

TESTIMONY TO BE PRESENTED TO THE  
NEW MEXICO OIL CONSERVATION COMMISSION  
REQUESTING APPROVAL OF COMANCHE (SAN ANDRES) UNITS  
AND UNIT AGREEMENT  
DECEMBER 15, 1964

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QUALIFICATIONS - Graduated from Ohio State University with degrees of Bachelor of Petroleum Engineering and Master of Science. Employed 9 1/2 years with Shell Oil Company as Exploitation Engineer in Corpus Christi, Texas, and as a Reservoir Engineer in Houston, Texas, and Roswell, New Mexico. Have recently made independent study and am familiar with area of interest.

LIST OF EXHIBITS

Figure 1 Unit Area Map

Figure 2 Structure Map - Top San Andres (Slaughter) Zone

Figure 3 Cross-section (north-south)

Figure 4 Cross-section (east-west)

Table 1 Description of Unit Acreage

Table 2 Classification of Unit Acreage by Type

Table 3 Development Plans - All Units

\*Unit Agreement - Comanche Unit A

\*Unit Agreement - Comanche Unit B

\*Unit Agreement - Comanche Unit C

\*Unit Agreement - Comanche Unit D

\*Unit Agreement - Comanche Unit E

\*Unit Agreement - Comanche Unit F

\*Previously submitted with Application for Hearing

Letters from U.S.G.S. (Dept. of Interior) granting temporary approval  
of Units A, B, C, D, E, and F.

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PURPOSE AND INTRODUCTION

Shell Oil Company herewith applies for approval of the Unit Agreement and designation of Unit Area for six San Andres formation Units. We request that these applications be considered separately for each individual Unit, although in the following testimony all references, unless otherwise indicated, are intended to mean the collective area of all six Units.

The area to be designated Comanche San Andres Units A, B, C, D, E, and F is comprised of approximately 102,880 acres of Federal, State, and Private Lands located in Townships 6, 7, 8 and 9 South, Ranges 25 and 26 East, Chaves County, New Mexico (See Figure 1 and Tables 1 and 2.) Formation of these six units will be for the purpose of delineating the accumulations and developing by the employment of supplemental recovery techniques the oil reserves in the Slaughter Zone of the San Andres formation within the respective unit areas.

## GEOLOGY OF THE COMANCHE UNITS:

A large stratigraphically controlled oil accumulation situated about nine miles northeast of Roswell, New Mexico, and localized at shallow depth (800-1500 feet) in the Slaughter Zone of the San Andres formation is suggested by the following factors:

### 1. Regional Easterly Dip

Tertiary uplift along the Sacramento Mountains *to west* is reflected in regional, north-northeasterly strike and easterly dip in the San Andres (Figure 2). Structure is regionally homoclinal and dips averaging 100 feet per mile into the Permian Basin. A sharp easterly plunging syncline is indicated at the southern end of the proposed Unit Area.

### 2. Northward Loss of Porosity

The Slaughter Zone is present over the northwestern shelf area of the Permian Basin and occurs as a 150-foot thick porous dolomite unit about 600 feet below the top of the San Andres (Figures 3 and 4). The upper part of the zone is replaced to the north by tight anhydrite and anhydritic dolomite, with porosity being lost progressively downward in a series of interfingering shingle-like steps designated as Divisions A and B (Figure 3).

### 3. Westward Permeability Barrier

A sharp transition from fresh to very saline formation water in the Slaughter Zone (Figure 4) is

believed to be caused by a permeability barrier, possibly developed by an asphaltic seal or by the precipitation of gypsum or anhydrite derived from solution near the outcrop some 20 to 30 miles west. The position of the fresh-salt water transition in the Slaughter Zone, as indicated by a few deep irrigation wells and scattered oil tests, extends north-south parallel to and approximately 3 miles west of the Pecos River.

4. Evidence and Nature of Accumulation

Several small San Andres oil fields (noted on Figures 1 and 2) have been developed in and adjacent to the area of the proposed Comanche Units. During the past 35 years, a total of 37 penetrations of the Slaughter Zone throughout the Unit Area have been reported. Of these tests, thirteen completions have been effected (5 in Linda, 4 in Pecos, and 4 in an undesignated area) with nine wells currently testing completions. The remaining fifteen wells were plugged and abandoned as "dry" holes. The history of field wells indicates very low productive rates and unattractive ultimate primary recoveries, even though considerable oil is indicated to be in place. Most of the "dry" holes drilled in the area encountered excellent oil shows in the Slaughter Zone. Many of these wells bailed, swabbed, or production tested live oil in

SLAUGHTER ZONE RESERVOIR CHARACTERISTICS:

Based on available log, core analysis and production data from wells in and adjacent to the Unit Area, the following average parameters have been assumed to be applicable to the Slaughter Zone reservoir development within the Unit Area: gross thickness 150 feet, porosity 10.5 per cent, permeability 2-5 md., net pay 27 feet, water saturation 35 per cent, and oil gravity 22-27 deg. API. From these parameters the original oil-in-place has been estimated to be 12,420 stock tank barrels per acre.

As previously mentioned, the primary performance of the Slaughter Zone fields in the general area has been very poor. The average per well primary recovery is estimated to be less than 4,000 barrels, or approximately one per cent of the estimated original oil-in-place, which is not sufficient to payout development costs. It is considered that the principal reason for these extremely low recoveries can be attributed to the lack of natural reservoir energy associated with the shallow depth of this accumulation. Contributing factors are low permeability and moderately high crude viscosity.

Shell Oil Company has recently instituted a pilot waterflood project in the South Bitter Lake San Andres Field located approximately seven miles south of the Comanche Unit Area. It is anticipated that the injection of water in this field will supplement the natural reservoir energy and result in the recovery of heretofore unrecoverable oil reserves although it is too early to observe any conclusive results at this time. Since the South Bitter Lake Field is considered to be typical of the Slaughter Zone

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accumulation in the area, the injection of water or some other fluid should be equally applicable in the Comanche Unit Area.

#### SELECTION OF UNIT TYPE AND ACREAGE

The division of the proposed unitized area into six smaller units, in lieu of one large unit, is strictly for unitization and operational convenience as all geologic evidence indicates the entire Unit Area to possess equal production potential. In this regard, the smaller Units will reduce the diverse working and royalty interest ownerships; therefore, facilitating both unitization and subsequent operations in each unit. The individual unit boundaries were determined as much as possible with the objective of creating units of roughly equivalent areas and shapes. However, adjustments wherever necessary to maintain individual royalty and/or working interest ownership within a single unit were made, if such adjustments proved feasible.

A fixed participation type unit, as to both working and royalty interests, based on surface acres has been selected as the best suited for the planned type of operation inasmuch as no one portion of any unit can be considered as having greater potential than any other portion of the same unit. Since the use of supplemental recovery methods will be required at or shortly after primary development in order to recover the reserves in this area, an expanding participating area type of Unit would not be practical from both administrative and operational standpoints.

#### DESCRIPTION OF UNIT AGREEMENTS

The Unit Agreement for each Comanche Unit is the conventional form employed wherever Federal and State Lands are involved. However, unusual features of this Agreement occur in Section 11, Development Obligation, which provides for a fixed minimum number of wells to be drilled during the first two years after formation of the Unit, and in Section 12, Plan of Development and Operation, which provides that a plan for development be filed for not only the first two-year period after unitization; but also for an additional three-year period whereby a minimum fixed number of wells be drilled.

## DEVELOPMENT PLANS FOR THE COMANCHE UNITS

The initial development plans for each of these six units will consist of drilling evaluation wells to determine reservoir continuity and productivity throughout the respective Unit Areas. In this regard, a minimum number of Development Obligation Wells, as provided in Section 11 of the Unit Agreement, is set up to be drilled in each of the six units during the first two years. The total combined obligation during this period for the six units will amount to 25 wells which, it should be noted, is approximately equal to the total development in the Unit Area during the past 35 years. A summary of the Development Obligation Wells for each unit is presented in Table 3.

Under the provisions of Section 12, "Plan of Development and Operation," of the Unit Agreements, a commitment for the third, fourth, and fifth years' development in each unit is set forth (See Table 3). The five-year development plan for the Comanche Units will call for a total of 118 wells.

Plans for instituting supplemental recovery programs in each of the six units will be formulated based on information obtained from the evaluation wells in conjunction with the results of pilot operations currently being conducted in the South Bitter Lake Field, and possible future pilot operations within the requested unit areas.

#### CURRENT STATUS OF UNITIZATION PROCEEDINGS

As the initial step in the formulation of the aforementioned six units, Shell, as the major working interest owner in each unit, called a meeting with the other working interest owners on May 6, 1964, in order to submit geologic and engineering data, economics, and a draft of the Unit Agreement. Subsequent to this meeting, application for preliminary approval of the Unit Agreement and designation of Unit Area was submitted to the United States Geological Survey and the Commissioner of Public Lands. This preliminary approval was received August 6, 1964, from the United States Geological Survey. Ratification copies of the Unit Agreement and Unit Operating Agreement were dispersed to the various working interest owners in all units upon receipt of this approval. Subsequently, copies of the Unit Agreement have been dispersed to the royalty owners and overriding royalty owners for ratification.

SUMMATION AND REQUEST FOR APPROVAL

In summary, Shell has attempted to show that the formation of the six Comanche (San Andres) Units, as proposed, will result neither in waste of hydrocarbon resources nor violation of correlative rights; but will, through the application of supplemental recovery methods, result in increased recovery from this heretofore low-potential San Andres (Slaughter) accumulation.

We, therefore, request approval of the Unit Agreement and designation of Unit Area for Comanche San Andres Units A, B, C, D, E, and F.