

STATE OF NEW MEXICO  
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT  
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING  
CALLED BY THE OIL CONSERVATION  
DIVISION FOR THE PURPOSE OF  
CONSIDERING:

*CASE NO. 10264*  
*ORDER NO. R-9495*

**APPLICATION OF ROBERT L. BAYLESS FOR  
DESIGNATION OF A TIGHT FORMATION,  
RIO ARriba COUNTY, NEW MEXICO**

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 8:15 a.m. on March 21, 1991, at Santa Fe, New Mexico, before Examiner Michael E. Stogner.

NOW, on this 6<sup>th</sup> day of May, 1991 the Division Director, having considered the testimony, the record and the recommendations of the Examiner, and being fully advised in the premises,

FINDS THAT:

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

(2) The applicant, Robert L. Bayless, requests that the Division in accordance with Section 107 of the Natural Gas Policy Act and 18 C.F.R. §271.703 recommend to the Federal Energy Regulatory Commission that the Pictured Cliffs formation underlying the following lands situated in Rio Arriba County, New Mexico, hereinafter referred to as the Pictured Cliffs formation, be designated as a "tight formation" in said Federal Energy Regulatory Commission's regulations:

TOWNSHIP 29 NORTH, RANGE 2 WEST, NMPM

Sections 1 through 36:      All

TOWNSHIP 29 NORTH, RANGE 3 WEST, NMPM

Sections 1 through 36:      All

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TOWNSHIP 29 NORTH, RANGE 4 WEST, NMPM

Sections 1 through 36: All

TOWNSHIP 30 NORTH, RANGE 2 WEST, NMPM

Sections 1 through 36: All

TOWNSHIP 30 NORTH, RANGE 3 WEST, NMPM

Sections 1 through 36: All

TOWNSHIP 30 NORTH, RANGE 4 WEST, NMPM

Sections 1 and 2: All  
Sections 11 through 14: All  
Sections 23 through 26: All  
Sections 35 and 36: All

TOWNSHIP 31 NORTH, RANGE 2 WEST, NMPM

Sections 2 through 36: All

TOWNSHIP 31 NORTH, RANGE 3 WEST, NMPM

Sections 1 through 36: All

TOWNSHIP 32 NORTH, RANGE 2 WEST, NMPM

Sections 7 through 10: All  
Sections 15 through 22: All  
Sections 27 through 35: All

TOWNSHIP 32 NORTH, RANGE 3 WEST, NMPM

Sections 7 through 36: All

containing 193,090 acres, more or less; of which approximately 30,720 acres are within the Carson National Forest and the remaining is located within the Jicarilla Apache Indian Reservation.

(3) The applicant has designated the above-described area the "Cabresto Tight Gas Area" and included within the confines of said area are portions of the Choza Mesa-Pictured Cliffs Pool, East Blanco-Pictured Cliffs Pool, and Gobernador-Pictured Cliffs Pool.

(4) The type log presented by the applicant to represent the Pictured Cliffs formation in the area proposed for "tight formation" designation is the Welex Induction Guard Log run in the applicant's Jicarilla 474 Well No. 4 located 1850 feet from the South line and 1775 feet from the East line (Unit J) of Section 31, Township 30 North, Range 3 West, NMPM, East Blanco-Pictured Cliffs Pool, Rio Arriba County, New Mexico.

(5) The top and base of the Pictured Cliffs formation are found at depths of 3699 feet and 3974 feet, respectively, on said type log.

(6) One hundred and twenty four wells have been drilled into or through the Pictured Cliffs formation in the proposed designation area. Of these, fifty-three are presently capable of producing from the Pictured Cliffs formation.

(7) The average depth of the top of the Pictured Cliffs formation in the proposed Cabresto Tight Gas Area was testified to be 3715 feet.

(8) The geological evidence presented by the applicant indicates that the Pictured Cliffs formation underlies essentially all of the area under consideration. The formation consists of a marine clay filled very fine to fine grained, reasonably well sorted, subround to subangular, slightly calcareous, "salt and pepper" sandstone; the dark grains are predominately glauconite, mica and carbonaceous shale. This sandstone was deposited as a lenticular beach and nearshore bars which represent the last marine strata in the northeasterly regression of the Cretaceous Sea and therefore creating stratigraphic entrapment for the accumulation of natural gas. The geologic evidence also indicates that there are two main zones within the Pictured Cliffs formation in this area with each zone representing a regressive sequence separated by a transgressive marine tongue of shale. There are also interbeds of this shale in the lower portion of each main zone, however, such interbeds became thinner and fewer in the upper portions.

(9) Further, geological testimony indicates that the sandstone grains are coated with an illite-smectite authigenic clay and is pervasive throughout the vertical extent of the Pictured Cliffs formation. This clay coating serves to reduce the effective permeability of the formation.

(10) The applicant included in his testimony as direct evidence a technical paper entitled *Effect of Overburden Pressure and Water Saturation on Gas Permeability of Tight Sandstone Cores*, authored by Rex D. Thomas and Don C. Ward, which was presented at the Society of Petroleum Engineers (SPE) 46<sup>th</sup> Annual Fall Meeting, New Orleans, October 3-6, 1971 as SPE 3634. Said paper was a published report of research conducted by the U.S. Bureau of Mines which attempts to verify that the gas

permeability of tight sandstone cores is markedly decreased with increasing overburden pressure. Said research was conducted utilizing Pictured Cliffs formation cores taken from wells within Project Gasbuggy located in Section 36, Township 29 North, Range 4 West, NMPM, Choza Mesa-Pictured Cliffs Pool, Rio Arriba County, New Mexico, (Division Order No. R-3197). Project Gasbuggy was a part of the Plowshare Program of the U.S. Atomic Energy Commission in which a 29-kiloton nuclear explosive was detonated at a depth of 4,227 feet on December 10, 1967 for the purpose of conducting the United States' first underground nuclear experiment for the stimulation of low productivity gas reservoirs.

(11) In said report, it was concluded from approximately 200 core samples taken from the Choza-Mesa Pictured Cliffs Pool in Project Gasbuggy, yielding an average initial gas permeability of 0.16 millidarcies (md), dry and an average water saturation of 48 percent, an effective overburden pressure for this reservoir of 3000 psi results in a total reduction of initial permeability of 95 percent to 0.008 md.

(12) Said technical report has been utilized to support many of the previously approved "tight gas areas" throughout New Mexico.

(13) Utilizing the technical procedure and calculations from said SPE paper, an analysis on three additional cored wells from the Cabresto Tight Gas Area along with a core utilized in the report indicates the average dry air permeability for the Pictured Cliffs formation from the four wells to be 0.66 md, the net confining overburden pressure at a depth of 3715 feet is approximately 2800 psi, the average core water saturation was found to be 46 percent. The resulting in-situ permeability from the four cored wells was determined to be 0.035 md.

(14) Obtaining stabilized unstimulated gas production flowrates for Pictured Cliffs wells is not a standard procedure in this area, therefore all existing Pictured Cliffs wells within said area have been stimulated with fracture treatments (usually hydraulic and not nuclear in nature).

(15) In preparation for this Cabresto Tight Gas study, the applicant performed a "partially" unstimulated flow test on its Jicarilla 31-3-32 Well No. 1 (acid was used to insure that the perforations in said wellbore were open) located in Unit L of Section 32, Township 30 North, Range 3 West, NMPM, Rio Arriba County, New Mexico, which resulted in a calculated 24-hour flowrate of 22.0 MCFD.

(16) The natural gas produced from the Pictured Cliffs formation in the Cabresto Tight Gas Area is virtually "dry" with a few wells reporting very little condensate production, which occurred only after stimulation.

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(17) Within the proposed area there is a recognized aquifer being the Ojo Alamo, located over 500 feet above the Pictured Cliffs formation.

(18) Existing State of New Mexico and Federal Regulations, administered by the U.S. Forest Service, U.S. Bureau of Land Management, and the U.S. Department of Energy, relating to drilling, casing and cementing of wells are in effect to help assure that development of the Pictured Cliffs formation will not adversely affect said aquifer.

(19) The data available indicates that the Pictured Cliffs formation within the proposed designated area, as described in Finding Paragraph No. (6) above, meets all the criteria set forth in 18 C.F.R. §271.703(C)(2)(a), (b), (c), and (d), viz:

- (a) the estimated average in-situ permeability throughout the pay section is expected to be less than 0.1 millidarcies;
- (b) the stabilized production rate, against atmospheric pressure, for wells completed for production in the Pictured Cliffs formation, without stimulation, is not expected to exceed 105 MCF per day (the average depth of the top of the formation is 3715 feet);
- (c) no well drilled into the formation is expected to produce more than five barrels of crude oil per day; and
- (d) the Division has not authorized the formation or any portion thereof to be developed by infill drilling.

(20) The Pictured Cliffs formation underlying the lands described in Finding Paragraph No. (2) above should be recommended to the Federal Energy Regulatory Commission for designation as a tight formation.

**IT IS THEREFORE ORDERED THAT:**

(1) It be and hereby is recommended to the Federal Energy Regulatory Commission pursuant to Section 107 of the Natural Gas Policy Act of 1978, and 18 C.F.R. §271.703, that the Pictured Cliffs formation, as further described in Finding Paragraph Nos. (4) and (5) of this Order, underlying the following described lands in Rio Arriba County, New Mexico, be designated as a tight formation:

**TOWNSHIP 29 NORTH, RANGE 2 WEST, NMPM**  
Sections 1 through 36: All

TOWNSHIP 29 NORTH, RANGE 3 WEST, NMPM

Sections 1 through 36: All

TOWNSHIP 29 NORTH, RANGE 4 WEST, NMPM

Sections 1 through 36: All

TOWNSHIP 30 NORTH, RANGE 2 WEST, NMPM

Sections 1 through 36: All

TOWNSHIP 30 NORTH, RANGE 3 WEST, NMPM

Sections 1 through 36: All

TOWNSHIP 30 NORTH, RANGE 4 WEST, NMPM

Sections 1 and 2: All

Sections 11 through 14: All

Sections 23 through 26: All

Sections 35 and 36: All

TOWNSHIP 31 NORTH, RANGE 2 WEST, NMPM

Sections 2 through 36: All

TOWNSHIP 31 NORTH, RANGE 3 WEST, NMPM

Sections 1 through 36: All

TOWNSHIP 32 NORTH, RANGE 2 WEST, NMPM

Sections 7 through 10: All

Sections 15 through 22: All

Sections 27 through 35: All

TOWNSHIP 32 NORTH, RANGE 3 WEST, NMPM

Sections 7 through 36: All

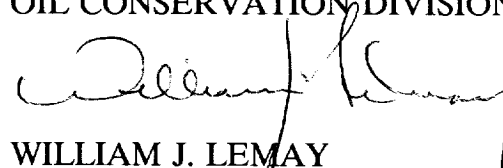
containing 193,090 acres, more or less, to be designated the Cabresto Tight Gas Area.

(2) Jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

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

STATE OF NEW MEXICO  
OIL CONSERVATION DIVISION



WILLIAM J. LEMAY  
Director

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