STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

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MEMORANDUM

TO: **MIKE STOGNER**

FROM: **ROBERT G. STOVALL**

SUBJECT: **CASE NO. 10693**

Enclosed please find the Division's draft order in the above-referenced case.

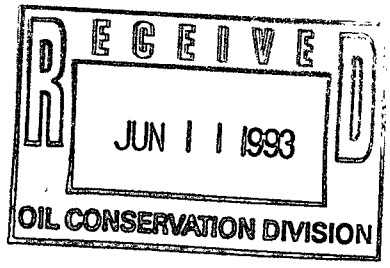
cc: Karen Aubrey/enclosures

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. 10693
Order No. R-

**APPLICATION OF PRONGHORN SWD SYSTEM
FOR SALT WATER DISPOSAL
LEA COUNTY, NEW MEXICO**



ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 8:15 a.m. on May 7, 1993, at Santa Fe, New Mexico, before Examiner Michael E. Stogner.

NOW, on this _____ day of _____, 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, Pronghorn SWD Systems, seeks authority to inject produced salt water into the Capitan Reef over a depth interval from approximately 3220 feet to 5000 feet. Applicant proposes to use its #6 Brooks Federal "7" Well located in Unit N, Section 7, Township 20 South, Range 33 East, NMPM, Lea County New Mexico. It presented its case with testimony and exhibits from a production engineer and a qualified expert hydrologist.

(3) Applicant's proposed injection well is currently producing from the Salt Lake Yates Field at a depth of 3026 feet to 3052 feet. The well was originally drilled in 1956 to a depth of 15,560 feet to test the Devonian formation. It was abandoned and then re-entered and completions were attempted at intervals of 4970 to 4975 feet and at 4620 to 4630 feet. Those

intervals were squeezed with cement and the well was plugged back to its current completion.

(4) Applicant proposes to inject up to 10,000 barrels of water per day produced from the Delaware formation and gathered by an existing 20 mile, eight inch PVC pipeline. The proposed injection water contains in excess of 220,000 parts per million (ppm) dissolved solids. The only Capitan Reef sample presented contained approximately 105,000 ppm dissolved solids. Log analysis of the reef section of the proposed well suggests that the water contains between 50,000 and 80,000 ppm total dissolved solids.

(5) The Oil Conservation entered an appearance in this case and presented testimony by a petroleum engineer from its staff responsible for administration of the Underground Injection Control Program and a hydrologist from the Office of the State Engineer. The Division did not take a position at the beginning of the case, but at the conclusion of the case recommended that the application be denied and that the matter be considered in a rule making proceeding which could define rules for all applications for injection into the Capitan Reef.

(6) The Division is responsible for administering the Federal Underground Injection Control (UIC) Program with respect to this application. That program was created under the Federal Safe Drinking Water Act to protect drinking water supplies.

(7) The State Engineer is responsible for managing the water resources of the State, including all fresh water which may or may not be usable for drinking water. the Division is required by statute to protect fresh water sources designated by the State Engineer.

(8) The Capitan Reef is a large Permian Age aquifer described by witnesses as a geologic tube which runs from the Guadalupe mountains west of Carlsbad to the Glass Mountains in Texas to the southeast. It is recharged primarily from the Guadalupe Mountains. The formation varies in thickness from 800 to more than 2,200 feet. The aquifer is hydrologically connected throughout its length. It is geologically complex, made up of canyons which act as restrictions to flow, fractures and solution channels; and the water qualities vary through different portions of the aquifer.

(9) The Capitan has some connection to other Permian formations, including oil and gas producing formations. When the Division obtained primacy over the Underground Injection Control Program, several of those formations were exempted from the prohibition against injecting produced water into fresh water aquifers. The Capitan was specifically not exempted.

(10) There is fresh water in the Capitan to the west of the proposed location from which the City of Carlsbad, White's City and Happy Valley obtain water for municipal purposes. Substantial quantities of Capitan water are also withdrawn for irrigation purposes in this area. The Capitan is connected to the Pecos River in the area of the City of Carlsbad. There is also fresh water in the Capitan starting 18 to 20 miles southeast of the proposed injection location

and continuing into the State of Texas.

(11) The portions of the Capitan Reef aquifer which contain less than 10,000 ppm total dissolved solids are designated fresh water by the State Engineer and are required to be protected by statute. The Pecos River, as a surface stream, is also designated for protection.

(12) There have been and continue to be significant withdrawals of water from the Capitan from the fresh water portions west and southeast of the proposed injection location.

(13) *Applicant's production engineer, who was not qualified as either a geologist or hydrologist, testified that he did not think that there was a practical hydrologic connection between the proposed injection well location and the fresh resources in the Carlsbad and Hobbs area. That testimony was not supported by any evidence or testing, and the witness did not quantify what he meant by "practical connection".*

Applicant's hydrologist testimony indicated that the Capitan is in hydrologic connection and that there are saline zones and fresh water zones in the reef. He testified that there are canyons in the reef which act as barriers to flow between portions of the reef. His opinions were based primarily on the literature, and from the information he made various assumptions regarding the reef for the purpose of constructing his model.

The evidence presented by the hydrologist from the State Engineer's Office was not inconsistent with that provided by Applicant's hydrologist in that it noted the development of the canyons which constrict flow, the varying permeability and the presence of high TDS water in portions of the reef. Based upon review of much of the same literature, the witness was of the opinion that the literature indicated that the canyons in the reef are restrictions but not barriers to flow there was not any loss of hydrologic connection between the Pecos River and the eastern most portions of the Capitan aquifer.

FINDING: The evidence does not prove conclusively that the hydrological connection throughout the Capitan is sufficiently restricted to prevent injected brine from impacting fresh water within the reef.

(14) *The applicant supported its application primarily with the testimony of its hydrologist who presented a two-dimensional SUTRA numerical simulator to attempt to model the impact of the injection of produced brine at this location.*

FINDING: The Oil Conservation Commission has determined that while modeling can be useful as a tool, careful scrutiny will be made of the parameters used in the model to determine if they reflect actual conditions, and the model should be calibrated to determine the validity of the parameters.

(15) *Applicant's hydrologist made several assumptions in developing the model:*

(a) The model is built on a flat domain with a constant vertical thickness of 1,000 feet and a constant width of 10 miles.

(b) That there are impermeable boundaries above and below and to the north and south of the aquifer. The Pecos River fully penetrates the Capitan, that it has a TDS concentration of 0.0 ppm and that there is a constant head boundary.

(c) The Capitan is homogeneous and isotropic with a constant hydraulic conductivity of 5 ft. per day and a constant porosity of 18%. It is assigned a longitudinal dispersivity of 100 meters, a constant transverse dispersivity of 10 meters and a coefficient of molecular diffusion of $5 * 10^{-10} m^2$.

(d) An initial distribution of brine exists in the model domain, constant throughout the thickness, and no additional sources of brine throughout time are present except the injection well.

(e) A constant source at the injection point with a rate of 12,500 bbls and a concentration of 250,000 ppm TDS for 50 years is assumed.

The assumptions used are taken from the literature or derived indirectly from information in the literature, and obtained from the U.S, Geological Survey and the State Engineer's Office. The hydrologist did no independent field work. The hydrologist testified that there is a lot of speculation about flow regimes.

The hydrologist from the State confirmed that there are very few aquifer tests which could be used to confirm aquifer parameters, which makes it difficult to obtain a realistic model.

FINDING: The model is based upon a simplification for the purpose of modeling of information which is contained in literature. The assumptions have not been verified against measured parameters. Therefore the parameter assumptions assumed in the model do not satisfy the Commission's requirement that modeling input be confirmed to be consistent with real data.

(16) *Applicant's hydrologist testified and his model report stated that the assumptions were very conservative, meaning that the model would predict that solutes injected would propagate the furthest distance away from the injection point.*

The State Engineer's hydrologist testified that the assumptions are not necessarily

conservative. They may be conservative with respect to one fresh water zone but not with respect to the other. Further, because the witness testified that because of the amount of speculation about the flow regime, there is uncertainty in the assumptions.

FINDING: The conclusions reached in the model regarding the impact of the injection operation on fresh water cannot be assumed to be accurate or conservative. The model, without corroborating evidence does not conclusively demonstrate the injection operation proposed will not have an adverse impact on fresh water.

(17) There has been no calibration or other confirmation that the model has a proper aquifer parameter distribution, and therefore the model does not satisfy the requirements for the use of modeling to predict how the injection will impact the fresh water in the Capitan.

(18) The hydraulic gradient between the Pecos River and the proposed injection site is relatively flat. There is substantial disagreement between the Applicant's hydrologist and the State Engineer's hydrologist about whether or not the proposed injection could reverse the gradient and cause degradation of the fresh water in and near the Pecos River and the City of Carlsbad. Because of the deficiencies of the model discussed in previous findings, the risk of gradient reversal must be considered.

(19) The Applicant's model assumptions regarding constant boundary conditions and zero permeability are not supported by any of the information. Nor is the assumption of constant thickness or permeability.

(20) The model is based upon an assumption that the only influence upon flows at this site is the proposed injection well. Because there are significant withdrawals from the Capitan at points east and west of the proposed injection, and because there is a hydrological connection throughout the reef, this assumption cannot be relied on to determine the actual impact of the injection operations.

(21) One of the advantages of modeling is the ability to change certain parameters and see how those changes affect the results, particularly when parameters used are based upon derived information or assumptions. The Applicant's hydrologist did not perform any such runs with different parameters.

(22) *The Applicant argued that this application must be considered as a stand alone application without consideration of any other possible applications for injection into the Capitan. Applicant further suggested that if there were any subsequent applications for injection that those applicants should be required to present evidence of the impact of their operations with consideration of the cumulative impact of any prior injection operations, and the Division could at any point determine a limit of allowable injection, sort of a reverse appropriation. However, Applicant did not provide any guidance to the Division about how to make such a*

determination or set a limit. Applicant's engineer did testify that it might wish to conduct additional injection operations if the capacity of this well were exceeded by the demand for injection.

The Division engineer testified that there has been one previous application for injection into the aquifer which was denied and that there have been other inquiries from operators about the possibility of obtaining approval to inject into the Capitan. He recommended that if injection into the Capitan is going to be allowed, a rule-making type of hearing should be conducted to determine what conditions, if any, should be imposed upon such operations.

FINDING: The Division has not allowed injection into the Capitan up to this point in time because of the concern for protection of fresh water in the reef. Approval of any application will be precedent setting and additional applications are likely. Before injection is allowed into the Capitan the Division or the Commission should require that extensive studies be conducted and that such approval only be considered after a rule-making type of hearing in which all of the factors and impacts of such operations have been considered, and that such studies be conducted using actual reservoir information.

(23) Fresh water resources in this state are scarce and valuable, and this Division cannot risk the possibility of contamination of a major source of fresh water based upon conclusions derived from a model which has been constructed upon assumptions which have not been tested or validated. There are other alternatives available for water disposal, and therefore this application should be denied.

IT IS THEREFORE ORDERED THAT:

(1) The application of Pronghorn SWD Systems for disposal of produced brine into the Capitan Reef formation is **DENIED**.

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

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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