

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
SUPERVISOR OF WELLS

THE PETITION OF CORE ENERGY, LLC FOR AN ORDER)
FROM THE SUPERVISOR OF WELLS APPROVING A)
PLAN OF UNITIZATION FOR PRESSURE MAINTENANCE)
AND ENHANCED AND/OR SECONDARY RECOVERY OF) ORDER NO. 09-2013
OIL, GAS, AND RELATED HYDROCARBONS, AND)
ABROGATING EXISTING SPACING AND PRORATION)
ORDERS AND RULES IN PARTS OF CHESTER)
TOWNSHIP, OTSEGO COUNTY, MICHIGAN.)

OPINION AND ORDER

This case involves the Petition of Core Energy, LLC (Petitioner), requesting (i) approval of a unitized operation of the Chester 16 Pool (proposed Unit Area), pursuant to Part 617, Unitization, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); (ii) approval of a secondary recovery operation pursuant to Section 61506(i), Part 615, Supervisor of Wells, of the NREPA and R 324.612; and (iii) abrogation of Order No. (A) 16-6-83 establishing the Chester 16 Unit, and abrogation of the Chester 16 Unit Plan of Unitization dated April 1, 1983, and recorded at Liber 330, Page 210, Otsego County Register of Deeds; and (iv) approval to operate the proposed Unit Area as an exception to Special Order 1-73, the applicable spacing provisions of Part 615 of the NREPA, and its administrative rules. The proposed Unit Area consists of approximately 320 acres, and is described as the SE 1/4 and SE 1/4 of SW 1/4 of Section 16; and NE 1/4 of NW 1/4 and N 1/2 of NE 1/4 of Section 21, T30N, R2W, Chester Township, Otsego County, Michigan. The Petitioner refers to the proposed project as the "Chester 16 EOR Unit," as distinguished from the "Chester 16 Unit" established by Order No. (A) 16-6-83.

JURISDICTION

The development of oil and gas in this state is regulated under Part 615, Supervisor of Wells; and Part 617, Unitization; of the NREPA, MCL 324.61501, *et seq.* and MCL 324.61701, *et seq.*, respectively. Part 615 authorizes the Supervisor of Wells (Supervisor) to regulate secondary recovery methods for oil and gas, including the

introduction of substances into producing formations for purposes of enhancing production. MCL 324.61506(i). A person proposing secondary recovery by injection of a fluid into a producing formation must file a petition for a public evidentiary hearing. 1996 MR 9, R 324.612. Such secondary recovery projects require establishment of a Unit Area and a Plan of Unitization. If all owners of oil and gas interests in a proposed Unit Area have not ratified the proposed Plan of Unitization, then the person proposing the project may petition the Supervisor for an order providing for the unitized operation of a Unit Area pursuant to Part 617. MCL 324.61703. Evidentiary hearings on these subjects are governed by the applicable provisions of the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201, *et seq.* See 1996 MR 9, R 324.1203. An evidentiary hearing in this matter was held on August 22 and 23, September 27, October 14, and 28, November 20 and 21, 2013.

PROCEDURAL HISTORY

The Petitioner's Verified Petition was filed on June 25, 2013, pursuant to MCL 324.61703 and 324.1202. A Protest in Opposition to Core's Verified Petition was filed by Respondents MP Michigan, LLC, MEP III Michigan, LLC, and MEP D-III Michigan, LLC (Merit) on July 24, 2013, and Merit filed an Answer on August 16, 2013, in opposition to the Verified Petition. An Appearance and Answer to Verified Petition was filed by Williams Minerals, LLC; Gottlob Investments, LLC; Dana Gottlob; and Miles and Colleen Gottlob (Williams) on August 15, 2013, in support of the Verified Petition.

Merit's July 24, 2013 Protest also included a Request for a Prehearing Conference and a Request for Adjournment. The Petitioner filed an Answer in Opposition to Request to Adjourn on July 29, 2013. Respondent's request to convert the hearing date of August 22, 2013, to a prehearing conference was denied by the Supervisor's August 7, 2013, Order on Request for Prehearing Conference. That Order also directed both parties to serve all proposed hearing exhibits on each other by August 19, 2013. Merit declined to exchange some exhibits, but offered the parties a limited opportunity to view them.

On August 21, 2013, the Petitioner filed a Motion in Limine to Exclude Merit Exhibits 15-33, requesting the Supervisor exclude from the hearing all of Merit's exhibits that were not served on the Petitioner. Note that during the hearing Merit introduced an Exhibit R-15, which was made part of the record. The Supervisor's August 22, 2013, Order on Motion in Limine to Exclude Merit's Exhibits No. 15-33 granted the Petitioner's request to exclude Merit's exhibits 15-33.

On October 27, 2013, Merit filed a Motion to Seal Portions of the Record Containing Confidential Seismic Data. Both Core and Williams filed responses on November 7, 2013, only partially stipulating to Merit's request. Merit filed a Supplement and Amendment to Motion to Seal Portions of the Record Containing Confidential Seismic Data on February 3, 2014, and Core and Williams filed responses on February 14, 2014, again stipulating to only part of Merit's request. An Order on Motion to Seal Portions of the Record was issued March 11, 2014, effective March 21, 2014, sealing Core's exhibits 25, 26, 27, 28, 30, 39 (page 2 only), 46, and 46a; and Merit's exhibit 15 from the hearing record.

The Administrative Law Judge determined the Notice of Hearing was properly served and published. The Supervisor designated the hearing to be an evidentiary hearing pursuant to R 324.1205(1)(b) and directed substantive evidence be presented in the form of oral testimony.

FINDINGS OF FACT

The Petitioner specifically requests that the Supervisor issue an Order allowing the Petitioner to inject carbon dioxide and other approved substances into the Guelph Dolomite/Ruff Formation, the productive zone, for purposes of secondary recovery and/or pressure maintenance and exempt the proposed Unit Area from the applicable spacing and proration rules and orders, and from Order No. (A) 16-6-83. The Petitioner requests that all owners within the Unit Area be made subject to the Plan of Unitization.

In support of its case, the Petitioner offered the testimony of the following witnesses: Robert G. Mannes, President; Kim Sanders, Land Manager; Allen Modroo, Geophysicist and Explorationist; Rick Pardini, Petroleum Engineer; Wayne Goodman,

Petroleum Geologist; Timothy J. Brock, Reservoir Engineer; and John C. Clark, Geophysicist. Mr. Modroo, Mr. Pardini, Mr. Goodman, Mr. Brock, and Mr. Clark were accepted as experts in their respective fields.

In support of its opposition, Merit offered the testimony of Jason Manning, Petroleum Engineer; Bradley Bauer, Petroleum and Reservoir Engineer; and Chris Dennen, Geologist. Mr. Manning, Mr. Bauer, and Mr. Dennen were accepted as experts in their respective fields.

I. Unitization

Mr. Mannes testified the proposed Unit Area consists of eight 40-acre tracts (Exhibit 1). The proposed Unit Area is near Petitioner's seven previously approved carbon dioxide (CO₂) enhanced oil recovery units (EOR) (Exhibit 2). Five wells were drilled in the Chester 16 Field in the early 1970s, two by Shell Oil Company and three by Miller Brothers. The Chester 16 Field was converted to waterflood operations in 1983 by Supervisor of Wells Order No. (A) 16-6-83. Waterflood operations ceased in mid-1990, and the last two wells in the Chester 16 Field were plugged and abandoned in July 1993 (Exhibits 3, 12). Antrim operations began in January 1993, with the Chester 22 Antrim Unit and Antrim production continues to date. No Guelph Dolomite/Ruff Formation operations have been conducted in the Chester 16 Field since the waterflood was discontinued in the 1990s.

Mr. Mannes testified the South Chester 10 CO₂ removal facility is the source of CO₂ for the proposed Chester 16 EOR Unit, together with CO₂ already in Core's existing seven CO₂ EOR projects, which is transported by Core's Whitefrost CO₂ Pipeline. The Whitefrost CO₂ Pipeline has the capacity to transport approximately 25 million cubic feet per day (MMCFD) of CO₂ and is currently transporting about 10.5 MMCFD of CO₂. The South Chester removal facility in Section 10 is the source of all of the CO₂ for Core's seven existing EOR projects (Exhibit 2).

Mr. Sanders testified all oil and gas interests in the Guelph Dolomite/Ruff Formation in the proposed Unit Area are subject to leases held either by Core, Merit, or Ward Lake Energy. Core holds all of the leases in tracts 1 through 5 (except Ward Lakes' 3.9 acres) and Merit owns the leases in tracts 6, 7, and 8. The Petitioner's Plan

of Unitization (Exhibit 7) constitutes a plan of unit operations containing all of the required terms and conditions as set forth in subsections 61705(a)-(j) of Part 617 of the NREPA, and expressly provides for the unitized operation of the proposed Unit Area for purposes of secondary recovery and pressure maintenance operations. Mr. Sanders testified Core has obtained sufficient ratifications to meet the thresholds set in MCL 324.61706(a) and (b). As of the date of Mr. Sanders' testimony, all owners in the Unit Area have ratified the Plan of Unitization except Robert Lewis, Amelia Proctor, Stephen Nelson, Ward Lake, and Merit (Exhibit 11).

I find that Petitioner is qualified to be named Unit Operator and has obtained sufficient approval to support entry of a final order approving the Plan of Unitization and approving unit operations pursuant to Part 617 of the NREPA.

II. Unit Area, Unitized Formation

The proposed Unit Area consists of eight 40-acre tracts (320 acres). Core conducted a three dimensional (3D) seismic survey for field development purposes over the Chester 16 reef in mid-2011 (Exhibit 27). Based on the 3D seismic survey and well control, Mr. Modroo prepared Exhibit 29, a structure map of the reservoir on the top of the Guelph or A-1 Carbonate cap above the oil/water contact. This map shows the location of contours of reef anomaly. It does not show the seismic limits of the reef anomaly below the oil/water contact. Mr. Modroo's Exhibit 29 was used by Core to design its CO2 EOR project and was used to compute the tract factors attributed to each 40-acre tract. Mr. Clark supported the reliability of Mr. Modroo's assessment of the reef by comparing Core's 3D seismic exhibits to exhibits from the 1983 two dimensional (2D) Shell waterflood hearing.

Mr. Dennen conducted an independent review of all available well data, Core's 3D seismic, and 2D seismic from the Shell waterflood hearing (Exhibit R-4), and concluded the structure map used by Shell in its 1983 petition continues to provide an accurate depiction of the Chester 16 reservoir. Mr. Dennen testified the well data reveals a substantial "belly" or depression beneath the Niagaran reef in the Veraghen 4-21 well. Because bellies are typically only found beneath the thickest portions of the reef, he believes the presence of a belly evident in the Veraghen 4-21 well data is

substantial evidence that it is a crestal rather than a flank well. It is Mr. Dennen's opinion that 3D seismic data cannot be used to precisely identify flanks and crests. It is his opinion that Core erred by depicting the Veraghen 4-21 well as a flank well and that error contributed substantially to the alleged diminution of Merit's tract participation percentages.

The Petitioner plans to conduct unitized operations within a Unitized Formation described as the stratigraphic equivalent of all formations between the top of the A-1 Carbonate (Ruff) Formation and the base of the Lockport (Gray Niagaran) Formation or the stratigraphic equivalent encountered in the Shell Western Veraghen-Rypkowski 5-21 well (Permit Number 28743) located in the NE 1/4 of NW 1/4 of Section 21, T30N, R2W, Chester Township, Otsego County, Michigan.

I find the Unitized Formation as proposed by the Petitioner is reasonable and appropriate. I find the Petitioner's characterization of the outline and contours of the reservoir to be more compelling. Therefore, I find the boundaries of the proposed Unit Area as proposed by the Petitioner are appropriate. Review of the evidence submitted indicates portions of the reservoir underlie each tract within the proposed Unit Area and all productive portions of the reservoir are within the proposed Unit Area.

III. Secondary Recovery

Proposed CO₂ EOR Operations

Mr. Pardini testified that five wells have been drilled into the Chester 16 Field, all of which have been plugged and abandoned. Total primary recovery and waterflood secondary recovery has been 2,370 thousand barrels of oil (MBO) and 2,555 million cubic feet (MMCF) of natural gas (Exhibit 12). The Petitioner calculated original oil in place to be 6,855 MBO (Exhibit 16) and believes significantly more oil will be recovered as a result of CO₂ injection based on the positive results of carbon dioxide injection in nearby CO₂ EOR Units, and a review of known data from the field. The Petitioner proposes to inject CO₂ into the reservoir by means of a new horizontal drainhole (HD) injector located high in the reef, and two high angle producer wellbores both traversing the entire unitized formation (Exhibits 18 and 19a). To reach initial fill-up (i.e. minimum miscibility pressure) the Petitioner expects to inject approximately 5.5 billion cubic feet

of CO₂ during a period of approximately 39 months (Exhibit 5). Mr. Pardini estimated that CO₂ injection in the Chester 16 Field would result in incremental oil recovery of approximately 711 MBO, or another 10.4 percent of original oil in place (Exhibit 16). Mr. Brock agreed with the estimated recovery as being consistent with known production from the mature Dover 33, Dover 35, and Dover 36 CO₂ EOR projects (Exhibit 45).

Mr. Pardini indicated no natural gas will be produced for sale from the unitized operations. All gas recovered in the production operation will be compressed for reinjection with CO₂ (Exhibit 17). Oil production from the Chester 16 Field will be handled at a new Central Production Facility (Exhibit 17).

Based on the Petitioner's analysis, there is evidence of significant amounts of oil remaining in the reservoir. I find the testimony indicates the proposed Unit Area contains accumulation of hydrocarbons that would not be recovered by further primary production of the wells in the field, but may be recovered by CO₂ pressure maintenance and secondary recovery operations conducted as a part of the unitized operation. I find the unitization requested is reasonably necessary to substantially increase the ultimate recovery of oil and gas from the unit area as required by MCL 324.61704(4)(a).

Feasibility, Prevention of Waste and Correlative Rights

Merit contested the feasibility of Core's proposed CO₂ EOR operations, expressing concerns over the difficulties of drilling HD and high angle wells in an under-pressured reservoir, and that CO₂ will prematurely break through and impair oil recoveries because the Shell waterflood experienced premature breakthrough. Merit characterized the Shell waterflood, authorized by Order (A) 16-6-83, as a failed waterflood, and testified it is too risky to initiate a CO₂ EOR project after a failed waterflood. Core's witnesses testified that Core's proposed pattern of injector and producers is entirely different from Shell's waterflood pattern. Shell's waterflood was designed to be a horizontal waterflood, whereas Core's plan is for a vertical displacement of oil by CO₂ injected high in the reef (Exhibit 18). In addition, Core plans

to case and perforate both the injector and producers, allowing a level of control if early breakthrough should occur at a particular perforation.

Core's witnesses testified the Chester 16 CO₂ EOR project will recover approximately 711 MBO. Any oil recovered must be considered incremental oil, since the field has no existing production and has not produced any oil since mid-1990 (Exhibit 12).

Merit witnesses testified a CO₂ flood will render future recovery of oil economically and technically infeasible and implementation of the proposed Chester 16 CO₂ EOR project will likely result in waste. Mr. Bauer testified a vertical well is more likely than a CO₂ flood to increase ultimate recovery of oil from the Chester 16 Field.

Mr. Pardini testified Core's tract factors, as set forth in Exhibit A of the Plan of Unitization (Exhibit 7) were based on hydrocarbon pore volume (HCPV) with a 10 percent positive adjustment for cumulative oil production and a 10 percent negative adjustment for cumulative water injection (Exhibit 19). Due to the heterogeneity of the reservoir, Mr. Pardini and Mr. Brock averaged all porosity shown in the five well logs, on six inch layers, across the entire Unitized Formation as shown on Exhibits 13 and 29. A 10 percent positive adjustment was used to recognize the historical superior producing capabilities of several of the wells, and a 10 percent negative adjustment was used to recognize the fact that regardless of its primary oil producing capability, the current value of a tract "for oil and gas purposes" was negatively affected by the introduction of large volumes of injected water. This tract factor allocation method resulted in Merit receiving a cumulative 17.18 percent tract factor in the unit based on its working interest in Unit Area tracts 6, 7, and 8.

Merit asserted it was entitled to a larger tract factor. Only Merit's Working Interest is involved in the objection, as all of Merit's royalty owners have ratified the Plan of Unitization. Mr. Dennen testified Merit is entitled to a 44.41 percent tract factor based on his interpretation of the areal extent of the reef, which placed significantly more of the reservoir on Tracts 6, 7, and 8. Mr. Dennen and Mr. Bauer disagreed with Core's averaging the porosity as to each six inch interval in the Unitized Formation, arguing that averaging the reservoir characteristics of the five well data points in the

field is arbitrary. Merit also advocated a porosity cut off of 3 percent for CO2 EOR operations in contrast to Core's having averaged all porosity shown in the well logs.

I find Core's plan for CO2 EOR drilling and completing wells, and its plan for operating the project, are feasible, will prevent waste, and protect correlative rights as required by MCL 324.61704(4)(b). Various methodologies can be used to determine tract factors. Part 617 only provides that the allocation be fair, reasonable, and equitable. I find the Petitioner's allocation of production to the separately owned tracts is fair, reasonable, and equitable as required by Section 61705 of Part 617 of the NREPA.

Economics

Mr. Mannes testified the Chester 16 EOR project is estimated to have a profit after taxes of \$14 million (Exhibit 5). Merit asserted Core's estimate of expenses was too low, and Core's estimate of 711 MBO recovery is too high (Exhibits R 14F, 14T, 14V, 14W, 14X, 14 Y). However, the preponderance of evidence shows the project will meet the Section 61704(4)(c) requirement that the additional cost of the project will not exceed the value of oil recovered.

An expense to the unit, in determining the economic viability of the project, is the expense of acquiring CO2 for injection. The Petitioner presented evidence that it plans to follow the method of valuation of CO2 used in western states (Exhibit 6), as a fair and reasonable method for determining the appropriate expense for CO2. Merit witnesses questioned the fairness of Core's method, given that Core is the provider of the CO2.

I find the estimated additional cost of unitized operations will not exceed the value of the additional oil recovered, and therefore, Section 61704(4)(c) of Part 617 has been met. I further find the expense to be charged to the lessees for the unit expenses of acquiring CO2 to inject, as portrayed in Exhibit 6, is reasonable.

I find abrogation of the existing Order (A) 16-6-83, as well as an exception to Special Order No. 1-73 spacing, well location and proration requirements, is necessary to implement the Plan of Unitization and proceed with unitized operations, except no

well shall be completed in the Unitized Formation at a location closer than 330 feet from the outside boundary of the proposed Unit Area.

I find the competent, material, and substantial evidence on the record as a whole, in this case, clearly supports the request of Petitioner and satisfies the Part 617 prerequisites.

CONCLUSIONS OF LAW

Based on the findings of fact, I conclude, as a matter of law:

1. The applicable spacing, well location, and proration requirements for the proposed Unit Area were established by Special Order No. 1-73 and Supervisor's Order No. (A) 16-6-83.

2. The Supervisor shall issue an order providing for the unit operation of a Unit Area if he or she finds all of the following:

(a) That the unitization requested is reasonably necessary to substantially increase the ultimate recovery of oil and gas from the Unit Area;

(b) That the type of operations contemplated by the plan are feasible, will prevent waste, and will protect correlative rights.

(c) That the estimated additional cost of conducting such operations will not exceed the value of the additional oil and gas so recovered. MCL 324.61704(4).

3. The Supervisor's Order may be declared effective if the Plan of Unitization has been approved in writing by one of the three ways specified in MCL 324.61706.

4. The Supervisor may regulate the secondary recovery methods of oil and gas, including pulling or creating a vacuum and the introduction of gas, air, water, and other substances into the producing formations. MCL 324.61506(i).

5. A person desiring to inject water, gas, or other fluids into a producing formation or use other technology for the purpose of increasing the ultimate recovery of hydrocarbons from a reservoir shall file a petition for hearing. 1996 MR 9, R 324.612(1).

6. The Supervisor has jurisdiction over the subject matter and the persons interested therein.

7. Due notice of the time, place, and purpose of the hearing was given as required by law, and all interested persons were afforded an opportunity to be heard. 1996 MR 9, R 324.1204; MCL 324.61704; MCL 324.61726; and MCL 324.61727.

DETERMINATION AND ORDER

Based on the Findings of Fact and Conclusions of Law, the Supervisor determines the proposed unitization for secondary recovery will prevent waste and maximize the recovery of hydrocarbons from the proposed Unit Area.

NOW, THEREFORE, IT IS ORDERED:

1. The Petition of Core Energy, LLC is granted, and the proposed Unit Area is created in accordance with, and subject to, this Order and the provisions of the Plan of Unitization, which is hereby incorporated by reference. The proposed Unit Area shall hereafter be known as the Chester 16 EOR Unit.

2. Order No. (A) 16-6-83 is abrogated.

3. Core Energy, LLC is appointed Unit Operator.

4. The geographic extent of Chester 16 EOR Unit is described as:

Section 16: SE 1/4 and SE 1/4 of SW 1/4;

Section 21: NE 1/4 of NW 1/4; N 1/2 of NE 1/4

T30N-R2W, Chester Twp, Otsego County, Michigan

5. The Unitized Formation is described as:

All formations lying between the top of the A-1 Carbonate (Ruff) Formation and the base of the Lockport (Gray Niagaran) Formation, or the stratigraphic equivalents encountered in the Shell Western Veraghen-Rypkowski 5-21 well (PN 28743) located in the NE 1/4 of NW 1/4 of Section 21, T30N, R2W, Chester Township, Otsego County, Michigan.

This represents the interval that is unitized for the Chester 16 EOR Unit.

6. Core Energy, LLC shall notify the Supervisor between 30 and 60 days prior to the commencement of injection operations, and between 30 and 60 days prior to the anticipated date of abandonment of injection operations.

7. Each tract within the Chester 16 EOR Unit shall participate in the unit production and other benefits and burdens of unit operations in accordance with the Plan of Unitization. Pursuant to MCL 324.61718, such person's share of income and cost shall be subject to the Allocation of Unitized Substances (Article 5) and Unit Expense (Article 17) of the Plan of Unitization.

8. Operation of the Chester 16 EOR Unit shall be conducted as an exception to Special Order No. 1-73, except no well may be completed in the Unitized Formation at a location closer than 330 feet from the outside boundaries of the Chester 16 EOR Unit. Core Energy, LLC is authorized to produce wells in the Chester 16 EOR Unit at rates that result in the maximum efficient recovery of hydrocarbons.

9. The unitized operations shall initially be accomplished by the injection of CO₂. During recycling, whatever native natural gas is left in the Unitized Formation that becomes intermixed with CO₂ may be cycled into and out of the Unitized Formation. Other substances may only be injected with written approval from the Supervisor.

10. The Plan of Unitization, which constitutes the plan for unit operations, is hereby approved; and unit operations thereunder may be commenced as of the effective date but subject to the Unit Operator determination of an effective date

consistent with Article 26 of the Plan of Unitization. Cessation of the unit operations shall be in accordance with the Plan of Unitization and only with the written approval of the Supervisor.

11. The Supervisor retains continuing jurisdiction over the Chester 16 EOR Unit in order that the Supervisor may exercise such administrative control as is consistent with the powers and duties of the Supervisor, as established by Part 615 and Part 617 of the NREPA.

12. The effective date of this Order is May 26, 2014.

Dated: May 16, 2014



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