Appalachian Underground Corrosion Short Course 2012

DATA INTEGRATION

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Data Integration

Data integration involves combining data residing in different sources and providing users with a unified view of these data.

ECDA Data

EXTERNAL CORROSION DIRECT ASSESSMENT REQUIRES ACCURATE RECORD KEEPING AND KNOWLEDGE OF YOUR SYSTEM

ECDA Data

- Some of the data required is;
  - Accurate maps of the pipeline
  - Know the location of the pipeline in the field
  - Inventory the system including location & condition
  - Test results

Pipeline Information

Important Information

- Pipeline history
  - Installation date & method
  - Material & coating
- System inventory
- Know where your pipeline is, maps, GPS, etc.
- Operation & maintenance history

Inventory Your System

- Test Stations
- Casings
- Bonds
- Rectifiers
- Insulated flanges
- Sleeves
- Sacrificial anodes
- Etc.




Mapping Your Pipeline

- The location of the pipeline can be plotted on topographic maps, aerial surveys or entered into a mapping program

Mapping Your Pipeline

- Google Earth is ideal for plotting pipelines and other features/facilities

Pipeline Location

- With the assistance of a pipe locator the location of the pipeline can be accurately recorded during a close interval survey
- Pipe to soil data can be correlated with other test data

Sub-Metre Location Accuracy

- Modern GPS Engines can determine locations within 200 mm – 1000 mm (8in – 3ft)

High Consequence Areas

- Buildings close to pipeline
- Wet lands
- River and stream crossings
- Foreign crossings

Operating History

- What fluid & pressure
- Leak history
- Maintenance work & digs
- Repair work

Personnel

- Sometimes the field guys know things the office guys don't.
  - How many times that area has been dug up
  - Were anodes installed directly to the pipe?
  - Landowner issues

Pipeline Conditions

- When was the last time the right of way was cleared?
- Are there any issues
  - Road crossing
  - Cliffs
  - Landowners
  - Livestock

Pipeline Conditions

- Encourage departments to share information
- Have someone walk the line
- Keep in contact with local people

Test Results

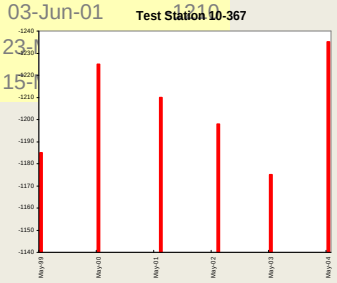
Test Results

- There are a number of ways to monitor the corrosion potential of a pipeline;
  - Test station surveys
  - Rectifier logs
  - Close Interval Potential Surveys
  - Direct Current Voltage Gradient Surveys
  - Internal inspection tools (Pigs)
  - Physical inspection from digs
  - Corrosion coupons

Test Station Surveys

- Performed on a regular basis
- When compared with prior readings, changes to the CP are seen

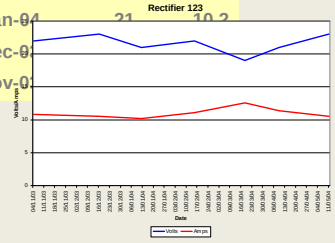
TP	10-367
10-May-04	-1235
02-May-03	-1175
08-Jun-02	-1198
03-Jun-01	-1210
23-M	
15-M	



Rectifier Logs

- Obtained by field crews or through remote monitoring
- Graphing the data over time can reveal trends

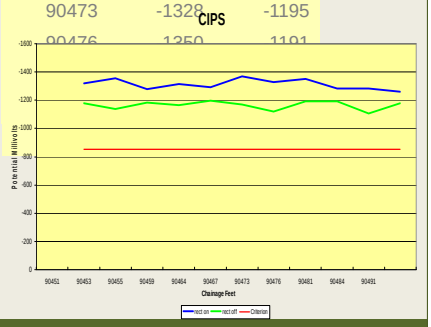
Rectifier	123	
	Volts	Amps
11-May-04	23	10.5
09-Apr-04	21	11.4
18-Mar-04	19	12.6
15-Feb-04	22	11.1
12-Jan-04	21	10.2
16-Dec-0		
04-Nov-0		



CIPS Surveys

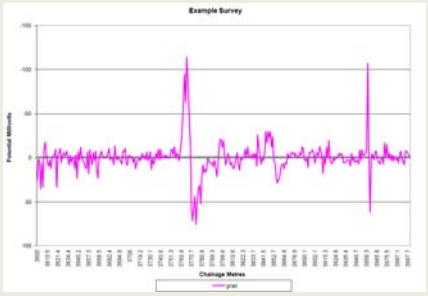
- Close Interval Potential Survey records the level of CP along a pipeline
- Used with NACE SP0169 criterion

90451	-1318	-1180
90453	-1357	-1190
90455	-1279	-1185
90459	-1313	-1188
90464	-1294	-1185
90467	-1367	-1190
90473	-1328	-1195



DCVG Surveys

- Direct Current Voltage Gradient and other coating survey methods provide an indication of any defects in the coating and their size



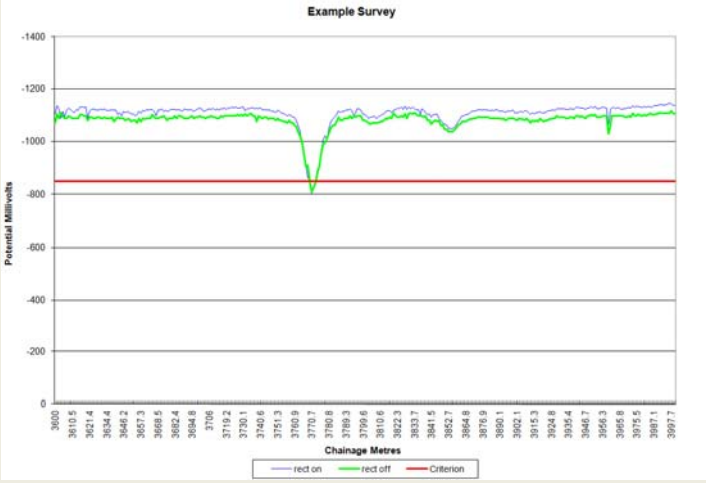
Modern CIPS Survey Equipment

- GPS synchronized with interrupters
- Records distance/chainage
- Rectifier ON and OFF potentials
- Rectifier ON and OFF voltage gradients
- GPS coordinates
- UTC time
- Signal quality
- Altitude
- Other information
- entered by user

CIPS Data Table

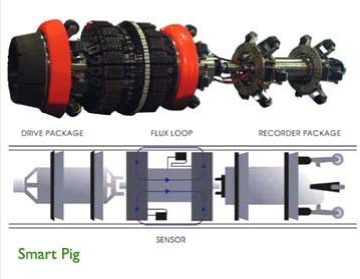
Dist	ON	OFF	Gain	Time	Lat		Long		Sig	Sat	P dop	Elev
90451	-1318	-1180	-850	144252	43	49.3739 N	70	26.31 W	1	7	2	105.7
90453	-1357	-1137	-850	144253	43	49.3745 N	70	26.3099 W	1	8	2.1	105.8
90455	-1279	-1185	-850	144254	43	49.3748 N	70	26.31 W	1	8	2.1	106
90459	-1313	-1164	-850	144256	43	49.3756 N	70	26.3104 W	1	8	3.2	106
90464	-1294	-1195	-850	144258	43	49.3762 N	70	26.3106 W	1	9	4	105.8
90467	-1367	-1169	-850	144259	43	49.3769 N	70	26.3108 W	1	9	2.4	105.7
90473	-1328	-1118	-850	144301	43	49.3782 N	70	26.3113 W	1	9	2.8	105.5
90476	-1350	-1191	-850	144302	43	49.3787 N	70	26.3116 W	1	9	2.8	105.5
90481	-1281	-1190	-850	144304	43	49.3798 N	70	26.3118 W	1	9	3	105.1
90484	-1281	-1106	-850	144305	43	49.3801 N	70	26.312 W	1	9	3.1	105
90491	-1259	-1178	-850	144308	43	49.3814 N	70	26.3127 W	1	9	2.4	104.8

CIPS Data Graph



Internal Inspection

- Inline inspection tools (smart pigs) can be used to monitor the wall thickness of a pipeline
- Changes in wall thickness can indicate a corrosion problem



Smart Pig

Stray Current

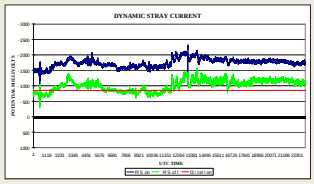
- When performing a CIPS, set out a stationary data logger in the survey area
- The data will show any telluric or dynamic stray current on the line

Stray Current Correction

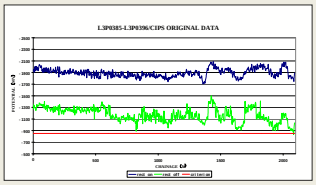
- GPS time stamp is used to compare the logger data with the mobile CIPS data
- Correcting for the stray current provides a more accurate reading of the CP on the pipeline
  - $CIPS_{Corrected} = CIPS_{Time\ X} + (Logger_{Time\ X} - Average\ (Logger_{Time\ Interval}))$

Stray Current

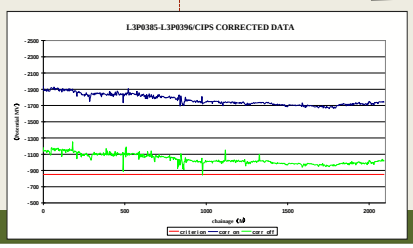
Data From Test Station



CIPS Data Along Pipeline



Corrected CIPS Data



Combining Data

Integrated CIPS & DCVG

- CIPS and DCVG surveys can be undertaken simultaneously for increased accuracy

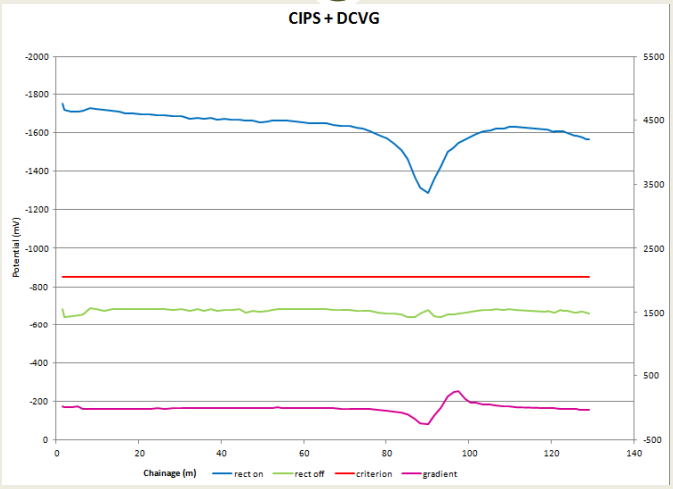
Combined CIPS + DCVG Surveys

- **By combining CIPS & DCVG, a correlation in the data is easy to see**

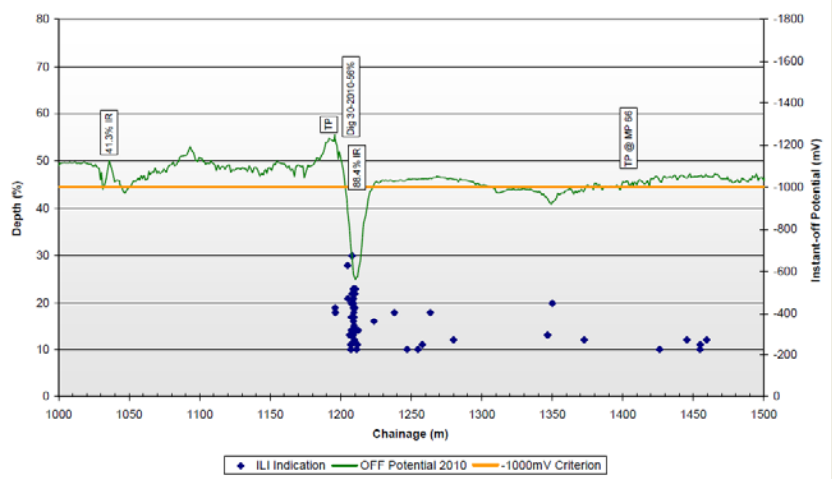
Combined CIPS + DCVG Surveys

- **The combined data makes it easier to assess the requirement for mitigation**
- **Coating defects that result in unprotected pipe should be repaired**
- **CIPS + DCVG not only point out the coating defects but the areas where corrosion is likely occurring.**

Combined CIPS + DCVG Surveys

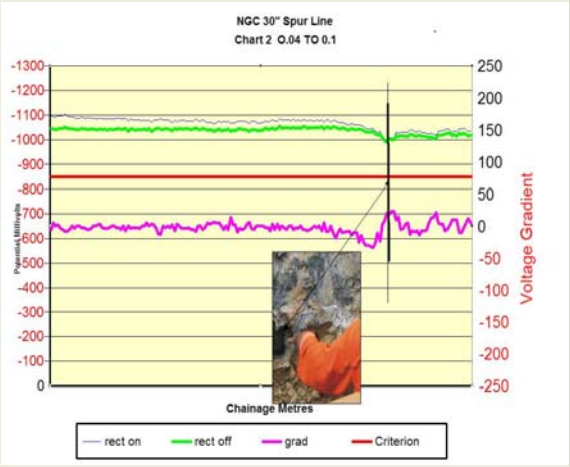


Internal Inspection



Correlation Digs

- Correlation Digs are required in most jurisdictions
- Investigate trouble spots from the surveys



Correlation Digs

Correlation Digs

Correlation Digs

- Accurate survey data allows accurate assessment on daylighting a pipeline

Combining Multiple Sources

- All of the data sources discussed and others can be looked at together
- By knowing the pipeline information and results from multiple tests, a complete picture of the line condition can be seen

Example

- CIPS meets criterion, DCVG shows defect, no construction in the area in years, PIG shows consistent wall thickness
- Monitor
  - low probability of corrosion

Example

- CIPS goes below criterion, DCVG shows defect, new maps show a new subdivision in that area
- High priority for repair
  - Coating damage
  - High consequence area
  - Inadequate levels of CP

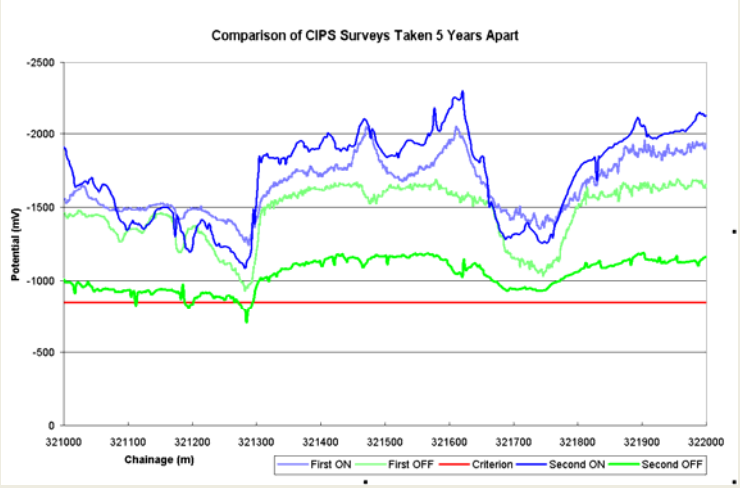
Example

- CIPS goes below criterion, DCVG shows no defect, foreign line in the area
- More investigation
  - Possible stray current interference
    - Foreign pipeline
    - DC transit, welding, mining, etc.
  - Soil resistivity

Comparing Years

- Another test data source is from prior years and surveys
- When you have access to multiple years of data for your pipeline, it can be useful to compare the results
- Trends can appear
- Also acts as a check for your survey methodology

Comparing Years



Data Storage

Data Integration

- There is lots of data available, now what?
  - Know where the information/reports are stored in the office or on the computer
  - Insist that any surveys done provide you with an electronic copy of the data
  - Purchase a database program to bring the different pieces of data together
  - Design your own database program

Data Base Programs

- There are several commercially available data base programs on in which you can store the information required for ECDA

- General DB:
- Oracle
- Microsoft Access
- AutoCAD Map

- Pipeline Specific:
- ProActive
- BassTrigon
- GreenPipe

Database Considerations

- Before purchasing software consider:
  - Number & ability of users
  - Other systems that need to connect, i.e. remote monitoring
  - In house technical ability
  - Type and amount of data to be tracked
  - Import/export ability, especially for your survey data
  - Budget

Database Security

Physical	Intellectual
•How to protect the data integrity •Backup on a regular schedule •Protect computers from power surges •Off-site backup •In case something ever happens to your office	•Who has access to info? •Who decides? •Is there information that is confidential? •Can you have different levels of access? •Can you view/print/share information when needed? •Unauthorized data entry

In Conclusion

- Know your pipeline and what data is available to you
- Know what works for you and your company
- Keep the data together as much as possible
- Compare different data sets to look for commonalities and changes

Thank You For Your Time and Attention

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