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. 14401
ORDER NO. R-5530-F

APPLICATION OF CHEVRON U.S.A., INC. FOR AMENDMENT OF DIVISION ORDER NO. R-5530-E TO REVISE THE INJECTION WELL COMPLETION REQUIREMENTS AND TO CHANGE THE BASIS FOR THE CALCULATION OF THE AUTHORIZED INJECTION PRESSURE FROM SURFACE PRESSURE TO THE AVERAGE RESERVOIR PRESSURE IN ITS PREVIOUSLY APPROVED TERTIARY RECOVERY PROJECT IN THE CENTRAL VACUUM UNIT EOR PROJECT AREA, LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This case came on for hearing at 8:15 a.m. on December 3, 2009, at Santa Fe, New Mexico, before Examiner David K. Brooks.

NOW, on this 12th day of January, 2010, the Division Director, having considered the testimony, the record and the recommendations of the Examiner,

FINDS THAT:

(1) Due notice has been given, and the Division has jurisdiction of the subject matter of this case.

(2) Cases No. 14401 and 14402 were consolidated for hearing and a joint record was made. However, separate orders will be issued.

(3) Chevron U.S.A., Inc. ("Applicant") seeks amendment of Order No. R-5530-E, which authorizes injection of water, carbon dioxide (CO2) and produced gases for pressure maintenance into the Central Vacuum Unit in Lea County, New Mexico, in three respects, as follows:

(a) amending Ordering Paragraph (3) of Order No. R-5530-E, which currently requires that the casing-tubing annulus in any injection well be filled with an inert fluid, and an approved leak detection device be attached to the annulus, to retroactively authorize continued injection into seven wells where the tubing has been cemented in place;

(b) amending Ordering Paragraph (3) of Order No. R-5530-E, which currently requires that injection tubing be installed in a packer set within approximately 100 feet of the uppermost injection perforations or casing shoe, to retroactively and prospectively authorize setting packers in injection wells more than 100 feet above the uppermost injection perforations or casing shoe, provided that the packer is set within the Unitized Formation; and

(c) amending Ordering Paragraphs (4) and (5) of Order No. R-5530-E, which currently limits surface injection pressure for CO2 to 350 pounds per square inch (psi) more than the pressure authorized for water injection, but in no event more than 1,850 psi, to establish an injection pressure limit for CO2 based on bottomhole pressure.

(4) At the hearing, Applicant appeared through counsel and presented geologic, operational and engineering testimony, as follows:

(a) Regarding the injection wells with <u>cemented tubing</u>, Applicant's witnesses testified:

(i) Applicant has cemented the tubing in seven injection wells in the Central Vacuum Unit (subject wells), as follows:

Central Vacuum Unit Well No. 58	API No. 30-025-25724
Central Vacuum Unit Well No. 73	API No. 30-025-25728
Central Vacuum Unit Well No. 71	API No. 30-025-25727
Central Vacuum Unit Well No. 57	API No. 30-025-25732
Central Vacuum Unit Well No. 16	API No. 30-025-25793
Central Vacuum Unit Well No. 6	API No. 30-025-25809
Central Vacuum Unit Well No. 27	API No. 30-025-25815

(ii) In each case, the tubing was cemented with the approval of the Division's Hobbs District Office following casing leaks and unsuccessful repair attempts.

(iii) Since filing this Application, Applicant has conducted blanking plug tests to determine tubing integrity on each of the subject wells, and all of them passed.

(iv) There is no practicable means to restore the casing-tubing annulus in the subject wells. Loss of the injection capacity of the subject wells and similarly constructed wells in the Vacuum Grayburg San Andres Unit would result in loss of approximately 485 barrels of oil per day of production.

(v) Re-drilling the subject wells would cost an estimated $2 million dollars per well and would likely not be economic under Applicant's investment criteria. Discontinuing use of these wells for injection, if they were not re-drilled, would waste approximately 2.21 million barrels of proven reserves.

(vi) Applicant proposes to conduct annual blanking-plug tests on each of the subject wells to insure tubing integrity, and to continuously monitor injection pressures versus injection volumes with its Supervisory Control and Data Acquisition (SCADA) system, to monitor cement and casing integrity.

(vii) A leak anywhere down-hole in the injection well would occasion an anomaly in the normally consistent correlation between injection rate and injection pressure. The SCADA system will be programmed to report an "alarm" if an anomaly in this relationship for any of the subject wells persists for 24 hours. This will provide more rapid leak detection than conventional inspection methods.

(b) Regarding <u>packer setting depths</u>, Applicant's witnesses testified:

(i) Due to wear on the tubing in these old wells, it is often necessary, when re-setting the packer, to move up-hole in order to secure a reliable packer seat.

(ii) There are a total of 31 injection wells in the Central Vacuum Unit and the Vacuum Grayburg San Andres Unit in which the packers are currently set more than 100 feet above the highest injection perforation and the casing shoe. The packers in all of these wells are set below the top of the injection formation and within the unitized interval. The existing packer setting depths in these wells have been approved by the Division's Hobbs District Office.

(iii) There are additional wells in these units where the packers cannot be re-set within 100 feet of the highest injection perforation or the casing shoe.

(iv) Correlated formation tops in this unit generally are approximately 350 feet above the uppermost injection perforations.

(c) Regarding <u>authorized injection pressure</u>, Applicant's witnesses testified:

(i) Order No. R-5530-E limits surface injection pressure for CO2 to 350 psi greater than the applicable injection pressure limit for water, but in no event more than 1,850 psi.

(ii) In this unit, if Applicant were injecting 100% pure CO2, a surface injection pressure of 1,850 psi would produce an average bottomhole injection pressure of approximately 3,600 psi.

(iii) However, the CO2 being injected by the Applicant is approximately 87% pure, as determined by tests at the tailgate of Applicant's recycle facility.

(iv) Using 87% CO2, a surface injection pressure of 1,850 psi produces a bottomhole injection pressure of approximately 3,200 psi, or 400 psi less than was contemplated when these limits were set.

(v) Applicant has conducted step-rate tests resulting in approval of surface injection pressures for water from 1,920 psi to 2,500 psi. Allowing for the 350 psi differential authorized for CO2 injection, as compared to water injection, provided in Order No. R-5530-E, these tests indicate that a surface injection pressure of 2,200 psi for CO2 will not exceed formation fracture pressure.

(vi) Applicant would prefer that the CO2 injection pressure limit for this unit be set by reference to bottomhole pressure, at the originally contemplated 3,600 psi. However, if a surface injection pressure limit is needed for purposes of inspection, Applicant requests that it be raised to 2,200 psi.

The Division concludes that:

(5) The Division's district offices do not have authority to waive requirements set forth in hearing or administrative orders issued by the Director unless specifically authorized in the order or by rule. Hence, the injection wells where the tubing has been cemented, and where packers have been set substantially more than 100 feet above the uppermost injection perforation or casing shoe, are currently in violation of permit conditions.

(6) Applicant's proposed inspection protocol using blanking plug tests and SCADA monitoring provides a reasonable substitute for monitoring annular pressure.

Hence, allowing continued utilization of the subject wells for injection, subject to the conditions proposed by Applicant and set forth in this Order, will not cause waste, impair correlative rights or endanger public health or the environment, and this application should be granted, as to these wells only, to allow their continued operation.

(7) Setting packers in which the injection tubing is installed in this unit more than 100 feet above the uppermost injection perforation or casing shoe will not cause waste, impair correlative rights or endanger public health or the environment so long as the packer in each well is set within the Unitized Formation, as defined in Finding Paragraph (4) of Order No. R-5530-E. Accordingly, this Application should be granted to allow packers to be set within these parameters both as to existing wells that are presently in violation, and as to wells in which a need may subsequently arise to raise the packer-setting depth.

(8) The evidence indicates that injection of CO2 in this unit at a bottomhole pressure not to exceed 3,600 psi will not damage the formation, and thus will not cause waste, impair correlative rights or endanger public health or the environment. However, to facilitate enforcement, the surface injection pressure limit should be set at 2,200 psi. The operator of the unit should be directed to notify the Hobbs District Office of the Division prior to implementing any significant change in the purity of the CO2 being used for injection in this unit.

IT IS THEREFORE ORDERED THAT:

(1) Ordering Paragraph (3) of Order No. R-5530-E is hereby amended to read as follows:

> (3) For all injection wells in the "EOR Project Area", excluding heretofore permitted injection wells where the tubing has been cemented in place, injection shall be accomplished through internally coated tubing installed in a packer set as close as practically possible to the uppermost injection perforations or casing shoe, so long as the packer set point remains within the Unitized Formation; and 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. Prior to re-setting any packer more than 100 feet above the uppermost injection perforation or casing shoe, the operator shall secure approval of the Division's Hobbs District Office.

(2) The seven heretofore permitted injection wells identified below, which have had their injection tubing cemented in place, are hereby approved for continued use as water or CO2 injection wells provided that each well's mechanical integrity is verified annually by a blanking plug Mechanical Integrity Test and, provided further, that the operator maintains records of monitoring that demonstrate the absence of significant

changes in the relationship between injection pressure and injection flow rate. Such records shall be available for inspection by the Division upon request.

Central Vacuum Unit Well No. 58	API No. 30-025-25724
Central Vacuum Unit Well No. 73	API No. 30-025-25728
Central Vacuum Unit Well No. 71	API No. 30-025-25727
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Central Vacuum Unit Well No. 6	API No. 30-025-25809
Central Vacuum Unit Well No. 27	API No. 30-025-25815

(3) Ordering Paragraphs (4) and (5) of Order No. R-5530-E are hereby amended to read as follows:

> (4) For any injection wells within the "EOR Project Area" whose current maximum injection pressure (pursuant to orders in effect on the date of issuance of Order No. R-5530-F) for water is less than 1,500 psi, the Applicant is 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 fracturing of the injection formation or confining strata, and shall be further authorized to inject CO_2 and produced gasses at a maximum surface injection pressure of 750 psi above the current maximum injection pressure for water, provided, however, such CO_2 injection shall not occur at a surface injection pressure in excess of 2,200 psi (which is estimated to be the equivalent of 3,600 psi average bottomhole injection pressure).
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> (5) For those injection wells within the "EOR Project Area" whose current maximum surface injection pressure for water exceeds 1,500 psi (pursuant to orders in effect on the date of issuance of Order No. R-5530-F), Applicant is authorized to inject water into each of these wells at the current maximum surface injection pressure, and shall be further authorized to inject CO_2 and produced gasses at a maximum surface injection pressure of 2,200 psi (which is estimated to be the equivalent of 3,600 psi average bottomhole injection pressure). The Division may grant increases in the maximum surface injection pressure authorized by this paragraph by administrative order.

(4) Except as specifically modified hereby, Order Nos. R-5530 through R-5530-E, inclusive, shall continue in effect to the same extent as immediately prior to the issuance of this Order.

(5) 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.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MARK E. FESMIRE, P.E.
Director

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