CRT

ACCURATE MEASUREMENT

Technical Library

As a Service to the HydroCarbon Measurement Industry, CRT-SERVICES Curates this collection of Digital resources.

www.crt-services.com
www.crtsupply.com

11133 Interstate 45 S Suite O
Conroe, Texas 77302
(713) 242-1190

Chromatograph Applications and Problems from a Users Standpoint
Class # 5040.10

Fred Ryel
Manager of Operations
Cherokee Measurement and Control
Tulsa, OK. U.S.A.

Introduction

Chromatographs are available for all types of applications in the natural gas industry. The main applications that this class will discuss are: process monitoring of liquids and gases, environmental flares and ambient air, landfill gas and contaminates. These can also include corrosives such as H2S, CO2 and O2, etc. Regardless of the application, the main priority is to capture an accurate sample and not change the properties before it can be analyzed. Maintaining the sample integrity is by far the most difficult process. The procedure of acquiring the sample and the way it is analyzed depends upon the media being sampled.

Applications

Chromatographs being used in online installations may be installed in any number of ways. Some units are designed to mount outside next to the pipeline or process. These units are less expensive initially to install but also have their own issues in relation to operations. They can operate very well exposed to the environment but also have to be maintained in the same conditions. Sometimes this means opening these enclosures to the adverse weather conditions. Most generally the locations where online units are installed are high volume, high priority sites. Any repairs or maintenance are required to be of short endurance and as quick as possible. This may require opening during rain, snow or other undesirable weather, possibly causing damage to internal electronics. Design and installation should be a high priority decision. Other chromatographs require the unit, or at lease the controller, to be indoors. This increases cost and the footprint required to install. Either way, there are advantages to both.

Chromatographs can be designed for multiple media to be analyzed on one analyzer. An example of this is when a processing plant uses a single unit to analyze the inlet, outlet and liquid product. This requires many different types of pressure regulation, sampling points, type of filtration and/or conditioning. The liquid product sample has to be vaporized before entering the analytical valves, columns and detectors. Also, by just using one chromatograph, the distance from some of the sample points may be so far that sample integrity could be jeopardized. The industry has worked for years on all kinds of sampling methods and improvements to handle diverse instances. By utilizing these guidelines during the design and installation process, most of the sample integrity problems can be resolved. These same guidelines have brought new equipment and maintenance needs with the process.

Sample Probes and regulation

When selecting the sample points, if at all possible, try to stay within the recommended AGA and API 14.1 guidelines. These are tested guidelines accepted by most companies. The right time to decide on the proper pressure regulation requirements is during the design process. Most sampling requires some type of regulation and conditioning. This can be accomplished by using a type of probe regulator and filters that reduce the pressure, remove particulates and free liquids. These devices also help eliminate the Joule-Thomson effect by doing the pressure reduction inside the sample stream. By doing this the chance of liquid contaminating the

sample system to the analyzer is prevented or at least minimized. This type of probe regulator helps maintain sample integrity at the sample point.

Every sample product needs to be examined for the proper type of pressure control and conditioning. As with liquids from the plant process, there are different devices to protect and condition these. Propane liquids and heavies are usually carried to the analyzer in the liquid state. At the analyzer, the sample pressure is regulated and vaporized and kept in vapor state through the analyzer. Although the sample needs to be kept liquid until injected into the analyzer, there still needs to be some types of filtration before reaching the sample injection valve or vaporizing. The type of filtration varies with the product being sampled. All of these techniques and devices are part of the conditioning process.

Sample Transport

During the design and budgeting process, there needs to be considerations made for maintaining the sample integrity after the sample leaves the pipe. What is important is that the gas samples not reach hydrocarbon dewpoint. The proper way to insure this is to use stainless steel tubing that is insulated and heat traced. There are several types of this tubing in regard to insulation and heating ranges. Probably the most common type is a 5 or 8 watt self regulating, pre-insulated tubing. Again, the purpose is to maintain the sample integrity by keeping all of the components in the vapor state. By using stainless steel we are keeping historical buildup of components out of the transport system. It is also recommended for extended distances to use ¼" tubing. Always check the device recommendations as these lengths vary per the manufacturer and API.

All pieces of the sample system should be stainless steel. If any one piece is not stainless steel, then there could be residual components held in the pores of the material or may weaken due to possible corrosion from contaminates. Within these decisions, distance should also be considered for real time sample analysis. If the distance is too far from the analyzer, the sample could be stale or not representative of what product has just been measured. This can be resolved by speed looping or slip streaming the sample, creating a constant movement through the sample tubing to the analyzer, either going to vent or to a lower pressure point within the pipe. This should be calculated to the length of tubing, flow rate through any bypass filters and cycle time between stream analyses. The flow rate for speed looping or slip streaming needs to be just high enough to obtain a real time sample. By having this flow rate too high, it is possible to actually cause more liquid to be drawn into the sample system than normally would be present at the lower flow rates. All of the sample conditioning should be researched properly to determine what is needed. In some cases, unnecessary devices may cause problems instead of correcting them.

Liquid Product

Liquids are also a special mix of components. Some are suppose to be in the product to be analyzed while other components will contaminate the whole analyzer. Depending on the type of liquid product being analyzed, there can be various inhibitors and particles. Some of these undesirable liquids, as far as harming the analyzer, are Amine, Glycol and numerous inhibitors. Most of these are heavy enough to be separated or retained when the liquid is allowed to flow through certain separators. Ideally, this kind of separator should be installed as close to the sample point as possible, allowing for convenient and frequent element replacement. There should also be a small bypass loop with isolation valves so there would be no interruption of sample to the analyzer. This type of filter separator should be at least a single element coalescing type.

There are some filters available that incorporate both a coalescing element and a membrane diaphragm all in one chamber. The other type of filter is a liquid membrane separator with high flow and pressure capabilities. This type of separator removes suspended immiscible liquids that are carried within the liquid hydrocarbon sample. The design of these devices is also for degassing the liquid or eliminating bubbles in the sample.

Calibration and Carrier Gases

These two components are sometimes not emphasized enough. In regard to the calibration standard, there are a lot of options and variations. These determinations of composition, regulation and environment can be some of the leading factors when it comes to accuracy and dependability. To help in these decisions, GPA 2145, 2172, 2198, and API 14.1 should be utilized. All of these references pertain to the components properties and constants, calculations, proper handling, storage of calibration mixtures and samples. By not using these resources, operating problems and accuracy can be severely effected.

Even the type of pressure regulation is a high priority. This needs to be applied to the carrier gas as well. Regardless of the type of carrier, Helium, Nitrogen or any other type, the guidelines are still the same. Only high purity grades of the carrier gasses should be used. Along with this goes the quality and type of regulators. It is extremely important to be able to maintain a very stable pressure and flow control of both the calibration and carrier gases. As with any type of analytical device, a leak free system is a must requirement. These few priorities concerning the calibration and carrier system, if not applied properly, can cause the highest percentage of maintenance and operational problems.

Power Supplies and Conditions

Every type of analyzer has certain power requirements. Whether it is the range, stability or form, this area of quality is overlooked frequently. Online analyzers are installed in remote areas a lot of the time. Power supplied to these sites can be erratic or unstable at the least. When AC power is needed to operate the equipment, there should be checks made to verify the quality and variance. This should also apply to DC devices using batteries, external power supplies and chargers. Always check polarity of wiring as to positive, negative, ground and hot, neutral and ground.

Most analyzers are using a very finely controlled signal to measure the components areas and baselines. If there is electrical noise, varying voltage or even the wrong type of wave form being supplied, inherent problems can be generated. Sometimes this is not apparent initially but can be recognized through the amount of electronic components having to be replaced or adjusted. If UPS systems are utilized, which usually is recommended, don't assume that the power is good. There are several factors to consider when selecting these devices. Some specifications to check are full or part time voltage conditioning, signal wave form is square or sine, reaction time and endurance. All of these have different effects on different types of chromatographs. A common area overlooked when the device is installed is grounding of the unit itself to a good earth ground. This is important due to the fact that most all of the internal electrical components are going to the frame or chassis for ground. In order for this ground to be stable and continuous, the unit usually requires that a good ground of the chassis or frame be attached to a ground rod or system to complete the grounding circuit.

Conclusion

Generally all chromatographs are designed and built to very high quality and comply with industry standards. When they are shipped, each has usually been through all the tests and documented to such. Through the end users design and final installation of the peripheral devices attached to the chromatograph, operational problems and maintenance time can be the inaccuracy not accounted for. All of the areas that have been examined in this paper have to be considered and resolved with all other design requirements to insure that the chromatograph accuracy is protected. These are just the most common items and resolutions to operations and maintenance of a chromatograph.

Even the best installation needs to be reviewed periodically to accommodate for possible process and /or environmental changes. Industry guidelines and standards are continually being revised as well. Along with this also come equipment improvements and capabilities. This industry has many resources available to help resolve most application and operations challenges. A few have been referred to in this paper. The greatest resource available for chromatograph applications and operation problems are through these publications, industry technicians and manufacturers. Always utilize as many of these resources as possible to make conclusions to chromatograph and related equipment problems. All of these applications of ideas, equipment and other operational guidelines are to assist in the preventative maintenance of the chromatograph. These principles, if applied properly, will help insure correct analytical data and control the operational cost.