

# AREA POTENTIAL-EARTH CURRENT (APEC) SURVEY

## ISSUE

Plants contain a complex network of underground piping that is connected to a copper grounding grid. Corrosion cells can cause degradation of the ferrous piping when it discharges DC current as an anode due to its connection to the more noble copper grounding grid that acts as the cathode of a corrosion cell; analogous to a battery.

The external corrosion condition of underground piping and structures can be initially assessed without excavation by evaluating the coating condition and CP effectiveness. Traditional buried pipeline survey methods (e.g., CIS, DCVG) require the electrical isolation of the pipe to be tested to provide the most reliable data. While the isolation of individual structures or piping systems in a plant is not usually possible, the CIS and DCVG indirect inspection approach will still provide data that, when properly combined and interpreted, can be used to prioritize areas within the plant with the greatest potential for external degradation.

## SOLUTION

The APEC survey procedure is a modified CIS and DCVG technique based on the Cu/CuSO<sub>4</sub> reference cell potential measurement, which is the foundation of CIS, combined with cell to cell earth current voltage gradient measurements, which is the data collection standard for DCVG. The APEC survey technique is a unique application of these two common testing methods. The subsequent specialized interpretation of the resulting data produces meaningful information within a complex network of grounded piping.

**AREA POTENTIAL:** Similar to CIS, the collection of many reference cell measurements in a plant will suggest the corrosion condition and/or CP state of the buried piping or structures in the area of the readings.

**EARTH CURRENT:** DCVG can determine coating condition on a long isolated buried pipeline. Likewise, the measurement in a plant of DC earth current voltage gradients associated with corrosion cells or CP system operation can indicate the condition of a piping system's coating and/or the excessive collection of CP current on the station grounding grid. In a plant environment, it is important to know where any DC corrosion cell or CP current is going. When no CP system is present, the direction and magnitude of any native corrosion cell currents are observed. If CP rectifiers are cycled "ON" and "OFF", the migration of CP current around the plant can be understood.

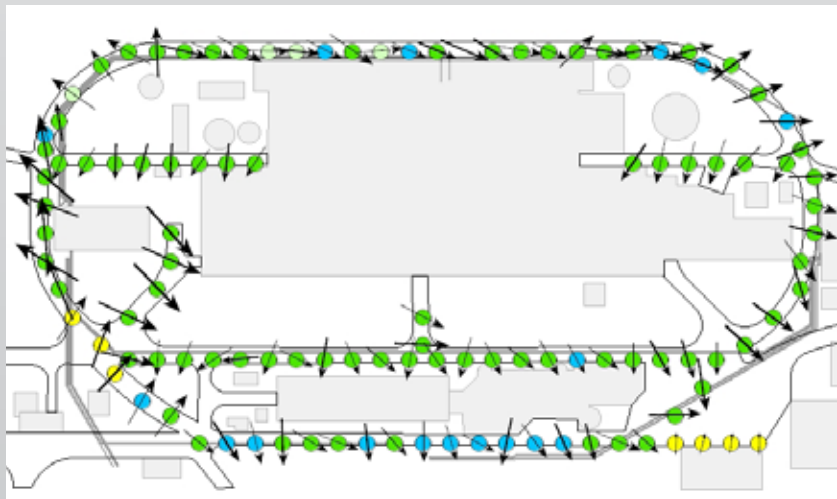
## RESULTS

The integration of **A**rea **P**otential measurements and **E**arth **C**urrent magnitude and direction vectors (i.e., APEC) provides an indication of any aggressive corrosion cells, and a clear picture of a CP system's effectiveness. The APEC survey will also help define areas of piping with coating degradation, as these areas will tend to collect more of the CP current, which will be indicated by its direction and magnitude in the ground.

*The APEC survey is the perfect choice for plants with and without CP systems.*

## DATA INTERPRETATION:

APEC data resultants and collection point locations are documented in MAPProView™. MAPProView™ is a graphical analysis tool that allows a system engineer to view the results of the APEC survey in relation to the underground structures, grounding grid and other inspection information (e.g., GWUT, visual, UT, leaks, etc.). This insures easy interpretation of possible corrosion cell locations and CP system effectiveness.



The APEC survey can be used to:

- prioritize high corrosion potential areas
- indicate piping system coating condition
- evaluate the need for CP system enhancements
- satisfy underground piping inspection requirements

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