼, SW¼ NE¼
	Section 16 - All
	Section 17 - S½ S½
	Section 18 - W½, S½ SE¼
	Section 19 - W½ NE¼
	Section 27 - SE¼ SE¼
	Section 30 - W½ E½
	Section 31 - N½ N½, SE¼ NE¼, E½ SE¼, SW¼ SE¼
	Section 32 - All
	Section 36 - All
T20S, R34E:	Section 32 - S½ SW¼, NW¼ SW¼
T21S, R31E:	Section 17 - SW¼
	Section 18 - All

Section 19 - NE¼

Section 20 - NW¼

T21S, R33E: Section 1 - S½ SW¼, SW¼ SE¼, N½ S½

Section 2 - S½

Section 3 - S½

Section 4 - S½

Section 5 - S½, Lots 1, 2, 7, 8, 9, 10, 15 and 16

Section 6 - S½

Section 8 - E½

Section 17 - E½

The Assignee assumes and agrees to perform all obligations to the State of New Mexico insofar as said described lands are affected and to pay such rental and royalties, and to do such other acts as are by said lease required as to the above described subdivisions, to the same extent and in the same manner as if the provisions of said lease were fully set out herein.

It is agreed that the Assignee shall succeed to all the right, benefits and privileges granted the Lessee by the terms of said lease, as to the lands above described.

IN WITNESS WHEREOF, the said party has hereunder caused these presents to be signed and sealed by its proper officers by authority of its Board of Directors this the 9th day of June, 1969.

CONTINENTAL AMERICAN ROYALTY COMPANY

By _____
President

ATTEST:

By: _____
Secretary

STATE OF N.M.
SANTA FE, N.M.
AUG 14 11 03 AM '69

STATE OF ILLINOIS)
) ss.
COUNTY OF COOK)

On this 9th day of June, 1969, before me personally appeared N. William Muller to me personally known who being by me duly sworn did say that he is the President of the Continental American Royalty Company, a South Dakota corporation, and that the seal affixed to the foregoing instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and said N. William Muller acknowledged said instrument to be the free act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal on this, the day and year first above written.

Nancy Ross
Notary Public

My commission expires:

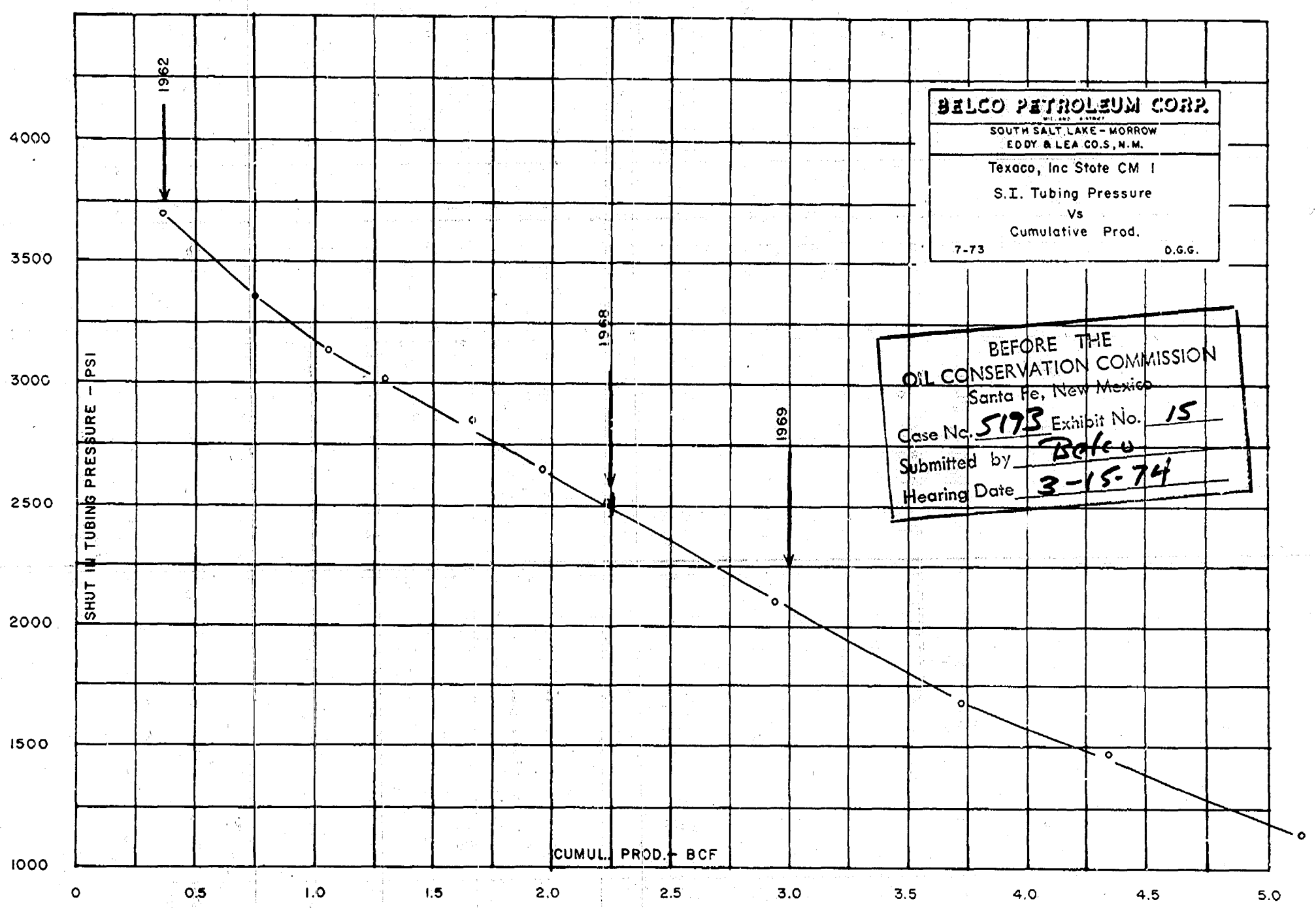
2/23/71

Office of Commissioner of Public Lands
Santa Fe, New Mexico

I hereby certify that the within assignment was filed in my office on August 14, 1969, and approved by me on September 16, 1969.

COMMISSIONER OF PUBLIC LANDS

SANTA FE, N. M.
AUG 14 11 03 AM '69



BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5173 Exhibit No. 15
Submitted by Belco
Hearing Date 3-15-74

BELCO PETROLEUM - [illegible] PERMIT
TO DRILL IN THE POTASH-OIL AREA.

Ph - 887-1117

Ken-McGee Corp.
Mr. Ray Green, Gen. Mgr.
Box 1130 —
Carlsbad - 88220

DOCKET MAILED
Date 3-1-74

Bob Lane - Carlsbad

Mr George Cochran
405-236-1313-Ext. 6397
Okla City.

Eddie Wyatt - 2565 - Wash.
AC 703-860-7535

Memo

From

A. L. PORTER, JR.
SECRETARY-DIRECTOR

To
Mr. Eddie Wyatt
U.S. Dept. of Interior
Geological Survey
National Center (620)
12201 Sunrise Valley Drive
Reston, Va.

DOCKET MAILED
3-1-74
22092

CASE No. 5193

Application,

Transcripts,

Small Exhibits

ETC.

NEW MEXICO OIL CONSERVATION COMMISSION

COMMISSION HEARING

SANTA FE, NEW MEXICO

Hearing Date MARCH 15, 1974 TIME: 9 A.M.

NAME	REPRESENTING	LOCATION
Jason Kellahin	Kellahin & Fox (Belco)	Santa Fe
R.S. Fulton	USGS	Carlsbad
Andrew V. Bailey	USGS	Reston, Va.
E. M. Gorence	Phillips Petroleum	Odessa, Tx.
Joe V. Peacock	" "	" "
Charles E. Childers	International Minerals & Chem	Carlsbad
Robert G. Kirby	Amax Chemical Corp	Carlsbad
H.W. Highfill	Dual Corp.	Carlsbad
Carl Traywick	USGS	Roswell
Jim Gillham	USGS	Roswell
D M VanSickle	"	"
Wallace Sutherland	"	Denver
Eddie R. Wyatt	"	Reston, Va.
N.O. Frederick	"	Roswell, NMex
Arthur B. Brown	USGS	Hobbs, NM
H.L. Kendrick	El Paso Natural Gas	El Paso
Dave H. Hamilton	Texaco Inc.	Midland
Ben Donegan	Leland A. Hodges, Trustee	Albuquerque
R.L. Lane	Ilfer-McGee Corp.	Hobbs
John D. Robb	Rodey, Dickason, Sloan, Akin & Robb, P.A.	Albuquerque
Mark K. Adams	"	"

NEW MEXICO OIL CONSERVATION COMMISSION

COMMISSION HEARING

SANTA FE, NEW MEXICO

Hearing Date MARCH 15, 1974 TIME: 9 A.M.

NAME	REPRESENTING	LOCATION
James H. Russell	Amax Chemical Corp	Santa Fe
R H Blackman	Patark Co of America	Carlsbad
J Evans Attwell	Belco Pet.	Houston
[illegible]	~~Belco~~ Belco	Albq.
Dean C. Boundy	Belco Pet.	Midland
Lee G Nering	Belco Petroleum	Houston
Bill Seltzer	(Perry R. Bass (Bass Enterprises Prod Co.	Midland
O. J Green	Belco Pet corp	midland
R L Medley	Natural Gas Pipeline Co	Midland
Bill Matthews	WELEX (BELCO)	MIDLAND
[illegible]	PETROLEUM CONS. SERV	MDL
P. R. STEWART	Belco Pet. Corp.	Hou.
W. J. Bill Henry	Belco	MIDLAND
Glenn Cope	"	"

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Morgan Hall
Santa Fe, New Mexico
9:00 A.M., March 15, 1974

IN THE MATTER OF:

Application of Belco Petroleum Corporation for a drilling permit in the Potash-Oil Area, Lea County, New Mexico. Applicant in the above Federal cause, seeks authority to drill its proposed Bass Federal Well No. 1 to test the Pennsylvanian Formation at an unorthodox location 660 feet from the south line and 1300 feet from the east line of Section 30, Township 20 South, Range 33 East, South Salt Lake Field, Lea County, New Mexico, said location being within the boundaries of the Potash-Oil area as defined by the Commission, Order R-111-A, and having been objected by the owner of the potash leases in the area. This unorthodox location was previously approved by the Commission by Order R-4699.

BEFORE MEMBERS OF THE COMMISSION:

A. L. Porter, Secretary and Director

Ralph Trujillo, Chairman of the Commission

Alex J. Armijo, Member of the Commission

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0386

APPEARANCES

For the Commission:
William Carr, Esq.
Land Office Building
Santa Fe, New Mexico

For Belco Petroleum Corp.:
Jason Kellahin, Esq.
KELLAHIN & FOX
500 Don Gaspar
Santa Fe, New Mexico
and
Evans Attwell, Esq.
William Pannill, Esq.
VINSON, ELKINS, SEARLS, CONNALLY & SMITH
Houston, Texas

For Kerr-McGee:
John Robb, Esq.
Mark Adams, Esq.
RODEY, DICKASON, SLOAN, AKIN & ROBB
P. O. Box 1888
Albuquerque, New Mexico

I N D E X

	Page
OMAR BROWN	
Direct Examination by Mr. Kellahin	8
Cross Examination by Mr. Robb	26
WILLIAM J. HENRY	
Direct Examination by Mr. Kellahin	27
Cross Examination by Mr. Robb	36
Redirect Examination by Mr. Kellahin	43
Cross Examination by Mr. Porter	45
Recross Examination by Mr. Robb	45
(Further) Redirect by Mr. Kellahin	46
(Further) Recross by Mr. Robb	49
GLEN COPE	
Direct Examination by Mr. Kellahin	50
Cross Examination by Mr. Robb	62
Redirect Examination by Mr. Kellahin	95
H. L. KENDRICK	
Direct Examination by Mr. Kellahin	104
KENNETH McPETERS	
Direct Examination by Mr. Kellahin	106
Cross Examination by Mr. Robb	112
Cross Examination by Mr. Nutter	120
W. J. HOLBERT	
Direct Examination by Mr. Kellahin	123
GEORGE WARNOCK	
Direct Examination by Mr. Attwell	131
Cross Examination by Mr. Robb	174
Redirect Examination by Mr. Attwell	202
Recross Examination by Mr. Robb	202

E X H I B I T S

	Page
Belco's Exhibits Nos. 1 through 10	26
Belco's Exhibits Nos. 11 through 13	35
Belco's Exhibits Nos. 14 through 17	62
Belco's Exhibits 18, 19, 20, 20(A), 21 & 22	173

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL.. (505) 982-0386

MR. PORTER: Gentlemen, we are going to take up next, Case 5193. Mr. Armijo tells me that because of pressing business elsewhere and a meeting with the Governor that he will not be able to stay with us for very long so Commissioner Trujillo and I will be here until the Hearing is concluded and later review the case with Commissioner Armijo in the event he does have to leave.

I wish at the outset to say that we want you to have the time you need in this case, but we would like for you to move as expeditiously as possible, because we would like to conclude this Hearing today, because all of us have some Saturday commitments and so with that we will ask the attorney to read a description of the case to be considered and then ask for appearances in the case.

MR. CARR: Case 5193. Application of Belco Petroleum Corporation for a drilling permit in the Potash-Oil Area, Lea County, New Mexico.

MR. PORTER: Mr. Kellahin?

MR. KELLAHIN: Jason Kellahin of Kellahin and Fox, Santa Fe, appearing on behalf of the Applicant Belco Petroleum Corporation. I am appearing in association with Mr. Evans Attwell and Mr. William Pannill, members of the firm of Vinson, Elkins, Searls, Connally and Smith, Houston, Texas,

and members of the Texas Bar who will be participating in the case with me.

MR. ROBB: I'm John Robb of the Rodey law firm and I'm appearing with Mr. Mark Adams of the same firm on behalf of Kerr-McGee. I have also been asked to make an appearance this morning on behalf of Teledyne Potash Company.

MR. PORTER: All right, sir.

MR. KELLAHIN: If the Commission please, we object to any appearance on behalf of Teledyne Corporation in opposition to the Application of Belco for the reason they have not complied with the rules of this Commission in filing a protest in this case. I'm not aware of any protest ever being made on behalf of Teledyne and we object to their participation in this case at this time.

MR. ROBB: Teledyne desires for us to make a statement on its behalf with respect to its position it has not filed a formal protest.

MR. PORTER: The Commission feels it is proper for Teledyne to make a statement at the closing of the testimony, as there will probably be other people who desire to make statements at that time.

Are there other appearances?

MR. PEACOCK: Mr. Joe Peacock with Phillips

Petroleum Company. We are the owner with interest in this proposed unit and I will want to offer a statement in support of Belco's Application, and since I may have to leave before the end of this Hearing I wonder if I might offer the letter supporting the Application at this time?

MR. PORTER: Yes, sir, you may.

MR. TRUJILLO: Who did you represent, Mr. Peacock?

MR. PEACOCK: Phillips Petroleum Company.

MR. PORTER: Mr. Robb, have you seen it?

MR. ROBB: No, sir, I haven't.

MR. PORTER: Does anyone else desire to make an appearance?

Mr. Kellahin, how many witnesses do you have?

MR. KELLAHIN: I believe I have eight, Mr. Porter, however, don't let that disturb you. We may not use a number of them depending on whether we use them for rebuttal.

MR. PORTER: All right. Mr. Robb, how many?

MR. ROBB: We have possibly three, but probably one.

MR. PORTER: Let's have all of the witnesses and potential witnesses stand and be sworn. It won't be much wasted effort if somebody raises his right hand and does not have to testify later.

(Witnesses sworn.)

MR. PORTER: The Commission will recognize Mr. Kellahin who is the attorney for the Applicant.

MR. KELLAHIN: If the Commission please, the Commission I know is thoroughly familiar with many of the problems that are involved in applications to drill in the potash area. However, this case is slightly different from some of the others and I would like to comment just very briefly on that point before we start with our testimony. The South Salt Lake-Morrow Gas Pool, which was involved in said cases was created by the Commission in November of 1961. By virtue of the date of creation of pool it came under the old rules of 160-acre spacing. On the application of Belco this pool was spaced on 320-acre units by Order R-4600 on August 1st, 1973, so what we're talking about here today is a 320-acre unit.

The location of Belco's proposed well is an unorthodox well location. However, it was approved by the Commission by Order R-4699. So there is no problem in connection with the well itself. Now, the area -- I think we all would agree is both under R-111-a and under the Secretary of Interior's Order creating the oil-potash zone area.

The Application has been objected to by Kerr-McGee Corporation. Kerr-McGee owns the Potash Lease, as our

testimony will show, within one mile of the location but not within the section involved here.

The only potash lease which exists under Section 30, the subject Section, is held by Teledyne Potash Company as subject to U. S. Potash and Chemical Company. Now, Teledyne, as stated in my objection to Mr. Robb's appearance on their behalf, did not file any form of objection to this Application.

With that, I would like to call as our first witness, Mr. Omar Brown.

MR. PORTER: Mr. Brown.

OMAR BROWN

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A Omar L. Brown.

Q By whom are you employed and in what position, Mr. Brown?

A I'm employed by Belco Petroleum Corporation in the capacity of District Landman.

Q Where are you located?

A In Midland, Texas.

Q Does your work as District Landman involve southeastern New Mexico?

A Yes, it does.

Q Does it involve the area involved in this Application South Salt Lake-Morrow Gas Field?

A Yes, it does.

Q Do you have anything to do with the acquisition of the rights to drill this area?

A Yes, I did.

Q For the benefit of the Commission, would you briefly outline your education and experience as a landman?

A I obtained an Associate of Arts degree from Casper College in 1956 and additional college work at a total of approximately three years. I have approximately 18 years of experience in the oil and gas industry, beginning as a draftsman, progressing to a drafting supervisor, associate landman, landman and acting district landman. I have been active in the Permian Basin Area in southeast New Mexico since January of 1969.

Q Are you a member of any associations?

A Yes, I'm a member of the Permian Basin Landman's Association, the American Association of Petroleum Landmen and

the New Mexico Association of Petroleum Landmen.

Q What companies have you worked for as a landman?

A I've worked for a Midwest Oil Corporation and for Belco Petroleum Corporation.

Q When did you start working for Belco?

A I was employed by Belco on February 8, 1972, in my present capacity.

Q Mr. Brown, are you familiar with Belco's operations in southeastern New Mexico?

A Yes.

Q Is it actively engaged in exploration of oil and gas in southeastern New Mexico?

A Yes. We are very actively engaged exploring for oil and gas in southeast New Mexico.

Q How long has Belco been active?

A Belco has been active in southeast New Mexico for approximately eight years. They have been actively exploring for Morrow gas production for approximately three-and-a-half years.

Q Has Belco had any success in their exploration for Morrow production?

A Yes, we have been successful. We have a number of producing gas wells and anticipate additional development

work that will be necessary to fully develop what we have discovered at this point in time.

Q Now, would you refer to what has been marked Belco's Exhibit No. 1 and state what that is?

A Exhibit No. 1 is a copy from the production by operators by -- run by some pipeline and oil sales in the State of New Mexico and it will show that Belco Petroleum Corporation is actively selling both oil and gas products in New Mexico.

Q What is the source of that information? Is that the official report of the Oil Conservation Commission?

A This is the official report of the Oil Conservation Commission.

Q Referring to what has been marked as Belco's Exhibit No. 2, would you identify that?

A Exhibit No. 2 is a composite map compiled from the U.S.G.S.-15-minute quadrangle topographic series.

Q For what purpose is this Exhibit offered?

A The purpose of the Exhibit is to show the geographic setting of the South Salt Lake Field, the location of the wells, the location of Belco proposed tests, the cultural features in the area such as roads, pipelines, ranches and the location of the Kerr-McGee potash mine, which is approximately five miles to the southwest of the South Salt Lake

Gas Field.

Q Is that almost a direct southwestern direction from the -- how is it shown?

A It is shown almost west, slightly south. It's in the Sections 3 and 4 of Township -- I believe that is 21 South, Range 30 East. Let me just double check that, please. I believe that's correct.

Q Does that show all wells completed in the South Salt Lake Morrow Gas Pool?

A It does today.

Q Now, does Belco own the lease underlying the proposed location?

A Belco has a right to the lease underlying the proposed location by virtue of a farmout agreement from the various leasehold owners.

Q Referring to what is marked as Exhibit No. 3, would you identify that?

A Exhibit No. 3 is an oil and gas lease ownership map of the immediate area surrounding the South Salt Lake Gas Pool.

Q Does it show Belco's holdings in there? How are they shown?

A Belco's holdings are shown in yellow. Belco owns

the south half of Section 24 of Township 20 South, Range 32 East. We own the west half of Section 29, the west half of the east half of Section 30 and we own the operating rights to the east half of the northeast quarter of Section 30 and the northwest quarter of Section 30. These are Belco leases and then, of course, in addition, Belco has farm-out rights to the east half of the southeast quarter and to the east half of the southwest quarter.

Q That is the prospect involved in this Application.

A The prospect involved in this Application is the lands that would be dedicated to this well would be the south half of Section 30 and conformity with the field rules, spacing rules for this South Salt Lake-Morrow Pool.

Q How many acres, roughly, does Belco hold in this area?

A Belco owns leaseholds covering 800 acres and we have farm-out rights to an additional 880 acres.

Q From whom were those farm-out rights obtained?

A They were obtained from Perry R. Bass, Bass Enterprises Production Company, Atlantic Richfield Company, Phillips Petroleum Company, Frank Elliott Trustees and Edna Hall Trustees, which these parties represent a 94-percent working interest in the farm-out land. The remaining six

percent is owned five percent by Texaco, Incorporated and one percent by Tenneco. These two parties did not farm-out to Belco and have indicated that they intend to join in this test and participate with their aggregate total of six percent.

Q As of the present time all of the working interests would be participating in the drilling of the proposed well, is that correct?

A That is correct.

Q Either by virtue of farm-out or by joining?

A That is correct.

Q Now, would you state to the Commission Belco has rights to drill at the present proposed location in the south half of Section 30?

A Belco's right to drill the subject well, of course, is derived from our ownership of the west half of the south east quarter, our contractual rights to a gross 160 and net 150.40 acres granted to us under previously mentioned farm-out agreement and commitments on the part of the remaining parties to join. However, Belco's farm-out rights will terminate at some point in the future if this well is not drilled.

MR. ROBB: We're not challenging Belco's land holdings in this area. We're not challenging the documents under which they derived title. We're not challenging that those

documents give them the right to drill if this will expedite the matter at all. There is no issue on this.

(Whereupon, a discussion was held off the record.)

BY MR. KELLAHIN:

Q With that in mind, Mr. Brown, would you just identify Exhibit No. 4 without any explaining?

A My Exhibit is not numbered; which one is it?

Q Farmout.

A Exhibit No. 4 is the farmout agreement from the various parties that I referred to, together with copies of various extension letters which Belco has received from these parties.

Q What date has it been extended to?

A It has been extended to April 1, 1974, as to all of the parties except Atlantic Richfield Company which granted us an extension to July 1, 1974. Atlantic Richfield having only a very small interest, one percent, I believe.

Q Now, did Belco drill another well in this same section?

A Yes, we did.

Q What was that well?

A That was Belco and Bass Federal No. 1 and located in the southeast quarter of the northwest quarter of Section 30, Township 20 South, Range 33 East.

Q Now, did Belco receive any protests from any potash companies at that time?

A No, we did not.

Q You did receive the permits to do it?

A We did receive a permit to drill.

Q That instrument is marked as Belco's Exhibit No. 5?

A Yes, that is. This instrument is a copy of Belco's Application to drill which gives evidence of receipt on the part of the United States Geological Survey and a letter dated October 12, 1972, signed by Mr. N. O. Frederick, Aera Oil and Gas Supervisor, granting Belco permission and indicating that our Application to drill this well had been approved.

Q Referring to Exhibit No. 6, would you identify that?

A Exhibit No. 6 consists of a copy of the Belco Petroleum Corporation letter dated Setpember 28, 1972, signed by Mr. Glen Cope, our District Engineer, informing Kerr-McGee Corporation of Belco's application to drill the No. 1 Bass Federal Well, which was sent in conformity with our R-111-A

regulations and attached thereto is a letter dated October 6, 1972, from Kerr-McGee Corporation, signed by Mr. Harold J. Klein, Vice President of Mineral Exploration, waiving any objection to the drilling of this well.

MR. ROBB: If this will expedite, we will stipulate that the Bass No. 1 was drilled and Kerr-McGee made no objection to the Bass Well.

BY MR. KELLAHIN:

Q Was the well completed by the producer?

A Yes, it was.

Q With what results?

A The well was completed as a commercial gas well.

Q Has the gas been contracted to any pipeline company?

A The gas has been sold to El Paso Natural Pipeline Company.

Q Referring to Exhibit No. 7, can you identify that Exhibit, please?

A Exhibit No. 7 is a copy of the gas contract with El Paso Natural Gas together with a copy of a mandatory letter dated September 21, 1973.

Q Now, does that contract cover gas which might be produced from proposed well?

A No, it does not.

Q Have you had any discussions with El Paso in connection with that?

A We've not had any formal discussions as I understand it, but I also have had some conversations with El Paso personnel and they have indicated to me that they are desirous of purchasing the gas from this well, are ready, willing, and able to do so and we have, in my opinion, that we can obtain a gas price for any gas that might be produced from the well that we propose to drill at a price equal to or perhaps greater than our present contract price.

Q What led Belco to the decision to drill Bass Federal No. 2 as proposed in this Application?

A Of course, the well appeared to be commercially an excellent well.

MR. ROBB: We make no issue of the fact that the proposed location of the Bass No. 2 is a good drilling prospect, if this will expedite the testimony some, that would be fine.

A There, of course, were some other decisions. We feel we have an obligation to protect the correlative rights of the royalty owners under the south half of Section 30, of the mineral owners within the south half of Section 30 is 80 acres that the United States Government, 80-acre State,

and 160 acres fee. This fee tract was broken up into approximately 25 mineral owners, the largest being Atlantic Richfield. These royalty owners are now being drained by existing production.

Q By what well, Mr. Brown? Would that be from the Bass Federal No. 1?

A I would assume it's from the Bass Federal No. 1. It is one of the closest wells to the proration unit dedicated to our -- would be dedicated to our proposed well.

Q You're not testifying to the drainage as an engineer, are you?

A No, I'm not.

Q You are basing your testimony as to drainage on the fact that the Commission has spaced this unit on 320 acres?

A They have, and I am basing my testimony on that basis.

Q Now, would you tell the Commission approximately the amount of royalty income that the proposed test could be expected to generate and how that would be allocated?

A Assuming that the proposed test, when drilled, results in production comparable to the No. 1 Bass Federal which is a little better than 5,000,000 cubic feet of gas per

day and 150 barrels of condensate per day. We estimate that royalty income would approximate $15,938 per month or $191,268 per year. This,would, of course, be a split between the U. S. Government, the State and the fee owners with a yearly basis with the U.S. receiving approximately $48,000, the State of New Mexico a like amount, $48,000,and the fee owners $95,628.

Q Referring to what has been marked as Exhibit No. 8, would you identify that, please?

A I believe Exhibit No. 8 is Belco's Application to drill out the Number 2 Bass Federal location located 1,300 feet from the east line and 660 feet from the south line of Section 30, Township 20 South, Range 33 East. Attached to this Application of materials of various support -- material that some of which is required to be submitted to the authorities, other giving evidence of designation of operator form to Belco, a copy of the Order of the Commission approving the unorthodox location.

Q Referring to what has been marked as Exhibit No. 9, would you identify that Exhibit, please?

A Exhibit No. 9 is a potash lease-ownership map of the same area as the oil and gas lease-ownership map.

Q That shows in the south half of Section 30 an area

that is uncolored. What does that indicate?

A There's a white area that designates the areas that are not to our best knowledge under potash lease.

Q The other areas which is marked, I believe, in green, is that leased?

A The area shown in green is under potash lease to the Teledyne Corporation.

Q Are you aware of any protest to this Application from Teledyne?

A No, I'm not aware of any protest. I'm aware that all potash operators to within one mile of the proposed test were notified by certified mail and evidence of that is attached to Belco's Application to drill in the previous Exhibit.

Q Is Belco's proposed location on the Teledyne potash lease?

A No, it is not. It is on land that is not subject to potash lease.

Q How close is the nearest Kerr-McGee lease?

A The nearest Kerr-McGee potash lease is in Section 25 of Township 20 South, Range 32 East, being almost a mile away, just under one mile. Incidentally, I might point out that the date of the Teledyne Potash Lease, which is in Section

30 is December 15, 1936. Kerr-McGee's Potash Lease in Section 25 is February 24 of 1953.

Q Are you aware of any potash mining in the area?

A I'm not aware of any potash mining any closer than approximately three to four miles.

Q Is that shown on Exhibit No. 9?

A In the lower-left-hand corner of Exhibit No. 9 is shown the present workings of the Kerr-McGee mine, as our information indicates, it may not be entirely correct, but we believe it to be substantially correct.

Q What is the source of that information? Do you know?

A This information has been compiled, I believe, from several sources and I don't think I could say exactly just where this source came from.

MR. ROBB: It's very close, Mr. Porter.

A I think one other point that I would like to make in connection with this map is the fact that we have several wells in the oil-potash -- pardon -- several wells in the South Salt Lake Field. You will note that that well location is not a wildcate location off two or three miles from its field, but on the contrary is a development location.

BY MR. KELLAHIN:

MR. KELLAHIN: If the Commission please, I have here an abstractor's certificate from the Federal Abstract Company. I only have one copy. Mr. Robb does have a copy, I believe.

MR. ROBB: What does it show?

THE WITNESS: It's just an abstractor's certificate, signifying that the only potash lease existing in the Section 30 is the Teledyne.

MR. ROBB: We don't quarrel with that.

BY MR. KELLAHIN:

Q Mr. Brown, just in summary, would you discuss Belco's reasons for applying to drill this particular location in potash area and what has occurred? When did you start to work on this project in the first place?

A Work began on this project in the first few months of 1972. We were, of course, aware that it was within potash area as Exhibits show with location of secretaries area and R-111 boundary. We determined that there was very little lands that were subject to potash lease and prospect and we subsequently drilled a No. 1 Bass Federal, and as previously testified, no objection was made to drilling that well.

Q Now, in your opinion, does Belco's Application to drill subject tests in the south half of Section 30 comply with

the regulations of Oil Conservation Commission's Order R-1118?

MR. ROBB: I object to that as calling for conclusion of the witness; move to strike the answer.

BY MR. KELLAHIN:

Q I'll rephrase the question. If Belco is allowed to drill this well, in your opinion, will it protect the correlative rights?

A I'm sorry. I didn't hear the question.

Q Would it protect correlative rights?

MR. ROBB: We object to that as calling for a legal opinion. I think that decision is not for the witness.

MR. KELLAHIN: If the Commission please, the witness has already testified as to ownership of drainage. I'll just withdraw the question, because I believe he's already answered it.

MR. ROBB: Well, the question asks whether it will protect correlative rights and he is passing judgment on whether or not what they're doing is going to affect adversely the rights of Kerr-McGee and Teledyne. We have no basis for drawing any such conclusion.

MR. KELLAHIN: I withdraw the question. We're talking about correlative rights in relation to the leasehold ownership and he has already answered the question on previous

testimony without objection so I don't believe we have--

MR. ROBB: Thank you.

MR. PORTER: Mr. Kellahin, in respect to that question, were you referring solely to oil and gas rights?

MR. KELLAHIN: Yes, sir. I don't believe this witness is qualified to testify in connection with the potash distribution. We have another witness for that.

That's all I have in connection with this witness.

BY MR. KELLAHIN:

Q Mr. Brown, were Exhibits 1 through 9 prepared by you or under your supervision?

A Yes, they were.

Q Now, Exhibit No. 10 is an abstractor's certificate. I would like to offer Exhibits 1 through 10, inclusive.

MR. ROBB: I haven't seen Exhibit No. 10, but if it says what Mr. Kellahin says it does and I have no reason to doubt it we have no objection.

(Whereupon, a discussion was held off the record.)

MR. ROBB: Do you offer No. 10 to show Teledyne owns the potash in Section 30?

MR. KELLAHIN: That is right.

MR. ROBB: We have no objection to any of those Exhibits.

MR. PORTER: Exhibits 1 through 10, Belco's Exhibits 1 through 10, will be admitted.

(Whereupon, Belco's Exhibits Nos. 1 through 10 for identification were admitted for evidence.)

MR. PORTER: Anyone have any questions of Mr. Brown?

CROSS EXAMINATION

BY MR. ROBB:

Q Mr. Brown, you indicated that you were aware of the fact that you were in a non-potash area at the time you were planning for this well?

A That's correct.

Q You're aware that that proposed location for Bass No. 2 is in the Secretary of the Interior's non-potash area?

A That's correct.

Q You mentioned the fact there has been no protest by Teledyne Potash Company. You know for a fact don't you, that Teledyne Potash Company is shut down; it's inactive; it's not mining any potash at this time at all?

A I did understand that certain restrictions in their activity has taken place. I'm not cognizant of the extent of that.

MR. ROBB: Thank you.

MR. PORTER: Anyone else have a question of Mr. Brown? He may be excused.

Call your next witness.

MR. KELLAHIN: Mr. Bill Henry.

WILLIAM J. HENRY

called as a witness, having been previously sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q State your name, please.

A William J. Henry.

Q What business are you engaged in, Mr. Henry?

A Consulting geologist.

Q Where are you located?

A Midland, Texas.

Q How long have you worked as a consulting petroleum geologist?

A Approximately four years.

Q And where?

A In Midland.

Q In connection with your work do you do work in southeastern New Mexico?

A Yes, almost exclusively. Prior to becoming a consultant and since, exclusively southeast New Mexico.

Q Prior to becoming a consultant, what were you doing?

A I went to work for the Pure Oil Company as a petroleum geologist in 1962 and then with Union Oil Cal in merger in '65-'66 and in '70 resigned to go as consultant.

Q Since 1970 you've been consulting?

A Right.

Q What is your education, Mr. Henry?

A I got my BS in petroleum geology from Texas Tech University.

Q When did you get that?

A 1952.

MR. ROBB: We are willing to stipulate that the witness is a qualified consulting petroleum geologist.

MR. KELLAHIN: Thank you.

BY MR. KELLAHIN:

Q Mr. Henry, were you employed by Belco to make any studies in connection with their proposed location of the Bass

Federal No. 2 Well?

A Yes, sir.

Q What did you do in connection with that?

A I reviewed the Salt Lake area and recommended a proposed location.

Q Did you recommend the proposed location?

A Yes, sir.

Q That is the location that has been approved by the Commission; is that correct?

A Right.

Q Now, refer to what has been marked as Exhibit No. 11, would you discuss the information shown on that Exhibit, please?

A Exhibit -- this is not marked, but this is Exhibit 11 and is a structure map contoured on top of the lower Morrow structure point or the South Salt Lake Atoka-Morrow Pool.

Q Now, with reference to that Exhibit, how would you consider the proposed prospect as a development well in the South Salt Lake?

A Well, it is a development well as designed and it is my own estimation it is the common source of supply with the field.

Q Your geological point of view is it is a development field?

A Yes, sir.

Q You consider it a good location?

A Yes, sir.

Q Generally, what is the geology of the South Salt Lake Field?

A It's an anticlinal structure plunging to the southeast.

Q What kind of formations are encountered?

A Morrow is more productive on this feature which is sand, primarily productive from sand.

Q Is it productive from the Atoka?

A From Morrow sand.

Q What is the nature of the Morrow sand in general, have you had any experience with them?

A The Morrow sands are very lenticular, stratigraphically speaking. In other words, they come and go and they are difficult to predict.

Q Referring to what is marked as Exhibit No. 12, what is depicted on that?

A Exhibit No. 12 is a stratigraphic cross section that goes through, beginning on the left side, the Belco No. 1

Bass Federal through the Texaco No. 1-A Audie Richards, which was a discovery well in the field into Texaco No. 1-CH, then, to Texaco No. 1-CM to the recently completed Amini No. 1 SL-State which is marked in blue on the structure map and also there is a little index map down in the southwest corner of this map or left-hand corner.

Q Would you comment on the information as shown on the cross section?

A Yes, this cross section is hung on structure datum to the top of the Lower Morrow as a flat zone and the sands are colored to show more or less the pictorial of the topography and the lenticular nature of this sand as they occur in the South Salt Lake feature.

I would like to point out that--you'll notice that the Belco No. 1 Bass Federal is located on the structure map on the northeast flank--shows a good gross aggregate of sand. I have not marked all of the sands. These sands have been culled to what I consider reservoir quality sands. There are other sands there that don't exhibit cleanliness to come up to reservoir quality. You will notice there are quite a few sands in the entire Morrow section there where I have labelled Lower and Upper Morrow. Move on up on the crest of the structure to the Texaco-Audie Richards you will notice that

there are some sands, less in the lower part of the Morrow and if you want to call them Middle Morrow, there seems to be a bar of cleaning sand and some in the upper part and the Audie Richards is producing from very near what I call the top of the Morrow sand on this particular well.

Let me digress just a minute. On this map the perforations are marked in red from these zones up in where each well is producing and the testing and calculated open flow is underlined in red by each log. I believe it's to the left of each well log. Then, moving to the Texaco No. 1-CH, you'll note it's over on the southwest part of the structure and it has fairly good sand development.

Then, moving onto the Texaco No. 1-CM, which is, or was originally, I'll not say originally, but it has been one of the better performers from the three Texaco wells which were first drilled in the late fifties and early sixties.

It has fairly good Morrow sand and almost the entire Morrow section is perforated. I would like to back up to the Texaxo CH and show that the Texaco CH was originally completed from the Morrow-Atoka. Now it is producing only from the Atoka, from the top yellow mark up near the top of the log. Cumulative on the Morrow was almost a half-a-billion when it was plugged back.

Moving on over to the Texaco CM, it produced about 5.2 billion to my records and it is contined to produce. We move on over to the right-hand corner and it's a Meaney SL New Mexico State which is a recent completion from the Morrow which is colored in red up about the middle of your log and you will notice that there is a little decrease in the sand section in the Morrow there.

Q With reference to the proposed location, you believe that that is a good prospect in the Morrow formation?

A I believe that is the best location of the Morrow. It has an excellent chance of discovering commercial, better than average commercial reserve.

Q Is the well necessary for full development of the South Salt Lake Pool?

A Yes, it is.

Q Would it result in the production of gas that would otherwise not be produced?

A Yes, sir, that's right.

Q If the well is not drilled that gas would be wasted?

A That's right, yes, sir.

Q Refer to what has been marked as Exhibit 13, could you identify that, please?

A Yes. Exhibit No. 13 is a graph chart of the production of the No. 1 Bass Federal. It's on a 10-by-10 grade.

It's daily production rate since it went on the stream in September of '73, you will notice that after the well was tested and they were satisfied with the flow rate that it has averaged almost 5,000,000. Right at the present time it makes 4.8. You can see the condensate was about 200 barrels originally and it settled down to, I think, oh, say, an average of 150 barrels a month, I think that's explained here on the graph; that's up through February 28th of this year.

Q That's the last information you had?

A That's the last I had, yes, sir.

Q Would you find a change in the porosity and permeability if you moved the well location one way or the other?

A Yes, sir.

Q What would be the result?

A Well, up-dip you have a loss of porosity and permeability in the sand conditions, and this location is on a strike with the Bass Federal and about the same structural position as the Texaco CM and from these two wells I've drawn my conclusion that this is the best place to encounter the maximum number of sands for maximum completion in the Morrow sands.

Q You have testified as to the lenticularity of the

Morrow formation. In your opinion, would this well encounter lens development that does not exist in other wells?

A Yes, sir.

Q In your opinion, the Bass Federal No. 1 is possibly draining lenses that are not present?

A Yes.

Q Is this normal?

A This is a normal trend of the Morrow sand.

Q Is it true in all Morrow?

A Yes, sir.

MR. KELLAHIN: That's all I have on Direct Examination.

BY MR. KELLAHIN:

Q Mr. Henry, were Exhibits 11, 12 and 13 prepared by you or under your supervision?

A Yes, sir.

MR. KELLAHIN: I'd like to offer in evidence Exhibits 11, 12 and 13.

MR. PORTER: Any objections?

MR. ROBB: No objections.

MR. PORTER: Exhibits 11, 12 and 13 of Belco will be admitted.

(Whereupon, Belco's Exhibits Nos. 11, 12 and 13 were admitted in evidence.)

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0386

MR. PORTER: Any other questions of the witness?

MR. ROBB: It's your custom to ask questions sitting down. I'm used to courtroom order, so is it satisfactory to sit down?

MR. PORTER: Perfectly satisfactory. You can sit down and ask the questions.

MR. ROBB: All right.

CROSS EXAMINATION

BY MR. ROBB:

Q Mr. Henry, do I understand that it is your testimony that there will be a substantial amount of drainage from the south half of Section 30 as a result of production from Bass No. 1?

A There will be drainage, how much I couldn't tell you.

Q You're not sure how much?

A No. That's right.

Q Spacing until recently in this area was 160 acres?

A Originally started out that way, yes.

Q I noticed that you included the Bass No. 1 in your projections and also the Amini Well?

A Yes, sir.

Q Did you determine whether or not individual zones

porosity could be easily traced from well to well in this group?

A That's the reason I colored them.

Q You felt they could?

A The individual zone?

Q Yes, sir.

A This cross section exhibits a lenticularity which is noted for Morrow in southeast New Mexico.

Q I'm sorry?

A The Morrow is lenticular in southeast New Mexico and these yellow tips on these particular logs are to demonstrate the lenticularity of the log of the sands in relation to South Salt Lake Field.

Q I see. The producing intervals, which you say are stratigraphic in nature with porous permeable zones randomly distributed throughout the Section; would that be another way of saying it?

A I don't say random, but I say they're stratigraphic lenticular.

Q All right, sir. Would you consider the volumetric determination of reserves from a four-volume study is very hazardous?

A I'm not a reservoir engineer, I'm a geologist and

I'm not qualified on that to testify as an engineer.

Q All right, sir. Well, I don't understand it very well either.

A I can testify, but I won't.

Q What would you determine to be --

MR. ROBB: Are you going to have an engineer testifying about the reservoir?

MR. KELLAHIN: Yes, sir.

MR. ROBB: You are?

MR. KELLAHIN: Yes, sir.

MR. ROBB: In that case, I have no further questions of Mr. Henry.

MR. PORTER: Does anyone else have a question of the witness? You may be excused.

(Witness excused.)

MR. PORTER: Call your next witness.

(Whereupon, a short recess was taken.)

MR. PORTER: The Hearing will come to order. Mr. Robb; do you have something?

MR. ROBB: I made an error about what witnesses I need to ask questions of. I would like to have Mr. Henry back.

MR. PORTER: Mr. Henry, will you please take the

stand?

CROSS EXAMINATION

BY MR. ROBB:

Q Mr. Henry, you testified that you considered that this is a good location and a central location,is that right?

A Yes, sir.

Q In arriving at that determination did you consider the fact that this location had been spotted in a known potash area?

A I just did the geology. I know about the potash being here, but I didn't take that into consideration that the potash was there or not there.

Q I'll ask you now for a moment to take that into consideration, that you are within a known potash area, that you are within the Secretary's 1965 Order. You know what that is, don't you?

A A little bit, yes, sir.

Q All right, sir. That you are within a R-111 area of the State of New Mexico.

A Okay. I agree with that.

Q All right. Now, I'm asking you to take that into consideration. Now, did you consider in your testimony that this was a good location the possibility of rechecking this

formation from directionally drilled well that was not an offset well?

A No, I did not. This is a straight hole.

Q All right, sir. Are you familiar with directional drilling?

A Now, what are you talking about, controlled deviated surveys, whipstocking or what?

Q Yes, sir. You know the terminology better than I do; whipstocking, I guess, is the phrase you would use.

A Now, whipstocking, you keep the hole for just a very short distance and it's not controlled. It can go anywhere.

Q No, I'm talking about drilling at a reasonably sharp angle of a distance up to a mile or more. What do you call that?

A Pinpointing a point at bottom of the hole. In other words, you want to put the bore hole in a certain spot.

Q In a general area, yes, that's right.

A Not any done in the State of New Mexico that I am aware of.

Q All right. You are familiar though with what directional drilling is, are you not?

A Yes, sir.

MR. PORTER: Mr. Robb, may I interrupt here a second?

You are asking him about the possibility of drilling where your surface location might be a mile from the bottom of the well?

MR. ROBB: Right, from the desired location. Not only from the horizontal displacement of an area approximately four to 5,000 feet.

MR. PORTER: And you want the bottom hole 660 feet from the south line and 1300 feet from the east line?

MR. ROBB: Yes, sir, and I'm going to ask about a specific drilling location in just a moment, but I wanted to establish the fact that as a consulting petroleum geologist he was generally familiar with directional drilling.

THE WITNESS: Well, you're qualifying me that I'm not. We had a little bit in school, but there has been none done in New Mexico and primarily my consulting work has all been in southeast New Mexico and I do not know of any controlled deviated drilling in New Mexico other than the whipstocking to get around a junction or whatever.

BY MR. ROBB:

Q But this is within your field, is it not? Directional drilling is a part of the thing you were trained to study and to consider?

A No, sir. I'm not an engineer or directional driller.

I'm a consulting geologist for oil and gas.

MR. KELLAHIN: If the Commission please, we object to this line of questioning. The man is qualified as a geologist and certainly plays some role in the question of directional drilling, but any question should be confined to those aspects and not to engineering aspects as this witness is not qualified in this line.

MR. PORTER: We sustain the objection, Mr. Robb. Do you have any further questions?

MR. ROBB: That was the main line I was going to ask about.

MR. PORTER: Mr. Kellahin, do you have a witness that will later testify to this?

MR. KELLAHIN: Mr. Porter, we have a number of witnesses to testify on this and will have our engineering witness who is qualified in this part to some extent. We also have two drilling contractors and a drilling consultant available who can testify at great length on the question of directional drilling. We hadn't planned to call him unless the question came up. It has come up, so we will certainly call him.

MR. ROBB: I want some witness as part of your case that I can question about directional drilling because your

landmen have both said they spotted this location and this was the only good location and I think I'm entitled to cross examine as to why that's the only good location.

MR. KELLAHIN: I agree with you, but my objection, Mr. Robb, is based, of course, on the questioning which was going to engineering and not to geology.

MR. ROBB: I see that's true so if you will assure me you're going to call a witness who can answer my questions as far as your direct, I will withdraw the question.

MR. KELLAHIN: Yes.

MR. PORTER: Does that conclude your questioning?

MR. ROBB: Yes, sir, it does.

MR. PORTER: No further questions, do you have anything further on Redirect?

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Henry, directional drilling has come up. Does the nature of the formation involved in this area have any bearing on what happens on directional drilling?

A From my limited knowledge, yes, they do.

Q Generally, what is that?

MR. ROBB: I don't understand. I thought this

witness was not qualified to give any directional drilling.

MR. PORTER: I'm having a little difficulty.

MR. KELLAHIN: I'm talking about the nature of formations that are going to be encountered in any well bore-drilled in South Salt Lake-Morrow Gas Pool

MR. PORTER: And not to the mechanics of directional drilling, whether it can be done a mile away?

MR. KELLAHIN: That's right.

MR. PORTER: I think the question is probably proper with those specific qualifications.

BY MR. KELLAHIN:

Q Does the nature of the formations encountered have any effect on directional drilling?

A Yes, they do.

Q What is the nature of the formation in this area that would have some effect?

A Well, there's sands and shales and we have heaving shales and Morrow sands are notorious, they can be notoriously banded by being on these formations, mud being on these formations for a great length of time and in a deviated hole there is slower drilling and there would be a real good chance that you're going to damage the formation and possibly not make a successful completion because the

Morrow is real susceptible to damage.

Q I believe you testified to your knowledge there has been no controlled directional drilling in southeastern New Mexico?

A No, as we pinpoint the bottom of the hole. In other words, whipstock which is just sitting and kicking the well off, but no deviated controlled survey, no.

MR. KELLAHIN: That's all.

CROSS EXAMINATION

BY MR. PORTER:

Q Whipstocking is generally employed to bypass junk in a hole or to straighten a crooked hole?

A Right. It goes wherever it wants to.

MR. PORTER: Mr. Robb, do you have any questions?

MR. ROBB: I have one.

RECROSS EXAMINATION

BY MR. ROBB:

Q You are not telling us, Mr. Henry, as I understand it, based on your limited experience that if a hole were directionally drilled underneath to the desired location from, let us say, Bass No. 1, you are not telling us that that would damage the Morrow formation, are you?

A Would you repeat your question?

Q You are not telling us that if a hole, in fact, were directionally drilled to the location for which application has been sought here, but it was started at the surface at the Bass No. 1 --

A (Interrupting) Yes.

Q (Continuing) -- you are not telling us that that would, in fact, damage the Morrow formation, are you?

A As I stated, the Morrow would be damaged insofar as the time that the mud and the bit and you're working in the Morrow formation. In other words, we normally drill the Morrow with a controlled mud system and try to get off it as quick as we can. Directional drilling, which I do have knowledge of the time, because of the slowness of the way the bit turns drilling would take considerably longer and there is a good chance you can damage it, which is not repairable in some cases.

Q What you are telling us is that it would take longer and cost more money?

A I didn't say either. Yes, sir.

MR. ROBB: Thank you.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q You are also telling us that you can damage the formation and not make a well, is that correct?

A Yes, sir.

Q Does the thickness of the formation involved have any bearing on directional drilling and in hitting your objective?

A On what?

Q Thickness of the formation; how thick is the Morrow formation in that area?

A The Morrow formation is approximately -- I'm speaking of the sands in one particular well, about 1,000 feet plus or minus.

Q They are lenticular?

A Lenticular sands, yes, sir.

Q With porosity development within that 1,000 feet, is that correct?

A That's right, yes.

Q That's what you testified to before?

A Right.

Q Now, if you'll assume with me for a moment that a later witness will testify on directional drilling he would come in at an angle, would this create a risk of missing your objective?

A Yes, sir, because of the lenticular nature of the sand, because you're coming in at an angle. That degree of angle I don't know, but it could be a mile away; it would have to be

probably pretty steep at that depth to get over that far.

Q Mr. Henry, you know for a fact there is considerable directional drilling on the Gulf Coast, don't you?

A Yes, I've heard of it.

Q Are you familiar at all with the formations involved there?

A Very inept -- let me think just a second -- in other words, a well on the Gulf Coast would take roughly a fifth of the time that it takes out here to drill a well. In other words, if it took --

Q (Interrupting) Why is that?

A Because you can almost wash those wells down rather than having to drill these hard formations out here where we use button and diamond bits.

Q What hard formations are you talking about in the South Salt Lake Morrow Pool?

A Well, when you get to the top of the Bone Springs at approximately -- I can't remember -- say, 7,000 feet is the total depth and you get on out of the salt and the Delaware sands, you're roughly in relatively hard formations.

Q Does that have any effect on directional drilling?

A Yes, sir, it slows us down to a crawl rather than a walk.

MR. KELLAHIN: That's all I have.

RECROSS EXAMINATION

BY MR. ROBB:

Q You mentioned in answer to one of the questions by Mr. Kellahin that in directional drilling you might damage the formation. That's true in straight drilling, too, isn't it?

A You damage -- yes, that's true in the sense that in straight drilling you might be on this formation out here five days. Directional drilling is possibly you could -- there again, you got the argument you could do it in five days, but it's never been done that I know of even in whipstocking that I'm familiar with. You might be there 25 days drilling the same 1,000 feet. So you're on that formation, it is accessible to damage as is well known in New Mexico -- any operator can tell you -- you can't dangle there on it too long. Even with a straight hole you can damage.

MR. PORTER: What you are saying, I believe, with directional drilling you'd have a longer exposure to the damage?

A Yes, and the units increase your time.

MR. ROBB: That's all, sir.

MR. PORTER: Anyone else have a question? You may

be excused again.

I believe Mr. Cope is to be called.

GLEN COPE

called as a witness, having been previously sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q State your name, please.

A Glen Cope.

Q What business are you engaged in, Mr. Cope?

A I'm a consulting engineer.

Q Where are you located?

A Midland, Texas.

Q Did you formerly work for Belco Petroleum Corporation?

A Yes, I did.

Q Have you testified before the Oil Conservation Commission of New Mexico and made your qualifications a matter of record?

A Yes, I have.

MR. KELLAHIN: I'll ask Mr. Robb if he'll stipulate to the witness' qualifications as a petroleum engineer?

MR. ROBB: I'm sure he is. Yes, I will.

BY MR. KELLAHIN:

Q Mr. Cope, were you employed by Belco in making any studies in connection with the drilling of the proposed Bass Federal No. 2 Well?

A Yes, I was.

Q What have you done in connection with that study?

A In connection with that study we have prepared reserve estimates for the proposed location, and a drilling program for the proposed well.

Q Did you make a study of the other wells within the pool?

A Yes, I did.

Q Did you make some determination of the possible reserve in the prospect?

A Yes, sir, I did.

Q Now, referring to what has been marked as Exhibit No. ..., would you identify that?

A Yes, sir. Exhibit No. 14 is a plot of the monthly production versus the time for the Texaco State CM Well No. 1 and the date that it began to produce in 1961 through the most recent information that I have.

Q Now, what did this indicate as to productive history of that well?

A This indicates that the early life of the well, from 1961 through approximately 1968, that the rate of withdrawal at the well was limited, probably would be due to the pipeline capacity, a limited market. In 1969, you'll note the producing rate of the well increased substantially and in 1971 the well began to decline.

Q Now, you say the well production increased substantially what was the capacity of the well at its peak performance, roughly?

A Well, in 1969, we have a month here of production in excess of 110,000,000.

Q Is that cumulative production?

A No, sir, that's monthly production.

Q What's the cumulative production on the well?

A The cumulative production on this well right now is approximately is 5.2 billion cubic feet.

Q It is still producing is it not?

A Yes, sir, that's affirmative.

Q On the basis of this performance history, do you anticipate it will produce much longer?

A No, sir. We constructed a pressure decline versus cumulative production curve.

Q Is that what is marked as Exhibit No. 15?

A Yes, sir, it is. This depicts the decline of the bottom hole pressure as the production from the well on a cumulative basis from the time the well began to produce and as you can see, the shut-in tubing pressure has declined to a point where the capacity of the well is declining at this time. The Morrow formation, one of the characteristics of a good Morrow well is that it would produce at a good rate until the bottom pressure declined to a point and the well declined rather rapidly to its economic rate.

Q Is a pressure production decline curve an accurate method of determining the reserve in the Morrow formation?

A Yes, sir, it's a very accurate method where you have adequate time and for the State CM No. 1 we have probably 80 or 90 percent of producing life of the well so this is a very accurate method by which to determine the curves of that well.

Q How would the production from the CM Well compare to the Belco Federal -- I mean the Bass Federal No. 1 Well?

A Well, we just -- the witness that proceeded me was a geologist that described the Bass Federal No. 1 geologically equivalent to the State CM No. 1.

Q Have you prepared a production curve on it? Is that marked as Exhibit No. 16?

A Yes, sir, I have. Exhibit No. 16 was prepared -- it's monthly production of the Bass Federal Well No. 1 for the five-and-a-half months which it has been produced. The objective of this Exhibit is to illustrate the fact that capacity of the Bass Federal Well No. 1 is in excess of that of the Texaco CM No. 1. It's on the same scale as the performance curve of the Texaco State CM No. 1 so they can be compared.

Q Would you say that that indicates the Bass Federal No. 1 as comparable to Texaco CM No. 1?

A Yes, based on the geologic testimony and based upon the capacity of the two wells, I would say that probably the Bass Federal Well No. 1 is equal to or better than the Texaco State CM No. 1.

Q Would you expect that well to produce ultimately about the same amount of gas as they Texaco Well?

A Yes, I would expect that well to produce equal to or possibly slightly greater amount of gas than Texaco CM No. 1 Well.

Q Would you anticipate that it would have the same productive life?

A No, sir, not exactly. As I mentioned awhile ago, in review of Exhibit No. 1, for the first --

Q (Interrupting) You mean Exhibit No. 14?

A Yes, sir. On Exhibit No. 14 you'll recall that the producing rate for Texaco State CM Well No. 1 does not reflect its deliverability or the capacity of the well. As you will recall, the market for gas in southeastern New Mexico was somewhat limited during that period of time.

Being allowed to produce at the optimum capacity for the Bass Federal Well No. 1, I would anticipate the life of the Bass Federal Well No. 1 to be approximately seven years.

This is illustrated by my next Exhibit which is the projected performance of the proposed Bass Federal Well No. 2.

Q Have you arrived at that curve based on the production performance of the Texaco and the Bass Federal No. 1 Well?

A By analogy I arrived at this projected performance.

Q Would you anticipate a well location proposed be comparable to those two wells?

A Yes, sir. If I may, previous geological testimony has indicated that the State CM Well No. 1 is on a strike with No. 1 Bass Federal although the proposed location is not in a direct line with the two wells. It's on a strike and geologically should be between the two wells and exhibit the same

productive capacity and reserves as these two wells. It would possibly be slighter than the State CM No. 1 and approximately equivalent to the Bass Federal No. 1.

Q What would the anticipated life of the No. 2 Well be if it's drilled?

A Sir, as my Exhibit of the projected performance of proposed Bass Federal No. 2, I illustrate I expect the life of that well to be somewhat less than seven years, approximately seven years.

Q Now, on the basis of your study of this area, would you say that the proposed location then was a good location or choice location; how would you characterize them?

A Well, sir, I'm under oath and my recommendation originally was that the location in Section 25 would be an optimum location. However, the Bass Federal Well No. 2 location is definitely an inside location, as you can see. It's within the circumference of semi-circle. By other locations it's a proven location.

Q Would you characterize it as a development well?

A Definitely.

MR. PORTER: Would you call it a good location?

THE WITNESS: Yes, sir, I sure would. I would say

that this location is necessary because of the lenticular nature described by Mr. Henry in his testimony, that the zones that are correlated with the Bass Federal No. 1 would possibly be drained by the Bass Federal No. 1 due to the lenticular nature of the Morrow sand. I don't believe that you can deplete efficiently the entire reserves under the south half of this section from the proposal well.

Q Now, in your opinion, is it necessary that this well be drilled?

A Yes, sir, it is.

Q In your opinion as an engineer, is drainage occurring to the south half of Section 30 at the present time from the Bass Federal No. 1?

A Yes, sir, as I just stated, the zones that correlate into the Bass Federal No. 1 with excellent permeability exhibited by the sands in the Morrow, you would normally expect a degree of drainage.

Q In other words, within the south half of the Section for protection against that drainage, would it be necessary to drill a well on the south half?

A Yes, sir, it would.

Q On the Exhibit does that Exhibit show that the dates of completion of the wells and their cumulative

production?

A Yes, sir, it does.

Q I don't believe we need to go into it, but do you know what the source of that information is?

A Well, the source of information are the scout cards and various information that we have obtained on the various wells, the annual records of the New Mexico Oil Commission.

Q Now, Mr. Cope, in connection with your work for Belco did you make any programs for the drilling and completion of this well?

A Yes, I did.

Q Would you outline what is supposed to be done in the drilling and completing of this well?

A Sir, we plan to drill a 20-inch hole to the anhydrite stringer immediately above the salt section and set 13 and three-eighths inch surface casing. This casing would be cemented to the surface with approximately 700 sacks of cement.

MR. PORTER: What size pipe was that?

THE WITNESS: 13 and three-eighths.

MR. PORTER: Thank you.

A (Continuing) This casing would be tested to 600 pounds before drilling the shoe. After drilling the shoe,

the hole would then be drilled to approximately 3,100 feet or 150 feet below the salt section. The drilling of fluids through that section of the hole would comply with Rule R-111-A. The pipe that would be set at approximately 3100 feet would be 10 and three-quarter inch, 40.50 pounds, K-55 and F-80 grade casing. This casing string will be cemented by the inter-string method whereby the drill pipe is run in the casing, sealed into the float chute. Cement is then mixed and pumped down the drill pipe until cement is circulated to the surface. The drill pipe is then displaced and this volume of cement is circulated out of the surface.

The 10 and three-quarter inch casing will be cemented with the necessary volumes of Halliburton light cement containing one-quarter pound flow seal, 14 pounds of salt and five pounds of Gilsonite per sack followed by 200 sacks of Class C cement containing five pounds of salt and one-half of one percent CFR-2 per sack. The compressive strength of this cement will be 2,000 pounds after 24 hours. This will be tested to 1,000 pounds before drilling the shoe and retested to 1,000 pounds after drilling the shoe.

The hole will then be drilled to approximately 10,300 feet and the second intermediate string of seven and five-eighths inch 26-40 pound M-80 CF-95 grade and 29-70 pound CF-95 grade casing line.

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0386

This stringer casing will be cemented to the surface in two stages. The first stage of cement will be approximately 800 sacks of Halliburton light cement containing one-half of one percent CFR-2 and one-quarter pound flow seal per sack followed by 200 sacks of Class H cement containing one-and-one half percent CFR-2 and three pounds of KCL per sack.

In the second stage the safe collar will be placed below the casing chute of the 10-and-three-quarter inch casing. From this point the cement will be circulated to the surface with light-weight cement followed by 300 sacks of loose cement. The hole will then be drilled to approximately 13,600 feet of five-and-a half inch 17 pound S-95 plus joint liner set from approximately 10,000 feet to the total depth. This liner will be cemented throughout from the bottom to the top of the liner.

This program complied in all aspects with the New Mexico Oil Conservation Commission Order R-111-A.

BY MR. KELLAHIN:

Q In your opinion, will the cementing and drilling and cementing program that you have outlined fully protect any potash known to be encountered in this well?

A Yes, it will.

Q Now, have you examined R-111-A in regard to plugging of a well in this area?

A Yes, sir, I have.

Q In your opinion, will plugging of a well in compliance with that Order, assuming the well has been drilled as you have outlined, fully protect against any possible seepage of oil and gas into the potash zone?

A Yes, it would.

Q Would your testimony be the same if you assume that due to subsidence the upper portion of the casing may have been severed some place?

A Yes. Under the Rule of R-111-A, upon plugging and abandoning a well, a solid-cement plug should be set in the base of the salt section and through the potash interval and should the casing be sheared off at the level of the potash mine, you would still have approximately 1,000-foot cement plug between it and the base of the sale in addition to the various plugs set above any possible pay zones.

Q Mr. Cope, were Exhibits 14, 15, 16 and 17 prepared by you or under your supervision?

A Yes, they were.

MR. KELLAHIN: At this time I would like to offer into evidence Exhibits 14 through 17, inclusive.

MR. PORTER: Without objection Exhibits 14, 15, 16 and 17 will be admitted into the record and the witness is available for Cross Examination.

(Whereupon, Belco's Exhibits Nos. 14, 15, 16 and 17 were admitted in evidence.)

CROSS EXAMINATION

BY MR. ROBB:

Q Mr. Cope, you were the representative of Belco who signed the Application that presently is pending before the Commission?

A That's correct.

Q You were the District Engineer at that time for Belco?

A Yes, I was.

Q And the filing of this Application and the planning of this location, including the drilling of this well, was at that time your responsibility for Belco; is that correct?

A That's correct.

Q You are the person then within Belco who made the decision to drill the well at this location?

A Negative. That is not correct.

Q Who within your company accepts the responsibility

for having selected this site?

A That's a function of our geological department.

Q The geological department?

A Yes.

Q Was that Mr. Henry, who testified here before?

A Mr. Henry is a consulting geologist. Our district geologist and his staff were primarily responsible for the selection of this location.

Q I see. Is your District Geologist here?

A Yes, sir, he is.

Q What is his name?

A Mr. Gene Boundy.

Q As the District Engineer are you his superior; does he report to you?

A No, we were all equivalent levels.

Q Equivalent levels?

A Yes, sir.

Q But you concurred in this decision that this was the right location for the well, didn't you?

A I concurred in that this is a justified location and a highly desirable location.

Q You testified it was a good location and that it was a necessary location; is that right?

A The drainage of the south half of this section.

Q Did you before you filed this Application with the Commission review the work of this Mr. Boundy?

A Yes.

Q All right. Did you, at that time, before you filed this Application concur that this was the right location?

A It's certainly obvious that this is a well-justified location. These are excellent wells.

Q All right, sir. Before arriving at this decision or was this decision based upon your decision concerning the value for simply developing an oil and gas well or did you consider the fact that you were within a known potash area within Secretary 65 or within an R-111-A area?

A Can you restate that question?

Q Yes. Did you consider the fact that it was potash or there might be potash in this area below your drill site at the time you made the decision?

A At the time we made the decision, or at the time the decision was made, I believe, that we felt like there was not potash beneath this location.

Q So you didn't consider the effect that this might have upon a possible potash deposit?

A We felt like that this would have no effect upon

deposit if we drilled this well in accordance with the Rule R-111-A.

Q Then you did consider it?

A We felt like it would have no detrimental effect.

Q All right. Do I understand then, that you addressed yourself to the question that there might be potash and concluded it would have no detrimental effect?

A Sir, you will have to recall that we obtained a waiver from Kerr-Mac to drill the Bass Federal No. 1. This is on the off side from this well from the mine.

Q Yes, sir. You obtained no waiver from Kerr-McGee on this location, did you?

A No, we did not obtain a waiver from Kerr-McGee on this location.

Q You were aware, I take it from your testimony, that you were within what is known as a known potash area designated by the USGS?

A We are very well aware that we're within a known oil-potash area.

Q Now, sir, with regard to the drilling, did you consider the possibility of an alternate location for this well?

A An alternate location for this well?

Q Yes, sir, other than Section 25, which you just testified to earlier?

A No, but the south half of this section -- I don't recall, we considered an alternate location.

Q All right. Now, I want to be really sure that I understand your testimony, Mr. Cope. Are you telling this Commission that you are going to guarantee that if this well drilled as you have indicated, that should subsidence occur as a result of potash mining operations in this area, that there would be no escape of methane gas from the hole?

MR. KELLAHIN: If the Commission please, we object to the question. The witness is in no position to guarantee anything. He has testified, he is an expert in his opinion, that this result would not occur, but to ask a witness or Belco or anyone else to make such a guarantee is an absurdance.

MR. ROBB: I would suggest, Mr. Porter, that because of the castostrophic results that can occur to the potash area that anyone who would presume to drill through a potash deposit ought to be prepared to give that kind of a guarantee. That's why I'm asking the question.

MR. PORTER: Objection sustained.

BY MR. ROBB:

Q Do you know of any person presently with Belco,

employed by Belco, who is prepared to give Kerr-McGee, or anybody else in this area, a guarantee that there would be no escape from such a well?

MR. KELLAHIN: We'll make the same objection. I think Counsel is overlooking the fact that under prior 111-A, we have the right to drill here. We're not interlopers. We're not presumptious as he seems to indicate. We have filed our Application in accordance with Orders of this Commission. We are having a Hearing hopefully in accordance with this. To ask for any guarantee from anybody is, again, I say absurd and he has no right to ask us to guarantee.

MR. ROBB: Those questions were asked and answered at the Phillips Hearing. That's the reason I asked. I drew the questions directly from the Phillips IMC Hearing.

MR. KELLAHIN: This is a different case.

MR. ROBB: I must say in response to what Mr. Kellahin is saying that I do think that the operator who wants to drill through this area has a burden to show that it isn't going to result in damage to the potash. That's one of the burdens that they carry in the case of the Applicant, and I think I have a right to inquire whether or not this witness will be satisfied to testify to that.

MR. KELLAHIN: If the Commission please, the witness

has testified what we're going to do and if that isn't sufficient and you want something else done, let's hear what it is, but to have a guarantee is meaningless anyway. To say, "Yes, we'll guarantee it," what kind of a guarantee are we talking about? We put on our testimony that we are going to comply with the Orders of the Commission, which the Commissioner has said this will satisfy him that no damage is going to occur and if anybody wants to make this will, let them be put on the stand.

MR. PORTER: The Commission will sustain this objection, too.

BY MR. ROBB:

Q Will you tell me, Mr. Cope, what study you made of the subsidence existing in this area before you arrived at the conclusion that the precautions that you have testified about would adequately protect against it?

A As you know, Mr. Robb, I have attended the various Hearings where you were present and heard the testimony by your mining engineers as to the degree of turbulent disturbance which occurs during subsidence and to answer your question, we feel like that after the well is plugged and abandoned, that it would be safe, reasonably safe, within all practicable reasons.

First of all, let's compare the plugging of a well

within the potash area to the plugging of a normal well. Reading from Rule 111-A, it said that a well plugged will provide a solid cement plug to the salt section and any water bearing horizon and prevent liquid or gasses from entering a hole at or below the salt section. If we plug a well, a normal well, say, within the town site of Carlsbad or within any other area, we would probably be required to place plugs above each possible pay zone encountered in the well bore and across the shoe of the intermediate casing and across the shoe of the surface plat, possibly a ten-sack plug at the surface. This has been accepted throughout Texas and New Mexico as adequate insurance that gas will not escape from these plugged wells and the Oil Conservation Commission of New Mexico witnesses the plugging of these wells and we accept this from experience that this is adequate.

In the potash area provisions have been made to set a plug in this particular well bore that would be approximately 1,000 feet of solid cement within the inner casing and sourrounded by two strings of casing cemented completely to the surface. In other words, you would have a solid cement plug in this well bore for in excess of 1,000 feet and I have heard testimony by the mining engineers that the shearing forces could completely shear the casing off at the

mining level and it appears to me that if this should so happen it would not change anything. The well would still be plugged with a solid 1,000 feet of cement between any possible gas entry and the level of mining.

Secondly, the staff of engineers made an in-depth study of the conditions involved and determined that if a well were drilled and plugged in a manner outlined by R-111-A, that it would be safe for subsequent mining.

Q Mr. Cope, that's a rather long answer to my question. My question was: Have you, sir, made a study of the subsidence that exists in this area including the kind of pressures that are exerted and your answer to me when you started, as I recall, was that you had observed -- you had been here and heard the testimony as I had at these Hearings, is that the extent of your knowledge about subsidence?

A Mr. Robb, I said that I accept your testimony that you're aware of that a most extreme case could be the shearing forces which could completely sever the casing string at the depth of the mining. I would say this is the most extreme example. This would be the most extreme hazard that could happen and in case this did after the well was plugged what might happen, I attempted to be completely honest with you in answering your question.

Q What you are saying, if I understand you correctly, Mr. Cope, you have not made an underground study of the forces subsident in this area; is that right?

A You see, I have been to the Hearings, too, and I don't consider myself an expert.

Q Did you accept the testimony as valid?

A Yes, sir, I did.

MR. PORTER: You have no quarrel with that testimony?

Q But that is the extent of your knowledge what you have picked up in these Hearings, is that right?

A Yes, sir, that is true. I accept this is what can possibly happen.

Q Now, let me ask you: Are you telling us it's not possible for gas to escape through the casing to the outside of the casing around your cement plug?

A If these wells are properly cemented, as it has been proposed here, then it's very difficult for gas to pass even a six-inch plug that is solid and we're talking about 1,000 feet.

Q You know, sir, don't you that the gas, in fact, does escape from wells that are plugged?

A Can you give me an example?

Q You mean you are not aware of the oil seepages that occur in this area or where the oil has come out, migrated 1,400 or more feet in the potash area of New Mexico from a plugged well?

A No, I'm not.

Q You're not?

A I'm under oath. I don't know of any specific examples.

Q Are you aware of no circumstances from your experience where a plugged well ever had gas escape?

A From the surface to the ground?

Q Or into the formation?

A I have no way of knowing.

Q You have no knowledge of this?

A No.

Q All right. I'd like to show you an Exhibit and ask whether or not you agree with this. I hand you what has been marked as Kerr-McGee Exhibit No. 2, Exhibit "H", about half way through it.

MR. KELLAHIN: Are you referring to a letter?

MR. ROBB: Yes, we are referring to a letter and a report from John Boyer.

MR. KELLAHIN: We object to the Exhibit, with any

reference to it as being completely hearsay. If Mr. Boyd's present and you call him as a witness to testify, but to ask this witness to accept this hearsay evidence for the purpose of a question, I object to it.

MR. ROBB: This witness says that he has heard testimony by Mr. Boyd and has attended these Hearings and this was an Exhibit attached to the presentation made to the Secretary of the Interior and is well known to everybody and I now ask if he agrees with the opinion of Mr. Boyd, whose testimony he's already cited.

MR. KELLAHIN: Mr. Boyd's testimony, you say, was submitted to the Secretary of the Interior. He is not here either. We object to the question.

MR. ROBB: The question is not whether he's here. The question is whether or not he agrees with Mr. Boyd, who was a witness of the IMC Hearing, and he testified here and this witness has said that he listened to the testimony.

Now, I want to ask him about a report that Mr. Boyd has prepared. This is a witness that he says he's familiar with. All I want to know is if he agrees.

MR. PORTER: Mr. Cope, as I understood, I believe you said you had no quarrel with the testimony that's being

referred to here of Mr. Boyd?

MR. KELLAHIN: If the Commission please, the testimony was he had no quarrel with the testimony in regard to subsidence. Now, Mr. Robb has presented a book here, a statement by Mr. Boyd which bears on what we know not; I assume it has something to do with seepage in some mine. Now, If Mr. Cope is familiar with this, then, yes, he could answer the question, but just to hand a witness cold an Exhibit of that size and ask him if he agrees with it, I object to it.

MR. PORTER: As I understood it, there were specific statements in a paragraph in the Exhibit that he was asking about. Is this true, Mr. Robb?

MR. ROBB: Yes, sir, there are several specific pages I want to ask about. I haven't had a chance to do that. May I do that?

MR. PORTER: The Commission is going to allow Mr. Robb, your reference to specific sections of this testimony in order to refresh the memory of this witness, and question him specifically on those passages as to whether or not he agrees with them.

BY MR. ROBB:

Q Would you please look over Exhibit "H" and I'll direct your attention to specific parts of it which is a report

from John T. Boyd, dated July 23rd, 1973, and that the Potash Committee of the New Mexico Mining Association has a copy of that Exhibit, I believe, already. It's Kerr-McGee Exhibit No. 2 and it's Appendix "H", which was about the middle of it.

A You're speaking of the second paragraph?

Q Well, I'll direct your attention in just a moment. Have you looked at it generally?

A Yes.

Q Now, you know who Mr. Boyd is, do you not?

A Yes.

Q You were present here at the Hearing, you and I both were, at the IMC-Phillips Petroleum Company Hearing? That was about a year ago.

A That's correct.

Q You heard him testify at that Hearing?

A Yes, sir.

Q You know that he is a mining engineer who has worked in and around the potash basin ever since 1952, over 20 years. You recall that testimony, don't you?

A It says, "I have a working knowledge of the Carlsbad Potash Basin."

Q Yes, sir. Do you recall his testimony at the Hearing,

IMC Hearing?

A Yes, sir.

Q And you recall that he has been a consultant for the potash company in the Carlsbad area since 1952?

A I don't specifically recall.

MR. KELLAHIN: If the Commission please, it sounds to me like the attorney is trying to qualify Mr. Boyd rather than whether he agrees or doesn't.

MR. ROBB: I'm asking him whether he accepts him as an expert.

BY MR. ROBB:

Q Do you accept Mr. Boyd as a mining engineer with vast experience in the potash mining area in New Mexico?

A I think he was accepted as an expert witness by the Conservation Commission.

Q You don't challenge that, do you?

A No, I don't.

Q All right. Now, on Page 2 of the Exhibit, it says, (Reading) With the underground mining of potash ore or hallite salt stresses originally distributed throughout a large area are concentrated in the pillars. These stresses are relieved as the pillars undergo continuous permanent deformation without a fracture, a process commonly called plastic flow.

As the mining continues the pressure on the pillars increases and plastic flow continues indefinitely or until the pillar crushes. (End of Reading) Do you accept that as a statement of what happens in the underground after there's been mining and subsidence begins to take place and the salt section begins to flow?

A I'll say this, that I'm not qualified to challenge his testimony.

Q All right, sir. Then, down below, the third paragraph, (Reading) The bedded potash ore in the Carlsbad Basin with a 15 to 20 percent K20 content and the roof fall have the following characteristics when the force is applied perpendicular to the flank of the stratification, compressive test per square inch, potash ore 15 to 20 percent K20, 3300 yield strength per pound per square inch, 2000 pounds. Then for the salt section, the salt section will yield under pressure at the rate of 2,500 pounds per square inch and will at compressor's rate test at 4,400, will cause it not to only yield, but to break at 4,400. (End of Reading) Do you agree with that or don't you agree with that?

A Sir, I don't know in what manner these compressive tests were performed. I assume that they're as represented here.

Q All right, sir. On the next page there is a three-column figure showing the amount of pressure of overburden thickness as exerted down at various levels of mining in the potash areas. Do you see that? One is at 1,000 feet, the other is 1,600 feet and the third column it is 2,100 feet.

A Yes, sir.

Q Now, you're in the eastern part of the potash ore area, are you not?

A That's correct.

Q And that's the deepest isn't it?

A Yes.

Q And about 2,100 feet would be about right if there's potash under this location and I know you won't concede that's right, but if there is, it's about 2,100 feet, isn't it?

A It should be.

Q All right, sir. If you have a mining recovery of only 30 percent, this table would indicate a pound per square inch pressure of 3,000; is that correct?

A The table illustrates this.

Q That would be the weight on the remaining pillars that are holding up that mine then?

A (No reply.)

Q And undoubtedly --

MR. PORTER: (Interrupting) I don't believe the witness answered that question.

MR. ROBB: I'm sorry. What is your answer?

A I said I believe this is what the table illustrates.

Q All right. You don't challenge that statement, do you?

A I have no way to know whether that's right or not.

Q And then below it says, (Reading) The potash before it starts compressing with 50 percent mining recovery at 1,000 feet of cover and when first mining starts at 2,100 feet of cover. (End of Reading) You disagree with that statement?

A Sir, I am not a mining engineer. I have no way to agree or disagree with it.

Q All right. On the top of the page 4, it says, (Reading) With normal pillar recovery system and mining at 10-foot seams the salt base will move as much as 12 to 14 feet. The salt becomes plastic and flows as a mass, the forces that would build up against any oil or gas well caused casing in the subsidence area would be uncontrollable. (End of Reading) You have accepted that statement, haven't you, for purposes of your testimony?

A Yes, I said that this is the most extreme situation.

Q All right.

MR. KELLAHIN: If the Commission please, in Cross Examination I feel it is improper going beyond anything that's testified to on Direct. Mr. Cope's made the assumption that the most extreme situation that could occur would occur, but his testimony then was that the cementing program would still protect the salt section and the potash section, if any existed there.

Now, of course, with this Cross Examination it would appear to be a means of just getting this testimony before the Commission without a witness being present to testify to it. We object to any further testimony on Cross Examination along this line.

MR. PORTER: We feel that the objection is properly taken. I don't feel that Mr. Cope is a mining engineer and actually qualified to testify on the questions that he's been asked. He has testified that he feels that the construction of this well is adequate under the most extreme conditions as have been outlined, and that would be the complete shearing of the casing at the potash depth. So I believe the Commission will ask you to discontinue this line of questioning.

MR. ROBB: All right.

BY MR. ROBB:

Q Are you aware of the properties of methane gas?

A Yes.

Q All right. Are you aware of the fact that methane gas can migrate through porous deposits?

A Yes.

Q On Page 5 of this report it says, (Reading) Gas has been known to migrate through salt strata and could easily migrate along the mud seams in the Salada Formation. (End of reading) Do you agree with that statement?

A On Page 5 where?

Q That's Paragraph 5.

A I'm not personally aware of these examples. I believe it might be possible.

Q All right, sir. If not withstanding this super plug that you have in this well, Mr. Cope, if gas did get out from underneath that plug and got through the casing, or got through the cement, or if you didn't get a proper cement job and gas got loose and then the gas migrated along the mud seams, do you know what would happen to a potash mine in this area if it got into the workings?

A May I say this: There were many wells drilled in this area during the 1930's before these programs were adopted, and in our drilling program we have said that on our 3,100-foot string of casing, we're going to circulate cement. We're

going to mix and pump cement until it circulates from the bottom of that string of casing to the surface. Now, I don't think that we can correltate between these instances where these wells are possibly drilled by other programs other than the one that we have designated.

Q Sir, my questions was: Do you know what would happen to a potash mine such as Kerr McGee's or any other mine in the area if that gas, in fact, got under the bore?

MR. KELLAHIN: If the Commission please, there isn't any mine under this area. There isn't any mine within five miles. He's asking this witness to assume that somehow Kerr McGee got himself a lease on this acreage and is in there mining it. The witness has testified that in his opinion, there isn't going to be any gas escape and that should be the end of the matter. Now, if they want to put on the testimony as to what happens when gas gets into the mine, they can call a mining engineer and testify to it.

MR. ROBB: Sir, we have our mine, at the present time, is approximately four miles away. We have a mining plan on file with the Commission to show that we expect to be within an area of approximately a mile-and-a-half within five years and we have other testimony which will indicate that if permitted to do so, Kerr-McGee is the only operator

that really can feasibly get into this area because of its workings and we expect to have mines a lot closer than the five miles from this location.

MR. PORTER: Mr. Robb, the Commission feels that it would be more properly matter to put into record from one of your own witnesses if you could develop this information, than trying to develop it through a man who is qualified only as, I believe, a petroleum engineer. Now, as you say the mine is some three to four miles away and this has not happened and Mr. Cope, I'm sure, has not had a chance to observe what happens to a mine when gas does escape into it. I doubt seriously if he is expert enough to testify on that so we're going to sustain that objection.

MR. ROBB: All right. I really didn't want to belabor that point, but this testimony has been covered a number of times before the Commission before. I wanted no expertise in this area.

Q Mr. Cope, let's be sure I understand your testimony correctly. With the enormous, tremendous, uncontrolled forces that are incorporated in this report by Mr. Boyd, that if those forces were brought to bear against the casing that you propose to put in this well, that under no circumstances would

there be no gas escaping from that well?

A Sir, I am not testifying to that at all. I said, that if this well were drilled and produced to depletion and plugged and abandoned in accordance with the program outlined in New Mexico Oil Conservation Commission Order R-111-A, where we have a solid 1,000-foot cement plug below the 2,100-foot potash level that I believe that within reason there would be no chance of escape of gas, even though the most extreme case of the casing being entirely sheared off would be the same.

Q In the process of shearing off this casing, the plug got dislodged, there would be gas escaping?

A Sir, it's very difficult to drill cement out of a casing, much less dislodge it. You might disrupt a few inches or a few feet, but certainly not 10 feet or hundreds of feet.

Q You're saying then that, in your opinion, then, it would not happen?

A Yes.

Q I see. All right. Now, let me ask you about the life of this well, Belco No. 2? The other wells in this area have been producing at a considerable longer period than the seven-year life that you give this well, haven't they?

Let's take the average-expected life of Texaco Audie Richards No. 1. What do you give that expected life in years?

A Sir, I'm presenting evidence where we compared like-well characteristics and conditions and previous geologic testimony to the effect that our Bass Federal Well No. 1 and our proposed Bass Federal Well No. 2 would be like the Texaco State CM Well No. 1 and in order to compare our proposed Morrow Well with the anticipated geological development to the Audie Richards is not comparing the equals.

Q You don't consider them comparable?

A No, sir.

Q All right. How about the Texaco CH No. 1 Well, would you consider that comparable?

A No, based on previous geological testimony, they're not comparable.

Q I believe you testified you considered the Bass No. 1 to be comparable to Bass No. 2; is that right?

A We anticipate these wells to be comparable.

Q All right, sir, but you rejected the other wells that are located nearby and your Exhibit, the two Texaco Wells, the CH No. 1 and the CM No. 1 -- I'm sorry -- the Richards No. 1 and the CH No. 1, right?

A That's right.

Q And instead you took the well to the north, the Bass No. 1 and the one to the south, CM No. 1; is that right?

A That's correct.

Q You overlook the intermediate two that are actually just as close or perhaps even closer than the CM No. 1?

A The proximity of the wells is not the critical factor here. The Morrow formation, where you're better development is on the flanks of your structure, you compare the wells on strike as being possibly more equal where the wells on top of the structure, as illustrated by the contours on Exhibit No. 11 illustrates the fact that the two wells which you are dwelling upon, are on the crest of the structure and are not comparable.

Q What was the production life of the CM No. 1 that you testified to?

A CM No. 1 has been producing since 1961.

Q 1961 and how many more years of life do you give that?

A I think that possibly this well has three years of additional life maximum with compression.

Q All right. Whether you agree they are comparable or not, do you agree that the average expected life of the

Texaco Audie Richards No. 1 which is right close to the Bass No. 2 is approximately 23 years?

A Sir, I'm not involved with the life of this well. We're not completing our well. We're not proposing to complete a well in equivalent zones with well conditions encountered in your well.

Q Whether you consider it equivalent or not, do you agree that that is the expected life of that well?

A I have not determined what the expected life of that well might be.

Q You've made no look,no check at all on the well adjacent to your own well location to see what that life was?

A Yes, I certainly have.

Q How about the Texaco CH No. 1 which is also right next to the 1?

A Yes.

Q Have you checked on the expected life of that well?

A I did not calculate the remaining life of that well or the total expected life of that well.

Q Well, sir, are you willing to testify that 23 and 21 years would be a normal expected life for a well of that kind in that location?

MR. KELLAHIN: If the Commission please, I don't

see the CH Well he's specified or what formation he's talking about.

MR. ROBB: Well, it's on your maps. Don't you know what formation the Texaco CH No. 1 is producing from Mr. Cope?

A Yes, I know what interval is perforated in that well.

BY MR. ROBB:

Q Would you say a 21-year life for that well would be about right?

A No, I would not say that. As I said before, I've not calculated the life of that well.

Q What reserve figure did you arrive at with regard to Bass No. 2?

A I said that the reserve was attributal to the drilling of that well and would be in the magnitude of five billion cubic feet plus.

Q You have Exhibit 1-A in front of you?

A Is this the --

Q It should be marked at the bottom.

A I've got Exhibit 1-B.

Q 1-B, that's the one. Do you know Mr. Roy Williamson?

A Yes, I do.

Q Do you accept him as a qualified petroleum engineer?

A Yes.

Q You heard him testify at the Phillips IMC Hearing, did you not?

A Yes, I did.

Q All right. Exhibit 1-B -- the Commission has a copy there -- is a letter dated March 9, 1974. I want to ask if you agree with certain statements here. (Reading) In accordance with your request we have calculated reserve producing wise from the product value from a more mature producing well in the vicinity of the proposed location and have discussed various questions concerning this area proposed in the letter of March 15, 1973. (End of Reading.)

I direct your attention now to the second page where it says, (Reading) Belco's proposed location -- Since the Atoka-Morrow Zone is stratigraphic in nature, the volumetric determination of reserves from a core-volume study is very hazardous. Therefore, no attempt was made to determine the reserve to be expected from Belco's Bass Federal No. 1 in Section 30, Township 20 South, Range 33 East, Amini's Well in Section 32 and 33, 20 South , 33 and Section 4, 21 South, 24 East or from Phillips Hat Mesa No. 1. (End of Reading)

Now, do you agree with that statement?

MR. KELLAHIN: If the Commission please, I don't know what he could mean that to agree with. The witness says that he didn't make the calculation and we agree that he didn't make the calculation, if that's what he wants, but if the witness didn't make the calculation, he should be produced and testify as to why he didn't make the calculation if Mr. Cope did.

MR. ROBB: I think you know what the question is. The question is: Whether or not the Atoka-Morrow Zones are stratigraphic in nature and a volumetric determination of the reserves from a core-body study is hazardous?

THE WITNESS: Yes, I will agree that reserve based upon volumetric calculations in the Morrow formation is very hazardous. That's the reason I prepared my reserve calculation and predictions based on performance history.

BY MR. ROBB:

Q You also notice in his doing the very same thing you attempted to do and he included the Texaco Audie Richards No. 1 and the Texaco State CH No. 1 as being comparable, do you not--at the bottom of the page-- comparable to the Bass No. 2, sir?

MR. KELLAHIN: There's nothing on the Exhibit to indicate that and, again, I object to this attempt to get hearsay testimony before the Commission by the back door of

cross examining our witness. If you have any questions about our witnesses testimony or his competence in making calculations on his own behalf we certainly have no objection to that kind of cross examination, but to come in here with this so-called Exhibit which is nothing but hearsay. There is no witness present to testify to it or subject himself to cross examination, we object to it. It's impossible for proper cross examination.

MR. ROBB: The feature of an expert witness by the use of an opinion by another expert is one of the classic means of cross examination. I think we are entitled to cross examine without the opinion of another expert.

MR. PORTER: The Commission is going to sustain this objection, too, Mr. Robb. At this time we are going to recess the Hearing until 1:30.

(Whereupon, the Hearing was recess at 12:03 P.M.)

AFTERNOON SESSION (1:30 P.M.)

MR. PORTER: The Hearing will come to order, please. Mr. Robb, do you have some further questions of Mr. Cope?

CROSS EXAMINATION (Continued)

BY MR. ROBB:

Q Mr. Cope, are you qualified in the field of directional drilling?

A Of original drilling?

Q Directional drilling?

A No, sir, I would say that I would not be qualified as a directional drilling expert.

MR. ROBB: Mr. Kellahin, do you have another witness on that?

MR. KELLAHIN: We'll have some other witnesses.

BY MR. ROBB:

Q If potash mining were to go first, go ahead of oil and gas drilling in this location and the area mined out and subsidence were completed and assuming that in the mining operation -- there will be testimony to this later on -- there are barren areas or other areas in or around mining workings where no mining has been conducted, dirt in place. Would you -- I have two questions. First is: Do you see any damage that would result to the oil and gas deposits from the mining

operations itself?

A I doubt that the deposits would be damaged. However, I think it would be difficult to drill a well to these deposits.

Q Okay. You lead to the second question. That's my next question. Would it be feasible to drill a well through this area, either through the subsident area where there has actually been mining or go through firm ground that has not be disturbed by the mining in adjacent areas?

A That appears to be two questions. After hearing the testimony that you introduced by Mr. Boyd about the tremendous forces involved in subsidence and the degree by which the rock is broken up and flows, I would say it would be very difficult to drill through this area and obtain a reliable cement job in this area of the hole.

Q I wouldn't want you to be drilling through that area, Mr. Cope, while it's still subsiding and if my question wasn't clear, let me make it clear. I'm assuming that the subsidence has ceased. There will be evidence that all but insignificant amounts of subsidence terminate at the end of five years. I'm really talking about after that. Let's assume your subsidence is over. You wouldn't have a problem drilling other than the loss of circulation problem, would you?

A The problem that comes to mind other than the loss of circulation is the obtaining of a reliable cement job. Any time you have loss of circulation you have the problem of obtaining a dependable cement job.

Q It increases the difficulty in drilling the well, isn't that what you're saying?

A Yes, sir.

Q But you have drilled through areas where you have that same problem, have you not?

A No, I have not.

Q I don't mean where it's mined out, but where you have circulation problems getting a good cement job?

A Yes, we have drilled through areas like that, but it was localized to one zone, more than a 2,100-foot zone as in this case.

Q If I understand your testimony, you are saying that you would have increased difficulty. You are not saying the well couldn't be drilled, are you?

A I'm saying that without an absolute guarantee that subsidence has entirely depleted,that to drill a high-pressure gas well like we're talking about would be a challenging proposition drilling through a disturbed area like this 2,100 feet, having to rely upon that casing string in that cementing

job after drilling --

Q (Interrupting) You're the one who is looking for the guarantee now?

A Yes.

Q That's a hard one. If you were to drill through adjacent areas to the mined out area where there hadn't been any mining at all, you would not expect any undue difficulty in drilling the well?

A As your question is worded, we would not expect any undue problems in an undisturbed area.

Q Fine.

MR. ROBB: No further questions.

MR. PORTER: Any questions of the witness?

REDIRECT EXAMINATION

BY MR.KELLAHIN:

Q Mr. Cope, you have drilled or supervised drilling wells in this area, have you not?

A Yes, sir, I have.

Q Was that for Belco?

A Yes, sir.

Q Where was that?

A Well, sir, I supervised the drilling of Bass Federal Well No. 1.

Q What kind of problems did you encounter on the vertical hole in this area?

A The most prominent problem we encountered in this well after we had set our intermediate casing, we drilled a shoe and we encountered a severe-crooked hole problem. Instead of running 40 to 50,000 pounds of weight which we normally would run on our bit, we were only able to run 10 to 20,000 with our crooked hole problem.

Q To what did you attribute that crooked-hole problem?

A Well, you have areas where you encounter crooked-hole problems. You never can tell where this will occur.

Q Is that due to the formation you are drilling in and the way it lies?

A I don't know why these areas are there. They just -- we just encounter crooked-hole areas.

Q Is that a problem that is common to Morrow, drilling through Morrow in this particular area? Have you found it in other wells?

A Well, sir, we have only been able to drill that one well so far, but I would say that this is a problem that would be common within a reasonable radius of that well, two or three miles.

Q Are there any other problems you encountered?

A Not in drilling our Bass Federal No. 1, we drilled a well on day work where Belco was responsible for drilling the well straight instead of the drilling contractor and, all in all, outside of the normal problems associated with drilling in a gas area, we encountered no abnormal problems.

Q Are the formations hard in this area or dense?

A Yes, sir, this is hard-rock country.

Q What kind of bits do you use in drilling?

A In drilling the Bass Federal Well No. 1 we justified the use of journal bearing bits. These are tungsten-carbide bits made for drilling in extra hard formations.

MR. KELLAHIN: That's all I have.

MR. PORTER: Any further questions?

MR. ROBB: No further questions.

MR. PORTER: Anyone else have a question of the witness? You may be excused.

(Witness excused.)

MR. ROBB: At this time we move for introduction of Exhibits 1-A, 1-B and 2.

MR. KELLAHIN: If the Commission please, Exhibit 1-A is a letter from Roy Williamson. Mr. Williamson is not present apparently, haven't seen him at least. The letter contains matters which purports to contain cost involved in

drilling in this area and he's not subject to cross examination. Letter 1-B is the same situation. It's a letter from Roy Williamson giving his reserve calculations and estimated life of the wells. In fact, that is a cross section prepared by Mr. Williamson, and again, he is not present in this Hearing Room to subject himself to cross examination as to these calculations and information contained in this letter.

Did you say 2, also, Mr. Robb?

MR. ROBB: Yes, that's right.

MR. KELLAHIN: 2 is an extremely lengthy document and it's a cover letter from Mr. R. H. Blackman, Potash Company of America, to Steve Wakefield transmitting the industry's position,papers relating to the drilling of the potash area. Now, I believe, the Commission has seen this. It contains a great deal of hearsay testimony. It contains calculations, exhibits and it goes on in great length to show economics of drilling in this area and the value of potash in the area, none of which is subject to cross examination. We think all of these Exhibits, our objection would be as being hearsay.

MR. ROBB: Mr. Porter, on Exhibit 1-A and 1-B, I think would be very helpful to the Commission. I don't think the criteria for admitting evidence at an administrative

Hearing like this is whether a witness is or is not subject to cross examination. Rules before administrative bodies are much more liberal than rules before a court and yet I have seen more technical objections made this morning than I ever witnessed before in a courtroom by opposing counsel. I thought this was an Administrative Hearing and the object was to arrive at the truth and not attempt, by technical rules, to exclude evidence that bears germanely on the subject before the Commission.

Now, we submit that all three of those Exhibits do so. Number 1 is a letter from Mr. Williamson that discusses the very things that these witnesses of Belco have testified to on direct examination. We have cross examined them to a considerable extent by the use of those documents. Those documents are important. They are vital on issues that are involved here in this case. Mr. Williamson was here at the Phillips Hearing. We're offering that that has a bearing on the subject and was cross examined by the very attorney who is now objecting and trying to keep this stuff out. He cross examined Mr. Williamson fully on all issues that are involved in these two letters. So if cross examination is a criteria, I suggest that it's been satisfied. I don't think it is a criteria. I think that an administrative proceeding

attempts to arrive at what is the truth with regard to conflicting statements of fact. Mr. Williamson has been before this Commission on many occasions. You have heard his testimony. You know his background and qualifications.

Now, with regard to No. 2 --

MR. PORTER: What about 1-B, what was that letter?

MR. ROBB: 1-B, your Honor, deals with the question of reserves. It deals with the problem of -- specifically it deals with the problem of the calculated reserves which are regarded as No. 2. It deals with the question of directional drilling. It deals with the question of ability to successfully drill through a mined out potash area if the potash mining were to go first. That's on Page 3 and then on Page 4, it contains the opinion about directional drilling. It is feasible; it is technically and economically feasible. Drilling from Bass No. 1 over to the proposed Bass No. 2. All those things are directly pertinent to what this Commission has to decide here today.

Now, those are the two Williamson letters. The first one deals with -- 1-A deals with the problem of directional drilling also and gives a breakdown of the cost of what directional drilling would cost if it were drilled on a horizontal displacement of up to 5,000 feet. It seems to me

that those things are directly relevant to what the Commission has to determine here today.

Would you like my argument on No. 2 or do you want to take them one at a time?

MR. PORTER: Go ahead.

MR. ROBB: All right. Now, No. 2 is more a historical document than anything else. No. 2 is a compilation of a history of development of potash in this area. It goes into the fundamental things that I hoped we wouldn't have to spend a lot of time here with the Commission, such as subsidence and how subsidence occurs, what the result is, where subsidence has occurred in the potash area, the migration of oil through potash. It deals with the problem of directional drilling. It has the Boyd report that I used extensively in cross examination. It deals with the question of whether or not you are likely to have danger to potash deposits from drilling in this area. It has a whole historical development basically of what has taken place in the oil-potash area and as a result we attached as an Exhibit -- everybody has seen it and knows what is in it -- 90 percent of it is not controversial at all. 90 percent of it is history that everybody agrees to, the history of the

Orders to this area from the very beginning, R-111-A, the Orders of the Secretary of Interior, it was attached as a historical background primarily, although it has some current pertinent things in it as well as in the submission that potash companies made to the Secretary of the Interior last summer. I believe a copy of that -- I believe everybody has got a copy of it, everybody has seen it -- and to raise a cross examination objection to a document like this, to me, seems ridiculous.

MR. KELLAHIN: In connection with Exhibit No. 2, he says 90 percent of it would be acceptable and I say 99 percent of it would not be acceptable and just as an example of the hearsay character of this thing, Exhibit A, Page 2, for example, purports to give values of ore that they claim would be left in the mine if we drilled. Now we are certainly hardly in agreement with this, but on the face of it we have no way of knowing how those figures are arrived at. We can't intelligently answer this without having witnesses who prepared it here and present to testify. The effect of this is simply to make Kerr-McGee's case on hearsay documents which have surely had wide circulation, but nobody agrees with them necessarily, because they have been circulated. The oil industry certainly does not, and prepared a counter statement which was filed with Mr.

Wakefield, also. This was admitted and we have the right to put in the New Mexico Oil and Gas Association's statement. The only thing here to constitute any evidence at all is 1-B, the cross section and even it is not entirely accurate, but we can intelligently look at it and see what it purports to show. Now, for Kerr-McGee to come in here saying this sort of thing is admissible to make their case denies us the right to be heard. We certainly do object to this type of material being admitted in any way.

MR. PORTER: Any response?

MR. ROBB: Exhibit A has a complete breakdown in calculations. If he's not satisfied with that, we have Mr. Lang here who can testify to what the differences are if there are any between these calculations and the ones that he's made. With regard to the question of the oil and gas presentation being submitted, I have no objection to that. Let them put in the oil and gas presentation to the Secretary. That may have some pertinent stuff in it, too. It seems to me the Commission is entitled to have the benefit of everything that bears directly on the issue here and this does bear on the issues. We respectfully renew our tender of those Exhibits into evidence.

MR. PORTER: The Commission does not feel that the

admission of these Exhibits is appropriate in connection with the cross examination of Mr. Cope and we are going to sustain Mr. Kellahin's objection.

MR. ROBB: May I be free to offer these again as part of our case?

MR. PORTER: You may offer them again at the appropriate time and the Commission will then rule on whether or not they should be admitted.

Mr. Kellahin, do you have any other witnesses?

MR. KELLAHIN: Yes, I do. I'd like to call Mr. H. L. Kendrick.

H. L. KENDRICK

called as a witness, having been previously sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A Harold L. Kendrick.

MR. ROBB: Is this an El Paso Natural Gas witness and is he going to testify that they're going to negotiate with you to cut Bass No. 2, going to make a well?

MR. KELLAHIN: He's going to testify that they've already negotiated.

MR. ROBB: Why? I stipulate. I don't see any reason to call a witness to establish things like this.

MR. KELLAHIN: Will you stipulate further that this witness would testify that El Paso Natural Gas Company has the need for all the gas that they can get from this particular area and will take the gas from this well when it's available?

MR. ROBB: Yes, you bet.

MR. KELLAHIN: Thank you, Mr. Kendrick.

MR. TRUJILLO: Is that the extent of his testimony?

MR. KELLAHIN: Yes.

Would you further stipulate that they presently have a line in this area connected to the Bass Federal No. 1?

MR. ROBB: Yes, I so stipulate.

MR. PORTER: Then there won't be any necessity for you to come forward with this witness, Mr. Kellahin. The stipulations have been agreed that they are in the area and available for connection and have need for the gas.

MR. KELLAHIN: Yes, sir. That's all we need.

MR. PORTER: Mr. Kendrick may be excused.

(Witness excused.)

MR. KELLAHIN: I'd like to call Mr. Ken McPeters.

MR. PORTER: I believe Mr. McPeters has not been sworn. Did he come in after the --

MR. KELLAHIN: I was going to ask you that.

MR. PORTER: Mr. Derryberry, would you swear the witness?

(Witness sworn.)

KENNETH McPETERS

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A Kenneth McPeters.

Q Where are you employed and what position, Mr. McPeters?

A Moranco, executive-vice president.

Q Where is Moranco located?

A We're located in Hobbs, New Mexico.

Q What business are you engaged in?

A We're in the oil and gas well drilling contracting business.

Q Where do you operate?

A Mostly around the Carlsbad area.

Q In southeastern New Mexico?

A Yes, we have seven rigs and right now six of them are operating in the Carlsbad area and one in Andrews County. We have had as many as all seven of them drilling for gas in that Carlsbad area.

Q In connection with your drilling operation, have you drilled for production from the Morrow formation?

A About 100 percent of our wells in the Carlsbad area are drilled in the Morrow formation.

Q Do you personally have anything to do with this drilling operation?

A Yes, I'm responsible for taking the contracts and pretty well responsible for running the company.

Q Do you have anything to do with procurement of supplies?

A Yes.

Q Drill pipes?

A Drill pipes, yes.

Q Now, Mr. McPeters, have you ever had any experience in directional drilling of wells?

A Yes, sir, we do it quite frequently. Some we whipstock to get around junk in the hole and a few, well, we drill to a depth target.

Q At what distance have you --

A (Interrupting) Up to 1,000-foot horizontal displacement.

Q Do you know of any case where a well has been directionally drilled to the Morrow formation in southeastern New Mexico?

A There probably has been some directional-drilled wells with small horizontal displacements.

Q Do you know of any where there has been as much as 3,000-foot displacement?

A There has not, to my knowledge.

Q In connection with your work would you make a bid on a well to be directional drilled to a displacement of 2,500 to 3,000 feet?

A No, sir, we would not.

Q Why not?

A There are several factors involved here. We are in the business to make a profit natu[illegible]. We would not take a contract -- first of all, normally, it would take to drill a Morrow Wel[illegible] to the depth of 13 - 14,000 foot, neighborhood of 60 to 70 days to drill it vertically. To directionally drill a well, one of displacement of 3,000 foot -- and I would just be guessing, it hasn't been done -- would take

at least three to four times longer than that.

Q Do you encounter any problems in directional drilling that are not normal to a vertical hole?

A Yes, we have extreme water to our drip out -- drill collars in a directional drilled hole. They are rubbing against the side of the formation and all these formations are extremely abrasive and it shortens the length of the drill pipe and the few wells that we've --

Q (Interrupting) You said the "length", you mean the length of the life?

A Life of the drill pipe. The times we did the directional drilling, we've had a real difficulty with the operator establishing what factor -- how much the drill pipe wears, what is it worth. So we shy away from even 1,000-foot displacements because you don't know really how much your damage is to your drill pipe. Along that line, another reason we wouldn't take it is because if you lose drill pipe today, we're looking at delivery of displacement of drill pipe of the first quarter of 1978. In a 14,000-foot well we would have in the neighborhood of $130,000 investment in a drill pipe and about $35,000 invested in drill collars and we would be jeopardizing how we're going to get it out of the hole and you can't replace it in today's market.

Another objection, of course, we would have is when you have troubles on a well and the longer you're on a well the more problems you are going to have. Instead of ending up with a friend, you end up with an enemy. We've got too many enemies as it is. We feel like we could do our customers more good by drilling a straight hole than drilling maybe three wells from one directional hole, rather than drilling one directional hole. Then there comes a personnel problem. Any directional hole, that number of days, we're going to have a lot of problems. Some of which I wouldn't even think of until we got there and got into doing it. You would be having more trips, more work. You would have very dissatisfied personnel, it would be difficult to keep your hands on the job.

Q When you're drilling a well deviated to the extent we're talking about, 2,500 to 3,000 feet, does that impose any problems on making drill-stem tests and well stem bore?

A Poses a problem with everything you do. The biggest problem is turning the drill pipe. On the wells that we've drilled directionally of 3,000 foot or more, you have a considerable amount of torque to the drill pipe and you could approach the point that you couldn't turn the drill pipe. You just twist it off on the surface.

Q That would mean loss of tools in the hole then?

A Yes, sir.

Q Would that incur a fishing job?

A Exactly.

Q Is that an additional expense?

A Yes, sir. Fishing is -- sky is the limit as to the cost of fishing.

Q Can you always recover fishing?

A No, sir.

Q That would mean a lost hole?

A Right.

Q Now, referring to the Exhibit on the board up there, Mr. McPeters, assuming with me for the moment that you would have a surface location approximately in the area of the Bass Federal No. 1 with a target area as a proposed location of the No. 2 Well.

A Which one is the Bass?

Q The one to the north, right there.

A How much displacement is there?

MR. ROBB: About 4,000 feet.

BY MR. KELLAHIN:

Q Is that a feasible operation from your point?

A In my opinion, it is not.

Q Does the fact that it is on strike apparently, as far as the formation is concerned, to pose any problems?

A That really doesn't have anything to do with my testimony. I'm just talking about the horizontal displacement. The strike, whether it's on strike or not, doesn't make any difference.

Q Does the cost of the drilling increase by the mud and other supplies?

A Yes, sir. My testimony is only has to do with the number of days on the job and it would be proportional and anything else would be an increase, porportionately.

Q As I understand your testimony, your company would not take it?

A We would not, no, sir.

MR. KELLAHIN: That's all I have of this witness.

MR. PORTER: Mr. McPeters, I have one question. You said there probably had been some wells deviated in this area. Do you have certain knowledge of any?

THE WITNESS: No, sir. I have no knowledge that any have or have not.

MR. PORTER: I see.

CROSS EXAMINATION

BY MR. ROBB:

Q Mr. McPeters, let's assume for the moment that

you didn't have a shortage of drill pipe and that you were willing to put up with the customer who might be a little bit unhappy and you were to drill a directional hole or somebody else were to drill. I'm not saying your company would have to do it. I understand you wouldn't want to do that, but you're familiar with drilling costs, are you not?

A Yes,sir.

Q If that hole were to be drilled, directionally drilled, how much additional cost would you say, could you estimate that it would cost over the drilling of a straight hole?

MR. KELLAHIN: If the Commission please, I think you would have to specify displacement distance.

MR. ROBB: I'm sorry. I thought we were talking about drilling from Bass No. 1 to Bass No. 2. That's the only thing you suggested, Mr. Kellahin, isn't it?

MR. KELLAHIN: Yes.

MR. ROBB: Add that to it, please.

A With that in mind, I would estimate the cost would be three to four times to infinite times. It could be infinite. You might not ever get it drilled. Your assumption that drill pipe is not scarce is a real good assumption, but we're faced with it.

BY MR. ROBB:

Q I'm just saying if it was not a factor.

A Yes, sir.

Q You are familiar, aren't you, with directional drilling that has taken place off-shore?

A On the Gulf Coast?

Q Yes, sir.

A I am familiar with it by talking to my other competitors. I have not done any of it.

Q You know, don't you for a fact, that directional drilling of distances up to four or 5,000 feet occurs in that situation?

A Yes, sir, but we're talking about the difference between tangerines and pineapples.

Q I don't think that's suitable. That's equivalent.

A Just because they do it on the Gulf Coast does not mean we can do it in Eddy County, because you have different formations basically. These soft formations, they would probably be on a 14,000-foot well 25 or 30 days and we'd have to take 60 to 70 days.

Q Let's talk about hard-rock formation.

A All right, sir.

Q Are you familiar with the directional drilling

programs that have been conducted over in Europe?

A No, sir.

Q Do you know that in Holland they have achieved horizontal displacement of over 9,000 feet in hard rock?

A I was not aware of it. We do not operate in Holland.

Q I understand. Now, the increased technical difficulties that you are referring to in drilling of a well, the estimate of the three to four times the amount, that's strictly a guess on your part, isn't it?

A To infinity, that's a guess.

Q You've never drilled one like this?

A No, sir. No one else has either.

Q You say no one else has?

A No one else has in Eddy County, to my knowledge.

Q Not down in your area?

A That's right. It might be possible to, but we don't want the contract.

Q All right. I'm not suggesting that we've got to go all the way to the moon. I just mean a little bit short of that distance. We have to bring in somebody; we want to bring in somebody who has done the kind of directional drilling that I referred to like this, like Templehauf over in Holland. You'd want somebody like that to consult with, wouldn't you?

A Yes, sir.

(Whereupon, a discussion was held off the record.)

Q Now, do you have Exhibit 1-B?

A Exhibit 1-B?

Q Yes. That top sentence, would you just read that?

A This is Mr. Williamson speaking here. (Reading) It would be technically and economically feasible to directional drill subject location from Belco's Bass Federal No. 1, located northwest quarter of Section 30. (End of Reading.)

Q All right. Second sentence?

A (Reading) Directional drilled holes have been successfully completed in southeastern New Mexico area. (End of Reading)

Q All right, that last sentence agrees with your earlier statement that there has been directional drilling down there near Carlsbad?

A He didn't say how much displacement though.

Q No, sir. Then, you agree the main consideration of such contemplated operation are the technical feasibilities and the additional cost incurred in directional drilling a well?

A I haven't agreed with any of this.

Q Okay. Then, you don't agree it is technically feasible to directional drill a well?

A Mr. Williamson is not in the drilling business.

Q No, sir.

A It's real easy for him to say this when it's not his money.

Q No, sir, but he has consultants available to him who have qualified competent knowledge, does he not?

A I haven't seen them, no. He might have, but I haven't seen any.

Q Then, you don't agree with his statement that contingency cost for unexpected trouble is estimated to be the cost of directional drilling to be $170,000 or approximately 22 percent of estimated straight hole cost of $781,000.

A How much displacement is he talking about?

Q 4,000 feet from Bass No. 1 to No. 2.

A I think he's a dreamer.

Q Do you know Mr. Williamson?

A No, I do not.

Q All right.

A For the record, I am also a professional engineer and I disagree with this professional engineer.

Q Exhibit 1-A, would you look at that, please?

A That's a cross section?

Q No, sir, that's a letter of July 31.

A I don't think I have it. Mr. Robb, I probably wouldn't agree with that either, probably save a little time here.

Q Okay. Let me summarize. That purports to be a cost breakdown of the drilling cost of horizontal drilling up to 5,000 feet at a depth of 13,500, which is the depth of the formation in this case. It comes up with the conclusion that approximately 21.39 percent additional cost for directional drilling over a straight hole.

A Mr. Williamson did this?

Q Yes, sir. Well, he and his consultants.

A I mean, did he actually drill a well, is that what he's basing it on?

Q He's basing it on consultants who have, yes, sir.

A In Eddy County?

Q No, sir, Midland, Texas.

MR. KELLAHIN: In the first place I object to Counsel testifying. This is another thing that is vicious about this sort of approach. This is purely hearsay evidence. Counsel says that he has consulted with engineers who have drilled this

well. There is nothing here to indicate who they are, where they are, what well was drilled, what displacement or anything else. This is improper line of questioning.

MR. ROBB: I answered this witness' question, Mr. Porter. I didn't bring it up, he did.

MR. PORTER: You were answering his question?

MR. ROBB: Yes, sir. He asked me whether I had consultants.

THE WITNESS: Well, would you like to change places with me.

MR. ROBB: That might be a good idea.

THE WITNESS: I'm sorry if I was leading you.

MR. ROBB: When you get through testifying, how about sitting down here with me?

MR. PORTER: Mr. McPeters, in giving your answers refrain from asking Mr. Robb questions. He's not under oath and I don't believe he's qualified to make an answer.

MR. ROBB: Thank you, Mr. Porter. I would be the first to agree.

BY MR. ROBB:

Q You don't agree with Mr. Williamson's letter?

A No, sir, I do not agree with either one of these letters from Mr. Williamson.

Q Let me ask you one question, Mr. McPeters. Did you testify at the Hearing before Mr. Riggs, Assistant Secretary of the Interior, in Albuquerque two weeks ago?

A I did not. I made a statement.

Q What did you say in that statement, do you remember?

A Essentially what I did today, I think. In fact, I'm looking at the same notes that I did that day. I think I spoke of the torque and drag and the wear, pretty well the same, yes, sir.

Q Didn't you testify -- let me see if I can refresh your memory?

A Testify, I did not testify.

Q In your statement, didn't you say that you favored the drilling in this area, because it would hurt your business if wells couldn't be drilled through a potash area?

A It would hurt our business if you closed any area to drilling.

Q Isn't that what you said at the Hearing?

A Yes, sir, absolutely.

MR. PORTER: Any further questions?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. McPeters, in reference to the torque on the

drill pipe and the drag and the wear and tear and everything you were considering whipstock drilling. How about Dyna-drilling, you wouldn't have that in Dyna-drilling in a directional?

A Right, but usually the Dyna-drill is just used for kicking a well off and then you go back to conventional drilling.

Q What's the maximum normal lateral displacement which you attempt with the Dyna-drill?

A We have displaced holes in the neighborhood of 500 to 1,000 feet.

Q That's using the Dyna-drill entirely?

A No, sir. The Dyna-drill is only used to kick the well off initially. The Dyna-drill costs $900, I believe, for an eight-hour minimum.

Q So you never use it for accomplishing the lateral displacements, just to kick it off?

A Just to kick it off is the only experience we have had. The cost of the tool is quite expensive and if you used it for the entire operation, you don't need it, it would be quite costly.

Q Is it feasible to use the Dyna-drill for lateral displacement rather than just kicking the well off?

Technically feasible, I'm saying?

A I don't think so.

Q So it would be a matter of comparison of the cost of the Dyna-drill and the cost of wear and tear on your string of drill pipe then would be the economics of --

A (Interrupting) There would be no wear and tear on the drill pipe if you used the Dyna-drill, is that what you're saying?

Q Now, you wouldn't have all the abrasive effect on your drill pipe with the Dyna-drill that you have with conventional whipstock drilling, would you?

A You wouldn't have as much, Mr. Nutter, but you would still have wear because you're pulling this pipe around corners. Anytime you do that you are going to have some wear.

Q But you're not turning with going around the corner?

A That's right. You're not turning.

Q You haven't made any comparison then of the economics of directional displacement with the Dyna-drill as compared with conventional directional drilling?

A No, sir. Of course, in our business we usually don't make economic comparisons like that, usually the operators do so.

Q All right, sir. Thank you.

MR. PORTER: Any further questions? You may be excused.

MR. KELLAHIN: Call Mr. W. J. Holbert.

W. J. HOLBERT

called as a witness, having been previously sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A William J. Holbert.

Q By whom are you employed and in what position, Mr. Holbert?

A Rowen Drilling, USA Division of the Rowen Company, Division Manager, Western Division.

Q What is the business of Rowen Drilling?

A Oil well contract drilling.

Q What areas do you operate under?

A I'm responsible for all land-rig operations in the lower 48 States.

Q Does Rowen Drilling operate world-wide?

A Yes, sir.

Q They are not confined to southeastern New Mexico?

A Well, no, sir.

Q Do you operate in southeast New Mexico?

A Yes, sir.

Q Have you had any experience in southeastern New Mexico?

A Yes, sir, we have two rigs under my supervision, one in Lea and one in Eddy at the present time.

Q What formations are they drilling in?

A Both of the rigs at the present time are on Morrow.

Q What is your education and experience in the drilling business, Mr. Holbert?

A I have a BS degree from Texas A & M in geological engineering and BS degree from Texas A & M in petroleum engineering and a year-and-a-half of graduate work.

Q How long have you been engaged in the drilling business?

A 26 years.

Q For whom have you worked?

A Well, I have been -- I was with the former Pan American Production Company which was later absorbed into Stanolind and then into Amoco, when they had company-operated drilling rigs and I was with Darvey Drilling Company for a very short time, primarily as a consultant, and then I was with Phoenix, Inc. an engineering company who was the engineer

architect for the drilling for the AEC at Nevada, about five-and-a-half years, the rest of the time with Rowen.

Q Where are you located at the present time?

A Midland.

Q Mr. Holbert, have you had any experience in directional drilling and by directional drilling I am talking aboutcontrolled directional drilling in target areas?

A Yes, sir.

Q Where was that experience?

A Texas Gulf Coast, south Texas and considerable experience in Nevada Test Site with AEC and have been associated with it some in Cook Inlet.

Q You say you have had experience in those areas. Do they compare to the directional drilling problems which would arise in the South Salt Lake-Morrow Pool, in your opinion?

A No, sir, in no way. We, at the present time, do have one rig in west Texas drilling a controlled deviation well. However, it is in Ward County and not in Eddy County.

Q In Ward County?

A Yes, sir.

Q Now, have you had any problems with that well?

A Yes, sir.

Q Would you describe those problems?

A Well, actually this is the third time we've tried to drill that same well. It's for a major company. Normally, these 17,000-foot wells would take in the neighborhood of 90 to 105 days. We re-entered this one at the casing set at approximately 9,800 feet and we have been on it between 80 and 90 days and we're at 12,700.

Q Did you have any problem with having to replace drill bits frequently?

A Yes, sir, the kickoff was done with downhole motor unit with a Dyna-drill or turbo drill. With the deviation and direction being established with that and then drilling with conventional bits and rotary, we have done others in that area and where we're furnishing the drill pipe, we add a 50 percent charge per day for the pipe while it's in use in a directional hole with another stipulation that should the pipe be damaged beyond repair,we expect the operator to replace that drill pipe in kind or rent pipe or until such time as it is available.

Q Do you know anything about the situation of availability of drill pipe?

A Yes, sir, that comes under my responsibility for requisitioning drill pipe through our Houston office.

Q How soon would you replace drill pipe should you lose it?

A I received a purchase order this week for pipe requisitioned about the middle of February, delivery in the third quarter of 1978.

Q Does directional drilling, controlled directional drilling, pose any problems in the drilling operation?

A Yes, sir.

Q Can you describe them?

A As Mr. McPeters said, extensive wear to drill pipe and drill collars, also you have additional wear in your hoisting and rotating equipment because of the high torques involved and the additional number of trips for bit changes. After using the Dyna-drill, you have considerably more expense to either high pump pressures and high volumes to operate these down-hole hydraulic motors.

Q In controlled directional drilling, do you use the Dyna-drill throughout the entire operation or as Mr. McPeters said, just to kick it off?

A Normally, to establish the angle of deviation and the direction. Now, we have used them all the way in some special cases. However, it's extremely expensive and normally the rig requirements are considerably larger or requires a

larger rig than what you would have for that depth in order to provide the necessary hydraulic horsepower pump to operate the Dyna-drill.

Q Do you have any problem in controlling the direction of your deviation or in the hard rock country such as has been described here?

A Very much.

Q What effect does that have on your drilling operation, do you have to re--

A (Interrupting) Well, it's quite frequent that you'll drift off in direction. If you can maintain the angle which will necessitate a plug back and redrill operation or you build too much angle or drop angle.

Q Now, assume with me for a moment that you're going to have a surface location at the site of the Bass Federal No. 1, which is the uppermost well on the chart here. You wanted to deviate that well to bottom it at the site of the star which is the proposed location of the Bass Federal No. 2. In your opinion, would that be an economically feasible operation?

A It would be marginal. I'd like to qualify that by stating it's been my experience with Morrow that it's not the most prolific reservoir and you get damage from the drilling

fluids in them and this has been pointed out earlier, this lenticular, which means limited reserves and you're going to spend three times or four times as much in drilling the well and it's not a barn burner, so to speak. In other words, it's not economical, no, sir.

We would not take one of those on what we normally call a footage basis under any circumstances.

Q You would not take a footage contract?

A No way.

Q Would you take a turnkey contract?

A No way.

Q What basis would you take it on?

A Straight day work.

Q Then, as I understand, you also make special arrangements as to the replacement of the drill pipe?

A Yes, sir.

Q Is there any danger of losing your string pipe in drilling such a well?

A Quite frequently.

Q Does deviating the hole in that manner cause any problems in making drill-stem tests or running logs?

A From my experience we have done some testing, drill-stem testing to deviated holes. However, the success ratio

was very low. Also, you have considerable problems with fishing jobs. Logging most of the time where we've had high angles, large displacements I'm talking about to the 6,000-foot displacement. Your logging is all done through a drill pipe which limits the type of logging you can do. The only way you can get the logging tool down is run it inside the drill pipe and pump it down.

MR. KELLAHIN: That's all I have of Mr. Holbert. Thank you, sir.

MR. ROBB: No questions, Mr. Porter.

MR. PORTER: The witness may be excused.

(Witness excused.)

MR. PORTER: Anyone else have questions of the witness. I have hope. Then, Mr. Kellahin, call your next witness, please.

MR. KELLAHIN: Could we have just a brief recess, Mr. Porter. I think this completes this portion of our testimony and we want to get together our Exhibits on the next witness which would take a few minutes.

(Whereupon, a discussion was held off the record.)

(Whereupon, a short recess was taken.)

MR. PORTER: Would you call the next witness?

MR. KELLAHIN: If the Commission please, Mr. Attwell will present the next witness, he being somewhat smarter than I am.

MR. ATTWELL: We'll call Mr. George Warnock.

GEORGE WARNOCK

called as a witness, having been previously sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. ATTWELL:

Q State your name and address.

A George Warnock, 403 Simms, Albuquerque, New Mexico.

Q What is your business, Mr. Warnock?

A Consulting mining geologist.

Q How long have you been a consulting mining geologist?

A Right a[illegible] four years.

Q In your capacity as a consulting mining geologist, Mr. Warnock, have you become familiar with potash mining?

A Yes, sir, but more correctly in my previous employment with W. R. Grace and Company.

Q Have you previously testified before this Commission?

A No, sir.

Q Generally summarize for the Commission your education and your experience.

A I've a BS in mining geology from the University of Arizona, 1958, MS in geology, University of Arizona in 1953. I was employed by American Smelting Refinery Company, Cerro de Pasco Corporation, a Canadian corporation by the name of Dominion Employers Limited, W. R. Grace from 1962 to 1969. The Goldfield Corporation from 1969 to '70 and began consulting in March of '70.

Q In your consulting capacity, have you become familiar with the potash mining area in southeast New Mexico which is covered by Order of this Commission in R-111?

A I was familiar with it prior to going into consulting and I have had occasion to work there since then as a consultant.

Q Have you prepared any feasibility study, for example, for clients concerning potash extraction in this area?

A Yes, sir, once under previous employment with W. R. Grace and once since then as a consultant.

Q Are you a registered geologist in any state?

A Yes, sir, State of Arizona.

Q Have you prepared studies for Belco showing where you believe commercial deposits of potash may exist or may not

exist in the vicinity of the proposed location of Bass Federal No. 2 Well based on core-hole data available to you?

A Yes, sir.

Q Let me ask you at the outset, is there any core-hole data available in Section 30, which is the section in which the well is proposed to be drilled?

A Located within the section?

Q Yes.

A No, sir.

Q Let me direct your attention now, Mr. Warnock, if I may, to Exhibit No. 18.

A Yes, it was.

Q Does this Exhibit reflect results of one of the studies that you prepared for Belco showing the potash ore in the vicinity of the proposed Bass Federal No. 2 Well?

A Yes, sir.

Q Would you generally explain how this Exhibit was prepared and in that connection would you explain the method that this was used as well as the data that was used?

A Yes, sir. Of course, ore reserve by definition means commercially refineable oil. So the first criteria

in oil reserve calculation is the so-called cutoff grade, which in essence is decimally the lowest amount contained in this page of potash versus the thickness that can be mined at an operating cost to break even. Anything bigger than that, of course, you make a profit on, but the cutoff grade and/or fees percent in this case, especially potash, is your gross operating cost or cash out.

Now, detail costs in this area are obviously proprietory information of the company and to set up basis for this calculation we had to use reported data from the U.S. Bureau of Mines and it's reported as an average of all of the costs. There is, as most people are familiar with here, an information circular put out in 1972, detailing economic problems of Carlsbad potash industry. This is the source of the basic economic data. That information in that report is tabulated as averages for the better mines that are in quotation marks and averages for poorer mines to come in for two reasons: No. 1, Kerr-Mac operations, the latest in the area and even though it's the newest and even though they have a certain operating problem that some of the operations don't, to come in on the conservative side of the calculation or on their favor we use the average for the better mines. So we assume Kerr-Mac is one of those better mines. Now, at

that time there were only seven so this is at best an average of four out of seven. Now there is six as you know. Based on this published data, we then calculated what feet percent is necessary to constitute ore in this area based against average cost only, not against Kerr-Mac's costs. Now, as a unit calculation we arrived at 72-feet percent. Of course as everyone knows the feet percent is the percent of K20 in sylvite times the thickness of the bed, the mineable thickness of the bed.

Based on this, we calculated cutoff for this area out here will be in the range of 72-feet percent and for rounding up ground for presentation on these maps, we have drawn these things as 70-feet percent. In other words, we're saying that based on the average cost as reported our calculation back, 70-feet percent is the cutoff.

Now, in addition, of course, there regardless of thickness, there's a minimum percent K20 that can be mined, otherwise, the theoretical-feet percent, you have a 100 percent and take 100 feet of K20, you got 70-feet percent there for ore. Obviously, there's a minimum percent K20 that can be mined. We calculated that in a 10.5 percent range.

Q Let me interrupt you for a minute and ask you if I understood you correctly, you said that you used the average

cost for the better mines as published by the U. S. Bureau of Mines in determining the cutoff of feet percent factor used in your Exhibit 18. That average cost data for the better mines; at what depth were those mines mined in potash?

A Again average for the district, and I haven't calculated that, but the average is going to be between 700 and 1400 feet, say, an average of 1,000 feet as a --

Q (Interrupting) At what depth is the potash located in the area of the Bass Federal No. 2 Well?

A 2100 feet.

Q Does the cost of mining potash increase as the deeper you go?

A Yes, as a generality, it does, but it is not as important a factor perhaps as the distance away from the cap, exception terms are first infraction versus second infraction which we'll get into.

Q What method did you use in arriving at the results shown on Exhibit 18?

A Okay. Once you have a feet-percent cutoff for an ore-reserve calculation, there are obviously certain functions you have to make and they're all based on the continuity of the economic grade with a given bed. There are two accepted systems in the Carlsbad potash area. That's the polygonal

system and the feet-percent system. This map shows the polygonal system calculation, using certain perameters which are outlined on the map, of which I'll go through.

To start out with, I'd like to say this is the broadest possible interpretation of the formal-ore-reserve calculation in this area. We'll get into this map. This is what I would call an objective calculation. You can see the difference in the outlines. Now, the parameters we used, experience factors in the district, what proof ore in terms of drill holes, how far can you project from a drill hole? I'm sure we'll get into a minor debate on that. I have used, as is enumerated in internal blockings within the polygons that you can see outlined on the map, the broad guideline of a 1500-foot radius, which is essentially equivalent to four holes per second. For proven ore the red, 2,000 feet projected, or which is roughly equivalent to two holes per second. For the probable ore, which is the blue on this map, 2,500 feet; for possible ore, which is the yellow on this map and which is equivalent to roughly one hole or one ore-hole per second.

Now, just to give you the background on the map, I should say all three of these maps are the same base maps with just different interpretations on them. The red, the solid red darts are ore holes as we calculate them from the

logs and the sole difference between this map -- well, that's not quite true -- the basic difference between the days of this map and that map --

Q (Interrupting) I think you ought to refer to the Exhibit No. that has been assigned to it, if you would?

A Exhibit No. 18, this is Exhibit No. 19, exactly the same system. The major difference is we did not have, as you can see, the mark for these four holes. The log is not available. The red marks -- I'm sorry -- crosses, all of these things and we did not have these newly drilled internal holes of Kerr-Mac's at that time.

Q Just focus, if you will, on Exhibit 18. Would you explain to the Commission how you went about making your polygonal method of ore reserve determination. After, I think you said you got a percent foot cutoff also a 10 percent factor for K2O content as a minimum regardless of height of bed?

A Yes, sir.

Q Then you had the core-hole data that's available to you, I presume, is shown from the core holes there on Exhibit 18. What did you do with that core hole data?

A Okay. Plotted the following schedule down here. It should be drawn in red there. The numerals around the

given hole are the hole number on the top, the surface elevation on the right hand, the elevation of the top of the Number 10 ore horizon following the USGS terminology on the left, the percent K20 as sylvite, the first number drills the hole on the part that's the thickness. The thickness is the first number below the hole, percent K20 is the second number, the feet-percent factor is the third number. That is simply multiplying the thickness times the grade and the last factor there where it is available is the insol aspect.

Q Mr. Warnock, is that the hole that you have colored red to determine --

A (Interrupting) That color is supposed to be green around the high insol hole.

MR. PORTER: Just a minute. Is that insol?

THE WITNESS: Insol, i-n-s-o-l, insoluble mix.

BY MR. ATTWELL:

Q Mr. Warnock, is it correct that the hole that you have colored red, you determined the net -- your minimum cutoff criteria for feet percent and those that have a brown center did not meet your criteria?

A That's correct.

Q Now, let me direct your attention, at least on my map, on Section 34, I believe is a hole that shows a brown

center and it's got a lot of blue around it.

A Which hole number?

Q F-11, I believe.

A Yes, if it's colored brown it's an ore hole, 75.8 feet percent. It should be colored red and the ore factor is a blue circle or blue polygon indicates an ore hole.

Q But the other holes that are colored brown in the center were determined to be used by you to be in effect economically not feasible because of the minimal content of K20?

A That's correct. There are, of course, minor areas for interpretations in this type of calculation. I should also say that we had posted in some of these instances minor differences in the data we had at that time from Kerr-Mac's calculations and our calculations of these logs and there's one possible exception on this map, they are so close --

Q (Interrupting) Refer to that Exhibit number.

A This is Exhibit No. 20, another method we'll get to, the K20 feet percent projection method. Now, you always have the polygonal method accepted in all mining, specifically imbedded deposits, but I don't think there is probably no data on that. The mechanics are very simple: One bisects the line between the holes, draws a line there, he does that all the way around, and he ends (Transcriber's break)

up at the polygon as you can see. In the case of enough holes all the way around and that polygon, that block takes the value that you see there. Then of course, all the polygons are adequately done or average taken toward the whole area.

Now, on the fringe -- there's always a fringe problem in everyone. How far can you project the hole where there's no data. Now, following the foremat down here, this says we can run this where there's a hole not close enough to put them together, we can run 1,500 feet out from the hole with proven ore around the fringe of a general ore body which you have internal holes you can generally connect up. In other words, this is a good ore body in here and no one argues with that. Based on that, you can project 1,500 feet out from proven ore around the sides of this thing. This is in essence what we've done here.

Now, in a case of probable ore and I might mention here that there is a very strict technical definition of proven probable and possible ore. There is generalized confidence factors attached to it.

In a case of proven ore, one, as a general criteria for industry, one says you are going to get the tons out there that you calculated within 95 to 100 percent. That's pretty

obviously not going to be in that shape. The lines always contract and expand, but the tonnage is a statistical method, the total tons that come out of that general area will very closely follow the calculation.

The probable ore, you have a probability factor in the range of 75 percent. Once you've added all these up and calculated the blue area as a guideline, probably you'll get about 75 percent of that calculation, without further data and based on a statistical method.

In the case of the yellow, when you're working internally we show what happens because I should state again, we did this calculation before we had this new data. The yellow areas were blocking this possible ore. You can talk about a generalized confidence factor, 25 to 30 percent range. Kerr-Mac then came back and drilled internally and it's no coincidence frankly that they drilled and these holes happen to fall in the yellow and blue areas. That's the obvious place to drill. I would agree that's where we drill; I would agree also that certainly in this case, they had to drill. In other words, they did not have enough data in here to, with confidence, consider this whole thing ore.

Q Where is Kerr-Mac mine located here on Exhibit 18?

A Right there. This is the open-working outline.

A new addition is here and here, up here as filed with the Commission, right off the Commission's files and these dashed lines here, this is the 1973-five-year plan. The dashed line there and the dotted line here is the 1974 plan filed just in January of this year.

Q Mr. Warnock, you said that the red coloring on Exhibit 18 constitutes proven reserves. The blue coloring constitutes probable reserves and the yellow coloring constitutes possible reserves. What does the white coloring represent?

A In this case it's formal calculation on the poly-gonal method. It indicates no ore reserve calculated in the white area. This has not said anything about projected mineralization. It just said that for investment decision for management, the assumption is this is barren.

Q Now, let's direct your attention, if I may, to Exhibit No. 19 and ask if you prepared that Exhibit?

A Yes, I did.

Q Would you please explain how the Exhibit was prepared and pay particular attention to how it differs from your Exhibit No. 18?

A It's exactly the same base as No. 18. It shows how it takes into effect the new data in these holes which

we didn't previously have.

Q When did you obtain that new data?

A 10:40 A.M. yesterday.

Q Would that be data from Kerr-McGee as a result of a subpoena?

A That's correct.

Q Would you explain your explanation?

A Now, because of that, I have to apologize for the condition of these maps. The numbers on the new holes which I have handwritten in here are not on your prints, but I understand that it's proper that we can correct this deficiency and get new prints.

Q I think you should address that to the Chairman and not to me.

A I had this blocked out. We knew where the hole locations were so we had this drafted up and blocked out as you see it, but then once we got these logs yesterday, I had to sit down and quickly calculate the logs and plot on the values. We simply did not have time to have those drafted again and printed.

Q In Exhibit 19, have you used the polygonal method again as you used in Exhibit 18?

A This is the polygonal method again and in this case,

it's a much more valid projection of ore reserve calculation than this one, because we're not taking full advantage of all those filled in holes. You'll note your polygons have become much smaller. Now, this is an important point in your confidence factor on reserves. The smaller the polygon, the less area given to a single hole and obviously because there's more holes the better ore calculation we have.

Q How many adjacent core holes did you receive data for?

A 13, I think.

Q That data was included in the estimate you have shown there on Exhibit 19?

A Correct.

Q Studies you have made?

A Correct.

Another prime feature of this is, we have not run possible ore or probable ore outside of the margins. Anywhere inside where we have drill data, if the blue ran past 2,000 why we gave it the benefit of the doubt and took the full polygon. On a marginal calculation we did not. We held the 1,500-foot radius. This is an important point because there is a certain amount of evasive reasons in the case of the margins how far one should run. The two previous studies

it's a much more valid projection of ore reserve calculation than this one, because we're not taking full advantage of all those filled in holes. You'll note your polygons have become much smaller. Now, this is an important point in your confidence factor on reserves. The smaller the polygon, the less area given to a single hole and obviously because there's more holes the better ore calculation we have.

Q How many adjacent core holes did you receive data for?

A 13, I think.

Q That data was included in the estimate you have shown there on Exhibit 19?

A Correct.

Q Studies you have made?

A Correct.

Another prime feature of this is, we have not run possible ore or probable ore outside of the margins. Anywhere inside where we have drill data, if the blue ran past 2,000 why we gave it the benefit of the doubt and took the full polygon. On a marginal calculation we did not. We held the 1,500-foot radius. This is an important point because there is a certain amount of evasive reasons in the case of the margins how far one should run. The two previous studies

I have done in this area used 1,000 feet which was as far as they would project out from a hole.

I think that's conservative. I think 15 is all right. I agree this is correct development of margins as opposed to this. As I said, this is the optimum case one can make for ore reserves. So the total projection included possible ores is 3,000 feet on the margins. Now, this is discussing only on the margins. It doesn't affect the inside. Here we have much better data inside and could do a complete polygon calculation. Where I have enough data to where it becomes accurate and one can see my interpretations of the ore reserves Kerr-Mac has in this area.

MR. PORTER: Are you saying that your information on Exhibit 19 is more accurate than your information on 18?

THE WITNESS: Yes, sir. On the basis of statistical method you have 13 additional data points to work from. So that's exactly what I am saying. Now, one thing I didn't say here, I put the lease map up as Exhibit No. 9. It's not an important factor, but I would like to point out the color scheme on this thing, on both of these, on all of these if it is solid, it's a calculation within Kerr-Mac lease. The hatched, it's the same thing outside Kerr-Mac lease. So the solid color versus the hatched is simply inside Kerr-Mac leases,

outside Kerr-Mac leases.

Now, another point you make strongly is the size of the polygons is extremely important. This type -- this large of a polygon up here and that's about the biggest guy I would ever draw is really getting too big. Here you got two holes exactly one mile apart following this theme that you can block possible ore one hole to a section. Put these together with polygons as you can see, the projection there. Then look at these -- there is more holes on here that aren't colored. I hope that they are on your map, the brown hole. The brown hole with the negative hole and that's a brown hole.

Are these colored on the sheets you're looking at?

MR. PORTER: Yes, the one I have is.

THE WITNESS: Let me see if I can find a better example; here is a better example of why I joined up these following that method. Keep in mind this is a geometrical method, that it is not interpretation of apart how far you can send it. Following these guidelines, there's really not that much personal interpretation involved.

BY MR. ATTWELL:

Q When you refer to these guidelines, Mr. Warnock, are you referring to Exhibit 18 and the material under the legend "ore reserve blocking method?"

A Exactly, which is that if the holes are within one mile of each other, you can consider that in terms of possible ore only following method as ore because these are more than one mile apart and there is some other factors which we'll show you here. We did not join these because they don't stretch. They're too far apart to join up even as possible ore.

Now, of course, from the practical point of view, if Kerr-Mac has that lease and they come in here and again drill internal holes and then they would know that following a system of what we know now, that's as close as you can run them under the broadest possible interpretation which is really 3,000 -- I beg your pardon -- 2,500 feet out for possible ore.

Q Direct your attention to Exhibit 19 again. I noticed there is no yellow coloring on that map?

A No, sir.

Q Does that mean there is no possible reserve shown?

A No, it does not mean that at all. This then would be a formal-type ore reserve calculation which, if I may make the assumption, Kerr-Mac might submit to their management to make an investment decision. Under that definition one does not block possible ore and calculate it into a dollar interval.

Calculate only the proven and probable that some of this is judgment factor thereof obviously depends on how strongly you believe in these factors here. We have in Kerr-Mac as opposed -- in the Carlsbad district as opposed to some potash areas and extremely erratic nature of the potasium content in the bed relative to other areas. This brings us to the point that you want basically, if you're making an investment decision on this type of calculation, you want an objective relative conservative calculation.

As I say, the two previous ones I did ran only 1,000-foot range rather than 1,500 feet.

Now, again, this question of how densely, this question of drilling density, how many holes do you drill per section before you have a confidence factor. I'm saying or I don't know how much argument I'll get on that, I think it's a pretty well accepted generality in this district. On that basis you see the difference here and this doesn't say that there's no ore here. It does not say that. It simply says that for formal calculations the ore is here and here. We have not yet, in these two calculations, we are not saying anything about geological projections in terms of trends of the mineralization.

Q Looking at Exhibits 18 and 19, what do you conclude

as to the question of whether core data available shows any potash commercial reserves around the Bass Federal No. 2 site?

A In a formal and relatively objective ore reserve calculation there is no ore that gets into the Belco location and further more, this flange of 2100 radius, which isn't on here, unfortunately will not reach that ore. So now, from a formal ore reserve calculation point of view, there is no formal ore reserves under this hole.

Q Let me direct your attention in that to what appears on my map as core hole 141 that USP which is -- I guess, that's United States Potash Company?

A Yes, sir.

Q It's a little to the north and to the east of the proposed well site. Can you see that core hole?

A Yes, sir.

Q Now, if I understand your map correctly, you show that as a core hole indicating existence of commercial potash reserves. In your opinion, why has no potash lease been taken on that, this tract?

MR. ROBB: We object to that as going beyond the competency of the witness. He can testify about the geology, but his opinion in regards to the fact nobody has taken a lease on there or why it hasn't been taken, is beyond the scope

of his competency. He's just speculating.

MR. ATTWELL: Well, I think expert witnesses do speculate, Your Honor. I mean, that's what we are relying upon is his expert testimony.

MR. ROBB: They don't speculate about things they don't know anything about.

MR. ATTWELL: I think I can get at it another way, perhaps to avoid the objection.

BY MR. ATTWELL:

Q How far is United States Potash 141 from the nearest mining operation?

A About six miles, four-and-a-half, five miles.

Q How far is it from the shaft of the nearest Kerr-Mac mining operation?

A I beg your pardon. How far from the --

Q (Interrupting) From the shaft, the shaft going down vertically into the ground?

A How far is that from 141? How far is that?

Q Yes.

A At least six miles.

Q Is the distance between the location of the potash reserve and the shaft as the distance that must be travelled by the miners an economic factor to be taken into consideration?

A Yes, it certainly is. I think probably the distance in this case is of more consequence than a slight change in dip going down. This was brought up before. Again, all ore reserves are calculated on an average cost for the better mines in the district mining within their immediate shaft area, we assume, or most of them I should say, mined within their immediate shaft area. There will be additional cost as they come out this way, no doubt about it.

Q Again, reflecting on U. S. Potash hole -- core hole 141, is it surrounded by core holes in which a negative result was obtained?

A It's triangulated by them. It's not surrounded by them, no. I see 153 is 63.7 feet percent. USGS 17 is 48 feet. Farmer No. 29 is 57.2. Incidentally, I should interrupt here. I didn't explain to the Commission, I don't think, that when you see two percents the left one is my calculation from the logs. The right one is Kerr-Mac's calculation of the logs. I would point out in USP 141 there is simply no conflict. This is too close to worry about. The same is true for USGS 17. The same is true for F-29 and my calculations on this one is by hand up here. I have 66.7 whereas Kerr-Mac 63.7. The point I make is there is no figure that's interpretation of logs that's within, I would say those agree in

principal.

Now, back to your question. It is triangulated by negative holes. However, there is a positive hole here, there is a positive hole here. These three closest holes are negative and that certainly will come into then the interpretation of trends as oppposed to ore reserve calculations.

Q Let me ask you about U.S. Potash Company's O-141. Do you know when that core hole was drilled, how many years ago?

A No, sir, I don't. It's going to be a minimum of 20 years. That's a guess, a speculation, I don't know.

Q All right. Would you now direct your attention to the document which has been marked as Exhibit No. 20.

A Yes.

Q Was Exhibit 20 prepared by you?

A Yes, sir.

Q Does this Exhibit reflect the result of a study that you made for Belco as to showing whether or not commercial potash existed in the area?

A Yes, sir, it does.

Q Would you please explain Exhibit 20, how it was prepared and the data used?

A This is a feet percent calculation. Again, we put

principal.

Now, back to your question. It is triangulated by negative holes. However, there is a positive hole here, there is a positive hole here. These three closest holes are negative and that certainly will come into then the interpretation of trends as oppposed to ore reserve calculations.

Q Let me ask you about U.S. Potash Company's O-141. Do you know when that core hole was drilled, how many years ago?

A No, sir, I don't. It's going to be a minimum of 20 years. That's a guess, a speculation, I don't know.

Q All right. Would you now direct your attention to the document which has been marked as Exhibit No. 20.

A Yes.

Q Was Exhibit 20 prepared by you?

A Yes, sir.

Q Does this Exhibit reflect the result of a study that you made for Belco as to showing whether or not commercial potash existed in the area?

A Yes, sir, it does.

Q Would you please explain Exhibit 20, how it was prepared and the data used?

A This is a feet percent calculation. Again, we put

on here the outline also only of the polygon blocking system. You can see on here this conforms with this outline in color in this case.

Q Let me interrupt, if I may. Is it correct that the polygonal system was used in Exhibit 18 and 19 and feet-percent system was used by you in Exhibit 20?

A That's correct.

Q Would you just briefly explain, if you can, the difference between the two methods?

A The feet-percent contour, which gives one a calculation of the effect of width or thickness on grade is a very accepted method to the district and it is probably more accurate in calculating your average grade, because of course, you're being influenced by the trends of mineralization in the area . So while this is a pure geometrical mathematical method -- in other words, this block was calculated at 5.3 of 17.5 percent potash. Over here you have the effect of the trend as interpreted. Now, I think we should just take a minute and go into some detail as to construction of a proper foot percent map. It's important in the interpretation. First of all the colors simply -- following the explanation -- simply designate the feet percent as its own. This is the 70 contour. This is the 90. The area colored in between it

is the 70 to 90 feet percent, the gray and the green going up into the red which is plus 150 feet percent. Again, as we follow the pattern of the solid colors on this map they are within the ore block and defined by this expansive type of ore blocking and where the color is solid it is inside Kerr-Mac's lease -- no, I beg your pardon -- it is not. Where it is colored solid inside of the ore block and where it hangs outside of the ore block and therefore becomes a projection of trend of mineralization.

Now, we have not calculated ore, Kerr-Mac ore reserve factor here. There is no interest to us other than their material, their material obviously, but if one were doing it in-house for Kerr-Mac he would then calculate the area of 70 to 90 foot percent within the boundary and he would average that percent and so forth and arrive at an ore reserve calculation in terms of tons and percent K20. The tons would be very similar to this and the percent K20 may vary because this is more accurate depiction, if you like, of the variances of grade in the ore body.

Q Le me interrupt if I may, Mr. Warnock, and ask you: Looking at the dashed areas, I call it, or the hatched areas, does that area represent either proof probable or possible reserves as comparable to what is shown on your prior

Exhibits?

A No, sir, it certainly does not. Proven ore reserve under the feet percent method is colored solid. Everything out of that is a geological projection of the trend of mineralization.

Q Again, looking at Exhibit 20, when you prepared that Exhibit, did you have available to you all of the core-hole data that you had available when you prepared your Exhibit No. 19?

A No, sir. This was prepared on this data. We did not have the internal holes as they are marked black.

Q Those are the 13 additional core holes from which you obtained data from Kerr-McGee?

A That's correct and, again, there was strictly no time to draft a change in this and draft up another proper map. The very important controlling holes are these in here. You will note that they're negative holes. They are low grade.

Q You are pointing to Exhibit 19?

A No. 19, yes. I'm referring to Kerr-Mac holes Nos. 114, 113 and 109, and these holes materially affect this interpretation.

Q Now, before we get into that though --

Exhibits?

A No, sir, it certainly does not. Proven ore reserve under the feet percent method is colored solid. Everything out of that is a geological projection of the trend of mineralization.

Q Again, looking at Exhibit 20, when you prepared that Exhibit, did you have available to you all of the core-hole data that you had available when you prepared your Exhibit No. 19?

A No, sir. This was prepared on this data. We did not have the internal holes as they are marked black.

Q Those are the 13 additional core holes from which you obtained data from Kerr-McGee?

A That's correct and, again, there was strictly no time to draft a change in this and draft up another proper map. The very important controlling holes are these in here. You will note that they're negative holes. They are low grade.

Q You are pointing to Exhibit 19?

A No. 19, yes. I'm referring to Kerr-Mac holes Nos. 114, 113 and 109, and these holes materially affect this interpretation.

Q Now, before we get into that though --

MR. PORTER: (Interrupting) You mean they materially affect the interpretation shown on Exhibit 20?

THE WITNESS: Yes, sir, that's correct, that's what I said.

A Now, first of all just one quick word on construction of a foot percent contour map. This is not all interpretation. The basics of the system are, one, as numbered here, the 18.2 feet percent and one has another here at 122.6. He must accurately and mathematically extrapolate between the two. He puts a point there for each line and he does that for all the holes that he has data on. Then, he has some interpretation freedom to connect them up, but the point is these lines where they pass between a hole must go there. They can't vary.

Now, with these additional holes and this hole here, is one that we seemed to have -- the only one I know of that we have no material difference with Kerr-Mac in the interpretation of the log.

MR. PORTER: What's that number?

THE WITNESS: That's D-165.

BY MR. ATTWELL:

Q As shown on Exhibit No.?

A No. 19. Now, we have no data out here. We received

from the Counsel for Kerr-Mac our Exhibit No. 121 -- I'm sorry -- No. 21, which is a blowup of a map they supplied to the USGS and the Commission, I understand, with calculations and which then their Counsel gave our Counsel. I understand that's the way I got it. From the map, we got data, additional data, which we previously didn't have in that Kerr-Mac had thickness, say, or values on here for certain holes

Q Now, are you referring to Exhibit No. 22?

A 21.

Q 21, excuse me.

A See them written on there IM-5153 up here 4.3 feet, 14.7 K20. This then, is an only source for this hole up here at 4.0 feet at 22.3 percent. Using that data, I made this calculation and this calculation. When I got these logs yesterday, I don't know where they got the 18.2 feet percent. So I come up with 68.09. Now, I'm not sure what the discrepancy is. It's immaterial in trying to draw this picture, but it's not immaterial to this question out here.

Q Let me ask you, Mr. Warnock, again, directing your attention to Exhibit 20, which is the Exhibit in which I understand you used the foot-percent method?

A That's correct.

Q I believe you said that the more recent core-hole

data you obtained from the 13 wells would make a material change in the geological interpretation that was made there?

A Yes, sir.

Q What would that change be?

A First of all, with your permission, just a word about when we get into the much more ill-defined realm of geological projections. Number one, in the northwest fringe on this map should be fairly obvious to everyone, the color map. That page of course, is a great trend, foot-percent trend. We know from the structure map still on the top of -- still to what displacement --

Q What is that Exhibit No.?

A 11.

There is a continuing --

Q (Interrupting) Number 11?

A Yes, Exhibit No. 11. This is a structural-contour map down on the Morrow somewhere. I'm not familiar with the geology of that, frankly. Anyway, from that structure map, you see the same northwest trend. We have USGS generalized information on the district. There's a structure contour on the map and so forth. Without bordering, but putting all this stuff on the wall, my interpretation of that data is they support this general northwest trend.

Now, your specific question, how does the new data change this picture.

Q The picture shown on Exhibit 20?

A On Exhibit 20, yes. We have, as we do the mathematical procedure at this point of finding the point where the contour line is supposed to go is a mathematical formula. It is not an interpretation. We have three sheets, two new holes that affect the calculation, these two here. I have done that on another piece of paper. This is just a crude pencil line. I propose to do it here, just roughly.

Why don't we put this up? Now, there is no other copy than this. Is that permissible?

MR. ATTWELL: Could we have this marked?

MR. PORTER: As long as you put it in the record as an Exhibit.

MR. ATTWELL: Please mark this as the next Exhibit, No. 23.

(Whereupon, Belco's Exhibit No. 23 was marked for identification.)

MR. ATTWELL: I think it would be 23 because there may be a document we have already marked as 22, that we still have to come to.

So if we could have this map marked as Exhibit 23.

(Whereupon, a discussion was held off the record.)

MR. ATTWELL: Mr. Chairman, I think it might simplify matters if the map that Mr. Warnock has just put up on the wall behind you was identified as Exhibit 20(A), since there are some other documents which have been previously marked, so if you will agree we will refer to it as Exhibit 20(A).

(Whereupon, the document just previously marked as Exhibit 23 was remarked as Belco's Exhibit No. 20(A) for identification.)

BY MR. ATTWELL:

Q Mr. Warnock, I direct your attention to the map on the wall that has been marked as Exhibit 20(A) and ask you if that was prepared by you?

A Yes, sir, at 2:00 A.M. this morning.

Q Would you please explain what is shown on Exhibit 20(A) by comparing it with Exhibits 20, which I believe you have put on the wall just next to Exhibit 20(A)?

A First of all there will be major changes in this contour over in this area, but major changes because we have

so much more data on that side. I've not tried to do that because of the hour and so forth. I just roughly tried to estimate what changes this new data, which we got from Kerr-McGee yesterday, what effect it will have in this general area.

Q When you say "this general area", are you speaking of the general area of the location?

A Right.

Q Bass Federal Well No. 2?

A Yes, sir. Now, I mentioned these additional holes along the fringe which are the only ones that play into the projection to the east. These two here are the only ones affecting the foot contours.

Taking that into account, the 90-percent contour, which is right here on this map will move west into the corner here of Section 101, I guess that is, no, that's section 2. The general line, this is 86.54 here, the general line then, the gray -- the line between the yellow and the gray which is a 90-foot percent will move west by approximately 1,000 feet in this calculation on this map here. Now, we have a problem here. We have a low zone coming through here and we get into a little bit of interpretation of contours. You an cut these things off and you can run this gray line back

like this and run this one around here to catch that, 70 here is why it has to be yellow in there. Those kind of interpretations are just that, interpretations. Again, the points between the hole will control the line interpretation. That's a mathematical extrapolation between the holes. Using that method, the 90 will move here, the 70 will move here. Otherwise you have the same data so the problem is an interpretive one getting it back into the area to look something like that.

Now, I have no argument on whether it swings like that or out like that. That's interpretation. Generally with moves the projected area are slightly wer with the new data.

Q Again, looking at Exhibit 20(A) you have shown an area colored in yellow, would that area constitute proved, probable or possible reserves as you previously identified them in discussing your earlier Exhibits?

A No, where they entered the ore block they would be ore reserves of that foot-percent factor, and a fairly low grade; the yellow is the 70 to 90. Where they are outside of the ore block they are a geological projection, you could hope to find low-grade ore in the yellow area, as a geological supposition.

MR. NUTTER: Mr. Warnock, just one moment. I think

you said that the new data would cause this percent line to move into the Section 2. I believe that is the extreme northeast corner of Section 1, I believe.

THE WITNESS: 3, 4, 5, 6, you're absolutely correct. I'm sorry.

MR. NUTTER: That's for the sake of the record.

THE WITNESS: That should be the extreme northeast corner of Section 1.

I want to say again, this is a rough approximation done late at night. If given the time, we'll redo the complete thing with the new data in detail. It will look quite different, but the same geological trends will be there. They are based on all the various evidence which is to a large part supposition. We're comparing various things. I have some personal data on the northern area, that is I don't have the data. I have personal knowledge of it. We know that there's good ore coming up through here. We know there are salt cores over here and there is low-grade ore around it. Based on that, all of the geology I have espoused here, there is no doubt in my mind that there is a northwest trend, to the potash mineralization through that area, and that as we find, would be my interpretation of it.

Q Mr. Warnock, let me ask you to direct your attention

to Exhibit No. 21, which is, I believe, previously mentioned in your earlier testimony and identified as a map, I believe, that Kerr-McGee submitted to the USGS and to this Commission?

A Yes, sir.

Q Would you please explain what is shown there?

A Well, this, of course, is a sketch map of the general area. I note out of curiosity the first mined areas conform very nicely to our sketches with the exception of this right here is not mined out. If you go into detail of that ore reserve, we're not interested in the detail of the ore reserves down there by their mine. If one looked into it, that's good reason, that's a negative hole. They've mined up here to an assay face and quit. Anyway --

Q (Interrupting) Does this Exhibit 21 indicate to you though that Kerr-McGee used identical parameters on its --

A (Interrupting) Yes.

Q Then this is an estimate that you have used in your estimates?

A Yes. May I take this down where the others are and compare them? I want to compare it with the oil reserve map which is Exhibit No. 19

Now, in this case, we made the supposition that these dotted lines are Kerr-Mac's raw ore outline. They're

not detailed, those are outlined. Now, what else can we garner from this map? Number one, please note Hole No. 114. Do you see the polygonal shape there? This is strong evidence to me that in house formal calculation of Kerr-McGee used this polygonal system.

Number two, the Martin areas, should we project it, say, out probably 2,000 feet or only 1,500 feet.

If you refer to Hole No. F-13, which is in the center of 33, this arc is exactly 1,500 feet to scale away from that hole, as is mined. This tells me that Kerr-Mac is conforming to the generalized system, 1500 feet on the margin.

How about the feet percent, what is the -- is the 70-feet percent really valid? If you refer to Hole F-18, I have in there at 62-feet percent and is outside of Kerr-Mac's ore outline. That tells me that given the insol or the intimate details of that hole, they are blocking no lower than 62 and probably close to my 70-feet percent.

Now, what else can we garner from this thing? First of all, I have no argument with Kerr-Mac's generalized-sketch-type map sent to the Commission so the difference in drafting and accuracy and so forth there is no argument on. It purports though, here we have probable ore outline.

Now, probable, as I mentioned, takes a technical

definition. It has a certain factor of confidence. Is Kerr-Mac -- now, what I'm going to lead up to here, you cannot simply draw a broad line and say this is probable ore. You can draw a broad line and say this is a known potash area or this is a potential, generally speaking, for potash.

One cannot call it probable ore. This does not fill the 75 percent factor. Those are three negative holes. They do not show on this map, but the three positive holes do show. I assume that's just coincidence. Coming on down here they draw a broad line up through here. I should qualify that last remark. If they were pinned down, say, in relation to the ore then they would have to show a negative hole.

The fact that they show a positive hole and not the negative ones they can argue, well, they were just generalizing.

As we go down into this fringe, this line, of course, follows the known KPE boundary roughly and they apparently in the case of F-29, they ran a line right through the hole and in this one, however, that hole by their calculations is 57.2 feet percent. It is just not ore. Under those circumstances this line simply has to turn up in there and demonstrate that, but it does not. Again a very generalized type of representation, which I have no argument with

other than I don't want to mislead anyone as to these being accurate boundaries. I don't think Kerr-Mac will argue that they are. The same thing applies for this again for this hole No. 113 and 109. Again, you see the dashed line there. They show it negative also within their probable ore outline. The same thing applies to No. 111 down here, which was very low in the logs, which they have. I can't really see any on here on this map.

Now, in the interest of fairness, I should also say that there maybe certain interpretations used on this thing. They apparently have one more hole in here than we do, K-103, and this right here is 69.68 percent or just four-tenths of the number below ore. It's a high insol, unfortunately shown by a green circle from their five-year plan. This is running down here. I have no argument that that might conceivably be ore. However, again, that then shows up in the feet percent where you can see there is strong foot percent running through there. It shows up in the sense you still show a formal calculation and you would not put it in unless they have on the basis of detailed cost come in, say, 66 percent cutoff. Then it would be entered, but don't confuse the formal calculation for what they do practically in the mine. That is so close to ore, they surely will run out and have a

look and then they will play it by ear of what they get, how good it is.

So the point I make is, again, this is a formal calculation and these lines will very definitely contract and expand both ways.

Q Mr. Warnock, turn your attention to the document there that is on the wall. It's been marked as Exhibit No. 22 and ask you to explain that map?

A Yes, sir, this is composites, open mine work of Kerr-Mac for the last nine years and filed with the Commission. The last two years are not colored. The heavy dashes is 1973, the dotted, 1974. There is really not too much taken from this apart from the general concept that all mining is east of the Section 3 line -- I beg your pardon -- west of the Section 3 line up until 1973 when they first -- 1972. Right, the red is 1972, when they mined out there and also in January of 1973 they put in a five-year plan showing this outline and the holes -- the new holes -- were not drilled at that time. The new holes show the IMC -- the old holes, I beg your pardon -- show IMC-142 and the good holes seven feet or 16 percent. So on that basis and generality they put their five-year plan in this form. They went back, drilled these holes in the middle here and this showed them that it really wasn't quite like

this blocking on Exhibit No. 18 depicted. Their five-year plan doesn't vary materially from this type of ore reserve calculation. So, of course, they change their -- plus 111 was low. It was not only low, it was good. There was very little in the log. It's essentially a blank hole. There maybe another salt course coming in here.

109, a good thickness, but low grade. The same thing with 114. 113 is also low. So they honestly had to retract their five-year plan and, in other words, what this tells us, that the five-year plan is a very generalized sketch. Against that, this is where they want to develop to find out if these ore reserves will, in fact, hold up.

Q Mr. Warnock, is it correct that on your Exhibit 22, the colored area that is on the left-hand side of the page. I think there is some cross-hatched area of a couple of tunnels, indicates the full extent of the area that Kerr-McGee has mined over here, approximately over nine or ten years?

A That's the information they filed with the Commission, yes. I have no reason to doubt that by any means.

Now, in this respect, of course, they can put in five-year plans each year. The very low production -- the low advance, I'm sorry -- in 1973 relative to 1972 simply tells us that, of course, all of these panels aren't filled in. They

are taking further production back into these colored areas, but it's a well-taken point that while a good new entry advances in terms of new areas in 1972 they did not, and in 1973 they had very little outside advance outside the main mine workings in 1973. At that rate they would not get out here, to which I assume is what you're driving at, in many years, but of course, this is a question of mine management, mine planning and it could be changed.

Q Just so the Commission may focus on this last point, would you specifically identify by areas that you referred to for 1972 and 1973 areas?

A The 1972 open mine workings are in red on the map, and area wise that's a good percentage of the total. The 1973, the latest year, are these cross-hatched areas. This development here, where you can start, I assume, from the main development coming out the main entry, this advance here, this advance down here, couple of entries here to test ore. This is -- these holes here based on Kerr-Mac ore lines are probably very low. They've got their ore line inside of those holes. We do not have the data. I take this supposition here that these are fairly negative holes even though I don't have the data and that is only on the basis of this map. Now, what this entry on here tells me is they're going out

there to find out just exactly the same thing. These holes are either low enough to be doubtful so they drove out there to see what it's all about. While the holes inside, again, no data, but that must be good ore because they've mined through there and they've developed it, of course.

Incidentally, I should say that you have here down to the southwest, we've no further data and no entry. That is blocked in the polygonal system strictly from supposition on these ore outlines here. So from here down we just -- it's all supposition. The data is on your base map of what we have information on. As you can see there is one in there. They are all cross-hatched.

Q Mr. Warnock, based on your Exhibits in your testimony, in your opinion, would there be any loss of proved probable or possible potash ores if the Bass Federal No. 2 were drilled?

A No, sir.

MR. ATTWELL: Mr. Porter, I at this time will tender the witness for cross examination, but before doing so I would like to offer in evidence Exhibits 18, 19, 20, 20(A), 21 and 22.

MR. PORTER: Has the witness testified that these were prepared by him?

MR. ATTWELL: I tried, Your Honor, to ask every time, but I think perhaps in the interest of being extra cautious I would ask the witness a general question now of whether each of these Exhibits was prepared by him?

THE WITNESS: Each with exception of the Kerr-Mac was prepared by me.

MR. ATTWELL: Thank you.

MR. PORTER: Any objections to the Exhibits, Mr. Robb?

MR. ROBB: No objections.

MR. PORTER: The Exhibits shall be admitted.

(Whereupon, Belco's Exhibits Nos. 18, 19, 20, 20(A), 21 and 22 were admitted in evidence.)

(Whereupon, a short recess was taken.)

MR. PORTER: Gentlemen, the Hearing will come to order again. There are some people here who have to make some travel arrangements, hotel arrangements, so our plan is to try to conclude the examination, the cross examination, of Mr. Warnock and then recess the Hearing until 8:30 tomorrow morning. Reporters are hard to come by. For one thing I had an 18-hour day yesterday and I wouldn't like two in a row.

We just feel that it would be better if we would announce at this time that the Hearing would run on late into the night if we try to finish and it would be better to knock it off as soon as concluded the cross examination of this witness. Mr. Robb tells me he just has a few questions. I hope we could finish the cross examination of this witness so that Mr. Robb may come forward with his testimony tomorrow morning at 8:30. So, Mr. Robb, the witness is available for cross examination.

CROSS EXAMINATION

BY MR. ROBB:

Q Mr. Warnock, you have testified about your experience in the mining area and you have indicated that you received your geology degree in 1963?

A BS in 1958, MS in 1963.

Q All right, sir, and when did you start working full-time in mining matters?

A 1958.

Q And you went to school while you were --

A (Interrupting) No, sir. I had finished the graduate requirement by the time I left the University of Arizona in the spring semester in 1958 and after three years of struggle at nights sent back a thesis, made one trip back to the University

on leave from the company, defended the thesis and received the MS degree. The resident requirements were finished all at once.

Q All right. Will you tell me please whether you have ever been employed in any kind of supervisory or responsible position for an operating potash company?

A No, sir, not for an operating potash company.

Q All right, sir. Have you had any experience in supervising then, any potash mining operation?

A I have had extensive experience in the supervision and management of mines. I have not -- this was experience gained with W. R. Grace who are major people in the fertilizer business and who had an inherent-in-house desire to find potash deposits and I explored,as I mentioned, world-wide for potash deposits. The specific answer to your question, no, I have not managed a potash mine, is that the question?

Q Yes. Your work with Grace then was exploration for potash?

A That's correct. Exploration, feasibility studies on specific property. Calculation of oil reserves as you see here today.

Q All right. Have you ever been employed in the Carlsbad Potash Basin?

A No, sir, I was employed by a Carlsbad potash producer.

Q Yes, sir.

A No.

Q Any kind, that's right?

A No.

Q All right.

A I've worked in the area for outside people, right.

Q You've done two feasibility studies, do I understand for potash mines?

A Yes, for potash prospects, exactly, for potash properties, on potash bearing properties.

Q What did those consist of?

A The same thing you see here today, a review of the detailed data, no operations in any of them. I think I've already inferred that one was the Haroon Run north of here, for W. R. Grace. The other was a client, who I am not at liberty to reveal in a completely different area in the langbeinite area to the south of Carlsbad, consists of review of detailed logs and data as supplied by the leaseholder, this type of calculation and estimation as to the potash ore reserves potential, performance feasibility studies in using average cost, is this ore profitable, a recommendation to management to spend "X" additional money in fill-in drilling

to prove this up or not.

Q Those two feasibility studies are essentially the extent of your experience in potash in the Carlsbad Basin?

A The Carlsbad Basin, that's correct.

Q How long did those studies take you, would you say, on a full-time basis?

A On a full-time basis?

Q How many man days would you say?

A The first one was an ongoing eight-to-10 month project. Now, how much time, I would say, two to three months. In other words, it was one of the major properties, projects being worked on, one of two or three, four in a given year.

Q How about the other one?

A Approximately the same. No, that would have been less, that was a shorter evaluation. Full-time spread over a month to six weeks.

Q But you never had to take those feasibility studies and economics that you assumed and have the proof of the pudding? In other words, go in there and mine it under the conditions you had outlined?

A Neither property has been mined yet to date for good reasons, it's uneconomical.

Q Now, sir, in making your study you testified that you arrived at a certain cutoff?

A Yes, sir.

Q That you used to determine the preference of ore, is that right?

A That's correct.

Q You arrived and you picked that figure at No. 72, but used 70 in terms of your maps?

A Yes, sir.

Q That was because data generally available in this area from the U. S. Bureau of Mines was used in the absence of having any specific data concerning the Kerr-McGee operation, is that correct?

A That's correct.

Q So you do not pretend to testify concerning the specifics of the Kerr-McGee operation?

A I do not and I would point out that Kerr-McGee has no better cost data on an area four miles out from their current mine.

Q Well, that remains to be seen.

A Okay. No one has operated or produced in Section 30 and no one ever will, as an aside.

Q All right. I think that you will find that your statement

is subject to rather sharp challenge in these proceedings. Have you ever been under ground in the Kerr-McGee mine?

A No, sir.

Q And you have already said that you have no access to the Kerr-McGee economic data?

A That's correct.

Q In determining this cut-off of 72-or-73-percent-grade times thickness product, did you, sir, consider the cut-off grade used by the United States Geological Service?

A Yes, sir.

Q What is that?

A The USGS uses a boundary of 40 feet percent to outline, broadly outline its KPA area, known potash area. It says clearly in the Minutes of the Administrative Meeting that there are known potash bearing areas within the boundary and I have made a very careful--I should characterize that--a very thorough-going attempt to try to determine if the USGS themselves consider 40 feet percent as an economic cut-off in the current economy of Carlsbad Basin in 1973, when these figures were developed, and we'll get into that I'm sure but that's against a 34 cent per short-ton-unit sales price.

Q Now, 34 cents or 34 dollars?

A 34 cents per short-ton unit.

Q Per unit?

A Yes, which equates to $20.74 per ton of product at 61 percent. Kerr-Mac uses 62; I've absolutely no argument with that. It may average 62; the industry norm is 61, taking it down, but no argument, so say $21 per ton of product, and that of course was the price for 1971 through 1973 and was the prorated-fixed price by the Saskatchewan Government.

Q Saskatchewan Government?

A That is correct. The Saskatchewan Government has fixed their prices, as I'm sure you are aware, at 33.75 Canadian per short-ton units and forced this on the Canadian mine which set the floor price world wide up until recent developments.

Q Do you know what the current posted field price is?

A No, I do not.

Q Per ton in the Carlsbad Mine?

A No, I do not, but when one talks of posted field prices one must talk of spot price versus long-term contracts and long-term price trends.

Q You have no information what it is now?

A No, sir. The last public price I saw in late 1973 was the supported price.

Q And you would be surprised if I told you that it approaches $34 a ton?

A Yes, I would be very surprised.

Q You did not take that into consideration in your calculations?

A These calculations are not based on that price. They are based on 1973 price and 1973 extrapolated costs from base date of 1969-70.

Q And that was approximately $20 a ton?

A $21 a ton, yes, quite correct.

Q Now, I believe you testified about some rather rigid rules that you had come up with in connection with the proven, probable and possible ore, is that right?

A Yes, sir. Rigid is your term but rules in any case.

Q All right, sir. I think you said that you had to have precisely four holes per section to have proven ore, two per section for probable and one per section for possible, is that right?

A No, that's not correct. If you will look at

the explanation of the map it says "Plus" or "Minus" which means more or less.

Q There's a little bit of variation?

A I beg your pardon?

Q There's a little bit of variation?

A Yes, all right.

Q In arriving at this did you consult with any personnel of Kerr-McGee to determine what terminology they used in terms of classifying ore?

A No, sir, I couldn't find any. I would like to point out to you on the map, they have here approximately the average of one-hole section out here; two holes per section in this area and they went back and filled that in with close-in holes. This tells me, by supposition, that while they might not have to hold to the rigid rules, they felt this had to be drilled to prove it up and now you have approximately, of all things, three to four holes per section average in this area.

Q Do you consider it important that Kerr-McGee had gone back and done some additional drilling?

A Based on the first calculation it was imperative that Kerr-McGee go back and drill that.

Q Did you talk to the Kerr-McGee people to find

out precisely why that additional drilling was done?

A No, sir, would they have told me?

Q Well, you issued a subpoena and you got all the warrants, and you got two more than you asked for, didn't you?

A Yes, sir.

Q All right. Now with respect to the data that you have of the classifications, have you made any other determinations of this formula that you have described for us? Would you measure the distance between the Bass No. 2 proposed location and Kerr-McGee's nearest mine workings to see if maybe the distance between there is closer to four miles than four-and-one-half or five?

A Yes, sir, I would be glad to; it was just estimated before. I beg your pardon; what do you want measured?

Q The differences between the proposed Bass No. 2 and the Kerr-McGee nearest mine workings as shown on the map.

A Nearest mine workings?

Q Yes, sir.

A It is 20,800 feet. A little short; around 4 miles.

Q You spoke a number of times of negative holes.

A Yes, sir.

Q By that you meant a hole that's below your 17-feet percent cut-off, is that right?

A Correct.

Q You suggested that maybe Kerr-McGee was using the polygonal directional method?

A Yes, sir.

Q Have you asked whether that is so?

A No, sir, I have not asked.

Q Do you know what method or reserve determinations Kerr-McGee uses?

A I beg your pardon.

Q Do you know what method or reserve determination Kerr-McGee has found to be the most effective in the potash area?

A Do I know that as a fact?

Q Do you know, yes.

A No, sir, I do not.

Q Now, let us go, if we can, to your Exhibit No. 20. This is your K20-feet method, is that right?

A Yes, sir.

Q All right. Now, what are the three closest

drill holes to the Bass No. 2 location?

A Three closest to Bass No. 2 location are USG No. 141, IMC No. 155 and Packer 29.

Q And if you draw a line connecting those three holes you will find that the Bass No. 2 falls within that area,would you not?

A Yes,you would. A triangle using those three holes as points, it passes somewhere inside this triangle.

Q All right, sir. And the hole to the northeast from there which is USG No. 141, would you agree is about 4200 feet away?

A I think I measured it at 44 plus or minus.

Q That's the closest to those three holes is it not?

A Yes, sir.

Q Those being the three closest holes, would or would not those be the three holes that you would place primary reliance on in arriving at a determination of whether there is or is not ore within that triangle?

A There are not, for the simple reason that this is 11,500 feet across here or 2.2 miles, this is just short of 2 miles, and this is 1.7 miles. You cannot, in good engineering practice -- and that is obviously a

matter of opinion -- you cannot in good engineering practice make a calculation in the Carlsbad potash area on holes two miles apart. The influence of this area in a formal pattern that is a 17.5-percent hole, and therefore high in grade in the average of the three, it's too bad because in an objective calculation the difference of the month doesn't make up for the other three.

Q Would you please draw a line between those three holes so we can see just where Bass No. 2 fits in.

A On this map?

Q Yes, sir, if you would.

A Can you see that? I might add that when you consider the area of influence drilling, the other prime engineering rule or opinion of a prime engineering rule is that you cannot average or grade hole with lower grade hole. You must cut that off somewhere, so even if you could triangulate that, even if you did you cannot include this hole because it is a below-ore grade and these two are above.

Q Fine, we'll get to that.

A Okay.

Q Now, the nearest hole, USG No. 141, I believe you said was the highest grade hole of the three?

A Correct.

Q All right. You projected ore around that hole out to about what distance? How close to Bass No. 2 did you come?

A In a formal closure calculation?

Q No, in the K20?

A In the feet-percent?

Q Yes, sir.

A That's right at 2500 feet out.

Q All right. So you are within about 1700 feet approximately, is that correct, of Bass No. 2 but you couldn't quite stretch it to reach Bass No. 2, is that right?

A I beg your pardon?

Q You couldn't quite stretch your projections to reach Bass No. 2?

A You're going to have to clarify that. What projections am I stretching?

Q The map, the calculations that you made here.

A I think that I specified that. It is not a matter of interpretation. You have two points; you have to extrapolate from the two points you have control on the contour line, along that line you cannot move that

control. The interpretation comes when you are drawing a line between two of those extrapolated points.

Q I understand that is what you said Mr. Warnock, but what you did when you found that you couldn't quite reach Bass No. 2, it lacked 1700 feet.

A Bass No. 2 was not in for consideration when the contour map was constructed.

Q Well, whether it was or was not, that is how it turned out.

A It turned out that Bass No. 2 is within 1700 or 1800 feet of potentially geological potential order.

Q All right. Now, let's go down to the hole, the next one in that triangle, the one that is marked F 29.

A That's right.

Q That is the southerly most of those three holes, is that right?

A Yes, sir.

Q Did you find that to have a factor of 56.4?

A Correct.

Q So that didn't measure up to the 70 percent that you had?

A That's right.

Q All right. Now, the difference between 56.4, which is the factor you had for that hole, and 92.3 which is the factor you had for the 141 hole, the one closest to Belco, what's the difference in those figures approximately?

A It's approximately, Mr. Robb, what 60, say 35 or so, but I would draw your attention to the fact that you have better grade holes to the left, and therefore the trend is increasing in this way and decreasing in that way, is it not?

Q I'm not asking about the trend; I'm asking you to tell us, describe to us -- and I'm leading up to -- the influence or effect you gave to that hole. Now, let me ask you some specific questions and then we'll get around to whatever explanation you would like to make.

A All right.

Q Now, in the contour method that you have used, isn't it customary that you draw contour lines between the two holes and go ahead, and then arrive at a standard. For example, if you had, let's say, that this hole down here, the south hole, was 70 instead of 56, are you with me?

A Yes.

Q And the one up there was 92, you would draw a contour line, would you not, normally between the 90 and the 70 and draw an 80 line, wouldn't you or would you split the difference between the two?

A In a hypothetical question you would.

Q All right, sir, and would there be an 80 line approximately equi-distance between those two holes and would include the Bass No. 2 site?

A Under theoretical consideration that F 29 is 17 and the theoretical consideration that is 70, that would be true.

Q All right, sir. Now, will you please take a line and draw a contour line and a dotted line, if you will please, midway between 141 and F 29.

A What is the purpose of this line?

Q Well, just draw it please, and I will explain the purpose later. I want to see where it falls.

A Do you want me to measure?

Q Well, do it anyway you want.

A What is the supposition, that this hole is not 57?

Q There is no supposition at all. I want a dotted line midway between those two holes.

A A line midway between those two holes.

Q All right. Now, the difference between 56.4 and 92.3 I didn't calculate, did you?

A No, sir.

Q 35.9, is that right, roughly thirty-six feet; thirty-six points or whatever you want to call them? Percentage points.

A Yes.

Q All right, and 18 would be mid one, right?

A Yes, sir.

Q All right. 18 from 92.3 is what?

A I beg your pardon?

Q 18 from 92.3; can you make that calculation? Lawyers are terrible calculators.

A Yes, I'm terrible in my head, also.

Q It's 74.3.

A Fine.

Q Now, if you had done that, if you had split the difference between the values in that hole up to the northeast No. 141 and F 29, you would have arrived at a figure roughly of 74.3, is that right, at the mid-point?

A If I had split them, yes, sir.

Q And that would then mean that if you had made

that split, that Bass No. 2 would be somewhere between 74.9, 34.3 and 92.3 in grade climb, is that right?

A Yes, that would be correct, yes.

Q Somewhere about 74 above your cut?

A Yes, sir.

Q Now, you did not do that, did you?

A No, I didn't.

Q What weight did you give to that hole down below that F 29?

A I gave full weight to it, and as any of the petroleum and/or potash people here know in general contours of any kind, including topographical contouring, I am coming up a high or off a high. I have 130, 110, 90, 70; I am going down a slope, am I not? Therefore, the 57 which is down slope from 2 Seventies then we have a firm control on this 70 line here, have we not?

Q That is your testimony; I am not agreeing with that.

A Okay, sorry. I don't know whether you do or not. I'm not supposed to ask you questions. We have a firm control on the 70 line; we have these down slope situations here; we have a saddle here, quite clear from the colors. The interpretations and this, of course, is a firm line

here. The 70 must be up here. If this is the 57, the 70 must be here. It can be nowhere else. If this is the 90, this is 130, if this is a 92, the 90 actually should just not get to your direct line between them to be absolutely perfectly correct. You have a low here 62; you have a 90 here, and there must be a 70 between them; there can be no other way. You are coming up slope in this direction, up slope in this direction. You have a saddle trend here. The interpretation is to put another 70 in here, splitting it exactly is an absolutely incorrect interpretation of the data. Look at the trend. There is a saddle coming through here; there is a saddle coming through there; you're going down dip here; you're going down dip there.

Q How many pounds of ore did you attribute to hole No. F 29?

A There is no ore -- I beg your pardon, F 29?

Q Yes, sir.

A There is no ore in F 29.

Q The answer is zero, isn't it?

A Correct.

Q And in determining whether or not there was any ore in the area up by Bass No. 2, you gave that hole

zero influence, didn't you?

A In terms of formal ore or in terms of geological projection?

Q Any way you look at it.

A Formal ore, it would have no influence on this location in a formal-ore calculation.

Q Now, let's go up to hole No. IMC 155.

A Yes, sir.

Q That's the third side of the triangle, and I guess we made a mistake. That's got the highest grade product, doesn't it; that's 129.

A No, that is the highest peak percentage, but not the highest grade product. It is a much thicker, lower grade.

Q No, but the highest grade product.

A In terms of contouring, it's the highest point, yes.

Q Yes. That's 129 against 92 over in the eastern-most hole.

A That's correct.

Q Now, in arriving at that 129.3, did you include only the sylvite that was in that hole, or did you include the carnallite that was in there too?

A Carnallite?

Q Carnallite.

A I may be predicting your question, but if this is it, I have no argument with it. That's another interpretation. That's strictly interpretive. You could bend the knotty line around like that. To go back to your answer, on IMC 155 -- and let me just check on this map -- no, there would be no K20 as carnallite.

Q All right. There was carnallite in the hole, was there not?

A I would have to check the load. I will if you like.

Q All right. I wish you would check that, yes.

A Yes, sir. There is a 0.95 percent K20 as carnallite.

Q All right. If you had added that grade product, what would that have amounted to?

A I would have to think. Well, it would have been 13.5.

Q So instead of 139 it would have been 142?

A Instead of 122 -- well, why don't we just calculate this log quickly. Now, do we want to debate that now?

Q No, I just want to know, that would have added approximately 13 to 139?

A Yes, but you don't want to debate why I didn't?

Q I want to answer your question about it.

A Would that increase it about 140; just one second.

Q All right.

A It would come to 13.88 percent K20 and sylvite and carnallite, right?

Q I don't know. I am relying implicitly on your figures.

A And that would give us 138.8 feet percent, yes.

Q All right, sir. Did you inquire whether or not Kerr-McGee extracted and used carnallite values in its mining operations?

A No, sir, I did not. Now, as a generality and I'm not familiar with the Kerr-Mac mill, the details thereof. As a generality, as has been testified before this Commission, carnallite is a dilatorious mineral in the process. It also has a K20 content, and up to the point that carnallite becomes dilatorious constituent I have said miner-K20 advantage of carnallite is offset by the dilatorious affects to the mill, and that is as strictly

experience or generalized factor.

Q Did you check to see whether or not Kerr-McGee had a flotation process to which the carnallite would be dilatorious?

A No, sir, I did not check.

Q So your reading off of those values was strictly based on speculation?

A And testimony before this Commission, and hearsay and discussions of people in the business, yes.

Q What discussions did you have with Kerr-McGee people as to whether or not those values were real values in the mill?

A None whatsoever.

Q Now, the areas of influence that you have established or the -- I guess that is what you call it, isn't it -- the distance that you go between holes to infer probable or possible ore?

A Yes, projection distances.

Q All right. Your figures were, I believe, that you would go as much as 2000 feet with a two holes per section to project probable ore and one and possibly 2500 feet to -- did I understand you correctly -- to a mile under some circumstances?

A Holes a mile apart or holes in a 2500-foot radius.

Q In a 2500-foot radius.

A If they are in adjoining sections, as I pointed out up there and they were both ore holes, I would let the whole area in between be called "possible ore" which is not possible under a feasibility-type statement.

Q And you have used these figures, as in hole No. 141 you allowed that at only 2500-foot intervals, isn't that right?

A Correct. On what projections?

Q On the contour K20-feet method?

A Yes, sir.

Q All right. Now, doesn't the amount of influence that you give to a hole depend to some extent upon what the mining experience is of the operator in the area who first drills, and then goes underneath to find out whether or not his earlier estimates proved out?

A State that again, please.

Q Is it the proof of the pudding, that a worker can infer from a hole that you actually find when you go underground?

A Yes, sir.

Q To what extent did you attempt to determine what Kerr-McGee's experience was in being able to infer ore, either probable or possible, based upon its prior mining experience?

A Two points. As I previously testified, I did not talk to Kerr-McGee; I can draw from the sketch maps that they put in the area of influence they put into their holes on the margins of the block; I can infer that they're using the polygonal system, and, second, therefore the answer to that part of your question was that I did not speak to them; I agreed that the proof is in the pudding, and there comes point number 2. Nobody, but nobody -- not even Kerr-McGee -- have mined,as you have pointed out,within four miles of this area, and when one calculates an area out that far or when one makes a general appraisal of the Haroon grounds out that far from known shafts, he must make an evaluation that assumes essentially a new operation because he has no detailed mining experience in that area either.

Q Kerr-McGee is the closest potash mine operator to Bass No. 2, is that not correct?

A Correct.

Q And so presumably it has information from areas

that are closer to Bass No. 2 than any other operator; would you agree with that?

A That's not true. Belco has the same information on Section 30 and the sections around it that Kerr-Mac has.

Q Is Belco in the mining business?

A No, sir.

Q What mining experience does Belco have to draw on?

A Well, you will have to ask the Belco representative for that. The point is, of course, that there is no one who has any mining experience in Section 30, including Kerr-Mac, and everybody in this case now that the data has been made available through various means, and after somewhat of a struggle, everyone has the same data available to make an appraisal of Section 30.

Q You are talking about drill-hole data, are you not?

A Absolutely. Is there any other data available on Section 30?

Q My question related to the mining experience what Kerr-McGee was finding underground as a mining operator of the hole, and now you are talking about drill

data.

A I'm saying there is no mining experience in Section 30.

Q Do I understand you to say that you would give zero influence to the experience that Kerr-McGee has acquired as the result of eight years of operations in the closest adjacent mining area in the Carlsbad Potash Basin?

A Zero?

Q Yes.

A No, I would not go that far. I would love to see their data, obviously. They have the very best data in close through mining experience, and let me reemphasize again that all these lines expand and contract, and that is where the miner finds out when he really has the ore. The proof of the pudding is when he eats that ore. On that basis there is no one better than Kerr-Mac to evaluate where they have mining that they have previously drilled to, and the immediate projected outcome in terms of maximum amount. Everyone is working with the same data on Section 30.

MR. ROBB: No further questions.

MR. PORTER: Does anyone else have a question?

The witness may be excused.

MR. ATTWELL: I'm sorry; I have a few redirect questions.

REDIRECT EXAMINATION

BY MR. ATTWELL:

Q Mr. Warnock, I am going to ask you some questions about core hole F 29. Did this core hole have an influence on your geological projection?

A F 29?

Q Yes.

A It certainly does, as described in the foot-percent method.

Q And you testified that you do not believe it is proper to split the difference between values in USG 141 and F 29, why not, in your opinion?

A In my opinion they are more than one mile apart; they are 1.7 miles apart, and it is simply too far to average them, in my opinion.

MR. ATTWELL: I have no further questions.

RECROSS EXAMINATION

BY MR. ROBB:

Q Your consideration of hole No. F 29 resulted in providing not one pound of ore for the proposed Bass

No. 2?

A I beg your pardon.

Q Your geological influence that you gave to hole No. F 29, the southerly most of that triangle, resulted in your attributing not one pound of ore to the proposed Bass No. 2 site.

A Please define "ore," geological projection or formal ore reserve?

Q Either way.

A Formal ore reserve, not one pound because it's non-existent.

Q And projections?

A Projections, it just cuts into it as you can see up there. Now, the new data, let me point that out; the new data mathematically cannot affect this line. This line stays right there, as it is here; the same place because all the data is over here. It's a simple mathematical contouring. That line stays as you say and is about 1700 or 1800 feet from the site, so potentially -- and if you want I can give you my opinion on the potential. Anywhere in the yellow is a very low potential. I wouldn't recommend drilling. I would recommend drilling the gray areas for possible ore. The 2100-foot radius will cut into that by what, 400, a 1000 feet, I'm not sure. I'll

have to calculate that.

Q But that is just a result of the geological data that you developed in the northern part of that area rather than as the result of F 29 data.

A The interpretation is a result of all the data available.

Q Did F 29 figure in that?

A Yes, sir, it certainly did.

Q How?

A How? By giving its influence to the location of the contour lines as every other hole and this was my testimony that you very obviously are coming down the slope in contouring, and you must interpret F 29 as the 70 being on the west side and the 50 on the east side because you are coming down slope. You have the northwest trend; you see it there in colors.

Q Then do I understand that F 29 data resulted in bringing ore from the north on down to close to Bass No. 2?

A Say that again.

Q That the holes in the south F 29 resulted in your bringing that yellow area down south?

A Yes, it did influence why, at this line here, F 29.

It certainly's influenced by F 29. If this were 10-feet percent, the other line would obviously have to contract in this direction.

Q I'm talking about the area immediately around Bass No. 2.

A All right.

Q Did F 29 have any influence on that?

A Yes.

Q What?

A It locates this line.

Q The line to the north?

A The line here that you see. It is just that this hole locates this one. It can be no other way.

Q I'm not even going to ask you the question.

MR. PORTER: Are there any further questions? The witness may be excused and the hearing will recess until 8:30 tomorrow morning. If there is anything you would like to leave in here, the room will be locked for the night.

(Whereupon, the Hearing was recessed at 5:00 P.M.)

STATE OF NEW MEXICO)
) SS.
COUNTY OF SANTA FE)

I, RICHARD L. NYE, Court Reporter, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me, and the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

RICHARD L. NYE, Court Reporter

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0386

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Morgan Hall
Santa Fe, New Mexico
8:30 A.M., March 16, 1974

IN THE MATTER OF:

Application of Belco Petroleum Corporation for a drilling permit in the Potash-Oil Area, Lea County, New Mexico. Applicant in the above Federal cause, seeks authority to drill its proposed Bass Federal Well No. 1 to test the Pennsylvanian Formation at an unorthodox location 660 feet from the south line and 1300 feet from the east line of Section 30, Township 20 South, Range 33 East, South Salt Lake Field, Lea County, New Mexico, said location being within the boundaries of the Potash-Oil area as defined by the Commission, Order R-111-A, and having been objected by the owner of the potash leases in the area. This unorthodox location was previously approved by the Commission by Order R-4699.

BEFORE MEMBERS OF THE COMMISSION:

A. L. Porter, Secretary and Director

Ralph Trujillo, Chairman of the Commission

APPEARANCES

For the Commission: William Carr, Esq.
Land Office Building
Santa Fe, New Mexico

For Belco Petroleum Corp.: Jason Kellahin, Esq.
KELLAHIN & FOX
500 Don Gaspar
Santa Fe, New Mexico
and
Evans Attwell, Esq.
William Pannill, Esq.
VINSON, ELKINS, SEARLS, CONNALLY & SMITH
Houston, Texas

For Kerr-McGee: John Robb, Esq.
Mark Adams, Esq.
RODEY, DICKASON, SLOAN, AKIN & ROBB
P. O. Box 1888
Albuquerque, New Mexico

I N D E X

	Page
ROBERT H. LANE	
Direct Examination by Mr. Robb	222
Cross Examination by Mr. Attwell	319
Redirect Examination by Mr. Robb	367
Recross Examination by Mr. Attwell	372
Further Examination by Mr. Nutter	373

E X H I B I T S

	Page
Kerr-McGee Exhibits 4, 5, 6, 7, 8, 8A, 8B, 8C, 8D, 8E, 9 10, 11, & 12	319

(Exhibits 11 & 12 are portions of Exhibit 2 which was not admitted.)

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0366

MR. PORTER: The Hearing will come to order. I believe that, Mr. Robb, you had finished your cross examination of Mr. Warnock. Mr. Kellahin, I think that was your last witness.

MR. KELLAHIN: That is correct, Mr. Porter.

MR. PORTER: The Commission will recognize Mr. Robb now. He can call his witness.

MR. ROBB: I would like to read at this time a statement of Teledyne Potash Company. (Reading) Teledyne Potash Company holds a State of New Mexico Mining Lease -- (end of reading) A copy of that is in your schedule of exhibits, Mr. Porter.

MR. PORTER: Yes, sir, I know.

MR. ROBB: (Reading continued) Which includes all of Section 36, all of Section 32, the North half of the North half of Section 31, and the West half of the East half of Section 30 in Township 20 South, Range 33 East, Lea County, New Mexico. Jim Walls, General Manager of Teledyne, has authorized for me, John D. Robb, Jr., Attorney, to advise the New Mexico Oil Conservation Commission that Teledyne is opposed to any intrusion of any well location that would penetrate a commercially valuable potash deposit and particularly to the intrusion of its

above-leased area including the present Belco Application to drill a gas well in Section 30 immediately adjoining its holdings. Teledyne has granted Kerr-McGee a sub-lease to mine other potash properties in this area and it is willing to enter into negotiations with Kerr-McGee for sub-lease to mine potash under the above State. Dated this 14th day of March, 1974. (End of reading.)

I am authorized to make that statement on behalf of Teledyne Potash Company to this Commission.

MR. PORTER: All right, sir.

MR. ROBB: Prior to presenting evidence, Mr. Porter, I would like to make a few brief remarks including presenting a statement by Kerr-McGee. There apparently has been some confusion, gentlemen, in the minds of some people concerning Kerr-McGee's intentions with regard to this matter and that is because Belco has been advising others that Kerr-McGee has not been serious about its protests. This statement is not correct. Ever since filing its protest, Kerr-McGee has acted in good faith and, we believe, the well-founded belief that there is a commercial ore deposit, potash deposit, which will be largely destroyed by the granting of the Belco Application. At Belco's suggestion, Kerr-McGee did recently make a

second review of its position, in an attempt to comply with the letter and the spirit of the proposed decision by the Secretary of the Interior in this dispute, concerning the controversy between the oil and the potash companies. However, Kerr-McGee concluded, after a second review of its position, that its position was precisely in accord with the proposed decision of the Secretary of the Interior which has now been entered, now been finalized, and that it could not conscientiously permit what it believes to be the obliteration of an important and valuable natural resource merely to gratify Belco. Kerr-McGee failed to protest early applications to drill in this same section but this was because it had failed to analyze the available data which demonstrates the existence of a commercial ore body. We submit to the Commission that the mere fact that other drilled wells have been drilled in this area at earlier times and under different economic conditions does not justify the wiping out of the bulk of what we believe to be a valuable potash deposit. Now, Belco advised Kerr-McGee that the USGS has already made up its mind to grant its Application to drill at this site and that a hearing before this Commission would be futile. We don't believe that. We

don't believe the USGS has prejudged this Application. The USGS has recently affirmed to this Commission in the ordering that it was going to give deference and consideration to the decision of this Commission, so we don't think we are here for a dry run, Mr. Porter and Mr. Trujillo; we think we're here for an effective hearing.

That having been said, may I present the statement of Kerr-McGee Corporation? A copy of that is also in your files.

I would like to discuss very briefly the history of Kerr-McGee's operations in the area. Kerr-McGee Corporation is one of the major potash operators in the Carlsbad Potash Basin with a capital investment in mining and milling plants and equipment exceeding $35,000,000. It employs approximately 440 in this operation. Its annual pay-roll has increased from 2.2 million dollars in 1966 to approximately $5,000,000 in 1973. Kerr-McGee and its predecessors have conducted a flourishing development in mining in the Carlsbad Potash Basin starting back in 1952, but large-scale mining and milling operations have been continuously conducted there by Kerr-McGee and its predecessors since 1965, so it has been about eight years they have been doing major operations

in this Basin. Major potash, of course, has been conducted in the Basin since 1932 and it has continued until the present time. The Basin is the only major source of potash in the United States. At a hearing in Albuquerque it was estimated that 75 percent of all the potash deposits in the United States were located in the Carlsbad Basin. For many years it has been well-known that subsidence has been a normal and inevitable result of the only economically-feasible method of mining potash in this area. Now, the New Mexico and Federal restrictions on drilling, as the Commission well knows, oil and gas drilling in the area have either been prevented or restricted since 1939 when the Secretary of the Interior reserved the potash deposits from oil and gas leases. Then in 1951 the Secretary enlarged the potash area and then permitted oil and gas leasing where it would not result in undue waste of or hazard to the potash. In the same year the Commission issued order R-111, since modified by R-111-A and subsequent modifications. On May 11, 1965, the Secretary issued a further order enlarging the potash area and permitting potash in oil and gas operations where no waste of, or hazard to mineral deposits existed, and furthermore the United States Geological Service has

established, outlined and maintained an area where potash is known to exist, which has been aptly described as a known-potash area. We are within that area and this Hearing is concerned with a proposed-well location in that area. Now, the events leading up to this present controversy are that in 1973, following increasing controversies between oil and potash companies in this area, there was an application by the New Mexico Oil and Gas Association for modification of the 1965 Secretarial Order. This resulted in the submissions by both the Oil and Gas Association and the Potash Association with regard to various material. Exhibit 1, that we have entered in evidence in this case or will enter shortly, is the submission that Kerr-McGee made to the Secretary of the Interior, and this contains a good deal of background material and its position in regard to the matter. Exhibit 2, which we discussed a little bit yesterday in the cross examination -- partly we did -- was the submission made by the potash companies to the Secretary of the Interior and in that presentation Kerr-McGee had picked a position that potash mining should be accorded a priority because, (1) There is a risk of losing large quantities of valuable potash and recurring hazards to

the men and mining operation if the oil-gas operations precede mining operations, whereas there is no such danger to the oil and gas deposits if the potash mining should precede the oil and gas; (2) the relatively small area involved contains the major source of potash in the United States, and is thus of enormous importance to the nation as well as the potash industry; and (3) that within this relatively small area the economic values of the potash and the large-scale mining and many pay-rolls coupled with the huge investment in mining and milling plants, outweighs the potential for oil and gas in this area. In our statement -- and I'm not going to read it all -- we have outlined the factual basis underlining those contentions and why we took the position we did, which I think is pertinent as part of the history before this Commission, and on pages 4, 5 and 6 of that statement, that the Commissioners have in front of them, we have outlined the major reasons and why we feel that from both the standpoint of natural resources and from the standpoint of economics that very careful consideration must be taken in preserving the potash deposits even as we think we can establish today at this Hearing, there are commercial deposits of potash underlying this location.

Now, it is Kerr-McGee's position that the Application of Belco should be denied; that the drilling of this proposed location would result in undue waste of commercial ore deposits; that it would unduly reduce the total quantity of such deposits which may reasonably be recovered, and also that it would constitute a hazard to other Kerr-McGee deposits and its miners, and finally it would seriously interfer with the commercial development of ore deposits in this area. Finally, we take the position that these effects are wholly unnecessary in that if Belco insists on drilling in spite of this evidence, that it should do so and can do so by directional drilling. Now, I'm not going to review the applicable statutes, but I have set those forth in our statement.

Now, in our contentions we say that the location proposed to be drilled does contain commercial deposits of potash ore. We say that it is an integral part of the potash ore body which Kerr-McGee is already presently mining approximately four miles away. Although Kerr-McGee's operations are some distance away, the ore deposit which it is mining, including the ore which we contend is present in this area, constitutes 30 percent of our overall reserves that are available in the Carlsbad Potash Basin,

available to Kerr-McGee. Now, we estimate that there is probable ore of 6.48 in thickness with a grade of 14.7 percent which is within the range of ore grades that we are presently mining and milling. If the proposed well is drilled, Kerr-McGee can do no second mining of any kind within 4200-foot pillar areas, our evidence will show. In other words, you have a diameter 4200 feet across which is a good portion of an entire section that would have to be left in place except for a very limited first mining, and we would have to look at the economics of the first mining at the time that the question posed itself to see if we can even do that. We are not sure that we can even do first mining which depends upon what the economics were at that time. Now, this enormous pillar enterprising the better part of an entire section contains enough ore, just as an example, to sustain Kerr-McGee's entire operation for over one year. Our evidence will show that that much ore would be wasted if this location is approved.

Now, the waste involved totals, our evidence will show, approximately 472,000-final-product tons at a posted price of $33.89 a ton. Our retail value in excess of $15,000,000 which we contend will in all probability be wasted if this Application is granted. We contend that

the dangers and the risks resulting from subsidence are sufficient that Belco's Application should not be approved. In addition, there are risks to the surrounding area if the methane gas should impregnate that area, if there should be a break in the casing or the cement job, and that would cause a risk of explosion as well as condemning a large area of potash deposits in the vicinity.

Now, finally, we take the position that the Belco Application will interfer with the orderly development of potash deposits in this area, and we say that, first of all, the proposed Belco site is less than a mile from Kerr-McGee's existing Federal potash leases. Kerr-McGee presently has no leases on the area covered by the drill site, however it does have an orderly plan of development for its existing lease area and for that portion of its ore body beyond the limits of the present leases to the northeast which includes the area in question. Kerr-McGee has filed a proposed five-year mining plan with the Commission showing that it anticipates being within approximately a mile-and-a-half of the proposed drill site within that period of time, within five years. Kerr-McGee holds the only Federal potash leases in this immediate vicinity and the proposed Belco location is a logical and natural

extension of its present leases. We also contend that Kerr-McGee expects in the normal course of its operation to apply for Federal leases in this area, and because it is the only company that has existing operations in this area, we believe that Kerr-McGee would appear to be the only company which could economically develop and mine the ore in this vicinity. Complete mining of the area, of course, would require some arrangements with Teledyne which owns a small potash lease in this area and assuming we obtain the Federal lease, it is Kerr-McGee's present intention and plan to mine this area within ten years from this date.

Now, we contend, gentlemen, that the conservation objective in this case should be the development of both the products, both the potash and the oil and gas, and that the question then before the Commission is how can that best be done? How can we best preserve the benefits of both natural resources, the economics that flow from developing both of those, including substantial royalties in both potash and oil and gas. We believe that the only sure way that we can be certain that both can be fully developed is, assuming that there is potash ore of commercial quantity underneath this location, that this

potash should be developed first since that can be done without damaging the oil and gas. Now, we contend that there is a heavy burden of proof that rests upon the Applicant, Belco, in this case, to establish that a well location at this site will not have the harmful effects, which we contend that it does, on the ore. So the key question seems to us in this Hearing -- and what we will devote much of our testimony to -- is are there underlying deposits of commercial ore. We contend that there is probable ore under this location. That concludes our statement. We're prepared to testify.

MR. PORTER: Mr. Robb, I don't believe my files contain a copy of your statement.

MR. ROBB: That was an oversight.

(Whereupon a discussion was held off the record.)

MR. ROBB: I would like to call our first and only witness, Mr. Bob Lane.

MR. PORTER: Let the record show that the witness was sworn previously.

MR. ROBB: Yes, sir, he was.

DIRECT EXAMINATION

BY MR. ROBB:

Q Would you state your name please, sir.

A Robert H. Lane.

Q How old are you, Mr. Lane?

A Fifty-two.

Q And what do you do?

A I am employed by Kerr-McGee as Superintendent of Engineering at the present time.

Q All right, sir. And would you please explain to the Commission what are your duties as Superintendent of Engineering.

A To control the Mine Engineering Department, which is responsible for reserve calculations, exploration, general geology, lease and control, royalty calculations. That covers it, generally, I think.

Q All right, sir. Insofar as your relationship is concerned to the mining operations, do you have any responsibility for mining plans?

A Yes. We develop the mining plans and also develop the production in capital forecasts which go with that.

Q All right, sir. Do you have responsibility concerned with mine equipment?

A Yes. We review on equipment needs to go along

with the mining plans. We will run efficiency studies on present equipment, and make recommendations for new equipment.

Q Do you have responsibility with regard to leases and the use of land?

A Yes, sir.

Q Explain to the Commission what that is, please?

A We maintain the lease files, prepare the extentions to applications for new or old leases.

Q Do you have some responsibility in connection with budgets and forecasts?

A Yes, to go along with the mining plans we will prepare our production and capital forecasts to go with it.

Q In connection with preparing mining plans and budgets, is economics or the price of ore or price of your product perhaps a factor?

A It is a major factor.

Q Now, would you please outline your education and experience to the Commission?

A I have a BS in Mining Engineering from New Mexico School of Mines, received in 1950. I was employed by International Minerals and Chemicals in their Carlsbad

operation from 1950 to 1957 as geologist and mine engineer; employed by IMC in Canadian operations from 1957 to 1960 as mine superintendent during the shaft construction; employed back in Carlsbad with IMC from 1960 to 1962 as Chief Mine Engineer. Since that date I have been with Kerr-McGee in their Hobbs operation. In the Hobbs operation, I have been Chief Mine Engineer, Mine Superintendent and, at the present time, Superintendent of Mine Engineering.

Q Do I understand, Mr. Lane, that you have been continuously associated on a full-time basis in a supervisory capacity with potash operating companies for the last 23 years?

A Yes.

Q Do I understand from that summary that during 20 of those 23 years you have been involved in actual mining operations in Carlsbad Potash Basin?

A Yes.

Q Would you please explain to the Commission what the duties of a Mine Superintendent are that you perform?

A The Mine Superintendent has complete control of the mining operations as far as production, maintenance, employment of new employees, termination of old ones,

responsible to the Manager for his daily, monthly and yearly costs and production tonnage.

Q In your work with International Minerals Corporation as the geologist, what were you doing there?

A Reserves, exploration, mine sampling, grade control on a daily and monthly basis.

Q All right, sir. Are you familiar with the Teledyne situation with regard to Teledyne's present operations or lack of them?

A I am.

Q Will you tell the Commission, please, whether Teledyne at this time is engaged in exploration, development or mining operations in the Carlsbad area?

A Teledyne Potash is not engaged in any active mining operations. They are in a way moth-balling the equipment they have. They have removed the narrow-gauge railroad from their mining site to their plant which indicates that it will be some time before any active mining operations would commence.

Q Would it be fair to describe the present situation as sort of a caretaker situation?

A It would be a caretaker situation.

Q Would you please describe very briefly when

Kerr-McGee first commenced commercial operations on a major scale of potash in the Basin in Carlsbad?

A Construction of the plant site and surface facilities was started in 1963; underground development started in January of '64, January of '65 rather, and actual mining operations on a production scale were started in October, '65.

Q Approximately how much tonnage does Kerr-McGee mine each year?

A Approximately 3,000,000 tons at the present time.

Q Has that been steady or has that been decreasing over the years since 1965?

A Gradually increased. It's been fairly stable for the last two years.

Q During the time that Kerr-McGee has been in this area, has it simply rested with its holdings or has it attempted to expand its holdings from time to time?

A We've expanded our lease holdings; we acquired some new leases. In 1964 or '5 we purchased leases from the old IMC property in the northeast, which portions are all of four sections. In 1970 we entered into a sub-agreement with Teledyne Potash for a State section over

in the western portion of the property.

Q Are you mining the potash under that sublease?

A Not under that sublease at the present time.

Q You have acquired the right to mine it?

A Yes, and in 1973 we acquired a new lease which was formerly held by National Potash and we're mining in that lease now.

Q Approximately, what is the annual pay-roll from your mining and milling operations?

A At the present time around $5,000,000.

Q How many employees do you have involved in the operations?

A Actual and the end of '73 there was 390.

Q Will you tell the Commission, please, what the total capital investment is that Kerr-McGee has in its milling and mining properties and facilities in the Carlsbad Potash Basin?

A In Excess of $35,000,000.

Q When Kerr-McGee first entered the Basin and first made its plans in 1963 to amortize this $35,000,000 investment, will you tell the Commission, please, how many years' supply of ore did you count on as being necessary to handle that operation?

A At that time, 30 years.

Q Now, would you turn your attention, please, to Exhibit No. 1. Can you identify Exhibit No. 1, please?

A Exhibit No. 1 is a letter from Mr. Roy C. Williamson; the subject is feasibility and additional costs of drilling.

Q No, you've got the wrong Exhibit.

A That's 1-A.

Q Exhibit 1 starts with a letter to Mr. Wakefield, Secretary of the Interior, signed by James J. Kelley.

A Yes.

Q Is that the signature of the President of Kerr-McGee Corporation?

A Yes. Exhibit 1 is from James Kelley, who is President of Kerr-McGee Corporation.

Q And was that material all submitted to the Secretary of the Interior in connection with this dispute last summer?

A Yes, sir.

Q Can you identify Exhibit 1-A?

A 1-A is a letter signed by Roy C. Williamson; subject is feasibility and additional costs of drilling a directionally-controlled hole.

Q Do you know Mr. Williamson?

A Yes, I do.

MR. KELLAHIN: We object to any questions along this line. This Witness has not been qualified as a Drilling Engineer or as Petroleum Engineer and he is not qualified to testify as to the accuracy of the feasibility studies made by Mr. Williamson. We object to any testimony in regard to Exhibit 1-A.

MR. ROBB: We're not going any further. We are just identifying the document right now.

BY MR. ROBB:

Q Can you identify Exhibit No. 1-B?

A Exhibit 1-B?

Q Yes, sir.

A Exhibit 1-B is another letter signed by Roy C. Williamson; subject in this letter is proposed location of Belco Bass Federal No. 2, Section 30, Township 20 South, 32 East, the location is 660 feet to the South and 1320 from the East.

Q All right, sir. Those are two letters that were discussed yesterday?

A Yes.

Q Can you identify Exhibit No. 2, do you have

your copy?

A I've seemed to have misplaced them or something.

Q In order to save time, Mr. Lane, can you identify Exhibit No. 2 as the submission made by the potash companies to the Secretary of the Interior last summer in connection with this oil-potash dispute?

A Yes.

Q Can you identify Exhibit No. 3?

A Yes, that's the latest guide lines or the Order of the Secretary.

Q Attempting to resolve this dispute between the oil and potash companies?

A Between the oil and potash companies.

MR. ROBB: At this time we move to introduce into evidence Exhibit 1, 1-A, 1-B, 2 and 3.

MR. KELLAHIN: If the Commission please, we would object to the introduction of these instruments as exhibits for the same reason as stated yesterday. The identification of the exhibit lends no merit to it as being testimony or evidence that can be considered by this Commission. Now, this is purely hearsay evidence and the attempt to get it into the record here by this manner is wholly improper. Well, let's take Exhibit 1, for

example: It's a statement by Mr. J.J. Kelley. This witness has not testified he prepared this or knew anything about it. Attached to it are tables; information concerning, for example, the economics of Eddy County. There is nobody here present to testify as to the accuracy of that information. The instrument has tables on employment in Eddy County, employment in the mines and the value of this oil and gas well drilling in potash areas, the value of potash mining in the area, a letter by Mr. Williamson relating to the economic impact of oil and gas industry in southeastern New Mexico. That is nothing but hearsay evidence. The same is true as to Exhibit 1-A and 1-B, being letters by Mr. Williamson regarding feasibility of additional drilling costs. Mr. Williamson is not here to state the source of his figures, nor are we able to test the accuracy of these computations. Now, when it comes to Exhibit 2, that table contains such a mass of information it would take us two weeks to cross examine any witness who is competent to withstand cross examination on the material contained in there. The whole thing is wholly improper and we do object to its introduction and I call the Commission's attention to its own rules in this regard in the conduct of hearings. The Commission requires

that full opportunity shall be afforded to all interested parties at the hearing to present evidence and to cross examine witnesses, and we are being denied the right to cross examine these witnesses whose testimony is contained in these instruments. That's Rule 1212, Rules of Evidence. In general the Rules of Evidence applicable in a trial before a court without a jury shall be applicable providing such rules may be relaxed where by so doing the ends of justice will be better served. No order shall be made which is not supported by competent legal evidence. Now, this material is certainly not competent legal evidence. The Commission cannot consider it as evidence. To introduce it merely clutters the record and causes confusion, and we object to its introduction.

MR. ROBB: In support of it, Mr. Porter, let me say that it seems to us that the Commission should be interested in any information which will help it arrive at the decision which it needs to make in this case. This is such information. Much of it, true, is simply background information, but it deals with matters such as subsidence; it deals with matters which the Commission has heard before. I'm not sure Mr. Trujillo has, but it will save a great deal of time in letting some of this

stuff come in so we don't have to spend a lot of time going through the subsidence testimony that the Commission has gone through so many times, but is necessary for us to make a record in case this matter is referred to court at a later time, and the purpose basically of this submission is to save a lot of this Commission's time. Much of this testimony, virtually all of it, was explored fully in the Phillip IMC Case. Mr. Kelley, in effect, cross examined the potash witnesses at that time at length about all the matters that are contained in here. None of this is new to anybody. It is simply information that is common knowledge basically. There are very few things in here that I could even describe as even remotely controversial, and we are trying to expedite this proceeding. Now, now the rule that Mr. Kellihan read of this Commission says unless the interests of justice required. We submit the interests of justice in trying to bring this Hearing to a conclusion, in trying to develop this material, that this is the simplest and most expeditious way to do it, and I honestly do believe that this will assist the Commission in arriving at its overall decision or I wouldn't tender it to the Commission at all. Now, we really think that this is crucial and that it will

save a great deal of time at this Hearing if the Commission will grant it.

MR. KELLAHIN: We would agree it would save a great deal of time, but Mr. Robb well knows the legal point of view does not go to make a record on which he could stand in court. Now, to say that we had ample opportunity to cross examine potash witnesses in the Phillips case is wholly immaterial. We have a different potash company, a different application, different circumstances involved, and it has no bearing whatever on this case.

MR. PORTER: The Commission, Mr. Robb, will sustain the objection. We will not accept these exhibits, Exhibits 1, 1-A, 1-B, 2 and 3. You may proceed with your witness.

MR. ROBB: Let the record respectfully show our exception to that ruling.

MR. PORTER: The record will show your exception.

BY MR. ROBB:

Q Mr. Lane, could you please turn to Exhibit No. 4?

A Yes, sir.

Q What does that show, please?

A Exhibit 4 is a copy of the known potash area

which was developed and drawn by the USGS. It also shows Section 30, the area in question today, is shown in red.

Q And does that indicate that the area that is in dispute in this case at this Hearing is within the known potash area designated by the Secretary of the Interior?

A Yes, sir.

Q Would you identify Exhibit 5, please.

A Exhibit 5 is a map showing several different things. One, it shows Kerr-McGee leases outlined in yellow; the blue outlines Belco's Exhibit, which there are several errors in, mainly in Section 19 and the Southwest quarter of 25 should be brought in.

The R-111-A line and the solid-blue line over on the east, our five-year mine developments, which have been submitted to the Commission in January as outlined in green, and State lands are in a broken-blue line.

Q Now, let's go through it a little more slowly so we can all follow that.

A All right.

Q The yellow line, do I understand, represents the exterior of the leases, basically the land held by Kerr-McGee under potash leases?

A Yes, sir.

Q Are most of those Federal leases?

A The majority are Federal leases, yes.

Q Approximately how far does the nearest point of the Kerr-McGee lease fall from the proposed Bass No. 2 site?

A Less than one mile.

Q Now, you say there are some errors in the Belco-oil-and-gas-lease agreement of the area covered by that?

A If I read their map right yesterday, yes, sir.

MR. ROBB: Now, Mr. Kellahin, I asked you to confirm that the information you had given me last year was accurate. I heard nothing further from you, so this is prepared on the basis of that.

MR. KELLAHIN: That is correct; you did ask me. It was my understanding at the time that it was correct, however, the Exhibit that was offered yesterday correctly reflects Belco's interests in this area. Any error in regard to their Exhibit, would have to be blamed on me.

BY MR. ROBB:

Q The dark-blue line that is over on the east side of this Exhibit, do I understand that that is the outline

of the New Mexico R-111-A area?

A Yes, sir.

Q And the green I believe you have identified as going the five-year-development plan for Kerr-McGee?

A Yes.

Q The blue over here on the left-hand side, the lower-left-hand side of the exhibit, what does that project?

A The unshaded blue in the green area?

Q The blue area, yes, within the green area.

A That shows open-mine workings.

Q All right. Does that indicate areas that have been mined up to the present time by Kerr-McGee?

A The areas shown here were mined up to January 1 of '74.

Q Is that shown at the very bottom of that Exhibit; is that what that means?

A Yes. Mined to date, 1/74.

Q Now, the green area over about the middle of the page which shows you driving toward the northeast and in the general direction of the proposed Bass No. 2 location, does that outline the approximate five-year-development plan that has been filed with this Commission?

A Yes, sir.

Q And is that the area that Kerr-McGee intends to mine within the next five years?

A We do.

Q Now, I notice down in the lower-left-hand side there among the existing mine workings, the open-land workings, you had a drift there as pointing up in the direction of this proposed location in the blue, that's the extreme-right-hand edge of the blue?

A Would you repeat your question again?

Q Yes. I notice over near the bottom of this Exhibit in the existing blue area, you seem to be going toward the northease in Section 3, is that correct?

A Yes.

Q All right, sir, and is Kerr-McGee presently working in this area at this time?

A Yes, sir, we are approximately at the section line between Sections 3 and 2.

Q Then you have advanced further from the date this map was prepared in January 2, 1974, in the direction of the Bass No. 2 well?

A There has been continuous operations in this area to the northeast.

Q Are those operations continuing at the present time?

A Yes, sir.

Q So would it be fair to say, then, that Kerr-McGee at this time is mining generally in the direction toward the Bass No. 2 well?

A Yes, sir.

Q When did Kerr-McGee start its operations in this eastern part of the mine going out in the general direction of the Bass No. 2 well, starting from the shaft or where you started from?

A I think it was in December of '71.

Q Have you in that period of time done mining in and around that core area before you started directionally out to the east, as you are going now, or the northeast.

A Would you repeat your question?

Q Did you do a good deal of mining in and around the shaft area before you started out to the northeast as you are going at the present time?

A Yes.

Q Would you explain, please, the system that you used in advancing your mining operation as you're doing

here in the area where you're now heading toward Bass No. 2?

A We have a four-rotor boring machine in this area, which as it indicates is a continuous-type mining machine. There is no blasting in the area. They're developing a five-entry system at a heighth of eight feet for our belt entry, and approximately five feet for the side entries, and we are advancing at a rate of approximately 600 feet a month.

Q 600 feet a month?

A Yes.

Q What is the boring machine; what does it do?

A It augers the ore from the face. It breaks it loose from the solid.

Q Is it a large machine?

A A machine that weighs approximately 50 tons, and 52 inches in height, 30-feet long. That would be the general description of it.

Q And it literally chews into the ore, does it?

A That is correct.

Q How, in your entry system how wide is that, how many machines do you have working in that area?

A There is one machine on this development, the

entry system to the northeast, the normal drift width is 25 feet.

Q 25-feet wide?

A Yes.

Q Would you describe, please, how Kerr-McGee intends to move out in this general area toward the northeast, including now the green area you have shown here, you show certain drifts going off to the side and also you show the advance; do you intend to continue with just one machine on the advance or will that be changed?

A On the advance of the entry system only, there will be one machine.

Q All right, sir. Just describe in general what your plans are within this five-year-plan area; what you'll do to implement that plan?

A The plans at present are to continue the development of the northeast mains to a point in the southwest quarter of Section 35, at which place the boring machine will be exchanged to a conventional unit. The conventional unit will develop the main both to the northwest and to the southeast.

Q Is that where you show a kind of intersection there?

A The intersection in the southwest quarter of 35.

Q With the blue lines going up toward the northwest and toward the southeast?

A That is correct.

Q Okay.

A At that point we have a transmission in our ore body where the top and bottom members of the 10th ore zone are mineralized. In the area where the boring machine is today, or the development of this entry system, the bottom member is only mineralized. So we're looking at present equipment limitations, we will use conventional mining where we have two member mineralization.

Q By that you mean ore at two different heights?

A We will be mining the total 10th ore zone. At the present time we are only mining the bottom member.

Q When you say you mine it by conventional methods, what do you mean?

A Drilling, undercutting, and blasting using explosives.

Q When you continue the advance, after you have reached this point, will you go conventional system?

A Yes, sir, driving the mains into the east.

Q You will continue, then, in the northeast direction

with your conventional method, if I understand you?

A That's correct.

Q All right. Then you get to the next intersection here; what is that?

A It shows development of another set of submains to the northeast, that is getting in preparation to set up additional panel areas which would be out in four, about four-and-a-half years.

Q What do you mean by "panel areas"?

A Panel areas where they're mined off the submain; where we can take our maximum extraction and still maintain haulage and travel routes to and from the area.

Q Is this what you call "first mining" or are you now referring to the total mining operation?

A To date Kerr-McGee has not used first and second mining terms. We found out early in our operations that the strength of our ore would not permit normal first mining, and then at some later date come back in and do second mining.

Q What do you mean, the "strength of the ore"? Do you mean it's not strong enough to hold up after you've done first mining?

A We are mining ore with a content of 7 percent

insol, where other operators in the Basin are normally operating around one, one-and-a-half percent of clay content.

Q What does that mean, the strength of the ground?

A The strength of the remaining pillar; it reduces the maximum.

Q So mining as you do, then, is a complete extraction of an area rather than first mining and then retrieving in a second-mining fashion?

A We use the terms "development of a panel" and "retrieve a panel" and the retreat immediately follows the development of the area.

Q Now, you showed this mining operation opposite Section 25 approximately almost to the center of Section 25, within this five-year period?

A Yes, sir.

Q Does this map also show the proposed or possible mining beyond that five-year period?

A Yes, sir.

Q Will you explain that to the Commission?

A The light-dotted-blue lines underneath would be our present mine plans, the layout of those mine plans, for the area to the northeast. Generally our mains are

on 5000-foot centers, or sub-main centers rather, normal panel connections would be 800 feet by 2500 feet in length. At a place in between Sections 30 and 36 there is a series of panels which are greater than the 2500 foot in length than the normal panel. That is brought about by other wells in this area, including Federal Bass No. 1 and the Audie Richards gas wells.

Q I notice those two blue lines beyond the green area going in a southeasterly direction, one on one side and one on the other side of the proposed Bass No. 2 location?

A Yes, sir.

Q What does that indicate?

A That there are sub-mains located; that's about the only spot available due to the Audie Richards and the Federal Bass No. 1 well at the present time.

Q You have a note there called "Proposed Bass Federal Well No. 2" with a circle around it, and then you have a small blue line going right to the center of that. Does that blue line and that small circle in the center indicate the approximate location of Bass No. 2?

A Yes, sir.

Q What is the small circle drawn around there

right at the center?

A That would represent a primary barrier pillar around a gas well and would be 300 feet in diameter.

Q What is the purpose of that?

A To give us protection if first mining was done in that area.

Q If a well were put in there, would it be your opinion that it would be necessary to leave that kind of pillar in which you would do no mining at all?

A That's correct.

Q Now what is the larger circle?

A The larger circle is a circle with a radius of 2100 feet which we would call our subsidence area, and the 2100 feet is derived from the depth from the surface to the ore zone.

Q Now, tell us what oil and gas wells were in that area, why would you leave a 2100-foot pillar and what mining would you do within that pillar?

A The 2100 feet or the depth from the surface to the ore zone represents the known subsidence angles which have been recorded in the potash area. Subsidence angle at 45 would be equal to the depth of the bed from the surface.

Q And in that area what mining would you do if you had a well there?

A It may be possible to do limited extraction mining up to 35 percent. There again at this time I'm not in a position to say if Kerr-McGee would do any mining in that area.

Q What would be the purpose of leaving the pillar in place, if you did leave it in place?

A The 2100 foot or the 300 foot?

Q The 2100 foot.

A To avoid possible contamination of the mine if there was a leak in a productive gas well.

Q Would that 2100 foot in general support oil and gas casings?

A I feel that it would prevent any damage to that well by subsidence.

Q In general, if the proposed Federal Bass No. 2 is not drilled, Mr. Lane, do these light-blue lines in this area indicate the approximate location of the entry system and the advance that you would use to extract whatever ore might be in the area?

A Yes, sir.

Q Now, I notice also in this diagram you have in

red an outline which is designated "probable ore outline."

A That is correct.

Q And what does that indicate?

A It indicates, to the best of my judgment, where commercial ore could be found or the possible limits of that commercial ore with the present data we have today.

Q What does that suggest with regard to whether or not, according to this probable ore outline, that there is probable ore underneath the proposed Bass Federal No. 2 site?

A Under this outline it shows that all of Section 30 and all the area under the proposed site would contain ore.

Q Now, I notice also on this Exhibit a black line starting in the lower-left-hand side there in Section 3 that starts "A" and connects the various ore holes. It starts with No. 50, is that correct?

A Fifty, that's right.

Q And goes to 103?

A Correct.

Q I can't read the next one.

A Eleven.

Q Eleven.

A 132.

Q 132

A 10.

Q 10.

A 155.

Q All right.

A The east to US 141.

Q All right, sir. What are you showing there basically?

A We have exhibits which will show a cross section ore in a little more detail on the data received from the core test of each of these tests.

Q All right, sir, well then we'll get back to that in connection with the next exhibit. Do I understand from this diagram then, Mr. Lane, that most of the mining that Kerr-McGee has done during the first eight years of its major mining operations has been in what you would call the central or northwestern portion of the mine?

A On this map, yes. There is some mining to the south.

Q Would you identify Exhibit No. 6, please?

A Exhibit No. 6 is the letter transmittal and the maps which were put on file with the Oil Conservation

Commission in January showing our five-year development plan and open-mine workings.

Q January of this year, 1974?

A 1974.

Q Is this your signature at the bottom of that letter?

A It is.

Q I call your attention to the language , "In addition you are being furnished with two copies of a map showing lands that will be developed by Kerr-McGee Corporation during the next five years." Is that correct?

A That is correct.

Q Is that Kerr-McGee's intention?

A Yes.

Q Now, over on page 2, what does that show?

A On my exhibit it shows the open-mine workings as of January 1, 1974.

Q And over on the lower-right-hand side does that show that same advance that is going on in the direct of Bass Federal No. 2?

A Yes, sir.

Q And what is on page 3 of that Exhibit?

A Page 3 shows our five-year-development plan

superimposed over the open-mine-working plans.

Q And these documents were actually filed with the Commission?

A Yes, sir.

Q On that date?

A Mailed January 22, 1974.

Q Have you superimposed that five-year-mining plan that's shown on this page 3 of Exhibit No. 6, on Exhibit 5 that we're looking at on that general layout?

A Yes, sir.

Q Okay. Would you explain to the Commission what Exhibit No. 7 is?

A Exhibit 7 is the cross section which we described before going from hole 50 which is located in Section 3 of 2131 through a series of holes and ending up in US 141 core test located over in Section 29 of 2033.

Q All right. Tell us first of all what a cross section is.

A A cross section is a diagram or sketch of what we found in the core itself as a result of the core test.

Q As a result of drilling?

A As a result of drilling, yes, sir.

Q All right, sir, and would you explain what the

colors mean?

A Colors, the top orange is the USGS marker 119 which is present throughout the potash area. The yellow would represent waste or salt; the brown would be a non-mineralized member of the 10th ore zone, and at the bottom is sylvite or K20 mineralization.

Q Now between the places marked "top member" and the bottom of the places marked "bottom member," is that the area replaced by the so-called 10th ore zone?

A Yes, sir.

Q All right. And then in order to see whether or not there is ore present in the 10th ore zone, do I understand you would begin at the top-dotted line there over in the left-hand where it says "top member" and then work on down or what's the trick: Do you blow one of them up and then look and see what it shows in that core hole; is that the area to look at basically?

A Yes, we can recognize where the 10th will be by polyhallite 119 marker beds. All members are easily recognized by clay partings always on the top and generally on the bottom also of each of the members.

Q By what, sir?

A A clay parting.

Q What is that?

A The clay seam can be a thickness of a 32nd of an inch to a half inch, but it is always present.

Q What is the significance of that seam?

A It occurs at the end of the mineralization cycle I would think so that it does define the top of an ore zone.

Q Looking at the bottom member, now, which is between on the left-hand side between the figures 1801 and 1797, you have shown an area in gray, is that, right in the middle of the purple bottom members?

A Yes, sir.

Q What is that?

A That is a high clay zone.

Q All right, sir.

A It will be anywhere in thickness from 6 inches to 18 inches and it can go up to 15 to 20 percent clay or insolubles.

Q Now going down, just tracing that bottom member from the left-hand side of this Exhibit all the way across to the right, is that clay member encountered in each one of the holes that were drilled?

A Yes, sir. You will find it in the bottom member

of any hole drilled in this general area.

Q Can you tell the Commission, please, whether or not that clay is a type of substance which would or would not permit the transmission of the migration of methane gas?

A I think it would afford a place where it could migrate.

Q Now, looking again at these colors if I understand you, the purple represents the ore?

A Yes, sir.

Q All right. The yellow represents the waste?

A Waste or salt.

Q All right. The brown represents what; is that wasted within the area?

A The area waste, it is not a mineralized portion of the ore zone. It contains high clays and salt.

Q All right. Then going from the left-hand side of this Exhibit over to the right, I noticed that you find ore in the first two holes in the bottom member and when you get to the third hole, which is described as I-132, do I understand that you have ore both in the top member and the bottom member?

A The bottom member is mineralized in the first

three holes, not the first two.

Q Yes.

A We have the transition from one-member mineralization to two-member mineralization between holes F 11 and I 132.

Q Now, is that the same situation you described just a moment ago when we were looking over here at Exhibit No. 5 where you were going to go from the boring machine to the conventional mining?

A That's correct.

Q As we continue to go over to the right, and we're going in a generally northeast direction, are we not?

A Yes.

Q As we go from the left side to the right side?

A Yes, sir.

Q And maybe, so the Commission can visulaize this, would you on Exhibit 5, the one we had before, can we tie the holes now on this cross section Exhibit 7 to the holes on Exhibit 5?

A Yes, sir.

Q Starting at the lower-left-hand side, where it says "A" we looked at that black line before.

A That is F 50.

Q That's F 50, that would be the hole on the left side of this cross section?

A Right.

Q Are we able to tell, then, from comparing these two exhibits that at the location shown on Exhibit 5 you found in the hole the information shown under F 50 in the extreme left-hand side of the ore zone?

A Yes, sir.

Q The cross section, I mean.

A Yes, sir.

Q And then the next hole would be what, 103?

A 103 is the next hole to the right.

Q All right. And then going from F 50 to 103 you're going in a generally north by northeast direction?

A That's correct.

Q And then the next hole would be the second cross section from the left on Exhibit 7, is that right, that's 103?

A 103 is the second cross section from the left.

Q All right. Likewise you can connect up each hole on this cross section with the holes shown on Exhibit 5.

A That is correct.

Q Do we then generally go, when you are going from the left side of Exhibit 7, that cross section, over to the right side, in a northeast direction and in the general direction toward the proposed Bass No. 2 well?

A Yes, sir.

Q And now going on Exhibit 7 over to the last two holes, I 155 and US 141; do you have those spotted?

A Yes, sir.

Q Now, going up to Exhibit No. 5 on the map, would the one on the extreme right, US 141, be the same as what's listed as A'?

A That's correct.

Q Over on the right-hand side of this Exhibit 5?

A That's correct.

Q That's the first hole to the east that you've shown on this?

A That is right.

Q That is the hole that we identified yesterday as being approximately 4200 feet from the proposed Bass Federal No. 2?

A That is correct.

Q All right. And then 155, I 155, which also has ore in two zones, two members?

A That is correct.

Q That would be, then, the hole on the section to the west of Section 30, is that right, in Section 25?

A That's correct.

Q And it's also designated on Exhibit 5?

A That's correct.

Q Now, in each of these holes that you have depicted here, can you tell us whether or not from this cross section these holes do or do not indicate the existence of commercial ore at those locations?

A All holes in this cross section represent commercial mineralization.

Q What is the significance of that, that as you go in a continuous line toward the proposed Bass Federal No. 1, that you find indications of commercial ore in every hole?

A That we probably have a continuous ore body from I 155 test over to the US test 141. Continuous ore would be present.

Q What does it indicate with regard to whether or not there is continuous ore from A in the vicinity where you are presently working over to 155?

A That would be continuous also.

Q Do I understand, then, that this cross section suggests the presence of continuous ore from the area where you are presently mining right up to the main vicinity of Bass No. 2?

A Yes.

Q And would that include the vicinity of Bass No. 2?

A Yes.

Q Would you please next identify Exhibit No. 8?

A Exhibit No. 8 contains our basic mine plan for the general area. Over on the right --

Q (Interrupting) General area of the proposed Bass Federal?

A Federal and northeastern portion of the property.

Q All right, sir.

A It contains contour lines which are referred back to as K20 feet which is the produce of the K20 value of the hole times the thickness of the mineralization. It shows the proposed Bass Federal No. 2 location in Section 30; probable ore is outlined again and it also contains the height and analysis values for most of the holes over on the right-hand side.

Q All right, sir. Now the blue lines that you

have going to the southeast and northwest are the same blue lines that we showed in the earlier Exhibit 5 that showed your general mining plans in that area?

A Yes, sir.

Q Now, these holes that you have shown here, over on the right-hand side, you have a line connecting three holes. 29 on the east side; I can't see the one on the south.

A It's 29.

Q 29, okay, and then up to the northwest is 155?

A That's correct.

Q 155 and 29 are the two holes that you showed on the earlier exhibit, the cross section?

A That's correct.

Q Oh, I'm sorry; I confused Section 29 for hole 141 up in the northeast. I apologize. The hole on the northeast side, to make the record clear is US 141?

A Correct.

Q And the hole to the south in that short triangle is F 29?

A Correct.

Q Now, you have a legend at the bottom that says, "Probable ore outline," and that seems to start a line

right approximately a little bit below F 29, that's the southerly hole, right?

A Right.

Q And it goes around, and then there's a dotted portion of it over there on the east side, and it goes up through Section -- let's see -- 33, what is that section below 30?

A 31.

Q 31, I'm sorry, and then it goes around on the extreme east side of this Exhibit that you call "Probable Ore Outline"?

A Yes.

Q All right. And then you have some additional, on that line you have 60, right next to that hole F 29 you have the letters 60. What does that mean?

A 60 would be a K20-foot line, which would represent four feet at 15-percent ore or 5 feet at 12-percent ore, that would be reasonable values.

Q That is multiplying the grade times the thickness of the ore?

A That is correct.

Q And is that the outline of the probable ore of the grade product of 60?

A That hole in the vicinity of hole F 29.

Q Yes, and the dotted line running to the east and the northeast from there.

A The dotted line to the east and northeast would represent the same 60 line that are available to the southeast, so I put it in as a dotted line.

Q That's why you drew it in as a dotted line?

A Yes, sir.

Q Let's go up to the next line, now, which is entitled "80." That's just up a short distance to the northwest from hole F 29?

A That's correct.

Q What does that mean?

A That represents the 80 K20 feet.

Q All right, sir. And does that intersect the proposed, the 2100-foot area surrounding the proposed Bass Federal No. 2 as you go to the northeast?

A It does.

Q Then the next line is what, 100?

A 100.

Q And then 120?

A 120 and so on up through.

Q And then up to 140?

A Correct.

Q Do those lines indicate that in your opinion, or what does it indicate?

A It gives a value of ore which you may expect to find in that area taking height and grade which are the two most important factors in any mining operation, and as long as height mainly fits your mine equipment or your mining method and the factor is still above your cut-off grade, I mean above your cut-off factor, it should be mineable ore.

Q When you say it "should be mineable ore," would you please explain to the Commission whether or not based upon this contour or K20-feet method that you made, was this done by you or under your direct supervision?

A Yes, sir.

Q Were all the maps that we have prepared prepared by you or under your direct supervision?

A Yes, sir.

Q What does this K20-contour map indicate with regard to whether or not, in your opinion, there is probable ore underneath the Bass No. 2 proposed location and the 2100-foot area surrounding it?

A In my opinion the area in question is underlain

by commercial ore.

Q Now, I notice that the Section of Bass No. 2 is right in the center there of that circle, lies between the 80 and 100 lines under the contour method, what does that indicate to you with regard to the grade produce of the ore at the place where they propose to drill?

A The well above our reserve cut-off values or our mining cut-off values?

Q What value would that suggest at that location, approximately?

A Slightly over 90.

Q All right. Now, did you have what is known as a cut-off that you use in calculating ore reserves or does Kerr-McGee have?

A For ore-reserve calculations we use the cut-off of four-and-a-half foot in height and 14-percent K20.

Q And what grade product does that give you?

A 63.

Q 63?

A Yes.

Q All right, sir. How do you arrive at that cut-off point?

A The cut-off values we use on our ore reserves

was established about the time we went into operation and for continuity of reserves and everything, we still use the four-and-a-half or 14 percent which was considered commercial at that time.

Q Has experience in the mining and milling business in this area since that time confirmed that this is an economic reserve cut-off figure?

A It has for reserves.

Q So for the purposes of computing ore reserves, do I understand this correctly, Mr. Lane, that you treat as commercial ore anything down to 63 grade product or above?

A Yes, sir, for reserve calculations.

Q Now, do you have a different or lower cut-off that you use when you're actually underground mining?

A Underground mining I would say in nearly every case when we have gone to the limits of the ore body, we have dropped that in actual practice down to about 11 percent at four-and-a-half feet or a product's value of around 53.

Q Do I understand correctly, then, that in actual practice, when you are actually mining underground, you will mine ore down to a grade product of 53?

A Yes, sir, in most cases at the extremities of an ore body or individual units.

Q Is the entire Belco site, the entire 2100-foot radius, or 4200 diameter around the Belco well, above the 5300 mining cut-off?

A Yes, sir.

Q Is the entire 4200-radius diameter of that gas well above the 63 on its ore reserve cut-off?

A Yes, sir.

Q Now, this K20 method that you used or the contour method that you used, is this the same as the contour method that was testified yesterday by Mr. Warnock?

A Methodwise, yes.

Q Now, in arriving at this ore determination, what values did you give to the three closest holes that form the triangle that is shown here, that is the three closest holes to the Bass No. 2.

A Starting up in Section 25 with hole I 155, that has a height of ten feet at 13.9-percent K20 or a K20-foot-contour value of 139.

Q That was a different figure than was used yesterday, isn't it?

A Yes, sir.

Q What is the difference between the figure you used and the figure that Mr. Warnock used?

A I think Mr. Warnock used only the sylvite value, which was shown on the log, where I've used the value of carnallite also.

Q Why did you use the value of carnallite?

A In our type process all values report when we have a chance of recovering it.

Q You used the milling system or process that Mr. Warnock had assumed you used yesterday?

A No, sir.

Q What system do you use?

A We use a flotation system where all mineralization is dissolved, put into solution, and it is recrystallized back out.

Q Do you consider the carnallite that's in this hole to be a detriment to the milling process as Mr. Warnock assumed yesterday?

A No, sir.

Q Do you expect to recover positive value in that?

A Yes, sir.

Q Is that why you included that in your calculations?

A Yes, sir, that was the reason it was included.

Q Now, the values you have described to hole No. US 141 on the northeast side and F 29 on the south are essentially the same values as Mr. Warnock?

A Yes, sir.

Q Is that correct?

A Yes.

Q But you arrived at a different calculation?

A I did.

Q Now, in making up an ore reserve determination, do you use the same category that Mr. Warnock uses, "possible, probable, proven" ores?

A Yes.

Q I believe your conclusion here is that this is probable ore?

A It is.

Q Now, how do you arrive at what is probable ore based on Kerr-McGee's practices and experience in the mining business in this area?

A My thoughts on it are when you have several drill holes at wide spacing which are located adjacent or a proven ore body, and also a big factor is actual mining operations in the general area.

Q Now, here you have three holes that are rather widely spaced, is that right?

A Yes, sir.

Q What is the distances essentially between 155 and 141 on the north side there?

A I think it is approximately 12,000 feet.

Q Do you have a calculator?

A No, I don't.

(Whereupon, a discussion was held off the record.)

Q Okay.

A Approximately 12,000 feet; its under 12,000.

Q And the distance between 141 and F 29?

A Slightly over 8,000 feet.

Q And then the distance from F 29 up to 155 on the other side of the triangle?

A Approximately 10,000 feet. I'm making these measurements off of the map that has been reduced from the actual scale map and it's not quite correct. It's approximate.

Q I see, okay. I had written down 10,500. Let me ask you this, Mr. Lane: You mentioned, now, that in arriving at this reserve you considered not only the

findings of these particular holes, but the proximity of these holes to a proven-ore deposit, is that correct?

A Yes, sir.

Q Where is that proven-ore deposit?

A Proven-ore deposit within our lease would be approximately 4500 feet to the northwest.

Q All right, sir. And that was a factor in your conclusion that this is probable ore?

A Yes.

Q You also mentioned that one of the factors that caused you to conclude this is probable ore was your mining experience in the area.

A Yes, sir.

Q During the eight years that you have been mining in this general area some four miles, four-and-a-half miles to the southwest, has your mining experience contributed to this result and in what way?

A The area around the shaft and to the northwest, the actual results of that mining has been very close to the original estimate from the drill hole data; the bottom member of the 10th ore zone is fairly consistent. It usually represents a large area of influence. I mean you can give a large area of influence to any hole that

has good bottom mineralization.

Q Is that the reason you prepared that earlier exhibit, cross section, showing a continuous seam of commercial ore in the bottom member starting from your existing mining operations all the way over to the vicinity of Bass No. 2?

A Yes, sir.

Q Now, based upon your use of this K20 or contour method that is depicted here in Exhibit No. 8, have you attached the data sheets concerning these three holes in question, US 141, F 29 and I 155 as exhibits 8-A, 8-B and 8-C to Exhibit A?

A Yes, sir.

Q Do they show what you have testified to?

A Yes, sir.

Q Now, based upon your conclusions that there was probable ore in the vicinity and under the proposed Bass No. 2, have you made calculations concerning the amount of ore that is located within that 2100-foot pillar?

A I have.

Q Are those calculations depicted on Exhibit 8-D?

A They are.

Q Would you turn, now, to Exhibit 8-D and explain

what page 1 is?

A Page 1 shows the mathamatical values which we used in determining K20 tons which may be present under the proposed location. Going back again to Exhibit 8, the contour map, you see that the proposed area is encompassed by values which may range from 105 on the north side of the circle to some values of 75 on the south side. We broke down the contour; instead of a 20-foot contour interval, like we have on Exhibit 8, to approximately two-and-a-half foot K20 contours so our calculations would be a little more accurate. Doing that we come out with 12 different areas.

Q Within this proposed 4200-foot diameter?

A We used 12 different areas to make our calculations firm.

Q All right, thank you.

A On page 1 of Exhibit 8-B, the numbers on the first left-hand column, the area number, you see 12 of those, and that will be going from K20 values, areas with K20 values, from approximately 105 down to 75. The second column from the left is planimeter reading.

Q That's under the K20-feet column?

A No, on the second column from the left we have

planimeter readings.

Q But the K20-feet values are shown in the third column?

A That's right.

Q And that .7625, the fourth line, too, if I understand you correctly, the extreme south edge of that 2100-foot radius around the proposed Bass No. 2?

A It is.

Q And between those two contour lines shown on Exhibit A between the 60 and the 80 lines?

A Yes.

Q And then the figure at the top where you say "Area No. 1" under the K20 5th column, would that be the north edge where the contour line would intersect the north edge of that circle around the proposed Bass No. 2?

A Yes, sir.

Q And so these are calculations of values between?

A That is correct.

Q And now proceed if you will, please?

A We make a planimeter reading, which is the second column from the left, for each of these 12 areas. All that does is give you a reading which is calculated back into the planimeter itself, and will give you area in

square feet. The fourth column over is the factor that was used and that factor is one planimeter reading which was equal. In this case we used a map with a scale of 4 inches equal one mile. That factor calculation would be one square inch on a four-inch map would equal 40 acres of 1320 feet squared divided by a factor of 15.3 which represents the number of cubic feet of ore in a ton of ore. The values over on the right-hand side of this sheet are K20 tons in each of these 12 areas, some of which would give K20 values of the total circle.

Q Now by K20 tons, do you mean the amount of ore that has actually been taken out of there?

A K20 tons?

Q Yes, sir.

A That's what we would expect to mine from that area, yes.

Q Is this the amount of raw ore that you have taken out of there?

A That is the ore in place, yes, sir.

Q That figure that you have, you're planning basically in this area about what grade of ore?

A In the area of the proposed oil well?

A Yes, sir. What grade of ore would you be mining,

based on your calculations?

A 14.5, 15 percent.

Q And then of every ton of ore you take out of there about 14.5 percent of it would be, or for every ton of material you take out of there about 14.5 percent of it would be ore, or 14.5 percent would be K20 content?

A Right.

Q So actually you would be moving more tons than this, wouldn't you, in a mining operation than 762,000?

A Yes, more tons, yes.

Q These would be the number of tons if you had 100-percent K20 content, is that right?

A This is the value of K20 tons in this circle. We don't mine K20 tons; we mine tons which have potassium chloride, and this is converted over to K20 system.

Q Okay, fine. We'll get to the other system where you made the calculation of the actual tons in place.

A Right.

Q Now on the second sheet, what does that show on Exhibit 8-D?

A It shows the calculation which base figure came from the first page, taking that K20 value and running it through to product tons or the tons we expect to ship

to the market.

Q After you have processed it through your mill?

A Yes, sir.

Q Will you explain to the Commissioner how you arrived at these calculations and what your result was?

A On page one we obtained the figure 762,254-K20 tons in place. Under normal mine plans we would expect to have an extraction in this area of approximately 80-percent mine extraction so we would reduce these tons in place to the 80-percent figure. Then the tons that are mined, we ship to the mill and in the mill we expect a 82-percent milling recovery and we produce a 52-percent K20-product value, and so the tons that the mill receives would be 609,803-K20 tons. They will lose 18-percent of that, so in the product that is made by the mill is still in K20 tons, which is divided by the product grade, which is 62 and we would end up with an expected product produced in this area of 806,513-product tons.

Q All right. Do I understand that you are assuming that there was no well in this area yourtree to extract 80-percent of the material that was in place?

A Yes, sir.

Q All right, sir. You call this your normal mine

plan?

A Normal mine plan.

Q Now, in the lower part of that sheet have you made calculations what the loss would be if it was necessary to leave the 150-foot radius pillar in place and only do 35-percent first mining in that 2100-foot radius?

A Yes, sir.

Q All right. Have you made the calculations, in other words, of the amount of ore you would lose if you had to leave those pillars around this proposed well site?

A Yes, sir. With 35 percent extraction and the same milling recovery in product grade, we could expect to obtain 352,350 tons from the second plan of mining.

Q All right, sir, and have you calculated what that loss would be in terms of retail value or sales value of the milled product?

A Yes. It is the difference our normal mine plan and a mine plan with no second mining which would be the difference of the two values, and that would amount to 453,663-product tons which would be lost to the well.

Q Do I understand you correctly, Mr. Lane, that would be the amount of resale value lost as a result of

leaving this ore in place and not mining it?

A That would be the loss by only doing first mining or 35-percent mining in this vicinity.

Q That would be the value of the material that is not extracted and processed?

A Correct.

Q Did you use another ore reserve calculation procedure in order to back stop or verify or to give further assurance to the ore calculations you have just described under the K20-feet or contour method?

A Yes, sir.

Q Will you explain to the Commission, please, what that was?

A Referring to Exhibit 8-E, is what we call a Triangular Method. It is the use of three test wells which encompass most of the area in question. You get a value for the triangle by averaging the data from the three test wells and use it for all of the area encompassed.

Q Now, are the three holes you've used here the same three we have been discussing?

A Yes, sir.

Q And is this diagram sort of a blow-up of the triangle that appears on Exhibit 8 we looked at

earlier?

A It is.

Q This just shows more detail?

A Yes.

Q All right, sir. Will you explain to the Commission how you go about doing that?

A Taking three holes and it is a straight average of the height and grade of each or K20 values of each and in this case the three would average out 6.48 feet in height and a 14.7-percent K20 grade.

Q Will you explain to the Commission, is that your opinion based on the Triangular Method of grade and thickness of the ore expected to be encountered within the triangle?

A It is an indicator, yes.

Q Maybe my question wasn't quite accurate. Within the triangle and the adjacent parts included within the whole 2100-foot radius, is that what the figure is, the whole 2100-foot radius around the well?

A Yes, I would use it for the 2100-foot radius.

Q Now, will you explain to the Commission what your experience has been with the Triangular Method. Is that a method normally and customarily used by Kerr-McGee in ore-reserve calculations in this area of the Carlsbad Potash

Basin?

A Yes, sir.

Q Now, you start out in the mining business, do you not, Mr. Lane, with some drill holes? You can't look under the ground, can you?

A No.

Q Okay. Do you, after you have drilled some initial holes, drill some additional ones in order to develop a mine plan? Just explain to the Commission how you go about mining, and then I want to get back to the correlation whether or not you have confirmed the validity of this method of ore-reserve calculation by your mining.

A In the case of Kerr-McGee, the original exploration started in 1952; a series of holes were drilled and evaluated by several companies, and in 1957 the data obtained from this early drilling was thought sufficient so they go ahead and start construction of property, at least to put down a production shaft. Things were delayed -- and I do not know the reason why they were delayed between 1957 and '62-- but at that time they did do some extra drilling generally in the shaft or around the shaft area or plant-site area. They added ten holes within approximately four sections, and the results from the original drilling

coupled with the results of the last ten holes that were drilled showed no difference in results for ore-reserve calculations. They still had roughly the same grade, same tons, same things available to them.

Q So the additional drilling made no difference in the result?

A Not in that case, the ten holes covering some four sections.

Q And then were some of those additional holes done for the purpose of developing a specific mine plan or was that done later?

A Are you talking about the ten holes I just described?

Q Yes. I'm really trying to get the procedure that you used.

A I'm sure they were used for specific mine plans at that time. I know they were used later.

Q Do you drill holes only for the purpose of outlining ore reserves or do you drill holes also for helping you to develop a specific mine plan in an area?

A You drill holes to obtain results to meet both those ends. We drilled a series of holes last summer which were primarily for mine planning, and that's to the northeast of the present workings, and that was to better

delineate our two-member mineralization of the 10th ore zone so equipment plans could be made at this time.

Q Were those the holes that Mr. Warnock referred to yesterday as the holes you had to drill in order to block out your ore and prove your ore reserves?

A Yes, sir.

Q And were they drilled for that purpose?

A Not primarily, no, sir.

Q What were they drilled for?

A For equipment selection and mining plans.

Q Now, after you have done your drilling and sunk a shaft and go underground, then is it correct that you are able then to look back to see whether or not you're pretty close to what your ore-reserve projections were before you went underground?

A That's the proof of the pudding, yes, sir.

Q All right. And does Kerr-McGee do that in order to attempt to verify the accuracy of its ore-reserve practices?

A We do.

Q Will you tell the Commission, please, whether or not that kind of study or that kind of review has resulted either in verifying or not verifying the validity of the triangular method of ore-reserve calculations you have used

here in this case?

A In most cases, it will verify the triangular method.

Q And have you from your practical experience found that the contour of K20-feet method, as you have used it in your testimony before the Commission today, is or is not verified by your actual experience in mining?

A That is also verified.

Q Now, sir, did you make the same calculations or did you arrive at the same results from the triangular method of ore-reserve calculation and from the contour method K20 method that you testified about earlier today?

A Yes, I ran it off by the triangular method also to look at the product value which might be lost by this well and, simply, they are the same.

Q Is the result of those calculations shown in the second sheet on Exhibit 8-E?

A Yes, sir.

Q Will you run very quickly through those for the Commission.

A Looking at the second page at the top, the area of the 2100-foot circle would be equal to some 13.8-million square feet. From that we deducted 1.15-million feet which we considered lost to the Federal Bass No. 1, giving a

remaining area of some 12.7 million square feet left. Coming down to the actual calculations we took 12.7-million square feet divided by our 15.3-cubic-feet-per-ton factor and we have a heighth of ore of 6.48 which again is the average of the heighths of the test wells. Multiplying the area times the height will give us also -- which includes the tonnage factor -- you'll end up with 5,379,626 tons in place at a grade of 14.7 which is the average of the three grade values of these holes resulting in a K20-ton value of 790,849 tons.

Q Now, does that compare with the figure that we used over on the contour method or the K20-feet method of 806,000?

A The 790,000 figure which I just gave for the triangular method compares with the 762,000 figure of the K20-foot method.

Q I see, and that is why you say the results of the second method of ore-reserve calculations were essentially the same as the first?

A Yes.

Q All right. The second one revealed a little higher figure?

A Yes.

Q All right, sir. More tons. And then did you

the same calculations based upon 790,000 K20-ton figure that you did with regard to the calculations to the K20 feet, in otherwords did you determine what the value would be of the product if you could remove it without having to worry about the well and how much retail value would be lost if you had to leave that same pillar around that well?

A Yes, sir.

Q Are these results depicted on the rest of the Exhibit?

A They are.

Q What value did you arrive at with regard to the sales value of the mill product that would be lost if you were not permitted to do any more than mine 35 percent around that well?

A $16,000,000.

Q That's a slightly higher value than by the other method?

A Yes.

Q Going back up to the middle of this Exhibit, do I understand this 5,379,000 tons, is that actually the amount of material you would move?

A No, that's the amount in place before any mining starts.

Q Okay. How does that compare with the amount of ore that Kerr-McGee mines each year, both full and annual production?

A It is slightly over a year, year-and-a-half.

Q Do I understand your testimony to be that you must maintain this 2100-foot pillar and the 150-foot pillar and only have 35-percent first mining; do I understand correctly that you would leave in the ground unmined and unused more than one year's total supply of ore that Kerr-McGee uses in its present operations?

A Yes, sir.

Q Now, sir, you used in calculating your values a price of $33.89 per ton of product, is that right?

A That's correct.

Q You testified, I believe, that that was the value of the ore that was the closest price of the ore in the Carlsbad Potash Basin for your --

A (Interrupting) Posted price for the finished product, yes, sir.

Q All right, sir. Would you explain what Exhibit 9 represents, please?

A Exhibit 9 is a copy of the price schedule which is distributed publicly. It shows the price in units of K20.

We ship a product which has a minimum value of 62-percent K20, or units of K20, so we arrive at a value for a ton of a product by if it is a course product, we would use 55 cents per K20 unit or it would be 55 cents times 62 or some 33-plus dollars.

Q Then you convert units into tons?

A Units into values, meaning into dollars.

Q Yes, sir.

A Our product split is a third and a third and a third of standard. We make a third standard-grade product, a third course-grade product and a third granular-grade product, so in this case here we'd average those up and we can derive at an average value for our product.

Q First of all, this represents 100 percent so you have to convert 62 percent, is that right?

A All muriate of potash is sold by K20 value. A ton of product is essentially 100 percent potassium chloride so this is a conversion to potassium oxide.

Q All right, sir. Then you convert it to tons from units?

A No.

Q How do you work the mathamatics on that? Oh, I'm sorry; dollars to units, that's how you arrived at the

33.89?

A Thirty-three.

Q All right, sir. And is Kerr-McGee actually selling potash ore for the posted-field prices?

A To the best of my knowledge, they are.

Q Now, Exhibit No. 10; would you look at that, please?

A Yes, sir.

Q What does that show?

A The base map the same as several we've looked at before so open-mine workings over on the left-hand side, coupled along with the five-year development plan shown on the cross-hatch. There are test wells without value on them and also existing gas wells over on the right-hand side.

Q You show the Bass Federal No. 1 up there?

A Yes, sir.

Q At the top, and two of the Texaco wells right below there?

A That's correct.

Q In other words, you've shown those three wells plus the one proposed well that are within the probable-ore outline, is that correct?

A Yes.

Q Now, you also have the proposed-mining plan shown in there, those lines going down there, blue lines, into the area of the Bass Federal No. 2, is that right?

A Yes.

Q Now, Bass No. 1 and the two Texaco wells, that area you've not shown as any mining being done under there, is that correct, except your drifting through between Bass Well No. 1 and that northerly Texaco well in order to get down to the vicinity of Bass Federal No. 2.

A On the Exhibit, we show panels laid out throughout the area but that would be our sub-main system to the end of the area of the proposed Bass Federal No. 2.

Q All right, sir. Now if the Bass Federal No. 2 is drilled and it is necessary to leave this 2100-foot pillar that we've described before, would it be economic for Kerr-McGee to go in this area and try to mine the area between Bass Federal No. 2 and those two Texaco wells?

A When this mining takes place, it might not be.

Q If you were going into that area and all you could get out was the ore between Bass Federal No. 2 and those two Texaco wells, would that by itself be an economic--mining operation?

Q Would you repeat that again, please?

Q If the only ore you can get out of this area is the area not covered by the circles, not included within those subsidence-color circles, and namely the area between Bass Federal No. 2 and the two Texaco wells, would it be economic for Kerr-McGee to go in there and mine just that area there outside those circles?

A I haven't made a special study of it, but I believe it would be economical today to do it.

Q If that were the only ore that you had to take out?

A Yes.

Q All right. I believe that's all on that. Now, are there any other holders of Federal potash leases in this immediate area except for Kerr-McGee?

A Not in there. The closest would be approximately two miles to the northwest.

Q Are there any other operations being conducted at this time by any potash company that are as close as Kerr-McGee's operations?

A No, sir.

Q How far away is the nearest operation other than Kerr-McGee's?

A I would think National Potash would be some eight miles, approximately eight miles.

Q Do you know of any operator in this area who could economically mine this area covered by the Bass Federal No. 2 except for Kerr-McGee?

A No, sir.

Q And why could Kerr-McGee mine that and the others not?

A It is adjacent to our present leases and is in the general vicinity of our proposed-mining operations. It's an integral part of it actually.

Q Now, part of the area within this 2100-foot circle of Bass Federal No. 2 is included within the State lease to Teledyne, is that correct?

A Yes, a quarter of Section 30 belongs to Teledyne, yes.

Q So a portion of the 2100-foot radius around the proposed Bass Federal No. 2 is included as a large portion of it in that State lease to Teledyne, is that correct?

A That's right.

Q All right. Kerr-McGee then could not completely mine that circle without making some deal with Teledyne, could it?

A That's correct.

Q And have you had any discussions with Teledyne concerning the possibility of negotiations for that?

A Yes.

Q Has Kerr-McGee, in fact, in the past had other successful negotiations with Teledyne while you described this in the other part of the mine where you're mining some of their products and have you had any indications from Teledyne that they are willing to negotiate that kind of a deal where you could mine their ore in this area?

A Yes, sir.

Q Is this the expectation of Kerr-McGee in the normal course of events: Application will be made to the Federal Government to obtain a Federal potash lease on the area embraced by the Bass No. 2 location?

A At the present time there is, yes, sir.

MR. ROBE: Now, we're going to go into things like subsidence that we're going to have to take up with the Commission.

MR. PORTER: We'll take a ten minute break.

(Whereupon, a short recess was had.)

MR. PORTER: The hearing will come to order, and please excuse the delay. Notice the proposed location

is on our Federal land as administered by the United States Geological Survey, and we would at this time like to thank the USGS for having a number of representatives attend the hearing. I'm advised that they're going to have to leave. They were trying to get some idea of how long we thought that this proceeding might go on, and, of course, we don't know, so because of prior travel arrangements they're going to have to leave and so we're really sorry gentlemen that you can't stay for the rest of the hearing but as you have requested to me, we will make available to you a copy of the transcript as soon as it comes out. Thank you very much.

MR. ROBB: Before they leave, I would like to make an apology to the USGS for the fact that in the letter of February 18, 1974, addressed to Mr. Fulton, we used an erroneous sales price in calculating the amount of ore lost to the well. We used a $24 figure instead of an approximate $34 figure, and I want to apologize to USGS before they leave.

MR. PORTER: You may resume your examination of the Witness. Thank you very much, gentlemen, for coming to the Hearing.

MR. KELLAHIN: If the Commission please, in the

interests of trying to save at least some time, in the question of subsidence, Belco is prepared to stipulate that subsidence will occur when section mining is done; that subsidence could cause to generate terrific forces in strata overlying the potash mine; that the 45° angle for determining what pillars should be left around a well bore is a valid concept for the purposes of first mining. We will not stipulate that even though we will stipulate it's possible that the forces generated could possibly rupture a casing in a well, we will not stipulate, however, that a well that has been drilled, completed, produced, plugged and abandoned in accordance with the provisions in R-111-A -- and as proposed by Belco -- would rupture or would permit methane gas to escape into potash formations or any mine workings. We will not stipulate that second mining cannot take place around a well bore when the well has been produced to abandon.

MR. PORTER: Mr. Robb, would you say that such a stipulation would shorten your testimony?

MR. ROBB: I think so. I've got to be sure that I understood him correctly. You will stipulate, as I understand it, that any mining within this 2100-foot radius would result in some subsidence, do I understand you correctly?

MR. KELLAHIN: Yes. We'd stipulate that any second

mining would result in some subsidence.

MR. ROBB: Even first mining.

MR. KELLAHIN: We're not talking about first mining as I understood your proposal; you would leave a 2100-foot pillar around the well bore in first mining.

MR. ROBB: Yes, but there is a possibility of subsidence in the first mining, if you take it out.

MR. KELLAHIN: We won't stipulate to that.

MR. ROBB: Subsidence would be within the potash formation as well, you're not meaning to exclude that because the flowing salt?

MR. KELLAHIN: We're not agreeing that there's any potash in this area.

MR. ROBB: All right, in the salt section.

MR. KELLAHIN: In the salt section if subsidence would occur, we would assume that you would have mined the potash before the subsidence occurred.

MR. ROBB: Yes. Will you stipulate that ordinarily the subsidence is approximately 65 percent of the height being mined at the surface?

MR. KELLAHIN: We will not stipulate that subsidence would extend to the surface from 2100 feet.

MR. ROBB: Let me confer with Mr. Lane, if I may.

MR. PORTER: I doubt seriously if we are going to save any time I think because --

MR. ROBB: (Interrupting) We're going pretty fast.

MR. PORTER: (Continuing) What would have to happen here before a stipulation, Mr. Kellahin would have to state clearly what he would be willing to stipulate to point by point so it can be made into a clear record and then you would have to agree to that. It appears that would take a lot of time point by point so, we'd like to shorten the Hearing, but I think we probably wouldn't save any time, so we might as well proceed.

MR. ROBB: Mr. Porter, we move the admission of Exhibits 4, 5, 6, 7, 8-A, 8-B, 8-C, 8-D, 8-E, 9 and 10.

MR. PORTER: Are there any objections to the admission of these records?

MR. KELLAHIN: We have no objection to admission subject to motion on any matters developed on cross examination.

MR. PORTER: Well, under those conditions they'll be admitted.

BY MR. ROBB:

Q Mr. Lane, during your 20 years of actual experience

in the Carlsbad Potash Mining Basin, had you encountered the phenomenon known as subsidence?

A Yes, sir.

Q Will you tell the Commission what that consists of?

A It's a phenomenon that results from high extraction of potash ores and results in crushing of your remaining pillars underground; it causes the plastic flow in the salt formations right above the mining zone; results in the fracture of what we call the over burden of the area from the surface to the salt section; it results in the actual subsidence of the dropping of the surface to approximately two-thirds of the mining depth underground.

Q That much subsidence takes place at the surface level?

A Yes, sir.

Q This phenomena of subsidence, when you mine out underneath the ground, you're mining in a cavity, is that right?

A So speaking, yes.

Q What causes the subsidence?

A It's the removal of supports within the ore zone; you reach a certain point where the pressures of the

overlying stratas will completely crush-out your remaining supports left after second mining.

Q What percentage extraction is customary in the Carlsbad Potash Basin, specifically in Kerr-McGee's operations?

A Kerr-McGee's? Upward of 80 percent.

Q This subsidence that takes place that you testified is a 45° angle, how is that computed?

A That is derived at from actual elevations run on the surface and plotting these changes in elevation on the surface from underlying workings.

Q Would you describe just very briefly what the geology is in this area and what the flowing processes and cracking process is?

A General geology in the area, we have what we call the over-burden which consists of sand, caliche, and gypsum for several feet; sandstone, limestones, shales, and clays, and some water-bearing dolomites just overlying the salt section, and this over-burden will range in 300 to 400 feet in the west to some 900 to 1000 feet out in Kerr-McGee area on the eastern side of the Basin. Underlying what we call the over-burden would be Salada formation which consists of hallite beds intermingled with clay seams,

polyhallite beds anhydrites, and some mineralized-potassium zones.

Q And the potash is contained within the salt zone?

A Yes, sir.

Q The salt zone is known as the Salada?

A Salada.

Q Okay. Above the Salada is it designated the Rustler Formation?

A Rustler Formation overlying the Salada.

Q All right, and that's the part you identified, you call it in a general classification, the over-burden?

A Yes, sir.

Q And that did you say contains limestone, dolomites, clays and shales?

A Shales.

Q Have you actually observed this subsidence in mined-out areas in this area?

A Yes, sir.

Q On numerous occasions or a few?

A I'd say numerous.

Q In connection with what operations have you observed this subsidence, what company operations?

A As an employee both with International Minerals

and Kerr-McGee.

Q And are these both within the Carlsbad potash area?

A Yes, sir.

Q Would you describe just very briefly what that has done to the surface?

A I have visually seen surface cracks over two properties, those being Southwest Potash Company and U.S. Potash Company, where you have tension cracks visible on the surface. Underground you can see a bending of the salt roof; sometimes it will block out the fall for a short height or distances above the ore zones and crushing out of the ore pillars that are remaining, and you visualize nearly complete closure of the ore zone.

Q Do you mean by that that the roof or the top will come down and meet the bottom or back to the floor?

A Yes.

Q And about how long does that take to occur in your experience?

A For the back to meet the floor?

Q Yes, sir.

A I think this would occur in five years, or approximately five years, maybe a little bit more.

Q Is it your opinion that essentially all of the subsidence will be completed in approximately five years?

A I believe it would be. I have to qualify that a little bit. That is in areas where large extractions have been extended over a large area of the mine without existing entry-ways or something else which are still standing.

Q Now, have you observed or are you familiar with subsidence encountered in the Carlsbad potash area?

A Yes, sir.

Q Have you actually observed this condition?

A I observed subsidence and these conditions both on the surface and underground at the U.S. Potash Company's holdings.

Q Will you please, in Exhibit 2, Exhibit B attached to there, that is a report on underground movement and subsidence over the United States Potash Company mine -- as part of Exhibit 2 that the Commission has in front of them -- are you familiar with that report?

A I am familiar with the report, yes, sir.

Q Does that report accurately describe the conditions of subsidence that you observed in that ground?

A Yes, sir, very well.

Q Moving in the introduction of Exhibit B to Exhibit 2.

MR. KELLAHIN: If it please the Commission, Exhibit B to Exhibit 2, did you say?

MR. ROBB: Yes, sir, that's right.

MR. KELLAHIN: Is that confined solely to subsidence?

MR. ROBB: Yes, sir. It's a report on subsidence with attached diagrams showing the measurements that were taken of the subsidence in that area.

MR. KELLAHIN: We have no objection to admission of Exhibit B to Exhibit 2.

MR. ROBB: None of the copies I have seen are very clear and only one copy that I know of, and that's Bob Lane's copy. They're all pretty bad. I'm going to ask Mr. Lane if he will make his copy available to the Commission so we can all have a rather better copy.

MR. KELLAHIN: I would ask that Exhibit B be extracted from Exhibit 2 and made a separate exhibit rather than leaving it in the form it is presently in.

MR. ROBB: All right.

BY MR. ROBB:

Q What happens in that Rustler Formation above the

salt beds when that condition of subsidence that you have observed occurs?

A It is indicated by the surface cracks. We do have fracturing.

Q All right, sir. What happens down in the salt formation when the subsidence occurs?

A In all indications, we have pressures which will cause the salt section to flow or a type of plastic flow.

Q All right, sir. Can you qualify those pressures with regard to what you would encounter when that volume or when that mass begins to flow?

A Yes, we know what the crushing strength of our ore-zone material would be, and we can visually see when the back starts to bend and deformation starts.

Q Have you observed the results of that flow?

A Yes, sir.

Q Would it be fair to categorize those as enormous pressures?

A I would.

Q How does subsidence operate? Does it just operate uniformally in one direction; is it just always down, or does it have different contours and configurations?

A No, there is both horizontal and vertical movement.

Q Is there twisting movement?

A If you would have both horizontal and vertical, I would think you would have twisting.

Q Is it fair to describe it as sort of a hula dancer, would that kind of explain it?

A Horizontal and vertical movement.

Q Mr. Lane, would you tell the Commission whether or not you have an opinion if more than 35 percent of ore is extracted from within the 2100-foot area of the proposed Bass No. 2 well, can you ascertain whether or not the subsidence of the kind that you testified would occur?

A More than 35 percent?

Q Yes.

A Yes, sir, I'm sure it would.

Q Would the conditions that you have testified about earlier with regard to the area generally apply to this location?

A Yes.

Q Do you have an opinion whether or not it would result in danger of the shearing of a well casing of the kind described here in this case for the Bass No. 2 location?

A In my opinion it would have a very good chance of shearing that casing, yes, sir.

Q Have you had an opportunity of observing the oil seepages that have occurred in this area from time to time?

A I observed one oil seepage, yes.

Q All right, sir. Was that from the plugged well in the Potash Company of America mining area?

A It is from an abandoned well. I don't know if it was plugged or not.

Q Was that in January of 1962 that you observed that?

A No, sir.

Q I'm sorry, did that seepage occur approximately in 1962 or prior to that time?

A No, that seepage occurred back in the '50s or earlier than that even.

Q Was it?

A Yes, sir.

Q All right. Did you observe that underground?

A I saw the seep underground, yes, sir.

Q Are some photographs in Exhibit No. 2, that you have in front of you, that you could show to the Commission and demonstrate to them what you observed at that time?

A Yes.

Q Would you please take those out and show the

Commission. We don't have color reproductions of the other. We will have some made. He is the only one who has a color photograph.

Would you explain to this Commission what the main one of those photographs show?

A These are photographs taken in the PCA Mine, dated January the 18th, 1962. The photograph on the top left shows a tension crack in the salt section, or in the high-grade section which was then filled with salt. The one on the top right is also in an anhydrite bed. It shows oil seeps which are depicted in dark here.

MR. KELLAHIN: If the Commission please, I object to the Witness testifying further from this Exhibit. There is no evidence to show that he took the pictures, that he made any analysis of the stains involved in this potash section or that he has any personal knowledge whatsoever that those are or are not oil seeps.

MR. ROBB: The Witness testified, Mr. Porter, that he observed these conditions himself.

THE WITNESS: I have seen the actual faces where these appeared.

MR. ROBB: Do those photographs actually portray the conditions that you have examined at the time of your

inspection?

THE WITNESS: They do.

MR. KELLAHIN: What led you to believe that that was oil?

THE WITNESS: I believe that I put it in the cars; nice and sticky or something. I feel pretty sure. It was a hydrocarbon that I would class as oil.

MR. PORTER: The Commission will overrule the objection.

MR. ROBB: We would offer that photograph in evidence as Exhibit 11. I guess it would be 12. No, it would be 11. This would be 12. The earlier one, which was the U.S. potash study would be No. 11. Let the record so show.

MR. PORTER: Are you saying that the Exhibit D are two, should be labeled Exhibit No. 11?

MR. ROBB: It might be simpler to do it that way so we'd have the consecutive --

MR. PORTER: (Interrupting) I think it would, if you remove that from Exhibit 2 and, incidently, we would like to have the best copy you have of that because the one I have is unreadable.

MR. ROBB: Yes, sir, we will. We will furnish

those to the Commission. I would like the copy that the Commission has, Exhibit 2 that the Commissioner has, to remain **intact** so that if there has to be a review of the decision it will know what it is that the Commission refused to accept.

BY MR. ROBB:

Q Now, with regard to this oil seep in PCA, did you as a part of your duties review the studies that were made by PCA concerning this oil seepage?

A No, I have not reviewed the studies they made.

Q Did you as part of your work, are you generally acquainted with the study -- not review of it -- but are you generally familiar with the findings that were made with regard to that? What I'm asking is where is the nearest oil; did you determine the location of the nearest oil well in which that seep could have occurred, approximately?

A An employee of PCA showed me a map where the seep was located underground, and on that mine plat there was several oil wells in the general vicinity which they showed.

Q Where is the location of the nearest one?

A Either 9 or 1400 feet. 900 and 1400 feet, yes.

Q May I show you, to refresh your recollection, Figure No. 1 from the Exhibit No. 2, containing a map showing that seepage?

A Yes, sir.

Q Which show the Continental Chase oil tests?

A Yes, sir.

Q That's about half of the way through that Exhibit. It's two pages ahead of the photographs. There are sort of blanks in it. It falls just a short distance beyond that unreadable report you were just asking us to make copies of, Mr. Porter.

Is that essentially the situation that was portrayed to you on this map?

A Yes, sir.

Q Does that indicate a seepage of 900 feet and 1400 feet respectively in these different portions of the mine?

A In the different portions, yes.

Q Were those the conditions which you observed?

A Yes, sir.

MR. ROBB: Second page. I guess the photographs are attached to that same report, that same map. We offer into evidence Figure 1 and Figure 2 which are the two pages just ahead of the photographs, part of the same study.

MR. KELLAHIN: If the Commission please, we would object to the Exhibit. It purports to show that a seepage occurred which moved some 1400 feet and some 900 feet from a well, but there is no evidence to show that that well ever leaked any oil or caused any seepage. The Commission well knows that in the drilling for oil, seeps are encountered under many circumstances, and there certainly is nothing to support this Exhibit. If the witness wants to testify that he made some examination of the well bore in terms of its leaking, I would be happy to hear it.

MR. ROBB: Well, Mr. Chairman, this Exhibit has been offered in two or three different hearings by this Commission. It is kind of late to be objecting to it on the basis that the oil came from a well. That has been testified to many times.

MR. KELLAHIN: In the first place, that is not a correct statement. I objected to it every time it has been offered in any case that I have been involved in. I'm objecting again.

MR. ROBB: It was testified to fully and admitted in evidence in the Phillips case.

MR. KELLAHIN: Over my objection, and I'm objecting again.

MR. PORTER: The Commission will sustain the objection so far as the Exhibit is concerned if you will develop further the line of questioning that the oil seep came from those particular wells or you can proceed to do so.

MR. ROBB: Let me continue in another line, and I'll see whether we can.

BY MR. ROBB:

Q You had testified earlier, Mr. Lane, that in your opinion methane gas, which might escape from that well, could migrate along mud seams that you showed us in those cross sections, do you remember?

A I think it could, sir.

Q If that were to happen, sir, what hazard, if any, does escaping gas from a well such as the Bass No. 2 or any well in this area pose as to your potash operation in the immeciate vicinity?

A If methane gas was found in potash mine, the mine would be classed as gaseous, and would make a major change in all equipment, ventilation requirements, explosive use, and in our case I'm sure it would cause some full shut-down for some period of time. Where equipment changes and ventilation changes could be rectified.

Q Is your mine presently, is it a gas-free mine?

A Yes.

Q No gas in the mine.

A No methane gas, no, sir.

Q All right, sir. Is that true of the other mining operations in this area?

A I would assume so, that would be correct.

Q Do you know of any mining operation in the Carlsbad potash area where methane gas has impregnated the mine?

A No, sir.

Q Can you tell us whether or not the equipment that Kerr-McGee presently uses in its mine would be suitable if they encountered methane gas?

A We have no equipment underground at the present time which would be permissible in a gaseous mine.

Q What equipment do you need to operate a gaseous mine, Mr. Lane?

A You need equipment which has permissible electrics, fire suppression equipment attached, all motors must be permissibly constructed, transformers of which we have none at the present time.

Q Do I understand that the danger of fire and explosion is a very real hazard if methane gas impregnates

the mine?

A Yes.

Q Do you know of instances where hard mining operations have sustained fires and explosions and loss of life?

A Moab, Utah Disaster back in the '60s; they had an explosion which reportedly was caused by methane gas and there was a great loss of life. They were not set up for permissible equipment at the time.

Q Has that occurred also in the case of coal mines?

A Numerous times.

Q Is that the reason why the U.S. Bureau of Mines has very strict regulations pertaining to acceptable equipment in a gaseous mine?

A Yes, sir.

Q Would you have to comply with those strict regulations if methane gas were encountered in the Kerr-McGee potash mine?

A I'm sure we would come under the coal mine regulations which we are not under now.

Q Now, do I understand you would have to replace essentially all of the present equipment that you are using in your underground mine if you encountered methane gas?

A In a general statement, I would say all.

Q What would it cost you to replace that with equipment that could cope with methane gas if this were to result?

A I made an estimate for our mine at present-operating levels and it would approach the $4,000,000 mark for mine equipment which includes the face equipment, transportation, maintenance vehicles, transformers, motors, and so forth. In addition to that, our mine is not laid out to give separate air splits to the different working areas. That would have to be revamped. We have two shafts located 250-feet apart. One is a 15-foot diameter, the other an 8½-foot diameter, with fans located underground. They would have to be moved to the top and supply enough air for separate splits. We would have to construct a larger shaft to replace the 8½-foot ventilation shaft we have now.

Q Do I understand that that would increase air circulation requirements that would have to be met by an extra shaft if methane gas were encountered in the mine?

A Yes, sir. We could not get the quantity to pass through the two shafts we have at the present time.

Q What would be the cost of an additional shaft for ventilation?

A I'd estimate a shaft at somewhere around $2,000,000.

Q You said earlier that it would require a shut-

down essentially in your operation during the conversion period?

A Conversion period and in shaft construction time.

Q All right, sir. How long would that take?

A A minimum of two years.

Q Once you got back into operation, sir, would your operations be as efficient with the new equipment as they were with the old?

A No, sir. It is not as efficient because we would have to have secondary ventilation carried closer to the face which is done by plastic cloth lines which direct the air flow or fans with vents on them; it would hinder the movement of our face equipment for hauling ore back to the conveyor heads to get rid of it. That would restrict maintenance where, for example, the cover on a control box on a machine is now held on by possibly two bolts, in a permissible control box it could be up to thirty bolts, which would have to be loosened each time; it would decrease efficiency.

Q Could you give a rough estimate as to the percent of loss of production that would result in that, a ball-park figure?

A Possibly 25 percent, possibly.

Q And from that time forward, would the presence of methane gas pose a continuing risk of some kind of mine disaster or fire explosion assuming these precautions did not prevent them?

A The risk is always there, yes, sir.

Q And at the present time, do I understand you correctly, none of those risks exist?

A No, sir.

Q May I call your attention, please, to the Exhibit H attached to Exhibit 2 which is a report by John T. Boyd Company of the Potash Committee of the New Mexico Mining Association. Are you familiar with that report, sir?

A Yes.

Q Do you agree with the conclusions that are contained within that report?

A I generally agree with the conclusions in the whole report.

Q We move the introduction of Exhibit H which should be No. 14, I guess.

MR. KELLAHIN: If the Commission please, we would strongly object to the introduction of Exhibit H. It is a report prepared by John T. Boyd which reaches numerous conclusions. The Witness has shown no ability to

withstand cross examination on the contents of this Exhibit, and if he did it would take hours to go through it and accurately query him on it. Now, the Exhibit H does not stand alone; it has a number of schedules attached to it such as a schedule showing Total Potash Reserves in the Area, the Area's Mining Depth, the Grade of Ore. These other factors, costs, figures, none of which could be sustained by this Witness. The Exhibit is objectionable.

MR. ROBB: I don't know how long it would take him on his cross examination, but the matters in that report he's already essentially expressed his opinions on to the Commission. I don't think it could take several hours to cross examine because if he is going to cross examine at all, the Witness is here; he has already testified about many of those areas. As far as the Exhibits are concerned, Mr. Porter, we would be glad to eliminate those.

MR. PORTER: We're going to sustain the objection. That portion that's referred to as Exhibit H will not be admitted.

BY MR. ROBB:

Q Mr. Lane, you have testified earlier that in your opinion there are commercial deposits of potash ore under Section 30 and particularly under the 2100-foot-radius

area underlying the Bass No. 2 proposed Federal well.

A Yes, sir.

Q Do you have an opinion as to whether or not the granting of this Application, the drilling of this well will unduly cause a waste of the potash deposits underneath that site?

A Yes, if the potash was mined before the well was drilled, it would be no question. There is always a question after the well is drilled to come back in.

Q Do I understand it is your opinion that there would be undue waste if the well is drilled first?

A Yes, sir.

Q Is that for the reasons you have outlined before, leaving the ore in place?

A Leaving the ore in place.

Q Do you have an opinion as to whether or not permitting the drilling of this gas well before the mining of that area will cause an undue interference with the mining of commercial ore underneath that site?

A There is a good chance that it would, sir.

MR. ROBB: No further questions.

MR. PORTER: Mr. Robb, do you have any more witnesses?

MR. ROBB: No, sir.

MR. PORTER: Then we'll be back at 1:15. The Hearing will recess until 1:15 at which time the Witness will be made available for cross examination.

(Whereupon the Hearing was recessed at approximately 12:00 P.M. and was re-convened at 1:15 P.M.)

MR. PORTER: The Hearing will come to order please. Mr. Lane, would you take the stand? Before we begin our cross examination, Mr. Lane, I would like for Mr. Carr to review the Exhibit numbers to be sure we've gotten them correct as he has written them down here.

MR. CARR: The Commission has admitted the following exhibits offered by Kerr-McGee: Exhibits 4, 5, 6, 7, 8, 8-A, 8-B, 8-C, 8-D, 8-E, 9, 10, 11 and 12, 11 and 12 being portions of Exhibit 2 which was not admitted.

MR. ROBB: That's my understanding, yes, sir.

MR. PORTER: All right. Any questions? Yes, Mr. Attwell?

CROSS EXAMINATION

BY MR. ATTWELL:

Q Mr. Lane, I don't know if my notes on your qualifications are complete, but I believe that I understood

that you are the Superintendent now of the Engineering of Kerr-McGee at Hobbs, New Mexico?

A Superintendent for Mine Engineering, yes.

Q And how long have you been in that position?

A Approximately six months.

Q And before that, what position did you occupy?

A Mine Superintendent.

Q Would it be a fair statement of your experience both with Kerr-McGee and prior thereto to say that your specialty really has been in the operating end in the potash-mining business?

A I have been in the engineering branch of the companies I have been with more times than in the operating end of it.

Q In the engineering part of it; basically what has been your responsibility from just generally speaking?

A Mine plans, geology, exploration, leasing.

Q Do you recommend to Kerr-McGee's management, make recommendations to them to construct drifts?

A That is part of the mine plans, yes.

Q Aren't these recommendations based on economic formalities made by you and your staff, the cost of the drift versus the ore you expect to recover?

A The recommendations are made, our accounting people enter into it; the economics as far as the value of the product; our mill people have to come into it; we get some milling costs tied in with it, so it's a group function. For final acceptance, it has to come from a group.

Q I would accept that, but the analysis that's made by this group is really an analysis of the cost versus the ore reserves to be recorded in the value of that ore reserve?

A Direct-mining costs, we would have most control over, yes.

Q And you analyze the input of these various groups and then they are recommended to your management?

A I'm a part of that group.

Q That in itself is a group decision?

A Right.

Q In your job as Superintendent of Engineering, do you keep up with Kerr-McGee's sales of potash?

A Not as an official duty or anything like that.

Q But do you otherwise?

A I like to keep after it for my own information.

Q Do you do that in order to perform your responsibility to make royalty calculations?

A I don't make royalty calculations.

Q I'm sorry, my notes show that maybe that was one of your functions that I overlooked.

A I provide the figures for the royalty calculations, the extractions, the tons produced, and the content of the tons produced.

Q I see. Again, relating to your qualifications, are you a geologist?

A No, sir, I graduated in mining engineering.

Q I believe my notes show that when you worked for IMC you said you worked as a geologist, but listening to you describe your duties, I thought that maybe they were more in an engineering nature?

A The geology duties in and around the potash mine lend itself more to engineering than it does to the hard-rock geology or uranium or some other field.

Q Now, you mentioned that the Teledyne Company was not active in the area. When did Teledyne shut down its operations?

A I think it was sometime during '73.

Q Would you accept the statement in a press release of June, 1973, announcing the shut-down of that mine?

A I might have given it.

Q Do you know why Teledyne shut the mine down or what the reason they stated for it?

A I couldn't give that reason today, no.

Q Does it refresh your memory if announced that they were shutting it down because it was no longer economic?

A That would have been a possibility.

Q All right. I would like if you would to turn to your Exhibit No. 5; I want to ask you some questions about that Exhibit. Now, looking at the area that has been colored in green, you said that those areas reflect Kerr-McGee's five-year plans at present. Isn't it true that Kerr-McGee had filed a series of five-year plans with this Commission and that these five-year plans change from time to time?

A They do.

Q And that such a change is based on what you encounter in your drilling in additional core-hole data you obtain, isn't that right?

A Would you repeat that question?

Q They're subject to change based on the conditions you encounter in your mining and the data you obtain from additional core-hole drilling?

A On a year-to-year basis, I think it would come

more from conditions in mining and availability of equipment.

Q More so than from the data you obtained from core-hole drilling or from actual mining?

A No, from the actual mining more so than core-hole drilling or from actual mining?

A No, from the actual mining more so than core-hole data.

MR. PORTER: Would the price of the product influence that?

THE WITNESS: It could to some extent. I can't relate a specific case where you made a change just on price change.

BY MR. ATTWELL:

Q Now, you defined this area that has been outlined in red as a probable-ore outline.

A That's correct.

Q Would you tell me what you mean by "probable ore"?

A Probable ore in this case is where we have several drill holes, very wide spacing, but they are adjacent to or near proven-ore bodies, relatively close to actual mining operations.

Q How far away from a core hole which shows economic

ore did you go in this particular Exhibit in projecting probable-ore reserves?

A The distance from the core holes 155, US 141 and F 29, is the general area.

Q Are you telling me, then, that it was those three core holes that were used to define the probable ore outline shown in your Exhibit 5?

A They were the basic holes, yes.

Q Were any other holes used?

A In drawing the K20-foot, yes; there were some holes to the north.

Q I'm speaking just of Exhibit 5, now.

A Yes, sir, on Exhibit 5.

Q Yes.

A Hole 128, 153 helped in the determination of the contour lines.

Q All right, so we got 153, 128 and the three holes you mentioned previously?

A Yes, sir.

Q Now, those five holes are the ones you relied upon to draw this probable-ore outline?

A Probable-ore outline?

Q Yes, sir, this in red shown on Exhibit 5?

A No, sir.

Q Well, what other core holes did you rely on?

A That line was on the southeastern portion of this map in red; it starts approximately at the hole of D 165 which is within our definition of reserves. It goes right along the edge of F 29 which is, I think has a value of 57, which is marginal for a reserve outline but not our mining cut-off data, and passes up around the U.S. Hole, which fits all cases for mineralization.

Q It could be fair to say that what's shown on Exhibit 5 compared to what is shown by your later contour study, which I believe is Exhibit 8, Exhibit 5 relies on a geological entrance which you have shown here?

A The probable-ore outline on Exhibit 5 is, I think, a conservative estimate in my own mind of probable-ore outline.

Q I am having some difficulty, though, in understanding what you mean by probable ore. What percentage change do you think that there will be there within that outline that is economically probable. Do you recommend to your management to make the investment necessary to recover the ore?

A I feel the ore is good enough to go ahead and make

plans for mining. Also, in my own mind, to recommend to our management to obtain leases and sublease agreements to that area and go ahead and make final plans for mining.

Q Let's assume, if you will, that there was no shaft sunk as you already have here in the lower left-hand corner of Exhibit 5 and you were confronted with recommending to your management to make an investment to sink a shaft to obtain potash from the area shown, shall we say, around the Sections 25, 30, 36, and that general area, could you or would you recommend, based on the data available to you, that they make the investment necessary to sink a shaft in order to mine this ore?

MR. ROBB: We object to that as a purely hypothetical, theoretical question. There is a shaft and the testimony has established that there is a shaft, there are underground workings, and it's purely speculation, and we object to it.

MR. ATTWELL: Your Honor, the Witness, of course, is presented as an expert and, of course, proper cross examination always asks a witness theoretical or abstract or hypothetical questions. This question, of course, is asked to test his recommendation here, particularly the reliance upon what we consider to be very widely scattered data and

I think that a very true test of that would be whether this man would recommend to his management that they make a major investment right here if he thinks there's sure enough of this potash here regardless of what may be over here on the lower left-hand side of the map.

MR. ROBB: What we object to is that he is asking the Witness to ignore the facts as they exist in this case; that there is a shaft and mine workings already there. It is not an accurate statement and it proves nothing.

MR. ATTWELL: Mr. Porter, I may be able to put another element into the hypothetical question that would take care of the objection that has been lodged, and that is if he would also assume that some geological condition occurred and developed that made it impossible to extend any further tunnels from the major shaft that now exists in order to get this potash out at these sections.

MR. ROBB: Well, that just compounds the problem. He is to assume things that are simply not in evidence. That's not the case we have before us and I don't see how it can help assist the Commission in any way to assume a state of facts that are false.

MR. PORTER: The Commission will sustain the objection.

MR. ATTWELL: All right. I'm really just trying to search for a more accurate definition, your Honor, of "probable ore." I find it is kind of elusive, at least in my own mind.

MR. PORTER: We understood your reasoning.

BY MR. ATTWELL:

Q I think that I asked this question before, but I don't believe it was answered. How far from any core hole have you projected economically-recoverable reserves which you classify as probable-ore reserve on Exhibit 5?

MR. ROBB: I think he answered that and said that he considered the area directly underneath the hole to be in that category.

MR. ATTWELL: Well, let me ask him, how far out from the hole he would go in classifying ore reserves as probable-ore reserves as he has used that term?

MR. PORTER: Do you feel that you can answer that question, Mr. Lane? Would you restate the question?

BY MR. ATTWELL:

Q All right. Let's say you can identify the core holes to rely on. How far out from those core holes, in your opinion, would you go in classifying ore reserves as probable-ore reserve if you had used that term; would

you go 1500 feet, 5000 feet; what is the limit?

A I classified all the area between these holes and under Section 30 as probable ore.

Q That still doesn't answer the question. How far out from the various holes,that you said you relied upon to draw this red line, did you go in projecting probable-ore reserves, as you'd use that term?

A For the red line?

Q Yes.

A As I stated before, I showed the red line at D 165, at F 29 encircling to the right of US 141.

Q I believe you said you had relied upon this hole No. 105 that appears in Section 23?

A I didn't say that.

Q You do not allow that hole?

A No, sir.

Q You did not rely upon 105 in determining the general red outline as shown on Exhibit 5?

A Are you talking about the other red line outlined now going through Section 23?

Q Yes, I am.

A I took that into consideration, yes.

Q How far out from 0105 did you project probable

reserves?

A In this case here it's slightly over 2000 feet.

Q Is that the maximum distance you think it can be extended out from any hole for purposes of determining probable reserves as you have used that term?

A No.

Q Do you think it can go beyond that?

A In certain areas it could.

Q Just kind of a subjective judgment in each case?

A You have to use your knowledge of the area and the ore zone itself, yes, and other related holes.

Q Again, look at Exhibit 5, I notice you got a white area that's shown in it, well, it's really in the, kind of in the southeast corner of Section 34, and, of course, over into Section 33. See that white area that I'm referring to? It's Range 33 written across there.

A Right.

Q Why is that area left white?

A That area didn't come into our five-year mine plan. That is boring-machine area, and we wouldn't have machines available to mine it within this five-year period.

Q Only because of a lack of machinery?

A Yes, sir. Lack of need for it.

Q You say "lack of need"?

A It's not required to produce ore during this period.

Q What are your requirements during that period?

A Pardon?

Q What are your requirements during this period?

A Approximately 3,000,000 tons per year.

Q Now, isn't it true, Mr. Lane, that Kerr-McGee has committed to this Commission and to the United States Government a map that has been previously marked as Belco Exhibit 21?

A Yes, sir.

Q Did you prepare the map or was it prepared under your supervision and direction?

A Under my supervision.

Q Was Exhibit 5 prepared by you or was it prepared under your supervision and direction?

A Under my supervision and direction.

Q So someone else actually located the red lines that are shown there?

A As a group, yes.

Q A group working under your supervision, okay, but you didn't do it yourself?

A Not personally.

Q I notice that the outline has changed from Exhibit 21 to your Exhibit 5, it's a slightly thicker line, shall we say.

A Could I have a copy of the Exhibit, please?

MR. ROBB: You want the one of the right side?

THE WITNESS: I have the small one.

MR. ATTWELL: It will be easier for him to see.

MR. ROBB: The broad red line that marks the outline seems to be missing on your Exhibit, so your's doesn't have that.

BY MR. ATTWELL:

Q And what I'm suggesting is that the outer nature of Exhibit 5 the red line has been extended from that which you previously submitted to this Commission?

A Just in thickness?

Q Yes.

A Inward?

Q Well, just look at the circle that you drew around the proposed location of the Bass Federal No. 2. See where your line cuts off of part of that circle on the

Exhibit 21?

A Yes, sir.

Q You see on Exhibit 5 you've just drawn it right there so it covers it all, isn't that right?

A Yes, sir.

Q Are you responsible for that change?

A I wouldn't call it a change. When the original of your Exhibit 21 was made, it was made for just internal information and no extra pains were taken in establishing that.

Q Well, it was submitted over to this Commission and the U.S. Government, wasn't it?

A Yes, but I did not submit it.

Q Did an official of Kerr-McGee submit it?

A Yes, sir.

Q Did you recommend that it not be submitted?

A No, sir, I did not recommend it to be submitted or not be submitted.

Q Let's turn if you will now to your Exhibit No. 6. If I understand it, the second page of this Exhibit shows the present actual workings of the Kerr-McGee mine?

A It shows the mine workings of January 1st, '71.

Q Yes. Now, I know that you said that there is a

major--I call them tunnels; I don't know what their proper name really is -- extending down directly south; do you all have leases in that area?

A Yes, we have leases in the south portion of 21 South.

Q And I presume that you have suggested that as being an economic-core area like you're extending on down?

A A portion of it, yes.

MR. ROBB: Can I ask what the purpose of this is? That's completely removed from the -- going in the opposite direction from Bass No. 2.

MR. ATTWELL: It seems to be one of the points I'm trying to make, Mr. Robb, is that the angle of your tunnel there seems to be south and one to the southeast. All of a sudden we come up in this proceeding, and we have a finger shot right down at us. That's the protest that's lodged in this proceeding.

MR. ROBB: That's your --

MR. ATTWELL: (Interrupting) That's my interpretation. That's why I'm asking questions about it.

MR. ROBB: Go ahead.

BY MR. ATTWELL:

Q There's another major tunnel, if I may, going

down to the southeast there, isn't there?

A Yes, sir.

Q And those are in your actual tunnel workings. Turning over to, well staying at the same place, is it correct that this is the full extent of your workings over a period of nine years, ten years?

A Since start of operations, yes, sir.

Q When was that?

A October of '65.

Q Now, let's turn to your Exhibit 7 which is your cross section. What is the approximate distance between all of the core holes shown on here except US 141? It looks to me like they're about the same.

A The distance from F 50 to which core test?

Q Start with K03 and then the distance from K03 to the upper left mill, they look to me to be about the same; excuse me, I'm reading this plat backward.

A It would be slightly over 4000 feet each.

Q And then I believe that you testified in connection with another exhibit, you jump between I 155 and US 141 to approximately -- according to my notes -- 12,000 feet, is that correct?

A That is correct.

Q Does Exhibit 7 show that we're going down dip as far as potash is concerned?

A Yes, sir.

Q By the way, I believe earlier in your testimony you stated that Kerr-McGee had been active in foreign leases in this area since it came in there in about 1965; do you recall that testimony?

A Yes, sir.

Q I believe that you gave us an example of leases you acquired in 1970 and 1973. Isn't it true that basically all leases that you have in the area were acquired, well let's say, at least five or six years ago?

A Basically, yes.

Q What would you estimate to be the leases that you have acquired in the last five or six years, additional leases?

A Acreage or what?

Q Well just in acreage?

A Actually acquired, we obtained sublease on Section 36 of 2130, it's a State Section. We have obtained a Federal lease on the southeast quarter of Section 30 of 20 South, 32 East. We have a lease application pending on Section 25 of 2031.

Q Is it then Kerr-McGee's common practice and policy to consider leasing policy when it saw a lease which it thought was economic, that it would try to get the lease?

A Would you restate that again, please?

Q Well, would you state it's Kerr-McGee's common practice and policy in this area when it saw a lease that appeared to be economically attractive to it from a potash standpoint, to try to get the lease?

A It hasn't been that policy. We have gone ahead and obtained leases. As we approached the area, we might try to obtain the lease on.

Q How far away were you generally when you tried to get these leases?

A In the lease on Section 30 of 2032 negotiations started for that lease when we were within a half a mile of it. At the signing of the lease, we were within 50 feet of it, waiting to go in.

Q That has been generally your policy, to wait until you're that close?

A Very close, yes, sir.

Q Let me, again, ask you to look at Exhibit 7. What is the "insol," and I believe that's your term.

A Insol, yes, sir.

Q Insol content of core hole 141?

A I may have that data and I may not. Reading from the log of core test 141, water insolubles for bed No. 1 is 1.94 percent.

Q Does that complete your answer?

A Yes, sir.

Q And what is the insol content of core hole No. 155, nearest one to 141?

A At the ten-foot height, reading from the log of 155, water insolubles 2.99 percent.

Q The reason I asked these questions is, in your earlier testimony, you said that when you mine, you don't give first and second mining because of the insol content of the ore?

A Yes, that is part of it, yes.

Q These two core holes don't show that high percentage of insol content, I presume?

A Looking at core test 155 and on the second sheet of that which is Exhibit 8-C, the high insolubles are still present from the lower member of the 10th ore zone.

Q Do you think insofar as that particular core hole is concerned that would preclude you from doing first

and second mining?

A That does weaken the remaining pillar that you have to leave.

Q Certainly as far as core hole 141 is concerned you have no problem?

A I don't have from the log or Exhibit 11-A; the analysis sheet is not broken down the same as for core hole 155. I do not know the location of the water insoluble.

Q I thought you just gave me an insol factor a minute ago?

A Yes, this is for the total height.

Q I see. Average, so you just don't have the necessary data for that core hole?

A No, I don't.

Q Let me ask you now to turn to your Exhibit No. 8. Now, am I correct that you used the contour map that's shown on Exhibit 8 to prepare one of your subsequent computations which I believe is shown in Exhibit 18?

A Yes, sir.

Q Was Exhibit 18 prepared by you personally?

A Under my direction and supervision, yes.

Q But was it prepared by you personally?

A No, sir.

Q It was prepared by some member of your staff or members? Who actually drew this contour line that is shown in Exhibit 8?

A An engineer by the name of William Henderson.

Q William Henderson?

A Yes.

Q Now, could you state for the record the core holes that were used to define that contour that is shown on Exhibit 8?

A We've got contours in the uranium dispute.

Q I didn't want all the contours.

A All the contours?

Q Yes.

A Starting up in the northwest corner with the highest value, 160 contour, hole 105; going across to the east hole 128, hole 153, another hole to the north of that one mile would be F 27, hole 155, hole 141, hole 10, hole 110, hole F 29, hole 113, 109 and D 165.

Q Let me ask you, Mr. Lane, are you aware that there is a core hole for which the data is available and which we have and you have where USP 127 that is located in the lower southeast quarter of Section 18?

A No, I am not aware of it.

Q Southwest, excuse me, I'm sorry.

A No, sir, I am not aware of it.

Q So that that did not enter into the computation of the contour shown here?

A No, sir.

Q It did not enter into it?

A No, it did not enter into it. According to this map, it did not enter into it.

Q What about core hole USP 129 which is, I believe, also in Section 18? I believe it's in the northeast quarter of Section 18. I think I said core hole 129; that should be 139, I misspoke.

A Whose hole is that?

Q United States Potash Company, I presume; its identified as USP.

A I don't think I have that logged.

Q Let me ask you regardless of whether you have the log or not, whether or not that core hole was taken into consideration to contours which you have plotted here on Exhibit 8?

A I would have to say "no" to that because it's not on this map.

Q So the holes that you have enumerated are the only

holes that influenced the contour that is shown on Exhibit 8?

A I think that's correct, yes.

Q Looking back for a moment at one of the earlier exhibits, I believe it is Exhibit 6, the second page shows your present workings. Tell me what the average depth of those workings is, the average potash.

A Average?

Q Yes, Approximately.

A 1600 feet at our shaft; 1550 feet up in the northwest, and we should be approaching approximately 1800 to the east, 17 to 18.

Q Do you still have a copy of Belco's Exhibit No. 2 up there with you, Mr. Lane?

A Yes, sir.

Q Would you focus on Exhibit for me on Section 33? There's a dotted line that appears there. What does that mean or what is the significance of that dotted line?

A This outline is the ore outline; that's in Section 33 of 32 East.

Q Yes, I believe that is correct. Isn't there is a core hole in the middle of that Section?

A Yes, sir.

Q What is the distance between that core hole and the dotted line?

A I don't know what scale you made this map to.

MR. TRUJILLO: What section were you talking about; what section is that?

MR. ATTWELL: 33. I think you have your legal map up there and you're having problems with it. It's this Section right here.

MR. TRUJILLO: Thank you.

BY MR. ATTWELL:

Q Are you unable to scale that off?

A No, I haven't.

Q Would you accept that as checked as approximately 1500 feet?

A Or slightly more.

Q Plus or minus?

A Plus or minus.

Q 50 feet maybe?

A A hundred.

Q All right. Looking over to Section 35 in the upper right-hand corner of that Section, I notice that there is another dashed or dotted line; what's the significance of

that line?

A In the northeast corner of Section 35?

Q Yes.

A Surrounding hole 114?

Q Yes, I had difficulty reading that number, but I believe that's correct.

A 114 is a hole containing carnallite, and for what this base map was made for, it was delineated out.

Q What was the base map made for?

A Study of ore reserve and mine plans.

Q Exhibit 21 is a copy of the ore-reserve map made by Kerr-McGee in your department?

A It was used as a base map, yes, for working.

Q And the dotted line in that Exhibit in Section 33 shows the limit, and then we just went on Section 35, and I presume that just shows there is no economically-recoverable potash in the area encompassed by the guideline there?

A For reserve purposes, we are not using it that way, but it still is within the mining plan.

Q All right. Does the shape there in the Exhibit in Section 35 of the dotted line indicate that a Polygonal Method was used?

A No, sir. If it is five-sided, I would agree to that but on that method we would split the distance between the surrounding holes, and I don't think you will find that it bisects the difference between there. It's not half way. I don't see any hole to the east of 114 to take and control lines which would come into lease line or lease boundary.

Q What method was used there on Exhibit 21?

A I think we were using straight K20 value, similar to K20-feet.

Q You say K20 value; would you explain what you mean when you say you were using "straight-K20 value" which is similar to K20-feet?

A I'm going by memory now to the K20 values for 114. I think it is around 9 percent.

Q According to our figures it is 9.9 percent.

A 9.9?

Q And I am referring to the Exhibit which was put into this proceeding by Mr. Warnock, Exhibit 19.

A Then we have a test hole to the south which is 110, which I show from Exhibit 8, to contain 4 feet 3 of 193 K20. I believe the line that is drawn between those two holes would approximate 14 percent.

Q It looks about equal distance. Let me see if I

understand what you have just said. Looking at hole 114 you got a certain K20 grade and in looking at, I believe, it says 9.9 and if you look at the K20 grade of hole 110, it said 19 approximately, and if you add the two of them up and divide by two you get what, 14.4 or something; is that what you said?

A 14.0.

Q 14.0?

A Someplace close to that from looking at this map.

Q What is the significance of 14.0?

A For reserve work we use four-and-a-half feet, 14 percent cut-off.

Q What that means is that method of evaluation, which obviously is used by Kerr-McGee, is that everything inside the dashed line then would be below 14 percent in ore-grade value?

A You would have to assume it, yes.

Q And that's what you have done here for the purposes of this Exhibit?

A Purpose of ore-reserve work, yes.

Q You said in response to a question which was put to you in direct examination about core holes on Exhibit 7 that contain commercial mineralizations. What do you mean

by "commercial mineralizations"; is that your 63 percent-foot, that they had at least that?

A We have a mining cut-off, 4½ at 11 percent, so we would not mine 11 percent if it wasn't commercial also.

Q Well, as I understand it for reserve-estimating purposes?

A 14 percent reserves.

Q You used a 63-foot percent factor as your cut-off?

A That is correct.

Q Now, again referring to Exhibit 7 you also testified that this indicated to you it is probably -- that's your words -- a continuous-ore body here. I presume that what you're doing is extrapolating right down the line from the different core-hole zone there including the 1200-foot distance between I 55 and US 141 in making that statement?

A Yes, sir.

Q Let's turn, if you will, to your Exhibit 8-B which you said a few minutes ago was based upon the contours made there in Exhibit 8. All right, let me ask you if this calculation of value is determined, as well as your other calculation of value, is based on the assumption that Kerr-McGee would be unable to second mine within a 2100-foot radius of the Bass Federal No. 2 well; in addition to that assumption,

of course, there would be no mining of any kind within 150 feet of the well bore?

A In this calculation, we did it both ways: Normal mine plan and with no second mining.

Q But the net result though that you come up with of the sales value that you claim is lost is predicated on the assumption there could be no second mining?

A That is true.

Q I beg your pardon; within a 2100-foot radius?

A 2100-foot radius.

Q Isn't it true that the testimony that you have given that there can't be second mining within a 2100-foot radius is based on the assumption that subsidence might shear the well bore and gas escape?

A Yes, sir.

Q But if we will assume that no gas will escape even if the well bore is sheared, can second mine, isn't that right?

MR. ROBB: Just a moment. Are you going to guarantee us that there will be no --

MR. ATTWELL: (Interrupting) I'm going on the evidence in this record, the only evidence in this record, because our witness has said that no gas will

escape if R-111 is complied with.

MR. ROBB: Are you going to give us that guarantee?

MR. ATTWELL: I'm not giving any guarantees, and you know it Mr. Robb.

MR. ROBB: All right, will you give us a bond to protect us against the loss of life and the loss of this mine and injured mining profits from now on?

MR. ATTWELL: Mr. Robb, I have asked the Witness a question, and I think I am entitled to an answer. It is a perfectly proper question. This case is to be decided on evidence.

MR. ROBB: That's right, it sure is.

THE WITNESS: Would you repeat your question?

BY MR. ATTWELL:

Q If you assume that no gas will escape from Bass No. 2 even if the well is sheared, then there is no reason you can't second mine it?

A I would not make that assumption.

Q All right. I'm not saying you would make that assumption, but if you did make that assumption.

A I would not make the assumption.

Q You just refuse to make that assumption?

A Yes, sir.

Q You have used a 35-percent-recovery factor on first mining; I'm not quite certain that my notes correctly reflect the reason for that. According to my notes, you told Mr. Robb that you didn't believe that there could be any greater recovery than that?

A That is correct.

Q That's subject to a plus-or-minus factor?

A No, that would be the top figure.

Q I see. That's as high as you think you could go the first go around, but if you could go in and second mine, you could get a lot more, couldn't you; in fact, you've shown you could get up to 28 percent?

A Yes, sir.

Q Now, in your calculations you have used a price of $33.89 per ton, is that correct?

A Yes, sir.

Q And that's based, I believe, is it not, on your Exhibit No. 9?

A Yes, sir.

Q You said that Kerr-McGee was actually selling potash at prices shown on Exhibit 9 to the best of your knowledge?

A That's correct.

Q How much potash has Kerr-McGee sold at this price?

A I couldn't answer that question. That schedule has been in effect since the First of January, but I don't know if there was any sold before or not.

Q Do you know how much has been sold since the First of January?

A No, I do not.

Q Do you know if any has been sold since the First of January at this price?

A Yes, sir, to the best of my knowledge.

Q Do you know how much?

A Since the First of January, we have sold approximately all of our production since that date.

Q At what price?

A To the best of my knowledge, we have got posted price.

Q How much of your production is sold under long-term contracts with fixed prices?

A I do not know.

Q It could be 95 percent, couldn't it?

A I do not know.

Q I see. Those contracts could provide for a price of $.21, couldn't it?

A I do not know.

Q Does Kerr-McGee have other price schedules for sale of potash for longer terms and on a spot basis?

A Not to my knowledge.

Q They have no other price scale than Exhibit 9?

A Not published at this time so far as I know.

Q They sell no potash under any other price schedule that you know of?

A Not that I know of.

Q Prior to this price schedule becoming effective, what was the price in effect?

A I do not have that schedule with me.

Q Do you have information available what the price level was from the years preceeding January 1, 1974; don't you know whether it was below a $20 figure, maybe $24 per ton?

A There is one figure here available here in front of the Commission and here at the hearing, and that was on the sheet that was attached to the, I guess the original of Exhibit 21.

Q That was that $24 figure that Mr. Robb made the dramatic apology about this morning, was it not?

A Yes.

Q Who put that $24-figure on that sheet?

A That is a figure I received from Oklahoma City, and it is a figure which was received about one year ago.

Q But you prepared that part of that study?

A Yes, sir.

Q But you did not prepare the map, as I understand it, and you were not responsible for sending this to the USGS?

A No, sir.

Q Isn't the major production of potash in the Western Hemisphere and in Canada, would you know that to be a fact, overwhelming deposits of that?

A Would you repeat that; I'm sorry?

Q Isn't the major volume of potash that is produced in the Western Hemisphere produced in Canada, produced in North America?

A I think they produce over 50 percent, yes; if you call it major.

Q It produces over 70 percent or you just don't know?

A I wouldn't make a statement to it.

Q Do you know if potash production is now being prorated in Canada, held down?

A I hear it is, yes.

Q Substantially prorated isn't it, below capacity; you know that to be a fact, don't you?

Q I know it is prorated. To what percent today, I do not know.

Q What are prices for Canadian potash?

A I do not know.

Q Now, on Exhibit 8-B and I guess also on 8-E, you come up with what you call a sales value. In one instance you showed some 15,000,000-odd dollars and in the other $16,000,000?

A Yes, sir.

Q Isn't it true that that is the gross revenue that Kerr-McGee would receive from the sale of potash if it was able to sell it at $33.89 a ton?

A That would be gross revenue from the area in question, yes.

Q Based on the assumption that you made about the inability to second mine that radius of 2100 feet?

A As so stated on the Exhibit.

Q What would be the cost of mining this potash?

A This potash?

Q This potash. How many tons is it that's going

to be lost, according to you, 453,663?

A I don't know what it will be when we mine that potash, no.

Q Cost just doesn't even enter into your determination?

A Not in this, no.

Q Does it enter into your determination of what is economically feasible, whether or not this reserve is economically -- I repeat -- feasible reserve to be recorded?

A It will when the study is completed, yes.

Q The study hasn't been completed yet, has it?

A No, sir.

Q So you don't know whether it would be economic to recover this?

A In my opinion it is.

Q But you don't know for sure until you finish the study as to what the cost will be. Kerr-McGee is not an eleemosynary institution, is it?

A I would say that the economics in today's conditions.

Q You mean at the price of $33.89 a ton?

A Yes, sir.

Q You are in the process of making a cost estimate, though of what it is going to cost to drill down 2100 feet

for potash, aren't you?

A Mining at 2100?

Q Yes.

A We have --

Q (Interrupting) That's where this potash is?

A Yes.

Q How far away from the mine shaft is it, about 7 miles?

A Six I think would be closer than 7.

Q All right. Would you agree, though, that the further away from the mine shaft you get, the higher the cost, and the deeper you get, the higher the cost of production; do you agree with that as a mining engineer?

A Distance has a larger effect than depth.

Q But they're both factors in increasing your cost, aren't they?

A Slightly.

Q I want to make sure I understand the record is clear on this: That you did not know and have not yet finished preparation of cost figures showing what it would cost to produce the potash which you say will be lost as shown on your Exhibit 8-D and 8-E?

A That is correct.

Q Do you consider such cost information private?

A Yes, sir.

Q So that if Mr. Warnock of Belco had asked you for your cost information, you would have given it to him?

A I wouldn't. I would refer him to our home office.

Q Do you know what your home office would do?

A I'm not sure?

Q You don't have a policy on this matter, a corporate policy?

A It depends what the needs of the figures might be.

Q I see. Let me ask you to look at Exhibit 8-E.

A E?

Q Yes. Is that Exhibit calculated on what you call the "triangular method"?

A Yes, sir.

Q Is it true that you were using Triangular Method strictly in the area of the radius around the Bass Federal No. 2 Well, it's cut-off by the line between F 29 and US 141 would be omitted in your calculations?

A No, sir.

Q It would not?

A No, sir.

Q That's your understanding of the Triangular

Method; how you applied it here in any event?

A The way I applied it here, yes, sir.

Q In your five-year projection -- I'm looking for the best of your exhibits here -- going back to Exhibit 5, you've got the five-year projection colored in green, and then I understood your testimony the lines that are the blue lines that go out are projections for a period beyond that time, is that right?

A Yes, sir.

Q And you show there is a tunnel -- as I call it -- coming on down to penetrate the 2100-foot radius around the Bass Well location, see that?

A Yes, sir.

Q You are aware that that would cross a substantial amount of fee land?

A Yes, sir.

Q And you think you could get a potash lease on that?

A I think we could, sir.

Q At least you made an assumption as you did in your five-year plan?

A Yes, sir.

Q I think you also made the assumption, have you

not, that you can get a potash lease on the tract with the well on it that are going to be drilled as the tract is not now subject to lease?

A The tract is subject to lease.

Q Is subject to potash lease?

A Yes, sir.

Q That's your understanding?

A It is on the east half of Section 30, subject to competitive bidding for lease.

Q Well, let's see where we stand. Where the well is supposed to be located, is that subject to lease?

A Yes, sir, to the best of my knowledge it is.

Q I see, and then the tract right next door to that, is that now subject to potash lease, I'm not talking about oil and gas lease?

A The tract to which side?

Q I guess it would be to the east; no, it would be to the west, excuse me, I'm sorry.

A The State land to the west?

Q Yes.

A We feel sure that we would get a sublease from Teledyne on that piece of State land.

Q But who has a potash lease, then, on the tract

where the well to be located is adjacent to Teledyne; does anybody presently have a potash lease on that?

A On the east half of the east half of 30?

Q Yes.

A No, sir. They don't.

Q That's where the well is to be located?

A Yes, sir.

Q And you assume that Kerr-McGee could get such a lease?

A I do.

Q And of course such a lease would be subject to competitive bidding by anybody else that wanted to try to get it?

A That's correct.

Q There is no guarantee that Kerr-McGee could get that lease or that they could get a lease on the fee tract, isn't that correct?

A You can say that, yes.

Q Has Kerr-McGee ever heretofore tried to get a lease on that tract where the well is to be located?

A Not to my knowledge.

Q In your opinion, one of the reasons that you feel that there is potash under this well location is because of

the test data shown in US 141 hole which is shown as that the potash hole test hole in Section 29?

A In conjunction with holes 155, 29, yes.

Q Would you say that US 141 had a major influence on your opinion? It had a pretty good 80-percent factor, didn't it?

A Approximately 90, yes.

Q A lot better than F 29, wasn't it?

A Better than F 29, yes.

Q In fact, when was that core hole drilled, that 141?

A I believe one of your exhibits shows that if I can find it here. Yes, 8-A shows it. 141 was drilled in September and October of 1954.

Q How long has this data been available to Kerr-McGee?

A Since last spring.

Q That's the first time you saw this?

A The first time I saw 141 test-well data.

Q Have you ever tried to get data on this test well before?

A Not to my knowledge.

Q When you say "last spring," you mean last March

or April, 1973?

A In the spring of 1973, yes.

Q They didn't know the results of that core data until then? No one that you know of at Kerr-McGee had that knowledge?

A Not to my knowledge.

Q Since they attained that data, has Kerr-McGee made any effort to lease that tract on which the well is to be drilled?

A No, sir.

Q Let me ask you some questions about your testimony on subsidence: You're going to have to educate me because I'm really not an expert like you are in the mining field.

Is it correct that subsidence occurs after second mining, is that what happens?

A Subsidence will occur after second mining, yes.

Q And subsidence occurs as the result of the mining regardless of whether there is any oil or gas well present?

A Would you repeat your question, please?

Q Subsidence occurs because of the mining, regardless of whether there is any oil or gas well present?

A I would assume that, yes.

Q It's your opinion, if I correctly understood your testimony, that if more than 35 percent of the ore is extracted in the first mining that some subsidence will occur?

A Some subsidence may occur, yes, sir.

Q "May occur"?

A Yes, sir.

Q It may not occur, too?

A I do not know. It is my thinking that would be about the highest abstraction we could go.

Q Without having some subsidence possible?

A Possible.

Q Now, you gave some testimony about some oil seepages. Do you recall that?

A Yes, sir.

Q Do you know whether any of the sources of any of those oil seepages was from oil wells?

A I couldn't say for sure they were.

Q You don't know?

A No, I don't.

Q Do you know if the wells within the vicinity were operating and producing wells or whether they had been plugged?

A I couldn't say for sure.

Q Therefore, you don't know whether they were plugged in accordance with the stipulations that are contained in Order R-111 regarding production?

A No, sir.

Q You testified that if methane gas escaped it could migrate along the mud seams shown, I believe, on Exhibit 7, which is your cross section?

A Yes, sir.

Q Do you recall that?

A Yes, sir.

Q It makes sense, does it not, that if the gas would escape, that there is gas to migrate?

A That would be assumed, yes, that there would be gas.

Q Of course, if the testimony in this record shows that no gas would escape even if there was a shearing of the well, there would be no gas?

A I can't make that assumption.

Q Mr. Lane, you stated in conclusion, I believe, a couple of questions that I thought came very close to being matters of law. In any event, did I understand that you said that you thought there was commercial deposits of potash

ore under Section 30, and in your opinion the drilling of a well there for potash mining would duly waste potash?

A I think that is a fair summary of what was said.

Q Is it true that this opinion of yours is based on the assumption that you would not be able to second mine within a 2100-foot radius of the well bore?

A Our calculations indicate that, yes.

Q And in your calculation of commercial deposits you considered only the value of the ore that would be extracted at that $33-plus-dollar-per-ton price, and did not consider the cost of mining potash?

A Commercial mineralization, yes.

Q I was correct in my statement, is that what you're saying?

A Repeat your statement?

Q That in your use of the term commercial deposits, commercial mineralization, you are not considering the cost of mining potash?

A No, sir.

Q You are not considering it?

A Not considering it at that time.

MR. ATTWELL: Thank you Mr. Porter. No further questions.

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0386

MR. PORTER: Does anyone else have any questions of this witness? Mr. Robb, do you have anything further?

MR. ROBB: I may have a little redirect. I wonder if we could have a five-minute recess, it may not be necessary.

(Whereupon, a short recess was had.)

MR. PORTER: The meeting will come to order, please. I believe Mr. Robb indicated he might have some redirect.

MR. ROBB: Yes, I just have a few questions.

REDIRECT EXAMINATION

BY MR. ROBB:

Q Mr. Lane, in my direct examination you indicated repeatedly that in your opinion there was economic-recoverable-commercial-ore body under Section 30, specifically under the Bass Federal No. 2 proposed location?

A Yes, sir.

Q And on cross examination you were asked whether or not you had made any cost study of mining costs in this area, and you indicated you had not. Would you please explain to the Commission what you mean by that?

A I made no direct cost estimates or studies of

the area in question. We have completed some cost studies of areas which are approximately five or a little bit over five miles away from the shaft, and from that study I feel that this area here, which is slightly further than that, would still fall within that study range.

Q Are you familiar generally with mining costs based upon your experience in this area?

A Yes, sir.

Q And in the calculation of an economic-ore body or I guess actually a commercial-ore body is an economic body, is it not?

A It should be.

Q That's a definition of a commercial-ore body; that's one where the ore is economically recoverable?

A Correct.

Q Okay. In giving your opinion concerning ore reserves, and the fact that this is a commercial-ore body, did you take into consideration, generally speaking, of the general cost information you have in this area?

A Yes.

Q You did not totally ignore costs, did you?

A No, not at all.

Q When you get ready to mine this area, Mr. Lane,

will you then make a detailed cost study?

A Yes, sir.

Q And was it that kind of cost study that you were referring to in your testimony in cross examination?

A A detailed one, yes, that is correct.

Q For purposes of making ore-reserve calculations normally, do you make that kind of detailed cost study of the kind that you make when you are about to mine?

A Not that complete, no.

Q Now, you were asked whether or not there was any guarantee whether you could get the fee land and the Federal leases that were in the immediate vicinity of this well, do you recall that?

A Yes, sir.

Q All right, sir, and I believe you said no there was no guarantee?

A That is correct.

Q You testified under direct examination that because of your existing workings in the area that Kerr-McGee was the only mining company that you felt could economically extract the ore in this area, is that right?

A I did.

Q Was that the reason why you stated that you

believed that you could get those two leases?

A That is correct.

Q You were asked about subsidence. If you mine more than 35 percent of the ore under the proposed-well location, will you tell the Commission whether or not, in your opinion, if more than 35 percent is mined, there will be subsidence in this area of the kind you described on direct examination?

A I feel subsidence would start at 35 percent, possibly less.

Q All right. And if you mined up to the 80 percent, that's normal and customary in this area, would you expect to enccunter the kind of subsidence that you testified on direct examination?

A Yes, sir.

Q You were asked about the three particular holes that made up the triangle in this case that you testified to extensively under direct examination, do you recall that?

A Yes, sir.

Q And you were asked about whether or not those were the only holes that you used in making calculations?

A Yes, sir, I remember that.

Q On direct examination, you had testified that in making a determination with regard to probable ore, you used

those three holes coupled with the fact that there was a proven-ore body within less than a mile away to the west?

A Yes, sir.

Q And of the fact that you had achieved mining experience in the area showing a reasonable continuity of the lower-ore member of the 10th horizon?

A Yes, sir.

MR. ATTWELL: Your Honor, I think that counsel's leading of the Witness is in error. I know we're trying to hurry up.

MR. ROBB: We really are, sir, yes.

MR. ATTWELL: I appreciate that, but I still think the witness is testifying, not Mr. Robb.

BY MR. ROBB:

Q Let me ask you, Mr. Lane, is your testimony based upon a probable-ore reserve underneath that Bass No. 2 site based solely on those three holes or is it based on some of those other factors also that you testified about this morning?

A All calculations were based on those three holes. The delineation of the K20-foot line was influenced in part by other holes in the general area and its, from past experience of mining and the other holes in the area, and from

personal experience and I made that statement.

Q Was it influenced to any extent by the fact that you have the proven-ore body less than a mile away?

A Sure.

MR. ROBB: That's all.

MR. PORTER: Mr. Attwell, do you have any further questions?

RECROSS EXAMINATION

BY MR. ATTWELL:

Q You are making a mining cost study for this area now; you testified that it's being prepared, didn't you?

A Not the complete detailed one, no.

Q But you're making a cost study of this area, you testified.

A We made some estimates, yes.

Q They have not been completed yet, have they?

A Not been completed, no, sir.

Q In the cost study of five miles away for a different part of your operations, what depth is that?

A The depth in that area would be 1500 feet. As stated before, depth does not have too much of a part on cost study.

Q As to subsidence, it occurred after second mining occurs, is that right?

A I can't use that term here. We advance and retreat right now.

Q Well --

A (Interrupting) The major subsidence will occur after second mining of high percentage extractions, yes, sir.

Q As far as danger is concerned, that's when it really is, after second mining, isn't that right?

A That's when you're hardest hit with dangers, yes.

Q That is what you had in mind so far as danger is concerned?

A This may be a reason, yes.

MR. ATTWELL: No further questions.

MR. PORTER: Does anyone else have a question of this Witness?

BY MR. NUTTER:

Q Mr. Lane, on your Exhibit No. 5, over here on Section 30 on the west side, according to the legend that is mined out and I can't read that light-fine writing, who mined that out?

A The west half of Section 30 of 2032 was mined out by National Potash.

Q National Potash Mine comes all the way down here, then? Okay, thank you.

MR. PORTER: Any further questions? The Witness may be excused. Any further testimony, Mr. Robb?

MR. ROBB: We may have some further testimony at this time.

MR. PORTER: What do you have in mind?

MR. ROBB: Offering some of the testimony that occurred in the Phillips-IMC Hearing. At that hearing the Commission took notice of some of the early proceedings the testimony it had, and at this time I am calling attention to the Commission -- this is case No. 4906 involving the Phillips Petroleum Company -- the Hearing was held here on February 21, 1973. I offer in evidence, at this time, that portion of the transcript, pages 125 to 147, inclusive, and 178 to 194 inclusive.

MR. PORTER: What were those last pages?

MR. ROBB: 125 to 147. I'm sorry, that was the first one. The second one was 178 to 194.

MR. KELLAHIN: If the Commission please, we object to the Commission incorporating Phillips' records or

any portion of it into the record in this case for the reason that involved an entirely different hearing, a different type of ore, different parties,and different witnesses, and it has no bearing whatever on the matters before the Commission at this time.

MR. ROBB: All that goes to is the weight to be given the evidence. It does not say it's not admissible. The portions of the testimony and I'm quoting: "Our testimony that was given by John Boyd of that hearing and the testimony given by Roy Williamson, testimony fully given, and fully cross examined by the same attorney, Mr. Kellahin, in that proceeding is part of the official proceedings of this Commission of which this Commission has undoubted power to take judicial notice that at this time we offer that in evidence and ask the Commission to take judicial notice ot that testimony."

MR. KELLAHIN: If the Commission please, the questions that we might ask in cross examination at this time and in this case and on the basis of this information that is now available to us, will be entirely different from anything previous in this record, and to say that I did the cross examination merely begs the question. I represent a different client here, different case, different testimony,

and an entirely different situation. We object to the incorporation of the evidence.

MR. ROBB: These are the same witnesses who testified and it only goes to the weight to be given the testimony, not their admissibility.

MR. PORTER: The Commission will sustain the objection in this case and proceed to statements of whatever summary you want to make in the case, closing statements.

MR. KELLAHIN: If the Commission please, I believe in performance of this matter, we have the right to close if Mr. Robb does have a statement to make.

MR. ROBB: Yes, sir. I think that my statement will be brief. It seems to me, Mr. Chairman, Mr. Trujillo, that the main issue we have here that we are faced with is whether there is a commercial deposit of potash ore underneath the proposed location because if there is, then I think that the record is clear that the risks that are involved in permitting oil or gas development to go ahead of the mining are such that they are unacceptable risks from the conservation standpoint. Now, the question that the well, that the people will do the very best that they can to cap this well, that they will cement it in the way they indicated, and that

in the opinion of one of their witnesses that ought to do the job, is not sufficient in my judgment to provide the kind of assurance that is necessary to prevent the kind of catastrophy that could result if gas escapes. It is clear that gas does escape from time to time from wells however careful the people are. It is clear that cement jobs are not always good; there is not always a full circulation of the cement. It is clear that there is no way that you can guarantee that that well will not permit the escape of gas and will not threaten the existence of potash mining that may be done in that area. Now, I don't know what the extent of that risk is, but I know it is present and anyone who has anything to do with the oil and gas business and who knows about the problems that occur, including gas that sometimes escapes from the outside of the casing, out around cement plugs, blowouts that occur, all these things are a common knowledge and all of these things are matters that we all recognize are risks that are involved in the drilling business. Now, it seems to me that what this Commission has to do at this point is decide whether or not, first of all, there is commercial ore and, secondly, if there is, whether or not the risk of escaping gas is such that they are willing to take the chance in permitting that development to go

ahead of the potash development. Now, I would submit that as long as there is any risks, however small it might be, that gas could escape and have the kind of result that has been testified here today, without contradiction, by Mr. Lane, the hazard that lies the men working the mines, the horrendous cost that would result or the abandonment of the potash mines, I would suggest that that kind of result is an unacceptable result from the standpoint of conservation. Particularly this is true where the testimony is undisputed -- and even by their own witnesses -- to the effect that if we permit the potash to be mined first, there is no corresponding risks to oil and gas deposits as there is the other way around. And so it seems to me that unless there is a guarantee here, which they refuse to give us, that there will be no such risk of that kind of catastrophe happening here, it seems to me that then the issue comes down to the question is there a commercial potash deposit underneath? Now, I submit that the testimony is overwhelming to the effect that there is such a deposit. I recognize that there is a difference of opinion among two qualified witnesses, and that this Commission is going to have to make that decision, but let me suggest why I think that the testimony of the Kerr-McGee witness, Mr. Lane, should be given a heavier weight than

that by Mr. Warnock. I say that the experience of the miner in the area who has to make these decisions concerning the economics of the ore body, who has to make the decision of whether or not it can be extracted, ought to be given primary weight. Mr. Lane and his crew have to make the decision whether or not an ore body is commercial every day in that mining operation or they wouldn't be in business very long. It's their every-day job to determine whether or not they have commercial potash, and they have two advantages here -- I should say perhaps one advantage, that would be a fair way to put it -- they have one very important decided advantage in their operations, and that is they are able to go underneath the ground and see how their ore projections and drilling came out, and as we mentioned before, the proof of the pudding is in the eating. You can make ore projections all day long from core holes, but unless you get underground and find out whether the ore is really there at the place where you think it is based upon your prior drilling, there is no way to tell whether or not you really have ore, and Kerr-McGee with an 8-year experience has found there is a continuity of that lower member of the potash which causes them to have confidence in the fact that even though the spacing in this area is admittedly wide spaced, that even

with that wide-spaced drilling they can be reasonably assured there is a probable deposit of potash ore underneath this location. Now, it seems to me that with that kind of evidence, coupled with the fact that we presented a cross section showing, in effect, that you have commercial ore going all the way from their present operations almost like an arrow right through the area occupied by Bass No. 2.

Number 3, you have the fact that Kerr-McGee is willing to expend the money that is necessary to get to that area as witness the five-year plans they have filed with the Commission, and the statement by Kerr-McGee's representative that they intend to follow that plan and go out to this area and mine. Now, they are willing to put their money where their mouth is. They have made a statement of what their mining plans are; they have talked to Teledyne about negotiating for the lease and this is not a situation with regard to utter speculation as to whether anything will ever be mined there any day which does take place in some circumstances in the potash area, and admittedly they don't have those areas under lease yet, and it's not the same situation as though they could guarantee it, but it does seem that the testimony that is undisputed is the fact that they are the only company that can really extract the ore from this area.

So it seems to me, that given the two alternatives of one development for the basic purpose of the conservation is to try to see that the very most of these very extremely valuable natural resources are extracted. That the $15,000,000 or $16,000,000-worth of potash that might otherwise be jeopardized or lost, will not be lost, but will be preserved as a national resource for the benefit of all the people including the economics involved from the employment of over one year of 400 men to extract it, which is the amount of ore that would have to be left because of the risks that are involved. Mr. Lane will not mine that area. He will not accept the risks of going into that area and the risk that methane gas may cause an explosion or danger to his men or equipment. And so it seems to me that given that state of facts, unless Belco can satisfactorily establish that it can directionally drill underneath this area, and do it without endangering the potash deposit, that it makes imminent more sense to have the mining take place first, which involves no risk at all to oil and gas, and then let the oil and gas development follow. That oil and gas will still be there. There may be minor drainage that takes place from that other location under the Bass No. 1, but essentially the deposits are going to remain there, and it seems to us that the alternative of

permitting the risk to take place should be not acceptable.

MR. PORTER: Mr. Kellahin?

MR. KELLAHIN: If the Commission please, this is a rather strange case, really, in many ways. Here we are arguing with a Protestant who doesn't own any interest in the area, and certainly I can see how that would hurt, but basically I don't think that it really affects the jurisdiction of the Commission because it is enjoined by Statute to protect potash and that is part of the duties pursuant to that duty. We have adopted Order R-111-A and stated that the purpose of it is to protect against the waste and protect correlative rights, and permit the economic recovery of oil and gas and potash, and to treat them all equally. Now, Paragraph 3 of Order R-111-A states that no well shall be drilled for oil or gas at a location which in the opinion of the Commission or its duly authorized representative would result in undue waste of potash deposits or constitute a hazard or interfer unduly with potash deposits. And it further says that no mining operations will be conducted in the potash area that would in the opinion of the Commission or its duly authorized representative constitute any hazard to oil and gas production or that would unreasonably interfere with the orderly development and production from any oil or gas pool.

Now, almost identical language is found in the Secretary's Order. Of course the Secretary's Order doesn't control this Commission, but it shows that they were working together in handling this situation and that Order provides that no mining operations under a potash lease would be permitted which would interfer with the orderly development and production under any oil and gas lease issued for the same land.

Now, what we're really talking about here, then, is whether in the first place this is the orderly development of the South Salt Lake Morrow Gas Pool. Certainly I think our testimony shows that it clearly is. We have some seven wells already drilled in the Pool which almost completely surround the well site. The pool is based on 320 acres which was done on the Application of Belco Petroleum, and I might point out that reduces the number of wells that I have because the Pool was originally under 160-acre spacing. Now, we're talking about whether or not this is a development well. There is just no dispute in question, in fact, I believe that counsel stipulated that it is. Now, we're talking about, then, whether or not there would be undue waste of potash, and the only evidence that is before the Commission. That's really the only controversy we have here. There has been considerable mention of directional drilling and other

things, but apparently that has been dropped and clearly the evidence that has been presented, Belco shows the impracticality of directional drilling to achieve any purpose in this particular area, and that evidence stands unquestioned in the record.

Kerr-McGee's testimony is constantly referring to the loss of potash which would result from the drilling of this well. Now, in the first place, of course, this is not their potash. Federal acreage is 80 acres; this is under a known geological structure and would have to be offered in open bid. You or I or Belco or anybody else could bid that acreage in if they wanted to, if they are willing to go high enough. The second acreage of 80 acres was held by Teledyne, and the only evidence we have in that regard is a letter or statement from Teledyne to the effect that they are willing to negotiate. I don't know just what "negotiate" means; it can mean a great many things. The fee acreage is 160 acres. It has some 25 owners, one of whom is the principal owner, as we have shown, is Atlantic Richfield who has an interest in the well if it is drilled, and I doubt that they would find a sympathetic potash owner to deal with in that regard. So I would say, off hand, that 160 acres is out of the question. Now, the question of gas occurring in the

mine, there is a very strong emotional appeal and it has been used to the fullest extent in this particular case. In this connection, we all know, that there is a great number of oil and gas wells drilled in potash area, and Kerr-McGee's witness says that he doesn't know of any methane gas in any potash mine in the Carlsbad area, and certainly that in itself would indicate that we don't really have a serious problem here. As to drilling in a cement plug, in this case they are mining and plugging the well as provided by R-111-A, and, testified to by Mr. Cope, would adequately protect against any leakage of gas into the mines if there is any mine in this area. He concluded that even if the casing were sheared at the level of the potash mine, no gas could possibly escape into the mine. We have a 1000-foot solid cement plug below that level. Now, again, this testimony stands unrefuted in the record, and the only thing that has been said in attack on it is pure speculation and no substantial evidence. So then we come back to standards of the question as set by R-111-A: Is there commercial potash in the area? We've shown the proposed area is essential to the orderly development of the Pool. The next question is, will the drilling of it unduly interfer with and cause waste of potash? Well, in the first place, as Mr. Robb said, their five-year plan

points the finger right out at the proposed-well location. That finger was pointed shortly after Belco brought its Application to drill in this area. Prior to that -- and the Commission's records will show this -- their five-year plan did not approach this area at all, and their own mining operations in nine years of activity, as shown by their exhibits, compared to where they're proposing to drill in the next five years, would cast some considerable doubt on whether they will be anywhere near this area in five years.

MR. ROBB: I'm sorry, I don't like to interrupt counsel, I'm sure he doesn't intend to state that fact, but the five-year plan that Kerr-McGee has filed with the Commission dating back to long before this year -- Mr. Kellahin, I'm sure you weren't aware of that -- do show that Kerr-McGee has intended to go out to this vicinity for quite some time. The Commission knows, it is in their own record. I have copies that were filed last year even before this Application was filed on the part of Belco.

MR. KELLAHIN: If the Commission please, I'll stand on the record that was filed and is in the Commission's records. It is my understanding and I looked at these two the five-year plan as filed in previous years came nowhere

near this area. It didn't extend in this direction, but this long shoot-out toward the Belco location was not filed until this year, in my judgment, and I think I'm correct in that, but the Commission's records will show.

Now, when we come down to the determination of whether there is any commercial ore in this area, we get a lot of definitions as to what is commercial ore, but I would point out that on cross examination of the Kerr-McGee witness the claim to state what their costs were, he gave a gross figure on what he said would be the ore left in place in there, but he wouldn't say what it would cost to remove it, so we don't know whether it's commercial or not. If he believes there is $5,000,000 worth of ore in there that would cost $6,000,000 to extract, it is certainly not commercial, and on the record we have before us today we don't know what is commercial. All we have is an assertion that they think it is commercial, but on cross examination he declined to give us any information on which we could judge this. Now, in Section 33, getting back to the exhibits on which Kerr-McGee reached a determination that there was commercial ore here, in Section 33 they used a core to project a 1500-foot cut-off point that is to the risk of the ore body, which we submit is the

proper way to do it, but then when they come over to where the Belco location is, they had the audacity to project some 12,000 feet in order to determine there was an ore body. In other words, they used the core information to suit the purpose, wherever it may be. Now, on the contouring exhibit, which was submitted by Kerr-McGee, they used only the ore data that was shown on the core which was shown on the exhibit and that, as was shown on cross examination, does not include all of the cores. In contract, Mr. Warnock utilized every available spec information they were able to get, including core data that was furnished to us by Kerr-McGee under subpoena.

Now, Kerr-McGee's conclusion, then, that there is ore underlying this area is just highly speculative. It's based on widely-spaced data and I'll call your attention again to the Triangular Method which they used to determine there is ore lying within that triangle. Here we're talking about a triangle which extended from 1.7 miles to more than 2 miles apart, and one of those cores, incidentally, by Kerr-McGee's own definition was non-commercial ore containing some 57-foot-per-peak percentage of ore where they said they had a cut-off point of 13. So nothing here shows that there is actually commercial ore underlying the tract. Now, when

they come to the south half of Section 30 -- and that's the area we are talking about -- there is no core data in that section whatsoever, and there is none close to it. There is no core data in the entire section. There is no core data in the north half of the section. Now, they want us to conclude on the basis of this speculative material that there is commercial ore underlying the south half of Section 30 which would be lost to the development of the well. Now, going back to we're confronted here with a Protestant who doesn't own any acreage in this area; their closest lease is 4000 feet away. It is impossible for me to see how they are going to be damaged by our Application, and to deny Belco's Application for the development well in a proven-gas pool on the basis of such highly speculative evidence from a company holding no interest closer than almost a mile away, would do violence to both the letter and the intent of the Commission's order R-111-A, and we ask that the Application be approved.

MR. PORTER: Is there anything further to come before the Commission? Mr. Carr, do you have any correspondence?

MR. CARR: The Commission has received several letters and telegrams concerning this case. Atlantic Richfield Company wire was signed by Mr. A.J. Brown, Joint

Interest Superintendent in Texas. (Reading) Atlantic Richfield Company has 25-percent mineral interest in the southwest quarter of Section 30, Township 20 South, Range 33 East and a working-interest owners in other tracts, and feels that correlative rights will be violated unless the No. 2 Federal well is drilled. Atlantic Richfield supports Belco's position in this Section 30, Township 20 South, Range 33 East is suffering drainage from other wells in the area. (End of reading)

We have a letter from Mr. Henry Montcliff and Vera Riggs which states that (reading) they own royalty interests in the Southwest quarter of Section 30, Township 20 South, Range 33 East, Lea County, New Mexico. These royalty interests are presently being drained by offsetting production and consequently urge the approval of the Application of Belco Petroleum Corporation. (End of Reading)

We have a letter from Audie Richards, who states that (reading) as the mineral interests owner under the Southwest quarter of Section 30, Township 20 South, Range 33 East, I ~~and~~ urges that the Commission unitize this acreages, ~~and that~~ they ~~reject~~ the request as ~~by~~ Belco Petroleum Corporation. (End of reading)

We have a letter from G.F. Clark of Texaco, in Midland

Texas which reads in part (Reading) Texaco as a non-operator-interest owner files this letter in support and in favor of Belco Petroleum Corporation's Application. In denying Belco's Application, would prevent the orderly development of production of oil and gas in the South Salt Lake Field. (End of reading)

We also have a letter from Mr. Joe Peacock of Phillips Petroleum Company supporting the Application of Belco Petroleum Company.

We have received a wire from Tenneco Company in support of Belco's position in the drilling of the well in this case signed by Mr. D.D. Meyers, Denver Division, Production Manager for Tenneco.

We have received correspondence from Perry R. Bass supporting the Application of Belco Petroleum Company, and a letter from Sharp Drilling Company. The letter from Sharp Drilling Company goes to a question that was discussed here, but doesn't take an actual position on the question.

MR. ROBB: May I ask that the record attendance that was kept at this table be made available. Specifically, I would like to call attention to the Commission, for the record, that representatives of five other potash companies were here at the Hearing including Teledyne, for whom an

appearance was made, International Minerals Company, who made an appearance through Chuck Childers, their Manager, Potash Company of America, through Mr. Blackman, the Duval Company through Mr. Jack Highfield, and Amack through Mr. Bob Kirby, all of them being potash companies in the Carlsbad Potash Basin.

MR. PORTER: I believe that attendance registration is made part of the transcript, is it not? If there is nothing further, the Commission will take the case under advisement.

(Whereupon, the Hearing was adjourned at 3:26 P.M.)

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0386

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

I, RICHARD L. NYE, Court Reporter, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me, and the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

COURT REPORTER

THE NYE REPORTING SERVICE
STATE-WIDE DEPOSITION NOTARIES
225 JOHNSON STREET
SANTA FE, NEW MEXICO 87501
TEL. (505) 982-0386