

XXX Gas Management

September 29, 2009

AGR Field Services Houston
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Various 3" Buried Lines

XXX
XXX

Inspection Completed by: Lloyd Nunes
Level 1 Guided-Wave Technician (Buried Pipe and Road Crossing Supp.)
API 570 (ID:34559)
ASNT NDT Level 3

<i>Site:</i>	XXX	<i>Client:</i>	XXX
<i>Site Location:</i>	XXX	<i>Client Contact:</i>	XXX
<i>Unit:</i>	N/A	<i>Line Identification:</i>	Various
<i>Technique:</i>	GWUT	<i>Line Diameter:</i>	3"
<i>Status of Report:</i>	Completed	<i>AGR Job #:</i>	N/A
<i>Procedures Used</i>	AGR-FOH-GWUT / GUL-WPSS-B Version 3		

Introduction

This report presents results from tests carried out in XXX from September 29th through October 3rd 2009.

The objective of these tests was to determine if wall loss was present on the various sections of 3" buried lines throughout the XXX Facility.

Summary of Pipe Conditions

Various 3" Lines

Roughly 5-6 years old according to Operations

No external or internal corrosion detected

FBE or general tar wrapping used

Buried in 8-10' of general soil

Test pits are not labeled since this was a random survey on different lines

Access to the pipe ranges from 3' to 8'

Tests Carried Out

Test Point ID	Notes	Category
TP-01	328 Dig Site- FBE coating in good condition	3
TP-02	433 Dig Site- FBE coating in good condition	3
TP-03	720 Dig Site- North Side- FBE coating OK	3
TP-04	1121 Dig Site- North Side- FBE Coating OK	3
TP-05	1121 Dig Site- Center Dig- FBE coating OK	3
TP-06	1420 Dig Site- General tar wrapping OK	3
TP-07	11-9 Dig Site- FBE coating in good condition	3
TP-08	13-5 Dig Site- FBE coating in good condition	3
TP-09	15-8 Dig Site- FBE coating in good condition	3
TP-10	316 Dig Site- FBE coating in good condition	3
TP-11	320 Dig Site- General tar wrapping OK	3
TP-12	322 Dig Site- General tar wrapping OK	3
TP-13	721 Dig Site- FBE coating in good condition	3

TP-14	933 Dig Site- General tar wrapping OK	3
TP-15	1221 Dig Site (North line) coating OK	3
TP-16	1221 Dig Site (South Line) coating OK	3
TP-17	1520 Dig Site- General tar wrapping OK	3
TP-18	1016 (East) Dig Site- General tar wrapping OK	3
TP-19	1016 (South) Dig Site- General tar wrapping OK	3
TP-20	1016 (North) Dig Site- General tar wrapping OK	3
TP-21	429 Dig Site- FBE coating in good condition	3
TP-22	1112 (East) Dig Site- FBE coating OK	3
TP-23	1121 (South) Dig Site- FBE coating OK	3

Category Level Description

Suspected corrosion can be classified as one of three categories

- **Non reportable corrosion (or Category 3).** This level of corrosion is appropriate when both the black (symmetric) trace and the red (non-symmetric) trace are below the call DAC. It should correlate with corrosion for which less than 10 percent of the cross sectional area has been lost. These indications are usually marked for information on pipes in good general condition.
- **Minor corrosion (or Category 2).** This level of corrosion is appropriate when the black trace is between the call DAC and the weld DAC, but the red trace remains below the call DAC. It should correlate with greater than 10 percent cross sectional area loss that is distributed in a manner that it is not likely to be a through wall defect.
- **Severe corrosion (Category 1).** This level of corrosion is appropriate when both the black and red traces are above the call DAC. It should correlate with a defect that has a strong possibility of penetrating the full wall of the pipe.

Results Summary

23 tests points were evaluated to determine if wall loss was present. None of these tests points exhibited greater than 10 percent wall loss. Both the FBE and general tar wrapping coatings used were in good condition on all 23 excavated pipes. Access and surface prep was sufficient on all tested piping and good signal to noise ratios were obtained. Test ranges varied from 20 feet to roughly 80 due to configuration or coating effects. On some of the tests the coherent noise was used to create the DAC rather than the standard weld feature level due to the low amplitude of the welds in some of the shots caused by coating effects. Measured attenuation ranged from 2.5 db/m to 7 db/m, this is due to coating effects. Pictures and GPS readings were taken at most locations so the Client can perform follow-up examinations in the future. Ultrasonic thickness readings were taken at each test point and none were found to be less than 10% of the nominal thickness of .216". No visible corrosion at any of the test points was noted. The GUL Wavemaker G3 instrument was used for all testing. Thickness readings were obtained with a Olympus EPOCH XT unit with a DL-790 dual element transducer.

Limitations

433- East Pipe- Unable to install ring properly due to an adjacent pipe
Lovett Pipe- Unable to inspect pipe since we did not have the 4" ring

General Information on GUL and System Limitations

Description of Technique:

The Wavemaker pipe screening system uses low frequency guided ultrasonic waves to propagate along the pipe wall and is designed for rapid screening of long lengths of pipe to detect external or internal corrosion. This system is composed of three components, the ring, the Wavemaker G3 instrument and the controlling computer.

Applications of this Technique:

- Long range screening
- Support Inspection
- Road Crossings
- CUI Inspection
- Off-Shore Risers
- Buried Piping

Features:

- Battery Operated
- Powerful reporting functions
- Portable
- User friendly software
- Built-in GPS

Advantages of GWUT:

- Highly accurate and sensitive to small defects
- Long lengths of pipe can be screened from one location
- Ability to inspect inaccessible areas such as buried and cased piping
- Fast reporting and decision making
- Permanent records
- No Couplant required
- Minimal surface prep necessary
- Inspection of piping 1.5" to 80"OD

Software Options:

- C-Scan pipe rollout
 - Built-in reporting system
 - Pitch catch and through transmission
 - Enhanced focussing capabilities
 - Overlay function
-

As with any NDE method there are limitations, GWUT's limitations include:

- Inability to interpret past a 45 degree bend, (2) 90 degree bends, reducers and flanges
- Total near field/ dead zone length is approx. 5 ft (1.5m)
- Since this is a qualitative method, we are unable to give an exact wall loss without supplementing GWUT with a quantitative method such as 0 degree UT
- Vibration or noise from compressors/ pumps on the line can affect the quality of the data
- Minimum sensitivity to cross sectional losses of 5-10% of the pipe circumference
- Viscous coatings, and internal products may attenuate the data
- Certain features such as welded supports, and branch connections can adversely affect the data
- Temperature limitations (see below)
- Attenuative coatings (see below)
- Under perfect conditions a max range of 150 ft. (45m) in each direction or 6 welds (whichever comes first) is expected
- Cannot inspect branch connections

Sufficient access to the line must be achieved. In any case, the line should be at waist level with access to all 4 sides of the pipe. If testing a road crossing, access to both sides of the road crossing is necessary to provide a confident inspection. If testing buried piping, OSHA regulations in trenching/ shoring of the confined space must be followed if the excavation is more than 4 ft (1.2m) deep.

The GUL equipment has certain temperature limits that cannot be exceeded, these limits are:

- Solid Rings (2",3",4")- Max temperatures: 125C, 250F
- Inflatable Rings (6"+)- Max temperatures: 70C, 150F
- When testing cold pipes there must not be any formed ice between the transducer face plates and the pipe

Estimation of test range:

Attenuative Coatings-

- Typical performance: 40-100m
- Generally corroded pipe: 15-30m
- Bitumen wrapped pipe (Cold Tar Enamel)- Highly attenuative (3db/m+)- Attenuation rate can depend on the age of the bitumen: 5-25m
- Buried, bitumen wrapped pipe: 5-15m
- Polyethylene- Moderate attenuation (3 db/m): 10-15m
- Factory applied insulation (PE Foam)- Moderate attenuation (2db/m): 20m
- Fusion bonded epoxy (FBE)- Moderate attenuation (1db/m)- In some cases it is possible to couple through the coating, but this can lower overall amplitudes: 40m
- Mineral wool insulation- No effect- 40 to 100m
- Paint- No effect- Improves signal- 40 to 100m

Effects of Pipe Contents:

- Gases- No Effect
- Liquids- Almost no effect on Torsional Mode (Mode used 99% of the time)
- Sludge- Heavy, viscous deposits in the pipe attenuates the signal and reduces the test range. This can be similar to the effects seen on bitumen wrapped pipes

The following steps need to be taken to prepare the test location and attach the transducer ring:

- Locate a 10" section of pipe with less than 10% wall loss
- This section of pipe must be free of loose material such as flaking paint, mud and corrosion
- If the pipe is insulated or a thick coating is applied, it is necessary to expose an area of 500mm (20in) for ring placement
- 4in (100mm) of clearance around the pipe for ring placement
- If the line is heat traced it will be necessary to turn the heat tracing off and expose a 6 ft length (1.8m) to allow the tracing to be pulled back
- Preferably, at least 2m (6.5 ft) should be left between the transducer ring and the beginning of the area that needs to be inspected
- In general, most hard coatings (such as paint) can be left on the pipe

WavePro Data Sheets