

OIL & GAS CONSERVATION COMMISSION
Meeting: October 18, 1967
John Bannister, Executive Secy

JACK WILLIAMS
GOVERNOR
LYNN LOCKHART
CHAIRMAN
LUCIEN B. OWENS
VICE CHAIRMAN
HIRAM S. CORBETT
MEMBER
GEORGE T. SILER
MEMBER
KENNETH G. BENTSON
MEMBER



OFFICE OF
Oil and Gas Conservation Commission
STATE OF ARIZONA
ROOM 202
1824 WEST ADAMS
Phoenix, Arizona 85007
PHONE: 271-5161

JOHN BANNISTER
EXECUTIVE SECRETARY
J. R. SCURLOCK
PETROLEUM GEOLOGIST

A G E N D A

Meeting

October 18, 1967

Arizona Highway Department Auditorium
206 S. 17th Avenue, Phoenix

9:30 a.m. Call to order

1. ✓ Approval of minutes of meeting of August 16, 1967
2. ✓ Executive Secretary's Report
3. ✓ Geologist's Report
4. ✓ Old business
5. ✓ New business : *Status of D.J. Simmons #1 Navajo well*
6. Adjourn

10:00 a.m. Hearing, Case 28, to consider Kerr-McGee Corporation application for unitization of Pinta Dome Field.

1:30 p.m. Hearing, Case 29, application of Kerr-McGee Corporation to dispose of salt water into its Navajo No. E-1 well, Dineh bi Keyah Field.

Govs. travel policy
vacation

OIL AND GAS CONSERVATION COMMISSION
1624 West Adams - Suite 202
Phoenix, Arizona

Minutes of Meeting
August 16, 1967
Arizona Highway Department Auditorium
206 S. 17th Ave., Phoenix, Arizona

Present:

Mr. Lynn Lockhart, Chairman
Mr. Lucien B. Owens, Vice Chairman
Mr. George T. Siler, Member
Mr. Kenneth G. Bentson, Member
Mr. John Bannister, Executive Secretary
Mr. J.R. Scurlock, Geologist
Mr. Dick Thomas, Phoenix Gazette

Absent:

Mr. Ralph W. Bilby, Member

Chairman Lockhart requested that Mr. Owens conduct this meeting and the subsequent hearings.

Meeting called to order at 9:30 a.m. by Vice Chairman Owens.

Minutes of meeting of July 19, 1967, with corrections to typographical errors, were approved. The executive secretary's report and the geologist's report were accepted.

Mr. Bentson moved, and the motion passed, that the proposed request for supplemental budget for 1967-68 and the new budget for fiscal year 1968-69 be approved by the Commission and forwarded to the commissioner of finance.

It was further decided that should any commissioner be unable to attend the budget hearing with the commissioner of finance, that the executive secretary would represent this Commission.

Meeting adjourned at 10:30 and the Commission immediately entered into the scheduled hearings.

APPROVED October 18, 1967

By _____
Lucien B. Owens
Vice Chairman



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JOHN BANNISTER
EXECUTIVE SECRETARY

J. R. SCURLOCK
PETROLEUM GEOLOGIST

September 12, 1967

Memo to: Commissioners
From: John Bannister, Executive Secretary
Re: Report of Activity

Humble Oil and Refining Company has announced the completion of another producing well, their #1 Navajo 88, located SE SE 25-36N-29E. This information has been revealed to the Commission; however it has not as yet been made public; consequently it is requested that it be kept confidential.

As the result of this well Humble has staked the location of its #2 Navajo 88, SE NE 25-36N-29E.

Kerr-McGee has commenced drilling in the NE NE 14-35N-30E. This well is a gas test and consequently does not come within the purview of the spacing order.

As you are aware, the Indians are holding a lease sale September 26 in Window Rock. It is my intention to attend this sale. The majority of the acreage being offered is in Townships 6 and 7 North, Range 7 West, NSM. In addition, there is some scattered acreage north and west of the Dineh Bi Keyah Field. There is no acreage being offered in the immediate vicinity of the Dineh bi Keyah area. 198,790.49 acres is being offered in Arizona; total acreage offered is 171,573.31 in Arizona, Utah, and New Mexico.

Kerr-McGee Corporation has recently advised this office that a producing well in the Dineh bi Keyah area costs between \$125,000 and \$150,000, depending upon location costs which run between \$15,000 to \$25,000 on an average, although the Humble #1 Navajo 88 location costs were in the neighborhood of \$70,000.

Kerr-McGee advised that pipeline costs ran about \$600,000. It was necessary that they put in a gathering system costing approximately \$300,000; generators for necessary electrical power cost approximately \$250,000 and the necessary highlines to carry power from generators to the various points ran

another \$125,000.

As you are aware, Kerr-McGee is now taking Humble's production into its pipeline.

It is encouraging to note that Pan American, Gulf Oil, DEPCO, and Texaco are drilling immediately north of the Canyon De Chelly. It is my opinion that the prime target of these holes is not the igneous sill as found in the Dineh bi Keyah Field. It is my feeling that the prime target here is the Mississippian and Pennsylvanian formations; of course they will be on the lookout for the sill, although it is possible that the sill will have pinched out prior to reaching this immediate area.

As you are aware, this office is now in the process of cleaning up wells which have been on a temporarily abandoned status. The Ari-Mass well in Pinal County has been plugged. The C & J well near Congress Junction is being worked upon.

The Harless wells were given 60 days in which to comply with our regulations and this time will expire in late September. It is anticipated that prior to our next meeting (October 18) the Commission will have requested the bonding companies to perform this work and in all likelihood the interim between now and the next meeting will see the accomplishment of this.

The Potter well, southwest of Flagstaff, too is in the category of temporarily abandoned. We have been in contact with Mr. Potter and he has advised that he is attempting to get work done. Consequently we are waiting to allow him to accomplish his purpose. He is attempting to have this hole logged.

The Ferrin wells were granted during our June meeting an extension until the end of the year.

Our Chairman, Mr. Lockhart, underwent additional surgery on September 7 and I am pleased to report at this time he is doing quite well. Should any of you desire to contact him, he is in John C. Lincoln Hospital, Room 315, in Phoenix.

Governor Williams is enforcing a new out-of-state travel regulation wherein only one person may attend a given convention or meeting at State expense unless others are immediately involved as a speaker or a committee member. Of course anyone wishing to attend out-of-state functions at his own expense may do so and "no cost to the State" travel orders will be issued to cover him by any workman's compensation, etc. in the event of accident. Any expenses incurred by an individual on such a trip are tax deductible expenses.

Transportation in this category will, where applicable, be done without the payment of federal taxes inasmuch as this office can and will issue a tax exemption certificate. The tax exemption certificate must be presented prior to the issuance of a commercial transportation ticket because once the federal tax has been recorded it is not refundable.

New Permits:

- 422: Kerr-McGee C-2 Navajo, SW NW 33-36N-30E, Apache County
- 423: Skelly Oil #1-Q Navajo, NW NW 18-38N-30E, Apache County
- 424: American Mining #1 Navajo, SE NW 28-38N-24E, Apache County
- 425: Miami Oil Producers #1 Navajo, NE NW 30-41N-30E, Apache County
- 426: Kerr-McGee #1-H Navajo, NE NE 14-35N-30E, Apache County
- 427: Kerr-McGee #1-F Navajo, SE SE 24-36N-29E, Apache County
- 428: Pan American #1 Navajo AB, NW SE 32-7N-7W NSM, Apache County
- 429: Gulf #1 Navajo-Defiance, NE SW 12-6N-7W NSM, Apache County
- 430: Texaco #1 Navajo BC, NW NE 26-7N-7W NSM, Apache County
- 431: Humble #2 Navajo 88, SE NE 25-36N-29E, Apache County
- 432: DEPCO #1 Navajo, SW SE 7-7N-7W NSM, Apache County

Arizona is now producing approximately one million dollars worth of oil per month. I do not anticipate that there will be a sizeable increase in production prior to the first of next year. However, this would be increased by any sizeable new discovery.

At last report the new helium plant at Navajo seems to be assured. Mr. Dick McDonald, president of Arizona Helium Corporation, has advised he anticipates construction of the plant will commence approximately October 1 and feels that the plant will be on full production by the first of the year.

Contracts have been let for the construction of the facility to house the plant and prefabrication of the plant itself has been completed. The eight-plus miles of pipeline to carry gas from the wells to the plant has been ordered. It is my understanding that initially 4-inch diameter steel pipe will be run to the plant across the Puerco River and permission from the county to attach this line to the bridge has been received. Necessary right of way on both State and fee land has been secured and trenching and laying of the pipeline should have been commenced by this date. There may be some slight delay due to the extreme wet weather in this area.

Interest of both independent oil operators as well as major company operators is very evident in this office and I feel that 1967 will be a banner exploration year for Arizona. I am extremely pleased that interest is shown not only on the Reservation and in the area of Dineh bi Keyah, but also in other areas within the state.

We are enclosing for your information a copy of a letter from Arizona Bureau of Mines, Tucson, concerning our sample situation. As you are aware, this Commission supports this function of the Bureau of Mines by a contribution of \$2,500 per year, as well as supporting a similar operation in the Museum of Northern Arizona.

The Four Corners Sample Cut in Farmington, with whom the Commission made arrangements years ago to receive all State well samples for cutting and distribution to the Bureau of Mines and the Museum, has been in financial difficulty due to slow down of activity in the Farmington area. As a result they recently place a prohibitive price on this service to our above agencies which is paid from our support money.

I am in contact with the directors of the Sample Cut in order to make certain that the purposes of this Commission are served. Should this contact not come to a satisfactory conclusion, it may be necessary that all samples be brought into the office for distribution to the Bureau and Museum. Inasmuch as the Commission has neither the physical space nor personnel to handle this operation, it is most desirable to continue our arrangement with the Sample Cut.



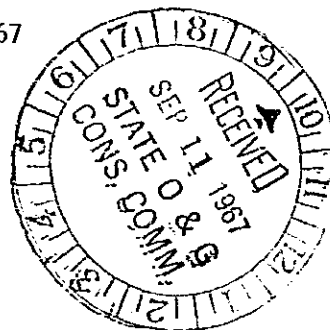
THE UNIVERSITY OF ARIZONA

TUCSON, ARIZONA 85721

Telephone: Area Code 602
884 - 2733

ARIZONA BUREAU OF MINES

September 8, 1967



Mr. John Bannister, Executive Secretary
Arizona Oil & Gas Conservation Commission
1624 W. Adams
Phoenix, Arizona - 85007

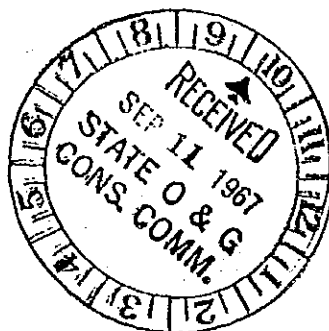
Dear Mr. Bannister:

Because the Arizona Oil & Gas Conservation Commission gives much appreciated financial and other supports to the operation of the well-sample repository maintained by the Arizona Bureau of Mines at the University of Arizona, I thought I'd indicate to you and the Commission that the facility is being utilized to the betterment of the State of Arizona.

As of July 1, 1967, we had 2210 sets of well samples, 309 of which are classed as "oil well" exploration holes. However, you know that samples from any hole drilled in the ground, regardless of purpose, can contain invaluable information. It is probable that the total significance of such information may not be immediately realized. It is this delayed action that gives much value to a sample repository. Once carefully stored, a sample set can be visited by many persons, persons with diverse interests.

The Commission might be interested to learn that since April of this year, we have been asked to loan 18 sets of samples, 14 of which were sought by 3 out-of-state major oil companies. In addition, since its inception, our samples and records have been a significant source of information for 4 doctorate and 2 masters theses, and for 5 professional articles contained in periodicals of wide circulation. Currently, a graduate student is doing his thesis on the geology of the Pinta Dome region. Subsurface data gleaned from the repository will constitute a major part of the study. Besides the above, well samples form the basis for special studies conducted as a part of class work, e.g., pollen and microfauna study techniques, as well as logging practice.

The bulletin on well information being assembled by the joint efforts of the Arizona Bureau of Mines and the Commission will provide widespread publicity of the fact that this repository exists. Thus, we anticipate that the use of the facility will continue to expand and that it will continue to provide new information about Arizona's geologic framework within which all mineral commodities exist.





THE UNIVERSITY OF ARIZONA

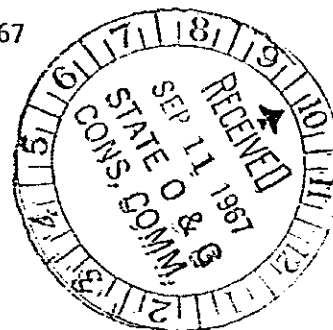
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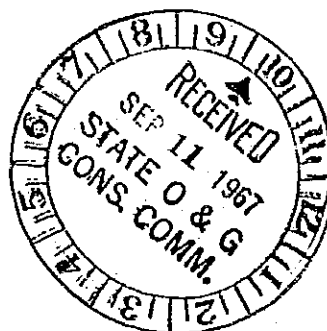
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Mr. John Bannister
Page 2.

September 8, 1967

Checking the number of "oil well" sample sets in storage against the number of oil, gas, or helium tests drilled reveals that all samples are not being made available to the State. In this regard, it might be in the best interests of the State for the Commission to review the regulations applicable.

Again, we are appreciative of the aid that the Commission gives to the perpetuation and enlargement of Arizona's working sample repository.

Sincerely,

H. Wesley Peirce

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Associate Geologist

HWP/h



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J. R. SCURLOCK
PETROLEUM GEOLOGIST

October 11, 1967

Memo to: Commissioners
From: John Bannister, Executive Secretary
Re: Report of Activity

The results of the Indian sale were furnished to you. The actual leases which will result therefrom have not been issued. So it is too early to anticipate any development of the newly leased acreage.

It appears that production from the Dineh bi Keyah Field will settle out at approximately 350,000 barrels per month.

I anticipate that initial drilling on the Field is about at a standstill due to, primarily, the current lease situation wherein further drilling by either Humble or Kerr-McGee would tend to prove up surrounding leased acreage and would consequently greatly increase the values of these leases, making it more expensive for Kerr-McGee or Humble to purchase this acreage when offered. It is my feeling that outside of one or two more wells we will not see further development until such time as additional acreage within the area is leased.

Some writers are of the opinion that the Field has been fairly well outlined. I do not, however, subscribe to this theory inasmuch as we have yet have no indication as to how far southwest or northwest the area does extend. This can only be accurately determined when the field is completely surrounded by dry holes.

You will note in the article by Hank Pohlmann, which is enclosed, that he anticipates a westward and southward extension of this Field.

To date the tests drilled immediately north of Canyon de Chelly have all resulted in dry holes. However, I have seen no indications of these few tests cooling the interest in this area. I anticipate that we will have additional drilling.

I anticipate, further, that due to the potential winter weather starting in the near future and in view of the fact that we are

getting into the end of the companies' budget year when all companies' budgets are normally low, that we will have a decreasing drilling activity for the rest of the year. After the first of the year as weather breaks and after budgets are renewed, drilling activity should show an upswing.

As you know, Kerr-McGee is planning to purchase a number of snow sleds for use in the Dineh bi Keyaj Field in order to get to wells for necessary maintenance during this period.

The Commission is one 48-hour alert to go into Superior Court on the Harless situation. As you are aware, the Court refused to make permanent the restraining order originally issued, but we are now under a temporary injunction pending the outcome of the trial.

Due to a crowded court calendar we do not know the actual time of the trial, but it is anticipated to be sometime during the week of October 16. The Attorney General's Office and this office feel we are in a strong position and will be able to refute anything Mr. Harless will bring up during the yearing.

I had occasion to fly over the Harless area recent and no activity has been resumed in spite of the rumors that additional activity is planned in the area.

Oil Discovery Corporation, a Sedona based company, should be filing for a permit to drill approximately 8 miles south and east of the old Petty location (now held by Jim Potter, Flagstaff). This location is on the plateau north of Verde Valley.

Activity has resumed on the C & J well, about 3 miles west of Congress Junction. The operator is fishing there for what he thinks is broken pipe.

As you are aware, the Commission has two hearings on October 18 in the Arizona Highway Department. The first at 10:00 a.m. will be concerned with unitization of the Pinta Dome area. This area, while it has been referred to as a unit, is presently composed of drilling units. Kerr-McGee is now seeking full unitization.

At the insistence of the State Land Department and this office, the percentage will be on the lease base rather than the old gerrymandered drilling units. We have reviewed the proposed unit agreement and feel that we can properly concur in this project. I have compared the Pinta Dome application with that of the Navajo Springs Unit plan previously approved, and there is no substantial variance.

At 1:30 p.m. we will hear Kerr-McGee's new proposal to inject salt water into the McCracken formation through their #E-1 well, located SE SE 20-36N-30E. This hearing of course is the outgrowth of the earlier request from Kerr-McGee to inject into the Coconino formation which the Commission denied. The McCracken formation in this area lies at a depth of 3619-3728, and is considerably below any zones used as a water source. Consequently it is my belief this may be approved if the Commission so decides.

As you have been previously informed, the Governor is drastically limiting out-of-State travel for all State agencies. The policy now in force is that one man may attend out of State functions under normal circumstances. However, if more than one person from an agency is involved in a committee or must be present to make a speech, additional travel may be approved.

The December IOCC meeting is scheduled in New Orleans. So far as is known now, Governor Williams will attend this session and is scheduled to make one of the major address, the response to the official welcome which will probably be Tuesday evening at the official banquet. This office has already been instructed to give aid in preparation of this speech.

Since our last meeting Directive 2-67 was issued setting up specific times for the enforcement of our gas-oil ratio tests on producing oil wells and pressure tests on gas wells. To date the response to this directive has been excellent.

I have appeared before the Finance Commission and the Joint Legislative Appropriation Committee concerning our 1968-69 budget request and our request for supplemental appropriation. I feel that both appearance were well and sympathetically received. It is not known at this time whether or not the special session which may be held in November will consider supplemental requests. As soon as this information is received you will be so informed. Should this forthcoming special session not consider supplemental requests the regular session of Legislature in January will undoubtedly do so.

New Permits:

- 433: MuCulloch #1-1 Navajo, NW NW 1-38N-22E Apache County
- 434: Champlin #1 Navajo 335, NE SE 4-41N-29E Apache County
- 435: Simmons #1 Navajo, SE SW 30-36N-27E, Apache County
(Issuance of this permit is being held pending receipt of bond coverage)

Since the establishment of the Dineh bi Keyaj pool and field at the August hearing, Kerr-McGee #13, located SE SW 31-36N-30E, and the Humble #1-88, located SE SE 25-36N-29E, have become producible and will necessitate the expansion of both the pool and the field.

Humble is currently drilling their #2-88, SE NE 25-36N-29E, and it is our plan to wait until this new well comes in before expanding the field. This expansion then will include the E/2 25-36N-29E and the SW/4 31-36N-30E.

A symposium on the Gasbuggy project was, as you know, held in Farmington on September 19 and 20. This was attended by me, George Siler and Ken Bentson. Due to Governor Williams' new travel policy, Mr. Bentson and Mr. Siler attended at their own expense.

This symposium was extremely interesting and the promise of a new tool it opens to the industry is tremendous. The actual atomic shot is now scheduled for approximately November 14. A small selected group of individuals will be invited to attend the actual shot, and in this respect the members of the Commission have already been invited. As you may recall, the actual shot was postponed from October 14 due to a prolonged fishing job in drilling the shot hole.

I am pleased to report that Senator Lockhart is responding well after his surgery and he anticipates being with us on October 18th and also making the December IOCC meeting.



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CHAIRMAN
LUCIEN B. OWENS
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Oil and Gas Conservation Commission

OFFICE OF
STATE OF ARIZONA
ROOM 202
1624 WEST ADAMS
Phoenix, Arizona 85007
PHONE: 271-5161

JOHN BANNISTER
EXECUTIVE SECRETARY
J. R. SCURLOCK
PETROLEUM GEOLOGIST

October 11, 1967

Memo to: Commissioners
From: J.R. Scurlock, Geologist
Re: Report of Activities

September 25th - Sedona

Six Harless wells. Took pictures for Jordon Green (Attorney General's Office) to use in our coming court action against Harless. Pictures show: (1) need to clean junk off locations, and (2) need to fill cellars and pits which, in some cases, are deep and precipitous enough to represent a danger to cattle.

September 28th

Showed picture slides of Dineh bi Keyah Field and Arizona Helium Corporation's new plant site to luncheon meeting (Neptunes Table) of Arizona Oil and Gas Association. This presentation was received with great interest.

Oct. 6 - Congress Junction

C & J Drilling Co. #1 State: Mr. Bill Sargeant, a knowledgeable oil field driller, has bought an Idaho Hydare rig (double mast; truck-mounted rotary) and has moved it on to the location. He is presently fishing for drill string.

Dineh bi- Keyah

Kerr-McGee 11 oil wells
Humble 1 " "

Field total 12 oil wells produced 361,420 bbls. in Sept. Navajos receive 1/6 of this (60,000 bbls.) in royalty which amounts at \$2.80 per bbl to \$168,000.

168,000
x12
\$2,016,000 annual royalty

Thus, the royalty from Dineh bi Keyah should bring approximately two million dollars to the Tribe next year. Their present income

is estimated at \$12,000,000 (@ Graham Holmes, Navajo Area Director) while over \$17,000,000 has been budgeted for the 1968 fiscal year. This \$2,000,000 in royalties (plus the \$654,299.98 received in bonus bids on the September 26 lease sale) will go a long way towards closing the indicated \$5,000,000 deficit.

Kerr-McGee produced 331,402 bbls. at Dineh bi Keyaj during September and Humble 30,018 bbls. After deducting royalty, operating expenses, and transportation costs (25¢ per bbl to Kerr-McKee Pipeline Co.), the net profit is approximately \$2.00 per bbl.

331,402 bbls (Kerr-McGee)
x \$2.00 per bbl
\$662,000 net profit

30,018 bbls (Humble)
x \$2.00 per bbl
\$60,000 net profit

Dineh bi Keyah has produced 1,000,000 bbls oil since February of this year. The U.S. consumes 12 million bbls. oil per day.

Toadlena Anticline

Kerr-McGee has set pipe on their I-1 Navajo, a New Mexico wildcat, located on the Toadlena Anticline, 20 miles southeast of the Dineh bi Keyah. This is a helium discovery which the company now plans to follow with five additional wildcats in New Mexico. No doubt we will see this wildcatting spread northwestward into Arizona along this large Toadlena Anticline. Kerr-McGee hopes to find sufficient reserves to warrant a pipeline to their Navajo plant--which lies 90 miles away. The government plant at Shiprock is closer (30 miles from Dineh bi Keyaj, where Kerr-McGee has helium shut in) to the wells; but, of course, the Government price would be low - approximately 20¢ per MCF (depending on helium content) - compared with \$1,0625 per MCF, which is the well head price for raw gas going paid at Pinta Dome.

American Mining #1 Navajo

O'Donnell & Ewing has located another derrick and should be drilling again in a day or two on American Mining. Their derrick collapsed while pulling on fish. TD 5800'.

Mike O'Donnell has a new 8½ lb. baby boy. Reports that he intends breaking him in right away on his drilling rig.

Arizona Helium Corp. Navajo plant

Building is up. Still working on plubing and electrical wiring. Installation of gathering system proceeding apace. Producing units ready to ship. Should arrive in Navajo and installation begun around last of October.

The United States has 31 billion barrels of known oil reserves. These reserves would be exhausted within ten years if no effort were made to unlock new reserves. We will use 78 billion bbls of oil between now and 1980.

KERR, DAVIS, IRVINE, BURBAGE & HENTZ
ATTORNEYS AND COUNSELLORS
1500 KERNAC BUILDING
OKLAHOMA CITY, OKLAHOMA 73102

ROBERT S. KERR, JR.
HOWARD DAVIS
FRANCIS S. IRVINE
E. NORTON BURBAGE
WM. WALTER HENTZ
RICHARD J. SPOONER
RUSSELL G. HORNER, JR.
PHILIP D. HART
CHARLES C. GREEN
WILLIAM W. NELSON

JACK T. CONN
WM. G. KERR
OF COUNSEL

October 2, 1967

AREA CODE 405
CENTRAL 6-8413

Oil and Gas Conservation Commission
Room 202, 1624 West Adams Street
Phoenix, Arizona 85007

Attention: Mr. John Bannister,
Executive Secretary

In re: Application of Kerr-McGee
Corporation to Dispose of
Salt Water in its Navajo
No. E-1 Well.

Dear Mr. Bannister:

Enclosed herewith please find an original and one copy of the Application of Kerr-McGee Corporation, as above described on Form 15, together with a copy of the Log of the No. E-1 Well, and two plats showing the ownership, as required by Rule 307. I am also enclosing a proposed form of Notice for such use as it may be to you.

By copy of this letter and a copy of the Application and Plat, we are notifying Rebel Oil Company, who is the only operator other than Kerr-McGee within one-half mile of the subject well, and the Navajo Tribe of Indians, who are the owners of the surface in this area.

We will appreciate your having the Notice run so that we might have the hearing on this matter on October 18. If you need anything further, please feel free to call on me.

Very truly yours

Francis S. Irvine
For the Firm

FSI:ra



Oil and Gas Conservation Commission
October 2, 1967
Page 2

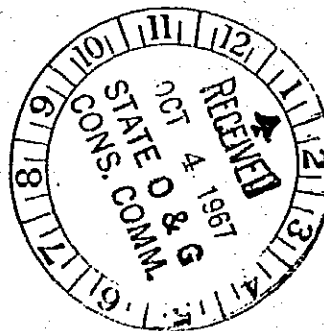
cc: Rebel Oil Company
101 North Turner
Hobbs, New Mexico 88240

Mr. Henry A. Pohlmann
Minerals Supervisor
The Navajo Tribe
412 Petroleum Plaza Building
Farmington, New Mexico 87401

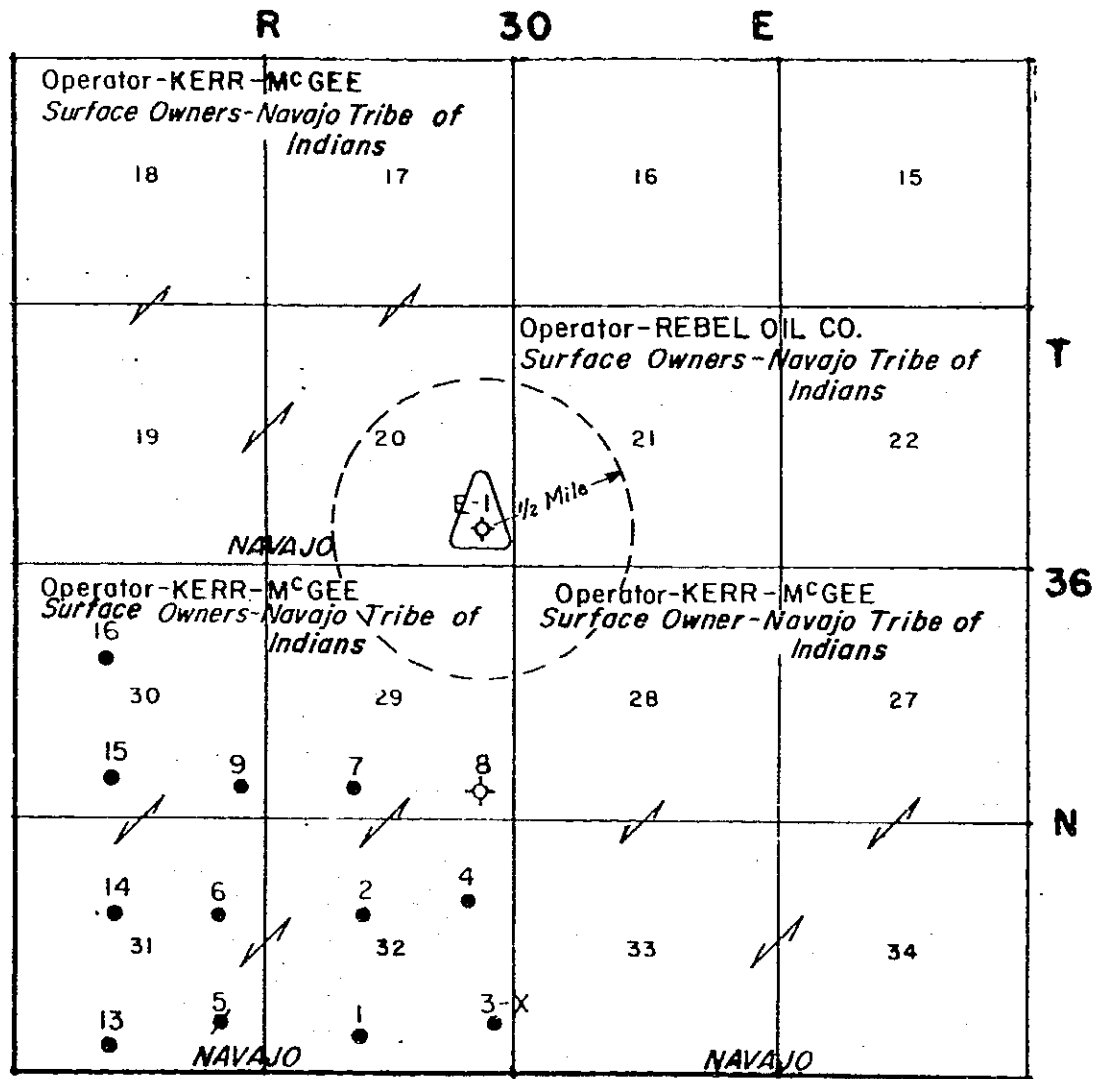
Mr. P. T. McGrath
U. S. Geological Survey
Oil and Gas Division
P. O. Box 959
Farmington, New Mexico 87401

Mr. Cato Sells
Director of Water Resources
The Navajo Tribe
Window Rock, Arizona

Mr. C. D. Williams
Kerr-McGee Corporation
Room 215 Petroleum Center Building
Farmington, New Mexico 87401



| APPLICATION TO DISPOSE OF SALT WATER BY INJECTION INTO A POROUS FORMATION | | | | |
|---|------------|--|--|--|
| Operator Kerr-McGee Corporation | | Address 73102 Kerr-McGee Building, Oklahoma City, Oklahoma | | |
| Federal, State or Indian Lease Number, or lessor's name if the lease | Well No. | Field | County | |
| 14-20-0603-5521 Navajo | E-1 | Dineh-bi-Keyah | Apache | |
| Location 740' FSL and 660' FEL Section 20-T36N-R30E (Permit No. 398) | | SEC-TWP-RGE or Block & Survey | | |
| CASING AND TUBING DATA | | | | |
| Name of string | Size | Length | Cement Data | |
| Surface Casing | 9-5/8" | 253.27' | Cemented with 340 sacks | |
| Intermediate | None | - | - | |
| Long String | 4-1/2" | 3,650' | Will probably cement with 350 sacks | |
| Will be run | | | Name, Model and Depth of Tubing Packer | |
| Tubing | 2-3/8" | 3,600' | Production packer at 3,600' | |
| Name of Top and Bottom of Injection Zone McCracken Sand open hole from 3,650' to 3,750' | | | | |
| Is Injection through Tubing, Casing or Annulus? | | Perforations or Open Hole? | | Is this a new well Drilled for Disposal? |
| Tubing | | Open Hole | | No |
| List all Cement Squeeze Operations, Giving Interval and Number Sacks Cement None | | | | |
| Is Injection Zone Productive of Oil or Gas in This Field? | | Depth of Deepest Fresh Water Zone | | Depth of Shallowest Productive Zone |
| Yes | | 1070' (Coconino) | | None |
| Anticipated Daily Injection Volume (bbls.) | Minimum | Maximum | Open or Closed System? | |
| | 500 | 2000 | Closed | |
| Is Injection to be by Gravity or Pressure? Plan to inject by gravity but will use pressure if necessary. | | Approx. Pressure (Psi) | Source of Water to be Injected | |
| | | 0# - 2000# | Oil and/or gas wells on Kerr-McGee's Navajo | |
| Are there any other Salt Water Disposal Wells using this same zone in this field? | | Yes or No | If so name one such well below | |
| | | No | Leases in vicinity. | |
| Name of Operator of Disposal Well in same zone | | Lease Name | Well No. | |
| | | | | |
| Is this well so cased and completed that water can enter no other formation than the above set out injection zone? | | Yes or No | Have notices of this application been mailed or given to all operators within 1/2 mile of this injection well? | |
| | | Yes | Yes | |
| List names and addresses of all operators within one-half (1/2) mile of this injection well: Mr. Hal Spears, Rebel Oil Co., Hobbs, New Mexico | | | | |
| <p>CERTIFICATE: I, the undersigned, under the penalty of perjury, state that I am the <u>Reservoir Engineer</u> of the <u>Kerr-McGee Corporation</u> (company), and that I am authorized by said company to make this report; and that this report was prepared under my supervision and direction and that the facts stated therein are true, correct and complete to the best of my knowledge.</p> | | | | |
| <p>INSTRUCTIONS:</p> <p>1. Attach a complete full-scale electrical log of this well, if available. Indicate on electrical log, or by other evidence, the base of fresh water zones in this field.</p> <p>2. Attach waivers from all operators within one-half (1/2) mile of injection well, or copies of letters notifying such operators of this application. Also attach waiver from surface owners of land on which the disposal well is located, or copy of letter from operator making this application notifying such surface owners of this application and requesting waivers.</p> <p>3. Should all necessary waivers not accompany application, the State of Arizona Oil & Gas Conservation Commission shall hold such application for a period of ten (10) days from date of receipt. If, after said ten (10) day period, no protest or request for a hearing is received, the application will then be processed.</p> | | <p>Signature <u>Bill P. Stauss</u></p> <p>Date <u>October 2, 1967</u></p> | | |
| <p>Date approved _____</p> <p style="text-align: center;">STATE OF ARIZONA OIL & GAS CONSERVATION COMMISSION</p> <p>By _____</p> | | <p>STATE OF ARIZONA OIL & GAS CONSERVATION COMMISSION Application To Dispose of Salt Water by Injection Into a Porous Formation File Two Copies</p> <p>Form No. 15</p> | | |



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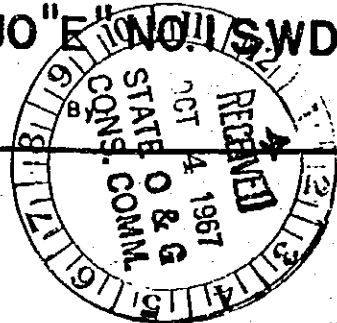
ARIZONA OIL & GAS
 CONSERVATION COMMISSION
 CASE NO.
 KERR-McGEE CORPORATION
 EXHIBIT NO. _____

KERR-McGEE CORPORATION

LUKACHUKAI AREA
 APACHE CO., ARIZONA
 DINEH-bi-KEYAH FIELD

PROPOSED NAVAJO "E" NO. 1 SWD

Scale: 1" = 4000' Date _____



Dineh bi Keyah lifts Navajo spirits

THE Navajo Reservation's new Dineh bi Keyah continues to grow and expand. It is very obviously a big strike and will get bigger. Present production is 15,000 b/d. The productive igneous or syenite sill is not the only economic target. The deeper Pennsylvanian and Devonian intervals contain commercial quantities of helium gas. Good pressure information is still being secured, and exploration continues, but available figures indicate large igneous rock reserves are probably present.

The people. The Navajo Indian people number about 110,000.

Some recent estimates have reached 120,000. One hundred years ago, the number was approximately 10,000 and times were even more difficult. Survival in the remote areas of the reservation is not an easy matter.

In 1846, the United States took possession of the southwest territories from Mexico. Treaties were

Henry Fred Pohlmann
Minerals Supervisor
The Navajo Indian Tribe

easily made and rapidly broken. Military forces came and went. The Navajos held their ground until Col. Kit Carson arrived in 1863. Carson's scorched earth policy brought the majority of the people to their knees. Some of the strongest never capitulated.

Approximately 8,000 of the people subdued by Carson's forces were made to take the Long Walk. The walk started at Fort Defiance, Ariz., and ended at Fort Sumner, N.M., a distance of 300 miles. After 4 years of misery, the treaty of 1868 was signed and the people returned home.

Today the people are strong and they get stronger. Many problems remain but solutions are forthcoming.

The government. The people are

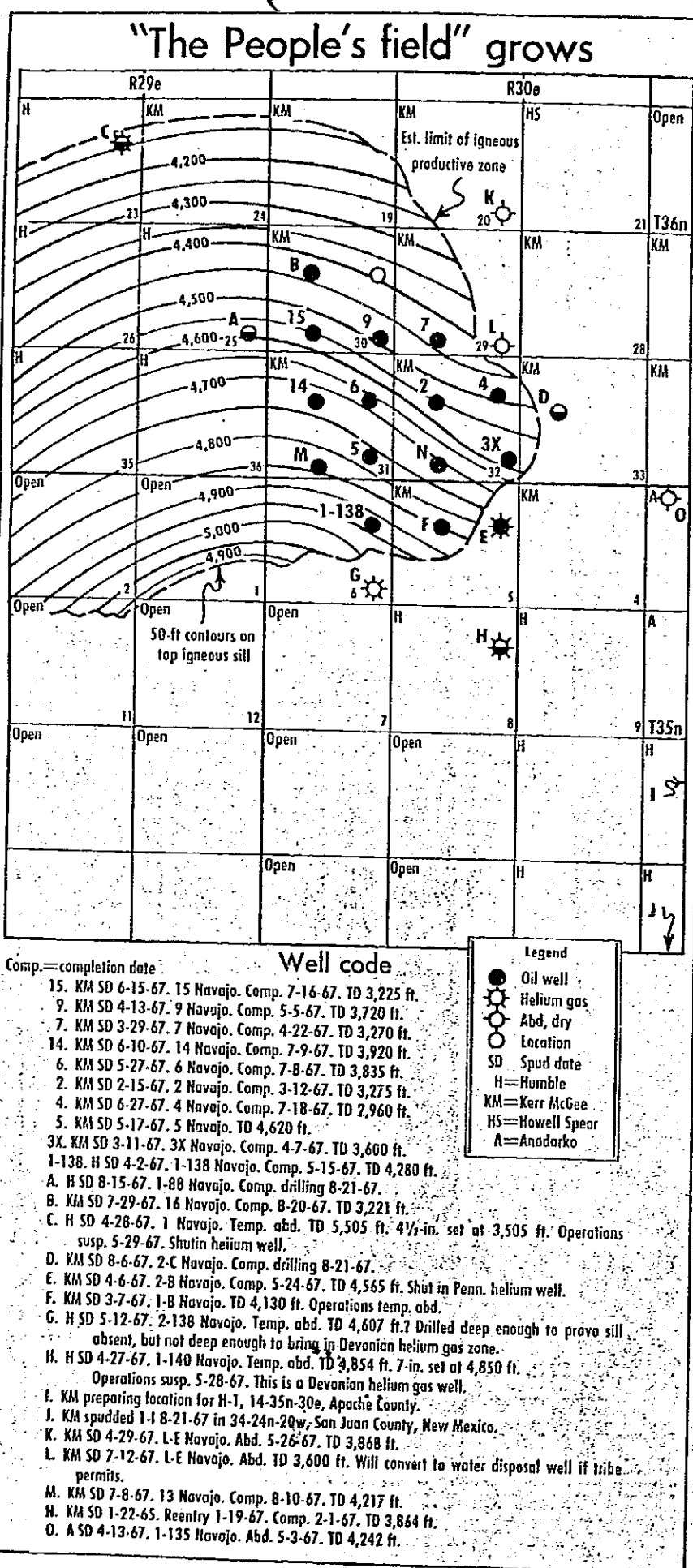
governed by a 74-member council, a chairman, and vice-chairman. An election takes place every 4 years and the infighting gets rough. The present chairman is Raymond Nakai and he has just started his second term.

All major business is done on the council floor at Window Rock, Ariz. The council members sit at individual desks facing the rostrum. If an oil and gas lease sale is being proposed, we must convince the majority of the council that such a sale has merit. The speaker stands on the lower level of the two-level stage. The chairman sits behind the speaker on the second level. The speaker employs English.

The English is recorded via the voice horn or "mocking bird" and by an interpreter using English shorthand. The interpreter signals the speaker when he has reached his maximum word volume. The interpreter then converts the Navajo oriented English shorthand into

NAVAJOS clear location for more well sites in Arizona's fast-growing Dineh bi Keyah field.





spoken Navajo. Questions are presented, (usually in Navajo), a vote is taken, and the majority rules.

The people have recently begun to assume their rightful place in the operation of state governments. Wilbert Begay, a member of the minerals department staff, is a New Mexico state representative. Three other Navajo people hold similar positions in New Mexico and Arizona ruling bodies. Herbert Tsosie, another key member of the minerals department, also contributes much to his Navajo people.

The land. The Navajo Reservation covers at least 16 million acres and is the approximate size of West Virginia. Most of the land is rocky, windblown, eroded, cruel, and overgrazed. Diné bi Keyah is on the Toadlena anticline in a heavily wooded portion of the Chuska Mountains.

Most of the Navajo Reservation is in Arizona, and large areas are held in New Mexico and Utah. The Ute Indian Tribe occupies the arrowhead of Colorado that juts into the side of the Navajo nation from the northeast.

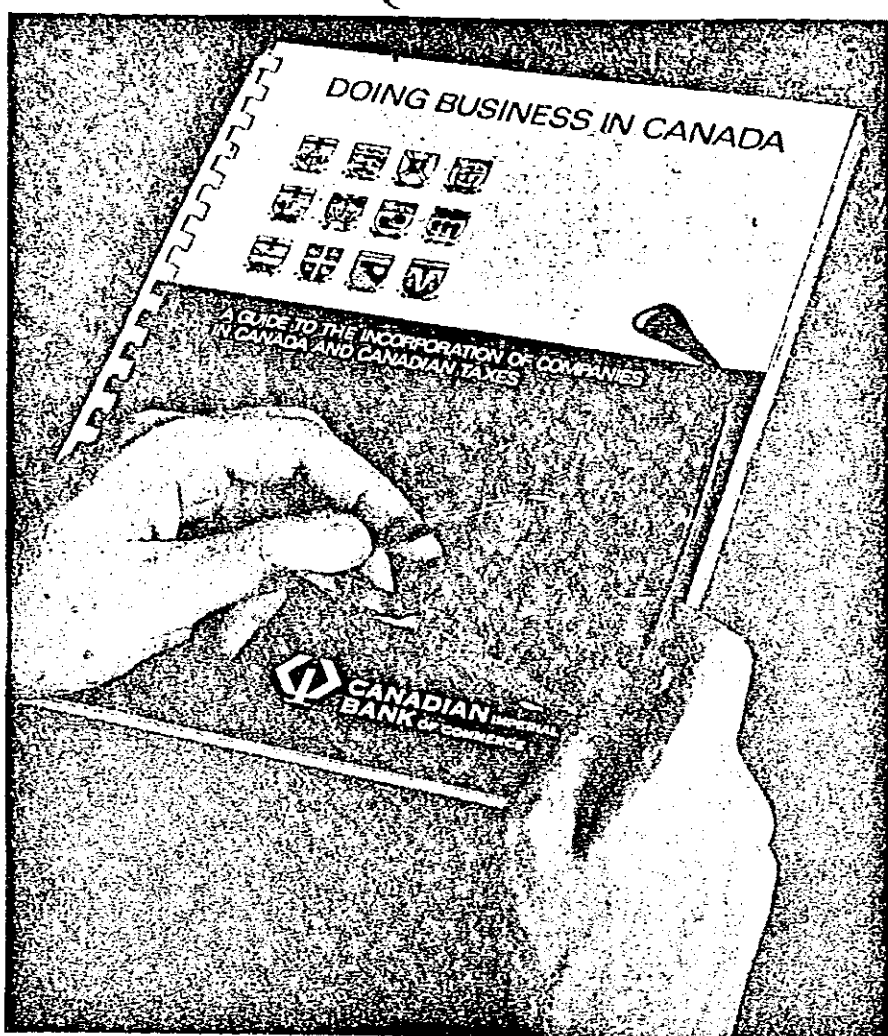
The volume of Navajo land under oil and gas lease (as of June 30) follows:

| State | Area (acres) |
|--------------|----------------|
| Arizona | 341,259 |
| New Mexico | 447,484 |
| Utah | 192,042 |
| Total | 980,785 |

The discovery well, Kerr-McGee's Navajo 1 was spudded on Jan. 22, 1965. Seven-in. casing was cemented at 3,159 ft on Feb. 13, 1965. After the casing operation, "Operations (were) temporarily suspended pending moderation of weather and availability of company-workover unit."

During early June 1965 the shallow Coconino interval (starting at 590 ft) was thoroughly tested. Helium containing gas was found, but pressure and volume remained too low for commercial interest. The presently producing igneous interval was not tested at this time. Kerr-McGee formally abandoned the subject well on June 22, 1965.

The first notice of reinterest came via an USGS notice dated Jan. 17, 1967. The indicated notice stated



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Petroleum and Natural Gas Department
Canadian Imperial Bank of Commerce
309 8th Avenue S.W., Calgary, Alberta

Ian F. Messer
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Canadian Imperial Bank of Commerce
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1967—Our 100th Year of Banking

Kerr-McGee wanted to reenter 1, clean out the cement plugs, perforate from 2,860 to 2,885 ft, and test said interval.

The following account of subsequent operations will be of interest:

1-26-67. Spotted 1,000 gal of 10% acetic acid at 3,020 ft. Perforated from 2,860-2,885 ft with 4 jets per foot. Swabbed well dry. No fill up.

1-27-67. Acidized with 358 gal of 10% acetic acid. Recovered 4 bbl of new oil in 5 hr of swabbing.

1-28-67. Swabbed 6.75 bbl of new oil in 8 hr.

1-29-67. Fractured well with 10,000 gal of crude oil and 10,000 lb of 20-40 sand.

1-30 and 31-67. Swabbed back all of frac oil and 137 bbl of new oil.

2-1-67. Tested well at rate of 611 b/d.

The discovery well ultimately settled at 1,400± b/d until July 19, 1967 when additional interval was opened. After the additional zone (2,885-2,942 ft) was introduced, production climbed. The production on July 23, 1967, was 1,851 b/d of 43.3° oil, 135 Mcfd gas, and 0 b/d water. The GOR was 73 cu ft/bbl.

Several very important and new obvious points were demonstrated by the action that took place in the discovery well. First, we can no longer ignore any igneous rock when some oil or gas saturation is indicated. Secondly, a negative drill-stem test (or swab test) of untreated but potentially production igneous rock means nothing. The same kind of rock can be acidized and results may still remain poor.

A frac job, in Dineh bi Keyah, was the obvious difference between the kind of economics we all desire and complete and utter failure. We wonder how close Kerr-McGee came to missing the Dineh bi Keyah? How many other Dineh bi Keyahs have been passed up? Bid patterns on recent Navajo oil and gas lease sales indicate some people believe other fields of this type may be sleeping under the surface cover of Navajo land. Areas that we have already sold, two or three times, are being purchased again.

The location. The people's field or pasture was discovered by the Kerr-McGee Corp. on top of the Toadlena anticline in the Chuska

Dineh bi Keyah production results

| Company | Well No. | Completion date | Initial production Oil (b/d) | Gas (Mcf/d) | June 1967 Oil (bbl) | Gas (Mcf) | Barrels July 1967 | Cum. oil prod. to 7/1/67 | Pumping (P) Flowing (F) |
|------------|----------|-----------------|------------------------------|-------------|---------------------|-----------|-------------------|--------------------------|-------------------------|
| Kerr-McGee | 1 | 2-1-67 | 611 | ..... | 18,061 | 1,230 | 22,350 | 92,902 | P |
| | 2 | 3-12-67 | 2,857 | ..... | 79,537 | 6,463 | 73,567 | 358,328 | P |
| | 3X | 4-7-67 | 2,865 | 367 | 81,706 | 5,256 | 52,971 | 259,255 | P |
| | 4 | 7-18-67 | 3,249 | 189 | ..... | ..... | 42,888* | 42,888 | P |
| | 6 | 7-8-67 | 163 | 22 | ..... | ..... | 2,395 | 2,395 | P |
| | 7 | 4-22-67 | 2,578 | 276 | 32,590 | 3,263 | 25,439 | 116,526 | P |
| | 9 | 5-5-67 | 2,622 | 36 | 44,997 | 4,506 | 44,499 | 144,361 | P |
| | 14 | 7-9-67 | 301 | 390 | ..... | ..... | 3,442 | 3,442 | F |
| | 15 | 7-16-67 | 250 | 25 | ..... | ..... | 3,397 | 3,397 | P |
| | 1-138 | 5-16-67 | 1,420 | 300 | 22,148 | 9,191 | 27,806 | 62,176 | P |
| Humble | | | | | | | | | P |
| Total | | | 16,916 | 1,605 | 279,039 | 29,909 | 288,754 | 1,085,670 | |

*Thirteen days production!
 †Indicates standard pumping unit. All others are Reda submersible pumps except flowing well KM 14.
 Note: The 1,000,000th bbl of Dineh bi Keyah oil was produced on July 27, 1967.
 Additional interval was opened in KM-No. 1 on 7/19/67. Production on 7/23/67 was 1,851 b/d of 43.3° oil, 135 Mcfd gas and 0 b/d water.

Mountains of Apache County, Ariz. The center of Dineh bi Keyah is approximately 5 miles due east of the Arizona-New Mexico boundary, or about 52 miles southwest of Farmington, N.M. Shiprock, N.M., (a large Navajo Reservation town) rests 33 miles northeast from the discovery.

This is high country. The discovery well is 7,560 ft above sea level. Kerr-McGee's 14 Navajo is 8,555 ft above the ocean's surface.

The climate is what should be expected at the indicated elevations. It is wonderful for 3 months, livable for an additional 4 months, and very doubtful for the remaining 5.

The rocks. The Chuska sandstone usually rests on the surface. The standard Northeast Arizona, geologic section lies beneath the Chuska. All of the normal rocks are present.

Our main interest centers on the intruded igneous syenite sill—the formation giving up the "money." The writer would be happy to think of and call this rock a quartz free granite containing many recognizable minerals, but some geologists might be chagrined. The following description should be more suitable:

"The interesting green rock is a biotite-rich vogesite and thus belongs to the syenite lamprophyre group of igneous rocks. The rock has undergone surprisingly little alteration. Lamprophyres are usually altered considerably but only a small part of some of the grains in your sample have been changed to chlorite, calcite, and ores.

The rock consists of euhedral grains of diopside, biotite, apatite, rutile(?), and ores enclosed in large anhedral grains of sanidine (poikilitic texture). Chlorite, calcite, and some of the ores are alteration products. Diopside imparts the green color to the rock and there is evidence of zoning of this pyroxene. The biotite is about medium brown with dark brown rims and is slightly altered to chlorite, diopside is a little more altered to chlorite, calcite, and ores. Small prisms of spatite and needles of rutile(?) are scattered throughout the sanidine. The opaque ores are silver in reflected light and probably are magnetite or ilmenite. The following model analysis is based on a count of 100 points.

| | (1) | (2) |
|----------|-----|-----|
| Sanidine | 43 | 47 |
| Diopside | 22 | 27 |
| Biotite | 21 | 22 |
| Chlorite | 3 | |
| Ores | 2 | 2 |
| Apatite | 1 | 1 |
| Rutile | * | * |
| Calcite | * | |
| Cavities | 8 | |

(1)—percent of all constituents.

(2)—percent of rock-forming minerals, excludes alteration products (chlorite, calcite) and cavities.

*—less than 1%.

Frankly we don't even know if this rock is really igneous. Another expert states, "My opinion is that

this rock represents a sedimentary rock that has been altered by heat and large additions of soda." He also says, "Loss of CO₂ by the carbonate could account for the porosity in the rock."

This rock demonstrates obvious primary porosity, but the degree and type of fracture system also must play an important role. Section 32-36n-30e probably enjoys a highly complex fracture system. All wells in this section are outstanding economic assets.

The thickness of the subject igneous rock varies. In 1-87 only a single 18-ft bed is present, but in 1-138 a multibed thickness of 160 ft to 170 ft exists. No. 1-138 is the only multizone well in this field to date.

Although the presently known syenite sill is confined to the Pennsylvania interval, it does not precisely conform to any "normal" horizon. In 1-87 the base of the 18 ft of intrusive is 66 ft above the Pennsylvanian-Mississippian contact. In the 1 Kerr-McGee discovery well the top of the perforations are 307 ft above the Pennsylvanian-Mississippian contact and the base of the perforations 225 ft above the same point. The top of the multilayered intrusive in 1-138 is 414 ft above the top of the Mississippian rocks.

The intrusive rock has been determined to be about 31 million years old. The invaded Pennsylvanian or host rock was born approximately 300 million years ago.

Although the writer was unable to define an obvious barrier between 1-138 and the remainder of the field, he believes 1-138 is in a separate pool or compartment. No.

1-138 is the structurally highest in Dineh bi Keyah (top of sill at +4,938), but 14 has a higher GOR. It will be interesting to note the GOR in 13 after it is placed on production. No. 13 is midway between 1-138 and 14.

The performance history table gives a better clue. Note the original field or pool pressure was 729 psia as determined in the discovery well on Feb. 4. Three months later the approximate pool pressure was 590 psia, but the pressure measured in 1-138 was 732 psia on May 10.

The multilayered and thicker intrusive zone in 1-138 is also vastly different from the single zone intrusive found in all other Dineh bi Keyah wells.

The drill-stem test results in the Devonian (McCracken and Aneth intervals) are of interest. The high helium content (5.18 to 6.23%) makes this gas valuable.

Flow rates of approximately 1,000 Mcfd may not seem to be world beaters, but other factors must be considered. After acid treatment and frac, a 1,000 Mcfd well will probably be capable of 4,000 Mcfd. Large reserves must be present—note the vast distance between wells.

The wellhead value of 1 Mcf of 5% helium gas is not 20 cents, (federal Government price at Shiprock plant in New Mexico), but will be closer to 50 cents if sold to a privately owned plant. Pure helium gas is now sold under competitive conditions and the current value of 1 Mcf is \$28. We believe much profit would be made by the plant owner if the total cost of raw gas needed to produce 1 Mcf of pure helium was only \$10.

In summary, don't get careless with an untreated Devonian well capable of producing 1,000 Mcfd of 5% helium gas. This kind of well could produce \$1,000 to \$2,000 worth of gas per day. What is the daily income from your average gas well?

The production and pressure. The subject matter is best explained by the two tables. Kerr-McGee's 4 is the best well to date. It is difficult to top 3,249 b/d in the U.S.A. today. No. 4 is probably capable of 10,000 b/d if additional pump capacity was added.

Some pressure decline has taken place. A plot of pressure vs. time

or pressure vs. cumulative production proves the idea in rapid fashion. Pressure decline is becoming less severe and will continue to do so for some unknown time. We expect a gas cap to start forming in the near future. Bubble point pressure of the Dineh bi Keyah oil is approximately 660 psia.

Expansion, solution gas, and gravity probably all contribute part of the energy needed to produce oil from this field. We don't expect any help from water although some is present in No. 7.

The economics. Big wells, no production restrictions, shallow easy drilling, quality crude oil, a firm market, and nearness to a half empty major pipeline make Dineh bi Keyah one of the most attractive economic ventures in the U.S.A. today.

This oil sells for \$2.80/bbl at the Four Corners. The Kerr-McGee pipeline charge to transport Dineh bi Keyah crude oil to the Four Corners will probably be 25 cents/bbl. (Kermac recently completed a 33-mile 8-in. Dineh bi Keyah to Four Corners line with a gravity flow capability of 20,000 b/d. If pumps are added the capacity could be doubled.) Royalty will mount to about 43 cents/bbl and another 8 cents will go to Arizona. An estimated operator value of \$2/bbl means the average Dineh bi Keyah well is producing approximately \$3,200/day. How much money does

your average oil well produce each day?

Conclusion. No detailed conclusions concerning the Navajo people, their government, or this land will be made. Work, education, and time will solve most of their problems. Mineral income will continue to furnish the needed fuel to keep the wheels of progress turning.

The Dineh bi Keyah story is just starting. Due to the unique nature of the discovery and our inability to predict the presence of subsurface intrusives, many wells will be drilled. Drilling contractors should enjoy the area.

The presently known limits of Dineh bi Keyah will continue to grow (probably to the west and southwest), but other syenite production will also be found on this vast structure. The next remote drilling action will probably take place on the Arizona-New Mexico boundary and in New Mexico. Close to production drilling in and around Dineh bi Keyah will obviously continue.

A superb economic and operations environment makes Dineh bi Keyah one of the most attractive current ventures in the U.S.A.

The Navajo Tribe and particularly the Navajo Minerals Department enjoys the action. It's been a long dry season in Arizona!

Reference

1. Izett, G. A. and Peterson, F., Branch of Mineral Classification, Conservation Division, U.S. Geological Survey, Denver.

Performance history*

Table 2

| Operator | Well No. | Date | Shut-in pressure† (psia) | Source of pressure measurement | Shut-in time (hours) | Cumulative total reservoir oil production‡ (stock-tank barrels) |
|------------|----------|---------|--------------------------|--------------------------------|----------------------|---|
| Kerr-McGee | 1 | 2- 4-67 | 729 | Liquid level | | 539 |
| | | 7- 6-67 | 517 | Sensor | 64 | 811,308 |
| | | 3-10-67 | 665 | Bomb | | 17,099 |
| | | 4- 7-67 | 612 | Sensor | | 92,658 |
| | | 7- 6-67 | 484 | Sensor | 64 | 811,308 |
| | 4 | 7-17-67 | 470 | Bomb | | 889,621 |
| | | 6-30-67 | 546 | Liquid level | | 772,645 |
| | | 4-18-67 | 594 | Bomb | | 151,457 |
| | | 7-10-67 | 462 | Sensor | 96 | 832,985 |
| | | 5- 4-67 | 597 | Bomb | | 262,901 |
| | 9 | 7- 9-67 | 439 | Sensor | 72 | 827,769 |
| | | 7- 8-67 | 551 | Bomb | | 822,049 |
| | | 7-14-67 | 471 | Bomb | | 865,024 |
| | | 1-138 | 732 | | | 322,951 |
| | | 5-10-67 | 732 | | | |
| Humble | 1-138 | 5-10-67 | 732 | | | |

* This information compiled by H. J. Gruy & Associates and used by Kerr-McGee at Arizona Oil and Gas Conservation Commission hearing on Aug. 16.

† Measured pressure converted to 4,500 ft datum.

‡ Relate to date column.

helium plant under construction at Navajo, Arizona. Carlson Products Corporation of Oklahoma will furnish pipeline products for an eight-mile gathering system to connect helium wells with the plant.

Don't Inject Salt Water in Coconino

Kerr-McGee Corporation has been denied permission by the Arizona Oil and Gas Conservation Commission to dispose of salt water by injection into the Coconino formation at an Apache County well, its 8 Navajo, in 29-36N-30E, Dineh bi Keyah field. The commission ruled that such injection might contaminate fresh water sources within the formation.

Texas Firm Acquires Leases

Virginia Gas & Oil Company, Box 969, Albany, Texas has leased nearly 18,000 acres of federal lands in Coconino and Yavapai counties.

Arizona Production Soars

Oil production figures for July have been released by the Arizona Oil & Gas Conservation Commission. July oil total was 323,819 barrels, cumulative oil for 1967 was 1,171,997 barrels, and cumulative oil production to date in Arizona 1,806,560 barrels. 316,262 barrels of the July oil came from the Dineh bi Keyah field.

Pan Am Tract Gets Drill Test

Pan American Petroleum was releasing no information on its wildcat effort some 14 miles southwest of Dineh bi Keyah, but Loffland Brothers had a rig ready to spud at last report. The well is slated to granite at about 3200 feet, and is located on a 640-acre tract Pan Am picked up at the Navajo lease sale for \$26.18 per acre. The well is the 1 Navajo Tribe-H, NW SE 32-7N-7W.

Salt Lake Firm Drills "Tight"

American Mining Company of Salt Lake City was reported drilling below 1790 feet at its pre-Cambrian wildcat in Apache County. The remote

wildcat is its 1 Navajo, SE NW 28-38N-24E, on a farmout from Superior Oil Company. It spots some 33 miles northwest of Dineh bi Keyah. O'Donnell & Ewing of Phoenix has the drilling contract.

Will Drill to Granite at 6500

Miami Oil Producers of Abilene, Texas has located its Miami-Federal 4154 in NE NW 30-41N-30E, Apache County, Arizona. This is about 30 miles north of Dineh bi Keyah, and will drill to 6500 feet or granite. Nearest

drilling was a failure about two miles to the east, drilled by Superior Oil in 1960, which tested the Mississippian at 5991 feet.

Gulf Tract Gets Drill Test

Gulf Oil has staked a location on its 640-acre tract purchased from the Navajo lease sale last May, which cost them \$10.07 an acre. Proposed depth has not been announced. Gulf's 1 Navajo-Defiance, NE SW 12-6N-7W, is about 16 miles southwest of Dineh bi Keyah.

Oil Firms Take Look at Navajo Indian Reservation Lands After Dineh bi Keyah

Most of Arizona is relatively unexplored for oil and gas. In fact, of Arizona's 14 counties, only two, Navajo and Apache, produce oil or gas. Its newest and biggest oil field, on the Navajo Indian reservation, in northeastern Arizona's Apache County, is still growing. The new field is called "Dineh bi Keyah" which means "The People's Field" (Dineh — people, bi — the, and Keyah — pasture or field), in the Navajo language.

Kerr-McGee discovered the field in February; now has nine producing wells in the field, and has a 100 percent working interest on about 47,000 acres in the area which it has leased from the Navajo tribe. Development of the field is continuing. Humble Oil & Refining has one producing well. The biggest producer so far was completed last month by Kerr-McGee at its 4 Navajo, less than a mile northeast of the discovery, which pumped at the rate of 3,147 barrels of oil per day, which gives a mighty fast pay out for wells drilled to around 2,900 feet.

produced only 132,000 barrels of oil.

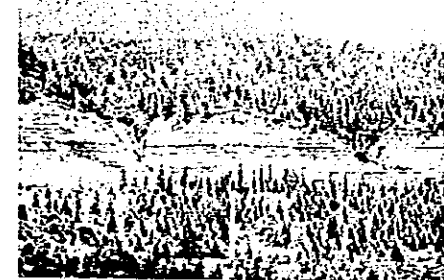
Helium bearing gas zones have also been found in the Dineh bi Keyah field. Kerr-McGee has completed one helium gas well, and Humble has announced finding helium in one of its wells. Additional drilling for the helium is planned.

The strangest thing about Dineh bi Keyah is that it is an oil field which just shouldn't exist. Some oil industry people call it a freak. However, the freak does exist, and results from drilling to date show it is a significant one. Kerr-McGee's geologists put it this way—250 million years ago nature deposited a formation of limestone and shale in the area, and 219 million years later a sill of Miocene igneous rock split the Pennsylvanian limestone and shale. Somehow this sill became saturated with oil — and some gas — and Kerr-McGee discovered it.

Normally, igneous rocks do not have the necessary reservoir characteristics to be an oil producing zone. Actually, Kerr-McGee's objective was to find production in the Pennsylvanian limestones and Devonian sandstones. Northeastern Arizona is the site of a multitude of ancient volcanic plugs, dikes and lava flows, but no consideration was given to the possibility that an igneous intrusive sill could or would be a prospective petroleum reservoir.

There are a few other fields in the United States that produce from igneous material, but these fields produce from altered igneous rock, the alteration creating the necessary secondary physical characteristics that an oil producing zone needs. Dineh bi Keyah field, from available information, is the only one of its kind in the United States — and perhaps in the world.

A couple of old sayings in the oil business come to mind. "Oil is where you find it," and, "the only way to find oil is to drill a hole in the ground." Sometimes drilling a hole in the ground is expensive and time-consuming, as with the development of this new field in the rugged Chuska mountains. But sometimes, also, the costs of exploring and developing provide rewarding results, and the future potential at Dineh bi Keyah seems promising indeed.



Kerr-McGee's Navajo 4 in foreground uses Chuska mountains as backdrop.

Raymond Nakai, chairman of the Navajo Tribal Council, has said, "The discovery of this new and unusual oil field brings a new light on the potential of the Navajo reservation lands." He reports the new discovery has revived interest in the Navajo reservation, which had become very dormant.

Crude oil production from the field is now running about 14,500 barrels per day. Total production from Kerr-McGee wells alone had reached the 1-million barrel mark by August 1. During 1966 the entire state of Arizona

ARIZONA OIL REPORT

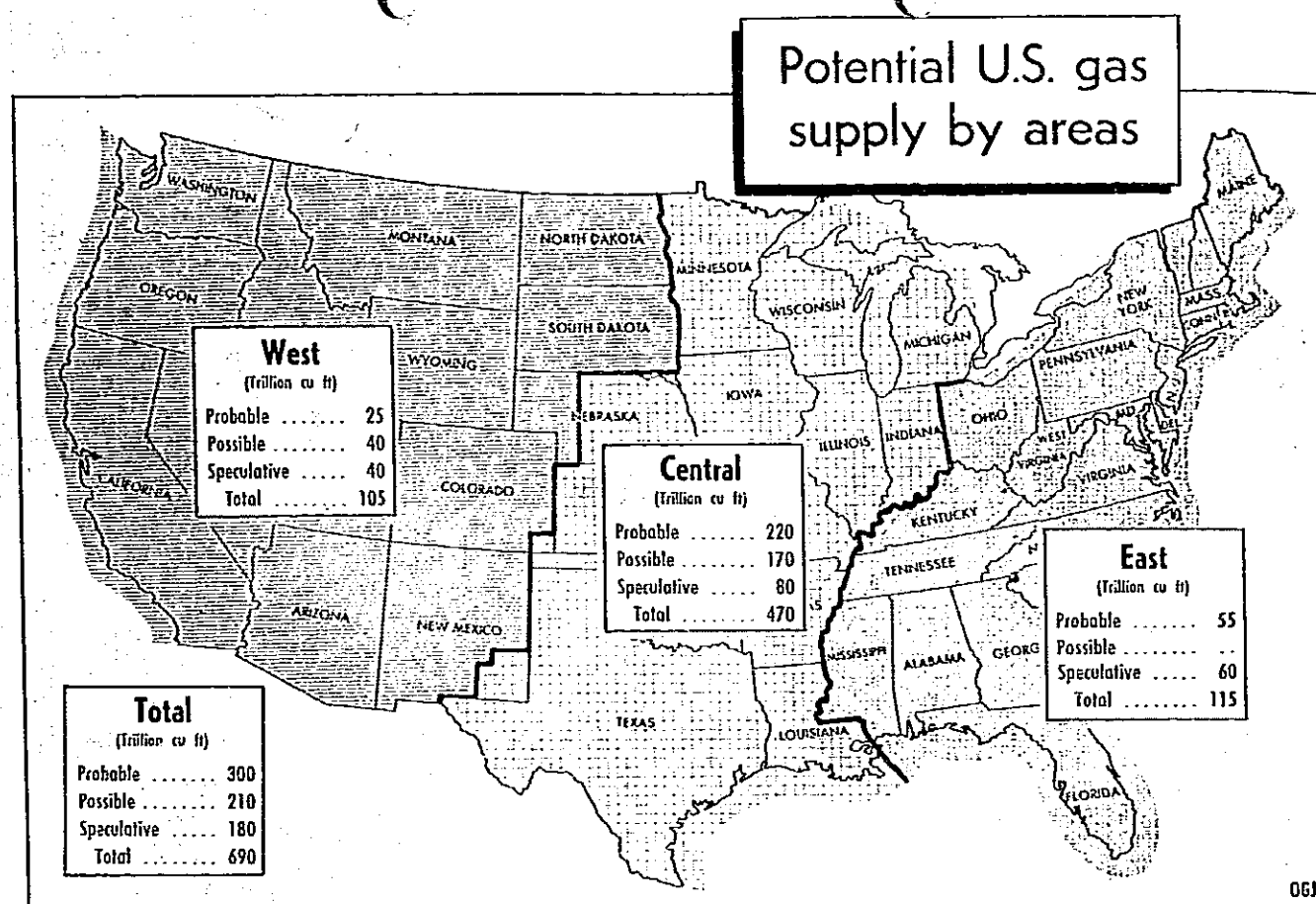
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Bulk of U.S. gas is still to be found

Potential Gas Committee estimates 690 trillion cu ft in probable, possible, and speculative reserves awaits discovery, more than double the present total.

WILDCATTERS have yet to find more than half of the estimated total supply of natural gas in the United States.

The remaining potential was estimated last week at 690 trillion cu ft. This is in addition to past production of 314 trillion and proved reserves of 286 trillion cu ft estimated as of Dec. 31, 1966, by the American Gas Association.

By this reckoning, total gas already produced, in proved reserves, and yet to be found, would be 1,290 trillion cu ft.

The estimate of remaining potential was issued Sept. 28. It was the first prepared by the Potential Gas Committee (PGC), under the aegis of the Potential Gas Agency of the Mineral Resources Institute, Colorado School of Mines Foundation

Inc., headquartered in Golden, Colo.

The new figure is about 10% higher than the estimate made in October 1964 by the Future Gas Supply Committee (FGSC), predecessor to the new organization. The new estimates also were based on figures developed by FGSC, whose work will now be carried on by the new group.

Potential supply is broken down into three categories: probable, 300 trillion cu ft; possible, 210 trillion; and speculative, 180 trillion. The potential figure picks up where AGA's proved reserves leaves off. While AGA measures the gas industry's "bird in the hand," the new group has set out to predict the "two in the bush."

The potential supply is described as the "prospective quantity of

natural gas yet to be found and proved by test wells . . . under assumed conditions of adequate but reasonable prices and with normal improvements in technology." It does not, however, reflect the rate at which future natural-gas supply will be discovered and produced.

Objective data sought. The report marks the start of a biennial series of objective studies on potential supply for the use of industry, Government, and the public.

The Gas Industry Committee, including representatives of the American Petroleum Institute, American Gas Association, and Independent Natural Gas Association, underwrites the project. But it takes no part in the work of the Potential Gas Committee.

The latter group, with its work committees, includes about 100 specialists from the production, transmission, and distribution sectors of the gas industry. There are also observers from the Federal Power Commission, Department of Interior, and the National Association of Railroad and Utilities Commissioners.

This structure is designed to provide reliable figures with broad acceptance for long-term appraisal of supply. The aim is to end the confusion and debate over widely varying estimates put out by various groups with narrower interests in the past.

A companion but separate effort is being made on the demand side by the Future Requirements Agency at the Denver Research Institute. Its report, issued last July, projected growth in annual U.S. gas requirements from 18.8 trillion in 1967 to 36 trillion cu ft in 1990 (OGJ, July 17, p. 44).

Scope of estimates. The first potential supply estimate of the new agency excludes Alaska and Hawaii because work for these states was not completed in time to make the report.

They will be included in the next one, however, in mid-1969.

The committee is also working toward counterpart groups to develop similar figures for Canada and Mexico, since both already provide a portion of U.S. requirements. Future studies will also look into the prospects for transported LNG, and gas from coal, lignite, and shale.

In the current report the committee confined estimates to prospective fields at drilling depths no greater than 25,000 ft and, in offshore areas, to waters no more than 600 ft deep.

Estimates were made without speculating on future levels of prices, costs, and trends in technology. Any improvement in exploration, drilling, development, and recovery techniques will be reflected in future reports.

The committee did not attempt to predict the rate at which potential supply can become available or the extent to which it will become available. This, it said, depends "on the complex interplay of many economic and technologic factors."

The figures on U.S. gas supply

(In trillion cu ft at 14.73 psia and 60° F.)

| Supply area | Cumulative production† | Proved recov. reserves‡ | Total gas to 1/1/67‡ | Potential supply |
|--------------------|------------------------|-------------------------|----------------------|------------------|
| East | 31 | 7 | 38 | 115 |
| Central | 248 | 252 | 500 | 470 |
| West | 35 | 27 | 62 | 105 |
| Total | 314 | 286 | 600 | 690 |

*Exclusive of Alaska and Hawaii. †Exclusive of 3 trillion cu ft produced but stored. ‡Inclusive of 3 trillion cu ft in underground storage.

Report appraised. David M. Evans, director of the Potential Gas Agency, hailed the estimate as the most reliable yet made.

It is the most reliable, he said, because it is based on confidential information in the files of committee members who represent the three branches of the industry. Most other estimates have been based on statistical methods or projections of average gas/oil ratios in past discoveries.

Evans said PGC is blazing new trails in four areas. It is the first, he claimed, to:

- Base estimates on the character of the rocks in which natural gas occurs.
- Report the potential supply of gas in three categories.
- Make periodic reports every 2 years.

- Publish estimates by areas smaller than the entire U.S.

Evans expressed hope that future estimates would be reported with greater geographical breakdown. He suggested the 12 work committee areas instead of the broad regional breakout into East, Central, and West sections, relating potential figures more closely to AGA reserves.

The eastern sector is divided into two work committee areas, the central six, and the western four.

In the past, some companies have been reluctant to report estimates of smaller areas for fear confidential information might leak. Evans feels, however, that the experience gained from cooperating on two reports may dispel some apprehension.

Definitions, methods. The committee placed potential supply in three categories according to these factors:

- **Probable**—includes future extensions of existing pools, future new pool discoveries in existing fields in reservoirs productive elsewhere in the same field; new pool discoveries in formations productive elsewhere in the same geologic province under different geologic conditions.

- **Possible**—includes future new field discoveries in formations productive elsewhere in the same geologic province.

- **Speculative**—includes future new field discoveries in formations not previously productive.

Potential supply was estimated with an "attribution" technique novel to this type of calculation.

The committee compared factors that control known fields with those present in prospective areas. Geologists first established the volume of gas discovered per unit area, or per volume of reservoir rock, in a well-explored portion of a geologic province. These known relationships were then attributed to incompletely explored sedimentary rocks in the same or similar geologic province.

By contrast, the Geological Survey, in preparing the most recent Government estimates in February 1966, used a gas/oil ratio of 2,500 cu ft of gas per bbl of oil discovered. With this technique the Department of Interior agency estimated 2,500 trillion cu ft of gas would be found ultimately, of which 2,000 trillion would be economically recoverable.

Langdon rips FPC for exploration lag

TRC head says gas price fixing dampens incentive to find new reserves. He warns intrastate competition may price interstate lines out of the market.

THE CHAIRMAN of the Texas Railroad Commission has branded the Federal Power Commission as the chief culprit behind the lagging exploration rate for natural gas and oil.

Jim C. Langdon denounced present governmental policies as having "a serious and depressing effect" not only on gas activity but oil as well. This is so, he says, because 25 to 30% of all produced gas in Texas is from oil wells.

"The result thus far of the gas price-fixing activities of FPC has been bad, but it could become much worse," Langdon warned Sept. 14. "The nation is producing and consuming more oil and gas each year than we are finding new reserves."

Unless FPC alters its course, the interstate long-distance pipelines might soon be priced out of the market. The interstate lines are regulated on the price they can pay for gas. Intrastate lines are not.

The occasion for Langdon's remarks was a Chamber of Commerce dinner honoring United Gas Corp. for its 39th year in Beaumont, Tex. United, recently merged into Pennzoil, is an aggressive intrastate gas buyer about to move into West Texas, an area where interstate pipelines always have dominated (OGJ, Sept. 11, p. 47).

Growing intrastate needs. The gas industry can expect much stiffer competition from the intrastate buyers for existing gas supplies, Langdon predicts.

With a declining ratio of reserves to annual production, evident as far back as 1946, the scarcity of new gas will provoke an even rougher fight between interstate and intrastate pipelines.

Although Texas produces about half of all the natural gas consumed in the United States, it consumes in Texas half of what it produces. And the state's rate of consumption is growing considerably faster than that of the rest of the nation, Langdon stated.

"Interstate purchasers are already experiencing difficulty acquiring new gas reserves along the Texas Gulf Coast. They will find their task even more difficult because of the straitjacket type of negotiation imposed upon them by FPC price-fixing determinations."

New gas. This nation is not running out of natural gas, Langdon explained. "But we are dangerously low in the exploration for and development of new reserves."

Supporting this, Langdon cited these figures:

"In 1966 this nation consumed 17.8 trillion cu ft of gas. Assuming we have a 20-year supply at the 1966 rate of consumption, which we do not, our proven recoverable gas reserves at the beginning of 1967 should add up to 356 trillion cu ft of gas."

"In June of this year, a report from the Future Natural Gas Requirements Committee was released which reflects that between now and the year 1980—just 12 years away—we will consume 356.8 trillion cu ft of gas and would for all practical purposes be out of gas unless we continue to find new reserves."

"In the 10 years from 1980 to 1990 the nation is expected to consume an additional 325.2 trillion or a total of 680 trillion cu ft of gas for the period from 1967 to 1990."

"This means we must start finding new reserves now at the staggering rate of almost 30 trillion cu ft annually just to maintain our gas reserves at their present level."

Incentives for the industry to perform this task do not exist today, unless the FPC makes an immediate change in its rate-making policy, Langdon feels.

"In the meantime, perhaps much sooner than many people expect, the intrastate demand for gas will reach a level and a price that will create an incentive to find sufficient new gas to keep up with the

intrastate market," he declared.

"What will happen to interstate markets? The markets will remain, but the out-of-state consumer probably will have to return to higher-priced, unregulated, competitive fuels until such time as the FPC revises its rate-making policies and makes it possible for interstate gas companies to contract for new gas."

West Texas gas. A change in regulatory philosophy could arise as a result of the intrastate pipelines' move into West Texas, according to Langdon.

"United's plan to construct a major intrastate gas line from the gas-producing area of West Texas to supply the growing demand for more and more gas on the Texas Gulf Coast is of tremendous importance, not only to the two areas directly concerned, but to this nation's entire natural-gas industry."

"It is important because it marks a significant departure from the usual pattern and direction of the intrastate transmission of large volumes of gas."

FPC pricing. Langdon takes issue with the FPC's manner of approaching its pricing policies.

"The FPC has determined that a producer of gas is a utility and has come forward with a variety of fundamental errors in which it has determined, among other things, that gas produced with oil should sell for a lower price than an identical grade and quality of gas produced from a gas well, and that gas produced from a well drilled and completed before a certain specified date should sell for less than identical gas produced from a new well completed as little as one day after the magic date."

These rulings have caused problems where different producers and their royalty owners in the same reservoir are forced to sell their gas at different prices, Langdon charged.

Intrastate sales. Langdon, as an

ected state official, leaves little doubt on which side of the fence he would align himself at any cross-road.

"Far more benefits are realized by the state through the sale and use of gas within its own borders than is realized from the same amount of gas sold and consumed outside Texas."

Langdon credits the "large and dependable" supply of natural gas in Texas with attracting new industry to the state. "Two plants in Texas consume as much gas as is

supplied to all the homes in Detroit, Milwaukee, and Kansas City combined."

The solution. The only way to avoid impending disastrous interstate gas shortages, Langdon believes, is to relax the Federal Power Commission's control over the gas industry.

"In my judgment, with adequate incentives, the gas producers of this nation could and would find new gas in sufficient quantities to meet the current and future needs of all

people in all states of this nation.

"This solution is simple and obvious: permit natural gas to find its fair, reasonable, and just price in competition with other buyers and with competing fuels in a free and open market.

"Then, like other commodities, if the price becomes too high it would be reduced or natural gas would be replaced in the consumer homes, stores, plants, and factories by a new, more economical, and perhaps even a better fuel than natural gas."

Reserves, production swell in Northwest Alberta

NORTHWESTERN Alberta is carving out an even bigger niche for itself in the giant oil-reserves and production category.

Reserves in the Keg River reef fields were estimated at 6 billion bbl 2 years ago by a federal cabinet minister. His estimates were pooh-poohed at the time. But there's less skepticism now.

Rainbow A pool alone has reserves of 150 million bbl, according to Banff Oil. To date, Rainbow, Rainbow South, and Zama fields contain 103 pools—6 in the Sulphur Point formation, 18 in the Muskeg, and 79 in prolific Keg River.

Although secrecy still surrounds many operations in the northwest, recent field orders by the Alberta Oil and Gas Conservation Board give this picture of mushrooming operations:

- Only 6 of the 103 pools (all in Rainbow) are listed in the board's September allowable order. They will produce 22,948 b/d during the month. Three wells in Keg River A pool will produce 1,901 b/d each, highest in the province.

- Success ratio in Rainbow Lake is a remarkable 70% if you include 13 gas wells with 92 completed oil producers. Dry holes total 44, many of them drilled before the tricky Keg River geology was unscrambled by Banff Oil.

- Rainbow pipeline is currently shipping about 55,000 b/d, indicating that another 32,000 b/d of northwestern production comes from the 2 Sulphur Point, 2 Muskeg, and 22 Keg River pools in Rainbow field, which are still on the confi-

dential, list, and from Rainbow South, Zama, and Assumption areas. This is possible since the board's September production order includes an allowance of 40,883 b/d from undesignated wells and confidential pools.

If the 55,000 b/d-pipeline figure is in the ball park for northwestern Alberta production, it represents 7% of the province's current liquids output and 8.1% of its conventional light and medium crude production.

Big growth ahead. Another startling aspect of the current Alberta situation: 1 bbl in 10 of September liquids production will come either from Athabasca oil sands in the northeast or from new fields in the northwest. Neither of these two sources appeared on the monthly reports of 2 years ago.

By the time Great Canadian Oil Sands' extraction plant hits full stride of 45,000 b/d, more than 100,000 b/d, or one-seventh of Alberta's liquids production, will be coming from these new areas.

Rainbow activity. Pace of development continues strong, with 18 new wells drilling in Rainbow area alone.

This summer around 30 rigs have been working in northwestern Alberta. Over 40 rigs have been stacked in the region, but most of them will be working in late fall or early winter.

High per-well production allowances in Rainbow are based on 160-acre spacing, which has been standard since the discovery, and the

comparatively small size, acreage-wise, of the pools. Those in Rainbow cover an average of 1,400 acres each, and those in Rainbow South 1,500 acres. Of the 40 pools in the two fields, no fewer than 16 enclose 1,440 acres each. If four "giants" of 2,400 to 5,100 acres are eliminated, the uniformity is even more striking.

This is not inconsistent with atoll reef reservoirs in other countries, but is still something of a novelty in Canada.

Industry to have go at Carter proposal

CANADA'S petroleum industry is busy preparing briefs to answer the Carter Royal Commission which earlier this year recommended that depletion allowances for oil and mining companies be abolished (OGJ, Mar. 20, p. 92).

Finance Minister Mitchell Sharp has given the industry a Sept. 30 deadline to present its views. No decision will be made, Sharp said, until industry's briefs are considered.

The Carter commission proposed that the depletion allowance for extractive industries be replaced with preferential treatment in the form of write-offs of exploration costs.

The petroleum industry is virtually unanimous against the commission's proposal. Oilmen say it would result in drastic curtailment, and possibly a complete suspension, of oil exploration in Canada.



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JOHN BANNISTER
EXECUTIVE SECRETARY
J. R. SCURLOCK
PETROLEUM GEOLOGIST

September 27, 1967

Memo to: Commissioners
From: John Bannister, Executive Secretary

Attached please find results of the Navajo oil and gas lease sale held in Window Rock on September 26, 1967 at 10:00 a.m.

Approximately 40 people attended the sale; however this does not reflect all of those who bid.

The attached results reflect only the successful bidders and does not of necessity reflect the interest in that particular tract. The tracts not checked were not bid upon.

You will note that none of the acreage offered was in the vicinity of Dineh bi Keyah Field. The Indians called for a minimum bid of \$2.50 per acre with 16-2/3% overriding royalty. The annual rental is \$1.25 per acre.

It is to be noted that Kerr-McGee did not submit any bids nor did Humble. However, it is suspected that the bids submitted by W.T. Blackburn could be submitted for Humble as he sometimes in the past has acted as nominee for Humble. Pan American's bids on the three tracts represents only a token bid.

I am pleased to report that the Arizona acreage by far received the most attention and most bids. You will note that 92,400 acres were available in Arizona with 47,900 being taken. A total of \$439,000 was bid for this acreage, the average bid being \$9.10. The high bid, by Skelly Oil Corp., was \$44.46 and the low bid was \$3.03 per acre.

Should you have any questions, would you please advise.

| <u>Tract No.</u> | <u>Description</u> | <u>Acres</u> |
|---|---|--------------|
| <u>T. 43 S., R. 25 E., S.L.M. (P.D. #50, approved 3/7/61)</u> | | |
| 108 | Section 13 - All | 640 |
| 109 | Section 24 - All | 640 |
| <u>T. 43 S., R. 26 E., S.L.M. (P.D. #50, Approved 3/7/61)</u> | | |
| 110 | Section 5 - All (Surveyed east of river) | 640 |
| 111 | Section 6 - All (Frac.) | 638 |
| <u>Apache County, Arizona</u> | | |
| <u>T. 4 N., R. 6 W., N.S.M. (Surveyed)</u> | | |
| 112 | Section 17 - S $\frac{1}{2}$ Section 18 - S $\frac{1}{2}$ | 632.61 |
| 113 | Section 19 - All (Frac.) | 625.76 |
| 114 | Section 20 - All | 640 |
| 115 | Section 29 - All | 640 |
| 116 | Section 30 - All (Frac.) | 625.78 |
| <u>T. 4 N., R. 7 W., N.S.M. (P.D. #46, approved 2/11/60)</u> | | |
| ✓117 | Section 1 - W $\frac{1}{2}$ <i>Texaco \$ 3,613 (11.29)</i> | 320 |
| 118 | Section 2 - All | 640 |
| 119 | Section 3 - All | 640 |
| 120 | Section 4 - S $\frac{1}{2}$ Section 5 - S $\frac{1}{2}$ | 640 |
| 121 | Section 6 - SE $\frac{1}{4}$ Section 7 - E $\frac{1}{2}$ Section 18 - E $\frac{1}{2}$ | 800 |
| 122 | Section 8 - All | 640 |
| 123 | Section 9 - All | 640 |
| 124 | Section 10 - All | 640 |
| 125 | Section 11 - All | 640 |
| ✓126 | Section 12 - All <i>Texaco \$ 21,529 (33.67)</i> | 640 |
| ✓127 | Section 13 - W $\frac{1}{2}$, SE $\frac{1}{4}$ <i>Texaco \$ 5,420 (11.29)</i> | 480 |
| 128 | Section 14 - All | 640 |
| 129 | Section 15 - All | 640 |
| 130 | Section 16 - All | 640 |
| 131 | Section 17 - All | 640 |
| 132 | Section 20 - All | 640 |
| 133 | Section 21 - All | 640 |
| 134 | Section 22 - All | 640 |
| 135 | Section 23 - All | 640 |
| 136 | Section 24 - All | 640 |
| 137 | Section 25 - All | 640 |
| 138 | Section 26 - All | 640 |
| 139 | Section 27 - All Section 28 - NE $\frac{1}{4}$ | 800 |

| <u>Tract No.</u> | <u>Description</u> | <u>Acres</u> |
|---|---|--------------|
| <u>T. 5 N., R. 6 W., N.S.M. (Surveyed)</u> | | |
| 140 | Section 3 - All (Irreg.) | 641.34 |
| 141 | Section 4 - E $\frac{1}{2}$, NW $\frac{1}{4}$ | 480.64 |
| 142 | Section 5 - N $\frac{1}{2}$ | 630.33 |
| | Section 6 - N $\frac{1}{2}$ } <i>Texaco § 10,912 (17.31)</i> | |
| 143 | Section 9 - E $\frac{1}{2}$ | 960 |
| | Section 10 - All | |
| 144 | Section 15 - All | 640 |
| 145 | Section 16 - All | 640 |
| 146 | Section 21 - N $\frac{1}{2}$ | 640 |
| | Section 22 - N $\frac{1}{2}$ | |
| <u>T. 5 N., R. 7 W., N.S.M. (P.D. #46, 2/11/60)</u> | | |
| 147 | Section 1 - All | 640 |
| 148 | Section 2 - All <i>Texaco § 7,284 (11.38)</i> | 640 |
| 149 | Section 3 - All <i>Texaco § 7,284 (11.38)</i> | 640 |
| 150 | Section 4 - All <i>Texaco § 3,540 (5.63)</i> | 640 |
| 151 | Section 5 - All | 640 |
| 152 | Section 6 - All (Frac.) | 617 |
| 153 | Section 7 - All (Frac.) | 617 |
| 154 | Section 8 - All | 960 |
| | Section 9 - N $\frac{1}{2}$ | |
| 155 | Section 11 - N $\frac{1}{2}$ | 640 |
| | Section 12 - N $\frac{1}{2}$ | |
| 156 | Section 17 - N $\frac{1}{2}$ | 639 |
| | Section 18 - N $\frac{1}{2}$ | |
| 157 | Section 26 - S $\frac{1}{2}$ | 640 |
| | Section 34 - E $\frac{1}{2}$ | |
| 158 | Section 35 - All | 960 |
| | Section 36 - W $\frac{1}{2}$ | |
| <u>T. 5 N., R. 8 W., N.S.M. (P.D. No. 46)</u> | | |
| 159 | Section 1 - All | 960 |
| | Section 12 - E $\frac{1}{2}$ | |
| 160 | Section 2 - All <i>El Paso Nat. Gas § 6,380.80 (9.97)</i> | 640 |
| 161 | Section 3 - All <i>Curtis Little § 3,955.20 (6.18)</i> | 640 |
| <u>T. 6 N., R. 6 W., N.S.M. (Surveyed)</u> | | |
| 162 | Section 16 - All <i>Union of Cal. § 2,080 (3.25)</i> | 640 |
| 163 | Section 17 - All <i>Union of Cal. § 2,080 (3.25)</i> | 640 |
| 164 | Section 18 - All (Frac.) <i>Union of Cal. § 2,074.15 (3.25)</i> | 638.20 |

| <u>Tract No.</u> | <u>Description</u> | <u>Acres</u> |
|---|---|--------------|
| <u>T. 6 N., R. 6 W., N.S.M. (Surveyed)</u> | | |
| 165 | Section 19 - All (Frac.) Union of Cal \$ 2,077.08 (3.25) | 639.10 |
| 166 | Section 20 - All " \$ 2080 (3.25) | 640 |
| 167 | Section 21 - All " \$ 2080 (3.25) | 640 |
| 168 | Section 28 - All " \$ 2080 (3.25) | 640 |
| 169 | Section 29 - All " \$ 2080 (3.25) | 640 |
| 170 | Section 30 - All (Frac.) " \$ 2078.70 (3.25) | 639.60 |
| 171 | Section 31 - All (Irreg.) " \$ 2080.65 (3.25) | 640.20 |
| 172 | Section 32 - All Texaco \$ 7,405 (11.57) | 640 |
| 173 | Section 33 - All Union of Cal \$ 2080 (3.25) | 640 |
| <u>T. 6 N., R. 7 W., N.S.M. (Surveyed)</u> | | |
| 174 | Section 13 - All | 640 |
| 175 | Section 14 - All | 640 |
| 176 | Section 15 - S $\frac{1}{2}$ } Gulf \$ 4,963.20 (5.17) | 960 |
| | Section 22 - All } | |
| 177 | Section 16 - S $\frac{1}{2}$ } Gulf \$ 4,963.20 (5.17) | 960 |
| | Section 21 - All } | |
| 178 | Section 17 - S $\frac{1}{2}$ } El Paso Nat Gas \$ 9,571.20 (9.97) | 960 |
| | Section 20 - All } | |
| 179 | Section 19 - All (Frac.) Skelly Oil \$ 28,385.93 (44.46) | 638.46 |
| 180 | Section 25 - All Skelly \$ 17,836.80 (27.87) | 640 |
| 181 | Section 26 - All Texaco \$ 28,535 (35.71) | 640 |
| 182 | Section 27 - All Gulf \$ 2,963.20 (4.63) | 640 |
| 183 | Section 28 - All Gulf \$ 2,963.20 (4.63) | 640 |
| 184 | Section 29 - All Gulf \$ 4,017.80 (6.27) | 640 |
| 185 | Section 30 - All (Frac.) El Paso Nat Gas \$ 6,369.64 (9.97) | 638.88 |
| 186 | Section 31 - All (Frac.) Gulf \$ 4,010.23 (6.27) | 639.59 |
| 187 | Section 32 - All Anadarko \$ 11,308.80 (17.67) | 640 |
| 188 | Section 33 - All Gulf \$ 2,963.20 (4.63) | 640 |
| 189 | Section 34 - All Texaco \$ 7,194 (11.24) | 640 |
| 190 | Section 35 - All Skelly \$ 17,836.80 (27.87) | 640 |
| 191 | Section 36 - All Skelly \$ 11,462.40 (17.91) | 640 |
| <u>T. 6 N., R. 8 W., N.S.M. (P.D. No. 46)</u> | | |
| 192 | Section 23 - S $\frac{1}{2}$ } Gulf \$ 6,892.80 (17.18) | 960 |
| | Section 24 - All } | |
| 193 | Section 25 - All Skelly \$ 28,454.40 (44.46) | 640 |
| 194 | Section 26 - All El Paso Nat Gas \$ 6,380.80 (9.97) | 640 |
| 195 | Section 27 - E $\frac{1}{2}$ } El Paso Nat Gas \$ 6,380.80 (9.97) | 640 |
| | Section 34 - E $\frac{1}{2}$ } | |
| 196 | Section 35 - All Skelly \$ 14,227.20 (22.23) | 640 |
| 197 | Section 36 - All Skelly \$ 14,227.20 (22.23) | 640 |
| <u>T. 38 N., R. 29 E., G.S.R.M. (P.D. #38, appr. 2/11/60)</u> | | |
| 198 | Section 1 - All | 640 |
| 199 | Section 2 - All | 640 |

| <u>Tract No.</u> | <u>Description</u> | <u>Acres</u> |
|---|--|--------------|
| <u>T. 38 N., R. 29 E., G.S.R.M. (P.D. #38, appr. 2/11/60)</u> | | |
| ✓200 | Section 4 - All Curtis Little § 1939.20 (3.03) | 640 |
| ✓201 | Section 5 - All (Frac.) Ruth Anderson (Houston) § 2369.46 (3.91) | 606 |
| <u>T. 39 N., R. 28 E., G.S.R.M. (P.D.#37, appr. 2/11/60)</u> | | |
| ✓202 | Section 1 - All (Frac.) S T M, Inc (Midland) § 2458.13 (4.01) | 613 |
| 203 | Section 3 - All (Frac.) | 613 |
| 204 | Section 5 - All (Frac.) | 613 |
| 205 | Section 7 - All (Frac.) | 628 |
| 206 | Section 9 - All | 640 |
| 207 | Section 11 - All | 640 |
| ✓208 | Section 13 - All El Paso Nat Gas § 2899.20 (4.53) | 640 |
| 209 | Section 15 - All | 640 |
| 210 | Section 17 - All | 640 |
| 211 | Section 19 - All (Frac.) | 630 |
| ✓212 | Section 21 - All | 640 |
| ✓213 | Section 23 - All El Paso Nat Gas § 2889.20 (4.53) | 640 |
| ✓214 | Section 25 - All El Paso Nat Gas § 2889.20 (4.53) | 640 |
| ✓215 | Section 27 - All S T M, Inc § 2566.40 (4.01) | 640 |
| 216 | Section 29 - All | 640 |
| 217 | Section 31 - All (Frac.) | 631 |
| 218 | Section 33 - All | 640 |
| 219 | Section 35 - All | 640 |
| <u>T. 39 N., R. 29 E., G.S.R.M. (P.D.#38, appr. 2/11/60)</u> | | |
| ✓220 | Section 2 - All Big Piney Oil & Gas § 6,566.40 (10.26) | 640 |
| 221 | Section 4 - All | 640 |
| 222 | Section 8 - All (Frac.) | 603 |
| ✓223 | Section 10 - All W. T. Blackburn (Denver) § 3,284.37 (5.13) | 640 |
| ✓224 | Section 12 - All W. T. Blackburn § 3,284.37 (5.13) | 640 |
| ✓225 | Section 14 - All W. T. Blackburn § 3,284.37 (5.13) | 640 |
| 226 | Section 16 - All | 640 |
| ✓227 | Section 20 - All (Frac.) El Paso Nat Gas § 2,745.45 (4.53) | 605 |
| ✓228 | Section 22 - All W. T. Blackburn § 3,284.37 (5.13) | 640 |
| ✓229 | Section 24 - All Big Piney Oil & Gas § 6,566.40 (10.26) | 640 |
| ✓230 | Section 26 - All Mobil § 3,027.20 (4.73) | 640 |
| 231 | Section 28 - All | 640 |
| 232 | Section 32 - All (Frac.) | 606 |
| ✓233 | Section 34 - All Mobil § 3,027.20 (4.73) | 640 |
| 234 | Section 36 - All | 640 |
| <u>T. 39 N., R. 30 E., G.S.R.M. (P.D. No. 38)</u> | | |
| ✓235 | Section 2 - All Pan Am § 2,062.20 (3.23) | 640 |
| ✓236 | Section 4 - All W. T. Blackburn § 3,732.37 (5.83) | 640 |
| ✓237 | Section 6 - All (Frac.) W. T. Blackburn § 3,227.81 (5.13) | 628 |
| 238 | Section 8 - All | 640 |
| 239 | Section 10 - All | 640 |
| ✓240 | Section 12 - All Pan Am § 3,360.00 (5.31) | 640 |
| ✓241 | Section 15 - All Bruce Anderson § 2451.20 (3.83) | 640 |

| Tract No. | Description | Acres |
|--|---|-------------------|
| <u>T. 39 N., R. 30 E., G.S.R.M. (P.D. No. 38)</u> | | |
| 242 | Section 18 - All (Frac.) | 629 |
| 243 | Section 21 - All | 640 |
| 244 | Section 30 - All (Frac.) <i>Pabco \$ 1911.93 (3.03)</i> | 631 |
| 245 | Section 32 - All | 640 |
| <u>T. 40 N., R. 29 E., G.S.R.M. (P.D. No. 38)</u> | | |
| 246 | Section 11 - All | 640 |
| 247 | Section 15 - All <i>Curly's Little \$ 1939.20 (3.03)</i> | 640 |
| 248 | Section 24 - All | 640 |
| 249 | Section 26 - All <i>Monsanto \$ 3360 (5.25)</i> | 640 |
| 250 | Section 28 - All <i>Monsanto \$ 3360 (5.75)</i> | 640 |
| 251 | Section 34 - All <i>Monsanto \$ 2720 (4.25)</i> | 640 |
| 252 | Section 36 - All <i>Monsanto \$ 4014 (6.27)</i> | 640 |
| <u>T. 40 N., R. 30 E., G.S.R.M. (P.D. No. 38)</u> | | |
| 253 | Section 8 - All | 640 |
| 254 | Section 13 - All | 640 |
| 255 | Section 16 - All | 640 |
| 256 | Section 18 - All (Frac.) | 625 |
| 257 | Section 20 - All <i>Occidental Pet. Co. \$ 6,420 (10.03)</i> | 640 |
| 258 | Section 22 - All <i>E.R. (Mike) Richardson \$ 2,732.80 (4.27)</i> | 640 |
| 259 | Section 24 - All | 640 |
| 260 | Section 26 - All | 640 |
| 261 | Section 28 - All <i>Bruce Anderson Occidental \$ 6420 (10.03)</i> | 640 |
| 262 | Section 30 - All (Frac.) | 627 |
| 263 | Section 32 - All | 640 |
| 264 | Section 34 - All | 640 |
| 265 | Section 36 - All <i>Pan Am \$ 2067.20 (3.23)</i> | 640 |
| Total Acreage: | | <u>171,573.31</u> |

Dineh bi Keyah

Location Costs

Average \$15,000 to \$20,000
(One Humble \$70,000)

Drilling

time - ave. 20 days
bits - 10 to 14
depth of production 2,800' to 3,800'
thickness of sill 60' to 135'

Well Costs

Dry Hole \$80,000 to \$100,000
Drilling " " "
Completing \$50,000
Ave. cost of well into tanks \$125,000

Production

IP's 200 BOPD to 3250 BOPD
Ave. field production 300,000 Bbls per Mo.
Appx. value per Mo. - \$1,000,000
Value per Bbl - \$2.80
Pipeline charge - 25¢ per Bbl.
Net to Operator before Royalty \$2.55
Indian Royalty - 16 2/3 %

Pipeline

Owner & operator - Kerr-McGee Pipeline Grp.
Cost \$1,275,000

- (1) line batteries to 4 Cor. - \$600,000
- (2) gathering system to battery 300,000
- (3) Generators 250,000
- (4) highline system 125,000

length - 33 miles of 8" pipe
Capacity - gravity flow - 20,000 BOPD
Pump 40,000 BOPD
Current 12,000 - 14,000 BOPD
Outlet - 4 Corners Pipeline, with Texas -
New Mexico pipeline as alternate

Wells

| | Prod | PA | shut in | TA | location on drilling |
|------------|------|----|---------|----|----------------------|
| Kerr-McGee | 10 | 2 | 1(H) | 2 | 4 |
| Humble | - 2 | 1 | 30- | 3 | 1 |
| Anadarko | - 0- | 1 | 0- | 0- | 0- |

Taxes

State - 1.5% of gross value at well head - payable monthly to Tax Commission

County - 6.72% Ad Valorem (varies according to school district taxes). Tax Commission furnishes County Assessor with gross value of production of previous year & County then levies.

Indian Royalty, and by inference Federal and State royalty, is deducted from gross value prior to tax levy.

EL PASO PRODUCTS COMPANY
PRODUCTION DATA

FIELD _____
 COUNTY _____
 TOWNSHIP OR RANCHO _____

SHEET NO. _____
 WELL NO. _____
 LEASE _____

| SPUDDING DATE | COMPLETION OR RECOM- PLETION DATE | TOTAL DEPTH | EFFECTIVE DEPTH | W. S. O. | PERFORATED INTERVAL | | CUMULATIVE PRODUCTION | | MONTHS PRODUCED | ZONE |
|------------------|---|----------------|--------------------|----------|---------------------|----|-----------------------|-----------------|--------------------|------|
| | | | | | FROM | TO | NET OIL BBL. | FORM GAS M.C.F. | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

YEAR _____

| MONTH | STA- TUS | DAYS PROD. | ALLOW- ABLE | TOTAL WATER & BS & W BARRELS | | DLY. AVG. | NET OIL PRODUCTION BARRELS | | DLY. AVG. | FORMATION GAS PRODUCTION M.C.F. | | DLY. AVG. | GAS - OIL RATIO CU. FT./BBL. |
|---------|-------------|---------------|----------------|---------------------------------|------------|--------------|-------------------------------|------------|--------------|------------------------------------|------------|--------------|------------------------------------|
| | | | | MONTHLY | CUMULATIVE | | MONTHLY | CUMULATIVE | | MONTHLY | CUMULATIVE | | |
| FORWARD | | | | | | | | | | | | | |
| JAN. | | | | | | | | | | | | | |
| FEB. | | | | | | | | | | | | | |
| MAR. | | | | | | | | | | | | | |
| APR. | | | | | | | | | | | | | |
| MAY | | | | | | | | | | | | | |
| JUNE | | | | | | | | | | | | | |
| JULY | | | | | | | | | | | | | |
| AUG. | | | | | | | | | | | | | |
| SEPT. | | | | | | | | | | | | | |
| OCT. | | | | | | | | | | | | | |
| NOV. | | | | | | | | | | | | | |
| DEC. | | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | | |

YEAR _____

| | | | | | | | | | | | | | |
|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| JAN. | | | | | | | | | | | | | |
| FEB. | | | | | | | | | | | | | |
| MAR. | | | | | | | | | | | | | |
| APR. | | | | | | | | | | | | | |
| MAY | | | | | | | | | | | | | |
| JUNE | | | | | | | | | | | | | |
| JULY | | | | | | | | | | | | | |
| AUG. | | | | | | | | | | | | | |
| SEPT. | | | | | | | | | | | | | |
| OCT. | | | | | | | | | | | | | |
| NOV. | | | | | | | | | | | | | |
| DEC. | | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | | |

YEAR _____

| | | | | | | | | | | | | | |
|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| JAN. | | | | | | | | | | | | | |
| FEB. | | | | | | | | | | | | | |
| MAR. | | | | | | | | | | | | | |
| APR. | | | | | | | | | | | | | |
| MAY | | | | | | | | | | | | | |
| JUNE | | | | | | | | | | | | | |
| JULY | | | | | | | | | | | | | |
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| SEPT. | | | | | | | | | | | | | |
| OCT. | | | | | | | | | | | | | |
| NOV. | | | | | | | | | | | | | |
| DEC. | | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | | |



JACK WILLIAMS
GOVERNOR
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HIRAM S. CORBETT
MEMBER
GEORGE T. SILER
MEMBER
KENNETH G. BENTSON
MEMBER

Oil and Gas Conservation Commission

OFFICE OF
STATE OF ARIZONA
ROOM 202
1624 WEST ADAMS
Phoenix, Arizona 85007
PHONE: 271-5161

JOHN BANIISTER
EXECUTIVE SECRETARY
J. R. SCURLOCK
PETROLEUM GEOLOGIST

September 14, 1967

Memo to: Commissioners
From: J.R. Scurlock, Geologist

Re: Report of Activities

8-17-67, Sedona

Accompanied Dr. Pye to look over the geology of the prospect in the Coconino National Forest filed on by Virginia Gas & Oil (Mr. John E. Carson, Albany, Texas). Dr. Pye was retained by Virginia Gas & Oil to locate a suitable drilling block on federal acreage for a shallow test. The play here is envisioned as a fault trap along the Oak Creek Fault. A well in this area, in view of its remoteness from production, represents a very high risk factor. The wildcat success ratio on a national average runs 10 to 1, i.e., ten dry holes to one discovery. However, to find a "good" discovery--one that returns the investment cost plus a profit--the wildcatter must drill an average of 30-40 wildcat wells.

The Virginia block of 14,000-plus acres, located just southeast of Sedona in Townships 16 N and 17N, Range 6E, is all federal acreage (10 year leases; 50¢ per acre paid in advance). These tests (probably 2 or 3) will go to basement at a depth of 2000-3000 feet. Drilling operations should begin soon after leases are issued, i.e., within 2 or 3 months.

8-17-67, Cottonwood

Harless. No activity. Walker-Neer cable tool rig has been removed from location in SW/4 Sec. 35-18N-4E.

8-17-67, Pine

Accompanied Dr. Pye to inspect Devonian outcrop 10 miles south of Pine, where the dolomite is stained with natural oil in spots along the road cut. Pungent odor of oil can be detected when rock is freshly broken. This regional characteristic of the Devonian marks this formation as a prime objective horizon for the Arizona wildcatter. Thus far, only well in Arizona, the Texaco

AG-1 Navajo (in the Four Corners area), produces oil. However, the future may yet see the Devonian as a substantial producer in Arizona.

September 5, Navajo

C.B. Construction Co. (Cook Bros.) of Phoenix has contracted to build Arizona Helium Corporation's new helium plant at Navajo. The cost of the plant (including production units) will be approximately \$300,000. The cost of the entire which will include the cost of the gathering system and the 20 acrea plant site. They are preparing to pour the 132'x40'x6" foundation.

On location are two house trailers (one to be used for a temporary office), a Cleveland trencher, one mile of 4" (ID) plastic pipe, and 7½ miles of 2" (ID) plastic pipe, 500 sacks of cement, plus sand and gravel.

The plastic pipe which will be used in the gathering system will be buried to a depth of 36 to 40 inches to avoid problems of shrinkage and contraction. The 35 foot joints are fitted on one end with a plastic sleeve coupling so that they can be laid about as fast as the trencher can dig the ditch. The joints will be fused together with a chemical "cement." This plastic pipe is cheaper than steel pipe (such as used in the Kerr-McGee gathering system), requires no wrapping, presents no problem of electrolysis, and will last longer than steel pipe. It is guaranteed for 25 years.

The raw gas will be supplied by Apache Drilling Co. (Truett Henderson, president). Its performance contract with Arizona Helium Corp. requires Apache to deliver sufficient raw gas (at 25 lbs. pressure; minimum 3½% helium content) to produce a minimum of 1,000 MCF refined grade A helium per month at \$10.50 per MCF--a gross of \$10,500 (minimum) per month for Apache. This gaseous helium (no liquid helium will be produced initially) will wholesale for approximately \$35.00 per MCF. Thus, the plant will gross a nimum of \$35,000 per month.

The plant which will employ 6 men, is scheduled to begin production on or before Jan 1st. The raw gas (approx. 12 million MCF per month or 400 MCF per day) will come initially from 2 (or possibly 3) wells:

1. Crest #8 Santa Fe (SE NW Sec. 25-20N-27E) Coconino well; TD 1372'; present shut-in pressure at wellhead is 206#; helium content 9.8%; initial deliverability calculated 500 MCF raw gas per day at 120 lbs. press.
2. Eastern-Aricon #21 Santa Fe (SE NW Sec. 31-20N-28E) Productive zone 1174'-1194' in Shinarump. Note: This will be the first Shinarump well on production in Arizona. Helium content 6.5%. Initial deliverability calculated 100 MCF raw gas per day at 60 lbs. press.
3. Apache #1 Santa Fe-Crest (SE NW Sec. 25-20N-27E). This well is very doubtful. Completion will be attempted in

Shinarump sand, which has been fracked with 60 tons of liquid CO₂. It still is thawing out.

Apache has, in addition, five other wells (temporarily abandoned) to the south of Pinta Dome which they will try to complete, and they expect to drill additional exploratory holes in this area. Along with these wells, Apache has a right (through Crest) to 16% of the production from Navajo Springs Unit. Thus, they should have no problem in supplying sufficient raw gas to the plant initially. However, it should be noted that by contract the plant capacity must be doubled within 15 months after it goes on stream; and it must be doubled yet again in the following 18 months. Arizona Helium Corp.'s success (and stock price) then will depend on Apache's ability to find and produce raw gas.

The government's use of helium declined in 1966; but the commercial use continued its rapid expansion.

| | |
|------------------------------|--------------------------------------|
| (1965 | 948 million cubic ft. grade A helium |
| U.S. production(1966 | 980 " " " " " " |
| government production..... | 908 million |
| Kerr-McGee Navajo plant ... | 60 million |
| Canadian Ld.(Saskatchewan).. | 12 million |
| 1966 Total | 980 million |

The anticipated U.S. yearly demand will be double this amount--or 2 billion cu.ft. grade A helium by 1980.

Note: Of the 600,000 shares offered to the public by Arizona Helium Corp., about half (280,000 shares) have been sold--at \$1.00 per share. To date approximately \$925,000 has been raised towards the initial capitalization of \$1,150,000.

Sept. 5-8: Four Corners

Skelly 1-Q Navajo (wildcat located 15 mi. north of Dineh bi Keyah): plugged and abandoned.

Humble 88-1 Navajo (Dineh bi Keyah Field) being completed. Sill present.

Humble 88-2 Navajo (SE NE Sec. 25-36N-29E; Dineh bi Keyah Field)--location being prepared.

Kerr-McGee H-1 Navajo (wildcat located 4 miles SE Dineh bi Keyah Field; NE NE Sec. 14-35N-30E) Unorthodox gas well location granted due to topographical conditions. Tight hole; contractor--Pico Drlg; Drilling at 4340 ft. (proposed 5250 ft. basement test.)

Miami #1 Navajo--wildcat located 6 miles SE of E. Boundary Butte Field. Proposed 6500' basement test. New location.

American Mining #1 Navajo. Wildcat located 12 miles SE of Dinnehotso. Proposed 6800' basement test. Contractor O'Donnell-Ewing; Drilling 3420 ft.

Kerr-McGee F-1 Navajo (Dineh bi Keyah Field; SE SE Sec. 24-36N-29E).
New location. (This well will probably wait to see whether Humble
#88-2 is productive.)

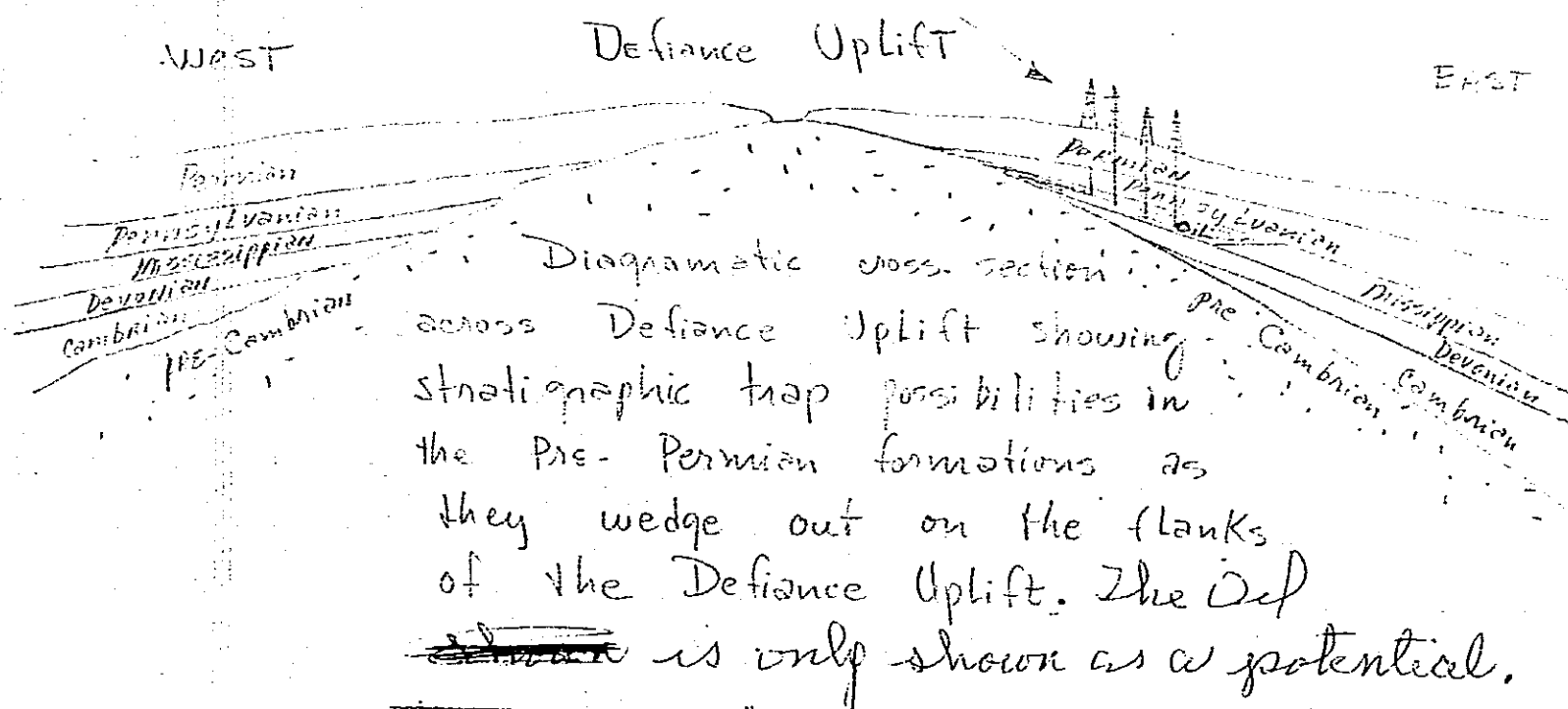
Pan Am #AB-1 Nav. (NW SE 32-7N-7W)
Proposed 3200' test

These 4 wildcats drilling
in hurried attempt to de-
termine stratigraphic
section prior to Navajo
sale on 9-26-67.

Texaco #BC-1 Nav. (NW SE 26-7N-7W)
Proposed 2850' test

DEPCO #1 Nav. (SW SE 7-7N-7W)
Proposed 2500' test

Gulf #1 Nav-Defiance (NE SW 12-6N-7W)
Proposed 3500' test.



Rumor: (Confirmed by Kerr-McGee). Kerr McGee has set pipe on their New Mexico wildcat, which is located just across Ariz. state line. This well located on same structure (Toadlena Anticline) as Dineh bi Keyah Field. Rumor suggest Pennsylvanian gas. This possible discovery could mean continued development of oil, gas, and helium along this large structure.

Monthly production

Another gain in production: 10 Kerr McGee wells alone produced 387,242 BO during August. (Production from all Ariz. wells totaled 323,819 BO in July.)

Dineh bi Keyah Field

Kerr-McGee #16 Nav. now on production. Making approx 200 BOPD. Will probably take out Reda and install beam pump. (Beam pumps cost \$15,000-20,000. Reda pumps cost about the same; however maintenance costs are much higher on Reda. Kerr McGee thinks that if well is making less than 800 BOPD, the beam pump is better.) Well making 1%-6% water.

Kerr McGee #14 Nav. Flowing. Will probably install Beam pump.

Kerr-McGee #9 Nav.--Making approx. 20% wtr.

Kerr-McGee #7 Nav. Making approx 15-20% wtr.

Kerr-McGee #6 Nav. Making trace wtr. Well no hooked in on gathering system.

Kerr McGee #4 Nav.--Still best well in field. Making 3000 BOPD.