Summary of Sampling and Analysis Plan

Carbon Dioxide Investigation
SW 30-05-13-W2M
Near Weyburn, Saskatchewan

July 13, 2011

Prepared for:

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1.0 INTRODUCTION

TRIUM Environmental Inc. (TRIUM) is pleased to provide Cenovus Energy Inc. (Cenovus) with the following summary sampling and analysis plan (SAP) to investigate the reports of carbon dioxide concentrations at the Kerr Property (SW 30-05-13-W2M) located near Weyburn, Saskatchewan.

2.0 PROJECT OBJECTIVES – KERR PROPERTY

The primary focus of this program will be to address the claims made in the Petro-Find report relating specifically to the Kerr property. While conducting the primary program, a secondary focus on satisfying the requests of the Saskatchewan Ministry of Energy and Resources (MER) to investigate potential historical oil or produced water releases.

2.1 Data Gap Analysis

Currently, Cenovus and the working group believe that the Petro-Find data is too limited in scope and analysis to substantiate claims linking CO_2, methane and the "blue-silvery" sheen to Cenovus EOR operations. The sections below provide information regarding the focus of each stage of the proposed investigation to collect information satisfactory to Cenovus and the working group.

2.1.1 Primary Program - Focus

The focus of the primary program investigation can be summarized by the following questions.

- What are the concentrations of carbon dioxide and other permanent/fixed gases present on the Kerr Property, what is their spatial distribution (vertically and laterally), and are seasonal fluctuations in concentrations observed?
- Is there a relationship between the permanent/fixed gases at the Kerr Property and:
    - Gases purchased/produced/recycled by Cenovus?
    - Potential naturally occurring or surface sources (i.e. biogenic) on the site?
- What is the seasonal water quality of the surface water dugouts on-site?
    - Is the "blue silvery" sheen material on the ponds related to petroleum hydrocarbons or is it a naturally occurring condition (i.e. biological)?
- What is the seasonal groundwater quality variability of the shallow groundwater in the vicinity of any gas anomalies at the site?

3.0 SAMPLNIG AND ANALYSIS PLAN

In order to compile the information currently deemed necessary to meet the deliverables of this program the following work plan will be instigated.

3.1 Timeline and Activities

Table 1 provides the proposed milestones for tasks currently planned for this program. Technical details of each to the proposed milestones listed in Table 1 below will be provided in the following sections.

Table 1: Proposed Timeline

Task	Date Completed by:
Development of work plan, DQO, and QAPP	**July 21, 2011**
Initial Site Visit	Completed
Desktop Review and Background Compilation	July 21, 2011
Preliminary Intrusive Investigation – 1st Program	
Surface Geophysical Investigation – On-site	August 8, 2011
Shallow (vadose) zone gas sampling	August 8–17, 2011
Surface Water Sampling – ponds	July 21-22, 2011 August 8–17, 2011
Groundwater and Dissolved Gas Sampling	August 8 – 17, 2011
Reporting	September/October, 2011

3.1.1 Intrusive Investigation

Upon completion of the CSM and baseline information compilation, the intrusive investigation program will be conducted. This program is intended to characterize environmental conditions at the Kerr property, and at the selected "background" location (Minard Farm Section 17/20-007-14-W2M). The intrusive program will include:

- Gas Sampling/Characterization – Injected CO_2 and produced gas (being a mixture of formation gases and CO_2);
- Shallow (vadose) zone gas sampling;
- Surface Water Sampling (Kerr site only);
- Groundwater and Dissolved Gas Sampling – Kerr property, and Minard Farm; and,
- Reporting, conceptual site model (CSM) update.
    - Interpret shallow groundwater physical and geochemical conditions; interpret surface water physical and geochemical conditions; interpret the permanent/fixed gas relationships (if any);
    - Characterize source gas signatures and markers;
    - Characterize produced gas signatures and markers; and,
    - Revise sampling strategy for follow up sampling events and/or incorporate components of secondary focus if needed.

3.1.2 Analytical Plan

Petro-Find has identified the following potential chemicals of concern (PCOC).

- Carbon Dioxide (CO_2) – as injected into Weyburn-Midale EOR program;
- Methane – as material originating from reservoir of injected CO_2; and,
- Petroleum Hydrocarbons – as material originating from underlying oil and gas reservoirs and migrating vertically through "macro-seeps"

The programs that are proposed will assess these PCOC's, however has incorporated an expanded list of analytes believed to be relevant to this investigation. The proposed analytes are listed in Table 2, below. This list is meant to identify all potentially important parameters but may be expanded or reduced as required and is based on information currently available.

Table 2: Analytical Plan

Analyte	*Laboratory*
Vadose Zone and Dissolved Gases	
Gas Chromatographic Analysis – N_2, CO_2, O_2, Ar, H_2, H_2S, He, CH_4, C_2H_6, C_3H_8, i-C_4H_{10}, n-C_4H_{10}, i-C_5H_{12}, n-C_5H_{12} and C_6+	Primary - Isotech Laboratories Inc. (Champaign Illinois)
VOC Open Scanning	ALS Laboratories (Edmonton, Alberta)
Sulphur Compounds (hydrogen sulfide, carbon disulfide, dimethyl disulfide, dimethyl sulfide, ethyl mercaptan, methyl mercaptan, propyl mercaptan, butyl (n) mercaptan, carbonyl sulfide, butyl (t) mercaptan	ALS Laboratories (Edmonton, Alberta)
Stable Carbon / Hydrogen Isotopes (^{13}C / ^{12}C, and ^{2}H / ^{1}H) of CH_4	Primary - Isotech Laboratories Inc. (Champaign Illinois)
Stable Carbon / Oxygen Isotopes (^{13}C / ^{12}C and ^{16}O / ^{18}O) and Radioactive Carbon (^{14}C) of Carbon Dioxide (CO_2)	Primary - Isotech Laboratories Inc. (Champaign Illinois)
Radioactive Carbon Isotope (^{14}C) of CH_4	Primary - Isotech Laboratories Inc. (Champaign Illinois)
Surface Water	
Petroleum Hydrocarbons (BTEX, F1-F2)	ALS Laboratories Inc. (Edmonton, AB)
Metals	ALS Laboratories Inc. (Edmonton, AB)
Routine Potability	ALS Laboratories Inc. (Edmonton, AB)
Algae/Bacterial Cultures	ALS Laboratories Inc. (Winnipeg, MB)
Groundwater	
Petroleum Hydrocarbons (BTEX, F1-F2)	ALS Laboratories Inc. (Edmonton, AB)
Metals	ALS Laboratories Inc. (Edmonton, AB)
Routine Potability	ALS Laboratories Inc. (Edmonton, AB)
Bacterial Cultures	ALS Laboratories Inc. (Winnipeg, MB)

3.2 Sampling Locations

In order to defensibly conduct this program, TRIUM has created a combination of statistical and judgmental sampling strategy for the sites as described below.

3.2.1 Kerr Property

At the Kerr property, shallow gas, dissolved gas, groundwater and surface water samples will be collected.

3.2.1.1 Vadose Gas Locations

A triangular grid based sample approach has been selected for the shallow vadose zone gas sample locations. All gas sampling locations will be drilled and the temporary monitoring points will be logged noting the soil layers and composition. Seventy-six sampling points will be installed below the “B” soil horizon across the site, as shown on the attached drawing, Appendix A. This spacing represents a spacing of approximately 96 m and statistically represents 95% probability of identifying a potential area of release with a 50 m radius. After field screening of the 76 samples, 24 sample locations will be judgmentally determined as infill sampling locations for delineation of hot spots.

Each of these locations will be field screened (see Section 3.3), and 50% (50 samples) of sample locations representing the highest CO_2 and CH_4 concentrations will be sampled for permanent/fixed gas GC analysis. The 25% (25 samples) of sample locations representing the highest CO_2 and CH_4 concentrations will be sampled for VOC, sulphur compounds and Isotope analysis. Locations for analytical sample selection will be determined by installing four or eight post run tubing (PRT) gas sampling probes, field monitoring all, then collecting samples from the selected locations before removing the PRT probes and installing in the next four or eight locations. A senior professional will be on-site to determine the final sampling locations. The choice of locations will be noted in the field notebook to document the decisions made in the field.

3.2.1.2 Dissolved Gas/Groundwater Sample Locations

Once the shallow gas field screening/sampling program has been completed, the 12 locations with the highest CO_2 and CH_4 concentrations, as well as 3 judgmental locations will be selected for dissolved gas/groundwater sample locations. These 15 dissolved gas samples represent 15% of the total number of vadose zone sample locations.

Each of these locations will be field screened, and all 15 locations will be sampled for the list of groundwater analytes, and dissolved gas analytes. A senior professional will be on-site to determine the final sampling locations. The choice of locations will be noted in the field notebook to document the decisions made in the field.

3.2.1.3 Surface Water Sample Locations

Eight surface water sample locations will be judgmentally selected around each of the two “gravel pit” ponds, thus distributing four samples (one on each direction – north, south, east, west) around the perimeter of each of the ponds. Should additional surface water bodies be identified in the vicinity of the Kerr house or of interest on the Kerr property (i.e. other areas of standing water), a sampling regime (one in each direction) may be applied to these locations. Additional judgmental samples may also be selected if visible signs of environmental impairment are noted or suspected (i.e. bubbling, odour, sheen, etc.).

Each of these locations will be sampled for the list of surface water analytes. A senior professional will be on-site to determine the final sampling locations. The choice of locations will be noted in the field notebook to document the decisions made in the field.

3.2.2 Background (Minard Farm)

In order to provide a baseline of previously identified background conditions (Minard Farm – BGS, 2000 – 2005), shallow gas, dissolved gas and groundwater samples will also be collected from the Minard Farm (SE ¼-20-07-14-W2M and NE ¼-17-07-14-W2M)

3.2.2.1 Vadose Gas Locations

TRIUM will collect approximately 20 sample locations from the same grid pattern applied by the British Geological Survey to this site for their investigation.

Each of these locations will be field screened, and 50% (10 samples) of sample locations representing the highest CO_2 and CH_4 concentrations will be sampled for permanent/fixed gas GC analysis. The 25% (5 samples) of sample locations representing the highest CO_2 and CH_4 concentrations will be sampled for VOC, sulphur compounds and Isotope analysis. Locations for analytical sample selection will be determined by installing four or eight PRT probes at a time, field monitoring all, then collecting samples from the selected 50% (highest concentrations) before removing the PRT probes and installing in the next four or eight

locations. A senior professional will be on-site to determine the final sampling locations. The choice of locations will be noted in the field notebook to document the decisions made in the field.

3.2.2.2 Dissolved Gas/Groundwater Sample Locations

Once the shallow gas field screening/sampling program has been completed, the 3 locations (15% of total vadose zone sample locations) with the highest CO_2 and CH_4 concentrations will be selected for dissolved gas/groundwater sample locations.

Each of these locations will be field screened and all 3 locations will be sampled for the list of groundwater analytes, and dissolved gas analytes. A senior professional will be on-site to determine the final sampling locations. The choice of locations will be noted in the field notebook to document the decisions made in the field.

3.2.3 Source Gas/Produced Gas

In order to evaluate the forensic identification and markers of the source gas, samples of this material as well as the produced gas must be collected. These samples will be used to compare similarities and differences between the injected gas into the Weyburn-Midale formation, the gas produced from this formation and recycled, and the gas samples collected from the investigation areas, including the Kerr property.

As the injected source gas is received as a compressed liquid form at the Cenovus injection facilities from the DGC facility, the collection of representative samples from this high-pressure material requires specialized sampling procedures. These are currently being determined with Cenovus.

In order to provide a representation of the source gas, TRIUM will collect one sample in July and one sample in August of the source/recycle gas. A senior professional will be on-site to determine the final sampling protocols. The choice of occurrence will be noted in the field notebook to document the decisions made in the field.

TRIUM understands that the International Performance Assessment Centre for Geologic Storage of CO_2 will be collecting source gas samples in June/July 2011. Cenovus will be requiring that they collect duplicate samples, which will be held by Cenovus for potential future analysis.

3.3 Subcontractors

All subcontractors will be selected based on their demonstrated technical expertise to the specific areas (i.e. drillers, laboratories, etc) and their health and safety qualifications relative to Cenovus requirements.

4.0 REFERENCE INFORMATION

4.1 Reclamation and Disturbance

Cenovus has developed reclamation requirements as outlined in their “general environmental protection plan”. TRIUM has reviewed this and will ensure that the necessary components are followed. Except in the borehole, no surface disturbance of topsoil or subsoil is required to complete this program, therefore the primary reclamation activity will be to clean all drilling equipment prior to accessing the area (weed distribution). This will be done before commencing the program and between moving between the different site areas. A post sampling evaluation will be conducted for potential rutting, however this is not expected to be a concern with the low ground pressure equipment being used.

5.0 CLOSURE

TRIUM has prepared the information herein to satisfy the foreseen technical and health and safety requirements for the assessment program, however as in any work activity, additional information and documentation is anticipated and will be added/amended to this document in future versions. TRIUM has prepared this letter for the account of Cenovus. The material in it reflects TRIUM's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this letter, or any reliance on or decisions made based on it, are the responsibility of such third parties. TRIUM Environmental Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this letter. This letter has been prepared in strict confidence for Cenovus. No disclosure of this letter, its technical contents or proprietary information is permitted without express written consent by TRIUM and Cenovus.

Should you have any questions or comments relating to this program, please contact TRIUM Environmental directly at (403) 932-5014, or the persons listed below at (403) 669-4158 or (403) 669-8566.

Respectfully submitted,

TRIUM Environmental Inc.

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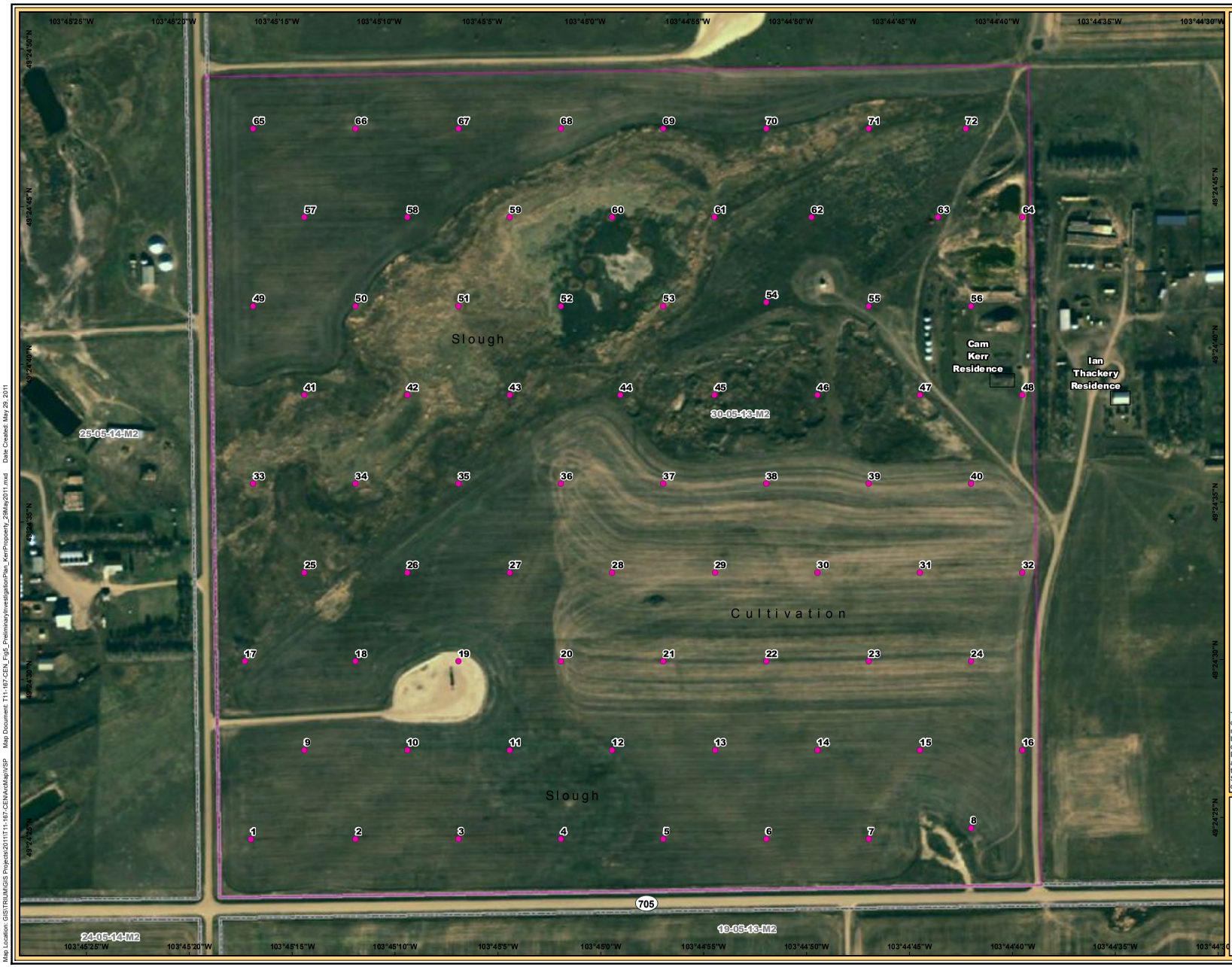
APPENDIX A

DRAWINGS AND FIGURES



Legend

- Kerr Property
- Section Boundary
- VSP Sampling Location

N
W E
S

0 50 100 200
Meters

1:3,500

NAD 83 UTM Zone 13N

Data Sources: Valtus Imagery

cenovus ENERGY

Preliminary Investigation Plan
Kerr Property

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Map 5

Map Location: GIS\TRIUM\GIS Projects\2011\T11-167-CEN\Arc\MapVSP Map Document: T11-167-CEN_Fig5_PreliminaryInvestigationPlan_KerrProperty_28May2011.mxd Date Created: May 29, 2011