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State of Louisiana
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF CONSERVATION

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LDNR/OC Comments on TBC's *Response to Ninth Amendment Directive 2*,
dated and submitted April 28, 2014

Section 1.0

1. As stated in the third paragraph of Section 1.0, "These additional PMWs coupled with the existing PMW network will be used for long term monitoring of pressures in the MRAA and will reduce the need for and frequency of repeat cone penetrometer testing (CPT) for gas pressure evaluation." Therefore, additional PMWs shall be installed (PMW-015S&M) in the southwest corner of the new south berm and PMW-XXXS&M(number TBD) southeast of ORW-55, along Bayou Corne for long term monitoring of pressures in the MRAA. Therefore a total of 5 (five) pressure monitoring wells shall be installed in lieu of the 11 (eleven) directed in Directive 2 of the Ninth Amendment, Declaration of Emergency.

TBC Response: *TBC agrees to install 5 additional PMWs (PMW-004, PMW-007, PMW-017, PMW-015 and PMW-020). Each of these PMW locations will require a new CPT to be installed in advance in order that the screen intervals of each of the PMWs can be appropriately set. The procedures and safety procedures for installing the CPTs will be per the Response to LDNR's Eight Amendment Order, Comprehensive Plan – CPT Program as update August 12, 2013.*

At the PMW-015 location, TBC proposes that if gas is not detected in the MRAA zone at an interpreted thickness greater than 1.5 feet then the PMW-015 nested well would not be installed.

LDNR/OC Response: Note that as per Directive 2 of the 9th Amendment, 11 PMWs were originally required. Therefore, there are not "5 additional PMWs," but 5 wells of 11 that are now required for installation per the Ninth Amendment, Directive 2.

PMW-015 shall be installed regardless of the proposal stated above.

Section 2.0

1. In the first paragraph, it is stated that "TBC proposes a modification to the BRC's recommended PMW monitoring network based on an evaluation of the proposed network and current data regarding the areal extent and present existence of methane gas in the MRAA." In the third paragraph, it is stated that "The areal coverage of the existing and proposed PMWs will provide data representative of the areas of the site with remaining MRAA gas." If there are changes in the MRAA gas cap over time (continued lateral/vertical gas migration to new areas and/or gas recharge to areas that were previously depleted) and/or new areas of gas are discovered, additional PMWs may be needed in the future to delineate and monitor the extent of gas.

TBC Response: *Comment noted.*

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LDNR/OC Response: No further comment.

2. In the third paragraph, it is stated that eight MRAA wells are equipped with pressure transducers. Currently, all the MRAA well transducers are installed in the middle (M) MRAA wells, with one exception of a middle and deep well in the MRAA-02 well cluster. Some of these MRAA shallow and middle well clusters could be used to monitor gas pressure similar to the other paired shallow and middle PMWs. Accordingly, it is recommended that at a minimum, wells MRAA-04S/04M and MRAA-05S/05M be equipped with pressure transducers to function as “control stations” to provide data to help interpret the pressure data from the PMWs.

TBC Response: *Wells MRAA-04M and -05M already are equipped with pressure transducers. Please explain what is meant by a “control station” and how the data from the pressure transducers in MRAA wells will be used.*

LDNR/OC Response: As stated in LDNR/OC’s original comment above, “Currently, all the MRAA well transducers are installed in the middle (M) MRAA wells.....” and “Accordingly, it is recommended that at a minimum, wells MRAA-04S/04M and MRAA-05S/05M be equipped with pressure transducers to function as “control stations” to provide data to help interpret the pressure data from the PMWs.” This Office acknowledged transducers installed in the “M” wells and recommends installation of transducers in the “S” wells (04 and 05; at a minimum).

It is recommended that MRAA “control monitoring stations” be established to quantify that the differential pressures between the shallow and middle portions of the MRAA are constant over time and location. This is recommended due to vertical hydraulic and density gradients within the MRAA and to define how differential pressure changes over time. TBC has established one such “control station” at the PMW-08S/M cluster. Two additional “control stations” are recommended at MRAA-04 and MRAA-05 well clusters. Transducers should be installed and monitored in the shallow wells at each of those MRAA well clusters.

Section 3.1

1. Exact locations are not described for the PMWs that will be installed in the community (PMWs 004S&M and 007S&M). Provide exact CPT locations and PMW well locations prior to installing these boreholes. LDNR/OC understands that the PMW locations will be based on the CPT results.

TBC Response: *Figures 1 and 2 attached shows the locations for the CPTs and PMWs, exact locations will be based on field verification of utilities. On-site LDNR representatives will be shown the final locations after the locations are staked.*

LDNR/OC Response: Exact locations shall be provided via conservation order with a photograph and brief description 48 hours prior to commencing work.

2. CPT logs shall be provided as soon as possible after the CPT sounding is completed and prior to installation of the PMW. These log(s) should be submitted via conservation order.

TBC Response: *TBC agrees to do this.*

LDNR/OC Response: No further comment.

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3. Provide safety precautions, procedures, and contingency plans for drilling both CPTs and PMWs in the community. This includes, but is not limited to air monitoring, traffic (vehicular and foot) control, and notifications to the community and applicable state and local agencies.

TBC Response: *TBC will follow the procedures described in the attached Comprehensive Work Plan for Bayou Corne Community Gas Mitigation & Monitoring, dated October 22, 2013.*

LDNR/OC Response: This Office does not object to TBC proceeding with its previously submitted October 22, 2013 *Comprehensive Work Plan for Bayou Corne Community Gas Mitigation and Monitoring Plan* as supplemented also by TBC October 30, 2013, responses to comments provided by this Office.

Section 3.4

1. Security fences shall be equipped with locks and secured when not accessed by TBC personnel.

TBC Response: *TBC will provide either a security fence with locks or a lockable low-profile irrigation cage to secure the PMWs in the community*

LDNR/OC Response: Provide specifications on the “low-profile irrigation cage” which was not mentioned in the previously submitted response.

2. Permanent air monitoring devices shall be installed at the well pad for PMWs installed in the community.

TBC Response: *TBC will comply with this comment, assuming permanent means as long as the PMWs are operational.*

LDNR/OC Response: The above assumption is correct – permanent in the above statement refers to the operational life of the PMW.

Section 3.6

1. A letter report shall be submitted within 21 days of completion of the PMWs. The report data should include, at a minimum:
 - CPT gas survey results documentation including Excel spreadsheets summarizing dissipation tests (dissipation test data, dissipation interpretation and gas interpretation) and continuous pore pressure and dissipation tests versus depth graphs.
 - Data and results of the PMW connectivity testing (gas zone) including transducer data, gas flow rate and volume data, and all other collected field data in Excel spreadsheets.
 - Data and results of the PMW connectivity testing (water zone) including slug test data and analysis.

TBC Response: *TBC will comply with this comment.*

LDNR/OC Response: No further comment.

Section 4.1

1. TBC is proposing a modification to the PMW bleed-down test, indicating that the “test would be difficult to implement, because it would likely lead to high gas flow rates in wells where substantial initial gas thickness is present.” Control of the gas flow can be achieved with the use

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of a throttling valve such as a choke or needle valve (a ¾-inch or 1-inch needle valve should provide the ability to flow 3 casing volumes in a controlled manner). A ball valve is not appropriate for controlling the flow of gas from the PMWs.

TBC Response: *TBC will use an appropriate valve to control gas flow.*

LDNR/OC Response: Provide the type of valve that will be used.

2. For initial testing, gas drawdown or buildup (recovery) tests may also be performed on the PMWs with gas. These tests include recording pressure on 10-second intervals with a 50 psi Troll in the gas column after the wells are shut in from the initial flow period. This type of testing is similar to groundwater recovery tests. The analysis method accounts for the gas compressibility. The Troll 700 transducers are capable of multiple readings per second if necessary to record the test data.

TBC Response: *TBC will use the suggested procedures in this comment. Please note that the Track-It pressure transducers have a reported accuracy of +/- 1%, resolution of 0.25% and repeatability of +/- 0.05%. TBC intends to use the Track-Its for this at as they will provide the required data and accuracy needed for this test.*

LDNR/OC Response: It is noted that TBC will use a Track-It in lieu of the recommendations above. Provide the exact recording frequency interval that will be used during the flow tests.

3. The second paragraph references the PMW pressure venting event as a “one-time test specified by the LDNR...” The April 15, 2014 LDNR/OC comments on TBC’s procedures for venting PMWs requested that a written schedule for bleeding down the PMWs be provided. Previously, TBC proposed a monthly schedule for the bleed-off events. There is no objection to the monthly bleed-off schedule; however, if there is a need to alter this schedule, the reason for the schedule change should be submitted in writing to LDNR\OC.

TBC Response: *TBC will implement a monthly PMW venting schedule.*

LDNR/OC Response: No further comment.

4. In addition to the instrumentation and measurements listed in the third paragraph, the following additional measurements are necessary (as outlined in the April 15, 2014 LDNR comments on TBC’s procedures for venting PMWs; see comments for Section 5.0):
 - After 3 casing volumes have been bled off, the master valve should be closed and the cumulative gas flow total and final flowing wellhead pressure should be recorded.
 - One hour after flowing, the wellhead pressure should be recorded.
 - The 24-hour pressure reading should be reported in the routine ORW/PMW monitoring. The monthly transducer data download should be conducted at this time.
 - An electronic report from PMW bleed-off events should be reported to LDNR/OC within 14 (fourteen) days after completion of the event. The report should include but is not limited to: data from the manual field measurements, gas flow meter, down-hole transducer, Track-It pressure data and a narrative with any deviations, observations, or interpretations. Raw data should also be electronically included as Microsoft Excel files as applicable.

TBC Response: *TBC will provide a schedule that will allow all pressure transducer data to be submitted routinely once per month for both the ORW and the PMW wells. It is planned to submit a schedule for venting of the PMWs starting mid-month with the ORW pressure transducer data being downloaded near the end of each calendar month.*

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LDNR/OC Response: No further comment.

5. All future PMWs located in or around the community shall also be connected to flare during venting activities. Temporary air monitoring should be provided immediately around the well site during the bleed-off process. At a minimum, LEL and H2S should be monitored in real-time.

TBC Response: *The quantity of gas to be flared during venting of PMWs is de minimis. Additionally there are safety concerns related to introducing a higher pressure of PMW vent gas into the low pressure gas line to the flare. It has investigated available small flares with the result that there are not any identifiable small flares for this small quantity of gas with the required safety features.*

Horizontal boring together with open trenches in the front yards of the two residences in the Sportsman's Paradise neighborhood would be required in order to connect these PMW vent piping to the gas line flowing to Flare #5. This additional disturbance is not warranted for this de minimis quantity of gas.

Therefore, as a safe alternative TBC will vent this de minimis quantity of gas (< 20 SCF) each PMW venting event through a 10-foot high vent pipe to allow rapid dispersion of this gas in a safe manner. Temporary real-time air monitoring will be performed with a portable gas meter to ensure the safety of workers and residents.

LDNR/OC Response: TBC states that “The quantity of gas to be flared during the venting of PMWs is *de minimis*. Additionally there are safety concerns related to introducing a higher pressure of PMW vent gas into the low pressure gas line to the flare.” Provide an explanation how the “higher pressure PMW vent gas” would pose a safety hazard as the release (flow) should be controlled by a needle valve or choke if the gas were introduced into the flow line to flare?

The venting alternative through a 10-foot high vent pipe is not approved. This height is shorter than surrounding, occupied residences adjacent to the proposed PMWs (assuming the PMW locations will be adjacent or near the recently completed CPTs-127 and 128).

Pending connection of the PMWs to the current vent lines, TBC shall propose an alternate venting procedure for at least those wells in or near the community or roadway (PMW-019S, PMW-018S, and the to-be-installed PMWs -004S, 007S, and the PMW near CPT-131 and ORW-55).

6. The PMW bleed-off procedure does not include provisions for management of PMWs that may become watered in. A written procedure should be developed and submitted to LDNR/OC for removal of water for re-establishing communication with gas cap. If TBC determines a PMW is not in good communication with the MRAA gas cap, any proposed well redevelopment shall be completed separately from the pressure bleed-down measurement events and separate detailed well redevelopment procedure should be provided for LDNR/OC review and comment as necessary.

TBC Response: *TBC will prepare a written procedure for removal of water for re-establishing communication with the gas cap, if one is present. TBC will prepare a separate well redevelopment procedure for the PMWs.*

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LDNR/OC Response: No further comment.

Section 4.2

1. In the first paragraph, it is stated that slug tests will be performed on the “water-zone MRAA piezometers and repeated annually to confirm adequate aquifer communication.” If at any time the well pressure data/operational conditions indicate poor communication with the MRAA, slug testing shall be conducted more frequently to determine the need to redevelop the well to reestablish good communication with the MRAA.

TBC Response: *TBC will comply with the above comment.*

LDNR/OC Response: No further comment.

2. Under item 6 of the slug test procedures, the type of “pressure indicator gauge” that is referenced needs to be specified in writing (make, model, pressure range, accuracy, etc.).

TBC Response: *TBC will provide pressure gauge details including: make, model, pressure range, accuracy, etc. TBC will use an In-Situ vented LevelTroll 700, 30 psi pressure transducer/datalogger retrofitted with a 1/8” NPT adapter to be screwed into the well head with a pressure-tight seal to record wellhead pressure.*

LDNR/OC Response: No further comment.

3. Under item 12 of the slug test procedures, the test shall be completed a minimum of twice at different pressure setting to provide quality assurance/quality control of the testing procedure.

TBC Response: *TBC will comply with this comment.*

LDNR/OC Response: No further comment.

Section 5.0

LDNR/OC provided comments on April 15, 2014, in response to TBC’s *Procedure for Venting Pressure Monitoring Wells*, Dated April 2, 2014 and submitted April 8, 2014. Similar comments are provided again below for Section 5.0:

1. Since some of the PMWs were constructed with narrow well casings; the wells should not be allowed to water-in during the pressure bleed-down events, as it will be difficult to remove water from the narrow casing of these wells in the event they water-in. It is recommended that the pressure bleeding procedure focus on bleeding down a fixed volume of gas from each PMW to demonstrate communication with the gas cap. To achieve the necessary data collection and procedural objectives, the following procedures and data collection are recommended for all PMW bleed off events:
 - a. Develop a written schedule for bleeding down the PMWs. This schedule will allow LDNR/OC or their designated representative prior notification to observe the process.
 - b. Read and record the gas pressure at the PMW wellhead prior to the pressure bleed-down.
 - c. Connect a choke and electronic gas flow meter to the PMW (the gas flow meter should be the same type used on the Observation Relief Well [ORW] -21 and ORW-

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38 dewatering tests that provided for an instantaneous gas flow-rate and cumulative flow total).

- d. Zero the flow meter totalizer or record the pre-test cumulative gas flow total on the totalizer.
- e. Confirm that the choke is closed.
- f. Open the master valve on the PMW and slowly open the choke while monitoring the wellhead pressure.
- g. Open the choke until the wellhead pressure has been reduced by approximately 25 to 30 percent of the pre-bleed-down pressure reading and no more than 15 to 20 psi.
- h. Bleed down the PMW until 3 casing volumes of gas have been removed from the well. The volume of gas in the casing can be calculated using the formula below (assuming approximately 110 feet from the ground surface to the top of screen and casing diameter in inches).
$$Volume (std ft^3) = \frac{Casing\ diameter^2 * \pi}{4 * 144} * 110' * \frac{(Wellhead\ pressure + 14.7)}{14.7}$$
- i. Record the venting (bleeding-off) wellhead pressure.
- j. After 3 casing volumes have been bled off, the master valve should be closed and the cumulative gas flow total and final flowing wellhead pressure should be recorded.
- k. One hour after flowing, the wellhead pressure should be recorded.
- l. The 24-hour pressure reading should be reported in the routine ORW/PMW monitoring. The monthly transducer data download should be conducted at this time.
- m. An electronic report from PMW bleed off events should be reported to LDNR/OC within 14 (fourteen) days after completion of the event. The report should include but is not limited to: data from the manual field measurements, gas flow meter, down-hole transducer, Track-It pressure data and a narrative with any deviations, observations, or interpretations. Raw data should also be electronically included as Microsoft Excel files as applicable.

TBC Response: *TBC will comply with the above comment.*

LDNR/OC Response: No further comment.

2. There is no objection to the monthly bleed-off schedule proposed in the above referenced procedure. If there is a need to alter this schedule, the reason for the schedule change should be submitted in writing to LDNR\OC.

TBC Response: *Refer to Section 4.1 Comment 3 above.*

LDNR/OC Response: No further comment.

3. The procedure does not include provisions for management of PMWs that may become watered in. A written procedure should be developed and submitted to LDNR/OC for removal of water for re-establishing communication with gas cap.

TBC Response: *Refer to Section 4.1 Comment 6 above.*

LDNR/OC Response: No further comment.

4. The procedure states that *“If enough gas is co-produced with groundwater, the well can be re-developed automatically during each purge cycle until groundwater is visibly clean.”* The monthly PMW pressure bleeding events shall not be used for well redevelopment to prevent

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the wells from watering in. If TBC determines a PMW is not in good communication with the MRAA gas cap, any proposed well redevelopment shall be completed separately from the pressure bleed-down measurement events and separate detailed well redevelopment procedure should be provided for LDNR/OC review and comment as necessary.

TBC Response: *Refer to Section 4.1 Comment 6 above.*

LDNR/OC Response: No further comment.

Safety Concerns

1. Explain how “the hose will be used to discharge total fluids and gas to the tank while gas is allowed to vent to the atmosphere.” Will gas be discharged into an enclosed tank?

TBC Response: *Comment not applicable as TBC will implement the PMW venting procedure described in Section 5.0 above.*

LDNR/OC Response: No further comment.

2. The PMWs shall be temporarily connected to a flare line and flared during all bleed off events. Based on recent field observations by LDNR/OC staff and/or our representatives, it appears that PMWs with significant wellhead pressures are currently hooked to flare lines with the exception TBC-3. BC-2 currently has little to no wellhead or casing pressure. All future PMWs located in or around the community shall also be connected to flare during venting activities.

TBC Response: *Please see response to Section 4.1 Comment 5 above.*

LDNR/OC Response: See response to Section 4.1, Comment #5.

3. Any water discharged from the bleed off process should be properly contained and discharged into the sink hole at a designated discharge point per an approved LDEQ permit.

TBC Response: *It is not anticipated that any water will be produced during the PMW venting (bleedoff) using the procedure in Section 5.0.*

LDNR/OC Response: While TBC has stated that “it is not anticipated that any water will be produced, in the event that water is produced, TBC shall commit that any *possible* water discharged from the bleed off process should be properly contained and discharged into the sink hole at a designated discharge point per an approved LDEQ permit.

4. Temporary air monitoring should be provided immediately around the well site during the bleed off process. At a minimum, LEL and H2S should be monitored in real-time.

TBC Response: *Please see response to Section 4.1 Comment 5 above.*

LDNR/OC Response: The applicable part of that comment states “*Temporary real-time air monitoring will be performed with a portable gas meter to ensure the safety of workers and residents.*” This comment does not address that air monitoring will be conducted for, at a minimum, LEL and H2S.

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Section 6.1

1. The first sentence of this section references Table 2 “Monitoring Program for ORW/PMW.” Why are wellhead gauges only included at specific ORWs and PMWs and not all ORWs and PMWs? Wellhead pressure gauges are needed on all wells to determine if gas pressure conditions are changing due to vertical and/or lateral gas migration or recharge over time. Are the columns in the referenced table switched? If not, provide an explanation of the table.

TBC Response: *The title of the right-hand column should read “Wells with wellhead Track-Its Installed”. A new Table 2 is attached.*

LDNR/OC Response: No further comment.

2. In the second paragraph, it is stated that the transducers are deployed at known cable length depths. Procedures for installation of the transducers shall be provided to make sure the installation depths of the transducers are documented and known with certainty such that there is concurrence between the depth to the transducers based on the cable length and the depth to the transducer based on the transducer depth to water measurements (below a designed measuring point) at the time of installation.

TBC Response: *It will update its existing SOP “Pressure Transducer Water Level and/or Gas Pressure Monitoring” and provide the requested procedure and tables for documenting transducer installation.*

LDNR/OC Response: No further comment.

3. In the third paragraph it is stated that “The lengths of the data cable at an individual well should be based on screen and/or perforation intervals to ensure that the Level TROLLs are always submerged in groundwater.” It is recommended that the transducers should be installed to depths that are at or near the screened or perforated intervals of the ORWs/PMWs so that the transducer readings are representative of the pressures measured at the screen and/or perforated intervals or the pressure readings can be calculated to determine the pressures at the well screened or perforated intervals.

TBC Response: *The written procedure referred to in Section 6.1 Comment 2 above will provide a methodology for determination of hydrostatic pressure at the screen/or perforated intervals.*

LDNR/OC Response: This Office will review the written procedure referenced above and comment as necessary. This procedure shall be submitted within 14 days of the date of receipt of this response document.

4. In the fourth paragraph, it is recommended that the desiccation indicator in the module be checked during routine monitoring to confirm the moisture conditions and if excessive moisture is indicated, appropriate corrective measures should be implemented to remedy this condition and or replace the equipment if needed.

TBC Response: *Desiccant is material in a device that is attached directly to the data cable that prevents moisture from damaging electronic devices, particularly in wet and humid environments. Desiccant must be replaced when the material changes color from blue to pink.*

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LDNR/OC Response: Is TBC committed to checking and replacing the material if color indicates it is necessary to do so?

Section 6.2

1. Note that a typo in the first bulleted paragraph on page 12 of the April 28, 2014 submittal, which has carried over through various responses from an original March 21, 2014, *Proposal to Change Monitoring and Sampling Schedule* document in which BC-2 is incorrectly labeled as BC-1.

TBC Response: *Comment noted.*

LDNR/OC Response: No further comment.

2. As stated in the referenced April 1, 2014 letter from LDNR/OC to TBC, “All data collected from the monthly monitoring events, should be submitted in an electronic monthly report similar to the format of the MRAA groundwater monitoring reports.”

TBC Response: *TBC will comply with the requirements of this comment.*

LDNR/OC Response: No further comment.

3. Note that LDNR/OC is also currently preparing the appropriate paperwork to officially transfer ownership of the 18 geoprobe wells (NSDMW001 through NSDMW018) to TBC. This paperwork will be forwarded to TBC upon completion.

TBC Response: *TBC will evaluate when the information is received.*

LDNR/OC Response: Information to be submitted to TBC following this response.

Section 7.0

1. As stated in the comment above for Section 3.6, a letter report shall be submitted within 21 days of completion of the PMWs. The report of the PMW installation should include, but is not limited to, all PMW well installation activities and final well completion/construction diagrams.

TBC Response: *TBC will comply with the requirements of this comment.*

LDNR/OC Response: No further comment.

2. This section also states that “ORW, PMW, and shallow geoprobe data will be compiled monthly and uploaded to Box.com file sharing site. The data submittal will include monthly graphing of the PMW results showing the differential pressure between the Zone-S (shallow) interval and the Zone-M (medium) interval for well pair.” Therefore, the required geoprobe pressure report previously referenced in the April 1, 2014 letter shall also include the ORWs and PMWs referenced in the statement above. Note that this report is a monthly, electronically submitted report with historical tables, graphs (for formation pressure), text including procedures, interpretations, conclusions, and appendices with raw data (which may be included as a compressed electronic attachment or uploaded to a file sharing site such as Box.com referenced above). The electronic report shall be submitted to conservationorder, however, large attachments or raw data may be provided via a file sharing site.

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TBC Response: *TBC will comply with the requirements of this comment.*

LDNR/OC Response: No further comment.

3. As stated above, TBC has proposed evaluating differential transducer pressures from the shallow and middle pressure monitoring wells. Prior to application of this approach, technical information and supporting documentation for this approach needs to be presented to the LDNR/OC for review and comment. Additionally, in Figure 4 the differential pressures on the graph are designated with a range between 1 and 2 psi, when the actual measured pressures at PMW-16S and PMW-16M are approximately 55 psi and 10 psi, respectively, resulting in a differential of approximately 45 psi. How was the differential pressure range of 1 to 2 psi on the graph determined?

Note that all differential pressure measurements between the Zone-S and Zone-M PMWs should be consistent. Field observations by LDNR/OC and/or our representative have documented that certain PMW's are open to the atmosphere and others are shut-in. All PMWs "M" wells should be open (to the atmosphere) unless TBC provides written justification to the contrary.

TBC Response: *TBC previously discussed and presented this method of evaluating measured pressure transducer data during its meeting with LDNR representatives on April 17, 2014. The calculation of differential pressure is the one proposed by the BRC.*

Per the document entitled "Blue Ribbon Commission on Bayou Corne and Grand Bayou Public Safety, GAS SAFETY BENCHMARK FRAMEWORK AND GUIDANCE" dated March 18, 2014, the BRC states "So that there is no confusion, the BRC asserts without ambiguity that the suggested criterion is the difference between the well shut-in pressure as measured at the top of the screened interval and the water pressure measured in the same or adjacent well and referenced to the same depth calculated using the measured water density in the well. This is referred to as capillary pressure and is a practical measure of gas accumulation in the MRAA and overlying aquitard. This pressure difference can be determined using a properly completed and instrumented pressure monitoring well."

LDNR/OC Response: In reference to the TBC differential pressure graph (Figure 4, April 28, 2014 TBC submittal), TBC shall submit to LDNR the equations and fluid densities used to calculate the differential pressures in the graph. In addition, TBC shall submit the water densities, transducer depths, and other variables TBC proposes to use to calculate differential pressures and how TBC proposes to monitor MRAA water density over time to calculate differential pressures in the gas cap.

Note that to avoid having to make additional corrections to the pressure transducer data when determining differential pressures, it is recommended that the middle well "M," be left open to the atmosphere. This will allow for application of standard barometric pressure corrections to the transducer data and fluctuations.

For long-term monitoring, it is recommended that TBC install the transducers at equal elevations to avoid having to make density corrections over time. Such an installation configuration allows for a direct comparison of the middle well transducer data with the data from the shallow well to determine differential pressure without consideration of the density of the water in the middle well. (The MRAA water density is variable both vertically and horizontally across the gas cap area as documented in the various Michael Pisani and Associates, Inc., reports for the MRAA

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well clusters.) Absent transducers at the same elevation, the density of water in the middle well must be measured to be able to correctly calculate the differential pressure in the gas cap.

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