

Using Infrared Surveys to Locate Corrosion under Wet Insulation

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ABSTRACT

Corrosion under insulation (CUI) is a major problem for petroleum and chemical process industries. Historically, there have been limited options for evaluating the presence and extent of CUI. Locating corrosion under wet insulation (CUWI) is of primary importance in the petrochemical industry. Unseen corrosion can lead to the release of process materials and cause costly downtime. Removing insulation and examining the equipment is very effective, but it's costly and time-consuming. Moisture density gauges (MDG) give good results to trained individuals, but they are cumbersome and slow to work with and require maintaining a radioactive isotope that must have specific licensing and regulatory monitoring. Infrared (IR) surveys can be the answer to the problem of locating CUWI in an economical, efficient way before it reaches the point of failure.

Keywords: IR surveys, infrared, thermography, corrosion, CUWI, MDG

INTRODUCTION

A chemical plant in Kentucky has 1300 feet of 1 1/2"-diameter insulated carbon steel piping for a critical raw material service. The insulated line is hanging in a pipe alley 20 feet off the ground. In the past, damage to the insulation has allowed water to become trapped in the insulation. This can cause degradation to the pipes' coating, resulting in accelerated corrosion. Since the pipe is covered by the insulation, this corrosion is not readily visible. The site has used a moisture density gauge in the past to survey for CUWI. This has required expertise by the inspector and the use of a man-lift to complete the survey, resulting in a process that took 3-4 days to complete.

A highly reliable and cost-effective examination technique was needed to be able to look for signs of moisture encroachment. The site decided to test the infrared camera to see the sensitivity it would provide in surveying for CUWI. A survey was performed with the moisture density gage and the IR camera, and the results were compared.

IR SURVEY VERSUS MDG SURVEY FOR CUWI



Figure 1. Because the moisture density gauge must contact the surface of the insulation, the use of a man-lift is required for pipe inspection. IR works great from ground level.

The site's mechanical integrity (MI) group first performed a survey using the moisture density gauge over a period of 3 ½ days. This survey revealed 2 areas of wet insulation. The evening after the MDG survey, the group surveyed the line using the FLIR 695 IR camera. The inspection was completed in about 1 hour, with the 2 areas identified by the MDG clearly present on the thermograph. The infrared image also identified 2 more areas that the MDG did not detect. The following week, site maintenance removed the insulation from the 4 areas for visual inspection by the MI group. The 2 areas identified by both the IR and MDG had excessive moisture, and the pipe in those locations showed degradation to the coating, with some corrosion present. The 2 areas identified only by the IR method had moisture present, but it had not yet saturated enough to cause damage to the coating. The IR survey had shown that it was more sensitive than the MDG survey.

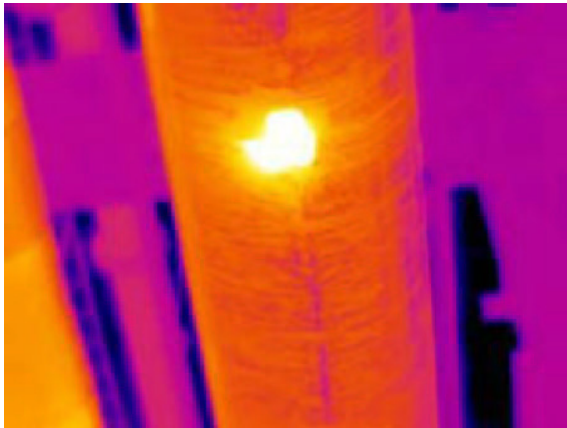


Figure 2. Pictured above is moisture identified by the infrared survey. By using a small temperature span, the moisture is clearly defined.

The site now uses infrared for 100% of its CUWI surveys due to its increased sensitivity and significant cost savings, compared to using the moisture density gauge. The chart below shows some of the savings in man-hours. In the work conducted at the facility, IR surveys were quicker and required only the user to perform the survey, whereas the MDG required the presence of 3 personnel (2 in the man-lift and 1 ground guide).

Survey Performed	MDG Man-hours	IR Man-hours	IR Savings
1300' Pipeline (header in paper)	84	1.5	98.3% / 82.5 hours
1100' Pipeline	72	1	98.6% / 71.0 hours
Vessel A	16	0.5	96.9% / 15.5 hours
Vessel B	24	0.5	97.9% / 23.5 hours
Vessel C	12	0.25	97.9% / 11.75 hours

Table 1. Man-hour savings comparing surveys using a moisture density gauge versus an infrared camera.

*These surveys are annual inspections – 600 man-hours have been saved in the last 3 years.

Besides the man-hour savings, no man-lifts, ladders, or scaffolding are required to perform the inspections noted in Table 1, reducing costs further. Based upon these results, IR has been more sensitive, faster, and has provided significant cost saving in the search for CUWI.

IR SURVEY METHOD FOR LOCATING CUWI

Performing the IR survey is relatively easy, once you set the parameters for your survey. Thought should be given to any structural, environmental, process, or any other outside influence that could affect your results. Once these are identified, the timing of the survey is considered. We conduct our surveys for non-traced (brine or steam) piping and vessels 2 to 3 hours after the sun sets in the evening. Any wet insulation will maintain the heat absorbed from the solar rays longer than dry insulation. We normally set our span at 30°F to have a high contrast in the temperature deltas. Unless there is reason to suspect recent damage to the insulation, our surveys are scheduled in the November-to-March window (we are located in Kentucky), on a sunny day, as the cooler ambient temperatures and the speedier ambient temperature decline after the sun sets allow much more contrast in the thermograph. Sunny days this time of year also have a tendency to have mild or no winds present. The absence of strong or gusty winds helps the wet insulation to maintain its heat longer than in the presence of these winds.

SUMMARY

IR surveys can be a very effective tool in locating CUWI. Planning to conduct the survey must include looking at outside factors that may affect your ability to gain the information needed. Though this article cites results on a non-traced (brine or steam) insulation system, both types of traced insulation can be surveyed for CUWI with proper planning.

REFERENCES

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ACKNOWLEDGEMENTS

The views in this paper represent the conclusions and opinions of the author. The author wishes to thank the Infrared Training Center at FLIR Systems, Inc. and DuPont Dow Elastomers for providing the resources to make this work possible and to express appreciation for the support of DuPont Dow Elastomers maintenance personnel who helped gather data and information for this paper.



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