

OIL AND GAS DOCKET NOS. 8A-0246698 AND 8A-0246699

THE APPLICATIONS OF OCCIDENTAL PERMIAN LTD. TO INJECT FLUIDS CONTAINING HYDROGEN SULFIDE GAS INTO A RESERVOIR PRODUCTIVE OF OIL OR GAS, WEST RKM UNIT, SLAUGHTER FIELD, HOCKLEY COUNTY, TEXAS

HEARD BY: Donna K. Chandler, Technical Examiner
Mark J. Helmueller, Hearings Examiner

APPEARANCES:

APPLICANT:

John Soule
Edward Knight
Trent Adcock
Robert Romero

REPRESENTING:

Occidental Permian Ltd.

PROTESTANT:

Bob Grable
Wayman Gore
Mark Deer

Bass Enterprises Production Co.

PROCEDURAL HISTORY

Applications Filed:	January 25, 2006
Protest Received:	February 24, 2006
Notice of Hearing:	April 13, 2006
Date of Hearing:	May 24 and June 16, 2006
Transcript Received:	June 27, 2006
Proposal For Decision Issued:	August 28, 2006

EXAMINERS' REPORT AND PROPOSAL FOR DECISION

STATEMENT OF THE CASE

Occidental Permian Ltd. ("Oxy") requests authority pursuant to Statewide Rules 36 and 46 to inject fluids containing hydrogen sulfide (H₂S) and carbon dioxide (CO₂) into 33

existing water injection wells on its West RKM Unit in the Slaughter Field. This authority is sought as part of Oxy's proposal to conduct a miscible CO₂ flood on a portion of the subject unit.

These applications are protested by Bass Enterprises Production Co. ("Bass"). Bass has several leases offsetting the West RKM Unit and believes that Oxy's proposed injection may result in breakthrough of gas containing both CO₂ and H₂S in offsetting Bass operated wells. Bass seeks assurances that Oxy will be responsible for producing problems that may occur to Bass wells if breakthrough occurs and Bass is forced to contend with higher volumes and pressures in its wells.

DISCUSSION OF THE EVIDENCE

APPLICANT'S EVIDENCE

The West RKM Unit covers several thousand acres and was formed in 1965, with waterflood operations beginning in 1966. Currently, there are 137 producing wells and 122 water injection wells on the Unit. Current production from wells on the entire Unit is 1,800 BOPD and about 31,000 BWPD. Water injection on the Unit is approximately 39,000 BWPD. The area which is the subject of these applications (Phase 1) is the southernmost area of the Unit and covers 1,045 acres. Production from this project area is about 350 BOPD. The producing interval is the San Andres between 4,600 and 5,200 feet. The native gas in the Slaughter Field contains approximately 4% H₂S and 10% CO₂.

There are numerous CO₂ injection projects in the immediate area, in both the Slaughter Field and the Levelland Field. These two fields produce from the same correlative San Andres interval and have grown together with development. The nearest CO₂ flood is the East Mallet Unit operated by Apache to the southwest of the West RKM Unit. CO₂ miscible floods are known to be successful in recovering additional oil from the San Andres in this area. Typically, CO₂ floods result in incremental recovery of 12-16% of original oil in place in Slaughter and Levelland Fields.

For the proposed Phase I project area on the West RKM Unit, Oxy estimates that the proposed CO₂ flood will result in the recovery of approximately 5.1 million barrels of incremental oil, or about 13.3% of original oil in place. Oxy expects response in oil production after less than one year of injection of CO₂, with peak production expected to be about 1,200 BOPD from 48 producing wells.

Currently, gas from the West RKM Unit is sent to the Slaughter gas plant for processing. After initiation of the proposed CO₂ flood, the gas from the project area within the Unit will be sent to the Mallet CO₂ recovery plant to extract the CO₂ for re-injection. Once the project is underway, it is expected that the produced gas from the project area will be only 0.92% H₂S, because the produced gas will be diluted by the injected CO₂. The maximum H₂S concentration of gas to be injected on the West RKM Unit is estimated to be 0.61%, a result of further dilution by CO₂ in the line delivering gas to the Unit.

Due to the H₂S content of the native gas in the Slaughter Field, there are existing sour gas production operations on the West RKM Unit (and on Bass properties) and contingency plans are already in place for those operations. Oxy has submitted Form H-9 for the proposed injection project, including distribution lines, and it has been approved by the Commission's District Office. The maximum escape volume is 32,500 MCFD. The 100 ppm Radius of Exposure (ROE) is 2,760 feet and the 500 ppm ROE is 1,261 feet. The 500 ppm ROE includes public roads and residences. Information explaining the characteristics of CO₂ and H₂S will be delivered to the residents within the radii of exposure. Residents will be given specific instructions about procedures to follow in the event of an emergency. A separate H-9 and contingency plan will be submitted for the gathering line which ties the unit wells to the existing line which carries the gas to the Mallet recovery plant.

The proposed sour gas injection operations on the Unit meet all safety requirements of Rule 36. There will be automated emergency shut-down valves installed on the CO₂ distribution line and injection laterals which will close whenever the pressure drops to a preset value. Manually operated block valves will be installed to isolate multi-well laterals from the main trunklines and to isolate each injection well. The injection system is designed for a maximum allowable operating pressure of 2,850 psi, while normal operating pressure will be 2,000 to 2,400 psi. All tubular and metal components that come in contact with H₂S meet NACE standards.

The 33 wells proposed for conversion to CO₂ injection meet all requirements of Rule 46 and would have been administratively approved by the Commission except for the protest by Bass. Oxy contends that the Bass protest is not based on any threat to useable quality water resources, but instead is premised on the negative economic impact to its operations which it contends would result be conversion of water injection wells to CO₂ injection.

Bass' acreage offsetting the West RKM Unit to the south is also adjacent to three existing CO₂ floods, one operated by Chevron, one operated by Apache, and one operated by Oxy. Data from 16 collection points on the Bass acreage indicated CO₂ content of produced gas to be generally from 10-13%, which is representative of native CO₂. However, two collection points indicate CO₂ content significantly higher. In March 2006, the CO₂ content of gas collected from the R.L. Slaughter Tr. 47 was 67.1% and gas collected from the R. L. Slaughter Tr. 27 was 71.1%. These two leases directly offset Apache's East Mallet CO₂ flood.

To keep the injected CO₂ within its proposed project area, Oxy plans to implement several measures. First, Oxy will maintain a water "blanket" around the CO₂ injection area by continuing water injection into the first row of injection wells nearest to Bass lease lines. Oxy will also limit injection pressure to 2,700 psi for 15 proposed CO₂ injection wells within ½ mile of Bass operated acreage. (See attachment 1). Similar procedures have been implemented on Oxy's Slaughter Estate Unit CO₂ flood for many years. These procedures have been effective in preventing CO₂ migration to offsetting acreage on Oxy's Sundown Unit to the north of the Slaughter Estate Unit and to Bass leases also adjacent to that Unit. Oxy contends that similar procedures are not in place on the Apache East Mallet Unit

where CO₂ injection has apparently resulted in increased CO₂ content in the adjacent Bass leases. Further, it is in Oxy's economic interest to prevent the migration of CO₂ off the West RKM Unit.

Notice of the subject Rule 46 applications were published in *The Lubbock Avalanche-Journal*, a newspaper of general circulation in Hockley County, on October 13, 2005. Copies of the applications were mailed to the Hockley County Clerk's Office, the Sundown City Clerk's office, the surface owners, and affected offsetting operators on January 25, 2006. The one surface owner, Mike Richardson, who was not mailed notice, signed a waiver of objection to the application.

PROTESTANTS' EVIDENCE

Bass does not contest that injection of CO₂ on the West RKM Unit will result in the recovery of additional oil. Bass' concern is that the proposed project will result in breakthrough of injected CO₂ to Bass operated leases, causing operational and safety issues on Bass properties. (See Attachment 2).

Regarding the CO₂ breakthrough which occurred on two Bass leases adjacent to Apache's East Mallet Unit, Bass points out that gas production on its leases under waterflood is minimal, with ratios averaging about 100 cubic feet per barrel of oil. As discussed previously, in the late 1990's, wells on the two R. L. Slaughter Jr. leases adjacent to the East Mallet Unit began to have increasing CO₂ content, from native 10% to 30-40% by 2000. Until about 2000, gas production remained low from the Bass leases. For the R. L. Slaughter Jr. "C" lease, gas production was less than 100 MCFD. By 2001, gas production was about 300 MCFD from the "C" lease. In July-August 2005, the gas volumes from the "C" lease were too high for Bass' system (up to 700-800 MCFD) and Bass was forced to vent some gas from its wells. Apache agreed to change injection into the No. 141 well on the East Mallet Unit from CO₂ to water-alternating CO₂. Gas production on the R. L. Slaughter, Jr. "C" immediately decreased. Bass' R. L. Slaughter Jr. Tr 47 lease experienced very similar increases in CO₂ content and gas volumes. Production data from both Bass leases indicate corresponding decreases in gas volumes and CO₂ content at times when Apache converted CO₂ injection to water injection.

In addition, in February 2006, the CO₂ content of the gas produced from the two Bass - R. L. Slaughter, Jr. leases was so high that the Slaughter Gas Plant would no longer accept the gas because it was contaminating the amine system at the plant. After a short shut-in of the "C" lease, the plant limited production from the lease to 300 MCFD. Bass continues to work with Apache in converting injection wells when a spike in gas volume/CO₂ content occurs the two Bass R. L. Slaughter Jr., leases.

Bass wells on leases immediately adjacent to the proposed injection by Oxy are all producing gas with CO₂ content indicating native gas. Bass is requesting assurances from Oxy that if CO₂ content and gas volumes increase on its leases due to breakthrough from

the West RKM Unit CO₂ injection, Oxy will take all the actions necessary to prevent any loss to Bass, including building facilities to handle the additional gas and treat it such that it will be acceptable to the plant. With these assurances, Bass would not object to the proposed CO₂ injection project of Oxy.

Assuming that oil production from the first row of producing wells (19 wells) on Bass properties adjacent to the West RKM Unit project would be lost due to CO₂ breakthrough, and another 13 wells on the leases would also have reduced oil production, Bass estimates that up to 1.2 million BO on its leases could potentially be lost. This estimate is based on the events on its two R. L. Slaughter Jr. leases offsetting the East Mallet Unit. Oil production in some of those wells essentially ceased for a period of time when CO₂ breakthrough occurred.

Additionally, should CO₂ breakthrough occur to Bass operated leases, numerous operational and safety issues would arise. The current gathering system is 10-15 psi and delivers to the Slaughter plant. A new higher pressure system would be required to handle the increased volumes of gas, with delivery to the Mallet Central Recovery Plant to handle the CO₂ content. Dewatering and compression would be required. Also, Bass' contingency plans are based on the low pressure system currently on its leases. There is no contingency plan in effect for Bass' leases which would take into account higher volumes of H₂S.

Bass requests the following language be included in any Order approving Oxy's application:

If breakthrough of CO₂ contaminated gas occurs in a Bass operated well directly offset by the West RKM Unit, upon notice by Bass to Oxy and the Commission, Oxy will immediately suspend further injection of CO₂ in the two injection wells nearest the Bass operated well experiencing breakthrough; provided Oxy shall have the right to request a prompt hearing to contest either that breakthrough has occurred or that injection by Oxy has caused the breakthrough.

EXAMINERS' OPINION

The examiners recommend that the applications for authority pursuant to Rules 36 and 46 be approved. The proposed project will result in the recovery of an additional 5.1 million BO. The subject 33 wells are already permitted for water injection and there is no evidence that the proposed addition of CO₂ and H₂S to the injection fluid will cause harm to useable quality water resources. The Form H-9 and contingency plan for the project has already been approved by the Commission's District Office and the requirements of Rule 36 pertaining to injection fluids containing hydrogen sulfide have been met.

Bass' protest is based on concern that it's adjoining leases to the West RKM Unit will be adversely affected if CO₂ breakthrough occurs. The examiners believe that procedures proposed by Oxy are sufficient to prevent breakthrough similar to that which occurred on Bass' R. L. Slaughter, Jr. leases as a result of CO₂ injection on the offsetting Apache East Mallet Unit. Bass' leases were not protected by a line of water injection wells

as is proposed by Oxy in this application. Oxy submitted evidence that the water “blanket” has been successful in preventing migration of injected CO₂ from its Slaughter Estate Unit, which has been ongoing for more than 20 years. Bass also has properties offsetting the Slaughter Estate Unit and their adjacent wells have not experienced breakthrough.

Additionally, Oxy pointed out that it is an economic benefit to them to contain the injected CO₂ on the Unit because it will be recycled. Because Oxy will have to purchase CO₂ for this project, re-use of the CO₂ is cost-effective.

FINDINGS OF FACT

1. Notice of these applications and hearing was provided to all persons entitled to notice at least ten (10) days prior to the date of the hearing.
2. Notice of these applications was published in the *Lubbock Avalanche-Journal*, a newspaper of general circulation in Hockley County, on October 13, 2005.
3. The subject 33 wells on the West RKM Unit are currently permitted for water injection in conjunction with the waterflood project currently ongoing on the Unit.
4. The proposed injection operations into the subject 33 wells will not endanger useable quality water and injected fluids will be confined to the San Andres between 4,600 and 5,200 feet.
5. The proposed CO₂ injection is necessary to conduct a miscible CO₂ flood on the West RKM Unit and will result in the recovery of an additional 5.1 million BO.
6. Oxy's proposed procedures will prevent migration of CO₂ onto offsetting acreage.
 - a. Water injection will be continued on the first row of injection wells nearest to the boundaries of the West RKM Unit.
 - b. Injection pressures for all CO₂ injection wells within ½ mile of the West RKM Unit boundaries will be limited to 2,700 psi.
 - c. The proposed procedures have been successfully employed on Oxy's Slaughter Estate Unit to the east of the West RKM Unit.
7. The 500 part per million (ppm) radius of exposure (ROE) for the project is 1,261 feet and the 100 ppm ROE is 2,760 feet. The radii of exposure are calculated based on worst case scenarios with maximum escape volumes and hydrogen sulfide concentrations.

8. The proposed injection meets the safety requirements of Rule 36 regarding warning and marker provisions, security provisions and materials and equipment.
9. The Contingency Plan for the injection project has been approved by the Commission's District Office.

CONCLUSIONS OF LAW

1. Proper notice was issued in accordance with the applicable statutory and regulatory requirements.
2. All things have occurred to give the Railroad Commission jurisdiction to consider these matters.
3. Oxy has complied with the safety provisions of Statewide Rule 36 for injection of fluid containing hydrogen sulfide for the 33 wells on its West RKM Unit in the Slaughter Field.
4. Approval of the applications will prevent waste of hydrocarbons that otherwise would remain unrecovered.
5. Approval of the applications will not harm usable quality water resources and will not present a hazard to other mineral bearing formations.
6. Oxy has met its burden of proof and satisfied the requirements of Chapter 27 of the Texas Water Code and the Railroad Commission's Statewide Rule 46.

EXAMINERS' RECOMMENDATION

Based on the above findings and conclusions, the examiners recommend that the applications be approved as set out in the attached Final Order.

Respectfully submitted,

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Technical Examiner

Mark J. Helmueller
Hearings Examiner