

November 20, 2009

Mr. Jeffrey Bull
Manager Health, Safety, & Environment
Windsor Energy Group, L.L.C.
14301 Caliber Drive, Suite 300
Oklahoma City, OK 73134

RE: WDEQ Review of - *Report of Investigation and Remedial Alternatives Evaluation - Final, July 7, 2009*, Crosby 25-3 Natural Gas Well Blowout; Clark, Wyoming

Dear Mr. Bull:

The Wyoming Department of Environmental Quality (WDEQ), Voluntary Remediation Program (VRP) has reviewed the Windsor Energy Group, LLC (Windsor) final *Report of Investigation and Remedial Alternatives Evaluation, July 7, 2009* (ROI/RAE) for the Crosby 25-3 well blowout (site). The ROI/RAE has been revised and recommends a final remedy, different from what was proposed in the earlier editions. The final ROI/RAE incorporates some of the WDEQ's January 5, 2009, comments on the amended draft; however, not all of the comments have been adequately addressed and the new proposed remedy alternatives were not previously evaluated. In addition, the WDEQ received comments on the ROI/RAE from five interested parties (enclosed). The WDEQ has incorporated those public comments which they believe are applicable into the report.

Please address the attached comments and incorporate them into a revised final ROI/RAE. Upon completion of the revised final ROI/RAE, please distribute to the WDEQ and to everyone on the interested parties mailing list who requests one. Once the WDEQ receives the revised final ROI/RAE, a draft Remedy Agreement will be prepared for review by Windsor and interested parties. If you have any questions, please feel free to contact me at (307) 335-6949.

Sincerely,

Kathy Brown, P.G.
Voluntary Remediation Program
Solid and Hazardous Waste Division

ENC: Public Comments on July 7, 2009 ROI/RAE – 5 parties commented

CC: Lander VRP File 58.093 (w/out ENC)
Jerry Breed, WDEQ/Cheyenne; VRP File 58.093 (w/out ENC)
Michael Bullock, Terracon, 2110 Overland Ave., Suite 124, Billings, MT 59102

**WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
SOLID AND HAZARDOUS WASTE DIVISION
VOLUNTARY REMEDIATION PROGRAM**

**REVIEW COMMENTS FOR
REPORT OF INVESTIGATION AND REMEDIAL ALTERNATIVES EVALUATION –
July 7, 2009 Final**

November 20, 2009
Windsor Energy Group, L.L.C.
Crosby 25-3 Natural Gas Well Release

1. Section 1.0, **EXECUTIVE SUMMARY** (page 1, 1st paragraph): Revise this paragraph to incorporate the recently installed groundwater monitoring wells on the east side of Line Creek.
2. Section 2.2, **Chronology of Release** (pages 4-7): Include all applicable Sundry Notices and analytical data to support the soil investigation and remediation. Again, it is requested that an estimate for the volume of fluids released during the blowout be included in this section. The WDEQ recognizes that this is only an estimate.

Both in this section and other areas of the document, it states that subsurface information suggests that bedding planes are relatively steeply dipping in the vicinity west of the well head and much shallower, perhaps nearly horizontal in other directions. Again, it is requested that a structural cross section showing the dip of the beds based on field data and subsurface information be included as a figure. It is recommended that the cross section be constructed perpendicular to the strike of the Fort Union Formation and include vertical exaggeration, if appropriate.

3. Section 2.5, **Groundwater and Surface Water Rights Search** (page 8): The public, most notably Clark Resource Council (CRC), has repeatedly requested that groundwater flow maps be prepared which include the domestic water wells in the Line Creek Subdivision. The WDEQ recognizes that Windsor attempted to complete this request, but required signed access agreements from the private water well owners prior to obtaining well data. It is also recognized that there was an insufficient number of signed access agreements to move forward with the request. The WDEQ believes Windsor made a concerted effort to access private water wells and is not requiring them to revisit the request at this time. However, using the well drilling and construction information from the State Engineer's Office, include a table listing the private water wells located in the Line Creek Subdivision, total depth of the well, screened interval of the well, the aquifer (geologic formation) that the well is completed in, and any other pertinent information. The WDEQ understands that water well records vary in terms of thoroughness and details and that some of this information is not available. If it is

unclear which aquifer a well is completed in, use professional judgment and knowledge of the local geology to indicate which aquifer(s) the well may be completed in.

4. Section 3.1.2, **Groundwater** (pages 11-12): Indicate where the field sampling data sheets are filed and how they can be reviewed by the public if requested.
5. Section 3.2.7, **February-March-April 2009 Monitoring Report** (page 21, last paragraph): Revise the text to indicate that the extent of the contamination is not defined to the east of Line Creek or provide data from recently drilled wells and discuss the extent of the contamination on the east side of the creek.
6. Section 3.4., **Nature and Distribution of Petroleum Impact in Soil/Bedrock** (page 28): Reference attached Sundry Notices (see comment #2 above).
7. Section 3.5.1, **Fort Union Formation** (pages 29-31): Provide a clear discussion on what the proposed dip of the Fort Union Formation is in the study area and supporting field data. Reference the figure requested in item # 2 above. Discuss the faulted nature of the area and acknowledge the potential for unmapped faults and fractures in the Fort Union and Wildwood Formations.
8. Section 3.5.3, **Recent Valley Fill Deposits** (page 33): Provide an explanation why it is proposed that the valley fill deposits are from glacial outwash. Provide information supporting the assumption that Line Creek cut through the valley fill glacial outwash deposits as opposed to contemporaneously depositing them.
9. Section 3.6.3.1, **Projected Water Balance in Valley Fill Aquifer** (pages 40-42): This section provides a discussion as to why there have not been impacts to Line Creek. This information needs to be included in the Ecological Risk Assessment, Steps 1 & 2, which Windsor still has not completed. Note, the WDEQ sent comments dated October 3, 2008, on the Risk Assessment and there still has not been a response from Windsor or finalization of the assessment.
10. Section 3.6.5, **Regional Groundwater Flow** (pages 44-45): Again, based on the available data, discuss Line Creek in terms of whether it is a gaining or losing stream and how it potentially changes with location and season. Discuss how this potentially influences groundwater migration.
11. Section 3.7.1, **Plume Geometry** (pages 46-47): The WDEQ does not agree that the benzene detection in MW-17D is likely due to communication from MW-17S nor the inference that the benzene plume on the Figure 13 series maps does not extend to MW-17 as depicted. Revise the text to indicate that this is a possibility, and that it is just as possible the plume is at least as extensive as depicted on the maps. Also, the last paragraph of this section states that Terracon modified the interpolations between well points. Describe why and how this was done and if the modification made the plume maps more or less conservative.
12. Section 3.7.2, **Petroleum Concentrations and Distribution** (pages 48-49): It is unclear what the shading on Exhibits 11 and 12 represents.

13. Section 3.7.3, **Volume of Impacted Groundwater** (page 49): Indicate if the volume of benzene impacted water is water above the MCL or water with benzene detections.
14. Section 3.9.4, **Threatened or Endangered Species Evaluation** (pages 53-54): This section should be replaced with a summary of the results of the Ecological Risk Assessment, Steps 1 & 2. Note, the WDEQ sent comments dated October 3, 2008, on the Risk Assessment and there still has not been a response from Windsor or finalization of the assessment.
15. Section 4.9, **Sampling Frequency** (pages 63-66): The WDEQ does not see any rationale in only extending the sampling program through 2011. Instead, indicate that sampling of groundwater, surface water, and private water wells will continue until, at a minimum, both the valley fill and bedrock aquifers meet applicable cleanup levels. State that sampling will continue at the frequency set forth in Exhibit 16; however, based on future analytical data, Windsor may request a change in sampling frequency.

The last sentence on page 64 should say “Exhibit 16 shows the schedule”.

Based upon the data obtained from the new groundwater monitoring wells being installed on the east side of Line Creek, there should be additional sentinel wells monitored on a monthly basis. Windsor should propose additional sentinel wells once the new monitoring well data is evaluated.

16. Section 6.1, **Remedial Action Objectives (RAOs)** (page 75): Revise the text to state that the cleanup level for DRO is 1,100 ug/L when any COCs are detected in groundwater above the MCL/DWEL or if there is free product present on the groundwater table, and the cleanup level for DRO is 10,000 ug/L when naphthalene and all other COC's are below the MCL/DWEL and there is no free product present on the groundwater table.
17. Section 6.2, **General Response Actions** (page 76): The recommended institutional control to restrict groundwater use until cleanup levels are met is a Groundwater Use Restriction which would be included in the Remedy Agreement.
18. Section 6.3, **Screening of Remedial Action Alternatives** (pages 76-77): The balancing criteria should be used to justify elimination of Pump and Treat as a potential remedy for the alluvial aquifer.

In the 2nd paragraph on page 76, revise text to indicate that cost is one of the balancing criteria used to evaluate the remedial alternatives.

On page 77, list what the actual fixed costs are for 1) the interim measures AS/SVE OM&M and what time period this covers, and 2) groundwater and surface water monitoring through 2010.
19. Section 6.4.1, **Alternative VF1 – Monitored Natural Attenuation (MNA)** (pages 77-78): Include a discussion on the assumed primary mechanism responsible for reduction in contaminants of concern (COCs) at the site. Include available data supporting this assumption. Provide a prediction of when the entire plume will meet all applicable cleanup levels through the natural attenuation process using trend analysis or other

applicable method. This data is necessary to provide an estimate of how long the plume will need to be monitored and for financial assurance estimates. Typically secondary lines of evidence (geochemical parameters) are presented to indicate natural attenuation is an effective remedy. Provide any existing geochemical data which supports natural attenuation is occurring at the site.

The cost listed for this alternative appears incorrect. The text states that the cost is based on 10 years of monitoring and uses the 2011 annual cost for the sampling schedule shown in Exhibit 16. Using the costs in Exhibit 27, the cost of sampling for 2011 is \$344,096. If this annual cost was extended for 10 years, then the total cost of MNA would be \$3.44 million versus the listed cost of \$667,000-\$833,000. Revise this section and Exhibit 27, if necessary, to include a correct cost analysis.

20. Section 6.4.2, **Alternative VF2 – Enhanced Aerobic Bioremediation Treatment Line** (pages 78-79): The WDEQ requests that all remedial alternative evaluations include a cost estimate for 10 years of sampling of the private water wells and surface water per the schedule proposed in Exhibit 16 for 2011 (as done for Alternative VF1). However, it seems appropriate to propose a reduced sampling frequency for the groundwater monitoring wells when evaluating the active valley fill remedies (VF2, VF3, VF4). Revise the proposed sampling schedule and cost for this alternative. Include a total cost for implementation and OM&M for this remedy.
21. Section 6.4.3, **Alternative VF3 – Air Sparge/Soil Vapor Extraction Treatment Line** (page 80): Comments from item #20 above are also applicable for this section.
22. Section 6.4.4, **Alternative VF4 – Chemical Oxidation** (pages 80-82): Comments from item #20 above are also applicable for this section.
23. **Exhibit 19** (page 83): Revise the cost estimates. It is unclear why MNA is ranked higher or the same as the other remedies in the cost category when the cost for MNA is listed as the most expensive.
24. Section 6.5, **Evaluation of Remedial Action Alternatives – Bedrock Water** (page 84, 2nd paragraph): The WDEQ does not agree that RAO #1(a) and #1(b) “could be met regardless of the remedial action taken for the bedrock”. It has not been shown that there are no private water wells completed in the bedrock aquifer, nor will there be in the future. In addition, Windsor has repeatedly stated that there is some communication between the valley fill aquifer and the bedrock aquifer and that the bedrock aquifer is confined in places. This would imply that water in the bedrock aquifer could migrate to surface water through the valley fill aquifer.

Include language to indicate that cost estimates for the bedrock remedial alternatives does not include costs to sample private water wells or surface water since this cost is included in the valley fill remedial alternative cost estimates.
25. Section 6.5.1, **Alternative B1 – Monitored Natural Attenuation (MNA)** (pages 84-85): This section states that monitoring of the bedrock plume “would be initially more frequently, with the frequency and number of wells being monitored reduced with time”. Reduction of sampling frequency should be tied to predicted plume concentration

reductions based on evaluation of the data. Include a specific monitoring schedule for this alternative and the estimated cost.

26. Section 6.5.2, **Alternative B2 – Chemical Oxidation** (pages 85-86): Include the estimated cost to implement this remedy and what the costs include.
27. Section 6.5.3, **Alternative B3 – Groundwater Pumping/Pump & Treat** (pages 86-87): Describe the proposed pilot study (number of wells, time frame, etc.) and include the estimated cost to conduct the pilot study. Include a cost estimate to implement the remedy and OM&M if the pilot study is successful.
28. Section 6.5.4, **Alternative B4 – Dual-Phase Extraction** (pages 87-88): Describe what “site specific condition of the bedrock” makes a single-pump system technically infeasible for implementation at the site. Describe the proposed pilot study (number of wells, time frame, etc.) and include the estimated cost to conduct the pilot study. Include a cost estimate to implement the remedy and OM&M if the pilot study is successful.
29. Section 6.5.5, **Alternative B5 – Enhanced Aerobic Bioremediation Treatment Line** (pages 88-89): Describe the proposed pilot study (number of wells, time frame, etc.) and include the estimated cost to conduct the pilot study. Include a cost estimate to implement the remedy and OM&M if the pilot study is successful.
30. **Exhibit 20** (page 90): Under “Screening Standards, Control any sources...”, it is unclear why all of the ratings are not the same since the comment says “source has been controlled.... Irrelevant”. Under “Balancing Criteria (BC), Consistency with Current and Anticipated Future Land Use”, it is unclear why pump and treat ranks differently than the other active remedies. Under “BC, Consistency with the Nature and Complexities of the Releases, (2)”, it is unclear why all of the proposed remedies are rated the same in terms of simplicity. Under “BC, Cost”, include estimated costs for each alternative and revise ratings as necessary.
31. Section 7.1, **Valley Fill Aquifer Recommendation: VF1 – Monitored Natural Attenuation** (page 91): Revise the text to indicate that the recommended remedy is based on results from evaluating each remedy using the Balancing Criteria and not on other factors listed. State that the proposed valley fill remedy (MNA and associated monitoring of private water wells and surface water) is actually being implemented through the currently approved monitoring plan. State that the proposed valley fill remedy, if approved by the WDEQ, would be formalized in the Remedy Agreement (RA) and the RA would require financial assurance for remedy implementation.
32. Section 7.2, **Bedrock Water Recommendation: Pilot Feasibility and Effectiveness Study** (page 91): Revise the text to indicate that the recommended remedy is based on results from evaluating each remedy using the Balancing Criteria and not on other factors listed. Revise text to clarify that the proposed valley fill remedy (MNA and associated monitoring of private water wells and surface water), if approved by the WDEQ, would occur independently of the bedrock aquifer pilot tests and final remedy implementation.
33. **Exhibit 21, Pilot Studies of Remedial Alternatives: Bedrock Water** (page 92): Alternative B-1 (MNA) is included as Pilot Study, but in the text it is proposed as a

remedy, not requiring a pilot study. MNA should either be removed from Exhibit 21 or a pilot study should be discussed in Section 6.5.1.

34. Section 7.3, **Recommended Monitoring Schedule** (page 94-98): Clarify that the sampling schedule as shown in Exhibit 23 is through 2011 or until the RA becomes effective. Clarify that the RA will specify the proposed sampling frequency and schedule and will include contingencies for unanticipated changes in plume concentrations and cleanup timeframes.

Clarify that the RA will specify the proposed suite of analytes as shown in Exhibit 24, and will include contingencies for unanticipated changes in constituents of concern.

Revise text on page 97 to include additional sentinel wells on the east side of Line Creek.

The estimated totals in Exhibit 27 need to be corrected to reflect the sum of the columns. Provide a subtotal for costs up to 2011 and for the year 2011 which is used as a basis for costs throughout the report.

35. Section 7.4, **Recommended Points of Compliance** (page 99): Revise the text to include the additional points of compliance on the east side of Line Creek. Clarify that the RA will specify the points of compliance and will include contingencies for unanticipated changes in the extent of the plume.
36. **Tables and Charts in General:** The WDEQ recommends that all analytical data available to date be incorporated into the tables and charts, as appropriate.
37. **Table XIV:** Include a column for the total cost of the remedy (implementation + OM&M). Update the table to reflect revised costs. Include in footnote #1 the value of the “fixed costs”. For the portion of the table on “Pilot Study Alternatives for the Bedrock”, break the costs into 1) cost for the pilot study, 2) costs for both implementation and OM&M of the remedy, assuming the pilot study is successful and, 3) total cost.
38. **Figure No. 2:** Label the ground cracks resulting from the blowout.
39. **Figure No. 15:** This figure is confusing and the legend does not appear to coincide with what is on the figure. Include a separate figure for each proposed valley fill remedy (iSOC, AS/SVE, and Chem OX), so that each remedy can be better understood and evaluated.