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# NUTRIEN LTD. SCM Float Plant

CATHODIC PROTECTION RE-SURVEY  
OCTOBER 2022

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October 2022

Nutrien Ltd.  
Swift Creek Mine Float Plant  
15843 SE 78<sup>th</sup> Street  
White Springs, Florida 32096-2703  
ATTN: Mr. Ken Tutt  
Project Representative

Swift Creek Mine Float Plant  
Effectiveness of Cathodic Protection  
Survey Underground Natural Gas System

## **INTRODUCTION**

The cathodic protection re-survey was conducted for Nutrien Ltd. – Swift Creek Mine Float Plant beginning October 4, 2022. During this survey, the Swift Creek Mine Float Plant natural gas system was inspected for the effectiveness of cathodic protection, as applied. The cathodic protection system for the Swift Creek Mine Float Plant consists essentially of Galvomag Magnesium anodes placed in various locations throughout the natural gas system.

## **RESULTS AND ANALYSIS**

A total of Twelve [12] cathodic protection voltage readings, Three [3] Galvomag anode / CTP readings, Four [4] gas casing pipe readings and Six [6] gas pipeline 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 [-0.850] or more negative direct current is the basis used in this report to confirm cathodic protection.

### **IR DROP CONSIDERATION**

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.

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 potential measurements contain the error produced by the voltage drop in the soil (electrolyte resistance) and the voltage drop (current) 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 *IR* drop is a voltage across a resistance, in accordance with Ohm’s law ( $V=IR$ ). Although there are several *IR* drops in a structure-to-electrolyte potential circuit, the *IR* drop of most concern is that which occurs between the reference electrode (half-cell) and the structure-to-electrolyte (pipe) boundary. This *IR* drop is due to a CP current in the resistance of the electrolyte and is an error in the measurement.

One way to reduce the *IR* drop is to bring the reference electrode close to the structure (pipe) to reduce the resistance of the electrolyte (soil). Another way to reduce the *IR* drop is to bring the current to zero by interrupting all sources of current (anodes) influencing that reference point at the same precise time.

### **SURVEY TEST INSTRUMENTATION & METHOD**

- Gas Electronics Model 601 Insulation Checker
- Fluke Model 71 Digital Multi-meter
- Tinker & Rasor 6-B Reference Electrode [CSE]
- Cu/CuSO<sub>4</sub> Reference Electrode Calibration 10/03/2022 – 3.7 Mv

## FINDINGS

Nutrien Ltd. – Swift Creek Mine Float Plant  
Underground Natural Gas System  
June 2022

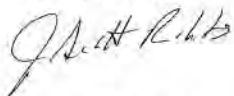
### CTP #1 – As Found

Pipe Potential -	-1.382 mv
Casing Potential -	-0.583 mv
Reference Potential -	-1.362 mv
Anode Current -	24 milliamp

### CTP #1 – As Left

Previous Anode #1 -	-1.450 mv
Installed Anode #1 -	-1.736 mv
Combined Anode #1 -	-1.729 mv
Combined #1 w/ Pipe -	-1.522 mv
Casing Potential -	-0.691 mv
Reference Potential -	-1.491 mv
Anode Current -	32 milliamp

Sincerely,



J. Scott Roberts  
C.P. Tester

## CATHODIC TEST POINTS

## CATHODIC TEST POINTS

Nutrien Ltd. – Swift Creek Mine Float Plant  
Underground Natural Gas System  
October 2022

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### Cathodic Test Point - #1

Black Anode Connection	-1.362 Vdc
Black Gas Pipeline Connection	-1.382 Vdc
White Casing Pipe Connection	-0.583 Vdc

### Cathodic Test Point - #2

Black Anode Connection	-1.850 Vdc (No Re-read)
Black Gas Pipeline Connection	-1.654 Vdc (No Re-read)
White Casing Pipe Connection	-0.756 Vdc (No Re-read)

### Cathodic Test Point - #3

*CTP #3 is surrounded by concrete. Two-inch riser next to CTP used to obtain potential reading. Two-inch riser will be used to obtain potential readings in future surveys.*

Black Anode Connection	-1.736 Vdc
Green 2" Riser Connection	-1.491 Vdc

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



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

Nutrien Ltd. – Swift Creek Mine Float Plant  
Underground Natural Gas System  
June 2022 (No Re-read 10/22)

<u>Test Location</u>	<u>Energized Potentials Volts</u>
Railroad Casing - #1	-0.597
Railroad Casing - #2	-0.581

**STRUCTURE - TO - SOIL POTENTIAL DATA**

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

Nutrien Ltd. – Swift Creek Mine Float Plant  
Underground Natural Gas System  
June 2022 (No Re-read 10/22)

<u>Test Location</u>	<u>Energized Potentials Volts</u>
Gas Metering Station - Inlet	-1.394
Gas Metering Station – Outlet	-1.644
4” Gas Riser @ Plant	-1.470
2” Gas Riser @ Boiler Room	-1.395