Tools for ECDA Indirect Inspections

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Indirect inspection techniques used for ECDA

- Close Interval Survey (CIS)
- Direct Current Voltage Gradient (DCVG)
- Alternating Current Voltage Gradient (ACVG)
- Pearson Survey
- Electromagnetic Survey (PCM/C-Span)
- Soil Resistivity Surveys
Pipeline Locating – Find the pipeline

There are two types of pipeline and cable locators. Some locators include both types in one unit:

• Conductive
• Inductive
Pipe-to-Electrolyte Potential Measurements

- Structure to positive meter connection
- Reference cell to negative or common meter connection
- From TM0497
Pipe-to-Electrolyte Data Interpretation

- SP0169-2007 has three cathodic protection criterion:
  1. -850mV current applied
  2. -850mV polarized
  3. 100mV polarization
100 mV Polarization Formation

- 100mV polarization can be measured by formation or decay
  - And here
Why ECDA Surveys?

• What are we trying to find?
  – Coating Holidays
  – Anodic zones on bare pipe
  – Stray currents
  – Shielded corrosion activity
  – Adjacent metallic structures
  – AC induced corrosion
  – Shorted Casings
Close interval survey (CIS)

- Assess the performance of the CP System
- Condition and anomalies that may be identified
  - Interference
  - Shorted casings
  - Shielding
  - Contact with other structures
  - Defective isolation joints

![Diagram of pipeline with reference electrodes and spacing 3-5 Feet]
Close Interval Survey Procedures

Equipment used: GPS controlled interrupters, dataloggers, copper sulfate electrodes, hip packs and CIS wire.

Procedure:

• A rectifier influence survey is performed and synchronized interrupters installed in all influencing CP sources.
• Dataloggers are placed at daily CIS midpoints and programmed to record the pipe potential at a rate of ten readings per second to confirm synchronization.
• ON/OFF potentials measured at the required interval and each DCVG indication. Values are recorded directly in the datalogger.
Typical CIS field survey equipment
Types of Close Interval Surveys

- “On” potential surveys
- “On/Instant Off” surveys
- Depolarization surveys
Typical On/Instant Off data
Typical On/Instant Off and Depolarization Data

From NACE CP-2
Current Voltage Gradient Surveys (ACVG or DCVG)

Equipment used: interrupter, DCVG analog meter and probes.

Procedure:
- Interrupters used to interrupt nearest most influencing rectifier.
- A surveyor walks along the pipeline placing one reference electrode above the pipe. One probe always kept near the pipeline centerline while the other is held five feet away perpendicular to the pipe.
- All indications marked with a numbered survey flag.
- Voltage drops and test point deflections measured to size indications.
Calculating %IR drop for DCVG

Straight line attenuation is assumed

Theoretical signal strength:
=200mV +((1500/(500+1500))(300-200))mV
=200mV + 75mV
=275 mV
Calculating %IR Drop at the Indication

Remote earth voltage at indication = 40 mV
Percentage IR = (Remote earth voltage/Signal Strength) * 100%
  = (40/275) * 100
  = 15%
Pearson Surveys

Pearson7 surveys are typically used to detect various coating holidays but cannot differentiate the size of each holiday.
Electromagnetic Surveys

Equipment used: Radiodetection Pipeline Current Mapper. Procedure:
• A transmitter set up at the nearest rectifier and the rectifier anode beds used to establish an electrical ground. If inadequate, grounding material will be used to install a temporary grounding site close to the section of pipe under investigation.
• Electromagnetic current attenuation carried out every 100 feet at pipeline location flags.
• Measured current value recorded.
Soil Resistivity

• Equipment:
  – Nilsson 400 Soil Resistance Meter
  – MC Miller soil pins and hand reel

• Procedure:
  – ASTM Standard G57-78
  – Pin spacing of 2.5, 5.0, and 7.5 feet
  – Measure soil resistance every 1000 feet
  – Record resistance values in project field book
  – Calculate soil resistivity
Testing Cased Crossings

• Typical test to measure a shorted casing
  – Structure-to-electrolyte
    • Both “on” and “interrupted”
  – Internal Resistance
Testing of Steel Cased Crossings

Structure-to-Electrolyte Potential Survey
Internal Resistance Test

NOTE: If a 4 pin soil resistance meter is used, the location for the test leads is the same. C1 is connected to T3, P1 to T1, P2 to T2, and C2 to T4
References


NACE Standard SP0169-2007 “Control of External Corrosion on Underground or Submerged Metallic Piping Systems,” (Houston, TX: NACE)

NACE Standard RP0502-2002 “Pipeline External Corrosion Direct Assessment Methodology,” (Houston, TX: NACE)


NACE Standard RP0200-2000 “Steel-Cased Pipeline Practices,” (Houston, TX: NACE)
Questions?

- Some possible answers?
- That depends