Process Sampling 101

Five Things to Know When Sampling in a Hydrocarbon Processing Plant

SENTRY

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Introduction

The focus in hydrocarbon processing is keeping the product safely contained. There are only two exceptions: when product is sold and when it is sampled.

Sampling is essential for gaining visibility into product quality, identifying corrosion and ensuring processes are operating as expected. It occurs at multiple points across virtually every stage of hydrocarbon processing.

But, sampling doesn't fit neatly into the organizational structure of refineries and petrochemical plants. There are multiple stakeholders with an interest in sampling — from quality lab technicians to operations personnel to safety managers — but no obvious "owner" of the sampling program.

That has left many organizations operating without the expertise required to ensure safe, consistent sampling. A strategic sampling partner will be committed to filling this gap by providing more than highly engineered sampling panels. They will support those panels with a range of installation, training and maintenance services. And, continually work with their customers to share their sampling expertise.

This e-book contains five things you should know when managing a sampling program. It is organized around the key principles of minimizing risk, matching the sample panel to the application, training, maintenance and upgrade options.

Improper sampling creates safety and environmental risks

A closed-loop sampling panel draws the sample within a sealed environment to protect the operator form spills and emissions. An open panel exposes the operator to increased risk.

Sampling can seem simple on the surface: you draw a sample from a process and transport it to the lab for analysis.

But there is a degree of complexity involved in ensuring samples are representative and in protecting the operator that is drawing the sample, particularly in the high-temperature and high-pressure applications commonly found in hydrocarbon processing. In these cases, sampling can expose operators to dangerous spills and hazardous emissions if the panel is not properly designed and the operator is not adequately trained.

Operator safety should always be the number one priority of any sampling program.

For many applications, the safest approach to sampling is to use a closed-loop design. Closed-loop sampling keeps liquids and gases fully contained throughout the sampling process, isolating operators from contact with high pressures, temperatures and volatile gases. By contrast, open sampling panels can expose operators to high-temperature or hazardous materials and emissions.

In addition to protecting operators, closed-loop sampling panels also protect the environment from spills and emissions, helping ensure compliance with EPA regulations.

The other consideration when evaluating the risks of process sampling is the quality of the sample. If the sample is tainted or not representative of the actual process stream or batch, testing can be inaccurate. Here, again, closed-loop panels have the advantage of preventing unintentional human contamination of the sample.

The design of the sampling panel can also help ensure a representative sample is secured. A simple spigot sampling system can fall victim to a condition known as "dead-leg leading" in which pooled material within the process causes old, non-representative product to be sampled, distorting results.

Samplers must be precisely matched to the application

The decision of whether to use open or closed sampling panels is only one of the many that must be made when configuring a sampling panel for a certain application. The type of material being sampled, the process conditions, and the sample volume all need to be taken into account.

While liquids are the most common material sampled in hydrocarbon processing, most refineries and petrochemical plants will have the need to sample a broader range of materials, including slurries, gases and steam.

This is one of the factors that makes sampling in hydrocarbon processing particularly challenging. While many other processes have very focused sampling requirements, hydrocarbon processing may require liquid sampling for product moving through pipes; solids sampling for materials removed through the process, such as sulfur; slurry sampling for crude oil assays or asphalt blending; and steam sampling for high-temperature processes. Working with a strategic sampling supplier that can support sampling of all of these material types can help simplify management of your program.

When configuring the panel to the application, the first question to ask, is how will the sample be used? Considering how and where samples will be analyzed helps ensure sample panels collect the appropriate volume in the appropriate container.

Typical sample application criteria

Process Stream	Process Condition	Sample Type	Materials Characteristics
Conveying	Area Classification	Gas	Abrasive
Distillation Towers	Composition	Liquid	Boiling Point
Mixers	Corrosiveness	Powder	Density
Pipes	Flammability	Slurry	Explosive
Reactors	Flow Rate	Solid	Freezing Point
Storage Vessels	Pressure	Steam	Hardness
	Radioactivity	Water	Magnetic
	Temperature		Moisture Content
	Toxicity		Particle Size
			Particle Shape
			Material Compatibility
			Thermal Conductivity
			Stratification
			Vapor Pressure
			Viscosity

Then, the specific characteristics of the application, such as temperature, pressure and pipe specifications, need to be evaluated to ensure flange and material specifications meet the application requirements.

For high-temperature processes special considerations need to be made for protecting operators handling cylinders. Processes under high-pressure may also require pressure-relief valves to support the panel, and those that contain corrosive chemicals may require special corrosion-resistant materials around seals and valves.

There is a lot to consider when configuring a sample panel to the application. Working with a sampling expert to evaluate application requirements and propose configurations and materials will deliver consistent, reliable performance in virtually any application.

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Operators require training

The Sentry Process Monitoring Tech Center in Houston provides a full curriculum of sampling training and maintenance programs

One of the most common challenges associated with maintaining the safety and integrity of sampling programs is operator training. Inadequate training increases the likelihood of both spills and contaminated samples.

A strategic sampling supplier will provide hands-on operator training at the time a panel is installed. This is an important foundation for any safety program; however, two factors contribute to the need to support this initial training with an ongoing program.

The first is the regular turnover that occurs within the typical refinery or petrochemical plant. This can result in operators having to draw samples that have never received any training on the process. The second is simply the day-to-day pressures and time constraints that can cause even trained operators to take shortcuts or rush through the sampling process. Almost any activity can benefit from regular reinforcement and sampling is no exception.

Sampling should be considered an integral part of any safety program and, as such, should receive the same level of attention in regard to training as other hazardous operations. Regular refresher courses for operators, performed on-site or an at an off-site location, can help ensure new hires receive the training they need, and experienced operators have an opportunity to review best practices on a regular basis.

Maintenance prevents problems

While a well-engineered sampling panel is designed for the tough applications found in hydrocarbon processing, like any mechanical device it requires regular maintenance to stay in peak operating condition.

Depending on the nature of the application, monthly, quarterly or annual inspections of the panels are recommended. Best practices for a comprehensive sampling maintenance program include:

- Monthly or quarterly visual inspections to check for wear.
- Annual system shutdown maintenance in which the panel components and related valves are disassembled and inspected and worn or damaged components are replaced.

Organizations that lack the capacity to conduct regular inspections of the sample panels throughout their plant can contract this activity to a third-party. This ensures a disciplined approach to panel maintenance and that maintenance isn't overlooked when personnel or operating conditions change. It also ensures that each inspection is documented with a highly detailed service and condition report that can be helpful in benchmarking performance and identifying early signs of potential problems.

Of course, any significant changes in the operation of the sample panels should also be noted and trigger maintenance. In these situations, it's important to work with a local service provider capable of responding quickly to ensure sampling downtime is minimized.

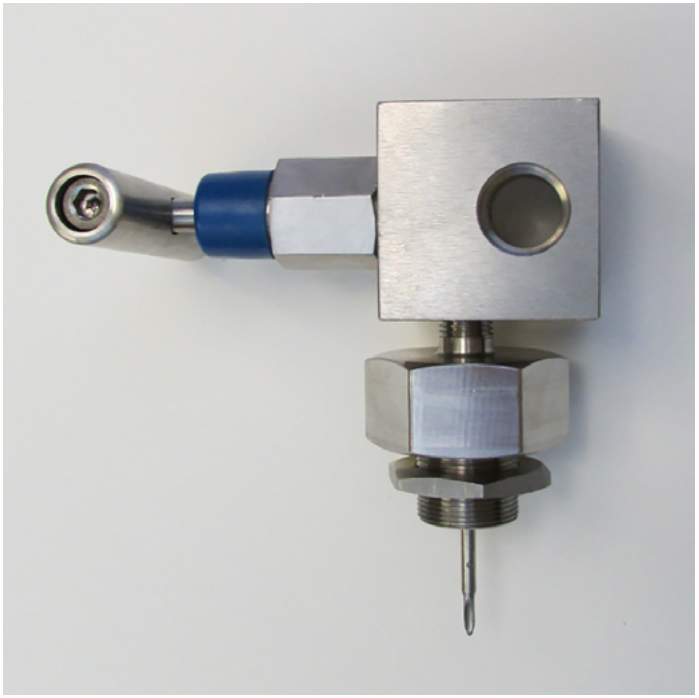
While working with a reliable service provider is important, installing panels designed to facilitate user maintenance is even more important. Processes such as replacing the needle or seal in a panel are relatively simple operations that can often be performed by plant maintenance personnel.

You don't have to live with unreliable sampling panels

If sampling is consuming an excessive amount of maintenance resources, or samples cannot be drawn consistently because of panel maintenance, it may be time to consider upgrading your panels to the latest technology.

In many cases, key components of the panel may be upgraded to improve overall sampler reliability and performance. For example, if the needle on a sampling panel is wearing prematurely, it can be replaced with a new needle with a coaxial design that prevents bending and breaking.

In some cases, it may be necessary to replace an entire panel, but often select components can be upgraded to improve operation. Your Sentry representative can help you evaluate the performance of your existing panels and determine the most cost-effective approach to improve performance and reliability.



The unique design of the Sentry needle allows sampling panels from other manufacturers to be upgraded to improve reliability.

A Better Solution. A Safer Experience.

At Sentry Equipment, we tailor our equipment, expertise and services to create solutions that enhance workplace safety and improve operations. We are the only sampling partner to the hydrocarbon processing industry to offer a complete range of sampling solutions supported by a full complement of lifecycle services. Our application and service experts have decades of experience in the hydrocarbon processing industry and our new Process Monitoring Tech Center (PMTC) ensures that expertise is easily accessible by our customers. We don't stop at delivering well-engineered samplers for every application. We are committed to providing the solutions and support that create a better sampling experience for everyone from process engineers to operators to HSE and maintenance personnel.

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