

PCS

SUWANNEE RIVER

CATHODIC PROTECTION SURVEY
JULY 2016

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July, 2016

Potash Corporation
Suwannee River Chemical Plant
Post Office Box 300
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ATTN: Mr. Ken Tut
Project Representative

Suwannee River Chemical Plant
Effectiveness of Cathodic Protection
Survey Underground Natural Gas System

INTRODUCTION

The annual cathodic protection survey was conducted for Potash Corporation's Suwannee River Chemical Plant during the month of July, 2016. During this survey, the Suwannee River Chemical Plant natural gas system was inspected for the effectiveness of cathodic protection, as applied. The cathodic protection system for Potash Corporation consists essentially of Galvomag Magnesium anodes placed in various locations throughout the natural gas distribution system.

RESULTS AND ANALYSIS

A total of Five [5] structure readings, Three [3] anode readings and One [1] casing reading were taken during this survey. As can be seen by the structure-to-soil potential measurements and the enclosed data sheet, 100% of the structure readings obtained are indicative of cathodic protection. A structure-to-soil potential of 850 millivolts or more negative 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. The analyzer 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.

Suwannee River Chemical Plant
July 2016

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/CuSO₄] 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

Potash Corporation – Suwannee River Chemical Plant
Underground Natural Gas System
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The sacrificial anode arrangement designed to protect the coated and wrapped steel natural gas system is providing adequate current to afford complete 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, with all CP reading being above State and Federal minimum standards of -0.850 volts direct current. The Railroad casing at CTP #2 was inspected and found to have a sacrificial anode installed on the casing pipe. The taped black casing wire on CTP #3 could not be located and requires remedial action to allow collection of potential readings of the gas casing pipe.

The six inch steel gas pipe from the metering station to the limestone unloading area is cathodically protected at this time. Structure-to-soil readings at the limestone unloading area have adequate cathodic protection levels and remedial action is not required to bring these piping areas into compliance with State and Federal minimum guidelines for applied cathodic protection.

At this time, the Natural Gas Distribution System for Potash Corporation's Suwannee River Chemical Plant complex is cathodically protected. Currently, no remedial action is required to meet the minimum standard State and Federal code. I trust the above information to be satisfactory and in sufficient detail, however, should you require additional information, please contact me.

Sincerely,



Mitchell L. Whitfield
C.P. Tester

CATHODIC TEST POINTS

CATHODIC TEST POINTS

Potash Corporation – Suwannee River Chemical Plant
Underground Natural Gas System
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CTP - #1

Red Anode Wire	-1.652 MV
Black Gas Pipeline Wire	-1.036 MV
Anode / Gas Line Wires Combined	-1.410 MV

CTP - #2

Red Anode Wire	-1.218 MV
Black [Tape] Casing Pipeline Wire	-0.892 MV
Black Gas Pipeline Wire	-0.973 MV
Anode / Gas Line Wires Combined	-1.225 MV

CTP - #3

Red Anode Wire	-1.339 MV
Black [Tape] Casing Pipeline Wire	Non Locatable
Black Gas Pipeline Wire	-1.002 MV
Anode / Gas Line Wires Combined	-1.199 MV

STRUCTURE-TO-SOIL POTENTIALS
GAS PIPE CASINGS

STRUCTURE-TO-SOIL POTENTIAL - GAS PIPE CASINGS

Potash Corporation – Suwannee River Chemical Plant

Underground Natural Gas System

July, 2016

<u>Test Location</u>	<u>Energized Potentials Volts</u>
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*Railroad Casing @ CTP #3	-0.000
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Scale House Drive Casing @ CTP #2	-0.884
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*Casing Anode Installed - Cathodic Test Point Missing Casing Wire which requires locating and replacing.

STRUCTURE - TO - SOIL POTENTIAL DATA

STRUCTURE – TO – SOIL POTENTIAL DATA

Potash Corporation – Suwannee River Chemical Plant

Underground Natural Gas System

July, 2016

Test Location	Energized Potentials Volts
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Metering Station [6" Steel Line Outlet]	-1.119
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Limestone Loading [6" Riser Inlet]	-1.084
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