

Implementing a Successful Downstream Sampling Program

Developing a reliable downstream sampling program requires a strategy that will keep your equipment running properly for years.



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This eBook will help you establish a holistic downstream sampling program through ensuring your equipment needs, helping you build a sampling strategy, and how to maximize your investment once installed.

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Introduction

With aging equipment and facilities, operators face increasing challenges in maintaining equipment's reliability and integrity, as well as safety. One of the biggest hidden threats to your plant's efficient and safe operation is deteriorating sampling equipment.

However, refineries often operate sampling systems as separate entities within the plant. This leaves plants open to gaps and potential risks in their sampling program.

Refineries can mitigate these risks with a holistic sampling program.

In this eBook, you will learn:

- When to repair or replace your equipment
- How to establish a sampling program
- How to develop a refinery-wide sampling strategy
- How to maximize your investment with installation and training

Identify Your Equipment Needs

Successfully identify your refinery's needs by identifying the type of updates and equipment for your process applications.

Identify Your Equipment Needs



It can be challenging to know how to plan and implement a service program. Plant operators and maintenance personnel are often unsure about how to implement a sampling program that will help them make strategic decisions.

1. Assess Assets

An assessment offers a comprehensive snapshot of all sampling assets in the hydrocarbon plant. It usually includes three components:

• Review Maintenance Backlog -

The "heart and soul" of a maintenance program is often found in the backlog of identified work. This backlog is an essential starting point that gives insight into where to start a comprehensive visual inspection.

- **Visual Inspection** -This is the largest portion of your assessment. It includes a comprehensive review of all your existing sampling equipment, including components such as connection points, needles and hoses, and operational states.
- **Process Inspection** Where it's safe and possible, going beyond visual inspection will provide a clear picture of equipment in operation.

2. Identify Sampling Needs

From inspection and backlog review, you will be able to establish a set of needs within your Hydrocarbon plant. This assessment of needs includes three phases:

Diagnose:The assessor will develop a set of diagnostics, including:

- Any historical information
- Any quirks of the sampling equipment
- Post start-up performance
- Document changes in the process
- Production seasonality

Assess Needs:This will offer process insights and outline specific recommendations from the inspection. It answers questions such as:

- What is the process currently doing?
- Where are the opportunities?
- What is the end goal of this sample?

Prescribe:This details the status of the equipment, including:

- Is the equipment working as expected?
- Is a repair of retrofit necessary?
- Should this equipment be replaced with engineered or new technology?



3. Prioritize Needs

This is where the right partner makes all the difference. An experienced partner can help you develop and maintain a proper sampling program that will ensure your plant runs smoothly and safely. They can also help you dig deeper into your needs to prioritize what must be done first. This typically includes strategizing needs into three tiers:

- First tier Needs immediate attention
- Second tier Activities that need planning within the next year
- Third tier Needs long-term planning prior to implementation

4. Execute and Implement

A properly designed representative sampling system that's implemented with the right sampling equipment ensures process samples are repeatable and reliable, every time to help refineries:

- Achieve reliable and accurate analytical results
- Maximize return on investment
- Reduce waste, downtime and costs
- Ensure operator, asset and environmental safety
- Comply with industry standards for automatic sampling practices, such as API MPMS CHAPTER 8.2, ASTM D4177 and ISO 3171

5. Develop a Maintenance Schedule

A well-engineered sampling panel is critical to your hydrocarbon processing plant. Like any mechanical device, it requires regular maintenance to stay in peak operating condition. Without conducting regular inspections, your plant could slowly lose performance quality and increase the possibility of safety risks.

Regular maintenance is critical to keeping your sampling system running smoothly and efficiently. Developing a routine maintenance schedule will help you track maintenance trends and catch potential issues before equipment malfunctions or worse, fails.



Do You Need to Repair or Replace?

When reviewing your sampling needs, it can be difficult to know when to continue maintaining or repairing equipment, and when to replace it.

Many industrial plants in the United States were built decades ago and were not expected to still be in operation. Yet many are still running today, well past their expected life span. Within these plants, hydrocarbon sampling systems and equipment are often overlooked, even as new technology and regulations demand more from them.

With aging equipment and facilities, operators face increasing challenges in maintaining equipment's reliability and integrity, as well as safety. One of the biggest hidden threats to your plant's efficient and safe operation is deteriorating sampling equipment.

Signs Your Equipment Needs Attention



- Maintenance data is coming back with recurring issues
- Lab data is indicating sampling errors
- Location and/or tie-in points no longer meet your sampling needs
- Systems aren't installed in the right locations for your processes
- Changes have been made to the sample requirements or formula since equipment was installed
- New technology has been developed
- Equipment has been degraded due to corrosion, erosion, wear or fatigue
- Equipment is now obsolete
- Changes to regulations have occurred

Repair vs. Replace: Key Considerations



Choosing the right upgrade or replacement based on key considerations can give hydrocarbon plants a second life and help avoid downtime or even a devastating shutdown.

When deciding whether to hang on to a piece of equipment through regular maintenance or spend the funds to upgrade or replace it, asset managers must consider a number of factors, including:

- Cost of the repair, upgrade or replacement
- Age of the equipment
- Process condition exposure
- Harsh environmental condition exposure
- Expected life cycle with or without repairs/upgrade

Key Questions for Assessing Cost

- How much would it be to upgrade the equipment?
- How much to replace it altogether?
- How much would it be to retrofit the existing equipment with updated technology?

Meet Application Needs with Detailed Planning

Ensure your programs longevity with a detailed sample panel audit that helps you successfully match the sampler to your application needs.

Meet Application Needs with Detailed Planning

Conducting a site-wide sampling audit evaluates a plant's sampling program to help ensure that all sampling stations are seamlessly working together. A comprehensive audit also helps refinery operators and managers develop a clear plan of action to ensure the processes they monitor remain safe and running properly.

A sampling audit is a technical review of a sampling system's Strengths, Weaknesses, Opportunities and Threats (SWOT). Audits are conducted by certified sampling experts to identify SWOTs in business areas, sampling units/types and within specific samplers.

This analysis reviews:

- If any updates, modifications or new systems need to be added
- Priority of divisions based on the refinery's needs
- Estimated costs of potential repairs, edits, etc.
- Risks associated with not taking recommended action(s)

Audits also take into account pressure (PSI), temperature and processes being audited to make a series of recommendations for the refinery.

Tailored recommendations. Each audit should be customized to the plant and domains or locations within the plant. No two samplers or processes work the same way, and many sampling areas are often under different types of management, depending on the location within the plant. These elements need to be considered when evaluating the system as a whole.

SAMPLER	KEY	ROUTINE MAINTENANCE	NOTES
TYPE	COMPONENTS	GUIDELINES	
TSI-3 Bottle System	TSI-31-T-SS Sample Valve	Inspect Sample Valve for proper function. Replace if cycle positions are not producing desired results.	This system is not currently functioning. Main line feeding the panel is plugged. Additionally, the N2 system has at minimum a faulty Flow Meter. If plug is cleared, entire N2 system should be serviced before returning to service.

Example of a Sentry Equipment Audit Report



Prioritized actions. The result of an audit is a comprehensive list of recommended actions that plant operators can take to optimize their sampling systems, from repairing equipment to replacing an entire system. When identifying needs, the sampling expert conducting the audit should use a system for identifying priorities.

For example, Sentry Equipment provides comprehensive insight into all samplers within a plant, regardless of manufacturer or brand. Our experts work to find the best solutions for a refinery's needs. Additionally, a maintenance schedule or best practices are provided to ensure the longevity of repairs, modifications and replacements.

Repeatable and Reliable Sampling

A properly designed representative sampling system with the right sampling equipment ensures process samples are repeatable and reliable, every time to help refineries:

- Maximize return on investment
- Better manage loss control
- Reduce operating costs
- Comply with industry standards

Match Your Sampling System to Your Applications

Capturing representative samples and protecting the operator is critical in high-temperature and high-pressure applications commonly found in hydrocarbon processing. That's why it's essential to match your application to the sampling equipment. Here's your guide to ensuring you choose the right sampler for your application.

APPLICATION	RECOMMENDED SAMPLER	
Low Vapor Liquid Pressures	A Bottle Manual Liquid Sample System is the best way to sample low vapor pressure liquids. These systems catch samples with a manual system using a simple fast loop valve.	
High Pressure Liquids	A Fixed Volume Sample System is ideal for sampling liquids under high process pressure. This type of system adds a volume chamber component to a manual system to capture samples in an intermediate stage that separates the human operator from the actual process pressure.	
Sampling Other Liquids	MIL/MVD Bottle Samplers are the right choice for sampling liquids in a hydrocarbon process. A manual low emission sampler samples liquids in-line without exposure to the operator.	
High Temperature/High Viscosity Applications	For high-viscosity materials, such as heavy oils and resids common in refineries, high-temperature, high-viscosity (HTHV) samplers are the right choice.	
Liquefied Gas or High Vapor Pressure Liquids	An LPG Liquid and Gas Sample System is ideal for sampling gas or high vapor pressure liquids. A standard system has one process inlet, one process outlet and one vapor recovery/flare outlet.	

Maximize Your Investment

Maximize the investment you have made in equipment with a secure start-up and ongoing sampling training.

Maximize Your Investment

These tips will help you establish a successful sampling program that will continue to ensure operator safety and equipment performance.



A new sampling system needs a well-planned startup and commissioning process to maximize the accuracy and extend the life of your investment. Sampling expertise ensures your equipment is brought online quickly and accurately while helping operators understand the intricacies of the system to maximize the life of your investment.

Evaluate the application.

Consult with your staff and vendor to ask:

- Is your sampler exactly what you need for your specific application? (A successful sample audit will help you answer this question.)
- Can you add or remove features, so the sampler is better suited for your needs?

Thoroughly review any drawings with your team to answer these questions. Review demo equipment to ensure it can handle your application, and thoroughly analyze IOMs and spec sheets.

Evaluate sampler placement.

Make sure you are placing the sampler in the most advantageous spot within your process. This supports reliable and accurate results, and it ensures that operation is seamless for current processes.

Identify peripherally necessary conditions.

- Identify and account for any utility requirements, such as:
 - cooling water
 - nitrogen supply
 - steam supply If you need steam supply, it's necessary to also establish a reliable steam loop with its own trap.
- Check upstream/downstream isolation valves. Not all aspects of your system will operate perfectly all the time, so it's important to add isolation valves as back-up protection to your equipment and to provide proper isolation for maintenance.
- Check the flare system. For anything vented to flare, the flare system needs to be in good shape and have block bleed assembly at the sample point. This protection allows you to blow out the flare or drain the sampler. A check valve is also necessary to ensure you're protecting equipment and performance, while giving you an avenue for service so your flare equipment is easy to maintain or fix.

Adequately check your equipment.

Conduct leak checks on the sampler and its connections and necessary valves to confirm that flow, results and function were as expected. It's important to let the sampler run for approximately five minutes to get an accurate result and flush out any dormant elements in the lines.

Conduct startup commissioning and training after installation.

Startup and commissioning service offers trouble-free activation of your original or upgraded sampling system. Technicians ensure operation as designed through proper setup and calibration. These technicians should be factory trained and authorized on all leading brands of analyzers frequently seen in SWAS panels. Combined with on-site technical guidance for accurate operation and maintenance, startup and commissioning service will help to keep reliable performance available throughout the entire lifecycle of the sampling equipment.

Maximize Your Sampling Program with Training

Conducting training at every level of a refinery ensures that all sampling stations and the processes they measure are seamlessly working together. Training plant operators to properly monitor the intricacies of the system also ensures shortened startup and reliable performance of your equipment, helping maximize accuracy and confidence in your system's measurements.

Training should begin when an employee is hired, and include equipment orientation and acomprehensive plant safety trainingper OSHA 1910 Plant Safety Regulations. After the initial training is completed, regular follow-up training sessions should be held for all employees on a regular basis.



Diverse Training Needs

Each operator in a plant has different needs when it comes to sampling equipment training:

- Junior Engineer needs to be aware of how the equipment works.
- Maintenance and Operations Personnel needs to be able to run new equipment to maximize its potential and extend the life of the asset.
- Training Operators needs adequate knowledge to properly install, run and maintain equipment.
- **Reliability Engineer** needs sampling equipment operators to be properly trained so the equipment is used consistently and properly.

Training offers detailed information on application-specific equipment so operators can safely collect emission-free samples. This should include:

- Types of sample systems installed in the refinery
- Why each type of sampling system is used
- How to use each sampling system
- How to conduct sample collection preparation
- Common issues with each type of sampling system
- General maintenance guidelines
- Routine maintenance checklist

By empowering employees to become sampling experts with customized, hands-on training complete with a full set of manuals for ongoing reference, you are trading costly surprises for



SENTRY

Take Action with Sentry ProShield

From day-to-day projects to big picture plans, you have enough to worry about. Your sampling processes shouldn't be one of them.

Sentry ProShield Lifecycle Services provides your personnel with technical support from experienced specialists to maximize up-time, ensure personnel safety and increase the life expectancy of your equipment.

Learn how our technicians can help you establish, maintain, and maximize your sampling program.

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