



826 21 ½ Road
Grand Junction, CO 81505
T: 970.263.7800
F: 970.263.7456

November 6, 2007

EnCana Oil & Gas (USA) Inc.
370 17th St., Suite 1700
Denver, CO 80202
Attn: Mr. Chris Williams

Dear Mr. Williams:

Cordilleran Compliance Services, Inc. (Cordilleran) has been retained by EnCana Oil & Gas (USA) Inc. (EnCana) to perform technical environmental services including; quarterly groundwater monitoring, surface-water assessment, and remediation of groundwater that has been impacted by dissolved phase volatile hydrocarbons comprised primarily of methane and benzene in the area of the West Divide Creek Gas Seep (Figure 1).

The objective of the continued operation of the remediation system and quarterly water sampling is to mitigate and control migration of the dissolved phase hydrocarbons in the down gradient direction and into nearby Divide Creek and surrounding area groundwater wells, and to treat the hydrocarbons.

This report summarizes the results of surface-water and groundwater monitoring in September 2007 at the seep site in a continued effort to monitor the possible migration of the benzene plume.

Groundwater and Surface-Water Monitoring

Water quality samples collected during this period were analyzed by Evergreen Analytical Laboratory (EAL) of Wheat Ridge, CO for the following analysis:

- BTEX/MTBE using EPA method 8021
- Dissolved methane using method RSK 175M
- Chloride (Cl) using method 300E
- Sodium (Na) using method SW6020
- pH using EPA method 150.1
- Total dissolved solids (TDS) using method SM240C
- Specific conductivity using method SM251B.

Isotopic methane was determined by Isotech Laboratories, Inc of Champaign, IL. Stable isotopes of carbon and hydrogen in methane and stable isotopes of carbon in ethane and propane and gas composition were determined where dissolved gasses were sufficient.

Cordilleran collected groundwater samples from twenty-four monitoring wells during September 2007. Twenty of these monitoring wells are located on the Langegger property, one well is located on the Thompson property, and three wells are located on the Eicher property. Groundwater samples and field parameters (temperature, specific conductance, dissolved oxygen, pH, total dissolved solids and turbidity), were collected from September 10, 2007 through September 13, 2007 from monitoring wells (MW-1, 2, 4, 6-9, 11-18, 20-27) (Figure 1). Prior to sample collection, static water levels were measured in monitoring wells to within 0.01 feet (ft) from the top of the PVC casing using an electronic water level indicator. Groundwater elevations are graphically illustrated in Figure 2. A total of three casing volumes were removed prior to sampling each well using dedicated disposable bailers with bottom loading valve assemblies. Field parameters were obtained at the completion of purging activities (Appendix A). Groundwater samples were collected following field parameter measurements.

Cordilleran collected eight surface-water samples (DCS-1-8) and field parameters (temperature, specific conductance (SpC), dissolved oxygen, pH, total dissolved solids, and turbidity) from the West Divide Creek located on the Langegger property on September 13, 2007. Groundwater and surface-water samples were placed in the appropriate sample containers provided by EAL, labeled, stored on ice, and delivered under chain-of-custody procedures to EAL. Groundwater and surface-water samples were analyzed for benzene, toluene, ethylbenzene, total xylenes, methyl tertiary-butyl ether, dissolved methane, chloride, sodium, total dissolved solids, and specific conductivity (SpC).

Site Hydrogeology and Hydrology

In the vicinity of the seep area, groundwater was encountered at depths ranging from surface level to 24.95 feet below ground surface (ft-bgs). The groundwater flow direction continues to be from the seep area towards the north, mimicking the creek flow direction. The shallow, unconfined groundwater is in communication with surface water of West Divide Creek from the east side of the creek and discharges to groundwater on the west side of the creek, and is generally of good quality. Groundwater found in the area, east of West Divide Creek is influenced by springs that originate from unlined irrigation ditches located on the mesa to the east.

The groundwater flow velocity was determined to be 0.021 feet/foot (ft/ft), which is consistent with other observed groundwater velocities for September. The interaction between groundwater and the creek based on water level measurements to evaluate water gain/loss was determined by measuring water levels in the stream and piezometers on the stream banks. The results generally indicate that the creek is losing water to groundwater on the west side of the creek and the creek is gaining water from the wetlands east of the creek.

The flow in the creek during September is generally lower in water due to the low runoff in fall. During September, the south-east side of the study area, primarily within the vicinity of the wetlands near monitoring wells 19 and 25 the area, was flooded and surface water is mixing with the groundwater within this area; therefore the hydraulic head was higher than average within this area.

Benzene

Monitoring wells 2, 4, 9, 12 and 17 have benzene concentrations of $260\ \mu\text{g}/\text{l}$, $170\ \mu\text{g}/\text{l}$, $4.2\ \mu\text{g}/\text{l}$, $5.4\ \mu\text{g}/\text{l}$ and $30\ \mu\text{g}/\text{l}$ respectively. Monitoring wells 2, 4, 12 and 17 have benzene concentrations exceeding the Colorado Basic Ground Water Quality (CBGWQ) standard of $5\ \mu\text{g}/\text{l}$. The laboratory results for benzene concentrations for each monitoring well are summarized in Table 1 in Appendix A. Benzene concentrations are graphically illustrated in Figure 3. No other monitoring wells showed benzene concentration above the standard. The size of the area underlain by groundwater that is impacted by benzene at concentrations above $1.0\ \mu\text{g}/\text{l}$ is approximately $109,297\ \text{ft}^2$.

Toluene

Toluene was not detected above the lower laboratory detection limit (LDL) $2\ \mu\text{g}/\text{l}$ in any monitoring wells during September of 2007 (Table 1).

Ethylbenzene

Ethylbenzene was present in MW-2 and MW-4 at a concentration of $8.1\ \mu\text{g}/\text{l}$ and $4.8\ \mu\text{g}/\text{l}$ respectively. This concentration is below the CBGWQ standard of $680\ \mu\text{g}/\text{l}$. Ethylbenzene was not detected in any other monitoring wells (Table 1).

Total Xylenes

Total Xylenes were present in wells MW-2, MW-4, and MW-9 at concentrations of $51.2\ \mu\text{g}/\text{l}$ and $57.9\ \mu\text{g}/\text{l}$, and $2.4\ \mu\text{g}/\text{l}$ respectively. These concentrations are below the CBGWQ groundwater standard of $10,000\ \mu\text{g}/\text{l}$. Total xylenes were not detected in any other monitoring wells. The laboratory results for total xylenes concentrations are summarized in Table 1.

MTBE

Laboratory results indicate that MTBE (methyl tertiary-butyl ether) was not present above the LDL $4\ \mu\text{g}/\text{l}$ in the groundwater samples collected in the monitoring area during September 2007 (Table 1).

Methane

Total dissolved methane concentrations in groundwater have decreased since the start up of the air sparge system in the area of MW-1, MW-6, MW-7, and MW-8. Total dissolved methane above the LDL was detected in monitoring wells MW-1, 2, 4, 9, 11-14, 16-18, 21-26 and Eicher well (E2). In general, the highest concentrations of dissolved methane in the groundwater are located near the seep. Total dissolved methane concentrations are graphically illustrated in Figure 4. In the remaining wells, dissolved methane was not detected above the LDL. Total dissolved methane is summarized in Table 1.

Thermogenic Methane

The laboratory results for methane were reported as total dissolved methane. This included both biogenic (methane gas generated by biologic reduction of organic matter) and thermogenic methane (methane gas generated by thermal reduction of deeply buried organic matter). Using the reported total dissolved methane concentration, the concentration of thermogenic methane was calculated. Hydrocarbon gas from ‘biogenic only’ sources contains a high proportion of methane (>99%) and has characteristic carbon and hydrogen isotopes ratios. Typically, thermogenic methane is indicated by isotope ratios that are less negative than ratios for biogenic methane. To estimate the fraction of total methane in a water sample that can be attributed to thermogenic sources, an algebraic mixing calculation was used after the data were evaluated on the basis of the laboratory-determined values of methane carbon-13 isotope ratio ($\delta^{13}C_1$), methane hydrogen isotope ratio (δDC_1) and ratio of methane to ethane and propane ($C_1 / C_2 + C_3$).

Initially ‘biogenic-only’ sources are easily identified by comparing the laboratory data to literature values of the parameters discussed above. The methane fraction of a ‘reservoir-typical’ thermogenic source (79%) is used as a baseline in the mixing calculations. The biogenic source is assumed to be 100% methane and then an algebraic mixing calculation is used to determine what percentage of the total methane comes for biogenic versus thermogenic sources.

Isotopic samples were collected from monitoring wells 2, 4, 9, 12, 14, 16, 17 and 18 during September 2007 sampling. These wells have shown high concentration of dissolved methane in the past. The remaining wells have showed low concentrations of dissolved methane. A compilation of isotopic data was analyzed from September 2004 to September 2007 for all monitoring stations with significant amount of methane to understand the thermogenic methane in the subsurface. Graphical results (Figures 5-7) indicate that thermogenic methane has fluctuated but remained the same in the area upgradient of the remediation system and near the seep. Thermogenic methane concentrations have dropped dramatically downgradient of the seep and within the remediation system.

Surface-Water Quality

Laboratory results indicate that BTEX/MTBE compounds were not detected in any of the Divide Creek surface-water samples. Dissolved methane was detected in all samples excluding DCS1; all with concentrations measuring less than 1.0 mg/l (Table 1). The only area where thermogenic methane is present is within and near the vicinity of the seep. DCS-2 had a thermogenic methane concentration of 0.578 mg/l. A compilation of isotopic data was analyzed from September 2004 to September 2007 for DCS-2 and DCS-3 (Figure 7). Graphical results indicate that thermogenic methane has dropped considerably within and down stream of the seep at DCS-2 and DCS-3; although during June 2007 an increase in thermogenic methane in DCS-2 was observed (See Figure 7). Isotopic results for September 2007 indicate that thermogenic methane within and down stream of the seep in Divide Creek are at an all time low.

Inorganic Results

Monitoring well and surface-water results for inorganic constituents, chloride (Cl), sodium (Na), total dissolved solids (TDS), pH, and specific conductance (SpC) are shown in Appendix A. The Divide Creek study area water continues to be high in TDS and sodium which can be attributed to the high amount of dissolved solids within the Wasatch Formation groundwater. Chloride, specific conductivity, and pH are within normal ranges as previously observed during other monitoring periods. To fully understand the interconnection between the groundwater and West Divide Creek an extended (alkalinity, cations and anions) analysis would be necessary.

QA/QC

Laboratory and field quality assurance and quality control (QA/QC) consisted of analyzing duplicate samples, matrix spikes and duplicate analyses. For quality assurance, duplicate water samples were acquired at an approximate rate of 1 for every 20 samples. In addition replicate/split samples were also obtained at an approximate rate of 1 for every 20 samples. Replicate/split samples were sent to ESN Rocky Mountain, Golden, Colorado. During September 2007 sampling event two duplicate and two replicate/split samples were obtained. Analytical results indicate insignificant differences between actual and replicate samples. Laboratory analytical reports and chain-of-custody forms are included in Appendix B.

Divide Creek Seep Status

The air sparge remediation system has operated continuously throughout the quarter with minimal down time. Since the start up of the system in April of 2004, the number of monitoring stations with benzene concentrations above the maximum contaminant level (MCL) in the area has been reduced from 14 to 4. The size of the area underlain by groundwater that is impacted by benzene concentrations above $1.0 \mu\text{g}/\text{l}$ has been reduced from 134,974 ft^2 in June of 2005 to approximately 109,297 ft^2 in September of 2007, a total reduction of 25,677 ft^2 . The size of the area underlain by groundwater that is impacted by benzene concentrations that exceeds the CBGWQ standard of $5 \mu\text{g}/\text{l}$ is approximately 66,557 ft^2 . Benzene was not detected in any well located within or down gradient of the remediation system during the September 2007 sampling event. Benzene greater than $5 \mu\text{g}/\text{l}$ in the groundwater is primarily located within 250 feet of the seep (Figure 3). Thermogenic methane has fluctuated but remained the same in the vicinity of the seep. Thermogenic methane concentrations have dropped significantly down stream of the seep and in area of the remediation system. BTEX/MTBE was not detected in the surface-water samples. Dissolved methane was not detected above $1.0 \text{mg}/\text{l}$ in the surface water samples. Dissolved methane in the groundwater greater than $1.0 \text{mg}/\text{l}$ is predominantly found within 200 feet of the seep. Thermogenic methane was present at two stations within West Divide Creek DCS-2 and DCS-3 near the seep at a low concentration of $0.011 \text{mg}/\text{l}$ and $0.001 \text{mg}/\text{l}$ respectively.

The size of the plume comprised primarily of methane and benzene has decreased since the start of the air sparge remediation system and dissolved oxygen concentrations have increased since the implementation. Therefore, the remediation system has been effectively mitigating the

chemicals of concern within the area of the treatment wells. A negative thermogenic methane trend is apparent in monitoring wells (2, 4, 9, 12, 17, and 18). Cordilleran will begin to reduce remediation treatment time in order to optimize the system in December 2007. If benzene is detected above the LDL during this time at well MW-7, the system will be returned to full treatment time. It is expected that the treatment time will be reduced from 24hr/day to 12hr/day.

Cordilleran has evaluated the remediation system extension to include the area from MW-4 to MW-17, which have shown benzene concentrations exceeding the standard. Fluctuations of BTEX will continue to occur without the extension of the sparge system. Increasing the oxygen content within the effected area will increase the microbial decay of the plume; therefore, extending the system will influence BTEX and thermogenic methane mitigation in a shorter period of time. The addition of added sparge wells will further aid in the process of reducing the plume size and mitigating the seep.

Comprehensive monitoring and remediation has been implemented since April 2004. Monitoring of all springs, ponds, monitoring wells, and West Divide Creek has continuously shown that the air sparge remediation system has successfully confined the hydrocarbon plume. Cordilleran has reviewed 42 months of data collected since the West Divide Creek Gas Seep discovery in March of 2004. Figure 8 illustrates BTEX and methane concentrations detected in the seep area from December 2006 to September 2007. A number of monitoring wells (11, 13, 15, 18, 19, 20, 21, 22, 23, 24, 25, 26 and 27) and West Divide Creek Monitoring Stations (DCS-1, 6, 7, 8) have not shown BTEX/MTBE concentrations above the detection limits for the past 42 months. Cordilleran is waiting on approval from COGCC that monitoring stations (MW-11, 13, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, DCS-6, 7 and 8) be sampled on a bi-annual basis, and water analysis for all monitoring stations will consist of BTEX/MTBE and methane. All remaining monitoring stations (MW-1, 2, 4, 6, 7, 8, 9, 12, 14, 15, 16, 17, DCS-1, 2, 3, 4 and 5) will continue to be sampled on a quarterly basis. Water levels will continue to be measured each quarter. Due to the site hydrology and continued operation of the remediation system benzene migration downgradient of the system is unlikely.

Cordilleran appreciates the opportunity to provide services to EnCana Oil & Gas (USA) Inc. If you have any questions or concerns regarding this information, please contact our offices.

Sincerely,
Cordilleran Compliance Services, Inc.

Prepared by:

Scotty Mann
Field Technician

Reviewed by

Dion Plsek, P.E
Principal Engineer

Brad Stephenson, P.G.
Associate Hydrogeologist