CONDUCTING CLOSE INTERVAL POTENTIAL SURVEYS

Presented by:
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CONDUCTING CLOSE INTERVAL POTENTIAL SURVEYS

- DEFINITION OF CLOSE INTERVAL SURVEYS (CIS)
- REASONS FOR CONDUCTING CIS
- TYPES OF CIS
- PRE-SURVEY CONSIDERATIONS
- DATA COLLECTION CONSIDERATIONS
- POST SURVEY PROCESSING AND ANALYSIS
- CONCLUSIONS
DEFINITION OF CLOSE INTERVAL SURVEY

• NACE DEFINITION – SP0207-2007
  • A potential survey performed on a buried or submerged metallic pipeline, in order to obtain valid DC structure-to-electrolyte potential measurements at a regular interval sufficiently small to permit a detailed assessment.

• PHMSA MANDATES
  • §192.455 External corrosion control: Buried or submerged pipelines installed after July 31, 1971.
  • §192.465 External corrosion control: Monitoring.

REASONS FOR CONDUCTING CLOSE INTERVAL SURVEYS

COLLECT BASELINE PROFILE DATA
TESTING FOR ADEQUATE LEVELS OF CATHODIC PROTECTION OVER ENTIRE LENGTH OF STRUCTURE
TROUBLESHOOTING KNOWN CP DEFICIENCIES
INTERFERENCE TESTING
CURRENT PICK-UP / DISCHARGE POINTS
DETERMINING SPHERE OF INFLUENCE
IDENTIFYING SUBSTANTIAL COATING HOLIDAYS/DAMAGE
Schematic Of A Close Interval Survey

TYPES OF CLOSE INTERVAL SURVEYS

• NATIVE SURVEY

• CURRENT APPLIED OR ON SURVEY

• ON/INTERRUPTED SURVEY

• DEPOLARIZED SURVEY
NATIVE SURVEY

- A Native pipe-to-soil survey is used to establish a base-line profile of the pipeline system, before designed CP is ever applied.

- Can help to determine if foreign or interference currents are present before CP is applied.

- Often used in conjunction with On/Interrupted surveys to establish 100mv polarization shift.

- Can create future cost savings and minimize risks associated with de-energizing facilities to obtain depolarized potentials.

NATIVE SURVEY W/FOREIGN CURRENT
CURRENT APPLIED OR “ON” SURVEY

• The On/only survey is normally conducted on legacy structures that have magnesium anodes directly attached to the structure, where it’s not practical to obtain IR Free potentials.

• An on survey does not take into account “IR drop”.

• Sometimes used in conjunction with IR drop coupons to confirm levels of cathodic protection.

• These surveys are performed to help verify cathodic protection levels and coating efficiency.

Current Applied “On” Survey
ON/INTERRUPTED SURVEY

• This is the most common type of CIS used on impressed current systems and galvanic systems where current sources can be interrupted.

• Requires “all” influencing current sources to be interrupted using synchronized current interrupters.

• Instant-off potentials provide an IR free reading of polarized pipe potentials.

On-Interrupted Galvanic Survey
On/Interrupted Survey

A depolarized survey is used in conjunction with an On/Interrupted survey to verify 100mV polarization.

The pipeline must have all influencing sources of current turned off and be allowed to depolarize sufficiently before conducting the survey.

It is necessary to survey as accurately as possible to the original On/Interrupted survey to be able to overlay potentials.

The Depolarized Data is then graphed against the On/interrupted data to determine if the 100mV polarization has been achieved.

- Graph includes calculated line Depolarized Potential + 100mv
Depolarized Survey

Depolarized Survey Graph
PRE-SURVEY CONSIDERATION

- DO YOUR HOMEWORK!!!!
- SPECIFICATIONS:
  - Payment Schedule and Conditions
    - Job Delays
    - Inclement Weather
  - General Requirements
    - Operator / Contractor
      - Personnel Qualification
    - Safe Work Practices
      - PPE Requirements
      - Daily Safety Meetings (TSM's / JSA's)
        - Right-of-Way / Geographical Challenges
        - Nearest Medical Facilities

Paralleling AC Corridors?
Safety is Paramount

BE SURE OF WHAT YOU TOUCH AND HOW YOU CONNECT
INCLUDE AC PIPELINE POTENTIAL READS IN THE DATA STREAM
COATED OR BARE,... WHICH IS AFFECTED MOST?
WHY?
ROW Mowed or Not?

Pre Survey Consideration

- Specifications Cont’d
  - Historical Data
    - Type of CP applied
    - Annual Test Point Inspections
    - Bi-monthly Rectifier inspections
    - Previous CIS data
    - Known out of circuit Influence
  - Mapping and Alignment Sheets:
    - Test Point / Rectifier location and ID.
    - Tie-in points and Isolation
### Pre-Survey Test Point Information

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Pre-Survey Corrosion Asset Mapping

PRE-SURVEY CONSIDERATION

- Specifications Cont’d
  - Instrumentation and Equipment
    - Volt Meter / Data Loggers
      - High Input Resistance – 10 Mega-ohm or greater
    - Reference Electrode
      - Type – Saturated Copper/Copper Sulfate
      - Reference Cell Balance/Calibration Intervals
  - Pipeline Location
    - Measurement Techniques – GPS / Slope Chain
    - Depth of Cover
  - Survey Wire
    - Type and Gauge
Close Interval Survey Equipment

SURVEY CONSIDERATION

- Survey Specifications
- Interruption
  - Cycle Time – On: Off ratio
  - Interruption Starting Position – “On” or “Off”
  - GPS Synchronized
- Pipe-to-Electrolyte Potentials
  - Potential Measurement Interval and Range
  - Survey Lead Connections – (-)Ref. Electrode (+)Structure
  - Field Data Collection
    - Environmental Conditions – Heat / Cold / Foliage.
    - Electrolyte Contacts – Concrete/Asphalt/Casings/Bores
    - Far Ground / Structure IR Drop / Near Ground Potentials
    - Foreign / Casing / Points of Isolation / AC Potentials
SURVEY CONSIDERATION

- Survey Specifications cont’d:
  - Data Integrity
    - Survey Equipment Continuity
    - Reference Electrode Balance/Calibration
    - Proper Contact to Structure
      - Reconnection Points
  - Measuring and Stationing
    - GPS / Slope Chain / Wire Counters
    - Permanent Landmarks / Appurtenance
  - Wave Prints
    - Predetermined specified intervals / Survey Irregularities
    - Used to help filter “spiking” and identify Interrupter Sync Issues.
  - Continuous Survey Data Logging

GPS SYNC’D CIS WAVEPRINT
Post Survey Considerations

- Final Reports:
  - Operator Qualification documentation
  - Depth of Cover and areas of exposure
  - Listing of all Rectifiers, Bonds, and Anodes interrupted during Survey
    - Rectifier Output and Tap settings – “As Found” and “As Left
  - List of all permanent Test Stations with all data Information required
    - AC potentials, Far Ground, Structure IR, Near Ground
    - Foreign, Casing, Isolation Point Potentials
    - Damaged (No Contact)
  - Summary of areas not meeting the CP criteria being evaluated
    - Potentials < -.850V “On” current applied surveys
    - Potentials < -.850V IR Free “Instant Off” Interrupted
    - Areas not meeting 100mv Polarization with respect to Native or Depolarized Surveys.
    - Excessive negative Potentials per specification
Post Survey Considerations

- Final Report Cont’d:
  - Data Graphs
    - Each type of potential easily distinguished.
      - Usually Color coding
    - Legend may Include:
      - Client / Operator Name, Survey Date
      - Structure or Asset name
      - Interruption Cycle times
      - Surveyor Name
    - Survey measurement: GPS’d – Stationing
      - Test Stations and Above Ground Appurtenances
      - Areas of Skip Potentials – Public Roads, Casings, Bores, Exposures
      - Points of Intersections / Geographical Features

Post Survey Considerations

- Final Report Cont’d
  - Wave Prints
  - Continuous Logging
  - Deliverables:
    - Bounded Reports
    - Electronic Reports
      - File Formatting: (.pdf, .xls, .svy)
  - Remedial Recommendations
    - Cathodic Protection Adjustments
    - Criterion change considerations
    - Additional Survey requirements – ACVG / DCVG
    - Confirmation / Repair Digs
Desired Results “Impressed Current”
CIS Graph

Desired Result “Galvanic Protection”
CIS Graph
SUMMARY

• A CIS PROVIDES A CONTINUOUS PIPE-TO-SOIL POTENTIAL PROFILE OF THE PIPELINE

• DETERMINES EFFECTIVENESS OF THE CATHODIC PROTECTION BEING APPLIED TO SYSTEM.

• A POWERFUL ANALYSIS TOOL

• DATA MUST BE TECHNICALLY ACCURATE TO ENSURE PIPELINE SAFETY.

• GARBAGE “IN” = GARBAGE “OUT”

Like a Walk in the Park
• QUESTIONS?

AUCSC
Appalachian Underground Corrosion Short Course