

Blue Book

**Department of Environmental Quality
Office of Oil, Gas, and Minerals**

02 - Orders of the Supervisor

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

THE PETITION OF TRENDWELL OIL CORPORATION)
FOR EXCEPTIONS TO WELL LOCATION REQUIREMENTS)
OF RULE 201 (R 299.1201) FOR WELLS DRILLED)
IN THE ANTRIM FORMATION IN PORTIONS OF) ORDER NO. 10-12-87
CHARLTON TOWNSHIP, OTSEGO COUNTY, MICHIGAN,) Effective: January 25, 1988
AND THE PETITION OF SUPERVISOR OF WELLS TO)
CONSIDER A SPECIAL ORDER FOR LOCATION OF)
ANTRIM FORMATION GAS WELLS.)

OPINION AND ORDER

On December 15, 1987 a public hearing was held before the Supervisor of Wells and the Advisory Board. The hearing was conducted pursuant to 1939 PA 61, as amended, and the promulgated rules. The purpose of the hearing was to consider the petitions of Trendwell Oil Corporation and the Supervisor of Wells to consider well location exceptions and completion techniques for wells drilled for gas into the Antrim Formation.

FINDINGS OF FACT

1. The Petitioner, Trendwell Oil Corporation, is the operator of Antrim Formation gas wells in Otsego County. The Petitioner proposes that they be allowed to drill directional or horizontal drain holes in order to encounter as many fractures as possible in the Antrim Formation and that they be granted an exception to Rule 299.1201 in order to accomplish this. R 299.1201 requires drilling units consisting of a quarter-quarter section and that all wells be similarly located if they are completed in the same objective formation. The Antrim Formation, particularly in Otsego County, has produced gas for a number of years. The wells typically encounter low porosity and low permeability with production dependent on encountering natural fracture zones or the successful fracturing of the formation. The wells typically produce fairly low volumes of gas, less than 100 Mcf per day and substantial amounts of brine. The availability of alternative completion techniques has caused an increased interest in Antrim development. These completion techniques do not and cannot meet the requirements of the rigid pattern inherent in Rule 201. One of those techniques is to directionally drill with the well encountering as much of the productive area of the Antrim as can be reasonably done with directional drilling. A second technique is the drilling of a short radius lateral drain hole commonly referred to as a horizontal drain hole. Both of these techniques are believed to increase production so as to make the

Antrim much more attractive and may prevent waste. In order to utilize these techniques, the Petitioner has requested location exceptions and provision for a variety of completion techniques for Antrim Formation gas wells so long as the producing portion of the well bore is no closer than 330 feet from the unit boundary. They further asked that there be no limitation on the completion techniques including the potential to drill multiple drain holes from the same well.

2. Several operators testified as to their current operations developing Antrim Formation gas. They testified that these differing completion techniques would increase the recovery of the gas reserves present in the Antrim. The Antrim is relatively flat throughout the lower peninsula of Michigan and is believed to be productive throughout the State. The primary limitation on its development has been economic. The availability of alternative completion techniques allows the development of the reserves present in the Antrim Formation which otherwise might not be developed. The nature of the Antrim Formation is such that use of these techniques will not interfere with the correlative rights of adjoining property owners. Each operator will be free to use the same techniques in developing their own reserves. The flexibility in terms of well location also prevents surface waste; that is, the wells can be located so as to minimize the effect on surface values. I find that location exceptions and allowing various completion techniques and well bore locations anywhere on the unit, not closer than 330 feet from the unit boundary, are necessary to prevent waste and assure the orderly development of the Antrim Formation. I further find that these provisions should apply to the Antrim Formation north of Townline 20 North in the lower peninsula of Michigan for those wells subject to the General rules and specific spacing orders.

CONCLUSIONS OF LAW

1939 PA 61, as amended, provides in Section 6 that the Supervisor shall prevent waste and to that end is empowered to fix spacing of wells. 1939 PA 61, as amended, provides at Section 13 that the Supervisor may provide for well locations in the approximate center of the drilling unit or at such other locations thereon as are necessary to conform to a uniform well spacing pattern as adopted after notice and hearing.

DETERMINATION AND ORDER

Based on the evidence and in accordance with the recommendation of the Advisory Board, it is the opinion of the Supervisor that location exceptions and various completion techniques are necessary to prevent waste and assure the orderly development of the Antrim Formation.

Now, therefore, it is Ordered:

(1) For purposes of this order the Antrim Formation is defined to include those rocks commonly referred to as "light Antrim" and "dark Antrim".

(2) A well location exception to the applicable general rules and Antrim spacing orders is granted for the Antrim Formation in the lower peninsula of Michigan north of Townline 20 North.

(3) Wells in the Antrim Formation shall be completed by any appropriate technique provided that the producing well bore or short radius lateral drain, at any point in the Antrim Formation, is no closer than 330 feet from a unit boundary.

(4) Appropriate techniques for developing the Antrim Formation gas production are as follows:

- a. Drill a standard vertical test well.
- b. Drill a test well by conventional directional drilling.
- c. Drill one or more short radius lateral drains within the productive interval in conjunction with a standard vertical well or a conventional directional well. The drilling of such drains shall not require an additional drilling permit. However, a well bore survey shall be filed that identifies, to the satisfaction of the Supervisor of Wells, the course and end point of the drains.

(5) This order shall apply to gas producing wells only.

(6) The operator shall file such additional reports as are required by the supervisor.

Dated:

1/25/88



R. THOMAS SEGALL
ASSISTANT SUPERVISOR OF WELLS

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

THE PETITION OF TRENDWELL OIL CORPORATION FOR)
AN ORDER OF THE SUPERVISOR OF WELLS GRANTING)
EXCEPTIONS TO THE WELL LOCATION REQUIREMENTS)
OF R 299.201 FOR WELLS DRILLED IN THE ANTRIM)
FORMATION IN PORTIONS OF CHARLETON TOWNSHIP,) ORDER NO. (A) 10-12-87
OTSEGO COUNTY, MICHIGAN, AND THE PETITION OF)
THE SUPERVISOR OF WELLS TO CONSIDER A SPECIAL)
ORDER FOR LOCATION OF ANTRIM FORMATION GAS)
WELLS.)

FIRST AMENDED OPINION AND ORDER

Order No. (A) 10-12-87 was originally issued in 1988. On December 15, 1987, a contested case hearing was held before the Supervisor of Wells (Supervisor) and the Oil and Gas Advisory Board regarding the above-captioned matter. The hearing was held under the authority of the Supervisor of Wells Act, 1939 PA 61, as amended, MCL 319.1 et seq.; MSA 13.139(1) et seq., and the administrative rules, 1979 AC, R 299.1101 et seq.¹ The hearing was conducted in accordance with the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 et seq.; MSA 3.560 (101) et seq. The purpose of the hearing was to consider the petition of Trendwell Oil Corporation to consider well location exceptions and completion techniques for wells drilled for gas into the Antrim Shale Formation. The Supervisor enlarged the scope of the hearing to consider the need or desirability of adopting a special spacing order for the location and spacing of wells and completion techniques for the Antrim Shale Formation in the lower peninsula of Michigan north of Townline 20 North. Order No. (A) 10-12-87 was signed by Assistant Supervisor of Wells, R. Thomas Segall on January 25, 1988 and was given immediate effect.

¹ By signature of the Governor May 23, 1995, the Supervisor of Wells Act, 1939 PA 61, as amended, MCL 319.1 et seq.; became Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).

On April 23, 2002, a contested case hearing was held before the Supervisor of Wells (Supervisor) pursuant to Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); MCL 324.61501 et seq., the administrative rules, 1996 AACRS, 2001 MR 2, R 324.101 et seq., and the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 et seq.; MSA 3.560(101) et seq. The hearing was initiated by the Supervisor for the purpose of receiving testimony and evidence pertaining to the need or desirability of issuing an order amending this Order and Order No. (A) 14-9-94 to include the Sunbury Shale Formation. The Oil and Gas Advisory Committee was present at the Supervisor's request to give advice regarding this matter.

Timely answers to the Notice of Hearing on the April 23, 2002 hearing were filed by MCN Oil & Gas Company, Trendwell Energy Corporation, Ward Lake Energy, and Muskegon Development Company. Staff of the Geological Survey Division (GSD) of the Department of Environmental Quality (DEQ) presented evidence in support of amending this Order and Order No. (A) 14-9-94. MCN Oil & Gas Company, Trendwell Energy Corporation, and Ward Lake Energy participating as full parties through their attorney, Mr. Gary Worman, also presented evidence in support of the proposed amendments. Representatives of Muskegon Development Company and T-Rex Resources made statements in support of the proposed amendments. No parties appeared in opposition to the proposed amendments.

FINDINGS OF FACT

1. For the purposes of Order No. (A) 10-12-87, the Antrim Formation was defined to include those rocks commonly referred to as "light Antrim" and "dark Antrim".

2. At the April 23, 2002 hearing, GSD staff presented evidence in support of the proposed amendment through the testimony of Mr. Rick Henderson, Cadillac District Supervisor; Mr. D. Michael Bricker, Petroleum Geology and Production Unit Supervisor; and Mr. Thomas Wellman, Permit and Bonding Unit Supervisor.

a. Upon being sworn, Mr. Henderson testified:

(i) An Application for Change of Well Status was received from Dominion Energy in December 2001, stating the applicant intended to perforate the "upper Antrim" Formation. Upon review it was discovered the formations to be perforated were actually the

Sunbury Shale and the Bedford Shale, and the application was subsequently denied.

(ii) An investigation by Cadillac District Staff found over 50 Antrim Shale Formation wells have been completed in the Sunbury Shale or Berea Bedford. This number did not include wells originally completed in the Sunbury Shale or Berea Bedford zones.

(iii) Since December 2001, the Cadillac District Office has received approximately 20 applications to Change Well Status, in the Sunbury Shale or Berea Bedford zones.

(iv) Amending Order No. (A) 10-12-87 and Order No. (A) 14-9-94 to include the Sunbury Shale and Berea Bedford would allow wells already drilled to be completed in the Sunbury Shale or Berea Bedford, will prevent waste, and will cause no economic or environmental harm.

(v) In the 50 plus wells that have been completed in the Sunbury above the Antrim, there have not been any problems. The shales of the Sunbury and Berea Bedford are shallow and behave much the same way as does the Antrim Shale; therefore, there should not be any problems.

b. Upon being sworn, Mr. Bricker testified:

(i) The Stratigraphic Nomenclature for Michigan (Exhibit 4) shows the Sunbury Shale as a separate formation above the Antrim Shale Formation.

(ii) Exhibit 6 is an electric log showing the original completion of a well in the Sunbury Shale Formation. The electric log shows completions in the normal Antrim zones of the Lachine Member and Norwood Member but also the Sunbury Shale and the Upper Antrim Member. This electric log demonstrates that even on original completions, not recompletions, these wells are being completed in zones other than strictly the Antrim Shale.

(iii) The inclusion of the interval between the Sunbury Shale and the Antrim Shale should apply only to gas wells, because the drainage characteristics between oil and gas are considerably different.

c. Upon being sworn, Mr. Wellman testified:

(i) Except for existing Berea fields in the subject counties, wells completed above the Antrim Shale Formation are subject to the general spacing provisions of R 324.301. Berea fields are spaced either on 10 acre units or have specific spacing orders.

(ii) Approximately 200 wells were found to be perforated above the Antrim Shale Formation.

(iii) The majority of the 10 acre spaced Berea fields were oil fields.

3. Mr. Robert Butka, Certified Petroleum Geologist, testified the Sunbury Shale is an organic rich black shale similar to the black Antrim Shales and should be included in orders addressing the Antrim Shale Formation with the exception of the Berea Sandstone, which is distinct from the shale reservoirs. Excluding sandstone from the Order would prevent waste by allowing shale gas to be produced from existing Antrim gas well bores and not restrict potential Berea development.

4. Mr. John G. Wilkinson, Senior Engineer, Ward Lake Energy testified reserves of between 270 and 450 billion cubic feet (Bcf) of gas are available in the upper shale formations, including the Bedford Shale, Sunbury Shale and Upper Antrim Formations. He further stated it would not be economic to drill new wells to recover resources from the Sunbury Shale, Bedford Shale and Upper Antrim Formations.

5. Mr. Michael Mesbergen of Muskegon Development Company and Mr. Dan McGuire of T-Rex Resources made statements in support of including the Sunbury Shale Formation with the Antrim Shale Formation in amendments to this Order and Order No. (A) 14-9-94.

6. I find the Sunbury Shale, Ellsworth Shale, and Bedford Shale Formations are sufficiently similar in characteristics to the Antrim Shale Formation and should be included in this Order and Order No. (A) 14-9-94.

7. I find the rock interval subject to this Order and Order No. (A) 14-9-94 should be expanded to include the interval from the top of the Sunbury Shale Formation to the top of the Antrim Shale Formation and equivalent, excluding the Berea Sandstone Formation.

8. I find the Berea Sandstone Formation means a fine-grained sandstone, some siltstone and shale, about 50 feet thick ranging upward to 100 feet thick (15.2-30.5 meters) in eastern and central Michigan, as described in the Stratigraphic Lexicon for Michigan (Exhibit 7).

CONCLUSIONS OF LAW

1. Section 61506(a) of Part 615 of the NREPA provides that the Supervisor shall prevent waste. To accomplish this purpose, the Supervisor is empowered:

To promulgate and enforce rules, issue orders and instructions necessary to enforce the rules, and to do whatever may be necessary with respect to the subject matter stated in this part to implement this part, whether or not indicated, specified, or enumerated in this or any other section of this part. MCL 324.61506(a)

2. Section 61513(2) and (3) of Part 615 of the NREPA states:

(2) To prevent the drilling of unnecessary wells, the supervisor may establish a drilling unit for each pool. A drilling unit, as described in this subsection, is the maximum area that may be efficiently and economically drained by 1 well. A drilling unit constitutes a developed area if a well is located on the drilling unit that is capable of producing the economically recoverable oil or gas under the unit. Each well permitted to be drilled upon any drilling unit shall be located in the approximate center of the drilling unit, or at such other location on the drilling unit as may be necessary to conform to a uniform well spacing pattern as adopted and promulgated by the supervisor after due notice and public hearing, as provided in this part. MCL 324.61513(2)

(3) The drilling of unnecessary wells is hereby declared waste because unnecessary wells create fire and other hazards conducive to waste, and unnecessarily increase the production cost of oil and gas to the operator, and therefore also unnecessarily increase the cost of the products to the ultimate consumer. MCL 324.61513(3)

3. R 324.302 of the administrative rules of Part 615 of the NREPA states:

The development of an oil or gas field after the completion of a discovery well may warrant the adoption of a drilling unit and well spacing pattern other than as specified in R 324.301. An interested person may request, or the supervisor may schedule, a hearing pursuant to part 12 of these rules to consider the need or desirability of adopting a special spacing order to apply to a designated area, field, pool, or geological strata. The drilling unit established by the special spacing order may be smaller or larger than the basic 40-acre unit pursuant to R 324.301(1)(a). 1996 AACS, R 324.302

4. The Supervisor of Wells has jurisdiction over the subject matter and the persons interested therein. Due notice of the time, place, and purpose of the hearing was given as required by law and all interested persons were afforded the opportunity to be heard.

DETERMINATION AND ORDER

Based on the Findings of Fact and Conclusions of Law and in accordance with the recommendation of the Oil and Gas Advisory Committee, the Supervisor of Wells finds that an amendment to Order No. (A) 10-12-87 is necessary and desirable to prevent waste.

NOW, THEREFORE, IT IS ORDERED:

1. For purposes of this Order the rock interval subject to this Order shall be described by amending Section 1, Determination and Order, Order No. (A) 10-12-87 as follows:

1. The rock interval subject to this Order is the interval from the top of the Sunbury Shale Formation to the base of the Antrim Shale Formation and includes all formations correlative to that interval, excluding the Berea Sandstone Formation.

2. All other provisions of the original Order No. (A) 10-12-87 are reaffirmed.

Amended Order No. (A) 10-12-87

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3. The Supervisor of Wells retains jurisdiction and any amendments to the provisions of this Order shall be by Order of the Supervisor of Wells after notice to all interested parties.

Dated: 7-2-02



HAROLD R. FITCH
ASSISTANT SUPERVISOR OF WELLS
Geological Survey Division
P.O. Box 30256
Lansing, MI 48909

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

THE PETITION OF AMOCO PRODUCTION)
COMPANY FOR AN EXCEPTION TO)
RULE 202(a) FOR WELL LOCATION)
REQUIREMENTS FOR ANTRIM GAS WELLS))
IN EIGHT COUNTIES IN THE SOUTHERN))
LOWER PENINSULA OF MICHIGAN)

ORDER NO. (A) 3-3-95

OPINION AND ORDER

On March 21, 1995, a contested case hearing was held before the Supervisor of Wells and the Oil and Gas Advisory Committee under authority of the Supervisor of Wells Act, 1939 PA 61, as amended, MCL 319.1 et seq.; MSA 13.139(1) et seq., and the administrative rules, 1979 AC, R 299.1101 et seq. The hearing was conducted in accordance with the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 et seq.; MSA 3.560 (101) et seq. The purpose of the hearing was to consider the petition of Amoco Production Company for well location exceptions and approval of alternate completion techniques for gas wells drilled into the Antrim Shale Formation in eight specified counties in Michigan. The Supervisor of Wells, on his initiative, expanded the area being considered to 34 additional counties.

FINDINGS OF FACT

1. Amoco Production Company (Amoco) is the operator of 31 Antrim Shale wells in eight counties in the southern lower peninsula of Michigan. I find, Amoco is a proper petitioner for the relief requested pursuant to Act 61.

2. Amoco's petition requests location exceptions in the eight counties where it has drilled Antrim Shale gas wells. The Supervisor expanded the subject matter of the hearing to include a total of 42 counties. The Supervisor expanded the area because of the uniform presence of the Antrim Shale Formation throughout this area of Michigan. See Exhibit 8. It appears likely that Antrim

Shale gas well drilling and development will continue to occur generally throughout the area. The area considered at the hearing is comprised of the following counties:

Allegan, Barry, Berrien, Branch, Calhoun, Cass, Clare, Clinton, Eaton, Genesee, Gladwin, Gratiot, Hillsdale, Huron, Ingham, Ionia, Isabella, Jackson, Kalamazoo, Kent, Lapeer, Lenawee, Livingston, Macomb, Mecosta, Midland, Montcalm, Muskegon, Newaygo, Oakland, Oceana, Osceola, Ottawa, Saginaw, Sanilac, St. Clair, St. Joseph, Shiawassee, Tuscola, Van Buren, Washtenaw, and Wayne.

3. All 31 of the wells drilled by Amoco have been located on 40-acre drilling units consisting of governmental quarter-quarter sections. The locations of such wells on the 40-acre drilling units is consistent with the requirements of Rule 201(c). These requirements are that the location of a well must be in the center of the drilling unit or in the center of one of the 10-acre quarters of the drilling unit. Pursuant to Rule 202(a), if a discovery well is located in one of the four corners of a drilling unit, then every development well within a two mile radius of the discovery well must be located on its drilling unit in the same relative corner as the discovery well. If a discovery well is located in the center of a drilling unit, Rule 202(b) requires that a hearing be conducted to determine the appropriate well spacing pattern for all development wells within a two mile radius.

4. Amoco presented the testimony of William D. Griffin, an Amoco petroleum engineer. Mr. Griffin testified the Rule 202(a) location requirements for development wells is unduly restrictive for purposes of Antrim Shale gas wells. He testified, and exhibits illustrate, the topography of the southern and central lower peninsula of Michigan is characterized by the presence of lakes, streams, drainage ditches, wetlands, and various surface improvements such as residences, farm buildings, and utility facilities. Mr. Griffin testified these topographic and man-made features in a significant number of situations will prohibit the location of a development well on a Rule 202(a) approved site. In other situations, the reasonable accommodation of surface values with drilling and development activities can best be accomplished by not drilling at a location which would otherwise be appropriate under Rule 202(a).

I find, location flexibility is needed so that wells may be drilled at a sufficient distance from environmentally sensitive areas. The Supervisor finds that allowing Antrim Shale gas well developers latitude in drilling location selection will serve to avoid surface waste. The Supervisor further finds that, for Antrim

Shale gas wells, imposing the rigid well spacing pattern required by Rule 202(a) is not necessary in order to avoid waste and protect correlative rights.

I find, slot or window spacing, whereby all Antrim Shale gas wells may be located anywhere on the drilling unit not less than 330 feet from a unit line, will allow the Antrim Shale gas developer sufficient flexibility to locate a well so as to avoid surface features incompatible with drilling and will allow the accommodation of other surface usages.

5. Mr. Griffin submitted into evidence four cross-sections of Antrim Shale well logs. Exhibit 5 illustrated 16 well logs along a North-South cross section from Otsego County to Hillsdale County. The other three log cross sections (Exhibits 4, 6 and 7) cross the lower peninsula from West to East. These logs consistently show the presence of the Antrim Shale Formation in the central and southern lower peninsula of Michigan. Exhibit 8, titled "Major Devonian Structural Features in the Michigan Basin," shows known fracture systems in the basin and shows the presence of the Antrim Shale in all counties except Monroe County. One theory is that the structural features caused the fractures which contribute to Antrim Shale productivity. I find, these exhibits illustrate that potentially productive Antrim Shale structure is present throughout all of the 42 counties subject to this proceeding.

6. The petition also requests the approval of alternate completion techniques for Antrim Shale gas wells. The Petitioner's witness testified the Antrim Shale Formation appears to be relatively flat throughout the 42 counties covered by this Petition. The Antrim Shale is tight, exhibiting low porosity and permeability. Achieving commercial levels of production appears to be dependent on encountering natural fracture zones or successfully fracturing the formation. He testified, if natural fracturing is absent or insufficiently developed, commercial production may require increased exposure of the formation to the well bore. Mr. Griffin testified alternate completion techniques are necessary to allow the operator to encounter as much of the productive or potentially productive portions of the Antrim Shale as possible. Petitioner requests approval of well completion techniques, other than a vertical hole, which will allow for a variety of completions in the Antrim Shale. First, a directionally drilled well may encounter a more productive area. A second completion technique is the lateral drain hole (LDH). A LDH will provide the opportunity to expose much more of the Antrim Shale to the well bore than either a vertical or directional well. Third, a potential technique is to drill one or more LDHs from a single vertical or directional well bore. The operator may elect to drill multiple

LDHs in one particular strata in the Antrim Shale, or LDHs variously located in one or more of the various strata making up the Antrim Shale. Mr. Griffin testified these techniques will prevent waste by making Antrim gas wells more productive and leaving less gas in the formation.

7. I find, the nature of the Antrim Shale and the productive characteristics of Antrim Shale gas wells is such that use of the alternate completion techniques proposed by Petitioner will not result in waste and will not interfere with the correlative rights of adjoining property owners.

8. The Supervisor of Wells finds that the completion techniques suggested by Petitioner are appropriate for the Antrim Shale. I find, all productive portions of vertical, directional, or LDH wells, and all portions of such wells which are open to the formation, should be located not less than 330 feet from a drilling unit boundary line to protect correlative rights.

CONCLUSIONS OF LAW

1. Act 61, as amended, provides in Section 6 that the Supervisor shall prevent waste and to that end is empowered to fix the spacing of wells. Act 61, as amended, provides in Section 13 that the Supervisor may provide for well locations in the approximate center of the drilling unit or at such other locations thereon as are necessary to conform to a uniform well spacing pattern as adopted after notice and hearing.

2. The Supervisor of Wells has jurisdiction over the subject matter and the persons interested therein. Due notice of the time, place, and purpose of the hearing was given as required by law, and all interested parties were afforded an opportunity to be heard.

3. A well spacing pattern which allows wells anywhere on the drilling unit not less than 330 feet from a drilling unit boundary satisfies the requirement for a well spacing pattern as contemplated by Section 13 of Act 61.

4. Rule 203 provides that a special spacing order may be entered for a specific geological formation to control the development of a gas field and the well spacing pattern may be other than that specified by Rule 201(a). 1979 AC, R 299.1203.

ADVISORY COMMITTEE RECOMMENDATION

The Oil and Gas Advisory Committee recommends approval of the requested location exceptions and the techniques for completing gas wells in the Antrim Shale Formation.

DETERMINATION AND ORDER

Based on the Findings of Fact and Conclusions of Law, it is the determination of the Supervisor of Wells that location exceptions and various completion techniques are necessary to prevent waste and assure the orderly development of the Antrim Shale Formation.

NOW, THEREFORE, IT IS ORDERED:

1. For purposes of this order the Antrim Shale Formation is defined to include those formations from the top of the "Upper Antrim," "Light Antrim," or the "Ellsworth Shale" down to the strata at the top of and immediately above the Traverse Group.

(2) An exception to the well location rules, Rules 201 and 202, is granted for the Antrim Shale Formation in the following counties in the lower peninsula of Michigan:

Allegan, Barry, Berrien, Branch, Calhoun, Cass, Clare, Clinton, Eaton, Genesee, Gladwin, Gratiot, Hillsdale, Huron, Ingham, Ionia, Isabella, Jackson, Kalamazoo, Kent, Lapeer, Lenawee, Livingston, Macomb, Mecosta, Midland, Montcalm, Muskegon, Newaygo, Oakland, Oceana, Osceola, Ottawa, Saginaw, Sanilac, St. Clair, St. Joseph, Shiawassee, Tuscola, Van Buren, Washtenaw, and Wayne.

(3) All wells completed in the Antrim Shale Formation may be completed by any technique listed in paragraph (4), following, provided that the producing portion of the well bore and that portion of the well bore exposed to the Antrim Shale Formation, or one or more lateral drain hole(s), is no closer than 330 feet from the boundary of a drilling unit.

(4) Appropriate techniques for completing wells in the Antrim Shale Formation for gas production are as follows:

- a. Drill and complete a standard vertical well.
- b. Drill and complete a well by conventional directional drilling.

- c. Drill and complete one or more lateral drain holes within the productive interval in conjunction with a standard vertical well or a conventional directional well. The drilling of one or more lateral drain holes from a single vertical or directionally drilled well shall not require an additional drilling permit. However, a well bore survey shall be filed with the Geological Survey Division, identifying the course and end point of all lateral drain holes, within 30 days after completion of the survey.

5. Each vertical or directionally drilled well will require a separate drilling permit. However, any number of LDHs may be drilled from a single vertical or directional well without additional permits.

6. The location provisions and completion techniques approved in this Order are available for use by all developers.

7. This Order shall apply to gas producing wells only.

8. The Supervisor of Wells shall retain continuing jurisdiction in order that he may exercise administrative control consistent with his powers and duties as established by the applicable statutes of the State of Michigan.

Dated: April 10 , 1995



SAMUEL L. ALGUIRE
ACTING ASSISTANT SUPERVISOR OF WELLS

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

11-1b

INTEROFFICE COMMUNICATION

January 13, 1989

TO: Floyd Layton, Region II Geologist
Elmore Eltzroth, Region III Geologist

FROM: R. Thomas Segall, Chief, Geological Survey Division

SUBJECT: Procedure for Change of Well Status

There is no written procedure for granting a change of well status (Form PR 7200-6, Rev. 3/86). Since this is basically a field responsibility I request you to jointly prepare a draft written procedure for this function.

Until procedures are developed and approved, please continue with business as usual with the following addition. Horizontal drain holes and the submission of the directional surveys that are subject to S.O. 10-12-87 (The Antrim Order), are to be processed in the same manner as other records as a result of a change of well status.

If you have any questions, please contact Jim Lorenz.



cc: Mr. Jack VanAlstine, DNR
Mr. James Lorenz, DNR
Mr. Rodger Whitener, DNR
Mr. Samuel Alguire, DNR
Mr. D. Michael Bricker, DNR
Mr. Ray Ellison, DNR
Mr. Greg Wilson, DNR

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
SUPERVISOR OF WELLS
SUPERVISOR OF MINERAL WELLS

IN THE MATTER OF:

| | | |
|----------------------------------|---|---------------------|
| THE NEED AND DESIRABILITY |) | |
| TO ISSUE AN ORDER ESTABLISHING |) | |
| PARTICULAR REQUIREMENTS FOR |) | ORDER NO. 3-6-92 |
| PLUGGING OF WELLS WHERE |) | ORDER NO.(M) 1-6-92 |
| NATURALLY OCCURRING RADIOACTIVE) |) | |
| MATERIAL (NORM) MAY BE PRESENT) |) | |

OPINION AND ORDER OF THE SUPERVISOR OF WELLS
AND SUPERVISOR OF MINERAL WELLS

On June 16 and 17, 1992, a technical evidentiary hearing was held before the Supervisor of Wells, the oil and Gas Advisory Board, the Supervisor of Mineral Wells, and the Mineral Well Advisory Board. The hearing was conducted pursuant to 1939 PA 61, as amended, the promulgated rules and 1969 PA 315, as amended.

The purpose of the hearing was to receive evidence and testimony pertaining to the need and desirability of establishing requirements for the plugging of wells drilled under the authority of 1939 PA 61, as amended, and 1969 PA 315, as amended, in which Naturally Occurring Radioactive Material (NORM) may be present.

FINDINGS OF FACT

1. NORM is the acronym for "naturally occurring radioactive material." NORM is found virtually everywhere in nature. NORM is found in small quantities in the ground, in the food we eat, in the air we breathe, in the elements that compose our bodies and in man-made structures composed of natural materials such as bricks and wallboard. We are all exposed to natural radiation sources which contribute to our annual radiation doses to various degrees.

2. Until recently the existence of NORM associated with the production of hydrocarbons in Michigan was unknown. In 1989 Louisiana notified other states of the potential for NORM associated with the production of hydrocarbons. NORM occurs as a result of scale deposition on well casing and down hole equipment. Raymond Vugrinovich, Michigan Geological Survey Division (GSD) geologist, testified the GSD and Michigan Department of Public Health (DPH) investigated the occurrence of

NORM associated with oil and gas operations. Hand-held gamma scintillometer surveys were conducted at approximately 270 oil and gas production sites and revealed elevated gamma radiation levels at about 20% of the sites. They determined the NORM levels detected were not an immediate threat to public health and safety. Based on the surveys, the Supervisor proposed consideration of a special order for the following counties:

Alcona, Allegan, Alpena, Antrim, Arenac, Barry, Bay, Benzie, Berrien, Branch, Calhoun, Cass, Charlevoix, Cheboygan, Clare, Clinton, Crawford, Eaton, Emmet, Genesee, Gladwin, Grand Traverse, Gratiot, Hillsdale, Huron, Ingham, Ionia, Iosco, Isabella, Jackson, Kalamazoo, Kalkaska, Kent, Lake, Lapeer, Leelanau, Lenawee, Livingston, Macomb, Manistee, Mason, Mecosta, Midland, Missaukee, Monroe, Montcalm, Montmorency, Muskegon, Newaygo, Oakland, Oceana, Ogemaw, Osceola, Oscoda, Otsego, Ottawa, Presque Isle, Roscommon, Saginaw, St. Clair, St. Joseph, Sanilac, Shiawassee, Tuscola, Van Buren, Washtenaw, Wayne and Wexford.

3. Full Parties to the hearing included the Department of Natural Resources-Geological Survey Division (GSD), Shell Western Exploration and Production, Incorporated (SWEPI), Amoco Production Company (AMOCO), Michigan Oil and Gas Association (MOGA) and the Michigan Public Service Commission (MPSC).

4. Several persons who did not elect to become full Parties made statements concerning the law and policy to be applied in this matter. A range of opinion was offered. One oil and gas operator expressed the opinion that NORM posed no health or environmental risk and no regulation was required or necessary. Others expressed the opinion that any source of radioactive material, regardless of its intensity, posed significant risk to health and the environment.

5. Raymond Vugrinovich, GSD staff, testified that NORM scale found in oil, gas and mineral wells in Michigan is formed over time and is found only on mature producing wells that are near or ready to be plugged. This conclusion was supported by Clay Harrelson, a SWEPI senior production engineer, who testified that NORM is most likely to appear as scale on the outside of casing exposed to the interval from the top of the Antrim Formation to the Dundee Formation.

6. SWEPI presented three internationally recognized experts who testified about radioactivity and its affects on people and nature. SWEPI's first witness, John Auxier, PhD, is an expert in nuclear engineering and health physics. During his

tenure at the Oakridge National Laboratory, where he was Director of the Health Physics Division, Dr. Auxier directed research in the investigation of pathways of exposure and biological affects of nuclear pollutants and radiation safety. Dr. Auxier testified as to his examination of pipe scale that was found to have NORM. He described the scale as being radium sulfate incorporated within a barium sulfate matrix. He testified this material is extremely insoluble and, therefore, difficult for plants and humans to retain. He concluded that workers in repeated contact with well casing measuring 50 micro R/hr. would experience no health problems. Notwithstanding Dr. Auxier's opinion that casing found to have NORM would pose no health risk, he testified he understood the instinctive public concern over anything "radioactive." Dr. Auxier testified that an action level of 50 micro R/hr. would be easy to measure in the field and would be far more restrictive than is necessary to protect health. Therefore, he concluded it made sense to return casing found to have NORM down the well bore.

7. SWEPI's second witness, Dr. Eugene Saenger, M.D., is Professor Emeritus of Radiology at the University of Cincinnati College of Medicine. He is an expert on radiation, radiation biology and radiation epidemiology. He testified that relatively small amounts of insoluble, radioactive scale do not pose a significant health risk. Dr. Saenger, in his work, has not observed harm to humans from any chronic exposure below 100 rem (100 million microrem) per year. He testified contact with NORM scale is not a significant health risk and that any NORM scale dust which was inhaled would be expelled by the body without consequence. He found a 50 micro R/hr. contact reading, as proposed by SWEPI as an action level, would pose absolutely no biological hazard to the worker or general public. In his opinion returning NORM to the bore hole is desirable from a point of general radiation hygiene.

8. SWEPI's third witness, Robert Rowland, PhD, is the former associate director for Biomedical and Environmental Research at the Argonne National Laboratory. He is an expert in mineral metabolism and the affects of internally deposited radioisotopes on humans. He studied workers who had cleaned NORM scale from well casings. He concluded that NORM found on well casings does not pose a health risk. His study found that pipeworkers, regularly exposed to NORM, had no more radium in their bodies than would be expected in a member of the general public. He testified the NORM scale is water insoluble and of relatively large particle size. Thus, it is not readily taken up by plants and, if inhaled or ingested by humans, it will simply pass out of the body. Dr. Rowland has done extensive studies of the radium exposure of radium dial painters. In Dr. Rowland's

opinion, a person could not ingest enough NORM to approach the body radiation counts demonstrated by his studies of radium dial painters. He testified the suggested 50 micro R/hr. action level is more than low enough to assure no harm to humans or the environment. Dr. Rowland testified leaving NORM casing in the well bore was a superb method of disposing of the pipe, insuring that the insoluble NORM stayed in the strata from which it came.

9. Based upon the testimony presented by these experts and the general consensus of the Parties I find, as a Matter of Fact, it is important to develop a safe and reasonable protocol for addressing oil, gas and mineral well operations when NORM scale is present.

10. Four proposals for plugging wells found to have NORM were offered by the Parties. There is general agreement among the proposals that casing containing NORM scale should be left in or reinserted into well bores. Based upon the evidence presented, I find, as a Matter of Fact, casing found to have NORM is best left in or reinserted into the well bore from which it came.

11. The proposals also agree that a 50 micro R/hr. action level is easy to measure in the field and is stringent enough to protect workers and the public. The GSD did not propose an action level for casing containing NORM scale. I find, as a Matter of Fact, when NORM scale is detected an action level of 50 micro R/hr. is sufficient to protect workers and the public.

12. There is disagreement among the Parties as to the proper plugging of a well containing NORM scale. Mr. Vugrinovich testified there is concern water in the NORM producing strata will migrate and commingle with strata containing fresh water if a proper plugging procedure is not required. Edward Everett, a hydrogeologist who has expertise in groundwater hydrology and with the hydrology of the northern Michigan reef trend, testified for SWEPI. He testified waters from NORM producing strata do not normally migrate and commingle with the strata containing fresh water. He testified fresh water may flow downward but that, in northern Michigan, brine will not flow upward. Mr. Everett concluded, based upon these facts, there was no chance of NORM contamination of freshwater from wells plugged as recommended by SWEPI. He also testified that the insolubility of NORM scale and its particulate form eliminated any real chance for migration in a well plugged under the SWEPI proposal. In his opinion a 10-foot cement cap is more than sufficient to insure NORM abandoned in the well bore will never move.

13. The Parties offered differing opinions as to the proper thickness of the uppermost cement plug to be installed in wells containing NORM. AMOCO asserted that a NORM well should be plugged in the same manner as any other well. It reasons the existing plugging method provides adequate protection against any potential migration of NORM materials. GSD recommended a 500-foot cement plug above any NORM materials is appropriate; MOGA and SWEPI suggest that a 50-foot cement plug is more than adequate to isolate casing with NORM scale. Clay Harrelson, a senior production engineer for SWEPI, testified about SWEPI's plugging procedure for Niagaran wells, the GSD/SWEPI experimental plugging of the Whitewater 3-38 Well containing NORM scale, and SWEPI's proposal for plugging wells containing NORM scale. I find, as a Matter of Fact, a 50-foot cement plug will adequately prevent surface or underground waste from NORM materials.

CONCLUSIONS OF LAW

1. Section 2(1) of 1939 PA 61, as amended, defines "waste" in addition to its ordinary meaning to include:

(1) "Underground waste" as those words are generally understood in the oil business, and in any event to embrace . . . (2) unreasonable damage to underground fresh or mineral waters, natural brines, or other mineral deposits from operations for the discovery, development, and production and handling of oil or gas.

(2) "Surface waste," as those words are generally understood in the oil business, and in any event to embrace (1) the unnecessary or excessive surface loss or destruction without beneficial use . . . (2) the unnecessary damage to or destruction of the surface, soils, animal, fish or aquatic life or property, or other environmental values from or by oil and gas operations; . . .

2. Section 5 of 1939 PA 61, as amended, provides in part:

The supervisor shall have, and he is hereby given (a) jurisdiction and authority over the administration and enforcement of the provisions of this act and all matters relating to the prevention of waste as defined herein . . .; and (b) jurisdiction and control of and over all persons and things necessary or proper to enforce effectively the provisions of this act and all matters relating to the prevention of waste and the conservation of oil and gas.

3. Section 2 of 1969 PA 315, as amended, defines waste as:

(s) "Underground waste" means damage or injury to potable water, mineralized water, or other subsurface resources.

(t) "Surface waste" means damage to, injury to, or destruction of surface waters, soils, animal, fish and aquatic life or surface property from unnecessary seepage or loss incidental to or resulting from drilling, equipping, or operating a well or wells subject to this act.

4. Section 3 of 1969 PA 315, as amended, provides:

A person shall not cause surface or underground waste in the drilling, development, production, operation or plugging of wells subject to this act.

5. I conclude, as a Matter of Law, the improper handling of NORM could result in waste by the unnecessary damage to groundwater and the surface environment.

DETERMINATION AND ORDER

Based upon the evidence and after consulting with and considering the recommendations of the Advisory Boards, the Supervisor finds that a special order for handling casing found to have NORM is necessary and desirable.

Now, therefore, it is ordered:

1. This Order is not intended to supersede any applicable federal or state laws or regulations or authorities pertaining to the possession, handling, storing, transporting, using or recycling of radioactive material.

2. For the purposes of this order, "material" means well casings, tubulars and down hole equipment from the well bore and miscellaneous substances, soils or equipment generated on site during the plugging operation of the well.

3. For the purpose of this Order, material shall be considered "NORM material" when the gamma radiation level, minus the average natural background, equals or exceeds 50 microRoentgens per hour. The radiation level shall be determined by using down hole or surface instruments for measurement

immediately prior to plugging the well or during the well plugging operation. The testing protocol and instruments to be used shall be as approved by the Supervisor.

4. If NORM material exists or it is not known at the start of plugging operations whether NORM material exists, the well permittee has the following options:

Option A. Remove all free tubulars and store, reuse or recycle all or part of the NORM material pursuant to applicable federal and state laws and regulations and plug the well pursuant to normal plugging instructions issued by the supervisor; or

Option B. Remove all free tubulars from the well bore until NORM tubulars reach the surface. Reinsert NORM materials along with tubulars still in the hole and abandon reinserted material in accordance with Sections 5A through 5F and 6 of this order; or,

Option C. Remove all free tubulars and down hole equipment from the well bore and reinsert and abandon part or all of the NORM material in the same well bore from which it was taken or generated as part of the plugging operation in accordance with sections 5B through 5F that follows in this Order.

5. The following conditions apply to wells plugged pursuant to section 4 above:

A. All tubular material reinserted in the well bore pursuant to Option B shall be encased in cement throughout its exterior and interior length.

B. All reinserted material must be between plugs or encased in cement and be placed as deep in the well as possible.

C. NORM material which is reinserted or must be left in the well bore due to well bore problems must be at least 100 feet below the surface casing shoe or 100 feet below the lowest known or suspected fresh water bearing aquifer, if that aquifer is below the base of the surface casing shoe.

D. Before any material is reinserted, any cement plug upon which it will rest must be allowed to set for at least 12 hours and must be tagged with at least 5000 pounds of weight to ensure it is properly located and set.

- E. A cement plug of at least 50 feet in thickness and formulated to resist sulfate solutions must be placed immediately above the highest point at which the reinserted NORM material is placed. The top of the plug must be confirmed by tagging with a 5000 pound weight or the plug of cement must be supported by a mechanical bridge plug that was tested by 5000 pounds of weight.
- F. All open hole plugs presently required by the supervisor pursuant to normal plugging instructions must be set.
- G. A detailed description of the plugging operation including a written inventory of all non-NORM and NORM material reinserted and the depths at which it was placed shall be filed with the plugging record along with a signed certified statement by an independent consultant experienced in plugging operations or by the permittee that all required conditions were met.

6. If special well conditions exist which prevents meeting the requirements of Options B or C, the permittee shall submit a detailed well plugging plan to the Supervisor for approval which demonstrates that the protective conditions prescribed are met or exceeded. Under no circumstances shall NORM material be abandoned in a well bore at a depth less than 100 feet below the surface shoe or 100 feet below lowest known or suspected fresh water aquifer, if that aquifer is below the surface casing shoe.

7. The Supervisors Notice dated June 6, 1991 is rescinded. Tubulars or other down hole equipment that are not NORM materials may be used for construction of other wells.

- 8. This Order shall be of immediate effect.

Dated: November 3, 1992

R. THOMAS SEGALL
ASSISTANT SUPERVISOR OF WELLS
SUPERVISOR OF MINERAL WELLS

STATE OF MICHIGAN



NATURAL RESOURCES COMMISSION

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DAVID F. HALES, Director

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b.

**SUPERVISOR OF WELLS ADVISORY
DECEMBER 1990**

During 1990, the Departments of Natural Resources and Public Health initiated a preliminary field survey for naturally-occurring radioactive material (NORM) at various Michigan oil and gas well sites to determine if oil and gas production equipment, material, and wastes could contain elevated levels of NORM. The survey was initiated in response to learning that radium had been found concentrated in certain oil field production equipment and wastes in areas outside of Michigan.

In Michigan, radium has been found in waste sediments in oil and brine tanks. Scintillation detector readings taken from the outside surface of the oil and brine tanks have indicated above background readings at a number of the sites surveyed. At this time, the principal concern is any radiation emanating from radium-226 found in production equipment, tank bottom sediment, brine, and scale deposits within tubing and piping.

Both the Department of Natural Resources and the Department of Public Health are concerned about the potential impacts on both public health and the environment, and will continue investigations to determine the extent of any problem and the need for any new handling and/or disposal requirements.

While field surveys conducted by the two agencies over the past year have involved facilities serving approximately 1,000 oil and gas wells, no clear pattern has emerged which would allow accurate predictions of which oil and gas formations, or which type of above ground processing facilities, are most likely to produce waste containing radiation levels sufficiently above background to warrant further attention. As a precautionary measure while the two agencies review data, confirm results, and consult other state and federal agencies on the issue, oil and gas operators in Michigan are advised that equipment such as pipe, tubing, tanks, or other processing equipment that has had long term direct contact with brine, oil, or gas could be contaminated with radium-226 and pose a risk to workers or the general public if improperly handled.



Operators should not allow such equipment to be removed from production sites for any purpose other than direct reuse in oil and gas operations or storage at a site under the control of the operator without prior testing, and specific approval of the Proration and Technical Evaluation Unit, Michigan Department of Natural Resources, Geological Survey Division (517-334-6945). As long as such equipment is in use for oil and gas operations, or stored at a controlled site, workers can be protected with the MIOSHA radiation standards cited later and attached to this Advisory. Any general public health risk to exposure from contaminated equipment can be minimized, provided the public access restriction standards appearing below are followed.

Operators are also advised that the survey indicated there may be areas around well-heads and production facilities where radiation levels are elevated to the point that public access to the area may need to be restricted pending further evaluation. It is the Michigan Department of Public Health's determination at this time that in order to reduce exposure to the general public, the operators should restrict public access to production areas where radiation levels exceed 50 microrems per hour. (See attached "Guidance for Conducting Radiation Surveys of Oil and Gas Field Production Sites in Michigan.")

Tank bottom sediments represent the highest level of naturally-occurring radium-226 accumulation and the highest radiation source found in the recent survey of oil and gas production sites in Michigan. Operators are advised to use extreme caution when handling this waste material. While this issue is under review, operators are advised to take the following actions with regard to assessing the radiation levels and handling and disposing of sediments, scale and other accumulations of waste solids or slurries associated with oil and gas or brine production:

1. Produced brines and associated wastes should be disposed to the extent possible in permitted Class II injection wells;
2. Review attached copy of applicable occupational radiation standards and measure radiation levels from material on sites to determine what steps must be taken to assure compliance and thus worker safety;
3. Review attached copy of standards governing the entry of confined space such as storage tanks, transportation tanks, or associated process spaces, where in addition to lack of oxygen and the presence of toxic chemicals, such as hydrogen sulfide, there also may be radiation risks;

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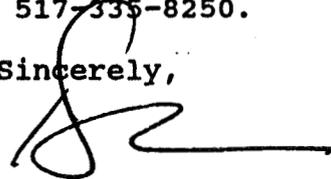
4. Pipe scale and tank bottom sediments and similar waste should be contained on-site or maintained in secure storage until testing shows radiation is below level of concern or further disposal instructions are provided by the Supervisor of Wells.

Formal Supervisor Instructions are under consideration on this issue. Any information operators have on radiation levels at Michigan facilities, technical expertise on the handling or disposal of NORM associated with oil and gas production, or related information helpful in evaluating and minimizing health or environmental risks associated with these materials would be valuable and should be provided to the Supervisor of Wells.

Field and laboratory data collected at individual oil and gas well sites by State agencies in Michigan is available for review by contacting the Michigan Department of Public Health, Division of Radiological Health, at 517-335-8200.

Questions about radiation surveys in addition to the attached survey guidance and list of testing equipment suppliers, can be directed to the Michigan Department of Public Health, Division of Radiological Health. Questions about occupational health concerns should be directed to the Michigan Department of Public Health, Division of Occupational Health, at 517-335-8250.

Sincerely,



David F. Hales
Supervisor of Wells
517-373-2329

Attachments

Michigan Department of Public Health
Bureau of Environmental and Occupational Health
Division of Radiological Health

Guidance for Conducting Radiation Surveys
of Oil and Gas Field Production Sites in Michigan

Purpose: To provide guidance to operators of Michigan oil and gas production sites on how to conduct radiation surveys with portable radiation detectors to determine areas where external radiation levels exceed 50 microroentgens per hour.

Radiation Survey - For the purpose of this guidance document, a radiation survey is considered to be an evaluation of the radiation levels measured near any equipment or ground surface involved in the extraction of oil or gas resources, and for which an oil or gas field site operator has access or control. Based on the results of the site survey, a physical barrier, such as a fence, should be erected to prevent access by any member of the public to an area in which the radiation level exceeds a total of 50 microroentgens per hour (including background).

Survey Instruments - Radiation levels to be measured during a radiation survey should include external gamma radiation levels measured with suitable portable instruments which meet at least the following specifications:

1. Capable of measuring radiation levels from one microroentgen per hour ($\mu\text{R/hr}$) through at least 5,000 microroentgens per hour ($\mu\text{R/hr}$). Portable, hand-held scintillation detectors are commonly used for these measurements. For radiation levels in excess of 500 $\mu\text{R/hr}$, the use of another survey instrument capable of accurately measuring the maximum radiation level encountered may be necessary. Ion chamber instruments may be useful for supplementary radiation level measurements that may be too high for measurement with scintillation detectors. It is not expected that radiation levels in excess of 500 $\mu\text{R/hr}$ will be commonly encountered.
2. Capable of environmental operating conditions from 0⁰F to 100⁰F and up to 95% humidity,
3. Calibrated at least semi-annually by the manufacturer or other qualified person to an appropriate gamma radiation field such that accuracy is within +/- 20% of actual. For the purpose of this survey guidance, an acceptable calibration could involve calibration to a gamma radiation field with an effective gamma energy between 600 and 900 kiloelectron-volts (keV).

4. Response time of less than 4 seconds for all but the most sensitive scale. Response time of 15 seconds or less for the most sensitive scale.

Instruments equipped with audible signal features in addition to a visual readout display are often more convenient to use. A list of some commercial suppliers is attached.

Survey Method - The survey method depends upon whether radiation levels are being measured near equipment such as pipes, tubing, and tanks or near ground surfaces. Since the response time of most survey instruments is relatively long, all surveys should be made carefully and slowly to ensure that any localized "hot spots" or areas having elevated levels of gamma-emitting radiative material are not missed. Instruments which are battery powered should only be used with alkaline batteries to optimize performance, especially under low temperature conditions. Extremes in the operating temperature and humidity ranges of the instrument should be avoided. Readings should be recorded in units of microroentgens per hour ($\mu\text{R/hr}$). For purposes of this guidance, instruments which read in microrem per hour ($\mu\text{rem/hr}$) can be assumed to read equivalently in microroentgens per hour. Survey instrument performance should be checked daily during the survey process by following manufacturer's recommendations or by checking radiation response to a small radiation source that is exempt from regulatory control, such as a commercially supplied instrument check source or a gas lantern mantle commonly available from hardware or camping supply stores.

The initial survey should be completed within 90 days of receipt of this guidance. All readings should include the total radiation level as measured by the instrument, including the local natural background level. Natural background levels in Michigan normally vary from 5-15 $\mu\text{R/hr}$ as measured by a portable, hand-held scintillation detector. The survey should include the local natural background radiation level at a minimum of two locations, including one within the oil or gas field site as far as possible from any elevated radiation levels and the other one at a location just off-site and away from the first location. Natural background measurements should be performed using the method described below for ground surface measurements.

All survey results should be documented on a sketch of the site showing representative survey instrument readings of any equipment or ground surface above the normal background radiation level. The date of the survey, instrument used, and name of the person conducting the survey should also be recorded. The survey documentation should also include instrument calibration details as well as the background radiation level readings (minimum of two) described above.

For radiation levels that exceed 500 $\mu\text{R/hr}$, a confirming measurement should be made with a properly calibrated ion chamber instrument.

Equipment Surveys - All piping and tubing should be carefully surveyed by placing the instrument detector in contact with or as close as possible to the exterior surface of the piping or tubing. Each bend or joint where fluid or gas flow may change direction or velocity should be surveyed, as well as other points along straight sections within a maximum 10 foot interval. Surveys of tanks (oil and brine storage tanks) and heater-treaters should be made with the detector in contact with or as close as possible to the exterior surface. Tank and heater-treater surface areas should be surveyed from the bottom to the top extending to the height of the solid or liquid material within the tank. At the height of maximum reading, additional readings should be taken around the circumference of the equipment.

Ground Surface Surveys - Ground surface survey readings should be taken near the ground or soil surface at selected locations within the oil and gas field site. These locations should include any area where subsurface materials may have spilled on the soil and areas beneath each access port to a storage tank. The detector should be within 3-6 inches of any ground surface during the survey. A simple distance indicator can be attached to the bottom of the survey instrument to facilitate the survey.

Radiation survey consultants can also be contacted to perform equipment and ground surface surveys. For your information, a firm that has indicated an interest in providing such service is Medical Physics Consultants, 2309 Shelby, Ann Arbor, Michigan 48103 [(313) 662-3197]. Other firms may also exist that can provide radiation survey services.

Should you have any questions concerning this radiation survey guidance, please contact the Michigan Department of Public Health, Division of Radiological Health at (517) 335-8200.

Michigan Department of Public Health
Bureau of Environmental and Occupational Health
Division of Radiological Health

COMPANIES PROVIDING LOW-LEVEL RADIATION SURVEY METERS FOR FIELD USE

Bicron Corporation
12345 Kinsman Road
Newbury, Ohio 44065
Telephone: (216) 564-2251

Eberline
P.O. Box 2108
Santa Fe, New Mexico 87501
Telephone: (505) 471-3232

Ludlum Measurements, Inc.
P.O. Box 810
501 Oak Street
Sweetwater, Texas 79556
Telephone: (915) 235-5494

Victoreen, Inc.
6000 Cochran Road
Cleveland, Ohio 44139
Telephone: (216) 248-9300

This list is not intended as an endorsement of any of these companies. Other companies may exist which do not appear on this list, and any information regarding them is invited.

GLOSSARY OF RADIATION TERMS

Curie (Ci) - A unit of radioactivity measurement equal to 3.7×10^{10} nuclear transformations per second. This unit is usually used to describe the amount of radioactivity contained within a given amount of radioactive material. Samples of radioactive material usually contain only a small fraction of a curie for which the following units are common:

millicurie (mCi) - One thousandth of a curie.

microcurie (μ Ci) - One millionth of a curie.

picocurie (pCi) - One trillionth of a curie.

For a given sample, laboratories usually report sample radioactivity results in units of picocuries per gram (pCi/g) for solids or picocuries per liter (pCi/l) for liquids.

Half-life - The amount of time for a radioactive material to decay to one-half of its original amount of radioactivity. The half-life is characteristic of each specific species of radioactive material and can vary from a fraction of a second to billions of years.

Natural background radiation - Radiation resulting from ambient radiation emissions from natural sources in the environment. Natural background radiation includes terrestrial radiation from natural sources in the earth's crust and cosmic radiation from sources located outside the earth's atmosphere. Natural background radiation can vary from place to place, but, on an average, results in an annual radiation dose of about 60 millirem per year to a member of the U.S. population (excluding the contribution resulting from the exposure to radon in the environment) due to terrestrial and cosmic radiation sources.

Naturally-Occurring Radioactive Material (NORM) - Any radioactive material that exists in nature and is not man-made.

Photon - A "particle" of electromagnetic radiation. The photon is used to refer to the corpuscular nature of electromagnetic radiation in microscopic radiation phenomena.

Radiation - Electromagnetic or particulate energy propagating through space and capable of producing ionization upon interaction with matter. Common types of radiation are as follows:

Alpha - A type of particulate radiation consisting of a completely ionized nucleus of a helium atom.

Beta - A type of particulate radiation consisting of a high speed electron.

Gamma - A type of electromagnetic radiation consisting of a high energy photon originating from the nucleus of an atom.

X-ray - A type of electromagnetic radiation consisting of a high energy photon originating from the electron cloud of an atom or from the absorption of a high speed charged particle in matter.

Radiation detector - A mechanical or electronic instrument capable of detecting radiation emitted from radioactive material or other sources of ionizing radiation. Radiation detectors usually depend upon the interaction of certain types of radiation with a sensitive material within the detector to quantify the radiation being measured. Portable radiation detectors usually measure the amount of radiation per unit time in units such as milliroentgens per hour or microroentgens per hour. Such radiation rates are often referred to as radiation levels or as radiation intensities.

Radioactive material - Any material that emits ionizing radiation of any type spontaneously.

Radioactivity - The level of radiation emissions from radioactive material per unit time. Radioactivity is usually measured in curies or fractional units of curies.

Rem - A unit of radiation absorbed dose equivalent used to quantify the amount of biological damage in living tissue. Radiation protection standards for individuals are usually described in units of rem per year or rem per calendar quarter and are referred to as radiation dose rates. For simplicity in using many radiation detectors, a dose equivalent of one rem results from a radiation exposure of one roentgen. Other common unit names related to the rem are:

millirem (mrem) - One thousandth of a rem.

microrem (μ rem) - One millionth of a rem.

Roentgen (R) - A unit of radiation exposure used to quantify the amount of ionization produced in air by photon radiation. One roentgen produces 2.58×10^{16} coulombs per kilogram of air at standard temperature and pressure. Other common unit names related to the roentgen are:

milliroentgen (mR) - One thousandth of a roentgen.

microroentgen (μ R) - One millionth of a roentgen.

Scintillation detector - A particular type of radiation detector that measures the amount of photon radiation. Portable scintillation detectors are usually designed to measure external radiation levels in units of milliroentgens per hour (mR/hr) or in units of microroentgens per hour (μ R/hr). Laboratory scintillation detectors are used to measure radioactivity in samples by way of photon emissions.

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COMMON MATHEMATICAL PREFIXES:

milli = one thousandth = $\frac{1}{1000} = 10^{-3}$

micro = one millionth = $\frac{1}{1,000,000} = 10^{-6}$

nano = one billionth = $\frac{1}{1,000,000,000} = 10^{-9}$

pico = one trillionth = $\frac{1}{1,000,000,000,000} = 10^{-12}$

ATTACHMENT TO
SUPERVISOR OF WELLS ADVISORY

JANUARY 1991

Rules 2410, 3301 and 3302 promulgated pursuant to the Michigan Occupational Safety and Health Act (Act No. 154, PA 1974, as amended) are attached for reference purposes.

Questions regarding these rules should be directed to the Michigan Department of Public Health's Division of Occupational Health at 517-335-8250.

Information on Title 10 Code of Federal Rules, Part 20 (10 CFR Part 20) is available at the Michigan Department of Public Health at 517-335-8200.

Rule 2410 Ionizing Radiation (Source: 1910.96 - entire section, except as noted)

(1) Definitions applicable to this rule.

(a) "Radiation" includes alpha rays, beta rays, gamma rays, X-rays, neutron, high-speed electrons, high-speed protons, and other atomic particles; but such term does not include sound or radio waves, or visible light, or infrared or ultraviolet light.

(b) "Radioactive material" means any material which emits, by spontaneous nuclear disintegration, corpuscular or electromagnetic emanations.

(c) "Restricted area" means any area access to which is controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.

(d) "Unrestricted area" means any area access to which is not controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.

(e) "Dose" means the quantity of ionizing radiation absorbed, per unit of mass, by the body or by any portion of the body. When the provisions in this rule specify a dose during a period of time, the dose is the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use. Definitions of units used in this rule are set forth in paragraphs (f) and (g) of this subsection.

(f) "Rad" means a measure of the dose of any ionizing radiation to body tissues in terms of the energy absorbed per unit of mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue (1 millirad (mrad) = 0.001 rad).

(g) "Rem" means a measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of 1 roentgen (r) of X-rays (1 millirem (mrem) = 0.001 rem). The relation of the rem to other dose units depends upon the biological effect under consideration and upon the conditions for irradiation. Each of the following is considered to be equivalent to a dose of 1 rem:

- (i) A dose of 1 (r) due to X- or gamma radiation;
- (ii) A dose of 1 rad due to X-, gamma, or beta radiation;
- (iii) A dose of 0.1 rad due to neutrons or high-energy protons;
- (iv) A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye;

(v) If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron dose in rads, as provided in subdivision (iii) of this paragraph, 1 rem of neutron radiation may, for purposes of the provisions in this rule may be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; or, if there is sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to 1 rem may be estimated from Table G-17.

TABLE G-17--NEUTRON FLUX DOSE EQUIVALENTS

| Neutron energy (million electron volts (Mev)) | Number of neutrons per square centimeter equivalent to a dose of 1 rem (neutrons/cm ²) | Average flux to deliver 100 millirem in 40 hours (neutrons/cm ² per sec.) |
|---|--|--|
| Thermal ----- | 970 x 10 ⁶ | 670 |
| 0.0001 ----- | 720 x 10 ⁶ | 500 |
| 0.005 ----- | 820 x 10 ⁶ | 570 |
| 0.02 ----- | 400 x 10 ⁶ | 280 |
| 0.1 ----- | 120 x 10 ⁶ | 80 |
| 0.5 ----- | 43 x 10 ⁶ | 30 |
| 1.0 ----- | 26 x 10 ⁶ | 18 |
| 2.5 ----- | 29 x 10 ⁶ | 20 |
| 5.0 ----- | 26 x 10 ⁶ | 18 |
| 7.5 ----- | 24 x 10 ⁶ | 17 |
| 10 ----- | 24 x 10 ⁶ | 17 |
| 10 to 30 ----- | 14 x 10 ⁶ | 10 |

(h) For determining exposures to X- or gamma rays up to 3 Mev., the dose limits specified in this rule may be assumed to be equivalent to the "air dose". For the purpose of this rule "air dose" means that the dose is measured by a properly calibrated appropriate instrument in air at or near the body surface in the region of the highest dosage rate.

(2) Exposure of individuals to radiation in restricted areas.

(a) Except as provided in paragraph (b) of this subsection, no employer shall possess, use, or transfer sources of ionizing radiation in such a manner as to cause any individual in a restricted area to receive in any period of one calendar quarter from sources in the employer's possession or control a dose in excess of the limits specified in Table G-18.

TABLE G-18

| | <u>Rems per calendar quarter</u> |
|--|--------------------------------------|
| Whole body: Head and trunk; active blood-forming organs; lens of eyes; or gonads ----- | 1-1/4 |
| Hands and forearms; feet and ankles ----- | 18-3/4 |
| Skin of whole body ----- | 7-1/2 |

(b) An employer may permit an individual in a restricted area to receive doses to the whole body greater than those permitted under paragraph (a) of this subsection, so long as:

(i) During any calendar quarter the dose to the whole body shall not exceed 3 rems; and

(ii) The dose to the whole body, when added to the accumulated occupational dose to the whole body, shall not exceed 5 (N-18) rems, where "N" equals the individual's age in years at his last birthday; and

(iii) The employer maintains adequate past and current exposure records which show that the addition of such a dose will not cause the individual to exceed the amount authorized in this paragraph. As used in this paragraph, "dose to the whole body" shall be deemed to include any dose to the whole body, gonad, active blood-forming organs, head and trunk, or lens of the eye.

(c) No employer shall permit any employee who is under 18 years of age to receive in any period of one calendar quarter a dose in excess of 10 percent of the limits specified in Table G-18.

(d) "Calendar quarter" means any 3-month period determined as follows:

(i) The first period of any year may begin on any date in January: Provided, That the second, third, and fourth periods accordingly begin on the same date in April, July, and October, respectively, and that the fourth period extends into January of the succeeding year, if necessary to complete a 3-month quarter. During the first year of use of this method of determination, the first period for that year shall also include any additional days in January preceding the starting date of the first period; or

(ii) The first period in a calendar year of 13 complete, consecutive calendar weeks; the second period in a calendar year of 13 complete, consecutive weeks; the third period in a calendar year of 13 complete, consecutive calendar weeks; the fourth period in a calendar year of 13 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included within the last complete calendar week of that year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included within the last complete calendar week of the previous year; or

(iii) The four periods in a calendar year may consist of the first 14 complete, consecutive calendar weeks; the next 12 complete, consecutive calendar weeks, the next 14 complete, consecutive calendar weeks, and the last 12 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included (for purposes of this rule) within the last complete calendar week of the year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included (for purposes of this rule) within the last complete week of the previous year.

(e) No employer shall change the method used by him to determine calendar quarters except at the beginning of a calendar year.

(3) Exposure to airborne radioactive material.

(a) No employer shall possess, use or transport radioactive material in such a manner as to cause any employee, within a restricted area, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table I of Appendix B to 10 CFR Part 20. The limits given in Table I are for exposure to the concentrations specified for 40 hours in any workweek of 7 consecutive days. In any such period where the number of hours of exposure is less than 40, the limits specified in the table may be increased proportionately. In any such period where the number of hours of exposure is greater than 40, the limits specified in the table shall be decreased proportionately.

(b) No employer shall possess, use, or transfer radioactive material in such a manner as to cause any individual within a restricted area, who is under 18 years of age, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table II of Appendix B to 10 CFR Part 20. For purposes of this paragraph, concentrations may be averaged over periods not greater than 1 week.

(c) "Exposed" as used in this subsection means that the individual is present in an airborne concentration. No allowance shall be made for the use of protective clothing or equipment, or particle size.

(4) Precautionary procedures and personal monitoring.

(a) Every employer shall make such surveys as may be necessary for him to comply with the provisions of this rule. "Survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present.

(b) Every employer shall supply appropriate personnel monitoring equipment, such as film badges, pocket chambers, pocket dosimeters, or film rings, to, and shall require the use of such equipment by:

(i) Each employee who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value specified in paragraph (2)(a) of this rule; and

(ii) Each employee under 18 years of age who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 5 percent of the applicable value specified in paragraph (2)(a) of this rule; and

(iii) Each employee who enters a high radiation area.

(c) As used in this rule:

(i) "Personnel monitoring equipment" means devices designed to be worn or carried by an individual for the purpose of measuring the dose received (e.g., film badges, pocket chambers, pocket dosimeters, film rings, etc.);

(ii) "Radiation area" means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any 1 hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirem; and

(iii) "High radiation area" means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem.

(5) Caution signs, labels, and signals. (See also Rule 4501)

(a) General.

(i) Symbols prescribed by this subsection shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol prescribed by this subsection is the conventional three-bladed design.

(ii) In addition to the contents of signs and labels prescribed in this subsection, employers may provide on or near such signs and labels any additional information which may be appropriate in aiding individuals to minimize exposure to radiation or to radioactive material.

(b) Radiation area. Each radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in paragraph (a) of this subsection and the words:

CAUTION
RADIATION AREA.

(c) High radiation area.

(i) Each high radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION
HIGH RADIATION AREA

(ii) Each high radiation area shall be equipped with a control device which shall either cause the level of radiation to be reduced below that at which an individual might receive a dose of 100 millirems in 1 hour upon entry into the area or shall energize a conspicuous visible or audible alarm signal in such a manner that the individual entering and the employer or a supervisor of the activity are made aware of the entry. In the case of a high radiation area established for a period of 30 days or less, such control device is not required.

(d) Airborne radioactivity area.

(i) As used in the provisions of this rule, "airborne radioactivity area" means:

(A) Any room, enclosure, or operating area in which airborne radioactive materials, composed wholly or partly of radioactive material, exist in concentrations in excess of the amounts specified in column 1 of Table 1 of Appendix B to 10 CFR Part 20 or

(B) Any room, enclosure, or operating area in which airborne radioactive materials exist in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25 percent of the amounts specified in column 1 of Table 1 of Appendix B to 10 CFR Part 20.

(ii) Each airborne radioactivity area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in paragraph (a) of this subsection and the words:

CAUTION
AIRBORNE RADIOACTIVITY AREA

(e) Additional requirements.

(i) Each area or room in which radioactive material is used or stored and which contains any radioactive material (other than natural uranium or thorium) in any amount exceeding 10 times the quantity of such material specified in Appendix C to 10 CFR Part 20 shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in paragraph (a) of this subsection and the words:

RADIATION SYMBOL

1. Cross-hatched area is to be magenta or purple.
2. Background is to be yellow.

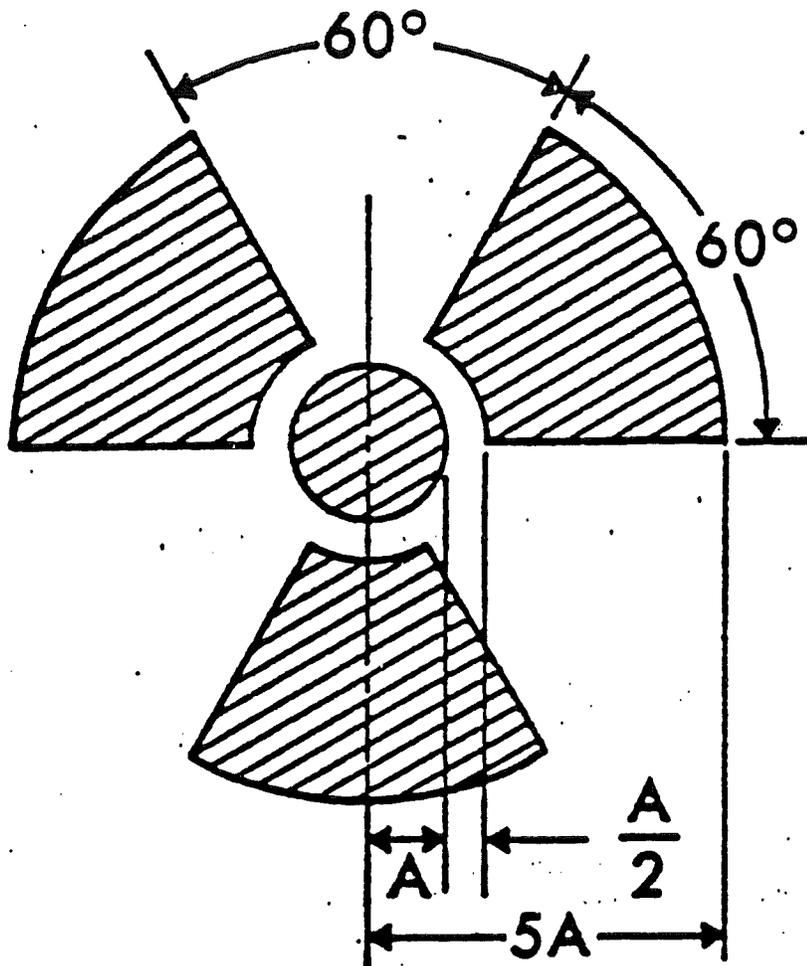


FIGURE G-10

CAUTION
RADIOACTIVE MATERIALS

(ii) Each area or room in which natural uranium or thorium is used or stored in an amount exceeding 100 times the quantity of such material specified in 10 CFR Part 20 shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in paragraph (a) of this subsection and the words:

CAUTION
RADIOACTIVE MATERIALS

(f) Containers.

(i) Each container in which is transported, stored, or used a quantity of any radioactive material (other than natural uranium or thorium) greater than the quantity of such material specified in Appendix C to 10 CFR Part 20 shall bear a durable, clearly visible label bearing the radiation caution symbol described in paragraph (a) of this subsection and the words:

CAUTION
RADIOACTIVE MATERIALS

(ii) Each container in which natural uranium or thorium is transported, stored, or used in a quantity greater than 10 times the quantity specified in Appendix C to 10 CFR Part 20 shall bear a durable, clearly visible label bearing the radiation caution symbol described in paragraph (a) of this subsection and the words:

CAUTION
RADIOACTIVE MATERIALS

(iii) Notwithstanding the provisions of subdivisions (i) and (ii) of this paragraph a label shall not be required:

(A) If the concentration of the material in the container does not exceed that specified in column 2 of Table 1 of Appendix B to 10 CFR Part 20, or

(B) For laboratory containers, such as beakers, flasks, and test tubes, used transiently in laboratory procedures, when the user is present.

(iv) Where containers are used for storage, the labels required in this subparagraph shall state also the quantities and kinds of radioactive materials in the containers and the date of measurement of the quantities.

(6) Immediate evacuation warning signal.

(a) Signal characteristics.

(i) The signal shall be a midfrequency complex sound wave amplitude modulated at a subsonic frequency. The complex sound wave in free space shall have a fundamental frequency (f_1) between 450 and 500 hertz (Hz) modulated at a subsonic rate between 4 and 5 hertz.

(ii) The signal generator shall not be less than 75 decibels at every location where an individual may be present whose immediate, rapid, and complete evacuation is essential.

(iii) A sufficient number of signal units shall be installed such that the requirements of subdivision (ii) of this paragraph are met at every location where an individual may be present whose immediate, rapid, and complete evacuation is essential.

(iv) The signal shall be unique in the plant or facility in which it is installed.

(v) The minimum duration of the signal shall be sufficient to insure that all affected persons hear the signal.

(vi) The signal-generating system shall respond automatically to an initiating event without requiring any human action to sound the signal.

(b) Design objectives.

(i) The signal-generating system shall be designed to incorporate components which enable the system to produce the desired signal each time it is activated within one-half second of activation.

(ii) The signal-generating system shall be provided with an automatically activated secondary power supply which is adequate to simultaneously power all emergency equipment to which it is connected, if operation during power failure is necessary, except in those systems using batteries as the primary source of power.

(iii) All components of the signal-generating system shall be located to provide maximum practicable protection against damage in case of fire, explosion, corrosive atmosphere, or other environmental extremes consistent with adequate system performance.

(iv) The signal-generating system shall be designed with the minimum number of components necessary to make it function as intended, and should utilize components which do not require frequent servicing such as lubrication or cleaning.

(v) Where several activating devices feed activating information to a central signal generator, failure of any activating device shall not render the signal-generator system inoperable to activating information from the remaining devices.

(vi) The signal-generating system shall be designed to enhance the probability that alarm occurs only when immediate evacuation is warranted. The number of false alarms shall not be so great that the signal will come to be disregarded and shall be low enough to minimize personal injuries or excessive property damage that might result from such evacuation.

(c) Testing.

(i) Initial tests, inspections, and checks of the signal-generating system shall be made to verify that the fabrication and installation were made in accordance with design plans and specifications and to develop a thorough knowledge of the performance of the system and all components under normal and hostile conditions.

(ii) Once the system has been placed in service, periodic tests, inspections, and checks shall be made to minimize the possibility of malfunction.

(iii) Following significant alterations or revisions to the system, tests and checks similar to the initial installation tests shall be made.

(iv) Tests shall be designed to minimize hazards while conducting the tests.

(v) Prior to normal operation the signal-generating system shall be checked physically and functionally to assure reliability and to demonstrate accuracy and performance. Specific tests shall include:

(A) All power sources.

(B) Calibration and calibration stability.

(C) Trip levels and stability.

(D) Continuity of function with loss and return of required services such as AC or DC power, air pressure, etc.

(E) All indicators.

(F) Trouble indicator circuits and signals, where used.

(G) Air pressure (if used).

(H) Determine that sound level of the signal is within the limit of subparagraph (a)(ii) of this subsection at all points that require immediate evacuation.

(vi) In addition to the initial startup and operating tests, periodic scheduled performance tests and status checks must be made to insure that the system is at all times operating within design limits and capable of the required response. Specific periodic tests or checks or both shall include:

(A) Adequacy of signal activation device.

(B) All power sources.

(C) Function of all alarm circuits and trouble indicator circuits including trip levels.

(D) Air pressure (if used).

(E) Function of entire system including operation without power where required.

(F) Complete operational tests including sounding of the signal and determination that sound levels are adequate.

(vii) Periodic tests shall be scheduled on the basis of need, experience, difficulty, and disruption of operations. The entire system should be operationally tested at least quarterly.

(viii) All employees whose work may necessitate their presence in an area covered by the signal shall be made familiar with the actual sound of the signal--preferably as it sounds at their work location. Before placing the system into operation, all employees normally working in the area shall be made acquainted with the signal by actual demonstration at their work locations.

(7) Exceptions from posting requirements.

Notwithstanding the provisions of subsection (5) of this rule:

(a) A room or area is not required to be posted with a caution sign because of the presence of a sealed source, provided the radiation level 12 inches from the surface of the source container or housing does not exceed 5 millirem per hour.

(b) Rooms or other areas in onsite medical facilities are not required to be posted with caution signs because of the presence of patients containing radioactive material, provided that there are personnel in attendance who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive material in excess of the limits established in the provisions of this rule.

(c) Caution signs are not required to be posted at areas or rooms containing radioactive materials for periods of less than 8 hours: Provided, That

(i) The materials are constantly attended during such periods by an individual who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive materials in excess of the limits established in the provisions of this rule; and

(ii) Such area or room is subject to the employer's control.

(8) Exemptions for radioactive materials packaged for shipment.

Radioactive materials packaged and labeled in accordance with regulations of the Department of Transportation published in 49 CFR Chapter I, are exempt from the labeling and posting requirements of this rule during shipment, provided that the inside containers are labeled in accordance with the provisions of subsection (5) of this rule.

(9) Instruction of personnel, posting.

(a) Employers regulated by the Atomic Energy Commission shall be governed by 10 CFR Part 20 standards. Employers in a State named in paragraph (16)(c) of this rule shall be governed by the requirements of the laws and regulations of that State. All other employers shall be regulated by the following:

(b) All individuals working in or frequenting any portion of a radiation area shall be informed of the occurrence of radioactive materials or of radiation in such portions of the radiation area; shall be instructed in the safety problems associated with exposure to such materials or radiation and in precautions or devices to minimize exposure; shall be instructed in the applicable provisions of this rule for the protection of employees from exposure to radiation or radioactive materials; and shall be advised of reports of radiation exposure which employees may request pursuant to the regulations in this rule.

(c) Each employer to whom this rule applies shall post a current copy of its provisions and a copy of the operating procedures applicable to the work conspicuously in such locations as to insure that employees working in or frequenting radiation areas will observe these documents on the way to and from their place of employment, or shall keep such documents available for examination of employees upon request.

(10) Storage of radioactive materials.

Radioactive materials stored in a nonradiation area shall be secured against unauthorized removal from the place of storage.

(11) Waste disposal.

No employer shall dispose of radioactive material except by transfer to an authorized recipient, or in a manner approved by the Atomic Energy Commission or a State named in paragraph (16)(c) of this rule.

(12) Notification of incidents.

(a) Immediate notification. Each employer shall immediately notify the Department of Public Health for employees not protected by the Atomic Energy Commission by means of 10 CFR Part 20; paragraph (16)(b) of this rule or the requirements of the laws and regulations of States named in paragraph (16)(c) of this rule, by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:

(i) Exposure of the whole body of any individual of 25 rems or more of radiation; exposure of the skin of the whole body of any individual to 150 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms of any individual to 375 rems or more of radiation; or

(ii) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limit specified for such materials in Table II of Appendix B to 10 CFR Part 20.

(iii) A loss of 1 working week or more of the operation of any facilities affected; or

(iv) Damage to property in excess of \$100,000.

(b) Twenty-four hour notification. Each employer shall within 24 hours following its occurrence notify the Department of Public Health for employees not protected by the Atomic Energy Commission by means of 10 CFR Part 20; paragraph (16)(b) of this rule, or the requirements of the laws and regulations of states named in paragraph (16)(c) of this rule, by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:

(i) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or

(ii) A loss of 1 day or more of the operation of any facilities; or

(iii) Damage to property in excess of \$10,000.

(13) Reports of overexposure and excessive levels and concentrations.

(a) In addition to any notification required by subsection (12) of this rule each employer shall make a report in writing within 30 days to the Department of Public Health for employees not protected by the Atomic Energy Commission by means of 10 CFR Part 20 of each exposure of an individual to radiation or concentrations of radioactive material in excess of any applicable limit in this rule. Each report required under this paragraph shall describe the extent of exposure of persons to radiation or to radioactive material; levels of radiation and concentration of radioactive material involved, the cause of the exposure, levels of concentrations; and corrective steps taken or planned to assure against a recurrence.

(b) In any case where an employer is required pursuant to the provisions of this subsection to report to the Department of Public Health any exposure of an individual to radiation or to concentrations of radioactive material, the employer shall also notify such individual of the nature and extent of exposure. Such notice shall be in writing and shall contain the following statement: "You should preserve this report for future reference."

(14) Records.

(a) Every employer shall maintain records of the radiation exposure of all employees for whom personnel monitoring is required under subsection (4) of this rule and advise each of his employees of his individual exposure on at least an annual basis.

(b) Every employer shall maintain records in the same units used in tables in subsection (2) of this rule and Appendix B to 10 CFR Part 20.

(15) Disclosure to former employee of individual employee's records.

(a) At the request of a former employee an employer shall furnish to the employee a report of the employee's exposure to radiation as shown in records maintained by the employer pursuant to paragraph (14)(a) of this rule. Such report shall be furnished within 30 days from the time the request is made, and shall cover each calendar quarter of the individual's employment involving exposure to radiation or such lesser period as may be requested by the employee. The report shall also include the results of any calculations and analysis of radioactive material deposited in the body of the employee. The report shall be in writing and contain the following statement: "You should preserve this report for future reference."

(b) The former employee's request should include appropriate identifying data, such as social security number and dates and locations of employment.

(16) Atomic Energy Commission licensees--AEC contractors operating AEC plants and facilities--AEC Agreement State licensees or registrants.

(a) Any employer who possesses or uses source material, by-product material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended, under a license issued by the Atomic Energy Commission and in accordance with the requirements of 10 CFR Part 20 shall be deemed to be in compliance with the requirements of this rule with respect to such possession and use.

(b) AEC contractors operating AEC plants and facilities: Any employer who possesses or uses source material, by-product material, special nuclear material, or other radiation sources under a contract with the Atomic Energy Commission for the operation of AEC plants and facilities and in accordance with the standards, procedures, and other requirements for radiation protection established by the Commission for such contract pursuant to the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), shall be deemed to be in compliance with the requirements of this rule with respect to such possession and use.

(c) AEC Agreement State licensees or registrants:

(1) Atomic Energy Act sources. Any employer who possesses or uses source material, by-product material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has either registered such sources with, or is operating under a license issued by, a State which has an agreement in effect with the Atomic Energy Commission pursuant to section 274(b) (42 U.S.C. 2021(b)) of the Atomic Energy Act of 1954, as amended, and in accordance with the requirements of that State's laws and regulations shall be deemed to be in compliance with the radiation requirements of this

rule, insofar as his possession and use of such material is concerned, unless the Secretary of Labor, after conference with the Atomic Energy Commission, shall determine that the State's program for control of these radiation sources is incompatible with the requirements of this rule. Such agreements currently are in effect only in the States of Alabama, Arkansas, California, Kansas, Kentucky, Florida, Mississippi, New Hampshire, New York, North Carolina, Texas, Tennessee, Oregon, Idaho, Arizona, Colorado, Louisiana, Nebraska, Washington, Maryland, North Dakota, South Carolina, and Georgia.

(1i) Other sources. Any employer who possesses or uses radiation sources other than source material, by-product material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has either registered such sources with, or is operating under a license issued by a State which has an agreement in effect with the Atomic Energy Commission pursuant to section 274(b) (42 U.S.C. 2021(b)) of the Atomic Energy Act of 1954, as amended, and in accordance with the requirements of that State's laws and regulations shall be deemed to be in compliance with the radiation requirements of this rule, insofar as his possession and use of such material is concerned, provided the State's program for control of these radiation sources is the subject of a currently effective determination by the United States Department of Labor that such program is compatible with the requirements of this rule. Such determinations currently are in effect only in the States of Alabama, Arkansas, California, Kansas, Kentucky, Florida, Mississippi, New Hampshire, New York, North Carolina, Texas, Tennessee, Oregon, Idaho, Arizona, Colorado, Louisiana, Nebraska, Washington, Maryland, North Dakota, South Carolina, and Georgia. [1910.96]

(17) For machine rooms in pulp, paper and paperboard mills covered by Rule 5001:

Radiation. Special standards regarding the use of radiation equipment shall be posted and followed as required by this rule. [1910.261(k)(32)]

(18) X-ray control in welding, cutting, and brazing, covered by Rule 3240.

(a) Transmission pipeline: X-ray inspection. The use of X-rays and radioactive isotopes for the inspection of welded pipeline joints shall be carried out in conformance with the American National Standard Safety Standard for Non-Medical X-ray and Sealed Gamma-Ray Sources, ANSI Z54.1-1963. [1910.252(g)(1)(vii)]

(b) Mechanical piping systems: X-ray inspection. The use of X-rays and radioactive isotopes for the inspection of welded piping joints shall be in conformance with the American National Standard and Safety Standard for Non-Medical X-ray and Sealed Gamma-Ray Sources. ANSI Z54.1-1963. [1910.252(g)(2)(ii)]

PART III - CONTROL MEASURES FOR HAZARDOUS ATMOSPHERES
(INCLUDING TANK AND VESSEL ENTRY)Rule 3301 Control Methods for Process Spaces Containing a Known or Suspected Non-respirable Atmosphere

(1) Definitions, as used in this rule:

(a) "Atmosphere immediately dangerous to life or health" means a non-respirable atmosphere. [R 325.2405(a)]

(b) "Non-respirable atmosphere" means an atmosphere which contains insufficient oxygen, or an elevated level of contaminants which may render a person incapable of self-rescue. [R 325.2403(d)]

(c) "Process space" means a tunnel, process equipment, shaft or enclosed space. [R 325.2410(f)]

(2) General

(a) Before an unprotected person enters a process space, the atmosphere shall be thoroughly ventilated and tested to determine the presence of a respirable atmosphere. Precautions shall be taken to prevent the creation of non-respirable atmosphere in the process space during the time that a person is inside. [R 325.2430(1)]

(b) In the absence of ventilation or tests, or if a test shows the presence of a non-respirable atmosphere, a person trained in the use of protective equipment shall be provided with an approved supplied-air respirator or self-contained breathing apparatus, safety harness and lifeline before entering the process space. Persons, capable, trained and equipped to perform rescue shall be stationed outside the process space to maintain surveillance over the person entering. [R 325.2430(2)]

Rule 3302 Use of Respirators in Dangerous Atmospheres - General

- Written procedures shall be prepared covering safe use of respirators
- in dangerous atmospheres that might be encountered in normal operations or
- in emergencies. Personnel shall be familiar with these procedures and the available respirators. [1910.134(e)(3)]

(1) In areas where the wearer, with failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional man shall be present. Communications (visual, voice, or signal line) shall be maintained between both or all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and have the proper rescue equipment to be able to assist the other(s) in case of emergency. [1910.134(e)(3)(1)]

(2) When self-contained breathing apparatus or hose masks with blowers are used in atmospheres immediately dangerous to life or health, standby men must be present with suitable rescue equipment. [1910.134(e)(3)(11)]

*Rule 3301
was Revisited
on 10-15-93
with adoption of
the Confined
Space
Standard*

(3) Persons using air-line respirators in atmospheres immediately hazardous to life or health shall be equipped with safety harnesses and safety lines for lifting or removing persons from hazardous atmospheres or other and equivalent provisions for the rescue of persons from hazardous atmospheres shall be used. A standby man or men with suitable self-contained breathing apparatus shall be at the nearest fresh-air base for emergency rescue. [1910.134(e)(3)(iii)]

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LANSING, MI 48909

~~XXXXXXXXXXXX~~ Delbert Rector, Director

June 6, 1991

II-2
C.

NOTICE REGARDING USE OF USED SURFACE CASING

The Supervisor of Wells has become aware of potential risks due to natural occurring radioactive materials (NORM) associated with oil and gas production activities. Those risks and associated concerns were summarized in the December 1990 Supervisor of Wells Advisory. This Advisory identified several areas of increased potential risk and outlined steps to reduce that potential.

Continued sampling and testing have identified pipe scale as a source of NORM. Specifically, scale found on the exterior of intermediate casings has been found to contain elevated levels of NORM. We have found that intermediate pipe with elevated radioactive content has been reused as surface casing on other wells. As a result, the use of used casing as surface casing or as conductor pipe poses a potential risk to the fresh water intervals they penetrate.

Rule 302(b) of Act 61 states in part:
Suitable surface pipe or casing shall be set through the glacial drift and all fresh water occurring below the drift. . .

Given the information gathered to date, used pipe may not be suitable for surface casing; therefore, all drilling permits issued after the date of June 6, 1991, shall require new pipe to be utilized for all conductor and surface casings.

This requirement may be modified following a further assessment of the health risks posed by used surface casing, the establishment of acceptable levels of NORM and the determination of procedures to standardize its measurement.

R. Thomas Segall
Assistant Supervisor of Wells
and Chief
Geological Survey Division
517-334-6923

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

THE REQUEST OF MICHIGAN)
ENVIRONMENTAL TRUST LIMITED,)
MICHIGAN OIL AND GAS ASSOCIATION,) ORDER NO. (A) 14-9-94
ET. AL., FOR THE ADOPTION OF A)
SPECIAL SPACING ORDER FOR ANTRIM)
SHALE FORMATION GAS WELLS IN 22)
NORTHERN MICHIGAN COUNTIES)

OPINION AND ORDER

On November 14 and 15, 1994, January 17 and 18 and February 14, 1995, a contested case hearing was held before the Supervisor of Wells and the Oil And Gas Advisory Committee regarding the above-captioned matter. The hearing was held under the authority of the Supervisor of Wells Act, 1939 PA 61, as amended, MCL 319.1 et seq.; MSA 13.139(1) et seq., and the administrative rules, 1979 AC, R 299.1101 et seq.¹ The hearing was conducted in accordance with the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 et seq.; MSA 3.560 (101) et seq. The purpose of the hearing was to consider the request of Michigan Environmental Trust Limited, et al., for an order pertaining to the need or desirability of adopting a special spacing order for the location and spacing of wells and the development of units or pooled areas in the Antrim Shale Formation (hereafter called "Antrim") in 22 northern Michigan counties.

FINDINGS OF FACT

1. The Parties requested the hearing cover 16 counties in northern Michigan. The scope of the hearing was expanded to 22 counties by the Supervisor, and includes:

Alcona, Alpena, Antrim, Arenac, Bay, Benzie,
Charlevoix, Crawford, Grand Traverse, Iosco, Kalkaska,

¹ By signature of the Governor May 23, 1995, the Supervisor of Wells Act, 1939 PA 61, as amended, MCL 319.1 et seq.; became Part 615 Supervisor of Wells of the Natural Resources and Environmental Protection Act, Act No. 451 of the Public Acts of 1994, as amended.

Lake, Leelanau, Mason, Manistee, Missaukee, Montmorency, Ogemaw, Oscoda, Otsego, Roscommon and Wexford.

Based on the historical development of the Antrim, these counties have the highest concentration of wells and potential for development of Antrim gas.

2. For the purposes of this Order, the Antrim comprises the rock interval from the base of the Berea-Bedford sequence to the top of the Traverse Group and includes all formations correlative to that interval including the Ellsworth Shale of western Michigan.

3. The Antrim is a part of the eastern Devonian shales sequence found throughout much of the Michigan, Appalachian, and Illinois basins. It is an organically rich shale of Devonian Age. In northern Michigan, the Antrim section ranges from 300 to 770 feet in thickness at subsurface depths ranging from less than 500 feet to approximately 1,500 feet. The Antrim is characterized by matrix permeability typically lower than one millidarcy. Extensive fracturing is required to create the necessary pathways for gas migration to the well bore. Economic production of gas is contingent on encountering such fracturing. Well logs show the presence or absence of fracturing is random. One well bore may reveal virtually no natural fractures, while another well less than a mile away may show extensive fracturing throughout the Antrim. Current geological and geophysical means cannot identify fractured areas without drilling test wells. Mr. J. Michael Gatens III, a petroleum engineer for S.A. Holditch & Associates, Inc., testified the Antrim is an unconventional, complex and unique reservoir. His description of the Antrim is:

. . . a low-permeability, organic-rich matrix rock which contains gas in a sorbed state. Free gas also exists in conventional pore space within the shale matrix and in the natural fractures. The shale matrix typically has very low permeability; permeabilities have been measured on the order of 2×10^{-8} md. To achieve commercial production from these formations, natural fractures must exist (as a general rule) which allow the gas to migrate from the very low permeability matrix into the permeable

natural fracture system, which then connect to the well bore and to induced hydraulic fractures created near the well bore.

I find, as a matter of fact, the Antrim is an unconventional, complex, and unique gas reservoir.

4. More than 4,000 Antrim gas wells have been drilled in the geographic area covered by this proceeding. Michigan's Antrim gas development began in 1940 with the Otsego Field in Section 34 of T30N R3W, Bagley Township, Otsego County. The Otsego Field was developed and produced under a special 160-acre spacing order. In the mid-1980s, Antrim gas began to experience significant development, due in part to the federal tax credit in Section 29 of the Internal Revenue Code. This development occurred under the existing 40-acre general rule spacing provisions. In 1992 alone, 1,189 Antrim wells were drilled. Although the federal tax credit ended in 1992, a significant number of wells continue to be permitted and drilled throughout the geographic area covered by these proceedings.

5. During the most recent years, Antrim gas wells have been characteristically, but not exclusively, developed as a group of wells or project basis rather than on an individual well basis. An Antrim gas well is rarely economical when developed individually. An Antrim project would include: 1) several Antrim gas wells; 2) a common gas gathering system; 3) a central production facility where all gas from the project wells is collected, separated, compressed, dehydrated, metered and sold, and; 4) a facility and well where all formation water from the project wells is collected and disposed.

6. Dr. Donald Inman, Deputy Director Region II, Michigan Department of Natural Resources, testified that surface resources and their associated values must be considered within the scheme of orderly development of the Antrim gas resource. He testified agricultural lands, forests, lakes, rivers, streams, wetlands and their associated fish and wildlife are important surface resources which should be considered. Over 70 percent of the land area in these counties is forested. The principal surface impacts come with the installation of wells, production facilities, flow lines, and maintenance roads. These impacts include forest fragmentation, loss of standing timber, disruption of the soil profile, reduction in forest aesthetics due to clearings, erosion and sedimentation impacting watercourses,

infringement on threatened and endangered species habitat, aesthetic and noise pollution, and disruption of wetlands and other sensitive ecosystems. I find, as a matter of fact, minimizing surface impacts to prevent surface waste is a principal factor in considering the proper spacing scheme for development of Antrim gas.

7. In developing a proper spacing scheme it is important to consider the relationship between well density and ultimate recovery of gas. Two well-qualified Antrim reservoir experts, Mr. Marvin J. Schneider, an engineer and team leader for Shell Western E&P, Inc.'s (SWEPI) Antrim gas development, and Mr. Gatens, analyzed the impact of well density on ultimate recovery. Both experts used different data bases and computer reservoir simulators to calculate ultimate gas recovery at different permeabilities and well densities. I find both Messrs. Schneider's and Gatens' evaluations to be essentially the same. Both experts opined, and I find, the closer the well spacing, the greater the gas recovery efficiency.

8. Three witnesses presented evidence regarding the impact of average project well density on the operator's economic rate of return. Mr. Gatens testified there is a substantial increase in economic benefit by decreasing well density from one well per 40 acres to one well per 80 acres. He testified the operator's economics are optimized and virtually flat within an average well density range of 80 to 160 acres per well. Mr. Schneider supports this conclusion based on his study of SWEPI's Albert/Loud project in Montmorency County. For a project of uniformly average wells, or a project of uniformly poor wells, the maximum economic indicator is achieved at an average well density of 120 acres per well. For a project of uniformly good wells, the optimum economic indicator is attained at an average well density of 160 acres per well. Mr. Sidney J. Jansma, Jr., President of Wolverine Oil and Gas Co., Inc., presented evidence demonstrating a 19.9 percent internal rate of return after taxes for a project developed on an average well density of 160 acres per well, and a 21.4 percent internal rate of return after taxes for a project developed at an average well density of 80 acres per well. I find an operator's economic rate of return is maximized and equal anywhere within the well density range between 80 and 160 acres per well.

9. Several of the parties suggested a continuation of 40-acre drilling units, or expressed a preference for 40-acre drilling units in special circumstances. The evidence shows the

development of Antrim gas on 40-acre drilling units results in excessive surface waste. The evidence also shows most Antrim wells will drain an area greater than 40 acres. The record shows well densities in Antrim development is tending toward more acres per well. This trend is attributed to the elimination of the Section 29 tax credit and the operators' increasing sophistication in developing the Antrim Shale. The trend cannot be ignored. The Supervisor rejects all proposals to continue 40-acre drilling units as operators' choice or to protect a 40-acre tract from actual or potential drainage. The Supervisor finds 40-acre drilling units cause waste and the drilling of unnecessary wells.

10. Several Parties supported 160-acre drilling units. The well could be located anywhere within the 160-acre unit but must be at least 330 feet from the unit line. Infill wells would be allowed, but could be located no closer than 990 feet from any other well on the drilling unit. At face value this proposal would seem to provide for one well per 160 acres, but because of the geological nature of the Antrim and using conventional drilling techniques, infill drilling would in fact move towards densities of one well per 80 acres. Spacing at 160 acres per well would provide for more room and flexibility in using lateral drain hole technology. However, to date the use of this technology has been limited. Mr. Gatens testified that in comparing the ultimate recovery of 80-acre spacing to 160-acre spacing, the loss of ultimate recovery of gas in a section of land for a good well (one having 12 millidarcies of effective permeability) would be 1.6 billion cubic feet (BCF); for an average well (one having between 6 and 9 millidarcies of effective permeability) would be 2.2 BCF and 2.8 BCF respectively; and for a poor well, (one having less than 6 millidarcies) would be 2.4 BCF. Mr. Jansma testified that when comparing 80-acre spacing to 160-acre spacing, the increased surface use caused by 80-acre average well density is offset by the fact that 80-acre average well density should result in 16.5 years of production as compared to 23.5 years of production for 160-acre average well density. I find 160-acre spacing would result in significant loss of important natural gas resources and, therefore, would result in underground waste.

11. Mr. Gatens testified if the reservoir rock has poor producing qualities, then 80-acre drilling units are best from a recovery efficiency view point. However, for the 25 percent of the wells which have better reservoir quality, Mr. Gatens favors a drilling unit of 160 acres. Considering only economics and

drainage efficiency, he would choose 120-acre drilling units if forced to make a choice. Given the technical evidence, the optimal spacing will usually fall within a range of 80 to 160 acres per well. Drilling units of 120 acres built on 40-acre quarter-quarter section blocks will not be adopted because this would result in drilling units that would radically deviate from the square or rectangular shaped units common to oil and gas spacing. As a matter of historical application in the development of oil and gas, drilling units built from square 40-acre blocks which can abut one another and can form quadrate units is a fair and equitable approach. I find, using contiguous 40-acre building blocks to form large pooled areas allows for drill location flexibility, lesser well densities, and better use of well completion technology such as lateral drain holes.

12. Several Parties support 80-acre drilling units. Mr. Gatens testified although there was some loss of ultimate recoverable gas at 80 acre spacing as compared to 40-acre spacing, ". . . in terms of recovery efficiency, it is generally between 80 and 120 acres and in fact, in terms of recovery efficiency at comparable high economic performance, 80 acres is generally superior for the cases we investigated." The fact that 80-acre spacing would significantly reduce surface waste as compared to 40-acre spacing is uncontested.

There is a conceptual problem, from a purely underground perspective, with a rectangular 80-acre drilling unit. However, the concept of an 80-acre rectangular drilling unit has enjoyed a long and fruitful history under Special Order 1-73, and is entirely workable for Antrim gas development. In fact, there is a distinct advantage to rectangular drilling units in the northern Antrim play. The flexibility offered in electing a stand-up or lay-down 80-acre drilling unit allows the operator of a project to configure the drilling units to accommodate many of the optimal surface locations that would otherwise be prohibited by the interior hard lines created under rigid 40-acre drilling units. I find, in most cases, 80 acres is the maximum area which may be efficiently and economically drained by one Antrim gas well. I find, 80-acre spacing for development of Antrim Gas will minimize both surface and underground waste.

13. Testimony was consistent that 330 feet should be the set back distance of the bottom hole location of any Antrim gas well or extent of any lateral well drain hole. I find, the bottom hole location of any Antrim gas well bore, or the location

of the end point of any lateral drain hole, should be no closer than 330 feet to a unit line to protect correlative rights.

14. The use of lateral drain hole technology for the development of Antrim gas is limited. Mr. Tinker of SWEPI suggested the Supervisor be consistent with a previous order, Order No. 10-12-87, providing the completion of lateral drain holes does not require a permit. That order also grants an unlimited number of lateral drain holes; under the facts and circumstances of this case, that grant is too broad. The potential for multiple drain holes from one well will increase over time and there is a need to provide reasonable controls to assure the protection of correlative rights and to minimize well communication. I find two (2) lateral drain holes within the Antrim may be completed from any one well bore without a permit or a hearing provided the end point of the drain hole is no closer than 330 feet of the drilling unit line as shown on a well bore survey identifying the course and end point of the drain, and the operator obtains a Change of Well Status approval from the Supervisor. Additional drain holes may be allowed only after a hearing before the Supervisor.

15. As discussed in Findings of Fact 5, Antrim gas is usually developed on a project basis rather than on a well-by-well basis. A typical Antrim project involves combining multiple tracts of land by private agreement into large development areas. These Antrim projects range in size from 400 to 9,000 acres. Many projects are between 1,200 and 2,400 acres. Antrim projects are assembled, in part, based on the landowners, lessors, and lessees agreeing to sign a private agreement. Such an agreement essentially establishes the Antrim project area. As a result, the geographic descriptions of many Antrim projects are highly irregular. The operator develops an Antrim project by applying for drilling permits on 40-acre drilling units (pursuant to existing spacing) located within the Antrim project area. Neither the agreement nor the geographic description of the Antrim project is reviewed or approved. Not every 40-acre drilling unit inside an Antrim project is actually drilled. Production is shared with owners of undrilled lands inside the Antrim project. The net result of such an Antrim project is a lower well density (a more recent density near 100 acres per well) than would be developed strictly on a 40-acre drilling unit basis. It is recent common practice of the Geological Survey Division to review applications of proposed wells in an Antrim project on a group basis rather than on a well-by-well basis. The operator's plan normally includes the proposed location of

wells, access roads, flow lines, and associated processing equipment. I find the continued practice of reviewing Antrim gas well applications on a project basis, rather than on a well-by-well basis, will minimize surface impacts thereby minimizing surface waste. I find, as a matter of fact, because of the uniqueness of the Antrim and the manner in which it is developed, a large development area which is approved by the Supervisor can be considered a "pool" as defined in Act No. 61.

16. Among the proposals presented to the Supervisor is the concept of the "Antrim Developed Area" (ADA). An ADA would consist of an area of contiguous quarter-quarter sections of land which have been voluntarily or compulsorily pooled. Presuming 80-acre spacing is adopted, an operator could exclude lands within the ADA boundary ("islands") if the excluded lands are comprised of two or more contiguous quarter-quarter sections. Proponents of the ADA suggest that the Supervisor could certify an ADA upon the submission of documentation showing the outer boundary of the ADA, showing that the interests within the ADA were voluntarily or compulsorily pooled (except excluded "islands" as previously noted), and showing that the well density within the ADA is at most one well per 80 acres. If certified, then setbacks resulting from individual drilling units within the ADA (except "islands") would be automatically abrogated. The operator would be permitted to drill additional wells at any location within the ADA no closer than 330 feet from an ADA boundary or no closer than 1,200 feet between wells, until the average density reached one well per 80 acres. There were various suggestions, ranging from 990 to 1,320 feet, relating to the minimum distance that should be allowed between bottom hole locations of wells. The maximum distance possible should be adopted to minimize the potential of well communication. Several witnesses testified that because of the unique productive characteristics of the Antrim Shale and the potential to minimize surface waste, a special regulatory approach such as the ADA must be adopted. Dr. Inman testified that to reduce surface impacts it is important to minimize the overall well density and ensure orderly development. He supports the concept of developing project areas. Dr. Inman further supports the elimination of project area interior setbacks which result from individual drilling requirements of each drilling unit. He testified the elimination of interior setbacks would provide for even greater flexibility in locating wells, thus significantly reducing surface impacts. I find, as a matter of fact, developing Antrim gas as a group of wells or a project basis provides for limiting well density and minimizing the number of associated surface

facilities, thus minimizing surface waste. However, the ADA proposal is rejected for the following reasons. First, the ADA 1,200 foot minimum distance between wells requirement could result in wells being too clustered or concentrated and increases the potential for well communication. Second, the ADA proposal has the potential to exclude blocks of land 80 acres in size resulting in the creation of "islands" which may not be economical to produce by themselves. As the ADA is developed and produced, the potential for draining gas from under these "islands" increases significantly. This result diminishes the protection of correlative rights.

17. I find the ADA concept meets the intent of a "uniform spacing plan" (USP) as provided in Act No. 61 and provides for maximizing gas recovery and minimizing surface and underground waste. I find it is reasonably necessary to provide flexibility in the locating of Antrim gas wells in the 22 counties because topographical and other surface conditions make drilling at a regular location unduly burdensome and imminently threatening to water and other natural resources. I find, to prevent waste, an operator should have the flexibility, other than the more rigid 80-acre drilling units, to develop a USP based on the following criteria:

- A. That it is developed using contiguous (common side) 40-acre building blocks.
- B. That it consists of voluntarily or compulsorily pooled tracts all under the operator's control;
- C. That the distance between bottom hole location of wells is no less than 1,320 feet;
- D. That it ensures well density within the USP is no less than 80 acres per one well, and;
- E. That it has bottom hole location of wells located no closer than 330 feet to the USP boundary.

I find that the elimination of USP interior setbacks resulting from individual drilling unit requirements would

provide for greater flexibility in locating wells, thus significantly reducing surface and underground waste.

18. Various proposals were made for exempting from the authority of this Order those lands previously developed on 40-acre drilling units. I find drilling units for wells which received a permit prior to the effective date of this Order are exempt. All drilling permits issued for 40-acre drilling units before the effective date of this Order may continue as established drilling units. Such wells may be drilled and the drilling unit shall be the 40 acres as identified by the drilling permit application.

Well permit applications filed prior to the effective date of this Order (hereafter referred to as "pending applications") may very well fit into the established spacing or USP established in this Order. I find the end result of any permit issued from a pending application must ultimately comply with spacing and other requirements of this Order. I find an operator who has a pending application may:

1. Withdraw the application;
2. Amend the application to comply with the spacing and other provisions of this Order, or;
3. Elect to allow the pending application to be processed as submitted (hereafter referred to as an "Item 3 Well").

Pursuant to existing requirements and procedures, any well permit issued is automatically terminated one year after issuance if the well is not drilled; the Supervisor after reviewing well data and classifying a well as a gas well may transfer the regulation of gas production from a gas well to the Michigan Public Service Commission (MPSC); the Supervisor may allow a permittee to test gas wells before being transferred to the MPSC; and wells that are dry or have not produced in 12 consecutive months must be plugged. Pursuant to the statute, the Supervisor may issue "Certificates of Clearance" and declare gas produced in violation of the statute, rules, or orders as "illegal gas." There must be administrative safeguards for an "Item 3 Well" to ensure compliance with existing statute and rule requirements and timely compliance with this Order. I find that:

- A. An "Item 3 Well" permit is automatically terminated if not drilled within one (1) year of the date of issuance.
- B. An "Item 3 Well" which has not complied with the spacing and other provisions of this order within 24 months of reaching total depth shall be plugged unless the Supervisor grants temporary abandonment status.
- C. A Permittee shall not produce, transport, or sell gas from an "Item 3 Well" without a Certificate of Clearance issued by the Supervisor. Any gas produced without a Certificate of Clearance is declared illegal gas.
- D. The Supervisor will not transfer regulation of gas production of an "Item 3 Well" to the MPSC until the well is in compliance with the spacing and other provisions established by this Order.
- E. "Item 3 Wells" shall be allowed a one-time production test of up to 30 consecutive days.

19. Certain Parties requested the Supervisor "announce" in this Order the appropriate compensation for the risk of a dry hole to be applied in connection with future Antrim gas well compulsory pooling proceedings. This suggestion must be rejected because every compulsory pooling proceeding is factually specific and the appropriate compensation for the risk of a dry hole is determined upon the facts of each case.

CONCLUSIONS OF LAW

1. Section 13 of Act No. 61 states, in part, as follows:

The drilling of unnecessary wells is hereby declared waste as such wells create fire and other hazards conducive to waste, and

unnecessarily increase the production cost of oil and gas to the operator, and thus also unnecessarily increase the cost of the products to the ultimate consumer.

To prevent the drilling of unnecessary wells the supervisor . . . may fix a drilling unit for each pool. A drilling unit, as contemplated herein, means the maximum area which may be efficiently and economically drained by 1 well and such unit shall constitute a developed area as long as a well is located thereon which is capable of producing the economically recoverable oil or gas thereunder. MCL 319.13.

2. Subject to limited exceptions, the drilling unit size for Antrim gas wells in the 22 counties subject to this proceeding is set at 40-acre quarter-quarter sections of land under Rule 1979 AC, R 299.1201. Based upon the Findings of Fact, I conclude, as a Matter of Law, that 40-acre drilling units for Antrim gas wells create waste in the drilling of unnecessary wells and in excessive surface disturbance.

3. I conclude, as a Matter of Law, in most cases the maximum area which may be efficiently and economically drained by one Antrim gas well is 80 acres.

4. I conclude, as a Matter of Law, an area developed under a Uniform Spacing Plan (USP) can be considered a "pool" pursuant to Act No. 61. "Pool" means an underground reservoir containing a common accumulation of oil or gas or both. MCL 319.2(d).

5. Section 6(a) of Act No. 61 directs the Supervisor of Wells to prevent the waste prohibited by Act No. 61. To accomplish this purpose, the Supervisor is empowered to:

make and enforce rules . . . issue orders and instructions necessary to enforce such rules and to do whatever may be necessary with respect to the subject matter stated herein to carry out the purposes of this act, whether or not indicated, specified, or

enumerated in this or any other section hereof. MCL 319.6(a).

6. Section 6(j) of Act No. 61 empowers the Supervisor to fix the spacing of wells. MCL 319.(6)(j).

7. I conclude, as a Matter of Law, Antrim gas developed pursuant to a "Uniform Spacing Plan" prevents economic, surface, and underground waste.

8. Section 13 of Act No. 61 authorizes the Supervisor to approve exceptions to a uniform spacing pattern as may be reasonably necessary, and after notice and hearing, where topographical or other conditions make drilling at a regular location unduly burdensome or imminently threatening to water or other natural resources. Based on the Findings of Fact, I conclude it is reasonably necessary to provide exceptions to a uniform spacing pattern. I conclude, USPs as provided in this Order, are reasonably necessary. I conclude the elimination of "hard lines" within an area under an approved USP will prevent surface waste by allowing the operator more flexibility in avoiding environmentally sensitive surface features.

9. Section 13 of Act No. 61 provides in part:

The pooling of properties or parts thereof shall be permitted, and, if not agreed upon, the supervisor . . . may require such pooling in any case when and to the extent that the smallness or shape of a separately owned tract or tracts would, under the enforcement of a uniform spacing plan or proration or drilling unit, otherwise deprive or tend to deprive the owner of such tract of the opportunity to recover or receive his just and equitable share of the oil and gas and gas energy in the pool. MCL 319.13.

I conclude, as a Matter of Law, an operator having unleased mineral interests within a proposed USP may utilize the provisions of section 13 of Act No. 61 to require pooling of these interests.

10. Section 14 of Act No. 61 provides: "The supervisor shall have authority to issue certificates of clearance or tenders whenever the same may be required to effectuate the purposes of this act." MCL 319.14.

11. Section 15 of Act No. 61 provides:

It shall be unlawful for any person to sell, purchase, acquire, transport, refine, process or otherwise handle or dispose of any illegal oil or gas in whole or in part, or any illegal product of oil or gas. A penalty or forfeiture shall not be imposed on account of any such act until certificates of clearance or tenders have been required by the supervisor as provided in section 14. MCL 319.15.

12. Section 6(o) of Act No. 61 authorizes the Supervisor to make rules for the classification of wells as oil or gas wells. MCL 319.6(o).

DETERMINATION AND ORDER

WHEREFORE, based on the Findings of Fact and Conclusions of Law, the Supervisor of Wells finds a special spacing order is necessary to prevent waste.

NOW THEREFORE IT IS ORDERED:

1. This Order applies to the following counties: Alcona, Alpena, Antrim, Arenac, Bay, Benzie, Charlevoix, Crawford, Grand Traverse, Iosco, Kalkaska, Lake, Leelanau, Mason, Manistee, Missaukee, Montmorency, Ogemaw, Oscoda, Otsego, Roscommon, and Wexford.

2. After the effective date of this Order, the following spacing options are in effect:

A. The drilling unit established shall be on eighty (80) acres, more or less, formed by combining blocks of two governmental surveyed quarter-

quarter sections of land with one common boundary of approximately 1,320 feet, with allowances being made for the differences in the size and shape of sections as indicated by official governmental survey plats. The bottom hole location of the well bore shall not be closer than 330 feet from the drilling unit line. A declaration of the unit must be indicated on the application for a drilling permit. An operator may designate whether these 80-acre units will be stand up or lay down.

- B. For the purpose of providing greater flexibility in locating wells to minimize surface waste and drilling of unnecessary wells, an operator may develop a uniform spacing plan (USP) approved by the Supervisor or unitize pursuant to the Michigan unitization law.

3. A USP may be approved and considered a pool if:

- A. The proposed USP is formed by combining blocks of governmental surveyed quarter-quarter sections of land with one common boundary of approximately 1,320 feet with allowances being made for the differences in the size and shape of sections as indicated by official governmental survey plats.
- B. The operator files a certified statement that all oil and gas mineral ownership within the proposed USP boundary is owned or leased by the operator.

4. The following requirements apply to drilling permits and the location of wells within an approved USP:

- A. The operator of the USP is the only person eligible for a permit to drill and operate an Antrim gas well within the USP.
- B. The course or endpoint of a well bore or lateral drain hole within the Antrim shall be no closer than 330 feet of a USP boundary.
- C. The distance between bottom hole locations for standard vertical or conventional directional drilled wells within a USP shall be no less than 1,320 feet. Lateral drain holes drilled for completion purposes in conjunction with these wells are excluded from this requirement.
- D. The number of wells within the USP shall be limited to the total number of acres in the USP divided by 80.
- E. The operator shall develop a USP as a project consisting of several wells. A project plan shall be submitted with the permit applications. The project plan shall show, at a minimum, the proposed location of the wells, flow lines, access roads, and associated primary processing facilities. Areas where access roads and flow lines cross surface water, and regulated wetlands shall be identified.
- F. Changes to a USP boundary shall require written approval by the Supervisor.

- G. An operator having unleased mineral interests within a proposed USP may utilize the compulsory pooling provisions in Section 13 of Act No. 61 by petitioning for a hearing.
- H. Once a USP is approved, all interior hardline drilling unit boundaries are abrogated.

5. Two (2) lateral drain holes within the Antrim may be completed from any well bore without permit or hearing provided the drain hole does not extend closer than 330 feet of the drilling unit or USP boundary. Such drain holes must receive "change of well status" approval prior to beginning lateral drain hole operations. A survey identifying the course and end point of the drain hole accompanied by all wireline, strata evaluation, and other logs shall be filed with the Supervisor within 60 days of completion of a lateral drain hole. In accordance with existing rule, a well shall not be produced until these records have been filed with the Supervisor.

6. All drilling permits issued for units established before the effective date of this Order may continue as established. Such wells may be drilled and the drilling unit shall be appropriately identified by the drilling permit application. Drilling units established by other previous orders shall continue pursuant to those orders. However, any of these pre-permitted or established drilling units that are incorporated into an approved USP shall be included in calculating the well density limitation set by paragraph 4(D) previously noted.

7. An operator who has an Antrim well permit application pending at the effective date of this Order may elect to:

- A. Withdraw the application;
- B. Amend the application to comply with spacing and other provisions of this Order, or;
- C. Allow the pending application to be processed as an "Item 3 Well" as detailed in section 18 of the Findings of Fact. An "Item 3 Well" permit is automatically terminated if not drilled within 12 months of the date of issuance. An "Item 3 Well" which has not complied with the spacing and other provisions of this order within 24 months of reaching total depth shall be plugged unless the Supervisor grants temporary abandonment status. A Permittee shall not produce, transport, or sell gas from an "Item 3 Well" without a Certificate of Clearance issued by the Supervisor. Any gas produced without a Certificate of Clearance is declared illegal gas. The Supervisor will not transfer regulation of gas production of an "Item 3 Well" to the MPSC until the well is in compliance with the spacing and other provisions established by this Order. An "Item 3 Well" shall be allowed a one-time production test of up to 30 consecutive days.

8. Exceptions to the spacing and location requirements of this Order may be granted after notice and hearing.

DATE: 6/20/95


R. THOMAS SEGALL
ASSISTANT SUPERVISOR OF WELLS

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

THE REQUEST OF MICHIGAN ENVIRONMENTAL)
TRUST LIMITED, MICHIGAN OIL AND GAS)
ASSOCIATION, ET AL., FOR THE ADOPTION OF) ORDER NO. (A) 14-9-94
A SPECIAL SPACING ORDER FOR ANTRIM SHALE)
FORMATION GAS WELLS IN 22 NORTHERN)
MICHIGAN COUNTIES.)

SECOND AMENDED OPINION AND ORDER

Order No. (A) 14-9-94 was originally issued in 1995. On November 14 and 15, 1994, January 17 and 18, 1995, and February 14, 1995, a contested case hearing was held before the Supervisor of Wells (Supervisor) and the Oil and Gas Advisory Committee regarding the above-captioned matter. The hearing was held under the authority of the Supervisor of Wells Act, 1939 PA 61, as amended, MCL 319.1 et seq.; MSA 13.139(1) et seq., and the administrative rules, 1979 AC, R 299.1101 et seq.¹ The hearing was conducted in accordance with the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 et seq.; MSA 3.560(101) et seq. The purpose of the hearing was to consider the request of Michigan Environmental Trust Limited, et al., for an order pertaining to the need or desirability of adopting a special spacing order for the location and spacing of wells and the development of units or pooled areas in the Antrim Shale Formation in 22 northern Michigan counties. Order No. (A) 14-9-94 was signed by Assistant Supervisor of Wells, R. Thomas Segall on June 20, 1995 and was given immediate effect.

Order No. (A) 14-9-94 was amended in 1999. On December 11, 1998, a contested case hearing was held before the Supervisor and the Oil and Gas Advisory Committee pursuant to Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); MCL 324.61501 et seq.; the administrative rules, 1996 AACRS, R 324.101 et seq., and Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 et seq.; MSA 3.560(101) et seq. The purpose of the hearing was to consider the Petition of Trendwell Energy Corporation to drill more than two lateral

¹ By signature of the Governor May 23, 1995, the Supervisor of Wells Act, 1939 PA 61, as amended, MCL 319.1 et seq.; became Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).

drainholes per well bore. The Supervisor enlarged the scope of the hearing to consider a statewide amendment to Order No. (A) 14-9-94.

Order No. (A) 14-9-94 was amended by Order No. (A) 20-12-98, issued March 9, 1999. In Order No. (A) 14-9-94, the Supervisor found two (2) lateral drainholes within the Antrim may be completed from any one well bore without a permit or a hearing provided the end point of the drainhole is no closer than 330 feet of the drilling unit line as shown on a well bore survey identifying the course and end point of the drain, and the operator obtains a Change of Well Status approval from the Supervisor. The original order stated additional drainholes would be allowed only after a hearing before the Supervisor. In Order No. (A) 20-12-98, the Supervisor found that more than two lateral drainholes drilled from the same well bore will not result in wasteful communication between wells and will not interfere with correlative rights of adjoining property owners. Section 5, Determination and Order, Order No. (A) 14-9-94 was amended in its entirety as follows:

5. Multiple lateral drainholes within the Antrim Shale Formation may be completed from any well bore, without obtaining an additional drilling permit, provided no lateral drainhole shall extend closer than 330 feet to the drilling unit or USP boundary, and each additional lateral drainhole shall receive "change of well status" approval prior to beginning lateral drainhole operations. Except as provided below, a survey identifying the course and end point of the drainhole, all wire line logs, strata evaluation logs, and other logs shall be filed with the Supervisor within 60 days of completion of a lateral drainhole. In accordance with the existing rules, a well shall not be produced until these records have been filed with the Supervisor. The Supervisor shall allow a lateral drainhole to be drilled and utilized without requiring a directional survey if the Supervisor or the authorized representative of the Supervisor grants an exemption in the Permit to Drill and Operate (for new wells) or the Application to Change Well Status (for existing wells), and the operator or his agent certifies that the length of the lateral drainhole does not exceed the distance from the vertical well bore to the closest point which is 330 feet from the nearest drilling unit or USP boundary.

On April 23, 2002, a contested case hearing was held before the Supervisor, and the Oil and Gas Advisory Committee pursuant to Part 615 of the NREPA, its administrative rules, and the Administrative Procedures Act, 1994 PA 451, as amended (NREPA); MCL 324.61501 et seq., the administrative rules, 1996 AACRS, 2001 MR 2, R 324.101 et seq., and the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 et seq.; MSA 3.560(101) et seq. The

hearing was initiated by the Supervisor to receive testimony and evidence pertaining to the need or desirability of issuing an order amending Order No. (A) 14-9-94 and Order No. (A) 10-12-87. The purpose of the hearing was to consider expanding the rock interval subject to Order No. (A) 14-9-94 and Order No. (A) 10-12-87 to include the interval from the top of the Sunbury Shale Formation to the top of the Antrim Shale Formation and equivalent.

Timely answers to the Notice of Hearing on the April 23, 2002 hearing were filed by MCN Oil & Gas Company, Trendwell Energy Corporation, Ward Lake Energy and Muskegon Development Company. Staff of the Geological Survey Division (GSD) of the Department of Environmental Quality (DEQ) presented evidence in support of amending this Order and Order No. (A) 10-12-87. MCN Oil & Gas Company, Trendwell Energy Corporation, and Ward Lake Energy participating as full parties through their attorney, Mr. Gary Worman, also presented evidence in support of the proposed amendments. Representatives of Muskegon Development Company and T-Rex Resources made statements in support of the proposed amendments. No parties appeared in opposition to the proposed amendments.

FINDINGS OF FACT

1. In Order No. (A) 14-9-94, the Supervisor made the following Findings, which are reaffirmed and incorporated in this Second Amended Opinion and Order:

a. For the purposes of this Order, the Antrim comprises the rock interval from the base of the Berea-Bedford sequence to the top of the Traverse Group and includes all formations correlative to that interval including the Ellsworth Shale of western Michigan. Section 2, Findings of Fact, Opinion and Order No. (A) 14-9-94.

b. The Antrim is a part of the eastern Devonian shales sequence found throughout much of the Michigan, Appalachian, and Illinois basins. It is an organically rich shale of Devonian Age. In northern Michigan, the Antrim section ranges from 300 to 770 feet in thickness at subsurface depths ranging from less than 500 feet to approximately 1,500 feet. The Antrim is characterized by matrix permeability typically lower than one millidarcy. Extensive fracturing is required to create the necessary pathways for gas migration to the well bore. Economic production of gas is contingent on encountering such fracturing. Well logs show the presence or absence of fracturing is random. One well bore may reveal virtually no natural fractures, while

another well less than a mile away may show extensive fracturing throughout the Antrim. Current geological and geophysical means cannot identify fractured areas without drilling test wells. Mr. J. Michael Gatens III, a petroleum engineer for S.A. Holditch & Associates, Inc., testified the Antrim is an unconventional, complex and unique reservoir. His description of the Antrim is:

. . . a low-permeability, organic-rich matrix rock which contains gas in a sorbed state. Free gas also exists in conventional pore space within the shale matrix and in the natural fractures. The shale matrix typically has very low permeability; permeabilities have been measured on the order of 2×10^{-8} md. To achieve commercial production from these formations, natural fractures must exist (as a general rule) which allow the gas to migrate from the very low permeability matrix into the permeable natural fracture system, which then connect to the well bore and to induced hydraulic fractures created near the well bore.

I find, as a matter of fact, the Antrim is an unconventional, complex, and unique gas reservoir. Section 3, Findings of Fact, Opinion and Order No. (A) 14-9-94

2. At the April 23, 2002 hearing, GSD staff presented evidence in support of the proposed amendment through the testimony of Mr. Rick Henderson, Cadillac District Supervisor; Mr. D. Michael Bricker, Petroleum Geology and Production Unit Supervisor; and Mr. Thomas Wellman, Permit and Bonding Unit Supervisor.

a. Upon being sworn, Mr. Henderson testified:

(i) An Application for Change of Well Status was received from Dominion Energy in December 2001, stating the applicant intended to perforate the "upper Antrim" Formation. Upon review it was discovered the formations to be perforated were actually the Sunbury Shale and the Bedford Shale, and the application was subsequently denied.

(ii) An investigation by Cadillac District Staff found over 50 Antrim Shale Formation wells have been completed in the Sunbury

Shale or Berea Bedford. This number did not include wells originally completed in the Sunbury Shale or Berea Bedford zones.

(iii) Since December 2001, the Cadillac District Office has received approximately 20 applications to Change Well Status in the Sunbury Shale or Berea Bedford zones.

(iv) Amending Order No. (A) 10-12-87 and Order No. (A) 14-9-94 to include the Sunbury Shale and Berea Bedford would allow wells already drilled to be completed in the Sunbury Shale or Berea Bedford, will prevent waste, and will cause no economic or environmental harm.

(v) In the 50 plus wells that have been completed in the Sunbury above the Antrim, there have not been any problems. The shales of the Sunbury and Berea Bedford are shallow and behave much the same way as does the Antrim Shale; therefore, there should not be any problems.

b. Upon being sworn, Mr. Bricker testified:

(i) The Stratigraphic Nomenclature for Michigan (Exhibit 4) shows the Sunbury Shale as a separate formation above the Antrim Shale Formation.

(ii) Exhibit 6 is an electric log showing the original completion of a well in the Sunbury Shale Formation. The electric log shows completions in the normal Antrim zones of the Lachine Member and Norwood Member but also the Sunbury Shale and the Upper Antrim Member. This electric log demonstrates that even on original completions, not recompletions, these wells are being completed in zones other than strictly the Antrim Shale.

(iii) The inclusion of the interval between the Sunbury Shale and the Antrim Shale should apply only to gas wells, because the drainage characteristics between oil and gas are considerably different.

c. Upon being sworn, Mr. Wellman testified:

(i) Except for existing Berea fields in the subject counties, wells completed above the Antrim Shale Formation are subject to the general spacing provisions of R 324.301. Berea fields are spaced either on 10 acre units or have specific spacing orders.

(ii) Approximately 200 wells were found to be perforated above the Antrim Shale Formation.

(iii) The majority of the 10 acre spaced Berea fields were oil fields.

3. Mr. Robert Butka, Certified Petroleum Geologist, testified the Sunbury Shale is an organic rich black shale similar to the black Antrim Shales and should be included in orders addressing the Antrim Shale Formation with the exception of the Berea Sandstone, which is distinct from the shale reservoirs. Excluding sandstone from the Order would prevent waste by allowing shale gas to be produced from existing Antrim gas well bores and not restrict potential Berea development.

4. Mr. John G. Wilkinson, Senior Engineer, Ward Lake Energy testified reserves of between 270 and 450 billion cubic feet (Bcf) of gas are available in the upper shale formations, including the Bedford Shale, Sunbury Shale and Upper Antrim Formations. He further stated it would not be economic to drill new wells to recover resources from the Sunbury Shale, Bedford Shale and Upper Antrim Formations.

5. Mr. Michael Mesbergen of Muskegon Development Company and Mr. Dan McGuire of T-Rex Resources made statements in support of including the Sunbury Shale Formation with the Antrim Shale Formation in amendments to this Order and Order No. (A) 10-12-87.

6. I find the Sunbury Shale, Ellsworth Shale, and Bedford Shale Formations are sufficiently similar in characteristics to the Antrim Shale Formation and should be included in this Order and Order No. (A) 10-12-87.

7. I find the rock interval subject to this Order and Order No. (A) 10-12-87 should be expanded to include the interval from the top of the Sunbury Shale Formation to the top of the Antrim Shale Formation and equivalent, excluding the Berea Sandstone Formation.

8. I find the Berea Sandstone Formation means a fine-grained sandstone, some siltstone and shale, about 50 feet thick ranging upward to 100 feet thick (15.2-30.5 meters) in eastern and central Michigan, as described in the Stratigraphic Lexicon for Michigan (Exhibit 7).

CONCLUSIONS OF LAW

1. Section 61506(a) of Part 615 of the NREPA provides that the Supervisor shall prevent waste. To accomplish this purpose, the Supervisor is empowered:

To promulgate and enforce rules, issue orders and instructions necessary to enforce the rules, and to do whatever may be necessary with respect to the subject matter stated in this part to implement this part, whether or not indicated, specified, or enumerated in this or any other section of this part. MCL 324.61506(a)

2. Section 61513(2) and (3) of Part 615 of the NREPA states:

(2) To prevent the drilling of unnecessary wells, the supervisor may establish a drilling unit for each pool. A drilling unit, as described in this subsection, is the maximum area that may be efficiently and economically drained by 1 well. A drilling unit constitutes a developed area if a well is located on the drilling unit that is capable of producing the economically recoverable oil or gas under the unit. Each well permitted to be drilled upon any drilling unit shall be located in the approximate center of the drilling unit, or at such other location on the drilling unit as may be necessary to conform to a uniform well spacing pattern as adopted and promulgated by the supervisor after due notice and public hearing, as provided in this part. MCL 324.61513(2)

(3) The drilling of unnecessary wells is hereby declared waste because unnecessary wells create fire and other hazards conducive to waste, and unnecessarily increase the production cost of oil and gas to the operator, and therefore also unnecessarily increase the cost of the products to the ultimate consumer. MCL 324.61513(3)

3. R 324.302 of the administrative rules of Part 615 of the NREPA states:

The development of an oil or gas field after the completion of a discovery well may warrant the adoption of a drilling unit and well spacing pattern other than as specified in R 324.301. An interested person may request, or the supervisor may schedule, a hearing pursuant to part 12 of

these rules to consider the need or desirability of adopting a special spacing order to apply to a designated area, field, pool, or geological strata. The drilling unit established by the special spacing order may be smaller or larger than the basic 40-acre unit pursuant to R 324.301(1)(a). 1996 AACCS, R 324.302

4. The Supervisor has jurisdiction over the subject matter and the persons interested therein. Due notice of the time, place and purpose of the hearing was given as required by law, and all interested parties were afforded an opportunity to be heard.

DETERMINATION AND ORDER

Based on the Findings of Fact and Conclusions of Law and in accordance with the recommendation of the Oil and Gas Advisory Committee, the Supervisor of Wells finds that an amendment to Order No. (A) 14-9-94 is necessary and desirable to prevent waste.

NOW, THEREFORE, IT IS ORDERED:

1. The rock interval subject to this Order is the interval from the top of the Sunbury Shale Formation to the base of the Antrim Shale Formation and includes all formations correlative to that interval, excluding the Berea Sandstone Formation.
2. All other provisions of the original Order No. (A) 14-9-94 are reaffirmed.
3. The Supervisor of Wells retains jurisdiction and any amendments or exceptions to the spacing and location requirements of this Order shall be by Order of the Supervisor of Wells after notice and hearing.

DATE: 7-2-02


HAROLD R. FITCH
ASSISTANT SUPERVISOR OF WELLS
Geological Survey Division
P.O. Box 30256
Lansing, MI 48909

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

THE PETITION OF TRENDWELL ENERGY)
CORPORATION FOR AN ORDER FROM THE)
SUPERVISOR OF WELLS ALLOWING MULTIPLE)
LATERAL DRAINHOLES IN THE SAME WELL) ORDER NO. (A) 20-12-98
BORE AS AN EXCEPTION TO ORDER NO. (A))
14-9-94. THE WELL IS LOCATED IN THE)
SW 1/4 OF SECTION 17, T29N, R2E,)
ALBERT TOWNSHIP, MONTMORENCY COUNTY,)
MICHIGAN.

OPINION AND ORDER

On December 11, 1998, a contested case hearing was held before the Supervisor of Wells (Supervisor) pursuant to Part 615, Supervisor of Wells, Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); MCL 324.61501 et seq., the administrative rules, 1996 AACS, R 324.101 et seq., and the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 et seq.; MSA 3.560 (101) et seq. The purpose of the hearing was to consider the Petition of Trendwell Energy Corporation (Petitioner). The Oil and Gas Advisory Committee was present at the Supervisor's request to give advice regarding this matter.

By Petition dated October 5, 1998, Petitioner requested an exception to Order No. (A) 14-9-94 in the form of an Order allowing multiple lateral drainholes in the same well bore, in order to effectively drain the Antrim Shale Formation. The well to be utilized is the State Albert #3-17, located in the NW 1/4 of SE 1/4 of SW 1/4, Section 17, T29N, R2E, Albert Township, Montmorency County, Michigan. The Supervisor voluntarily expanded the scope of the hearing pursuant to R 324.1204(5) to include those counties covered by Order No. (A) 14-9-94:

Alcona, Alpena, Antrim, Arenac, Bay, Benzie,
Charlevoix, Crawford, Grand Traverse, Iosco, Kalkaska,
Lake, Leelanau, Mason, Manistee, Missaukee,
Montmorency, Ogemaw, Oscoda, Otsego, Roscommon, and
Wexford.

Timely answers to the Petition were filed by Shell Western E & P, Inc. (SWEPI), Muskegon Development Company and Ward Lake

Energy. Ward Lake Energy did not participate in the hearing but submitted a statement in support of the Petition provided each drainhole honors a 330 foot setback from the drilling unit or Uniform Spacing Plan (USP) boundary. Muskegon Development Company participated as a full party, making a statement in opposition of the Petition as an operator of wells adjacent to the State Albert #3-17, and cross-examining Petitioner's witnesses, but did not present any witnesses. SWEPI also participated as a full party, making a statement in support of the Petition, but did not present or cross-examine witnesses.

FINDINGS OF FACT

1. Petitioner presented the testimony of Mr. Larry Keelian, consultant for Petitioner. Upon being sworn in, Mr. Keelian testified:

a. Petitioner seeks to drill four lateral drainholes (LDHs) from the well bore of the State Albert #3-17 well. The well currently is not in sufficient communication with the fracture system and is therefore, a poor producer. Initially, Petitioner will drill two LDHs in northwest and southeast directions in the Norwood section of the Antrim and two LDHs in the Lachine section of the Antrim, also in northwest and southeast directions, using the hydrojet drilling technology. Petitioner intends to evaluate the results of completing four LDHs to determine whether additional LDHs will be necessary to adequately and efficiently drain the Antrim Formation.

b. The well is located at the center of the 40-acre drilling unit and none of the four lateral drainholes will be longer than 325 feet from the location of the existing vertical well bore of the State Albert #3-17 well. The exact depth of the four drainholes will be determined after a tracer survey has been run to determine the best permeable zones along the well bore.

c. Petitioner is requesting an exception to Order No. (A) 14-9-94 to drill more than two LDHs from a standard vertical or conventional directionally drilled well. Petitioner believes drilling more than two LDHs will more efficiently drain the gas within the unit and leave less gas within the formation.

d. Petitioner also requests the Supervisor eliminate the restriction on the number of LDHs, which can be drilled in the Antrim formation throughout the counties included in this proceeding. Petitioner intends to drill more than two LDHs from other vertical well bores and believes, based on experience with Antrim wells in other counties, that drilling more than two LDHs will enhance production of

Antrim gas within units located throughout the Antrim in northern Michigan.

e. Supervisor's Order No. (A) 14-9-94 provided that a directional survey must be submitted for each LDH. In a letter dated September 11, 1998, the Assistant Supervisor of Wells recognized that it is not possible at this time to conduct such a survey for LDHs drilled with the hydrojet drilling technology. The letter stated LDHs could be drilled with this technology and without a directional survey if certain specific conditions were met, satisfying the Geological Survey Division that the proposed laterals would not violate spacing requirements and would protect correlative rights.

f. The Order should not restrict the type of LDHs which may be drilled to those where a directional survey can be completed and that issues relating to the use of the hydrojet drilling technology and other methods used to drill LDHs be addressed at the administrative level.

2. Petitioner presented the testimony of Mr. Richard Redmond, Manager of Operations at CMS Oil & Gas. Upon being sworn in, Mr. Redmond testified:

a. The Antrim Shale is an unconventional reservoir that is tight, exhibiting low porosity and permeability. Extensive fracturing is required to: (i) allow gas to desorb from the rock; and (ii) provide the necessary pathways for gas migration to the well bore. Economic production of gas is contingent on encountering such fracturing. If natural fracturing is absent or insufficiently developed, commercial production may require increased exposure of the formation to a well bore. Antrim fractures are not found consistently or uniformly throughout a drilling unit or USP. Current geological and geophysical means cannot identify the more densely fractured areas.

b. A LDH provides the opportunity to expose much more of the Antrim Shale to a well bore than either a vertical well or conventional directionally drilled well. Multiple LDHs provide an opportunity to better access fracturing within the same strata, and also in each of the multiple productive sections within the Antrim Shale formation.

c. Allowing multiple LDHs per well gives an operator a way to access fracturing within the productive sections of the Antrim, and to adequately and efficiently access and develop the randomly located fracturing within a drilling unit or USP. This makes Antrim gas wells more productive, leaves less gas in the formation and is a prudent completion technique using drilling methods to maximize gas recovery and prevent waste.

d. Allowing more than two LDHs will not result in waste and will not interfere with the correlative rights of adjoining property owners, as all LDHs are required to comply with setback requirements which require that no well bore, conventional or lateral drainhole, be located any closer than 330 feet from a drilling unit or USP line. Compliance with the setback requirement of 330 feet will adequately protect correlative rights. Moreover, each operator will have the opportunity to use the same completion techniques in developing their own properties.

e. Allowing multiple LDHs per well should reduce the need for drilling of additional vertical well bores, which is beneficial in that it reduces the number of wells and related surface facilities.

f. Lateral drainholes are a completion technique using various drilling methods, such as conventional coil tubing, hydraulic (mud) motor and jetting drilling, and hydrojet borehole drilling. Currently available drilling methods are continuously being improved, and emerging technology may offer yet additional alternatives.

3. Under cross-examination Mr. Redmond testified that:

a. Petitioner is requesting an Order allowing multiple lateral drainholes per well bore with no limit.

b. The number of lateral drainholes per well bore would be limited by economics.

4. I find that the drilling of LDHs as proposed by the Petitioner is a continuation of drilling pursuant to R 324.206(5). I further find that LDHs as proposed by the Petitioner are intended to improve efficiency of recovery of reserves in the Antrim Shale Formation.

5. I find that allowing more than two LDHs to be drilled from the same well bore will not result in wasteful communication between wells and will not interfere with correlative rights of adjoining property owners. Order No. (A) 14-9-94 allows wells drilled on adjoining drilling units to be a minimum of 660 feet apart between all portions of wells open and in communication with the Antrim Shale Formation.

6. Order No. (A) 14-9-94 found the course or end point of a well bore or lateral drainhole within the Antrim Shale Formation shall be no closer than 330 feet from a drilling unit or USP boundary.

7. I find the use of any or all of the available methods to drill LDHs shall be subject to the requirement that the method

of drilling be described to the Supervisor in an Application for Permit to Drill and Operate (for new wells) or Application to Change Well Status (for existing wells), to be filed with and approved by the Supervisor prior to the commencement of operations, and that the Supervisor shall be satisfied that no LDH will extend closer than 330 feet to the drilling unit or USP boundary. I find correlative rights will be adequately protected so long as assurances exist that the course and distance of the LDHs will not extend closer than 330 feet to a drilling unit or USP boundary.

8. I find, for the purposes of this Order, the Antrim Shale Formation comprises the rock interval from the base of the Berea-Bedford sequence to the top of the Traverse Group and includes all formations correlative to that interval including the Ellsworth Shale of Western Michigan.

9. I find the evidence set forth above is to be applicable to the Antrim Shale Formation found throughout the 22 counties included in this matter.

CONCLUSIONS OF LAW

1. Section 61506 of Part 615 of the NREPA provides that the Supervisor shall prevent waste. To accomplish this purpose, the Supervisor is empowered:

"To promulgate and enforce rules, issue orders and instructions necessary to enforce the rules and to do whatever may be necessary with respect to the subject matter stated in this part to implement this part, whether or not indicated, specified, or enumerated in this or any other section of this part."
MCL 324.61506(a)

2. Section 61513(3) of Part 615 of the NREPA states:

"The drilling of unnecessary wells is hereby declared waste because unnecessary wells create fire and other hazards conducive to waste, and unnecessarily increase the production cost of oil and gas to the operator, and therefore also unnecessarily increase the cost of the products to the ultimate consumer."
MCL 324.61513(3)

3. Section 5, Determination and Order, Order No. (A) 14-9-94 states:

"Two (2) lateral drainholes within the Antrim may be completed from any well bore without permit or hearing provided the drainhole does not extend closer than 330 feet of the drilling unit or USP boundary. . . . A

survey identifying the course and end point of the drainhole accompanied by all wireline, strata evaluation and other logs shall be filed with the Supervisor within 60 days of completion of a lateral drainhole. In accordance with existing rule, a well shall not be produced until these records have been filed with the Supervisor."

4. R 324.206(5) of the administrative rules of Part 615 of the NREPA states in part:

"A permittee of a well who desires to continue the drilling of a well below the permitted depth, but within the permitted stratigraphic or producing horizon where drilling completion or well completion has occurred, shall file an application for change of well status pursuant to R 324.511." 1996 AACS, R 324.206(5)

5. R 324.303(1) of the administrative rules of Part 615 of the NREPA provides in part:

"The lessees or lessors, or both, of separate tracts or mineral interests that lie partially or wholly within an established drilling unit or larger area may pool or communitize the tracts or interests to form full drilling units or multiples of full drilling units . . ." 1996 AACS, R 324.303(1)

6. The Supervisor has jurisdiction over the subject matter and the persons interested therein. Due notice of the time, place, and purpose of the hearing was given as required by law and all interested persons were afforded the opportunity to be heard.

DETERMINATION AND ORDER

Based on the evidence presented, the Supervisor of Wells finds that an exception to Supervisor's Order No. (A) 14-9-94 is necessary and desirable to

prevent waste and prevent the drilling of unnecessary wells. The Supervisor of Wells further determines that an amendment to Order No. (A) 14-9-94 is necessary and desirable.

NOW, THEREFORE, IT IS ORDERED:

1. Petitioner's request to drill multiple lateral drainholes at the State Albert #3-17 well is granted.

2. Section 5, Determination and Order, Order No. (A) 14-9-94 is hereby amended in its entirety to provide as follows:

5. Multiple lateral drainholes within the Antrim Shale Formation may be completed from any well bore, without obtaining an additional drilling permit, provided no lateral drainhole shall extend closer than 330 feet to the drilling unit or USP boundary, and each additional lateral drainhole shall receive "change of well status" approval prior to beginning lateral drainhole operations. Except as provided below, a survey identifying the course and end point of the drainhole, all wire line logs, strata evaluation logs, and other logs shall be filed with the Supervisor within 60 days of completion of a lateral drainhole. In accordance with the existing rules, a well shall not be produced until these records have been filed with the Supervisor. The Supervisor shall allow a lateral drainhole to be drilled and utilized without requiring a directional survey if the Supervisor or his authorized representative of the Supervisor grants an exemption in the Application to Change Well Status, and the operator or his agent certifies that the length of the lateral drainhole does not exceed the distance from the vertical well bore to the closest point which is 330 feet from the nearest drilling unit or USP boundary.

3. The amendment to Section 5, Determination and Order, Order No. (A) 14-9-94 shall apply to the following counties covered by Order No. (A) 14-9-94:

Alcona, Alpena, Antrim, Arenac, Bay, Benzie, Charlevoix, Crawford, Grand Traverse, Iosco, Kalkaska, Lake, Leelanau, Mason, Manistee, Missaukee, Montmorency, Ogemaw, Oscoda, Otsego, Roscommon and Wexford.

4. Petitioner shall meter individual wells and report all well production data to the Supervisor for six (6) months following drilling of the wells.

5. The Supervisor retains jurisdiction and any amendments to the provisions of this Order shall be by Order of the Supervisor after notice to all interested parties.

Dated:

HAROLD R. FITCH
ASSISTANT SUPERVISOR OF WELLS

Order No. (A) 20-12-98
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Geological Survey Division
P. O. Box 30256
Lansing, MI 48909

DEPARTMENT OF ENVIRONMENTAL QUALITY

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

THE PETITION OF THE MICHIGAN OIL AND GAS)
ASSOCIATION FOR AN ORDER FROM THE)
SUPERVISOR OF WELLS AUTHORIZING A SECOND)
ANTRIM SHALE FORMATION WELL IN ANY ANTRIM)
SHALE FORMATION DRILLING UNIT IN) ORDER NO. (A) 24 -8-05
MONTMORENCY AND OTSEGO COUNTIES AS AN) ON APPEAL
EXCEPTION TO ORDER NO. (A) 14-9-94.)
)
)

ORDER ON APPEAL

This matter involves the Petition of the Michigan Oil and Gas Association (MOGA) to obtain authorization to drill a second well on existing Antrim drilling units in Montmorency and Otsego Counties. The second well would provide gas production from a zone either beneath or above the formation currently subject to production. After an evidentiary hearing, the Assistant Supervisor of Wells issued a Final Determination and Order on February 17, 2006, that granted MOGA's petition, subject to a number of limitations. Certain parties challenged that Order in an Appeal to the Director.¹ MCL 324.61503(2) and R 324.1212. Those parties and MOGA filed briefs and participated in Oral Argument on May 15, 2006, in Gaylord. R 324.1212(3).²

During the hearing on September 27, 2005, there was an indication that a form of settlement was reached between MOGA and the other parties. That settlement was embodied in a series of two stipulations. The first series consisted of seven factual stipulations, which were read into the record. Tr. Vol. II, pgs. 229-231. These stipulations were offered by MOGA, the Otsego County Soil Conservation District, and other surface owners.³ The second series consisted of four factual stipulations between MOGA, Mr. Sagasser, and Mr. Caple. *Id.* at pg. 233. This series was termed an "agreement in principle" and was read into the record. *Id.* at pgs. 233-242. Both series are attached in

¹ The Appealing parties are: Susan Hlywa Topp; Charles E. Caple; Kevin D. Sagasser; Anthony Petrella; John Kurczewski; Gary Wikowski; and Jaime Long

² Due to his unavailability, Mr. Petrella submitted Written Argument in lieu of Oral Argument.

³ The record is unclear on specifically which surface owners, besides Ms. Topp, entered into these stipulations

the Briefs on Appeal filed by Ms. Topp (Exhibits B and C) and Mr. Sagasser (Exhibit 5). After considering the stipulations, the Assistant Supervisor's Order rejected Stipulations 3, 6, and 7, from the first series, and all four from the second series, as either non-factual or immaterial to the merits of the case.⁴ Order No. (A) 24-8-05, pg. 13. This Appeal challenges those determinations.

The importance and legal significance of stipulations is well established in Michigan:

To the bench, the bar, and administrative agencies, be it known herefrom that the practice of submission of questions to any adjudicating forum, judicial or quasi-judicial on stipulation of fact, is praiseworthy in proper cases. It eliminates costly and time-consuming hearings. It narrows and delineates issues. But once stipulations have been received and approved they are sacrosanct. Neither a hearing officer nor a judge may thereafter alter them. This holding requires no supporting citation. The necessity of the rule is apparent. A party must be able to rest secure on the premise that the stipulated facts and stipulated ultimate conclusionary facts as accepted will be those upon which adjudication is based. Any deviation therefrom results in a denial of due process for the obvious reason that both parties by accepting the stipulation have been foreclosed from making any testimonial or other evidentiary record.

Dana Corp v. Employment Security Commission, 371 Mich 107, 110; 123 NW2d 277 (1963).

Dana stands for the proposition that stipulated facts must be followed by the fact-finder in adjudicating the case, and the failure to do so violates the party's constitutional due process protections.⁵ See US Const, Am XIV and Const 1963, art 1, § 1. However, *Dana* also obligates the fact-finder to reject stipulations that are incomplete or legally erroneous. *Id* at 371 Mich 111. In this case, the Assistant Supervisor rejected the seven proffered stipulations after the hearing closed, which leads to the Appealing parties claim of a violation of due process. However, the first series of stipulations were read into the record

⁴ Stipulation 7 in the first series and Stipulation 1 in the second series both pertain to the formation of an *ad hoc* committee that would discuss issues/problems and offer suggestions/compromises. Putting this stipulation into effect is dependent on first obtaining approval of the MOGA Board.

⁵ "Due process applies to any adjudication of important rights." *In Re LaFlure*, 48 Mich App 377, 385; 210 NW2d 482 (1973). See also *Board of Regents v Roth*, 408 US 564; 92 S.Ct 2701; 33 L Ed2d 548 (1972)

during the hearing, after which MOGA proceeded with its case.⁶ The second series of stipulations were characterized on the record as “agreement[s] in principle” that were not reduced to writing until after the hearing concluded. Tr., Vol. II, pgs. 233-234. As a result, the Assistant Supervisor of Wells was not in a position during the hearing to approve the stipulations. In fact, counsel for MOGA acknowledged the agreement was not binding on the Assistant Supervisor. *Id.* at 232. Given these circumstances, the rejection of the stipulations in the Assistant Supervisor’s Order did not violate the Party’s due process. This leaves the appropriateness of the rejected stipulations.

Dana requires that stipulations pertain to material facts, which is controlled by the nature of the case. In this matter, MOGA seeks an exemption to a 1995 Order covering the development of Antrim Formation natural gas in Montmorency and Otsego Counties. To that end, and consistent with Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, a contested case hearing was conducted to establish the legal rights, duties and responsibilities of MOGA and the Appealing Parties. MCL 24.203(3). The Assistant Supervisor’s Order noted, from a policy perspective, the value of the steps proposed in the rejected stipulations. The Department of Environmental Quality (DEQ) is prepared, as stated in the Order, to assist in facilitating those agreements. However, for the purpose of this contested case, no basis exists to conclude that Stipulations 3, 6, and 7, from the first series are either factual and/or material to the determination of the legal rights, duties or responsibilities of the parties. The same is true for the stipulations listed in the second series. Therefore, this Appeal must be denied.

NOW, THEREFORE, IT IS ORDERED:

1. The Appeal of Susan Hlywa Topp; Charles E. Caple; Kevin D. Sagasser; Anthony Petrella; John Kurczewski; Gary Wikowski; and Jaime Long is DENIED.

⁶ One of the Appealing parties, Ms Long, also put on a case by calling a DEQ employee as a witness. All of the witnesses offered after the stipulations were discussed were subject to cross-examination.

Order on Appeal
Order No (A) 24-8-05
Page 4

- 2 The Assistant Supervisor's Order of February 17, 2006, is ADOPTED and INCORPORATED into this Order on Appeal.
- 3 This Order on Appeal constitutes the final agency decision on the Petition filed by the Michigan Oil and Gas Association.

DATED: 6/15/06



STEVEN E. CHESTER
SUPERVISOR OF WELLS

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
SUPERVISOR OF WELLS

IN THE MATTER OF:

THE PETITION OF THE MICHIGAN OIL AND GAS)
ASSOCIATION FOR AN ORDER FROM THE SUPERVISOR)
OF WELLS AUTHORIZING A SECOND ANTRIM SHALE)
FORMATION WELL IN ANY ANTRIM SHALE FORMATION) ORDER NO (A) 24 -8-05
DRILLING UNIT IN MONTMORENCY AND OTSEGO)
COUNTIES AS AN EXCEPTION TO ORDER NO (A) 14-9-94.)
)

at a session of the Department of Environmental Quality held
at Lansing, Michigan, on April 4, 2006, Harold R. Fitch, Assistant
Supervisor of Wells, Presiding

ORDER ON MOTION FOR RECONSIDERATION

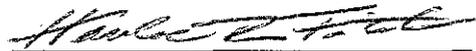
On March 15, 2006, Susan Hlywa Topp, on behalf of herself and Mr. Charles Caple, filed a Motion for Reconsideration of Order No. (A) 24-8-05, approving Michigan Oil & Gas Association's request for a second Antrim Shale Formation well on drilling units in Montmorency and Otsego Counties. The Motion specifically requests the Supervisor: incorporate Respondents stipulations into the Order; or alternatively, rescind the Order and schedule a rehearing to allow presentation of testimony, witnesses, and cross-examination by all Respondents; and stay the issuance of any permit on the application of a second well until resolution of this matter.

Also on March 15, 2006, Ms. Topp, on behalf of herself and Mr. Caple, filed a Petition for Appeal with the Director of the Department of Environmental Quality (DEQ) pursuant to R 324.1212. The relief requested of the Director in the Petition for Appeal is identical to that requested in the Motion for Reconsideration. As the requests made in the Motion for Reconsideration are currently being processed as an appeal to the Director under R 324.1212, I find a Reconsideration of Order No. (A) 24-8-05 is not appropriate.

NOW, THEREFORE, IT IS ORDERED:

The Motion for Reconsideration filed by Ms. Susan Topp on March 15, 2006, is DENIED.

Dated: April 25, 2006



HAROLD R FITCH
Assistant Supervisor of Wells
Office of Geological Survey
P.O. Box 30256
Lansing, MI 48909-7756

DEPARTMENT OF ENVIRONMENTAL QUALITY

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

THE PETITION OF THE MICHIGAN OIL AND GAS)
ASSOCIATION FOR AN ORDER FROM THE)
SUPERVISOR OF WELLS AUTHORIZING A SECOND)
ANTRIM SHALE FORMATION WELL IN ANY ANTRIM) ORDER NO. (A) 24 -8-05
SHALE FORMATION DRILLING UNIT IN)
MONTMORENCY AND OTSEGO COUNTIES AS AN)
EXCEPTION TO ORDER NO. (A) 14-9-94.)

FINAL DETERMINATION AND ORDER

This case involves the Petition of the Michigan Oil and Gas Association (MOGA) requesting that the Supervisor of Wells (Supervisor) allow two wells to be drilled and produced on the same Antrim drilling unit. The basis for this request is the existence of at least two distinct reservoir zones capable of production in Antrim drilling units. Provided it can be accomplished without waste, production from both zones is currently achieved by utilizing the same well bore. This process is known as commingling. In its Petition, MOGA asserts, in developed areas, commingling is not a practicable approach to producing these two distinct reservoir zones. Therefore, MOGA seeks approval for a second well on certain existing Antrim units in Montmorency and Otsego Counties ¹

JURISDICTION

The development of oil and gas in this state is regulated under Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. MCL 324.61501 *et seq.* The purpose of Part 615 is to ensure the orderly development and production of the oil and gas resources of this State. MCL 324.61502. To that end, the Supervisor can establish drilling units and uniform spacing plans. MCL 324.61513. In Montmorency and Otsego County, 80-acre

¹ The second well is referred to in the oil and gas industry as a "twin well", or "twinning."

Antrim drilling units with one well are required under Order Number (A) 14-9-94 (Antrim Order).² As an alternative, the Antrim Order provides for Uniform Spacing Plans (USPs), which are larger tracts with multiple wells subject to specified spacing conditions. In filing its Petition, MOGA seeks an exception to the Antrim Order by allowing two Antrim wells on a drilling unit in Montmorency and Otsego Counties, or by twinning existing wells in a USP. The evidentiary hearing is governed by the applicable provisions of the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 *et seq.* See also R 324.1203. After proper notice, the hearing in this matter was held on August 30 and September 27, 2005, in Gaylord, Michigan.

PARTIES

MOGA is represented by Mr. Gary L. Worman. During the hearing MOGA presented testimony from John Wilkinson, Director of Operations, DTE Gas and Oil Company; Nelson Fairchild, Eastern Regional Manager, Quicksilver Resources; James Mills, petroleum engineer, Dominion E & P; Allen Hackman, petroleum engineer, Dominion E & P; Kevin Ringwelski, environmental consultant; and Raymond Barnhart, Regional Operations Manager-expert in petroleum engineering, Dominion E & P.

The other Parties involved are: the Otsego County Soil Conservation District; Mr. Anthony Petrella; Mr. John Kurczewski; Mr. Charles Caple; Mr. Kevin Sagasser; Mr. Gary Witkowski; Ms. Deborah Liddy; and Ms. Jamie Long. The Otsego County Conservation District is represented by Ms. Susan Topp, while the individuals all appeared *pro se*. Ms. Long offered the testimony of Mr. Rick Henderson, District Supervisor, of the Department of Environmental Quality (DEQ), Office of Geological Survey (OGS). Other than Mr. Henderson, the District and *pro se* Parties did not offer any witnesses, but limited their involvement to cross-examining MOGA's witnesses.

² See IN THE MATTER OF THE REQUEST OF MICHIGAN ENVIRONMENTAL TRUST LIMITED, MICHIGAN OIL AND GAS ASSOCIATION, ET AL. Order No (A) 14-9-94, June 20, 1995 1995 WL 374797 (Mich Dept Nat Res.)

FINDINGS OF FACT

To provide context to the Petition and relief sought, it is helpful to examine the history of Antrim Shale Formation gas development in Montmorency and Otsego Counties. The activity in this area began in earnest in the 1980's. During the early stage of development, most wells were drilled to the Lower Antrim Formation, which is comprised of the Norwood and Lachine Members, on 40-acre drilling units. In 1995, the Supervisor issued the Antrim Order, *supra*, fn 2. The Antrim Order defined the Antrim Shale Formation as the rock interval from the base of the Berea-Bedford to the top of the Traverse Group. The Order required that all Antrim Shale Formation wells be drilled on 80-acre units or in an approved USP.

Subsequent to the entry of the Antrim Order, operators indicated an interest in producing gas from the Upper Member of the Antrim Formation, the Sunbury Shale, and the Bedford Shale, collectively referred to herein for purposes of this Order as the "Upper Shales." Production from the Upper Shales was originally thought to be economically viable by opening the Upper Shale interval in an existing Lower Antrim well, i.e. commingling. To allow that production, the Antrim Order was amended in 2002 to include the Sunbury Shale and Bedford Shale. Subsequently, MOGA's members have sufficient experience producing gas from both zones through one well bore. Based on that experience, MOGA contends that commingling production from these distinct reservoirs is wasteful, and the Upper Shales can be produced without waste by allowing a second well. Therefore, it seeks an amendment to the Antrim Order that allows a second well on Antrim drilling units, and twinning of Antrim wells in USPs, in Montmorency and Otsego Counties. This contested case is to determine whether that amendment is warranted under Part 615.

Production Qualities of the Upper Shales

John Wilkinson, an expert in petroleum engineering, testified in support of the MOGA Petition. Mr. Wilkinson has substantial experience in the development of the

Antrim Formation in the two counties with Ward Lake Energy and DTE Gas and Oil Company. Likewise, he has substantial experience with the Upper Shales and with attempting completions in this zone. Exhibit I is an Upper Shale completion summary for 56 wells operated by Ward Lake Energy in the subject counties. Over an average 95-day testing period, the average production of these 56 wells was 48 thousand cubic feet of gas per day (MCFD) and 70 barrels of water per well. Exhibits 2, 3 and 4 show long-term production from Upper Shale completions on three Ward Lake Energy wells where the Lower Antrim was bridge plugged while the Upper Shales were produced.³ Two of the three wells show long-term production at or above 100 MCFD and the third well averages approximately 60 MCFD. Given the volume of gas produced by these wells, Mr. Wilkinson opined that the Upper Shales in these counties have the potential to make commercially viable gas wells under the present economic conditions. Tr. p. 42.

This opinion is supported by the testimony and experience of the two other operators of Antrim wells in the two counties. Nelson Fairchild, a petroleum engineer with Quicksilver Resources, testified about Quicksilver's experience with the Elmer Fudd A-1 project. This project is in Oscoda County near the southern border of Montmorency County and, according to Mr. Fairchild, is substantially similar to the Antrim zones in Montmorency and Otsego Counties. Tr., p. 137. The Elmer Fudd A-1 project had 30 wells completed in the Lower Antrim that were producing a total of approximately 2.2 million cubic feet of gas per day (MMCFD). In 2001, Quicksilver tested three of these wells in the Upper Shales by placing a bridge plug to isolate that zone from the Lower Antrim, similar to the method used by DTE. These wells were tested for approximately 30 days and produced an average of 32 MCFD per well. Exhibit 14

The other witness on this issue was James Mills, a petroleum engineer with Dominion E & P. He testified that the State Briley A2-27 well was tested over a long

³ A bridge plug is a device placed in the well that separates and isolates different zones of production

term in the Upper Shale zone by setting a bridge plug between it and the Lower Antrim. Over a period of almost two years, the isolated Upper Shales produced an average of 90 MCFD. Later in the test period, another Upper Shale zone was completed yielding an additional 20 MCFD of gas. Exhibit 18. Mr. Mills found the Upper Shales to produce commercially sustainable volumes of gas.

Based on this testimony and the data presented in the Exhibits, I find the Upper Shales zone has sufficient quantities of gas to make it a commercially viable reservoir in and of itself.

The Problem with Commingling

As noted, the 2002 amendment of the Antrim Order allowed production of the Upper Shales zone through commingling. During the hearing on that matter, Mr. Wilkinson testified that it would not be economically efficient to drill a second well to recover resources from that zone. Rather, at that time his opinion was that these resources could be recovered from one well bore simultaneously with the Lower Antrim zone. However, based on his experience with dual completions since the 2002 amendment, Mr. Wilkinson is now of the opinion that in most cases both the Upper Shales and Lower Antrim cannot be produced simultaneously through one well bore without causing waste. Tr. p. 104. The basis of this opinion is the large disparity in pressure between the two zones. Mr. Wilkinson testified that most of the current Lower Antrim wells are produced at approximately 40 pounds per square inch (psi). In contrast, the pressure in the Upper Shales where no production has occurred is generally over 500 psi.⁴ This is typical of his observation that in areas where the Upper Shales zone has not been produced and the Lower Antrim has been produced, there is roughly a 400-psi difference between the two zones. As a practical matter, Mr. Wilkinson testified the large pressure disparity between the two producing zones makes it difficult or impossible to produce them simultaneously.

⁴ The static pressure of a Otsego County well completed in a virgin area of the Upper Shales is 530.7 psi. Exhibit 5

The data from two wells support Mr. Wilkinson's position. Specifically, Exhibits 6 and 7 show the results of a well that was producing an average of 120 MCFD of gas from the Lower Antrim. A bridge plug was placed in the well separating the upper and lower zones and the upper zone was completed. During a three-week test period in 1998, the upper zone produced 160 MCFD of gas. The bridge plug separating the two zones was then removed and production from the well monitored and tested. According to Mr. Wilkinson, one would expect the combined production to average 280 MCFD of gas; however, during the test period it produced only 198 MCFD. Producing both zones from the same well bore resulted in a loss of over 80 MCFD. Mr. Wilkinson testified that an analysis of the gas from the combined flow supports the conclusion that the Lower Antrim contributed little to the gas stream when commingled. Gas produced from the Lower Antrim contains a field-wide average carbon dioxide (CO₂) content of 22 percent while the Upper Shales contain an average of slightly less than 2 percent. Exhibit 8. The commingled gas contained slightly more than 4 percent of CO₂. Exhibit 9. A second well tested in a similar manner produced substantially the same results. Exhibits 10, 11, 12 and 13. In Mr. Wilkinson's opinion, these results support the conclusion that the commingled gas contained no significant contribution from the Lower Antrim zone. Tr. p. 41. He reasons that opening the Upper Shales causes water to fall down hole to the Lower Antrim because of its lower pressure gradient. This results in flooding the Lower Antrim, and thereby shutting off the flow of gas.

Nelson Fairchild's experience with the Elmer Fudd A-1 project for Quicksilver Resources resulted in similar problems with commingling production from the upper and lower zones. When separated from the Lower Antrim with bridge plugs, the wells were tested and produced from the Upper Shales for an average of 32 MCFD. Armed with this data, Quicksilver decided it would be economic to re-complete all 30 wells in the project and produce the gas from the two zones commingled. It also drilled an additional five in-fill wells that were completed in both zones. As a result, Quicksilver expected to produce an additional 800 MCFD from the existing wells and another 200 MCFD from the 5 new wells. Tr., p. 139.

Mr. Fairchild testified that as a result of re-completing and drilling five new wells, water production jumped from 150 to 2,000 bpd while gas production dropped from 2.2 to 1.9 MMCFD. After re-completion, the decline rate increased from 4.5 to 5.5 percent. Tr., p. 142. As can be seen from Exhibit 15, by January of 2005, the water production rate declined but gas production never rebounded to pre re-completion rates. The Elmer Fudd project, once re-completed in both zones, produced 1.0 MMCFD less than that anticipated by Quicksilver. In Mr. Fairchild's opinion, the Lower Antrim fracture system became water blocked because of flooding that zone with Upper Shales water. Tr., p. 144. The result is that the Lower Antrim in the Elmer Fudd project was "severely damaged" by the water block. Tr., p. 167. In Mr. Fairchild's experience, he has seen no successful dual completions where one zone was previously produced; and, in his opinion, there is no technical solution at this time to produce and commingle both the upper and lower zones. Tr., p. 185 and 210.

Mr. Mills, a petroleum engineer, testified Dominion's experience commingling and producing both the Upper Shales and Lower Antrim tracked that detailed by Mr. Wilkinson and Mr. Fairchild. The wells he tested had been produced in the Lower Antrim for some time and had a significantly lower pressure than that of the Upper Shales. When the Upper Shales zone was isolated from the Lower Antrim and re-completed, it produced significant quantities of gas over the test period. When the two zones were commingled, total production was either less than or slightly greater than that previously produced from the Lower Antrim itself. The gas analysis performed on the commingled wells support his conclusion that most of the gas produced came from the Upper Shales and the Lower Antrim was damaged by water coming from the upper zone. Tr., p. 253. Exhibits 23 and 24 illustrate the effects of commingling the two zones in the Chester Field in Otsego County. Gas and water production and CO2 content in this field are similar to the experiences related by Mr. Wilkinson and Mr. Fairchild. In Mr. Mill's opinion, commingling does not work on wells where there is a significant pressure differential between the Upper Shales and Lower Antrim zones. Allen

Hackman and Raymond Barnhart, both petroleum engineers for Dominion, share in this opinion. Tr., p.283 and 317, respectively

I find, as a Matter of Fact, where the Lower Antrim has been produced for a period of time it has a much lower formation pressure than that of the Upper Shales where no production has occurred. I find that because of the significant pressure differential in the two zones coupled with large amounts of water in the Upper Shales, commingling production from these two zones is not practicable. I find that commingling production from the two zones with these characteristics cause waste by damaging the production potential of the Lower Antrim.

Alternatives to Commingling

Mr. Wilkinson testified that the preferred approach to producing the Upper Shales and Lower Antrim would be to deplete the Lower Antrim to the point it is no longer commercial, and then come up hole and produce the Upper Shales where possible. Tr. p. 114. The benefit of this approach is its cost effectiveness and minimal disruption to the surface. However, its drawback is the length of time necessary to drain the Lower Antrim of commercial quantities of gas. This time span, coupled with the time it would take to subsequently drain the Upper Shales, is beyond the useful life of the infrastructure, including the compressors and flow lines. Mr. Barnhart testified that it could take 10 to 15 years to drain the Lower Antrim and another 10 to 15 years to drain the Upper Shales. Tr., p. 315. Both Mr. Barnhart and Mr. Mills agree that the pressure differential problem between the two zones is a long-term problem. For the same reasons, shutting in the Lower Antrim and producing the Upper Shales to equalize pressure is not viable in that the existing infrastructure will need to be replaced. Tr., p. 321. According to Mr. Wilkinson, the result is substantially increased costs required to replace the existing surface equipment and this is not cost effective.

Another alternative method of capturing gas from the upper and lower zones through one well bore is to use two or three separate tubing strings in the well casing. However, most producing Antrim wells do not have adequately sized casing to

accommodate two tubing strings. Tr., p. 159, Exhibits 25, 26 & 27. In Mr. Fairchild's opinion, where there has been production in the Antrim, there is technically no alternative to drilling a second well to optimally produce both the upper and lower zones. Tr., p. 197. See also, Hackman, Tr., p. 285-288 and Barnhart, Tr., p. 320.

The only other alternative to producing both the Upper Shales and Lower Antrim contemporaneously in situations where there is a large pressure disparity between the two zones is to drill a second well to the Upper Shales. The MOGA Petition requests that a second well be allowed in these situations and that it be located within 25 to 200 feet of the existing Lower Antrim well. Mr. Wilkinson testified that producing both zones with separate wells provides a means to produce each of them as efficiently as possible. Tr. p. 104. Further, placing a second well on an existing drilling unit and within 25 to 200 feet from the existing well will cause little surface disturbance. Specifically, the second well will, in most cases, not require additional surface facilities, which minimizes surface impact. Mr. Ringwelski, an environmental consultant, testified that surface impacts would be minimal using the existing well pad. In his opinion, impacts to groundwater are minimal because the second well would use the existing water flow lines, tanks and water injection wells. He testified that noise at the wellhead would increase during drilling, but that would be short-term. Nuisance noise during production is regulated under Part 615. In Mr. Wilkinson's opinion, the benefit of the additional gas recovered far outweighs the minimal surface impact of drilling a second well under the arrangement proposed in the MOGA Petition. Mr. Mills testified that the best candidate for a twin well is a location with Lower Antrim production and significant pressure differential between it and the Upper Shales. Tr., p. 254. In Mr. Mill's opinion, a twin well in these situations is a necessary option to efficiently and effectively extract gas from the upper zone. Tr., p. 255.

Mr. Barnhart testified regarding the advantages of producing the Upper Shales from a second well on the drilling unit. One of the biggest advantages is that a twin well adds production when the existing infrastructure has the capacity to handle it. Sharing in these costs helps to spread them out over higher volumes of gas. With twinning,

there is also less surface waste than drilling a well at a different location. The existing roads, flow lines, well pad, and other surface facilities could be used for the twin well, eliminating the need for duplication. Tr., p. 322-324. However, in limited instances, some flow lines may need to be upgraded. The result of producing both the upper and lower zones simultaneously is that once both zones are drained, the surface facilities can be removed and the sites restored. As a result, twinning will result in the equipment being on a parcel for a much shorter period of time. Tr., p. 314.

Mr. Barnhart also provided an economic analysis of placing a twin well on an existing Antrim drilling unit. Exhibits 29, 30, 31 and 32. Exhibit 28 summarizes his findings. His model provided the following assumptions: 1) capital costs of \$185,000; 2) a production rate of 40 MCFD peak with a 5% expected decline; 3) operating costs of \$500/month; 4) gross reserves of 150MMCF and; 5) net reserves of 120MMCF. The only variable in the model was the gas price per MCF, and he factored four alternatives: \$2.50, \$3.50, \$4.50 and \$8.32. At \$2.50 per MCF, the after tax rate of return was -0- after a payout life of approximately 16 years. The after tax rate of return at \$8.32 per MCF was 29.05% and the after tax payout occurred between years 3 and 4. See Exhibit 28. In Mr. Barnhart's opinion, the twin well infrastructure and cost sharing would result in more gas being produced from the Lower Antrim before it is deemed non-commercial. In his opinion, twinning would have a positive impact on the economy in the state by increasing severance taxes and royalties and creating additional jobs.

The Parties also entered into a stipulation regarding the location of the twin well on the drilling unit:

With respect to the wellhead location for any twin well, operator will attempt to stay in the footprint of the existing pad; and also operator will attempt to avoid expansion of the footprint of the existing well pad. If there is a need to expand the footprint of the existing pad, operator will submit documentation justifying the need to expand the footprint when the permit is applied for.

Stipulation 1 (Tr., p. 229-230).

A second stipulation was entered on the location and use of mud pits.

In an attempt to minimize mud pits; operator will, where practical, submit a plan that consolidates cuttings from up to four (4) wells in one pit. The +/- (3) wells without a pit will utilize a closed system. The cuttings will not be consolidated in one location without consent from the surface owner. Any pit will not be built without first identifying the location of the prior pit. In the event it is not feasible to have a consolidated pit, operator, upon demonstration to the DEQ, may have a pit for each well it can not (sic) consolidate.

Stipulation 2 (Tr., p. 230).

I find that these stipulations are based in fact and adopt both as findings.

Based on this record, I find, as a Matter of Fact, if a twin well is permitted on a drilling unit, it must be located between 25 and 75 feet from the existing well. I find this requirement will provide the best protection against surface waste. I find that an operator may request a twin well location greater than 75 feet from an existing well, due to the proximity of surface equipment or for other reasons. The request must be accompanied by documentation justifying the alternative location.

Limits on Twin Wells

There are inherent physical limitations on drilling a second well on a drilling unit. First, Mr. Fairchild testified twinning is unfeasible in areas of both Counties where the Upper Shales cover depth is 150 feet or less. Regulations require that the well's surface casing be set 100 feet below the base of the glacial drift and that no zone within 50 feet of the casing's bottom may be fractured. Therefore, if the Upper Shale zone to be opened has 150 feet or less of cover, no completions could occur in that zone. Tr., p 146. Exhibit 16 is a map of Otsego and Montmorency Counties identifying the 150-foot cover line. Those areas north of the line would generally not be conducive to producing the Upper Shales under the existing rules. Additionally, both Mr. Fairchild and Wilkinson testified that twinning is unnecessary in areas where the Antrim Formation had not been extensively produced because the zones would not have a significant pressure differential. In these virgin areas, new wells could be configured to

produce both zones from one well bore and twinning would be unnecessary. See Tr., p. 186.

The Parties also entered into a stipulation regarding this issue.

Petitioner will request that the scope of the Petition and Order be limited to the south 3 tiers of townships, excluding the northern tier of townships in Otsego and Montmorency County (sic). Exceptions could be granted in northern tier upon application for an exception and DEQ approval. Stipulation 4 (Tr., p 230).

This stipulation is a request, by MOGA, to limit the scope of its Petition as identified. The stipulation is accepted as an amendment to the Petition. I find, as a Matter of Fact, twinning may occur only in the south 3 tiers of townships in the two counties. I find, the Supervisor may grant exceptions only if documentation justifies it is warranted. No well, whether a twin well or other, shall be perforated or have an open interval in a zone that does not have 150 feet or more of cover over the zone. I further find, as a Matter of Fact, in areas where production from the Antrim Formation has not significantly reduced the reservoir pressure, twinning would not be necessary because a new well could be configured to produce both zones.

Spacing Issues

Certain spacing issues will arise regarding spacing of twin wells where the Antrim was developed on 40-acre spacing versus that developed on 80-acre spacing under the Antrim Order. The Parties entered into a stipulation regarding this issue.

80-acre spacing, per 14-4-94 (sic) will control location of twin wells, even in areas developed on 40-acre spacing. Stipulation 5 (Tr., p 231).

The spacing of twin wells shall be in conformance with the Antrim Order, which is on 80-acre drilling units or in accordance with a USP approved by the Supervisor. In areas of the two counties where the Antrim Formation was developed on 40-acre spacing, a question arose on the location of twin wells. One approach would be to disallow twin wells on immediately adjoining 40-acre parcels to the north, east, south and west of a

40-acre parcel that is twinned. Only those 40-acre parcels touching the twinned 40-acre parcel on the diagonal would be eligible for a second well. Another approach would be to allow twin wells on 80-acre units comprised of immediately adjoining 40-acre parcels with a 1320-foot setback between wells. I find the spacing and location conditions under the Antrim Order adequately address this issue. In all instances involving wells on 40 acre units, operators are encouraged to submit a plan of development. If an offset operator has concerns that it is not protected by a particular proposal, the offset operator may petition the Supervisor for relief.

Other Stipulations

The Parties placed several other stipulations on the record. Stipulation 3 pertains to a hypothetical question regarding any requested expansion of the scope of this order by MOGA, and evidence it agrees to proffer if it does seek other relief. Tr., p. 230. Stipulation 6 requests that certain individuals meet to discuss soil conservation issues and make suggestions to the DEQ. Tr., p. 231. Stipulation 7 discusses the formation of an Ad Hoc Committee made up of MOGA and private citizens in the Counties to hear issues and problems regarding oil and gas operations. Tr., p. 231. Mr. Sagasser, Mr. Caple, and MOGA also agreed to the concept of an Ad Hoc Committee to address oil field practice issues and concerns. They agreed, in principle, that operators should conduct a thorough engineering evaluation of the well and pipeline network prior to drilling a twin well. Further, they agreed that obsolete piping would be removed concurrently with installation of any new piping and not be abandoned in place.

Although these stipulations have merit, and the Supervisor strongly encourages this interaction, these are not stipulations of fact or matters that concern the merits of this case. That being said, it would be extremely fruitful for both the industry and citizens of these two counties to engage in an open dialog addressing concerns and implementing suggestions for improving oil and gas operations

CONCLUSIONS OF LAW

Based on the stipulations and the findings of fact, I conclude, as a Matter of Law:

1. Producing the Upper Shales by commingling production with previously produced Lower Antrim damages the Lower Antrim reservoir and causes underground waste. MCL 324.61501(q)(i).
2. To prevent the drilling of unnecessary wells, the Supervisor may establish a drilling unit for each pool. A drilling unit is the maximum area that may be efficiently and economically drained by one well. MCL 324.61513(2).
3. An 80-acre drilling unit is the maximum area that may be efficiently and economically drained by Antrim Shale Formation wells. Order No. (A) 14-9-94
4. Drilling unnecessary wells in the Antrim Shale Formation would cause waste. MCL 324.61513(3).
5. Twin wells will prevent excessive surface waste because the existing infrastructure is utilized and surface facilities and equipment would be removed much earlier than if the Upper and Lower Antrim were drained sequentially. MCL 324.61501(q)(ii).

DETERMINATION AND ORDER

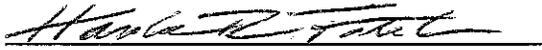
Based on the Findings of Fact and Conclusions of Law, the Supervisor of Wells determines that to prevent waste, it is necessary to amend Order No. (A) 14-9-94 to allow twin wells on an Antrim drilling unit or within a USP in Montmorency and Otsego Counties.

NOW, THEREFORE, IT IS ORDERED:

1. The Petition of MOGA is GRANTED, consistent with the following limitations:
 - a. Twin wells are permitted only in those circumstances where alternative methods of production are, for the reasons set forth in this Order, wasteful.
 - b. Drilling units are established as follows:
 - i. For an established USP, the USP boundary shall remain the same and each well within the USP is eligible to be twinned.

- ii. Where a USP has not been established, the drilling unit size for twin wells is 80 acres. For wells with existing 80-acre units, pursuant to Order (A) 14-9-94, the unit for the Upper Shales shall consist of the same 80 acres.
 - iii. For wells drilled on existing 40-acre units prior to Order (A) 14-9-94, the unit for the twin well shall consist of two adjoining 40-acre units having a common 1320-foot boundary.
 - c. A twin well must be located between 25 and 75 feet from the existing well and be consistent with the intentions of Stipulation 1.
 - d. A twin well on an existing drilling unit must be at least 330 feet from the drilling unit boundary;
 - e. Mud pits shall be consolidated consistent with Stipulation 2
 - f. A twin well may be drilled in only the southern three tiers of townships in Montmorency and Otsego Counties, i.e., Townships 29N, 30N, and 31N.
 - g. This order is for the purpose of establishing well spacing only and neither establishes a right, nor diminishes any independent right, of the Petitioner to operate on the surface or subsurface lands of a surface or mineral owner.
2. To ensure greater flexibility in locating wells, and to minimize both surface waste and drilling of unnecessary wells, administrative exceptions to the drilling unit size (80 acres) and distance from the existing well (25-75 feet) may be granted by the Supervisor of Wells if warranted under Part 615. All other requirements of Order No. (A) 14-9-94, as amended, shall apply to twin wells.

Dated: Feb. 17, 2006


HAROLD R. FITCH
Assistant Supervisor of Wells
Office of Geological Survey
P. O. Box 30256
Lansing, MI 48909

DEPARTMENT OF ENVIRONMENTAL QUALITY

ORDER OF THE SUPERVISOR OF WELLS

IN THE MATTER OF

A HEARING TO BE HELD AT THE INITIATIVE OF THE SUPERVISOR)
OF WELLS TO DO THE FOLLOWING WITH RESPECT TO TRENTON)
AND BLACK RIVER FORMATION WELLS WITHIN A CERTAIN)
GEOGRAPHIC AREA: SET OIL AND GAS ALLOWABLES; ESTABLISH)
OR MAINTAIN SPACING AND LOCATION OF WELLS; CONSIDER THE) CAUSE 18-2007
DESIRABILITY OF RESTRICTING FLARING OR VENTING OF GAS;)
AND AMENDING OR ABROGATING CERTAIN PROVISIONS OF)
ORDERS (A) 9-7-84 AND (A) 4-10-88, WHICH PROVIDE FOR SPACING)
AND PRORATION OF TRENTON BLACK RIVER FORMATION WELLS)
IN CALHOUN, JACKSON AND HILLSDALE COUNTIES.)

OPINION AND ORDER

This case involves the request of Staff of the Office of Geological Survey (OGS), Michigan Department of Environmental Quality, for an order establishing spacing and allowables and restricting flaring within a certain geographic area for wells in the Trenton and Black River Formations. The basis for this request is the recent resurgence of interest in the Trenton and Black River Formations and the existence of at least 36 orders of the Supervisor of Wells (Supervisor) addressing spacing and allowables for Trenton Black River Formation wells in southern Michigan. In common Michigan oil and gas terminology, the Trenton Formation and Black River Formation are typically referred to collectively as the "Trenton-Black River Formation," and that term will be used herein where appropriate.

JURISDICTION

The development of oil and gas in this state is regulated under Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Part 615). MCL 324 61501 *et seq.* The purpose of Part 615 is to prevent the waste of oil and gas and foster the orderly development thereof. MCL 324 61502. To that end, the Supervisor may establish drilling units, well spacing, and oil and gas proration allowables. MCL 324.61513.

Order No. 9-7-84 established the Albion-Scipio Trenton-Black River Formation Field in parts of Calhoun, Jackson, and Hillsdale counties with wells to be drilled on 20-acre drilling units

formed by dividing a governmental surveyed quarter-quarter section of land into a west half and an east half. This Order also established the allowable production for full allowable wells as 110 barrels of oil per day (BOPD) and/or 150 thousand cubic feet of gas per day (MCFGPD).

Order No. 4-10-88 established a drilling unit size of 40 acres, consisting of a quarter-quarter section, and an allowable of 110 BOPD and/or 175 MCFGPD for wells in the Stoney Point Field, which consists of parts of Jackson and Hillsdale counties.

In its initial request for a hearing, Staff sought an order that would do the following:

1. Comprise a certain geographical area to include the following counties: Barry, Eaton, Ingham, Livingston, Oakland, Macomb, St. Clair, Wayne, Washtenaw, Jackson, Calhoun, Branch, Hillsdale, Lenawee, and Monroe.
2. Establish or maintain oil and gas allowables in the above mentioned geographic area equivalent to the current allowables in the Stoney Point Field of 150 BOPD and 175 MCFGPD.
3. Establish spacing for new wells and maintaining spacing for existing wells.
4. Restrict the flaring or venting of gas.
5. Amend or abrogate Order No. 9-7-84 and Order No. 4-10-88.

The evidentiary hearing is governed by the applicable provisions of the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 *et seq.* See also R 324.1203. After proper notice, a prehearing conference in this matter was held on December 18, 2007, and the hearing was held on June 3, 4, 5, 10, and 11, 2008, in Lansing, Michigan. Members of the Oil and Gas Advisory Committee attended the hearing at the request of the Supervisor.

PARTIES

Answers were filed by Continental Resources, Inc.; West Bay Group¹; Savoy Energy LP; Trendwell Energy Corp.; David Dzierwa; and Matrix Exploration & Development, LLC and Titan Energy, LLC

OGS Staff was represented by Mr. James Stropkai and Mr. Daniel Bock. Mr. Thomas Godbold testified on behalf of Staff during the hearing.

¹ The West Bay Group is a consortium of West Bay Exploration Co.; Jordan Exploration Co.; Rock Oil Co.; Energy Quest Inc.; Rainbow Oil and Gas, LLC; Queenmaya LLC; Scandia Energy Companies; Michigan Ventures, LLC; Antares Exploration Fund LP; and Meridian Production Services, LLC.

Continental Resources, Inc (Continental) was represented by Mr. Jack Sage. During the hearing, Continental presented testimony from: Mr. Lew Murray, Exploration Manager, recognized as an expert in geology; Mr. Richard H. Straeter, P E., President, Eastern Division, recognized as an expert in petroleum engineering; and Mr. Michael W. Barratt, Petroleum Geologist Consultant, Barratt Consulting, LLC.

The West Bay Group (West Bay) was represented by Mr. James R. Neal. West Bay presented testimony from: Mr. William Stelzer, Geological Petroleum Consultant, recognized as an expert in petroleum geology; Mr. Timothy J. Brock, Registered Professional Engineer, recognized as an expert in petroleum engineering; and Mr. Randall L. Schroeder, Consulting Petroleum Engineer, recognized as an expert in petroleum engineering.

Savoy Energy LP (Savoy) was represented by Mr. John Norris and presented no testimony during the hearing, limiting its involvement to cross-examining the other parties' witnesses.

Trendwell Energy Corporation (Trendwell) was represented by Mr. William Horn. Trendwell presented testimony from Mr. Richard A. Sandtveit, Registered Professional Engineer, recognized as an expert in petroleum engineering.

Mr. David J. Dzierwa appeared *pro se* and testified as a geophysicist and explorationist.

Matrix Exploration & Development, LLC and Titan Energy, LLC (Matrix/Titan) were represented by Mr. Peter J. Zirnhelt. Matrix/Titan presented testimony from: Mr. Brian D. Deans, Managing Member of both Matrix Exploration & Development, LLC, and Titan Energy, LLC, recognized as an expert in geology of the Trenton-Black River Formation; Mr. Claude Woods, Geophysics Consultant, recognized as an expert in geophysics; and Mr. Ronald R. Suckle, Consulting Petroleum Engineer, recognized as an expert in petroleum engineering.

FINDINGS OF FACT

To provide context to the Petition and relief sought, it is helpful to examine the history of Trenton-Black River Formation hydrocarbon development in the Albion-Scipio and Stoney Point Fields. The Albion-Scipio Field was discovered in the mid 1950s. The Albion-Scipio Trend extends for about 35 miles in a northwest-southeast direction across parts of Hillsdale, Jackson, and Calhoun counties in southern Michigan. It is comprised of several narrow, linear oil fields located on, or along, a probable deep-seated fault or fracture zone. Oil and gas are produced

from a dolomitized fracture zone in the Trenton-Black River Formation of Middle Ordovician age.² The current Albion-Scipio well spacing pattern of 20-acre drilling units, consisting of half a quarter-quarter section, was established by Order No. 9-7-84, effective September 17, 1984.

The Stoney Point Field is made up of heterogeneous and discontinuous reservoirs. Permeability, porosity, and reservoir quality change significantly over very short distances. The producing trend is linear, narrow, and elongate in nature. Permeability barriers exist throughout the field, which is noted for such isolated discontinuous productive zones. The reservoir rock is fractured. The great productivity of the field is attributed to the presence of natural fractures and associated vugular or cavernous porosity. It is well established that drainage patterns are non-radial and that low permeability areas (barriers) prevent uniform and predictable drainage patterns. The reservoir contains dual porosity: one component related to fracture and vugular or cavernous features and the second component related to the matrix of the rock. Spacing in the Stoney Point Field was established by Order No. 4-4-84, as 40-acre drilling units with the well located in the southeast quarter.

Recently, a few productive wells associated with the Albion-Scipio and Stoney Point Fields have caused a renewed interest in the area. This hearing was the result of a desire to standardize spacing and proration in the two fields, as well as in other areas of potentially similar Trenton-Black River reservoirs, while maintaining flexibility for well locations due to the narrow nature of the fields. A recurring concern, repeated by many witnesses in this matter, is the need for flexibility in locating wells over the targeted bottom hole location. Today with the increased use of 2D and 3D seismic, bottom hole targets can be more precisely identified.

Stipulations

At the evidentiary hearing, the parties stipulated to the geographic area of this Order to include Barry, Eaton, Ingham, Livingston, Oakland, Macomb, St. Clair, Wayne, Washtenaw, Jackson, Calhoun, Branch, Hillsdale, Lenawee, and Monroe.

The parties also stipulated to the formation to be covered by this Order as follows:
The interval from the base of the Utica Shale Formation at a measured depth of 4,911 feet on the gamma ray log to the top of the Glenwood Formation at a measured depth of 5,638 feet for the Mobil Oil Corporation Reeve Unit No. 1,

² "Structures Associated with the Albion-Scipio Oil Field Trend" by Garland D. Ells

Schlumberger Compensated Formation Density Log, Permit No. 29672, in Section 36, T1N, R1W, Leslie Township, Ingham County.

Abrogation of Existing Spacing Orders

OGS Staff recommended that the five unitization orders that apply to the North Stoney Point Field and South Stoney Point Field (Orders No. (A) 1-1-90, (A) 1-1-90 Supplemental, (A) 21-7-91, (A) 26-9-91, and (A) 26-9-91 Supplemental) remain in effect. OGS Staff requested the abrogation of all existing Trenton-Black River Formation spacing orders in the stipulated geographic area, except that the spacing provisions of those orders would remain in effect with respect to any unit associated with an existing well. However, the existing order would be abrogated at such time as the well is plugged, and the lands in the unit would then be subject to this new Order. Staff further requested that an order issued in this cause shall apply to all lands not part of an existing Trenton-Black River drilling unit. There was general support for Staff's position with regard to abrogation of existing Trenton-Black River Formation spacing orders at least to the extent they varied from the respective party's position.

I find that it is appropriate to abrogate all Trenton-Black River Formation spacing orders for the stipulated geographical area except with respect to units associated with an active permit or well. All Trenton-Black River units associated with an existing producible well or with an active permit for a well that has not been plugged before the effective date of this Order may continue as established drilling units under the provisions of the previous applicable order. Pending well permit applications for which a permit has not been issued prior to the effective date of this Order shall comply with the requirements of this Order. An operator who has a pending application may either withdraw the application or amend the application to comply with this Order.

Drilling Unit and Well Spacing Pattern

Mr. Godbold testified the Supervisor's Order should establish drilling units consisting of quarter-quarter sections of land containing 40 acres, more or less, with the well being located anywhere within the drilling unit, but no closer than 330 feet from the unit boundary. This recommendation was based on the current requirements established for the Stoney Point Field in Order No. 4-4-84, and Mr. Godbold's opinion that the Supervisor's previous findings regarding the Stoney Point Field also generally describe the Trenton-Black River Formation in the area of

consideration. In its closing argument, OGS Staff states it would also support the position of West Bay of combining two 20-acre parcels to form a square 40-acre drilling unit.

Continental, West Bay, and Trendwell also supported 40-acre drilling units, with some differences in the make-up of those 40-acre units. West Bay and Trendwell supported square 40-acre units made up of 20-acre building blocks consisting of the north, south, east, or west halves of a quarter-quarter section, with the well being located no closer than 330 feet from the unit boundary and a distance of 660 feet between wells. Mr. Stelzer testified this drilling unit configuration would result in 75 percent of a theoretical section being drillable, whereas 40-acre drilling units comprised of quarter-quarter sections would result in 75 percent of the section not being drillable. Mr. Brock testified that the recovery of original oil in place to date for the Stoney Point Field, with the existing 40-acre spacing, is 37.5 percent, which is considered very good recovery. He further testified that after review of production data for some recently drilled Trenton-Black River Formation wells in Calhoun County, he has no reservations that 40 acres will be efficiently drained by one well throughout the 15-county area. Mr. Brock also testified that based on his economic assumptions for Trenton-Black River Formation development, 40 acres per well is a more efficient use of capital and results in a better return on investment than 20 acres per well. Mr. Sandtveit testified 40-acre drilling units generally provide the most efficient development pattern. He discussed the potential for draining areas outside a drilling unit boundary through acidizing and fracturing treatments, but concluded that a 330-foot setback from the unit boundary would adequately protect correlative rights. Mr. Sandtveit also testified that, in his opinion, a second well was not necessary on a 40-acre drilling unit due to the ability to more accurately pick well locations using 2-D and 3-D seismic.

Continental supported square 40-acre drilling units comprised of 10-acre quarter-quarter-quarter section building blocks, with the well being located no closer than 330 feet from the unit boundary and a distance of 660 feet between wells unless the operator can prove the wells are on separate reservoirs. In Mr. Murray's opinion, a 40-acre drilling unit is appropriate and fair; and by adding flexibility as to how to build that unit, environmental exposure will be limited, reservoir efficiencies will improve, and correlative rights will be dealt with more fairly. Mr. Murray also testified that drilling a second well on a 40-acre drilling unit may be appropriate if an operator could show their 40 acres was not being drained by one well. Mr. Straeter testified a second well would also increase the ultimate recovery of oil where there are two

separate reservoirs in the same unit, or where the first well drilled is on the edge of a reservoir and the operator wishes to drill into a better portion of the reservoir to recover more oil. In his opinion, a second well may also be necessary to prevent drainage and protect correlative rights due to the location of an offset well. Mr. Straeter also stated a horizontal well could possibly drain an entire reservoir across more than one drilling unit.

Mr. Dzierwa testified in favor of 20-acre drilling units with the ability to expand them to 40-acre, or larger, drilling units, with the well being located no closer than 330 feet from the unit boundary and a distance of 800 feet between wells. His testimony cited the improved success rate of wells drilled on 20-acre units. Matrix/Titan recommended maintaining 20-acre drilling units for the Albion-Scipio area previously spaced on 20-acre units and for any areas where the Trenton Formation is greater than 4,000 feet in depth from the surface, with the well being located no closer than 165 feet from the unit boundary and a distance of 330 feet between wells. Mr. Deans testified 40-acre drilling units would be acceptable in areas where the Trenton Formation is less than 4,000 feet in depth; however, fractures are narrower and more sharply defined at greater depths, which favors 20-acre spacing.

I find the most efficient and orderly drilling unit configuration to be a square 40-acre unit consisting of a north half and south half, or an east half and west half, of governmental quarter-quarter sections, with the well being located anywhere in the drilling unit no closer than 330 feet from the unit boundary. This spacing plan will allow operators to assemble units that best cover the interpreted reservoir while minimizing the inclusion of unproductive acreage and precluding 10-acre stranded parcels. To provide the flexibility necessary to produce in a narrow and potentially compartmentalized reservoir, a second well should be allowed on a 40-acre drilling unit.

Stranded Acreage

With the establishment of 40-acre drilling units, it is recognized that stranded 20-acre tracts may occur. OGS Staff recommended a well be allowed on a stranded 20-acre drilling unit provided it is drilled at least 330 feet from the unit boundary. Continental stated the Supervisor should provide a hearing, on a case-by-case basis, for any stranded parcels smaller than 40 acres to balance spacing regulations with flexibility to access the reservoir. West Bay was agreeable to allow a well to be drilled on a stranded 20-acre drilling unit provided the well is not less than 300 feet from the unit boundary. Trendwell was also in favor of allowing a well to be

drilled on a stranded 20-acre drilling unit with a 330-foot setback; however, a well drilled within 12.5 feet of either side of the long central axis of the unit would be permissible.

I find that allowing a well to be drilled on a stranded 20-acre drilling unit will protect correlative rights and prevent waste. The well shall be no closer than 330 feet from a "short" side and 300 feet from a "long" side of the rectangular drilling unit boundaries.

Fractionals and Areas of Private Claims

OGS Staff recommends that no well be allowed within one mile of an undersized fractional quarter-quarter section or a private claim³ until an appropriate drilling unit has been determined by the Supervisor at a hearing. Staff also recommends that this Order apply to fractionals and private claim areas except for the drilling unit size. It is Staff's opinion that undersized fractional quarter-quarter sections that cannot accommodate a well which is no closer than 330 feet from the unit boundary should be considered undrillable and should be combined with an adjacent quarter-quarter section. Oversized fractional quarter-quarter sections that can accommodate a well, which is no closer than 330 feet from the unit boundary, shall be treated as a full drilling unit. Continental and Trendwell generally agreed with Staff's recommendations.

For areas of private claims Staff recommends that, if the Supervisor opts to establish spacing under the terms of this Order, that drilling units be determined by superimposing the governmental survey grid, wherever feasible, into the private claim area; and that where that is not feasible, to establish units approximately 40 acres in size with boundaries parallel and perpendicular to the private claim boundaries.

I find fractionals may be adequately addressed on an individual well-by-well basis within the other provisions of this order. I find it is appropriate to form drilling units by extending government survey lines into immediately adjacent private claims areas.

Proration Allowables

OGS Staff recommends extending the allowables of 150 BOPD and 230 MCFGPD established for the Stoney Point Field in Order No. 4-4-84. These allowables were based on

³ A private claim is a parcel established prior to the first governmental survey, typically having lateral boundaries generally perpendicular to a river or lakeshore

extensive expert testimony. In its closing argument, Staff stated they would also support West Bay's position of 200 BOPD and 230 MCFGPD.

Continental proposed a gas/oil ratio (GOR) based maximum allowable of 1500 cubic feet of gas per one barrel of oil (1500:1); and if a well exceeds that GOR, then it would be assigned a gas allowable. Mr. Murray testified this means a well should be able to produce at any rate determined by the operator as long as the GOR of the well never exceeds a ratio of 1500:1. In his opinion, that is far below the rate that would cause any damage to the reservoir or create waste, yet is sufficient to accelerate the recovery of reserves without undue or unnecessary protracting of operations. Mr. Murray stated that Continental's testing showed that reservoir energy would be maintained, efficient recovery of oil would occur, and waste would not be created at production rates determined by a GOR allowable. Mr. Murray testified the problem with a fixed allowable is that when the well reaches its maximum gas allowable rate, the GOR starts to climb. This, in effect, makes the reservoir inefficient because the operator is producing a disproportionate percentage of the gas from the reservoir at the expense of oil.

Continental's witnesses also testified to the heterogeneous nature of the Trenton-Black River Formation in the designated 15-county area and determined a GOR based allowable was the best way to address these differences while protecting correlative rights and preventing waste. Mr. Straeter testified Continental's Exhibit 13 shows that by producing the McArthur 1-36 well at 500 BOPD instead of 200 BOPD, abandonment would be reached approximately three years earlier thereby minimizing environmental risk, surface use, waste of other energies in producing the well, and saving operating costs.

West Bay recommended a proration allowable of 200 BOPD and/or 230 MCFGPD for wells on 40-acre drilling units and 100 BOPD and/or 115 MCFGPD for wells on stranded 20-acre drilling units. This would be an increase from the current Stoney Point Field allowables of 150 BOPD and 230 MCFGPD set in Order No. 4-4-84; Mr. Brock testified it is based on a study of past practices in the Stoney Point Field and more recent development in the Marengo 12 Field. Mr. Brock's study of the Stoney Point Field indicates the reservoir was very efficient at recovering oil while minimizing the GOR. This means the reservoir energy was conserved until late in the life of the reservoir when most of the oil recovery was obtained anyway. It is Mr. Brock's opinion that a 1500:1 GOR allowable could result in premature abandonment of the reservoir when significant reservoir energy remains. He testified a set allowable, as

recommended by West Bay, would provide for the most efficient drainage of the reservoir without a large reduction in pressure resulting from high withdrawal rates. This slower withdrawal would allow time for lower permeability portions of the reservoir to feed into the rest of the reservoir while there is still sufficient reservoir energy.

Matrix/Titan concurred with West Bay's recommended allowables of 200 BOPD and/or 230 MCFGPD. Mr. Suckle testified that rate equates to a GOR of 1150:1, which in his opinion is *more appropriate than a 1500:1 GOR.*

Trendwell supports the oil allowable of 200 BOPD proposed by West Bay but recommended a gas allowable of 300 MCFGPD. In Mr. Sandtveit's opinion, the typical Trenton-Black River Formation reservoir will not be damaged with production rates of 200 BOPD and 300 MCFGPD. He believes the higher gas allowable will delay, by six months to a year, the need for an operator to request higher gas allowables from the Supervisor to keep producing its wells.

Mr. Dzierwa recommended no fixed daily allowable for oil or gas in the absence of any technical reason to justify them. He states there is no proof producing gas at any rate will reduce recoverable reserves.

After considerable discussion with the Oil and Gas Advisory Committee of the objectives of establishing parameters to conserve reservoir energy and maximize oil recovery, and upon the recommendation of the Committee that a conservative gas allowable be established in this Order due to the considerable areal extent covered by the Order, I find, based on production history and GOR trends in the Stoney Point and Albion-Scipio Fields, that a fixed allowable of 200 BOPD and/or 200 MCFGPD is appropriate to preserve reservoir energy, protect correlative rights and prevent waste. The gas allowable should be based on the total gross gas production. A 200 MCFGPD allowable generally will not limit oil production rates except late in the life of some wells, when it will help to promote ultimate oil recovery from the reservoir. The 200 BOPD and/or 200 MCFGPD allowable is to be considered a unit allowable. I find that a separate allowable for a second well on a drilling unit shall only be granted pursuant to a petition for a hearing before the Supervisor, upon a finding that the well is in a separate, distinct reservoir. Also, the request for a higher allowable for horizontal drainholes extending beyond one drilling unit shall be by petition for a hearing before the Supervisor. I further find that due to the

variability of reservoirs, bottom hole pressure data is helpful to the OGS and shall be submitted as requested by the Supervisor.

Restrictions on the Flaring of Gas

Given the size of the geographic area at issue in this matter, OGS Staff recognizes that it may not be economically feasible to construct pipelines and build gas plants to sell the gas from some wells. However, Staff feels that operators should take all reasonable steps necessary to market gas from their wells. Therefore, Staff recommends that, as long as gas is not gathered and marketed from a well, flaring of gas be limited to one-half the basic daily gas allowable for that well. This recommendation is consistent with Order No. 4-4-84.

Additionally, Staff made the following recommendations regarding flaring of gas: A permittee of a well that is flaring shall, within 30 days of a letter of request from the Supervisor, submit to the Supervisor data necessary to determine whether the well can economically market gas. If data is not timely submitted to the Supervisor, the Supervisor may direct the permittee to shut in the well. Using the data supplied by the permittee and when possible, after meeting with the permittee, the Supervisor or his authorized representative shall inform the permittee in writing whether the well is capable of economically marketing gas. Within 90 days of a determination in the affirmative, the well determined to be capable of economically marketing gas shall cease the flaring of gas. If the permittee disputes the Supervisor's determination, the permittee may file a petition and request a hearing; but the filing of such petition shall not stay the effectiveness of the determination. The permittee of a well determined to be incapable of marketing gas shall be allowed to continue flaring gas up to one-half the daily gas allowable applicable to the well.

Staff further recommended that in the event of a temporary or short-term interruption of the availability of an economic gas marketing arrangement, or in the event of a long-term interruption with permission from the Supervisor, the permittee may commence or resume flaring of gas subject to the forgoing provisions.

West Bay supported the recommendation of OGS Staff for flaring up to one-half (115 MCFGPD) the full daily gas allowable proposed by Staff and West Bay (230 MCFGPD). Trendwell supports the recommendation for flaring up to one-half the gas allowable proposed by Staff and West Bay.

Matrix/Titan supports flaring up to 115 MCFGPD but also proposes that the marketing of gas be deemed not economic when an operator provides reasonable evidence to the Supervisor that the cost to connect a well to a pipeline or facility for the transportation and processing of gas will take in excess of two years to pay out based upon the average monthly natural gas production sales. This two-year payout test was also supported by Continental. For a well incapable of economically marketing gas, Continental recommends the well be allowed to flare at 125 MCFGPD.

Mr. Dzierwa testified an operator should be allowed to flare all its gas if there is no economic market for gas sales, but flaring should be limited while waiting for a sales line connection or during a sales line interruption.

I find it is appropriate to allow flaring of gas at a rate of one-half the gas allowable if the operator can show it is not economic to build a pipeline within a reasonable time. The volume restriction should apply to the net volume of gas flared not including fuel gas used. The approval to flare gas does not grant an exception to any other required permits or approvals.

Other Issues

In addition to the issues of geographic area, formation, spacing, allowables, and flaring that were noticed as issues to be discussed at the hearing, West Bay recommended two other issues be included in this Order. First, West Bay feels multi-stage cementing tools or a DV tool should be required by the Supervisor to obtain an acceptable cement job when a well loses circulation in the production hole. I find this issue is more appropriately addressed in each individual well permit and not in this Order.

Second, West Bay requested the Order allow permits to be issued on drilling units not totally leased, pooled or communitized on condition that the application for permit is accompanied by a certified statement establishing that a good faith effort had been made to obtain the lease or leases or to obtain a communitization agreement to form the full drilling unit and that such effort failed. Should a well be completed on such a drilling unit as a producer, a pooled unit shall be formed by voluntary or compulsory pooling. I find that allowing the drilling of wells on partially leased drilling units will not cause waste and is appropriate.

CONCLUSIONS OF LAW

Based on the stipulations and the findings of fact, I conclude, as a Matter of Law:

1. To prevent the drilling of unnecessary wells, the Supervisor may establish a drilling unit for each pool. A drilling unit is the maximum area that may be efficiently and economically drained by one well. MCL 324.61513(2).
2. Drilling unnecessary wells in the Trenton-Black River Formation would cause waste. MCL 324.61513(3).
3. The establishment of proration limits on daily oil and gas production is necessary to prevent waste and to protect correlative rights. MCL 324.61506(j).
4. Restrictions on the flaring of gas are necessary to prevent waste. MCL 324.61501(q)(ii).
5. The Supervisor has jurisdiction of the subject matter and the persons interested therein.
6. Due notice of the time, place, and purpose of the hearings was given as required by law and all interested persons were afforded an opportunity to be heard. 1996 MR 9, R 324.1204.

DETERMINATION AND ORDER

Based on the Findings of Fact and Conclusions of Law, the Supervisor determines that a special spacing order for the Trenton-Black River Formation is necessary and desirable.

NOW, THEREFORE, IT IS ORDERED:

1. This Order applies to the following 15 counties:
Barry, Eaton, Ingham, Livingston, Oakland, Macomb, St. Clair, Calhoun, Jackson, Washtenaw, Wayne, Branch, Hillsdale, Lenawee, and Monroe.
2. This Order applies to the following formation:
The interval from the base of the Utica Shale Formation at a measured depth of 4,911 feet on the gamma ray log to the top of the Glenwood Formation at a measured depth of 5,638 feet for the Mobil Oil Corporation Reeve Unit No. 1, Schlumberger Compensated Formation Density Log, Permit No 29672, in Section 36, T1N, R1W, Leslie Township, Ingham County.

3. This Order hereby abrogates all existing Trenton Black River Formation spacing orders in the geographic area that is subject to this Order except with respect to units associated with an active permit or well.

A. The following Supervisor of Wells Orders are abrogated in their entirety and are superseded by this Order:

Order No. 11-9-61 ("Spacing Order for Wells Drilled for Oil and Gas and Natural Dry Gas in the Partello Salina-Niagaran and Lower Formation Pools," effective November 9, 1961)

Order No. (A) 1-2-72
Order No. (A) 2-1-79
Order No. (A) 18-8-79
Order No. 1-4-80
Order No. (A) 20-11-80
Order No. 13-10-82
Order No. 32-9-83
Order No. (A) 35-9-84
Order No. (A) 59-12-85
Order No. (A) 28-8-86
Order No. 3-3-87
Order No. (A) 9-2-88
Order No. (A) 18-4-88
Order No. (A) 40-6-88
Order No. (A) 27-11-89
Order No. 7-8-90
Order No. (A) 1-1-91
Order No. (A) 2-1-91
Order No. (A) 4-2-96
Order No. (A) 9-4-05

B. The following Supervisor of Wells Orders are abrogated and superseded by this Order with respect to any area that is not within a unit established by either an existing producible well or an active permit to drill and operate for a well that has not been plugged as of the effective date of this Order:

Order No. 15-12-82
Order No. 4-4-84
Order No. 9-7-84
Order No. (A) 12-3-85
Order No. 4-10-88
Order No. 4-10-88 Amended

For areas where the above existing Orders remain in effect due to the existence of a producible well or active permit, the existing Order shall be abrogated and shall be

superseded by this Order with respect to spacing and well location requirements at such time as the well is plugged or the permit is terminated; however, the provisions of this Order are in effect immediately with respect to proration (paragraph 8) and flaring of gas (paragraph 10)

C. This Order shall be in effect for each respective area subject to the following existing unitization Orders at such time as the unit is dissolved under the terms of the existing Order:

- Order No. (A) 1-1-90
- Order No. (A) 1-1-90 Supplemental
- Order No. (A) 21-7-91
- Order No. (A) 26-9-91
- Order No. (A) 26-9-91 Supplemental

D This Order supersedes the provisions of Special Order No. 1-73 and Special Order No. 1-73 Amended with respect to the formation described in paragraph 2.

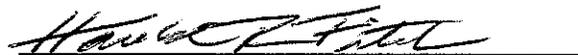
4. An operator who has a Trenton-Black River Formation well permit application pending within the geographic area that is subject to this Order, at the effective date of this Order, may elect to either withdraw the application or amend the application to comply with the provisions of this Order.
5. A standard drilling unit shall consist of 40 acres, more or less, in the form of a square, assembled by combining two 20-acre parcels, each of which shall consist of the north and south, or east and west halves of a quarter-quarter section or of adjacent quarter-quarter sections. The bottom hole location shall be anywhere on the drilling unit not less than 330 feet from the drilling unit boundaries.
6. If no 20-acre building block is available to combine with another 20-acre building block to form a square 40-acre drilling unit, then a drilling permit may be issued for a 20-acre drilling unit consisting of the north, south, east, or west half of a quarter-quarter section. The bottom hole location of any well drilled on a 20-acre drilling unit shall be anywhere on the drilling unit not less than 300 feet from the long boundaries of the drilling unit and 330 feet from the short boundaries of the drilling unit.

7. Properties or parts of properties in one or more private claims may be combined with immediately adjacent properties that are within a governmental survey to form a full 40-acre unit by extension of government survey lines into the private claims area. In areas of private claims where the governmental survey cannot be thus extended, units shall only be established pursuant to a Supervisor of Wells hearing.
8. The Supervisor, after receiving technical data that one well may not economically and efficiently drain a drilling unit, may allow a second well on a 40-acre drilling unit provided both wells are not less than 330 feet from the drilling unit boundaries.
9. Proration allowables for wells subject to this Order are hereby established at 200 BOPD and/or 200 MCFGPD for 40-acre drilling units. The gas allowable shall apply to the total gross volume of gas produced. Proration allowables for 20-acre drilling units shall be one-half the daily allowable for a standard 40-acre drilling unit. An additional allowable for a second well shall only be granted after a determination by the Supervisor, pursuant to a petition for a hearing, that the wells are in separate reservoirs.
10. For each well subject to this Order, the report of oil and gas produced, purchased, or transported required by rule under Part 615 shall include the gross volumes of oil and gas produced as well as the volume of gas utilized for lease fuel or other uses and the volumes of gas sold or flared.
11. The Supervisor may issue a permit to drill on a drilling unit described in this Order that is not totally leased, pooled, or communitized on condition that the application for permit is accompanied by a certified statement establishing that a good faith effort had been made to obtain the lease or leases or to obtain a communitization agreement to form the full drilling unit and that such effort failed. Should a well be completed on such drilling unit as a producer, a pooled drilling unit shall be formed by voluntary or compulsory pooling. This pooled unit shall conform to this Order or to a drilling unit adopted following a Supervisor's hearing.
12. Gas that is not reasonably marketable may be flared. The volume of gas flared is restricted to 100 MCFGPD for a 40-acre drilling unit or 50 MCFGPD for a 20-acre drilling

unit, which shall be the net volume of gas flared not including gas used for reasonable and necessary lease fuel purposes. The permittee of a well that is flaring gas shall, within 30 days of a letter of request from the Supervisor, submit to the Supervisor data necessary to determine whether the well can economically market gas. If data is not timely submitted to the Supervisor, the Supervisor may require the permittee to cease the flaring of gas. Based upon the data supplied by the permittee and other information available to the Supervisor, and after meeting with the permittee as necessary, the Supervisor or his authorized representative shall determine whether gas from the well can be economically marketed and shall inform the permittee in writing of that determination. Within 90 days of a determination in the affirmative, or at such later date as the Supervisor may specify, the permittee shall cease the flaring of gas from the well. If the permittee disputes the Supervisor's determination, the permittee may file a petition and request a hearing; but the filing of such petition shall not stay the effectiveness of the determination. If the Supervisor determines that gas from the well cannot be economically marketed, the permittee shall be allowed to continue flaring gas at the rate specified above. Permission to flare does not grant an exception to any other required permits or approvals.

13. Exceptions to the requirements of this Order may be granted after notice and hearing.
14. The Supervisor retains jurisdiction in this matter.
15. This Order is effective immediately

Dated: Dec. 26, 2008



HAROLD R. FITCH
Assistant Supervisor of Wells
Office of Geological Survey
P. O. Box 30256
Lansing, MI 48909

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
SUPERVISOR OF WELLS

IN THE MATTER OF

A HEARING TO BE HELD AT THE INITIATIVE OF THE)
SUPERVISOR OF WELLS TO DO THE FOLLOWING WITH)
RESPECT TO TRENTON AND BLACK RIVER FORMATION WELLS)
WITHIN A CERTAIN GEOGRAPHIC AREA: SET OIL AND GAS)
ALLOWABLES; ESTABLISH OR MAINTAIN SPACING AND) CAUSE 18-2007
LOCATION OF WELLS; CONSIDER THE DESIRABILITY OF)
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AND (A) 4-10-88, WHICH PROVIDE FOR SPACING AND)
PRORATION OF TRENTON BLACK RIVER FORMATION WELLS IN)
CALHOUN, JACKSON, AND HILLSDALE COUNTIES.)

ORDER ON APPLICATION FOR ISSUANCE OF SUBPOENA

Matrix Exploration & Development, LLC (Matrix) and Titan Energy, LLC (Titan), through their attorneys, Zirnheld & Bowron, P.L.C. filed an Application for Issuance of Subpoena dated March 12, 2008, requesting access to documents and data in the possession of the parties to this matter, related to oil and gas wells drilled by the parties. On March 31, 2008, an Order Directing Response to Application for Issuance of Subpeona was issued offering the other Parties in this matter an opportunity to respond. Responses in opposition to the Application for Issuance of Subpoena were filed by David Dzierwa, Continental Resources, Inc., Trendwell Energy Corporation, Office of Geological Survey (OGS), and the West Bay Group.

Matrix and Titan state the ability to develop an evidentiary record with respect to the issues covered by the hearing is vitally dependant on access to documents and data in the possession of the Parties. They further argue that the absence of production of the requested data and documentation will prejudice their ability to fully participate in this matter. Respondents' argue the additional 10 days to review exhibits and witness lists submitted by the parties along with Matrix and Titan's own data and additional information in the public record, should provide Matrix and Titan ample opportunity to participate in the hearing. In addition the Respondents called the Application overly broad, oppressive, unduly burdensome, and unreasonable in view of the scope and purpose of the hearing. Respondents further stated they believe the information sought is proprietary and confidential and to grant the subpoena would likely result in some parties withdrawing from the hearing.

I agree that the subpoena request is unreasonable, and the concern for protecting the proprietary nature of the information requested outweighs its usefulness to the Supervisor and the Parties. The intent of this technical evidentiary hearing is to allow the participants an opportunity to offer testimony and exhibits they determine to be appropriate and relevant in

support of their respective positions. Granting the subpoena request would turn this hearing into an adversarial proceeding and squelch the cooperative nature of the proceeding

Respondents assert good cause for and relevance of the subpoena have not been demonstrated as required under R 324.1207(3) and R 324.1207(2)(a) respectively of the administrative rules of Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended.

Matrix and Titan filed Applicants' Reply to Respondents' Objection to the Issuance of Subpeona, supporting their objections and stating that the information sought, particularly three-dimensional seismic, is relevant and necessary for the Supervisor to reach a reasoned determination of the appropriate well spacing for the Trenton Black River Formation.

While the information requested by Matrix and Titan is relevant to the matter, I find there is no good cause to order the Parties to share proprietary information when their participation in this hearing is at their own initiative. It is anticipated each Party will present sufficient technical evidence to support its position without the need for a subpoena.

THEREFORE, IT IS ORDERED:

The Application for Issuance of Subpoena dated March 12, 2008, is DENIED.

DATED: April 23, 2008



HAROLD R. FITCH
ASSISTANT SUPERVISOR OF WELLS
Office of Geological Survey
P.O. Box 30256
Lansing, MI 48909-7756

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
SUPERVISOR OF WELLS

IN THE MATTER OF

A HEARING TO BE HELD AT THE INITIATIVE OF THE)
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ORDER ON MOTION TO AMEND AND CLARIFY ORDER OF ADJOURNMENT

Matrix Exploration & Development, LLC and Titan Energy, LLC, through their attorneys, Zirnheld & Bowron, P.L.C. filed a Motion to Amend and Clarify Order of Adjournment, requesting the date for exchange of witness and exhibit lists between the Parties in this matter be changed to May 19, 2008; and clarification on whether this was a mail date or service date.

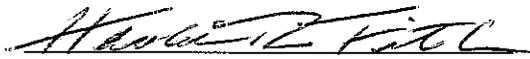
In his Motion, Mr. Aaron Bowron states the five days between the date given for exchange of witness and exhibit lists in the Order of Adjournment and the hearing does not allow enough time for the parties to adequately analyze the exhibits and witness lists before the hearing and will compromise the integrity of the evidentiary record.

I find there would be no prejudice to any one party to allow more time between the exchange of exhibits and witness lists and the hearing. The pre-hearing conference transcript clearly states the exchange date was intended to be a service date, not a mail date.

THEREFORE, IT IS ORDERED:

The Parties shall serve their exhibits and witness lists on the other Parties, so that the exhibits and witness lists are received by the Parties, on or before May 19, 2008.

DATED: Mar. 21, 2008


HAROLD R. FITCH
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Office of Geological Survey
P.O. Box 30256
Lansing, MI 48909-7756

STATE OF MICHIGAN
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CALHOUN, JACKSON, AND HILLSDALE COUNTIES.)

ORDER DIRECTING RESPONSE TO APPLICATION FOR ISSUANCE OF SUBPOENA

Matrix Exploration & Development, LLC and Titan Energy, LLC, through their attorneys, Zirnhelt & Bowron, P.L.C. filed an Application for Issuance of Subpoena dated March 12, 2008, requesting access to documents and data in the possession of the parties to this matter, related to oil and gas wells drilled by the parties. The parties should have an opportunity to respond to this motion.

THEREFORE, IT IS ORDERED:

The parties shall file with the Supervisor and serve responses to this Application on the other parties on or before April 3, 2008.

DATED: Mar. 21, 2008


HAROLD R. FITCH
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Office of Geological Survey
P.O. Box 30256
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STATE OF MICHIGAN
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ORDER ON MOTION

Mr. David J. Dzierwa filed a letter dated January 16, 2008, requesting that he be made a full party to the above captioned matter. The parties were provided an opportunity to respond to this motion. Replies were filed by the West Bay Group, Savoy Energy, L.P., Trendwell Energy Corporation, Matrix Exploration and Development, LLC and Titan Energy, LLC, Continental Resources Inc., and the Office of Geological Survey.

DETERMINATION AND ORDER

Mr. Dzierwa filed a timely answer to the Notice of Hearing. In his answer he indicated that he may not be present for the pre-hearing conference, but stated his desire to participate in the hearing as a full party. Because he was not present at the pre-hearing conference, he was not made a full party to the proceeding. None of the replies to Mr. Dzierwa's motion suggest that prejudice would result should Mr. Dzierwa be made a full party to this proceeding. Only one party objected to his participation in that capacity, but provided no independent basis for that position. I find that Mr. Dzierwa's participation in this proceeding as a full party will not prejudice the existing parties, provided that he is bound by the schedule established in the Order of Adjournment issued on January 31, 2008.

THEREFORE, IT IS ORDERED:

1. Mr. David J. Dzierwa is a full party to this proceeding.
2. Mr. Dzierwa is bound by the schedule established in the Order of Adjournment issued January 31, 2008.

DATED: Feb. 8, 2008



HAROLD R. FITCH
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Office of Geological Survey
P.O. Box 30256
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ORDER OF ADJOURNMENT

The Office of Geological Survey through its attorney, Ms. Barbara Schmidt, has requested an adjournment of the hearing scheduled for March 4, 5, 6, and 7, 2008, in this matter. All parties, as determined by Pre-Hearing Conference Order dated December 20, 2007 (with the exception of Mr. Jack Sage now representing Continental Resources Inc.), have agreed to an adjournment of the hearing. The parties have agreed to participate in an informal meeting on March 4, 2008, in order to obtain stipulations of fact.

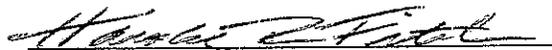
The following is the procedure for the hearing.

THEREFORE, IT IS ORDERED:

1. The Notice of Hearing set January 15 and 16, 2008, as the days for hearing. The Pre-Hearing Conference Order set new hearing dates of March 4, 5, 6, and 7, 2008. These dates are cancelled and the new hearing dates are June 3, 4, and 5. The hearing shall begin on Tuesday June 3, 2008 at 9:30 a.m. in the Stephen Nisbet hearing room, atrium level, south tower, Constitution Hall, 525 W. Allegan, Lansing, Michigan 48933.
2. The parties shall meet in an effort to reach agreement on issues pertinent to this matter. This meeting is to be held on March 4, 2008 at 9:30 a.m. in the Stephen Nisbet hearing room, atrium level, south tower, Constitution Hall, 525 W. Allegan, Lansing, Michigan 48933.

3. On or before February 14, 2008, the Office of Geological Survey shall notify the other Parties of its positions on the issues and provide the approximately 32 orders that may be affected by this case.
4. The Office of Geological Survey shall present its evidence first. The remaining five Parties shall discuss their order of presentation and shall notify the Assistant Supervisor on or before May 15, 2008, of their agreement or lack thereof. If no agreement is reached, the Assistant Supervisor shall notify the parties of their order of presentation no later than May 29, 2008.
5. The remaining Parties shall serve their exhibits and witness lists on the other Parties on or before May 29, 2008.

DATED: Jan. 31, 2008



HAROLD R. FITCH
ASSISTANT SUPERVISOR OF WELLS
Office of Geological Survey
P.O. Box 30256
Lansing, MI 48909-7756

STATE OF MICHIGAN
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PRE-HEARING CONFERENCE ORDER

On December 18, 2007, a pre-hearing conference was held in the above captioned case. After review of the Notice of Hearing and its publication, the Administrative Law Judge determined that the Notice and its publication were adequate to provide notice to those persons who may be interested in this proceeding and were proper. During this pre-hearing conference, the Parties and their representatives were established as: the Office of Geological Survey by Barbara Schmidt, Department of Attorney General (DAG); Savoy Energy, L.P. by Mr. John Norris, attorney; Matrix Exploration and Development, LLC and Titan Energy, LLC by Mr. Peter Zirnhelt, attorney; Trendwell Energy Corporation by Mr. William Horn, attorney; Continental Resources Inc. by Mr. Gary Worman, attorney; and the West Bay Group by Mr. James R. Neal, attorney.

Mr. David Dzierwa filed a timely answer. However, he did not appear for the pre-hearing conference and, therefore, is not a full party to this proceeding. Mr. Dzierwa may make a statement on the record, not under oath, at the close of the proofs.

The Parties agreed to the following procedure for the hearing.

THEREFORE, IT IS ORDERED:

1. The Notice of Hearing set January 15 and 16, 2008, as the days for hearing. These dates are cancelled and the new hearing dates are March 4, 5, 6, and 7, 2008. The hearing shall begin on March 4, 2008 at 9:30 a.m. in the Stephen Nisbet hearing room, atrium level, south tower, Constitution Hall, 525 W. Allegan, Lansing, Michigan 48909.

2. The Office of Geological Survey shall present its evidence first. The remaining five Parties shall discuss their order of presentation, and shall notify the Assistant Supervisor on or before February 14, 2008, of their agreement or lack thereof. If no agreement is reached, the Assistant Supervisor shall notify the parties of their order of presentation no later than February 28, 2008.
3. There is no need for pre-hearing Motions to be filed in this case.
4. On or before February 14, 2008, the Office of Geological Survey shall serve its witness list and exhibits, including approximately 32 orders that may be affected by this case, on the other Parties.
5. The remaining Parties shall serve their exhibits and witness lists on the other Parties on or before February 28, 2008.

DATED: Dec. 20, 2007


HAROLD R. FITCH
ASSISTANT SUPERVISOR OF WELLS
Office of Geological Survey
P.O. Box 30256
Lansing, MI 48909-7756

STATE OF MICHIGAN
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NOTICE OF HEARING

Take notice that a pre-hearing conference and subsequent hearing will be held before the Supervisor of Wells (Supervisor) in the city of Lansing, Michigan, on the EIGHTEENTH DAY OF DECEMBER (DECEMBER 18) 2007 (PRE-HEARING CONFERENCE); and FIFTEENTH AND SIXTEENTH DAYS OF JANUARY (JANUARY 15 AND 16) 2008, (HEARING), BEGINNING AT 9:30 A.M.; AT THE DEPARTMENT OF ENVIRONMENTAL QUALITY, STEPHEN NISBET HEARING ROOM, ATRIUM LEVEL, SOUTH TOWER, CONSTITUTION HALL, 525 WEST ALLEGAN STREET, LANSING, MICHIGAN. The pre-hearing conference and hearing will be conducted pursuant to Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA), MCL 324.61501 et seq.; the administrative rules, 1996 AACS, 2001 MR 2, 2002 MR 23, R 324.101 et seq.; and the Administrative Procedures Act, 1969 PA 306, as amended, MCL 24.201 et seq.; MSA 3.560(101) et seq.

The Supervisor of Wells is initiating a technical evidentiary hearing for the purpose of receiving testimony and evidence pertaining to the need or desirability of issuing a Trenton Black River Formation order considering the following:

1. Establishing a certain geographical area to include the following counties:
Barry, Eaton, Ingham, Livingston, Oakland, Macomb, St. Clair, Wayne, Washtenaw, Jackson, Calhoun, Branch, Hillsdale, Lenawee, and Monroe
2. Establishing or maintaining oil and gas allowables in the above mentioned geographic area equivalent to the current allowables in the Stoney Point Field of 150 BOPD and 175 MCFD
3. Establishing spacing for new wells and maintaining spacing for existing wells.
4. Restricting the flaring or venting of gas.
5. Amending or abrogating Order No. (A) 9-7-84 and Order No. (A) 4-10-88 which provide for spacing and proration of Trenton Black River Formation wells located within specified areas of Calhoun, Jackson, and Hillsdale counties.

The pre-hearing conference is for the purpose of establishing parties and identifying and clarifying issues

Take note that if you wish to participate as a party in the hearing by presenting evidence or cross-examining witnesses, you shall prepare and mail or otherwise deliver to the Supervisor, not less than 5 days before the pre-hearing conference date, an answer in the matter. The answer shall state with specificity the interested person's position with regard to the matter. Mail the letter to the Supervisor in care of the Assistant Supervisor of Wells, Mr. Harold R. Fitch, Geological Survey Division, P.O. Box 30256, Lansing, Michigan 48909-7756.

Questions regarding this Notice of Hearing should be directed to Ms. Susan Maul, Office of Geological Survey, Michigan Department of Environmental Quality, P.O. Box 30256, Lansing, Michigan 48909-7756, telephone number 517-241-1552. Persons with disabilities needing accommodations for effective participation in this hearing should call or write Ms. Maul at least a week in advance of the hearing date to request mobility, visual, hearing, or other assistance

Dated: *Oct. 30, 2007*



HAROLD R. FITCH
ASSISTANT SUPERVISOR OF WELLS
Office of Geological Survey
P.O. Box 30256
Lansing, MI 48909