

# PCS – SWIFT CREEK

CATHODIC PROTECTION SURVEY  
JULY 2016

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July, 2016

Potash Corporation  
Swift Creek Mining Plant  
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Swift Creek Mining Plant  
Effectiveness of Cathodic Protection  
Survey Underground Natural Gas System

## **INTRODUCTION**

The annual cathodic protection survey was conducted for Potash Corporation – Swift Mining Creek Plant during the month of July, 2016. During this survey, the Swift Creek Mining Plant natural gas system was inspected for the effectiveness of cathodic protection, as applied. The cathodic protection system for the Swift Creek Mining Plant consists essentially of Galvomag Magnesium anodes placed in various locations throughout the natural gas system.

## **RESULTS AND ANALYSIS**

A total of Seven [7] structure readings, Three [3] anode readings and Five [5] casing readings were taken during this survey. As can be seen by the structure-to-soil potential measurements and the enclosed data sheet, 100% of the gas pipeline readings obtained are indicative of cathodic protection. A structure-to-soil potential of 850 millivolts or more negative direct current is the basis used in this report to confirm cathodic protection.

## **IR DROP CONSIDERATION**

The effectiveness of any cathodic protection system can be determined by taking potential measurements between the structure and a reference electrode. These potential measurements have traditionally been recorded with “average reading” digital voltmeters while the protective current is flowing or applied. These on-potential measurements contain the error produced by the voltage drop in the soil (electrolyte) and the voltage drop in the structure being protected. This error is referred to as IR drop. Interpretation of a current applied measurement requires consideration of the significance of voltage drops in the earth and metallic paths.

An instant off-potential measurement is the reading taken instantaneously after the protective current reaches zero. Off-potential measurements eliminate the IR drop error, allowing the true IR drop free polarized potential of a cathodically protected structure to be determined in the field. IR drop error is eliminated since there is no current flowing when the measurement is taken (i.e.,  $I=0$ ).

## **SURVEY TEST INSTRUMENTATION**

The Cathodic Protection Analyzer, developed by Universal Rectifiers, Inc, (Hereinafter referred to as CPA), is a handheld instrument used with a reference electrode to measure the uninterrupted characteristics of the signal generated from a CP source. It can be used to evaluate the coating of a pipeline to ensure that the pipe is fully protected from corrosion. The CPA is designed for use with any pipeline system or structure at risk to corrosion factors. Aging pipes and changing conditions can cause significant problems, such as an increase in applied CP levels and enlarged holidays in coating. In addition, increased environmental concerns also emphasize the need to minimize leaks as much as possible.

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The CPA has computer capabilities of filtering interfering signals. The instrument is also capable of measuring several facets of the protection waveform. The software-driven instrument reads the minimum, average, and maximum voltage levels emanating from the pipe, thereby allowing an overview of the entire CPv signature. Digital signal processing makes the accuracy and precision of the CPA possible. It utilizes software to provide the extra speed and flexibility that is becoming increasingly important in the field.

The CPA is operated in conjunction with a Copper – Copper Sulfate [Cu/CuSO<sub>4</sub>] shielded reference electrode known by its model number SPI, which allows the user to make a measurement of the cathodic protection voltage without interrupting the potential source.

## **RECOMMENDATIONS**

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Underground Natural Gas System  
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The sacrificial galvanic anode arrangement designed to protect the coated and wrapped steel natural gas system is providing current to afford cathodic protection to the steel distribution system. Structure-to-soil readings obtained from Cathodic Test Points and gas risers on the steel distribution system indicate approximately 100% cathodic protection. One [1] highway casing, Two [2] railroad casings and Two [2] CTP casings were inspected during this survey. Four [4] of the Five [5] carrier casing pipes were found to be isolated from the natural gas piping. The structure-to-soil potential of CTP #2 white casing pipe wire indicates -0.985 volts DC on the casing pipe, representing a short from the carrier pipe to the casing pipe. This is indicative of either a “metallic contact” short [metal to metal] or an “electrolytic” [water or soil in the casing] short.

Cathodic Test Point #3 has been returned to service through repair or replacement of once severed wires connecting the anode and steel gas main to the test point. Re-connection has been established to the steel gas pipe which is at an approximate depth of 18 feet. Cathodic Protection levels around the Swift Creek complex are comparable to levels reported on the 2013 CP survey and continue to provide protection to approximately 100% of the steel gas system.

At this time, the Natural Gas Distribution System for the PCS – Swift Creek complex is approximately 100% cathodically protected. I trust the above information to be satisfactory and in sufficient detail, however, should you require additional information, please contact me.

Sincerely,



Mitchell Whitfield  
C.P. Tester

## **CATHODIC TEST POINTS**

## **CATHODIC TEST POINTS**

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### CTP - #1

Black Anode Wire	-1.810 MV
Black Gas Pipeline Wire	-1.040 MV
White Casing Pipe Wire	-0.420 MV

### CTP - #2

Black Anode Wire	-1.090 MV
Black Gas Pipeline Wire	-1.043 MV
White Casing Pipe Wire	-0.985 MV

### CTP - #3

Black Anode Wire	-1.390 MV
Green Gas Pipeline Wire	-1.010 MV



**STRUCTURE-TO-SOIL POTENTIALS**  
**GAS PIPE CASINGS**

## **STRUCTURE-TO-SOIL POTENTIAL - GAS PIPE CASINGS**

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<u>Test Location</u>	<u>Energized Potentials Volts</u>
Railroad Casing - #1	-0.601
Railroad Casing - #2	-0.517
Highway Casing - #3	-0.413

**STRUCTURE - TO - SOIL POTENTIAL DATA**

## **STRUCTURE – TO – SOIL POTENTIAL DATA**

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Underground Natural Gas System

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<u>Test Location</u>	<u>Energized Potentials Volts</u>
Gas Metering Station - Inlet	-1.081
Gas Metering Station – Outlet	-1.064
4” Gas Riser @ Plant	-1.311
2” Gas Riser @ Boiler Room	-1.452