Evaluating Loading Rack Emissions Surveys Using a GasFindIR Camera

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ABSTRACT

Using a FLIR® GasFindIR HSX Camera we will describe how you can perform loading rack emissions surveys to detect any possible hydrocarbon gases escaping into the atmosphere. We will look at gasoline distribution terminals utilizing positive pressure vapor recovery systems where tanker trucks load product at gasoline distribution terminal loading racks. Common vapor emissions issues occur here and we will discuss and identify them. Documentation of these vapor emissions surveys will also be discussed.

INTRODUCTION

The GasFindIR camera is the perfect tool for detecting and documenting gas vapor emissions at gas distribution terminals. These 'Optical Gas Imaging Surveys' will show that no harmful vapor emission releases are occurring to the atmosphere. The gas camera is also a reliable condition monitoring tool to show the company operating the gas distribution terminal where repairs are necessary since they may not see a vapor emission issue, but the camera would.

A NEED

Petroleum Companies operating gas distribution terminals where they use a positive pressure vapor recovery system have a need to monitor their vapor emissions. This need arises so that they operate in compliance to Federal and State air standards and for predictive maintenance management to assess their facilities systems operation. The department within the petroleum companies that typically contract these infrared optical gas imaging services are usually the environmental air advisors and they work together with the maintenance department and terminal operations personnel to ensure the survey is performed in compliance to company protocols and in a safe manner.

PLANNING

As with any IR survey they each pose a different application situation with different application specific circumstances. Optical Gas Imaging Surveys are very unique and different from how 'traditional' infrared surveys are performed. For one they always occur during the day, during normal business hours, and a sunny warm day is advantageous to doing the vapor surveys. I mention this since I do most of my 'normal' IR surveys at night and during off hours to enhance the survey images and optimize the particular applications outcome. Vapor Surveys are a nice change to that. However a lot more is expected at the start of these surveys and they include being properly badged and security tested by the facilities, being TWIC compliant, needing specialized equipment and clothing in certain instances for surveys like having fire retardant clothing (FRC), and hardhats, safety glasses, gloves, steel toed footwear, safety vest, safety cones and whatever else may be deemed as required by the facility. On top of that all of your infrared equipment needs to be ready to go prior to your arrival at the terminal in that sufficient batteries are all charged and the recording equipment needs to be ready too. I also use a hygrometer for temperature and wind condition tracking.
A JSA or Job Safety Analysis Form is usually required and it outlines your job steps identifying potential hazards that may occur and what critical actions you would use to mitigate those hazards should one or more occur. In most instances a cold work permit can be issued by the facility since you usually do your surveys of the racks at a predetermined distance from the loading event. When you survey within the loading rack area, which may be necessary at times, a hot work permit is required and the FRC needs to be worn. Also, prior to the survey I have had the report template started and the items needing scanning prearranged and labeled in an approximated order it would occur in the template when the report's completed, with desktop folders already made for digital pictures and for the asf video files that will be taken. Vapor Survey protocols are done in advance by the company's operating the gas distribution terminals and when necessary common themes from those protocols will be addressed.

OPTICAL GAS IMAGING, AKA VAPOR LEAK SURVEYS

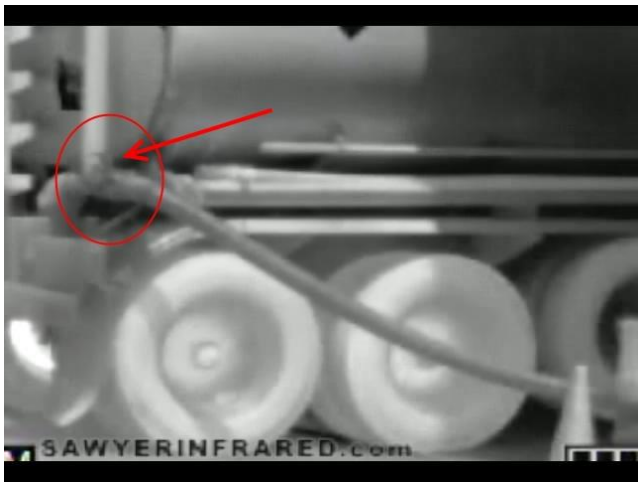
After signing in with the terminal's facility security and attending the company's morning safety meeting you grab your safety cone and you're good to go. Well almost good to go. Before you actually set up for the days survey your JSA and hot, or cold, work permit needs to be done and it's helpful to have had your camera warming up prior to your arrival at the terminal site to optimize the camera's performance. I take this time just prior to the survey to set up the camera with the tripod, put on the appropriate safety gear, comply with permit display, placed on the dash of the truck, have a terminal radio, and make sure the recording equipment works properly, making sure there's a backup, and then meeting the company environmental representative and a maintenance or operations personnel. A method-21 technician is in attendance when required, usually when conducting a compliance survey. If vapor emissions are observed with the IR camera the method-21 tech gives a quantitative reading of vapors detected in parts per million and if they are over a predetermined survey protocol threshold a repair would be necessary which is why a maintenance or operations employee is in attendance during the survey. Now you grab your safety cone and head to the racks.

1. IR Camera and tripod.

2. Tank Truck in loading bay receiving product.

The loading rack consists of any number of side by side bays, usually six to twelve or more, for loading product into tanker trucks (18 wheelers) for delivery to gas stations or other bulk delivery locations (fig 2). Approximately 25-35 feet behind the loading racks is a safety line where the camera and tripod is set up to do the vapor survey (fig 1). The trucks load from the right side and that is where the vapor recovery line is too, usually at the rear of the truck, but it can also be located at the middle of the tank where product is loaded. It's easier to locate vapors at the rear vapor recovery line (fig 3) when standing at the loading rack stop line. When the vapor recovery line is connected at the middle of the truck tank and the camera is at the rack stop line you have more distance to locate vapors. The product loading lines, the drip buckets, along with less light, since the scan area is under the middle of the bay canopy, makes locating vapors from this vapor recovery line a little more complicated. You are scanning the product loading lines for vapors as well.
Before the actual loading survey, as part of most protocols, a calibration video is shot in an empty bay using a full propane cylinder to view actual hydrocarbon vapors. This ensures the camera is picking up vapors and gives you an indication of wind direction and how the vapors may appear when you start scanning the trucks in the loading bays. A method-21 tech may also record the propane vapors in parts per million as well. And, this will tell the camera operator the severity of any later observed vapor leaks from knowing this calibration reading, using it as a reference indicator.
Each truck is scanned and videoed for a loading sequence which usually takes around twenty minutes. The video documentation is done on a Cowon portable video recorder and is started when the truck pulls into the loading rack bay. The camera is positioned at the rack stop line, at the right side (rear view) of the truck tank, see figures 2 and 4. This procedure allows for a cold work permit and no FRC is required.

The camera operator in this instance is ITC Level III TIR (thermal infrared) and OGI (optical gas imaging) certified. Worn is a hardhat, safety glasses, safety vest, steel toed shoes with appropriate clothing for the weather conditions, for some reason it's usually cold and windy at gas distribution terminals. A TWIC card, company identification badges, gloves and a company radio are also worn or attached to your person in plain view. The portable recording device can be attached to the tripod or worn on a lanyard around the operator's neck, whichever is more convenient. On sunny days I also wear a camera shroud around my neck to put the recorder in so the videos can be easily seen on the recorder display. Now you can scan the loading rack bays with trucks loading product to determine if any vapors can be detected with the IR camera.
In figure 2 you can see where you are positioned in relationship to the tank truck and a safety cone, or cones, are positioned behind the camera tripod for visibility. The operator observes the vapor recovery line connection, the loading line connections, the tank vents, and the loading bay equipment, vapor checks, relief valves, the bays vapor header, and header flanges all from this stationary position at the rack stop line. This is done for a full loading sequence. After the loading event is completed a view of unattached loading arm drybreaks is useful as leaks can occur there as well. A digital picture, usually required to be time stamped, is taken of the tank truck in the loading in the rack bay. Additionally with any equipment where a vapor event is detected that equipment is also captured digitally to be documented with the report. After one bay's scan is completed you move on to the next bays survey. An eight bay loading rack usually takes about four hours. Then it's time for the report.



3. Vapor recovery line hose connection.

4. Black cloud shows vapor emission from vapor line.

OGI VIDEO REPORTING

The report is the most important part of the OGI survey for your client, telling the story of the days survey events. This report is unique, different and interesting in a number of ways. Notably that it's a video report and I find using a customized powerpoint report template is the best way to present this OGI survey to the client (figures 5 and 6). It contains all of the relevant identifiers in text with a digital picture, including the fifteen second video clip all on one page, for each of the event sequences surveyed.
Each loading rack bay is observed and recorded for twenty or more minutes. The standard for the reporting video clip of each bays loading sequence is fifteen seconds. If a vapor emission event is detected I attach two reporting video clips, one of the vapor emission and the other of the post repair of the vapor emission event. I keep a bag attached to my tripod containing a notepad and other various items, pencils, hygrometer, compass, camera, extra batteries. The notepad makes preparing the video report easier. Notes for each bays truck numbers and any vapors event with recorder times is documented to use in the video editing of the individual clips for the report.
After the vapor survey the video report is usually completed on-site. Depending upon the number of bays and events detected the report can be up to twenty pages. It's helpful to transfer the digital pictures to a folder on

your desktop and the cowon recorder videos to a desktop folder too. The video files are in an asf format and an editing program is necessary to go through your days videos to compile your fifteen second clips (fig 6) to put in wmv format. This is done because wmv is a more standard format and your client won't have to purchase additional software to play the files to read your report. The editing is the most time consuming aspect of the day's work. Once it's completed it's only a matter of placing the appropriate digital picture, video and relevant text identifiers in the report template frames. When the report frames are completed a summary text page ends the report which will highlight any vapor emissions events, repairs done and any other circumstances encountered during the days optical gas imaging survey.

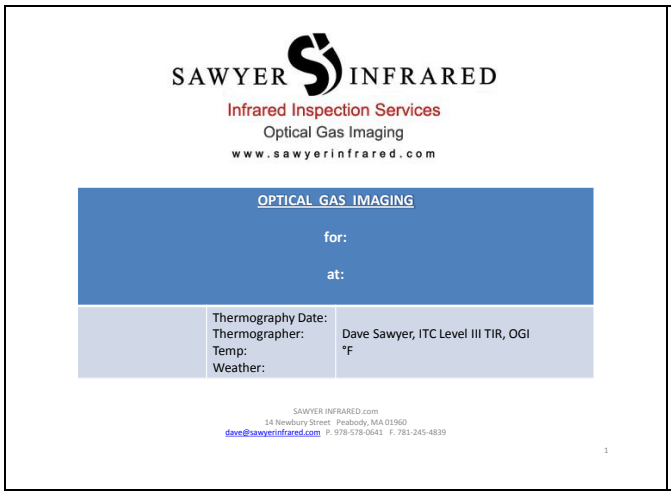


Fig. 5.

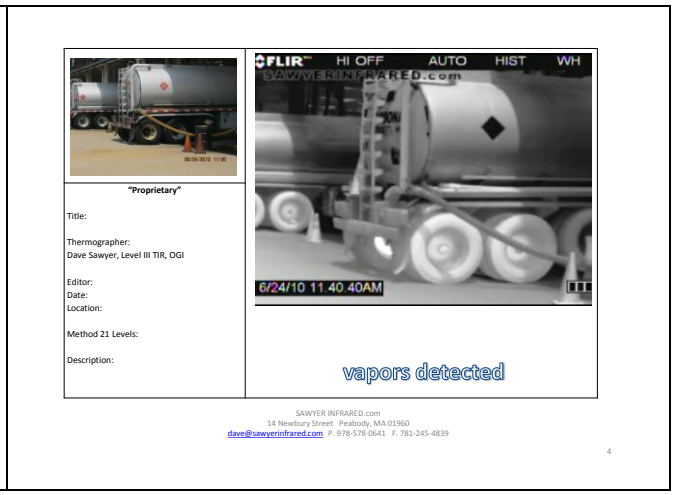


Fig. 6.

SUMMARY

Vapor emission surveys are a perfect Optical Gas Imaging application for the FLIR® GasFindIR Camera at gasoline distribution terminals utilizing positive pressure vapor recovery systems. The tank truck taking on product at a loading rack bay can be completely scanned in a twenty minute period to detect any vapor emissions that may occur whether for compliance or for facility maintenance related matters. Negative pressure vapor systems can also be accommodated with these IR services with additional equipment at the carbon bed being included in the survey. Most positive pressure vapor systems are being updated to negative pressure systems and the need is still there for vapor leak surveys with these systems as well. I hope you found this paper helpful.

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ABOUT THE AUTHOR

Dave is an ITC Level III Thermographer and OGI certified. He is the owner of **SAWYER INFRARED**, a Boston based Infrared Inspection and Optical Gas Imaging Company and has been doing infrared consulting professionally since 2003. This year his company have completed Optical Gas Imaging Surveys for major petroleum and LNG companies. A week’s long trip to the Marcellus Shale in the areas of western Pennsylvania and West Virginia was undertaken in June to scan and assess various gas drilling fracking operations and methane’s impact on the local watersheds there. We’ll have information on that project available shortly.
For more information on OGI and Infrared Services visit Dave’s company webpage at ***sawyerinfrared.com*** and view the videos there, and on his attached YouTube page. You can contact him at *dave@sawyerinfrared.com*.

*good*IR *to you!*