See Also Order No. R-4442

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. 12592
ORDER NO. R-4442-A

APPLICATION OF TEXACO EXPLORATION & PRODUCTION, INC. FOR AMENDMENT OF DIVISION ORDER NO. R-4442, AS AMENDED, TO AUTHORIZE A TERTIARY RECOVERY PROJECT BY THE INJECTION OF CARBON DIOXIDE IN ITS VACUUM GRAYBURG-SAN ANDRES PRESSURE MAINTENANCE PROJECT AREA, APPROVAL OF AMENDMENT OF THE COOPERATIVE WATER INJECTION AGREEMENT BETWEEN THE CENTRAL VACUUM UNIT AND THE VACUUM GRAYBURG-SAN ANDRES UNIT, AND QUALIFICATION OF THE PROJECT FOR THE RECOVERED OIL TAX RATE PURSUANT TO THE "ENHANCED OIL RECOVERY ACT," LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This case came on for hearing at 8:15 a.m. on February 8, 2001 at Santa Fe, New Mexico, before Examiner Michael E. Stogner.

NOW, on this 18th day of September, 2001, the Division Director, having considered the testimony, the record and the recommendations of the Examiner,

FINDS THAT:

(1) Due public notice has been given, and the Division has jurisdiction of these cases and their subject matter.

(2) By Order No. R-4433, issued in Case No. 4851 on November 8, 1972, as amended by Order No. R-4433-A dated December 11, 1972, the Division, upon application of Texaco, Inc., approved the Vacuum Grayburg-San Andres Unit comprising the 1405.64 acres, more or less, of State lands described as follows:

LEA COUNTY, NEW MEXICO
TOWNSHIP 18 SOUTH RANGE 34 EAST, NMPM
Sections 1 and 2: All

Section 11:	NE/4 NE/4
Section 12:	N/2 NW/4.

This Unit was expanded in 1981 to include an additional 80 acres of State lands comprising the W/2 SW/4 of Section 35, Township 17 South, Range 34 East, NMPM, Lea County, New Mexico, by approval of the: (i) New Mexico State Land Office by letter dated February 2, 1981; and (ii) Division by letter dated December 9, 1980.

(3) By Order No. R-4442, issued in Case No. 4852 on November 27, 1972, the Division authorized Texaco, Inc. to institute a pressure maintenance project within the aforementioned Vacuum Grayburg-San Andres Unit by the injection of water into the Grayburg and San Andres formations, Vacuum Grayburg-San Andres Pool. The project was designated the Texaco Inc. Vacuum Grayburg-San Andres Pressure Maintenance Project.

(4) The "Unitized Formation" for the Vacuum Grayburg-San Andres Unit, as defined by the "Unit Agreement" which was introduced as Exhibit No. 2 in consolidated Cases No. 4851 and 4852 on November 1, 1972, includes the stratigraphic interval underlying the Unit Area in the Vacuum Grayburg-San Andres Pool between the depths of 3,902 feet (plus 105 feet sub-sea) and 4,809 feet (minus 802 feet sub-sea) on the Welex Acoustic Velocity Log, run on February 22, 1965 in Texaco, Inc.'s State of New Mexico "M" State Well No. 8 (**API No. 30-025-21107**), now Texaco Exploration & Production, Inc.'s ("Texaco") Vacuum Glorieta West Unit Well No. 113, located 330 feet from the North line and 1880 feet from the West line (Lot 3/Unit C) of Section 1, Township 18 South, Range 34 East, NMPM, Lea County, New Mexico.

(5) The applicant, Texaco, now seeks:

(a) to amend Division Order No. R-4442 to authorize the implementation of tertiary recovery operations within the Texaco Inc. Vacuum Grayburg-San Andres Pressure Maintenance Project by the injection of carbon dioxide ("$C0_2$") and other produced gases into the Grayburg and San Andres formations;

(b) authorization to inject $C0_2$ and produced gases at a maximum surface injection pressure of 350 psi above the maximum allowed surface water injection pressure, not to exceed 1850 psi;

(c) to qualify the proposed tertiary recovery project as an "Enhanced Oil Recovery ("EOR") Project pursuant to the

"Enhanced Oil Recovery Act," Sections 7-29A-1 through 7-29A-5, NMSA 1978, and Division Rule 30 (19 NMAC 15.A.30); and

(d) approval of the amendment of the lease line injection agreements between the Central Vacuum Unit and the Vacuum Grayburg-San Andres Unit.

(6) Current secondary recovery operations within the Vacuum Grayburg-San Andres Unit Area include 25 water injection wells and 47 producing wells. Texaco proposes to utilize all 25 water injection wells as $C0_2$ and produced gas injectors and to convert one producing well into a $C0_2$ and produced gas injection well.

(7) According to evidence and testimony presented by the applicant, its plan of operation in the implementation of this tertiary project includes:

(a) implementing a change in the process used for the displacement of crude oil by initiating water-alternating-gas ("WAG") injection;

(b) injecting an estimated 256 BCF of $C0_2$ and other produced gases and 128 million barrels of water over the life of the proposed tertiary recovery project, which is estimated to be approximately 50 years;

(c) utilizing a total of twenty-six (26) injection wells (all as shown on Exhibit "A" attached hereto) and forty-six (46) producing wells within the proposed tertiary recovery project; and

(d) injecting at sufficient pressure so as to maintain reservoir pressure at high enough levels to meet miscible pressure requirements in the reservoir.

(8) The applicant proposed that the project area for the tertiary recovery project comprise an area within the Vacuum Grayburg-San Andres Unit Area described as follows:

LEA COUNTY, NEW MEXICO
TOWNSHIP 18 SOUTH RANGE 34 EAST, NMPM

Section 1: Lots 1, 2, 3, and 4, S/2 N/2, N/2 S/2, SW/4 SW/4, N/2 SE/4 SW/4, SW/4 SE/4 SW/4, and N/2 S/2 SE/4

Section 2:	Lot 1, N/2 of Lot 2, E/2 SW/4 of Lot 2, SE/4 of Lot 2, NE/4 of Lot 3, S/2 NE/4 SW/4, SE/4 NW/4 SW/4, NE/4 SW/4 SW/4, N/2 SE/4 SW/4, NE/4 SE/4, NE/4 NW/4 SE/4, N/2 S/2 SE/4, and SE/4 SE/4 SE/4
Section 11:	NE/4 NE/4 NE/4
Section 12:	N/2 N/2 NW/4 .

This area represents less than the total area contained within the Vacuum Grayburg-San Andres Unit Area. According to the applicant's testimony, the proposed tertiary recovery project is being limited to only the portion of the Vacuum Grayburg-San Andres Unit Area that contains the best hydrocarbon pore volume within the Vacuum Grayburg-San Andres Pool.

(9) Further evidence and testimony presented by the applicant indicates that the amount of recoverable oil attributed to a positive production response from the proposed tertiary recovery project is an estimated 14.4 million stock tank barrels along with 19.3 BCF of hydrocarbon gas.

(10) Texaco presented testimony to the effect that the initiation of tertiary recovery operations utilizing the methodology proposed should result in the additional recovery set forth in Finding Paragraph No. (9) above for a projected cost of approximately $93.5 million, which includes field installations and upgrades, well remediation, separation and compression facilities, the purchase of $C0_2$, and the costs associated with the recycling of injected fluids.

(11) The proposed tertiary recovery project is offset by the following described WAG tertiary recovery projects within the Vacuum Grayburg-San Andres Pool, approved respectively by Division Orders No. R-5530-E and R-10599-B:

(a) to the east is Texaco's Central Vacuum Unit located in portions of Townships 17 and 18 South, Ranges 34 and 35 East, NMPM, Lea County, New Mexico. The authorized surface injection pressure for $C0_2$ and produced gases in this project area is 1850 psig; and,

(b) to the north is the Phillips Petroleum Company State "35" Unit Pressure Maintenance Project underlying the N/2, E/2 SW/4, and SE/4 of Section 35, Township 17 South, Range 34 East, NMPM, State "35" Com Unit Area, Lea County, New Mexico. The authorized surface injection pressure for $C0_2$ and produced gases in this project area is also 1850 psig.

(12) Pursuant to a Cooperative Water Injection Agreement, dated April 14, 1978, water has been injected into the Grayburg-San Andres formation through various wells located in Townships 17 and 18 South, Ranges 34 and 35 East, NMPM, Lea County, New Mexico. Texaco seeks authorization to amend this agreement to also provide for the injection of $C0_2$ and produced gases.

(13) To assure that the interest owners in Texaco's Vacuum Grayburg-San Andres Unit and Central Vacuum Unit continue to receive their fair and reasonable share of the reserves produced from each of these Units, the proposed amendments dated January 4, 2001 to the Cooperative Water Injection Agreement, which was presented as Exhibit No. 5 in this case, should be approved.

(14) The evidence and testimony presented in this case indicates that it is prudent to implement the proposed tertiary recovery project within the Vacuum Grayburg-San Andres Unit at this time, and that such implementation will result in the recovery of additional oil and gas from the project area which may otherwise not be recovered, thereby preventing waste. The proposed tertiary recovery project should be approved.

(15) The evidence further indicates that the oil and gas recovered as a result of implementing the proposed tertiary recovery project will be allocated to each tract within the Vacuum Grayburg-San Andres Unit on a fair and reasonable basis, thereby protecting correlative rights.

(16) The evidence presented by Texaco indicates that the proposed tertiary recovery project meets all the criteria for certification by the Division as a qualified "Enhanced Oil Recovery Project" pursuant to the "Enhanced Oil Recovery Act," Sections 7-29A-1 through 7-29A-5, NMSA 1978 in accordance with Division Rule 30 (19 NMAC 15.A.30). The proposed tertiary recovery project is economically and technically reasonable and has not been prematurely filed either for economic or technical reasons. The project area has been so depleted that it is prudent to apply tertiary recovery techniques to maximize the ultimate recovery of crude oil therefrom.

(17) The certified "EOR Project Area" should initially comprise the area described in Finding Paragraph No. (8) above; provided however, the "EOR Project Area" eligible for the recovered oil tax rate may be contracted and reduced dependent upon the evidence presented by the applicant in its demonstration of the occurrence of a positive production response.

(18) To be eligible for the recovered oil tax rate, the applicant should advise the Division when WAG injection commences within the "EOR Project Area" and request that the Division certify the subject tertiary recovery project to the New Mexico Taxation and

Revenue Department.

(19) At such time as a positive production response occurs from $C0_2$ (WAG) injection operations and within seven years from the date of the Certificate of Qualification, the applicant must apply to the Division for certification of positive production response, which application shall identify the area actually benefiting from tertiary recovery operations. The Division may review the application administratively or set it for hearing. Based upon evidence presented, the Division will certify to the New Mexico Taxation and Revenue Department those lands and wells which are eligible for the recovered oil tax rate.

(20) Division Order No. R-4442, which approved the Vacuum Grayburg-San Andres Unit Pressure Maintenance project, did not set a pressure limitation for water injection in the unit area.

(21) The current maximum surface injection pressures within the proposed tertiary recovery project area range from approximately 1395 psi to 2300 psi. Exhibit "A" to this order contains the current, approved water injection pressures for each well in the project area.

(22) Texaco seeks authority to inject $C0_2$ at a surface injection pressure for $C0_2$ which is 350 psi above the current maximum surface injection pressure for water for a given well (all as shown on applicant's Exhibit No. 15) with $C0_2$ injection pressure not to exceed 1850 psi.

(23) Texaco seeks no change in the approved injection pressure for water.

(24) Throughout the course of secondary recovery operations, the maximum surface injection pressures for the injection wells within the Vacuum Grayburg-San Andres Unit have been increased upon a showing by the operator that such higher pressure will not result in the fracturing of the injection interval or confining strata. Pressure increases such as described are usually based upon the results of step-rate tests. Texaco also seeks authority to continue to conduct step-rate tests and receive pressure increase authority on injection wells within the tertiary recovery project area with a current maximum surface injection pressure for water less than 1500 psi.

(25) The evidence and testimony presented by Texaco indicates that the proposed maximum $C0_2$ surface injection pressure of 1850 psi, or 350 psi above the current maximum surface injection pressure for water, is reasonable and necessary and should not result in the migration of injected fluid from the proposed injection interval.

(26) All injection wells or the pressurization system should be initially equipped with a pressure control device or acceptable substitute that will limit the surface injection

pressure to no more than the individual well surface injection pressure authorized by this order.

(27) Texaco presented testimony that it has reviewed the available data on all wells in the project area including all injection wells, producing wells, and plugged and abandoned wells, and that there is no remedial work required on any well in the project area to enable Texaco to safely conduct $C0_2$ injection and produced gas reinjection operations.

(28) Texaco presented testimony that to ensure the integrity of each wellbore, wells in the Vacuum Grayburg-San Andres Project Area will be monitored like wells in the offsetting $C0_2$ tertiary floods which involves: **(i)** equipping each injection well with an automation system that monitors pressures in the well and shuts in the well if pressures increase above predetermined levels; **(ii)** conducting monthly Division-monitored bradenhead surveys on each injection well and annual Division-monitored bradenhead surveys on each producing well; **(iii)** conducting periodic wellbore integrity tests on each well; and **(iv)** visually inspecting each well each day.

(29) Texaco's request should be granted; provided however, the Division may require the installation of additional or upgraded wellbore tubulars and packers should it become apparent that the injection of $C0_2$ and/or produced gases is causing abnormal corrosion problems.

(30) If not previously so equipped, each of the injection wells shown on Exhibit "A" should be equipped with internally coated tubing installed in a packer set within 100 feet of the uppermost injection perforation or casing shoe; the casing-tubing annulus should be filled with an inert fluid; and a gauge or approved leak-detection device should be attached to the annulus in order to determine leakage in the casing, tubing or packer.

(31) The operator should give advance notification to the supervisor of the Hobbs District Office of the Division of the date and time of the installation of any new injection equipment and of the mechanical integrity pressure tests in order that the same may be witnessed.

(32) The application should be approved and the project should be governed by the provisions of Division Rules No. 701 through 708.

IT IS THEREFORE ORDERED THAT:

(1) The applicant, Texaco Exploration and Production Inc. ("Texaco"), is hereby authorized to institute an enhanced oil tertiary recovery project by means of combined water, carbon dioxide ($C0_2$), and produced gas injection ("WAG") into the Grayburg and San Andres formations, Vacuum Grayburg-San Andres Pool, in its Vacuum Grayburg San

Andres Unit Area located in portions of Township 17 South, Range 34 East, NMPM, Lea County, New Mexico. Injection is authorized within each of the twenty-six (26) injection wells shown on Exhibit "A" attached hereto through the gross perforated interval in each well that is correlative to the interval between the depths of 3,902 feet (plus 105 feet sub-sea) and 4,809 feet (minus 802 feet sub-sea) found on the Welex Acoustic Velocity Log, run on February 22, 1965 in Texaco's State of New Mexico "M" State Well No. 8 (**API No. 30-025-21107**), now Texaco's Vacuum Glorieta West Unit Well No. 113, located 330 feet from the North line and 1880 feet from the West line (Lot 3/Unit C) of Section 1, Township 18 South, Range 34 East, NMPM, Lea County, New Mexico.

IT IS FURTHER ORDERED THAT:

(2) Any injection authority granted by Order No. R-4442, issued in Case No. 4852 on November 27, 1972, not in conflict with the provisions set forth in this order shall remain in full force and effect.

(3) WAG injection operations shall be accomplished through internally coated tubing installed in a packer set within approximately 100 feet of the uppermost injection perforations or casing shoe; the casing-tubing annulus shall be filled with an inert fluid and a gauge or approved leak-detection device shall be attached to the annulus in order to determine leakage in the casing, tubing or packer.

(4) For those injection wells within the enhanced oil tertiary recovery project with a current maximum surface injection pressure for water less than 1500 psi (as shown on applicant's Exhibit No. 12), the applicant is hereby authorized to inject water into each of these wells at the current maximum surface injection pressure; provided however, such pressure may be administratively increased by the Division upon a showing that such increase will not result in the fracturing of the injection interval or confining strata. The applicant is further authorized to inject $C0_2$ and produced gases at a maximum surface injection pressure of 350 psi above the current maximum surface injection pressure for water; provided however, such $C0_2$ and produced gas injection may not occur at a surface injection pressure in excess of 1850 psi.

(5) For those injection wells within the enhanced oil tertiary recovery project with a current maximum surface injection pressure for water exceeding 1500 psi (as shown on applicant's Exhibit No. 15), the applicant is hereby authorized to inject water into each of these wells at the current maximum surface injection pressure, and is further authorized to inject $C0_2$ and produced gases at a maximum surface injection pressure of 1850 psi.

(6) The Division Director shall retain the authority to administratively authorize a pressure limitation in excess of the above pressure limits upon a showing by the operator that such higher pressure will not result in the fracturing of the injection interval or

confining strata.

(7) The Unit operator shall immediately notify the supervisor of the Hobbs district office of the Division of the failure of the casing in any of the injection wells, the leakage of water, natural gas, $C0_2$, or oil from or around any producing well, or the leakage of water, natural gas, $C0_2$, or oil from any plugged and abandoned well within the enhanced oil tertiary recovery project, and shall take such steps as may be necessary to correct such failure or leakage.

(8) The proposed amendments to the Vacuum Grayburg-San Andres Cooperative Water Injection Agreement with the Central Vacuum Unit, which were dated January 4, 2001 and presented as Exhibit No. 5 in this case, are hereby approved.

(9) The subject enhanced oil tertiary recovery project is hereby certified as a qualified "Enhanced Oil Recovery Project" pursuant to the "Enhanced Oil Recovery Act," Sections 7-29A-1 through 7-29A-5, NMSA 1978, and Division Rule 30 (19 NMAC 15.A30).

(10) The certified and approved "EOR Project Area" shall include those lands described as follows (provided however that the "EOR Project Area" eligible for the recovered oil tax rate may be reduced depending upon the evidence presented by the applicant in its demonstration of the occurrence of a positive production response):

LEA COUNTY, NEW MEXICO
TOWNSHIP 18 SOUTH RANGE 34 EAST, NMPM

Section 1:	Lots 1, 2, 3, and 4, S/2 N/2, N/2 S/2, SW/4 SW/4, N/2 SE/4 SW/4, SW/4 SE/4 SW/4, and N/2 S/2 SE/4
Section 2:	Lot 1, N/2 of Lot 2, E/2 SW/4 of Lot 2, SE/4 of Lot 2, NE/4 of Lot 3, S/2 NE/4 SW/4, SE/4 NW/4 SW/4, NE/4 SW/4 SW/4, N/2 SE/4 SW/4, NE/4 SE/4, NE/4 NW/4 SE/4, N/2 S/2 SE/4, and SE/4 SE/4 SE/4
Section 11:	NE/4 NE/4 NE/4
Section 12:	N/2 N/2 NW/4 .

(11) To be eligible for the recovered oil tax rate, prior to commencing WAG injection operations, the Unit operator must request from the Division a Certificate of Qualification, which will specify the proposed project area as described above.

(12) At such time as a positive production response occurs and within seven years from the date of the Certificate of Qualification, the operator must apply to the Division for certification of positive production response, which application shall identify the area actually benefiting from enhanced recovery operations. The Division may review

the application administratively or set it for hearing. Based upon evidence presented, the Division will certify to the New Mexico Taxation and Revenue Department those lands and wells that are eligible for the recovered oil tax rate.

(13) The injection authority granted herein for the twenty-six WAG injection wells shall terminate one year after the effective date of this order if the operator has not commenced WAG injection operations into these wells; provided however, the Division, upon written request by the operator, may grant an extension thereof for good cause.

(14) The subject oil tertiary recovery project is hereby designated the Vacuum Grayburg-San Andres Unit Tertiary Recovery Project and shall be governed by the provisions of Division Rules No. 701 through 708.

(15) Monthly progress reports of the tertiary recovery project herein authorized shall be submitted to the Division in accordance with Division Rules No. 706 and 1115.

(16) Jurisdiction of this case 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.

SEAL

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

LORI WROTENBERY
Director

EXHIBIT "A"
CASE NO. 12592
ORDER NO. R-4442-A
TEXACO EXPLORATION AND PRODUCTION INC.
VACUUM GRAYBURG SAN ANDRES UNIT
ENHANCED OIL TERTIARY INJECTION WELLS

ACTIVE WATER INJECTORS TO BE CONVERTED TO CO_2 INJECTION				
Ref. No.	**Well No.**	**Permit Date**	**Pressure Limit for Water**	**Pressure Limit for CO_2 and Produced Gas**
1	4	11/17/98	2150	1850
2	5	**11/1/72**	**N/A**	1850
3	14	11/17/98	1420	1770
4	15	**11/1/72**	**N/A**	1850
5	16	4/15/97	1480	1830
6	17	**11/1/72**	**N/A**	1850
7	18	4/15/97	1930	1850
8	19	**11/1/72**	**N/A**	1850
9	20	11/17/98	1680	1850
10	31	**11/1/72**	**N/A**	1850
11	32	4/15/97	1730	1850
12	33	**11/1/72**	**N/A**	1850
13	34	11/10/93	1395	1745
14	35	**11/1/72**	**N/A**	1850
15	46	5/24/91	1765	1850
16	47	**11/1/72**	**N/A**	1850
17	48	11/17/98	2210	1850
18	49	**11/1/72**	**N/A**	1850
19	50	11/10/93	1730	1850
20	63	4/15/97	2115	1850
21	146	4/15/97	1800	1850
22	147	4/15/97	2030	1850
23	148	11/17/98	2300	1850
24	149	2/8/95	1845	1850
25	150	2/9/95	1810	1850
ACTIVE PRODUCING WELL TO BE CONVERTED TO CO_2 INJECTION				
26	122	N/A	N/A	1210