Inspecting Underground Pipeline Coating

Eagle Ford Case Study

ANSI/NACE SP0502-2010, Pipeline External Corrosion Direct Assessment Methodology using Alternating Current-Current Attenuation

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Executive Summary

According to Oil and Gas Journal, installing one mile of 30" transmission gas pipeline costs between $5 and $7 million. After installation, years or decades may pass before the line is inspected for coating holidays.

When installation-caused coating damages are found during inspections performed years after installation, repair costs are paid solely by the operator. How do you know that coating issue wasn't there from day one? If you did nothing more than follow §192.461(c) Pre-Ditch & Backfill Inspection (i.e. jeeping before burying) than you have no idea whether the coating in excellent shape after it was buried. You have no idea whether you got what you paid for, which was a well-coated, buried pipeline.

Would it make sense to spend $1,000 per mile to verify the coating on a pipeline segment that you just spent $5.54 million installing?

ScanTegrity Pipeline Coating Scanning scan can look at 528 feet of coating in one shot and cover five to ten miles of pipeline per day.

There is a technology that can help you take control of you Pipeline Quality Assurance Program.

ScanTegrity™ Alternating Current-Current Attenuation scanning is an efficient attenuation survey that provides your company with the assurance you need. ScanTegrity will find issues with poorly installed coatings or confirm that your pipeline coating is in good condition after it is buried.

An AC-CA inspection system is comprised of:

- A signal generator outputting pure sine wave at 4Hz
- A detector unit, requiring neither electrical contact with the ground nor the pipe, nor the signal generator
- Results that can be used to establish the condition of the pipeline coating, locate faults, and find metallic shorts.

All parts of the system are designed to perform in tough field conditions.

ScanTegrity surveys are designed using a versatile information acquisition tool which utilizes electromagnetic field attenuation measurement technology to obtain very accurate

data on coating condition, pipeline location, and anomaly definition and location.

Why not get the same results in a fraction of the time?

The QC Burden of New Buried Pipelines

So isn't the industry doing enough already? Do I really need to inspect my piping after it's buried to control the quality? Let's look at what PHMSA Construction Inspections discovered in 2009.

Issue Area	No. of Problems
Coatings	117
Welding	87
Excavation	20
Nondestructive Testing	20
Pipe Materials	12
Bending	9
Lowering/Installation in Ditch	7
Hydrostatic Testing	4
Design	3
Miscellaneous	5

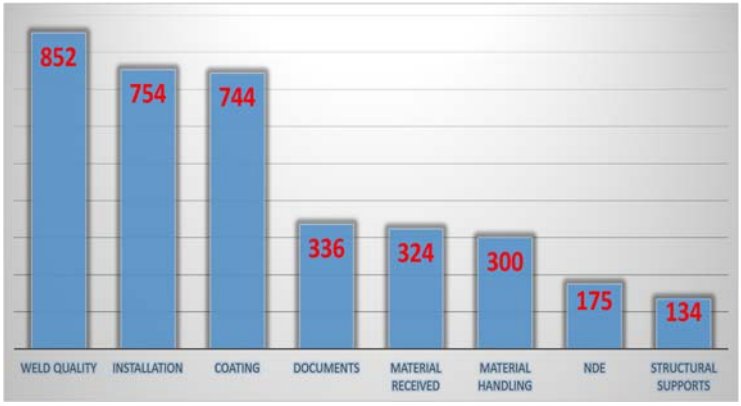
Figure property of PHMSA (Pipeline Construction FAQs)

After your lines are covered with dirt, how do you know it's not damaged?

Coating issues were the number one finding during these inspections. These findings indicate that 117 coating flaws would otherwise have been backfilled.

PHMSA guidelines establish the minimum acceptable construction inspection standards. However, at $5-$7 million of your shareholders money per mile of pipeline installed, is it prudent to follow the minimum standards?

Is it possible that one thousand dollars insurance, per $5 million dollars installation costs, is something to consider?



During a pre-backfill quality assurance interrogation led by a leading engineering company, the defects listed in the above chart were detected.

This thorough quality assurance inspection discovered 744 potential defects that would have been backfilled and put into service. After burial was complete on this same project, ScanTegrity uncovered another 50 more anomalies. These anomalies were the total of a) mechanical damage during install/backfill, and b) poor coating application at the butt welds.

ScanTegrity can help you take control of your Capital Project Quality Assurance.

Since the pipeline operator carries the full responsibility of its pipeline safety and performance, it is not only in the operator's best interest to make sure the line coating is intact upon startup, it is also what the operator paid for and is owed by the pipeline construction firm.

Who is responsible for jeeping your new lines?

Jeeping is one of the best ways to tell if your coating is good *before your line is lowered into the ground*. Who managed your jeeping program?

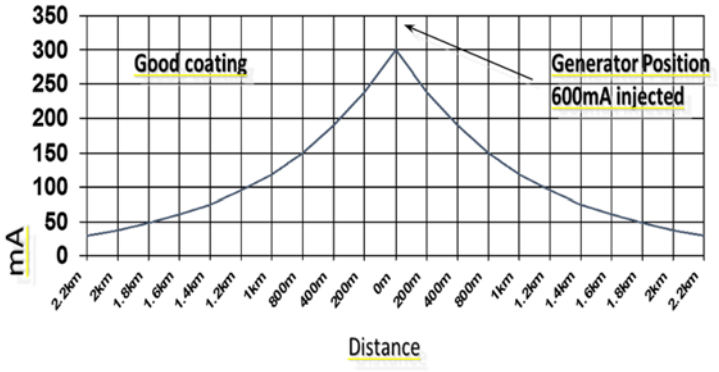
Are your hiring a third party inspection firm to jeep, or are you allowing the construction contractor to build, coat, jeep, and backfill?

Homo Economicus, aka the "Economic Man Theory," says that humans rarely act inconsistently with the manner in which they are compensated. In play English, did you hire your fox to guard your hen house?

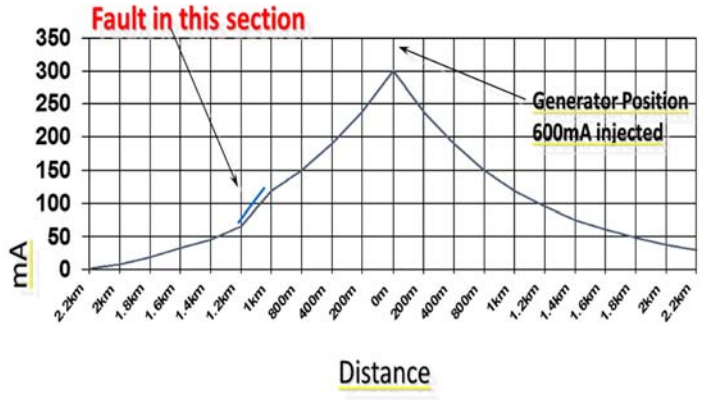
Coating Scan Technology

ScanTegrity functions by measuring the attenuation of a low frequency AC signal impressed upon the pipeline.

The AC signal is gradually lost to the surrounding soil through the pipeline resistive coating as it passes along the buried pipeline. This is the Rate of Attenuation as seen below.

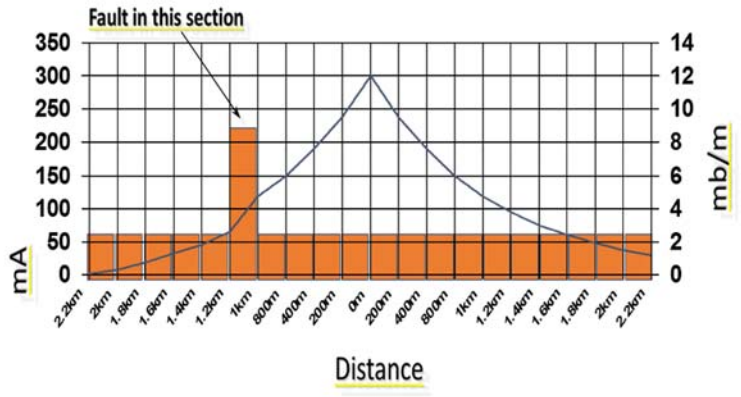


Where the coating is decaying or damaged, there is a significant increase in the rate of current loss. This is an increase in the Rate of Attenuation. In the figure below you can see a slight step change in the exponential curve of the AC signal.



Shot locations can very along the survey chainage information is gathered via the on board GPS.

The fault clearly seen below, in the logarithmic chart. The rate of current loss over any section of pipeline measured in millibels per meter (mB/m), is an absolute measure of the average quality of the coating over that section.



Specialized Applications

The theory is simple enough, but it's the application of the theory that makes this technology useful.

No CP system required for survey. Can your current technology do that?

- ScanTegrity can: Survey (with drivable access) ten miles of pipeline per day.
- Provide underground coating analysis below roadways and river crossings.
- Provide immediate real times results. 80% of anomaly calls are made in the field.
- No CP system is required for the survey. ScanTegrity can inspect lines almost immediately after backfill, both before the line is on-stream and before the CP system hooked up.
- Common impediments to other survey methods, such as sand, soil, ice, snow, asphalt, gravel, concrete, do not impede ScanTegrity.
- GPS location of every AC Current Attenuation reading is encoded in the data, making inspections 100% TVC (traceable, verifiable, complete) *and replicable.*

Eagle Ford Proving Grounds

Future repairs cost tens to hundreds of thousands of dollars, per incident.

Installation costs run $5.5 to $7 million dollars, per mile.

Warranty repairs are free.

Alternating Current-Current Attenuation (ACCA) surveying was deployed to evaluate one of six creek bores in an Eagle Ford gathering field. All six lines crossed under a semi dry creek in a shared right of way. The lines did not have cathodic protection and were installed less than six months before the evaluation was performed.

The bores were approximately 300 to 400 feet in length and were electrically isolated. The line in question, a four inch liquids line, was independently surveyed using ACCA. The survey indicated a large anomaly in the range of 40 millisiemens at the crossing. A bore profile drawing was provided by the owner/user which indicated the pipe depth to be in the 12-15 foot range. It was determined the line would be taken out of service and further evaluated before a repair would be scheduled. The bore was exposed on both sides and a cut was made so a “smart pig” could be deployed to further assess the line. ScanTegrity ACCA surveys the coating integrity but not wall loss, while the internal tool examines wall loss, but not coating anomolies.

The internal ILI “smart pig” inspection found no anomalies with the line and recommended the bore be restored to service.

Due to the conflicting recommendations by the two technologies utilized to assess the line and the owner's previous 87% success rate verifying ScanTegrity ACCA findings, the owner pulled the bore. As seen in the photos below, the damage was extensive.

ScanTegrity is quality assurance that goes beyond visual inspection!

The bore consisted of six pipe segments, each averaging forty-two feet. Abrasion-resistant coating and girth weld wrapping were used to protect the pipe during installation. The wrap was wiped off the pipe during the horizontal directional drilling (HDD) installation, leaving bare the entire heat effected zone. Severe metal loss was found from 3-6 o'clock positions on the girth weld location number 3 (see left photo below). Weld number 4 (see right photo below) had a corrosion cell that measured .187 in deep on a .237 in wall pipe.

Did you know many in line inspection (ILI) technologies entirely miss wall loss at the welds or in the heat affected zone?

The five remaining creek bores were later inspected with ScanTegrity surveys. Four of the remaining five lines in the crossing were also damaged. These bores were also pulled and each had coating missing from all heat-affected zones.

Customized Reports and Programs

Turnkey coating integrity programs or reporting that fills gaps in your current program.

The ScanTegrity Survey reporting is completely customizable. We can export the data in a variety of formats and include Google Earth applicable KML files for geo mapping. The reports and program can be set up for:

- New construction QC to confirm coating meets NACE TM0102-2002 criteria
- Profiling 3 axis baseline information for unknown pipeline paths and depths.
- Anomaly location callouts within a 10 foot window
- Baseline and Condition monitoring program for coating degradation over time.

ScanTegrity assess coating to the NACE SP0502-2010 ECDA (External Corrosion Direct Assessment)

Conclusions

ScanTegrity Technology streamlines your coating inspection program, making it fast and economical. You will get instant feedback, placing control of underground coating quality assurance back in your hands.

No CP system is required to perform this service. All ScanTegrity surveying requires is a single metallic connection to the pipeline and a remote ground.

Why not get the same results in a fraction of the time?

The detector unit does not require ground contact, allowing data collection beneath roadways and water crossings. No other NACE SP0102 approved survey method can complete this survey.

ScanTegrity can perform both ACCA and ACVG surveys, simultaneously, and the data loads directly into your PIMS program.

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