KELLAHIN, KELLAHIN AND AUBREY
ATTORNEYS AT LAW
EL PATIO BUILDING
117 NORTH GUADALUPE
POST OFFICE BOX 2265
SANTA FE, NEW MEXICO 87504-2265

W. THOMAS KELLAHIN
KAREN AUBREY

CANDACE HAMANN CALLAHAN

JASON KELLAHIN
OF COUNSEL

TELEPHONE (505) 982-4285
TELEFAX (505) 982-2047

May 11, 1990

HAND DELIVERED

Mr. David Catanach
Oil Conservation Division
Post Office Box 2088
Santa Fe, New Mexico 87504

Re: Application of Socorro Petroleum Company for Increased Injection Pressure Authorization
NMOCD Case No. 9929

Dear Mr. Catanach:

On behalf of Socorro Petroleum Company and in accordance with your request at the hearing held on May 2, 1990, please find enclosed a proposed order for entry in this case.

Please call me if you have any questions.

Very truly yours,

W. Thomas Kellahin

WTK/tic
Enclosure

xc: Wyatt Fender
Socorro Petroleum Company
P.O. Drawer 3268
Midland, Texas 79702

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 9929
ORDER R-

APPLICATION OF SOCORRO PETROLEUM
COMPANY FOR A WATERFLOOD EXPANSION
AND TO AMEND DIVISION ORDER R-2268
AND ADMINISTRATIVE ORDERS WFX-585
AND WFX-587, EDDY COUNTY, NEW MEXICO.

SOCORRO PETROLEUM COMPANY'S
PROPOSED ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 8:15 A.M. on May 2, 1990, at Santa Fe, New Mexico before Examiner David R. Catanach.

NOW, on this ____ day of May, 1990, 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, Socorro Petroleum Company, seeks authority to increase the surface injection pressure limitation for all injection wells in its Keel-West Waterflood Project to a maximum of 450 psi above the formation parting pressure as determined from the most recent step-rate tests taken within the Project Area, Grayburg-Jackson Pool, consisting of all of Sections 3 through 10 of T17S, R31E, N.M.P.M., Eddy County, New Mexico.

(3) Applicant is the current operator of the Keel-West Waterflood Project which is a lease co-operative waterflood originally approved by Division Order R-2268 entered June 21, 1962, and subsequently amended and expanded by Order R-2268-A and R-2268-B.

(4) From inception to early August, 1986, the former operator utilizing some ten injection wells in the Project injected water into the Grayburg and San Andres formations at surface injection pressures as high as 2500 psi.

(5) By Administrative Order WFX-585 entered August 31, 1989, and Administrative Order WFX-587 entered September 26, 1989, the Division approved new injection wells but limited the surface injection pressure for those wells to approximately 670 psi (0.2 psi/ft limitation).

(6) Decline curve analysis and analogy to waterflood recovery from other areas of the project area shows that if sufficient volumes of water are injected through the injection wells an estimated additional 1.48 million barrels of oil will be recovered.

(7) Injection volumes with the 0.2 psi/ft limitation are not sufficient to recover the estimated additional 1.48 million barrels of additional recoverable oil.

(8) Step-rate tests have been conducted on some nine of the injection wells.

(9) Injection volumes limited to the formation parting pressure as established by step-rate tests are not sufficient to recover the additional 1.48 million barrels of estimated additional recoverable oil.

(10) Water injection conducted at 450 psig above the parting pressure of the formation as determined from the step-rate tests is necessary in order to improve injectivity from the injection wells and will result in the recovery of an estimated additional 1.48 million barrels of oil from the Project area that may not otherwise be recovered.

(11) The resulting increase in surface pressure limit for all of the Project injection wells will approximate the surface injection pressure for the original injection wells for which no pressure limit was imposed.

(12) Engineering studies conducted on behalf of the Applicant have demonstrated that the water injected into the original injection wells at pressures up to 2500 psig which exceeds the 0.2 psig/ft limitation by approximately 1830 psig remained confined to the Grayburg San Andres formations within the Grayburg-Jackson Pool.

(13) That there is no indication water injected into the original injection wells at pressures higher than the formation parting pressure has moved outside the vertical limits of the Grayburg San Andres formation in the pool.

(14) Prism logs were run on 11 wells in the project area with eight of them being located in the immediate area of concern. The prism log is obtained by locating within the formation, the position of fracture sand that has been tagged with radioactive material. These logs show that the greatest vertical distance that a fracture extended beyond perforation was 50 feet. These fracture treatments were conducted at injection rates and pressures

that far exceed expected waterflood injection rates and pressures using 450 psig above the most current step-rate pressures for the waterflood project.

(15) A study of the fracture heights above and below perforations from the prism logs shows that the fracture materials were confined to the Seven Rivers Queen Grayburg San Andres formations.

(16) Fracture would have to propagate some 1,000 farther than shown on the prism logs before those fractures would extend beyond the Seven Rivers, Queen, Grayburg and San Andres Pool authorized for waterflooding.

(17) Since the water injection rates and pressures for the waterflood are far below the fracture treatment rates and pressures, water injected at 450 psig above the formation parting pressure will be confined to the authorized flood interval.

(18) By Order R-7773-A entered effective September 8, 1988, the Division approved a similar increased surface injection pressure request for Anadarko Petroleum Corporation for its Ballard Grayburg San Andres Unit located approximately eleven miles southwest of the subject Project.

(19) Anadarko studied its project to determine the anticipated extent of the vertical fracture propagation by (a) using rock properties obtained from full wave sonic logs and density logs to determine how the confining stresses vary vertically through the zone of interest, and (b) by using pseudo-3D fracture design models to study the injecting water at a pressure limit of 450 psig above the formation parting pressure as determined by step-rate tests to show the improved injectivity and oil recovery while at the same time confining the resulting fractures to the Grayburg formation.

(20) In August, 1989, Devon Energy Corp using an analysis similar to Anadarko's applied for and obtained approval from the Division in Order R-7926 for a similar pressure limitation increase for a waterflood project in the same formation.

(21) Anadarko has not experienced any adverse results from injection of water at rates up to 450 psig above the formation parting pressure in its project.

(22) The Applicant's engineering study of pressure limits based upon the prism logs provides actual field data which shows the actual extent of the fractures and conclusively demonstrates that those fractures will not be propagated outside of the formation to be flooded.

(23) As the reservoir pressure in the project increases as a result of the injection of water, it will be necessary to periodically adjust the surface pressure limitation for the project which should be authorized administratively so long as said surface pressure limitation does not exceed 450 psig above the parting pressure established by that most current step-rate test.

(24) That the number and location of the wells from which step-rate tests have already been taken is adequate and sufficient from which to determine accurately the formation parting pressure for all injection wells in the project area and, therefore, no further step-rate tests need be taken.

(25) In order to prevent waste, a new pressure limitation of not greater than 450 psig above the formation parting pressure as determined by the most recent step-rate tests is required for the Keel-West Waterflood Project operated under Orders R-2268, R-2268-A, R-2268-B, WFX-585

and WFX-587 with provision made to increase the pressure limitation based upon additional step-rate tests as the project continues.

(26) That surface injection pressure limitations, subject to subsequent increase by administrative order, shall be established for the injection wells and at the limits set forth in Exhibit "A" attached hereto.

(27) That approval of this Application will prevent waste, protect correlative rights, and will not constitute a risk to fresh water sources.

IT IS THEREFORE ORDERED THAT:

(1) The Applicant, Socorro Petroleum Company, is hereby authorized to increase its surface injection pressure in its Keel-West Waterflood Project up to the maximum rates shown for each of the injection wells described in Exhibit "A" attached hereto and made a part hereof.

(2) That the maximum surface pressure limitation set forth in Ordering Paragraph (1) above, may be increased for all of the injection wells in the Project administratively by the Applicant submitting to the Division subsequent step-rate tests provided that any subsequent

increase in the surface pressure limitation shall not exceed 2500 psig or 450 psig above the formation parting pressure as established by the new step-rate test, whichever is less.

(3) Jurisdiction of this cause is 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

SEAL

EXHIBIT "A"

WELL	LOCATION	U-S-T-R	CURRENT LIMIT	REQUESTED LIMIT
H. E. WEST "A" NO.8	1980'FNL & 660'FWL	E-03-17S-31E	672 PSIG	2407 PSIG
H. E. WEST "A" NO.9	1980'FSL & 660'FEL	I-04-17S-31E	672 PSIG	2250 PSIG
H. E. WEST "A" NO.11	1980'FNL & 1980'FWL	G-03-17S-31E	688 PSIG	2203 PSIG
H. E. WEST "A" NO.14	720'FSL & 1980'FEL	O-04-17S-31E	643 PSIG	2203 PSIG
H. E. WEST "A" NO.15	660'FNL & 330'FEL	A-03-17S-31E	696 PSIG	2203 PSIG
H. E. WEST "B" NO.12	1980'FNL & 1980'FEL	G-09-17S-31E	652 PSIG	1872 PSIG
H. E. WEST "B" NO.13	1980'FNL & 660'FWL	E-10-17S-31E	662 PSIG	2027 PSIG
H. E. WEST "B" NO.15	1980'FNL & 1980'FEL	G-10-17S-31E	674 PSIG	2266 PSIG
H. E. WEST "B" NO.16	660'FSL & 660'FWL	M-03-17S-31E	667 PSIG	2203 PSIG
H. E. WEST "B" NO.18	660'FSL & 1980'FEL	O-03-17S-31E	677 PSIG	2350 PSIG
H. E. WEST "B" NO.20	660'FSL & 1980'FEL	O-10-17S-31E	671 PSIG	2203 PSIG
H. E. WEST "B" NO.21	660'FSL & 660'FWL	M-10-17S-31E	659 PSIG	2075 PSIG
H. E. WEST "B" NO.22Y	660'FSL & 1990'FEL	O-09-17S-31E	648 PSIG	2118 PSIG
H. E. WEST "B" NO.24	660'FNL & 660'FEL	A-10-17S-31E	675 PSIG	2203 PSIG
H. E. WEST "B" NO.34	1980'FSL & 660'FEL	I-10-17S-31E	668 PSIG	2203 PSIG
H. E. WEST "B" NO.43	660'FSL & 760'FWL	M-09-17S-31E	628 PSIG	2470 PSIG