Petroleum Development Corporation

March 9, 2010

Ms. Debbie Baldwin
Colorado Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801
Denver, CO 80203

Re: Produced Water, Condensate, and Drilling Mud Profile Sampling
Wattenberg Field
Denver-Julesburg Basin, Colorado

Dear Ms. Baldwin:

Petroleum Development Corporation (PDC) is submitting analytical results for samples of produced water and condensate generated during production operations to the Colorado Oil and Gas Conservation Commission (COGCC). The purpose of the sampling was to establish the specific chemicals of concern based on the four different production intervals accessed by PDC's production wells in the Wattenberg Field. PDC will use the data acquired to establish site-specific analytical profiles when conducting future site assessments in the Wattenberg Field during spill/release response or facility closure activities.

PDC is also submitting analytical results for a sample of water-based bentonitic drilling mud used during the drilling process. PDC will use the acquired data to establish site specific analytical profiles when conducting future drilling pit closures in the Wattenberg field.

Sampling and Analysis Program

PDC's operations in the Wattenberg Field are split into two distinct areas of operation referred to as the Kersey Pod and Johnstown Pod. PDC's wells produce natural gas, condensate liquids, and produced water from either the Codell Formation, J-Sand Formation, a combination of the Codell and Niobrara Formations, or from all three formations simultaneously.

PDC collected both a condensate and produced water sample from tank battery locations tied to single or multiple wells that only produced from each of the production intervals in the Kersey Pod and Johnstown Pod as indicated in the table below. Produced water and condensate samples were not collected from the J-Sand production interval in the Kersey Pod since there are no wells that produce from only the J-Sand in the Kersey Pod. The purpose of these analyses was to determine if there is any variability among the chemicals of concern (COCs) based on production interval or geographic area. The tank battery locations are illustrated on Figure 1.

Production Zone	Kersey Pod	Johnstown Pod
Codell	Wells Ranch 12 & 21-3 SWNE 3-T5N-R63W	Hahn 13 & 14-27 SWSW 27-T5N-R67W
J-Sand	Not Applicable	Heinricy 22-7U 7-T5N-R67W
Codell/Niobrara	Wells Ranch 13 &14-10 & 10B C-SW 10-T5N-R63W	Heinricy 11 & 12-7U 7-T5N-R67W
Codell/Niobrara/J-Sand	Sater 14 & 24-19U SENW 19-T4N-R63W	Kinzer 28A & 28KD SENW 28-T5N-R67W

PDC collected a composite drilling mud sample from a single well pad location tied to both the Gold 11-9DU and the Gold 9A-DU wells that produce from the Codell/Niobrara interval in the Johnstown Pod. The drilling mud sample was collected once PDC had reached total depth during the drilling process. The drilling mud sample location is illustrated on Figure 1.

PDC submitted the condensate, produced water, and drilling mud samples for laboratory analyses as indicated in the table below.

Analyte	Method	Produced Water	Condensate	Drilling Mud
Benzene, toluene, ethylbenzene, and total xylenes (BTEX)	EPA Method 8260B	X	X	X
Total Petroleum Hydrocarbons (TPH) – Gasoline Range Organics (GRO) and Diesel Range Organics (DRO)	EPA modified Method 8015	X	X	X
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA Selective Ion Method (SIM) 8270	X	X	X
Electrical Conductivity (EC)	USDA Agriculture Handbook Saturated Paste Method	NA	NA	X

Analyte	Method	Produced Water	Condensate	Drilling Mud
Sodium Adsorption Ratio (SAR)	USDA Agriculture Handbook Saturated Paste Method	NA	NA	X
pH	USDA Agriculture Handbook Saturated Paste Method	NA	NA	X
Arsenic	EPA Method 6010B	X	NA	X
Barium	Louisiana Department of Natural Resources (LNDR) method for True Total Barium	X	NA	X
Boron (Hot Water Soluble)	Gupta Method	X	NA	X
Cadmium	EPA Method 6010B	X	NA	X
Chromium (III)	Calculated	X	NA	X
Chromium (VI)	EPA Method 6010B CR6	X	NA	X
Copper	EPA Method 6010B	X	NA	X
Lead (inorganic)	EPA Method 6010B	X	NA	X
Mercury	EPA Method 7471A	X	X	X
Nickel (soluble salts)	EPA Method 6010B	X	NA	X
Selenium	EPA Method 6010B	X	NA	X
Silver	EPA Method 6010B	X	NA	X
Zinc	EPA Method 6010B	X	NA	X

NA – not applicable

Analysis of EC, pH, and SAR were not analyzed in condensate since it is not appropriate for petroleum hydrocarbons. EC, pH, and SAR were not analyzed in the produced water samples because PDC acknowledges that these compounds have the potential to exceed the Table 910-1 Concentration Levels depending on the volume of produced water released. PDC plans to analyze for these compounds for surface releases of produced water in the Wattenberg Field.

Analytical Results

PDC compared the laboratory data with the list of compounds presented in Table 910-1. Analytical results indicated BTEX, TPH-GRO, and TPH-DRO compounds are present in measurable concentrations in each of the produced water and condensate samples collected from both the Johnstown and Kersey Pod.

Produced Water

The produced water analytical results for both the Kersey and Johnstown Pods indicate the potential for benzene to exceed COGCC Table 910-1 Concentration Levels in soils fully saturated with produced water is high.

The analytical results indicate that toluene, ethylbenzene, xylenes, TPH-GRO and TPH-DRO compounds are present but at concentrations suggesting that soils fully saturated with produced water would not exceed COGCC Table 910-1 levels. However, data collected from historical produced water release sites at PDC tank batteries confirm that toluene, ethylbenzene, xylenes, TPH-GRO and TPH-DRO compounds can exceed COGCC Table 910-1 levels. The potential for these compounds to exceed COGCC Table 910-1 levels is based on the variability of the separation process and the variability of the soil media. PDC acknowledges the potential for toluene, ethylbenzene, xylenes TPH-GRO and TPH-DRO to exceed COGCC Table 910-1 levels in soils at future produced water spill/release sites.

Produced water analytical results for both the Kersey and Johnstown Pods indicated certain PAH compounds listed in COGCC Table 910-1 were detected above the laboratory reporting limits. Analytical results indicate the naphthalene concentration for the produced water sample collected from the Codell/Niobrara/J-Sand production interval in the Kersey Pod was 0.180 milligrams per liter (mg/L). The COGCC concentration level for naphthalene listed in COGCC Table 910-1 is 23 milligrams per kilogram (mg/kg) in soil. Based on the laboratory result, the naphthalene concentration detected in the produced water sample collected from the Codell/Niobrara/J-Sand production interval in the Kersey Pod is two orders of magnitude lower than the concentration listed in COGCC Table 910-1.

Each of the other PAH compounds detected in the produced water samples collected from each of the production intervals in the Johnstown and Kersey Pods are one to four orders of magnitude lower than the concentrations listed in COGCC Table 910-1. Even in soil fully saturated with produced water, the potential for PAHs to be present in soils at concentrations above the values listed in COGCC Table 910-1 is low. Therefore, PDC does not believe that PAHs (with the exception of naphthalene) are present in produced water in the Wattenberg Field and will not include them when assessing produced water releases.

Most of the metals compounds listed in COGCC Table 910-1 were detected above the laboratory reporting limits in the produced water analytical results for both the Kersey and Johnstown pods. The hot water soluble method listed in COGCC Table 910-1 for analyzing boron can only be run on soils; therefore, the laboratory analytical results for boron in produced water cannot be compared to COGCC Table 910-1. Although boron concentrations were detected in each of the produced water samples collected. the total boron analysis was run for PDC's own process knowledge and is not representative of the soluble fraction of boron that may or may not be present in soil. As per COGCC direction. soil samples will be analyzed for boron by the hot water soluble method only where a crop or plant receptor sensitive to boron is known to be present.

Each of the metals compounds detected in the produced water samples collected from each of the production intervals in the Kersey and Johnstown Pods are one to five orders of magnitude lower than the concentrations listed in COGCC Table 910-1. The potential for metals to exceed COGCC Table 910-1 levels in soils fully saturated with produced water is low unless precipitation occurs. The catalysts for promoting the precipitation of metals in soils would be through a chemical reaction or heat transfer. Since the metals compounds were detected in the produced water samples at relatively low concentrations, the potential for heat transfer or chemical reaction to promote the precipitation of metals absorbed to soils is low. The produced water sample analytical data is presented in Table 1.

Condensate

Typically, the term condensate refers to natural gas liquids condensing from the natural gas stream with pressure and temperature changes during the production process. In this report, the term condensate refers to all of the petroleum hydrocarbon liquids (excluding produced water) recovered during the production process and actually includes condensates and light end crude oil.

With the exception of naphthalene, the analytical results did not confirm the presence or absence of PAHs in condensate due to matrix interference which resulted in elevated method detection limits. The laboratory conducted a secondary analysis based on the boiling point ranges of compounds contained in the samples to determine the potential for PAHs to be present. The boiling point range observations indicated the samples are classified as light crude oils containing condensate as expected. All of the samples' boiling point ranges exceeded the boiling range for condensate which is 200 degrees Fahrenheit (°F) to 250°F. Laboratory chromatographs confirmed that 60% of all of the material within the sample contained petroleum hydrocarbon constituents that were in the diesel range organics (carbon chain C11-C28) where light end crude oils and PAHs have the potential to appear. As a result of the boiling point analysis, the laboratory data cannot confirm the presence or absence of PAHs in condensate samples. While PDC does not believe that PAHs exist in the condensate/light crude oil range, we recognize its potential to exist and plan to assess PAHs further at condensate release sites.

However, the laboratory results also indicate that acenaphthene, anthracene, flourene, and pyrene are not present in condensate at concentrations above the COGCC Table 910-1 Concentration Levels. Even if the concentrations of these particular compounds could be quantified by the analytical laboratory below the laboratory method detection limit, the potential for these compounds to be present in soil fully saturated with condensate would be low.

The laboratory results confirmed naphthalene was detected above the COGCC Table 910-1 level. PDC acknowledges the potential for naphthalene in soils fully saturated with condensate to be present at concentrations above the level listed in COGCC Table 910-1.

Mercury was not detected in the condensate samples and the method detection limit is two orders of magnitude lower than the concentrations listed in COGCC Table 910-1. Mercury was the only metal compound analyzed since the melting point and boiling point of all of the other metals listed in COGCC Table 910-1 are greater than the temperature at which condensate forms. The material boiling point range analysis conducted by the analytical laboratory confirmed the boiling range for each of the condensate samples was less than the boiling temperature (900°F) for metals compounds.

The potential for metals to exceed COGCC Table 910-1 levels in soils fully saturated with condensate is low. The condensate sample analytical data are presented in Table 2. Laboratory analytical reports are provided as an attachment.

Drilling Mud

The analytical results also indicate the potential for BTEX, TPH-GRO and TPH-DRO compounds in drilling mud to exceed COGCC Table 910-1 Concentration Levels. Historical analytical data collected by PDC indicates that drilling mud samples collected from various reserve pits may contain BTEX, TPH-GRO, and TPH-DRO compounds in excess of the COGCC Table 910-1 levels. The potential for these compounds to exceed COGCC Table 910-1 levels varies based on the various production intervals encountered during drilling. PDC acknowledges the potential for BTEX, TPH-GRO, and TPH-DRO to exceed COGCC Table 910-1 levels in drilling mud.

Analytical results indicate the only PAH compound detected above laboratory limits was naphthalene. The naphthalene concentration detected in the drilling mud sample collected is two orders of magnitude lower than the concentration listed in COGCC Table 910-1. The potential for naphthalene to impact drilling mud above the Table 910-1 levels is dependent on the volume of condensate that may or may not enter the reserve pit during the drilling process. PDC acknowledges the potential for naphthalene to exceed COGCC Table 910-1 levels in drilling mud if high volumes of condensate enter the drilling pit.

The laboratory results confirmed SAR and pH levels were detected above the COGCC Table 910-1 concentration levels. PDC acknowledges the potential for SAR and pH levels to be present in drilling muds above the values listed in COGCC Table 910-1.

Laboratory results confirmed arsenic was detected above the COGCC Table 910-1 concentration levels. This concentration is not uncommon. as background concentrations for the Front Range in Colorado have been observed to range from 0.3 to 26 parts per million (ppm) (*Severson, R. C., and Tourlet, H. A., 1994, Assessment of Geochemical Variability and a Listing of Geotechnical Data for Surface Soils of the Front Range Urban Corridor: U.S. Geological Survey Open-File Report 94-648*).

However, PDC acknowledges that arsenic may be a compound of concern in drilling mud in the Wattenberg Area, primarily due to the low concentration allowable in Table 910-1 (0.39 mg/kg) but also due to the potential for drill cuttings from deeper formations to contain elevated levels of arsenic. Therefore, PDC plans to include arsenic analysis at drilling mud sites. PDC will also collect background samples for analysis of arsenic for use in comparison to the arsenic concentrations detected in the potentially impacted drilling mud. Ultimately, PDC plans to compile arsenic data on a site by site basis for future use in a regional evaluation of background concentrations of arsenic in the Wattenberg Area.

Each of the remaining metal compounds detected in the drilling mud sample are one to four orders of magnitude lower than the concentrations listed in COGCC Table 910-1. The potential for metals (except for arsenic) in drilling mud to exceed COGCC Table 910-1 is low. The drilling mud sample analytical data is presented in Table 3.

Quality Assurance/Quality Control (QA/QC)

Analytical results indicate the BTEX analysis holding time for the condensate sample collected from the J-Sand interval in the Johnstown Pod was exceeded. Due to the matrix interference caused by a fully saturated organic substance (light crude oil), the sample needed to be diluted many times in order to reach a threshold range set by the laboratory equipment. The condensate sample exceeded the analytical holding time once the laboratory was able to dilute the sample enough to meet this threshold range. Although the analytical holding time was exceeded, PDC believes the analytical results still confirm BTEX levels are present in elevated concentrations in the condensate sample collected from the J-Sand interval in the Johnstown Pod. The analytical holding time exceedance does not change the conclusion of this analysis.

The hexavalent chromium analysis holding time for all of the produced water samples, except for the sample collected from the Codell/Niobrara interval in the Johnstown Pod, was exceeded. The analytical results for the total chromium value listed in Table 1 consists of the chromium 3 calculated value and hexavalent chromium results added from each sample. Since the total chromium value is less than the Table 910-1 level, hexavalent chromium cannot exceed the Table 910-1 level. Therefore, the holding time exceedances do not change the conclusions regarding this analysis.

The pH analysis holding time for the mud samples was exceeded. The laboratory has indicated that the hold time exceedance has not greatly impacted the pH results. Routine sampling of drilling mud yields similar pH results. Since PDC believes pH does have the potential to exceed the COGCC Table 910-1 Level, the holding time exceedance does not change the conclusion of the analysis.

Conclusions

This analysis has shown that the variability of potential COCs based on production interval and geographic area is minimal. Based on the analytical results, the primary COCs include BTEX, TPH-GRO, and TPH-DRO. Naphthalene has been detected at relatively low levels, therefore PDC plans to include analysis of naphthalene at produced water and condensate release sites and during drilling pit closure assessments. However, PDC plans to conduct further analysis on the potential for naphthalene to exceed regulatory limits and may request exclusion of naphthalene as a COC at a later date.

PDC plans to exclude PAHs and metals analysis for produced water releases in the Wattenberg Field. Additionally, PDC plans to exclude metal compounds for condensate releases in the Wattenberg Field.

In the short term, soils impacted by condensate will be analyzed for PAHs. PDC will compare the laboratory results for PAHs in the samples with the list of concentration levels presented in COGCC Table 910-1. PDC will use the data sets to determine whether PAHs can be excluded from future analysis.

The potential COCs for reserve pit closure activities in the Wattenberg field include BTEX, TPH-GRO, TPH-DRO, naphthalene, pH, and SAR. PDC plans to exclude metals compounds (with the exception of arsenic) in drilling mud used in the Wattenberg Field based on the findings of this evaluation. PDC will continue to evaluate the potential for arsenic to exceed the concentrations levels presented in COGCC Table 910-1 and/or background levels on a site by site basis until such time a regional evaluation is determined to be more appropriate.

Based on the sampling matrix of the mud samples that are collected, the analytical laboratory is unable to lower its reporting limits for dibenz(a,h)anthracene and benzo(a)pyrene to meet COGCC Table 910-1 Concentration Levels. Since these compounds were not detected above the laboratory reporting limit, PDC requests that the COGCC acknowledges the lowest reportable limit as an acceptable screening level for these compounds.

PDC has established a specific set of COCs for future assessments of spills/releases and drilling pit closure in the Wattenberg Field. A summary of the COCs for the Wattenberg Field based on this evaluation has been included in Table 4. PDC is currently conducting sample analyses in accordance with this document. PDC will continue to use this analytical guidance document unless directed otherwise by the COGCC staff. Additionally, PDC reserves the right to periodically submit appropriate changes to the COGCC for consideration.

If you have any questions regarding this approach or require additional information, please contact me at (303) 831-3904.

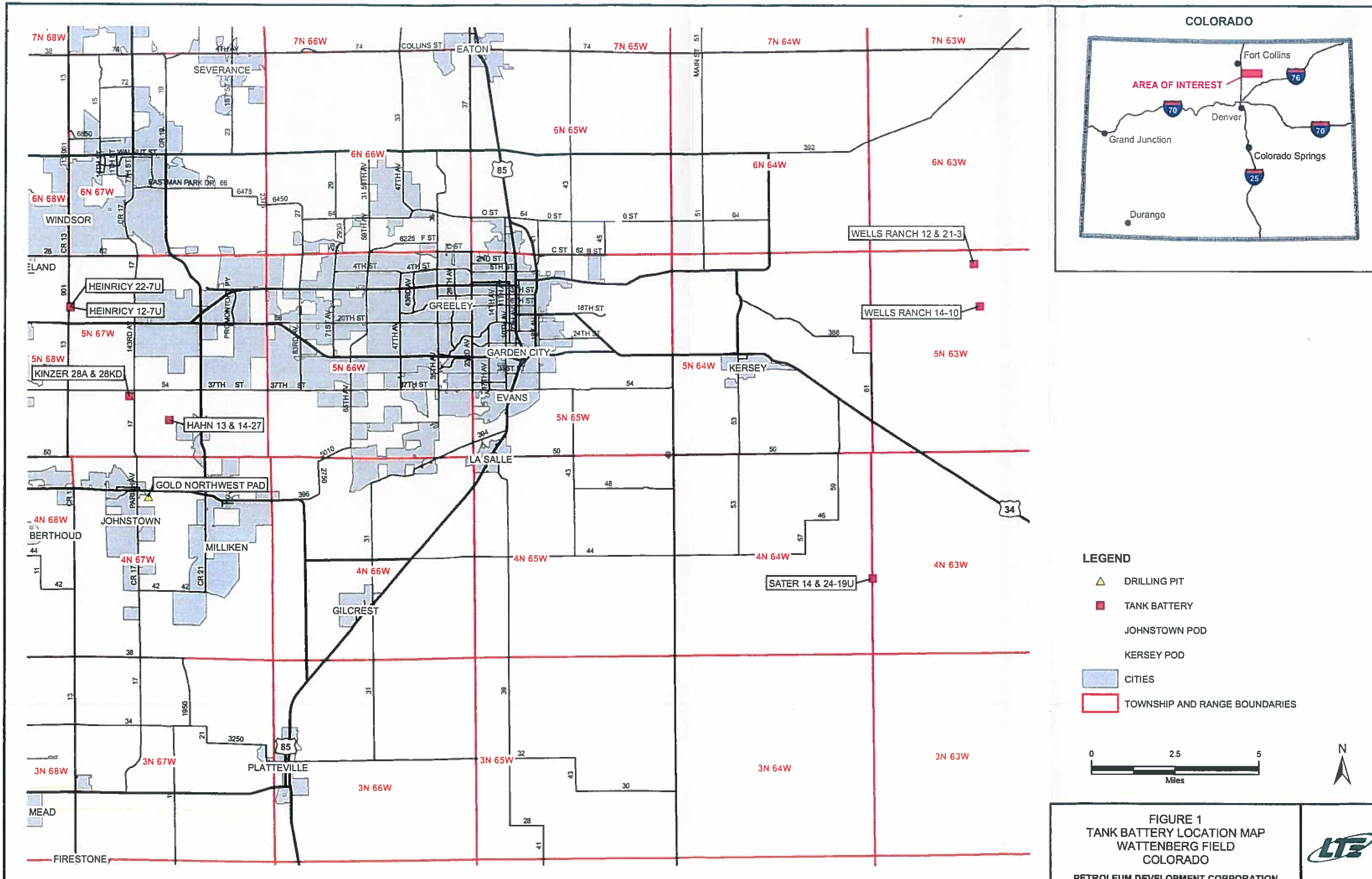
Respectfully submitted,

Randall Ferguson
Environmental Supervisor

Attachments

cc: Steve Linblom – COGCC w/o Lab Data Attachment
John Axelson – COGCC w/o Lab Data Attachment
Robert Chesson – COGCC w/o Lab Data Attachment

FIGURE



LEGEND

- DRILLING PIT
- TANK BATTERY
- JOHNSTOWN POD
- KERSEY POD
- CITIES
- TOWNSHIP AND RANGE BOUNDARIES

0 2.5 5
Miles

N

FIGURE 1
TANK BATTERY LOCATION MAP
WATTENBERG FIELD
COLORADO

PETROLEUM DEVELOPMENT CORPORATION

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TABLES

TABLE 1
WATER SAMPLE ANALYTICAL DATA
WATTENBERG PROFILE SAMPLING
WELD COUNTY, COLORADO
PETROLEUM DEVELOPMENT CORPORATION

Pod	Kersey	Johnstown	Johnstown	Kersey	Johnstown	Kersey	Johnstown	COGCC Table 910-1 Concentration Levels*
Production Interval	Codell	Codell	J-Sand	Codell/Niobrara	Codell/Niobrara	Codell/Niobrara/J-Sand	Codell/Niobrara/J-Sand	
Sample ID	Wells Ranch 12 & 21-3 PW	Hahn 13 & 14-27 PW	Heinricy 22-7U PW	Wells Ranch 14-10 PW	Heinricy 11 & 12-7U PW	Sater 14 & 24-19U PW	Kinzer 28A-28KD PW	
Collection Date	06/18/09	06/19/09	06/19/09	06/18/09	07/08/09	06/18/09	06/19/09	
Organics								
Benzene (mg/L)	5.14	6.33	23.3	7.15	8.59	6.6	5.63	0.17 mg/kg
Ethylbenzene (mg/L)	0.191	0.183	0.584	0.472	0.267	0.242	0.207	100 mg/kg
Xylene (total) (mg/L)	1.26	1.76	9.33	2.86	1.75	2.11	1.71	175 mg/kg
Toluene (mg/L)	3.78	5.04	35.9	8.1	6.14	6.56	4.97	85 mg/kg
Diesel Fuel (No. 2) (mg/L)	19	15	6	330	13	270	77	NA
TPH-GRO (C6-C10) (mg/L)	30.5	35	183	62.4	40	41.6	36	500 mg/kg
Acenaphthene (mg/L)	<0.002	<0.001	<0.001	<0.002	<0.005	<0.002	<0.002	1,000 mg/kg
Anthracene (mg/L)	<0.0026	<0.0013	<0.0013	0.0086	<0.0065	<0.0026	<0.0026	1,000 mg/kg
Benzo (a) anthracene (mg/L)	<0.002	<0.001	<0.001	<0.002	<0.005	<0.002	<0.002	0.22 mg/kg
Benzo (a) pyrene (mg/L)	<0.0018	<0.0009	<0.0009	<0.0018	<0.0045	<0.0018	<0.0018	0.022 mg/kg
Benzo (b&k) fluoranthene (mg/L)	<0.004	<0.002	<0.002	<0.004	<0.01	<0.004	<0.004	2.2 mg/kg
Chrysene (mg/L)	<0.002	<0.001	<0.001	<0.002	<0.005	0.0063	<0.002	22 mg/kg
Dibenz (a,h) anthracene (mg/L)	<0.0032	<0.0016	<0.002	<0.0032	<0.008	<0.0032	<0.0032	0.022 mg/kg
Fluoranthene (mg/L)	<0.0024	<0.0012	<0.0012	<0.0024	<0.006	<0.0024	<0.0024	1,000 mg/kg
Fluorene (mg/L)	0.0028	0.0028	0.0022	0.0097	<0.007	0.032	0.016	1,000 mg/kg
Indeno (1,2,3-cd) pyrene (mg/L)	<0.005	<0.0025	<0.005	<0.005	<0.013	<0.005	<0.005	0.22 mg/kg
Naphthalene (mg/L)	0.057	0.058	0.1	0.16	0.058	0.18	0.088	23 mg/kg
Phenanthrene (mg/L)	<0.004	0.0022 J	<0.005	0.013	<0.01	0.042	0.018	NA
Pyrene (mg/L)	<0.002	<0.001	<0.001	<0.002	<0.005	<0.002	<0.002	1,000 mg/kg
Inorganics								
Arsenic (mg/L)	0.013	0.0011 J	<0.00084	<0.00084	0.0072	<0.00084	<0.00084	0.39 mg/kg
Barium (mg/L)	8.7	4	0.016 J	16	31	3.2	7.9	15,000 mg/kg
Boron (mg/L)	11	3.3	0.67	12	7.7	18	8.3	2 mg/l
Cadmium (mg/L)	<0.00049	<0.00049	0.00056 J	<0.00049	<0.00049	<0.00049	<0.00049	70 mg/kg
Chromium (mg/L)	0.086	0.0066	0.0056	0.011	0.0065	0.011	0.012	NA
Chromium, Hexavalent (mg/L)	<0.005 H	<0.005 H	<0.0050 H	<0.005 H	<0.005	<0.005 H	<0.025 H	23 mg/kg
Chromium+3 Calculated (mg/L)	0.086	0.0066	0.0056	0.011	0.0065	0.011	0.012	120,000 mg/kg
Copper (mg/L)	0.054	0.19	0.026	0.063	0.067	0.18	0.26	3,100 mg/kg
Lead (mg/L)	0.0084	0.097	0.048	0.05	0.024	0.19	0.12	400 mg/kg
Mercury (mg/L)	0.00016	0.00016	0.00036	0.00026	0.00063	0.00023	0.00042	23 mg/kg
Nickel (mg/L)	0.025	0.0041 J	<0.0025	0.011	0.012	0.011	0.021	1,600 mg/kg
Selenium (mg/L)	0.061	0.011	0.0024 J	0.012	0.026	<0.0011	<0.0011	390 mg/kg
Silver (mg/L)	0.0037	0.000068 J	0.000084 J	0.00013 J	0.00012 J	0.00011 J	0.00014 J	390 mg/kg
Zinc (mg/L)	0.052 B	0.1 B	0.021 B	0.065 B	0.036	0.056 B	0.11 B	23,000 mg/kg

J = Estimated value below the Lower Quantitation Limit (LQL)
H = Prep or Analytical holding time exceeded
< = Less than the reporting limit
B = Analyte detected in the Method Blank, value not subtracted from results
*Based on concentration levels in soils

COGCC = Colorado Oil and Gas Conservation Commission
mg/L = Milligrams per liter
mg/kg = Milligrams per kilogram
TPH-GRO = Total Petroleum Hydrocarbons - Gasoline Range Organics

TABLE 2
CONDENSATE SAMPLE ANALYTICAL DATA
WATTENBERG PROFILE SAMPLING
WELD COUNTY, COLORADO
PETROLEUM DEVELOPMENT CORPORATION

Pod	Kersey	Johnstown	Johnstown	Kersey	Johnstown	Kersey	Johnstown	COGCC Table 910-1 Concentration Levels*
Production Interval	Codell	Codell	J-Sand	Codell/Niobrara	Codell/Niobrara	Codell/Niobrara/J-Sand	Codell/Niobrara/J-Sand	
Sample ID	Wells Ranch 12 & 21-3 C	Hahn 13 & 14-27 C	Heinricy 22-7U C	Wells Ranch 14-10 C	Heinricy 11 & 12-7U C	Sater 14 & 24-19U C	Kinzer 28A & 28KD C	
Collection Date	07/08/09	06/19/09	06/19/09	06/18/09	07/08/09	06/18/09	06/19/09	
Organics								
Benzene (mg/kg)	3,490	7,300	7,900 H	4,900	3,400	7,500	5,600	0.17 mg/kg
Ethylbenzene (mg/kg)	1,810	2,400	3,600 H	2,900	1,760	3,200	2,900	100 mg/kg
Xylene (total) (mg/kg)	11,600	19,800	50,700 H	15,600	10,800	25,800	21,500	175 mg/kg
Toluene (mg/kg)	10,700	17,000	51,000 H	14,000	9,900	16,000	18,000	85 mg/kg
Diesel Fuel (No_ 2) (mg/kg)	450,000	380,000	120,000	600,000	460,000	490,000	510,000	500 mg/kg
TVH-Gasoline (mg/kg)	390,000	660,000	1,100,000 H	400,000	320,000	860,000	540,000	
Acenaphthene (mg/kg)	<750	<150	<150	<150	<150	<150	<150	1,000 mg/kg
Anthracene (mg/kg)	<750	<150	<150	<150	<150	<150	<150	1,000 mg/kg
Benzo (a) anthracene (mg/kg)	<1,300	<250	<250	<250	<250	<250	<250	0.22 mg/kg
Benzo (a) pyrene (mg/kg)	<750	<150	<150	<150	<150	<150	<150	0.022 mg/kg
Benzo (b&k) fluoranthene (mg/kg)	<750	<150	<150	<150	<150	<150	<150	2.2 mg/kg
Benzo (g,h,i) perylene (mg/kg)	<750	<150	<150	<150	<150	<150	<150	NA
Chrysene (mg/kg)	<750	<150	<150	<150	<150	<150	<150	22 mg/kg
Dibenz (a,h) anthracene (mg/kg)	<1,000	<200	<200	<200	<200	<200	<200	0.022 mg/kg
Fluoranthene (mg/kg)	<1,300	<250	<250	<250	<250	<250	<250	1,000 mg/kg
Fluorene (mg/kg)	<750	<150	<150	<150	<150	<150	<150	1,000 mg/kg
Indeno (1,2,3-cd) pyrene (mg/kg)	<750	<150	<150	<150	<150	<150	<150	0.22 mg/kg
Naphthalene (mg/kg)	<750	190 J	220 J	280 J	300 J	200 J	250 J	23 mg/kg
Pyrene (mg/kg)	<750	<150	<150	<150	<150	<150	<150	1,000 mg/kg
Inorganics								
Mercury (mg/kg)	<0.064	<0.056	<0.05	<0.058	<0.061	<0.052	<0.056	23 mg/kg

J = Estimated value below the Lower Quantitation Limit (LQL)
H = Prep or Analytical holding time exceeded
< = Less than the reporting limit
mg/kg = Milligrams per kilogram

TVH = Total Volatile Hydrocarbons
mg/kg = Micrograms per kilogram
COGCC = Colorado Oil and Gas Conservation Commission

TABLE 3
DRILLING MUD SAMPLE ANALYTICAL DATA
WATTENBERG PROFILE SAMPLING
WELD COUNTY, COLORADO
PETROLEUM DEVELOPMENT CORPORATION

Pod	Johnstown	COGCC Table 910-1 Concentration Levels
Production Interval	**Codell/Niobrara**	
Sample ID	Gold (Northwest Pad)	
Collection Date	09/23/09	
	Organics	
Benzene (mg/kg)	0.530	0.17 mg/kg
Ethylbenzene (mg/kg)	<0.500	100 mg/kg
Toluene (mg/kg)	1.500	85 mg/kg
Xylene (total) (mg/kg)	2.24	175 mg/kg
Diesel Fuel (No. 2) (mg/kg)	31	500 mg/kg
TPH-GRO (C6-C10) (mg/kg)	18	
Acenaphthene (mg/kg)	<0.073	1,000 mg/kg
Anthracene (mg/kg)	<0.077	1,000 mg/kg
Benzo (a) anthracene (mg/kg)	<0.073	0.22 mg/kg
Benzo (a) pyrene (mg/kg)	<0.073	0.022 mg/kg
Benzo (b) fluoranthene (mg/kg)	<0.081	0.22 mg/kg
Benzo (k) fluoranthene (mg/kg)	<0.086	2.2 mg/kg
Chrysene (mg/kg)	<0.086	22 mg/kg
Dibenzo (a,h) anthracene (mg/kg)	<0.073	0.022 mg/kg
Fluoranthene (mg/kg)	<0.073	1,000 mg/kg
Fluorene (mg/kg)	<0.075	1,000 mg/kg
Indeno (1,2,3-cd) pyrene (mg/kg)	<0.073	0.22 mg/kg[2]
Naphthalene (mg/kg)	0.180	23 mg/kg[2]
Pyrene (mg/kg)	<0.077	1,000 mg/kg[2]
	Inorganics	
Arsenic (mg/kg)	1.6	0.39 mg/kg
Barium (mg/kg)	330	15,000 mg/kg
Boron (mg/L)	1.5 B	2 mg/L
Cadmium (mg/kg)	<0.77	70 mg/kg
Chromium, Hexavalent (mg/kg)	<0.75	23 mg/kg
Chromium +3, Calculated (mg/kg)	5.3	120,000 mg/kg
Copper (mg/kg)	8.4	3,100 mg/kg
Lead (mg/kg)	<5.6	400 mg/kg
Mercury (mg/kg)	0.015	23 mg/kg
Nickel (mg/kg)	4.7	1,600 mg/kg
Selenium (mg/kg)	<7.7	390 mg/kg
Silver (mg/kg)	<2.3	390 mg/kg
Zinc (mg/kg)	20	23,000 mg/kg
	Other Analyses	
Electrical Conductivity (EC) (mmhos/cm)	0.898	<4,000 mmhos/cm or 2x background
Sodium Adsoprtion Ratio	19	<12
pH	10.2 H	6-9

H = Prep or analytical holding time exceeded
< = Less than the reporting limit
B = Analyte detected in the associated Method Blank, value not subtracted from result
COGCC = Colorado Oil and Gas Conservation Commission
mg/L = Milligrams per liter
mg/kg = Milligrams per kilogram
mmhos/cm = Millmhos per centimeter

TABLE 4
CHEMICALS OF CONCERN
WATTENBERG PROFILE SAMPLING
WELD COUNTY, COLORADO
PETROLEUM DEVELOPMENT CORPORATION

Produced Water Releases	Condensate Releases	Drilling Pit Closures
BTEX	BTEX	BTEX
Naphthalene*	Naphthalene	Naphthalene*
TPH-GRO	TPH-GRO	TPH-GRO
TPH-DRO	TPH-DRO	TPH-DRO
EC**	PAHs*	SAR***[1]
pH**		pH***
SAR**[1]		Arsenic

BTEX = Benzene, toluene, ethylbenzene, total xylenes
TPH-GRO = Total Petroleum Hydrocarbons - Gasoline Range Organics
TPH-DRO = Total Petroleum Hydrocarbons - Diesel Range Organics
PAHs = polynuclear aromatic hydrocarbons
* indicates analytes may be removed from the list following further site specific evaluation
** will only be analyzed for surface releases of produced water that affect soil within 3 feet below ground surface
*** will only be analyzed if the final disposition of material will be less than 3 feet below ground surface
[1] - SAR will only be analyzed where EC in soil exceeds Table 910-1 in accordance with Rule 910 b(3)E.
SAR = sodium absorption ratio
EC = electrical conductivity