Northeast GAS ASSOCIATION

NYSEARCH

Technology Brief

Corrosion Camera

Description: A portable imaging system utilizing infrared light to evaluate pipeline corrosion.

Status: Feasibility study completed.

BENEFITS

Corrosion under a coating is virtually invisible to the naked eye. Identifying corrosion under a coating requires close visual inspection for the swelling of paint or coating. Salvation of the pipeline is often possible if corrosion is identified prior to coating rupture.

Infrared cameras may be able to identify the early stages of corrosion. Furthermore, such inspections can be performed at distances which eliminate the need for extensive traffic safety provisions (ex: bridge crossings). Also remote inspections make some difficult and impossible inspections possible and practical.

Lab Scale Prototype under a Bridge Crossing

BACKGROUND

The rapid advancement of optical techniques for the detection of various chemicals is well established. However, the parallel development of increasingly inexpensive digital cameras covering an increasing range of the electromagnetic spectrum has resulted in new applications in many industries and across a wide spectrum of technical fields.

Corrosion is a concern for the utilities and requires the systematic monitoring of the infrastructure. In most cases, cathodic protection systems, coatings, and periodic inspection form the core of a corrosion management program. However, there are pipe applications such as bridge crossings where protection and inspection of a pipe is difficult. The use of new imaging techniques may be the answer in such cases.

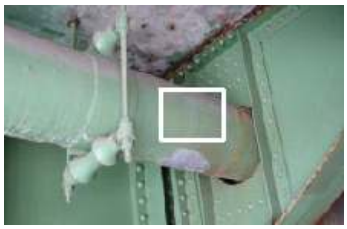
Through the ORACLE program, NYSEARCH discovered the potential to assist the inspection of steel pipelines using infrared imaging. Member interest resulted in a feasibility study which was conducted at Brooklyn Polytechnic University.

Two distinct strategies were explored for the detection of corrosion. The final choice of method depends on application and the ability to detect the desired anomalies. The first approach was near-infrared and mid-infrared spectroscopy. Here, the absorption of light within the substance of interest results in a unique reflected frequency of light. The second approach is thermography. Here, temperature differences that are created by corrosion induced coating 'blisters' are recorded.

Lab Scale Prototype

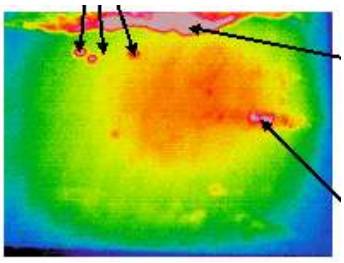
TECHNICAL APPROACH

In Phase I, a survey was conducted to identify popular coating types at exposed pipe locations. These popular coatings were tested in the laboratory to explore the performance of the infrared imaging concept. Lab and field specimens were used to test the performance of each concept. Technical concepts that were tested were Near Infrared, Mid Infrared, Passive Thermography, and Active Thermography.



Area Inspected

Areas of Predicted Corrosion



Thermographic Image

Minor Corrosion Revealed

Active thermography was found to be successful in identifying corrosion under coatings. A concentrated light source was used to project heat onto a distant pipe (30' to 50' away). It was proven that areas under a coating which trap corrosion products have less thermal conductivity than adjacent areas with no corrosion products or coating disbond. Thermal imaging illustrated the areas having greater temperatures. These higher temperatures are due to differences in heat transfer properties at locations which have corrosion or coating disbonds.

The success of the first phase has lead NYSEARCH to pursue Phase II. Jenoptik, a world wide leader in the optic and infrared imaging markets, is developing a field prototype based on the lab equipment of the first phase. The goal is to provide a field friendly packaged device which builds upon Jenoptik's OEM infrared camera. Here, a higher resolution camera coupled with an engineered active heat source, specialized controls and packaging will provide a unit that is practical for field use. Custom software may be incorporated to provide more description to the operator regarding anomalies detected by the new corrosion camera.

PROJECT STATUS

The feasibility study has been completed. Repeatable success was demonstrated with Active Thermography. Algorithms have been developed to automatically identify and evaluate the severity of corrosion.

A second phase for developing a more commercial tool is underway with a leading manufacturer of industrial thermographic inspection tools.

HIGHLIGHTS

- Safer inspection of hard to reach areas of coated above ground steel pipe
- Real time inspection
- Instant identification of corrosion
- Ability to inspect through a variety of coatings

FOR ADDITIONAL INFORMATION

George Janega
Project Manager,
NYSEARCH
Northeast Gas Association
1515 Broadway, 43rd Floor
New York, NY 10036-5701
212-354-4790
Fax: 212-764-7014
gjanega@northeastgas.org