

May 11, 2010

ExxonMobil Production Company  
CORP-MI-3011  
PO Box 4358  
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Attention: Adrienne Rosecrans, P.E. – Senior Environmental Engineer

Subject: **Pit Evaluation and Site Background Findings Report**  
**Location PCU 296-7A**  
**Rio Blanco County, Colorado**  
**KRW Project No. 1001-02**

Dear Adrienne:

As requested by ExxonMobil Production, KRW Consulting, Inc. (KRW) collected sediment and soil samples for laboratory analysis at the subject site to evaluate disposal options for pit contents prior to the removal of synthetic pit liners at the subject site. Also, background soil samples from areas not impacted by site development were collected to evaluate background conditions for specific parameters. This report presents findings of field observations and analyses.

### **Background**

Well pad PCU 296-7A is located in Section 7 of Township 2 South, Range 96 West in Rio Blanco County, Colorado. The site presently consists of nine wells; a fresh water pit; a reserve pit; and a cuttings pit/trench. Each of these pits is lined with a synthetic liner. In addition, a large stockpile or “spoils pile” of excavated and removed material from the pits exists adjacent to the pits. Based on field observations, this spoils pile appears to contain former cuttings trench material that had been previously solidified and removed from the cuttings pit/trench area. Refer to the attached Site Plan for the locations of the pits and the spoils pile.

### **Sampling Event**

Soil sampling was conducted at the subject site on January 14, 2010 (pits, one stockpile grab, and background), and February 17, 2010 (additional stockpile samples). KRW collected soil/sediment samples from the fresh water, reserve, and cuttings pits, as well as the spoils pile. These samples were collected prior to initiating any pit closure or reclamation activities. One representative sediment sample was collected from each of the pits and from the spoils pile. Subsequently, three additional composite spoils pile samples were collected to better characterize potential sediments contained in the spoils pile. All samples were submitted for analysis of Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 parameters. These

parameters include the following: total metals; BTEX (benzene, toluene, ethylbenzene, and total xylenes); select semi-volatile organics; total petroleum hydrocarbons (both volatile and extractible); SAR (sodium absorption ratio); EC (electrical conductivity); and pH. In addition, paired background samples were collected at three undisturbed locations adjacent to the site. Paired samples consisted of a surficial sample, collected at a depth of one-foot below ground surface (bgs) and a sample collected at a depth consistent with the depth of pits at the site, generally between 12 and 14 feet bgs. Background samples were analyzed for total arsenic, SAR, EC, and pH.

During the sampling events, samples were collected in accordance with KRW's sampling protocol attached as Appendix A. Samples were placed in laboratory prepared bottles, sealed and delivered to Accutest Laboratories in Wheat Ridge, Colorado for analysis. Proper chain of custody protocol was followed for the sampling event. Refer to the attached Site Plan for approximate sample locations.

### **Analytical Findings**

Refer to Table 1 for a summary of the laboratory results and to Appendix B for a complete laboratory report. Detected concentrations of specific parameters that exceed COGCC Table 910-1 "Allowable Levels" are summarized below.

- TPH levels detected in all pit content samples are above allowable level of 500 mg/kg, ranging from 946 mg/kg to 172,000 mg/kg.
- Naphthalene was detected above the allowable limit of 23 mg/kg in the fresh water pit sample at a concentration of 174 mg/kg.
- Arsenic was detected above the allowable limit (0.39 mg/kg) in all pit samples and all spoil pile samples; fresh water pit at 3.5 mg/kg, reserve pit at 3.6 mg/kg, and cuttings pit at 15.1 mg/kg, with spoil pile samples at 6.1 mg/kg, 6.3 mg/kg, 5.1 mg/kg, and 7.5 mg/kg. It should be noted, however, that background levels detected for arsenic all exceeded the allowable limit as well. Using the statistical methodology recommended by the Colorado Department of Public Health and Environment (CDPHE)<sup>1</sup>, Background Data Evaluation Method B for sites with more than five but less than nine background samples, a background level of 7.6 mg/kg for arsenic has been calculated. Adding an

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<sup>1</sup> CDPHE, December 31, 1997, *Proposed Soil Remediation Objectives Policy Document (Attachment 4)*, Hazardous Material and Waste Management Division.

additional 20 percent factor for site variability to this value results in a maximum allowable arsenic level at the site of 9.1 mg/kg. However, looking specifically at the background Pt. 2 deep sample result of 16.0 mg/kg and the similar cuttings pit arsenic result of 15.1 mg/kg, it is suspected that the background arsenic concentrations do vary at this location within the near surface formations. A maximum allowable arsenic level of 18.0 mg/kg is proposed.

#### Arsenic Background Data Evaluation Method B

Sample Point	Arsenic (mg/KG)
Bckgrnd. Pt. 1 surficial	5.8
Bdkgrnd. Pt. 1 deep	5.0
Bckgrnd. Pt. 2 surficial	6.5
Bckgrnd. Pt. 2 deep	16.0
Bckgrnd. Pt. 3 surficial	6.2
Bckgrnd. Pt. 3 deep	5.3
Median	6.0
Upper Quartile (Qu)	5.3
Lower Quartile (Ql)	6.5
IRQ (Ql-Qu)	0.8
Background Level at a 95% Confidence level	
(MEDIAN + 2 X IRQ)	7.6

Based on this proposed background arsenic range, arsenic levels detected in the fresh water pit, reserve pit, cuttings pit, and each of the spoil pile samples are below the maximum allowable arsenic level for the site.

- Boron concentrations were detected in the pit and spoil pile samples above the allowable limit. However, recent COGCC guidance indicates that the reference to the Hot Water Soluble Boron allowable limit concentration is an artifact from a previous table version and is no longer applicable (answer to question No. 33 on COGCC's website "Frequently Asked Questions").
- Mercury was detected above the allowable limit (23 mg/kg) in the fresh water pit sample at a concentration of 71.6 mg/kg.
- Electrical conductivity was detected above the allowable limit of <4 mmhos/cm in the cuttings and fresh water pit samples (7.180 mmhos/cm and 5.360 mmhos/cm,

respectively), as well as in two of the stockpile samples (7.990 mmhos/cm and 6.010 mmhos/cm). A review of the background sample data does not increase the allowable limit above the 4 mmhos/cm.

- Sodium adsorption ratio was detected above the allowable limit of <12 in each of the pit samples and one of the spoils pile samples; cuttings trench at 23.5; reserve pit at 26; fresh water pit at 30.3; and spoils pile at 17.1. A review of the background sample data does not increase the allowable level above the stated Table 910-1 limit.
- The allowable limit for pH (6 – 9) was exceeded in the reserve pit, fresh water pit, and each of the spoil pile samples, ranging from 9.07 to 9.76. It should be noted, however, that pH levels were also detected above the allowable limit, and at similar levels in two of the three deep background samples (9.40 and 9.22). Using the CDPHE Background Data Evaluation Method B referenced above, a background level of 10.60 for pH has been calculated. Adding an additional 20 percent factor for site variability to this value results in a maximum allowable pH level at the site of 12.72.

#### pH Background Data Evaluation Method B

Sample Point	pH
Bckgrnd. Pt. 1 surficial	8.99
Bdkgrnd. Pt. 1 deep	8.40
Bckgrnd. Pt. 2 surfical	7.79
Bckgrnd. Pt. 2 deep	9.40
Bckgrnd. Pt. 3 surficial	8.93
Bckgrnd. Pt. 3 deep	9.22
Median	8.96
Upper Quartile (Qu)	9.22
Lower Quartile (Ql)	8.40
IRQ (Qu-Ql)	0.82
Background Level at a 95% Confidence level	
(MEDIAN + 2 X IRQ)	10.60

Based on this statistical method and the 20 percent factor for site variability, the elevated pH levels detected in the fresh water and reserve pits, and each of the spoils pile samples are below the maximum allowable pH level for the site.

Please contact us should you have any questions regarding our methods or findings.

**Report Compiled by:**

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