

White Paper

Operations Monitoring: Improving Plant Performance, Reliability and Safety



Executive Summary

Any business running a process plant wants to maximize asset uptime, reduce maintenance costs and avoid unplanned outages. Operational excellence is becoming an expectation with clear definition and not just a buzzword in the industry. This requires a clear understanding of the facility's process variables, operational constraints and production targets.

As industrial organizations expand and optimize operations to meet customer demand in domestic and international markets, they must also maintain a commitment to eliminating accidents, injuries and harm to the environment.

Plant owners and operators are under increasing pressure to achieve greater productivity more efficiently with fewer resources. Data about plant performance is key to making smart operational decisions, but in most cases, operators have access only to piecemeal information about their units and processes—examining performance without a view to the larger picture of operational targets or safety issues.

Many automated industrial plants have now implemented some type of operations monitoring program. However, the effectiveness of these programs—the next logical step after alarm management—can be limited by the use of ad-hoc or standalone tools such as spreadsheet applications to evaluate process variables against operating limits, conduct plant data analysis and perform stewardship reporting.

The following whitepaper describes the implementation of an effective operations monitoring solution for process industry facilities. New software tools are available for systematically monitoring plant performance data and analyzing deviations from operating plans. They enable plant managers and operations personnel to better track plant performance against targets and identify problem areas. Becoming aware and reporting to the right people is key to achieving operational excellence.

Table of Contents

Today’s Operational Challenge	3
Understanding operating limits.....	3
Need to Optimize Performance	3
Importance of alarm rationalization and management.....	4
Value of operations monitoring.....	4
Typical Industry Applications	5
How the technology is used.....	5
Latest Software Solution	6
Alternative to spreadsheets.....	6
Integrated with plant data sources.....	6
End User Benefits	7
Real World Examples	8
Conclusion	9

Today's Operational Challenges

The current economic climate is pushing plant management to dramatically improve the quality and timeliness of their operational decisions. Fundamental economic and regulatory forces are unrelenting in punishing plants that use outdated tools and methods to make operational decisions.

For facility owners in the process industry sector, it is important to support control engineers, optimization engineers and operations personnel who are implementing best practices for operational excellence towards the plant's business and safety goals. Personnel must monitor a wide range of measurements and key performance indicators (KPIs) from plant and equipment at a production site and maintain the required values of variables to meet operating objectives such as maximum yield, utmost efficiency and minimum emissions (See Fig. 1).



Fig. 1. For process plants, best practice operation means ensuring maximum yield, utmost efficiency and minimum emissions

Understanding Operating Limits

An operating envelope is a collection of constraints, boundaries and operating limits in an industrial facility that, when exceeded, put the integrity of assets at risk. These limits are typically based on combinations of factors such as process unit capacity, equipment constraints and safety concerns. They can also be implemented for alarm systems and operating targets.

According to the Abnormal Situation Management Consortium[®] (ASM[®]), ensuring operations remain within correct limits is central to avoiding many of the root causes of abnormal situations.

To maximize the life of an asset in an industrial facility, it must be operated according to design parameters and not simply within process safety limits. That means extending operating strategies beyond operator visibility to the entire operations team and all those interacting with the process. Without a comprehensive limit management solution, operators lack the insight needed to run plants within operating envelope boundaries.

Industrial sites typically employ multiple types of process control applications, each of which can be used to independently enter and control respective targets, constraints or limits. Although these applications may relate to the same process measurements, the limits they use are sometimes inconsistent or conflicting. This situation can result in inefficient operation, costly process upsets and unplanned shutdowns.

Various groups within the plant are responsible for maintaining safe operating limit information. As these variables are often system configuration parameters entered by humans, there is the possibility values may fall outside of the safety and compliance envelope. Additionally, some processes have dynamic safe operating limits that are continually changing, which is challenging for plant operators to manage. As these limits are adjusted for safety, reliability and optimization reasons, staff across the facility must have current and updated operations reporting to effectively manage site performance.

Need to Optimize Performance

Plant owners and operators are under continual pressure to optimize their facilities and processes. This means achieving greater productivity more efficiently with fewer resources. Data about plant performance is key to making smart operational decisions, but in most cases, operators have access only to piecemeal information about their units and processes—examining performance often in a vacuum.

Importance of Alarm Rationalization and Management

Process industry facilities typically devote considerable resources to rationalizing their alarm systems so operators can effectively manage the process and not just respond to alarms throughout the shift. Alarm rationalization involves reconciling individual alarms against the principles and requirements of the alarm philosophy. It is important that the relevant data for each alarm is documented to support the other stages of the lifecycle. This includes the alarm description, settings, causes of an alarm, consequence of no action, required operator action, response time, consequence rating, and so on.

A properly designed and well functioning alarm system is imperative to operational excellence initiatives, but it is not enough to simply operate within alarm boundaries. Operations managers need to know if units are running in a range that will assure production plans are met while staying within limits, which include (but are not limited to) equipment constraints, economic targets, environmental standards, safety system regulations and advanced process control strategies (See Fig. 2).



Fig. 2. A properly designed and well-functioning alarm system is imperative to operational excellence initiatives.

Value of Operations Monitoring

Many automated industrial plants have now implemented some type of operations monitoring program. These programs provide the tools for an operations department to establish and manage engineering limits and constraints, monitor performance to plan and limits, and to follow-up on performance problems.

Operations monitoring is meant to address questions such as:

- Are operating plans being met?
- What are the safety, process, design, reliability and environmental limits, and are these limits in effect consistently?
- If plans or limits are being violated, why?
- How can process performance and unit reliability be improved?

In many cases, operations monitoring programs make use of ad-hoc or standalone tools, such as spreadsheet applications or a combination of e-mail and printed reports, to evaluate process variables against operating limits, conduct plant data analysis and perform stewardship reporting.

Because personal spreadsheets are generally not subject to the same rigid control standards as other IT applications, errors and omissions can occur, impacting the accuracy of information used to develop planning targets and identify environmental constraints. Without a central data repository, different individuals may apply different data as the basis for reporting and decisions. Spreadsheets may also limit access to daily operating information for the rest of the organization.

In addition, ad-hoc tools linked to plant historians can be a headache for IT to support. Spreadsheets are often inconsistently applied and difficult to keep up to date when the process or historian changes, or when their owner moves to a different job or site. Plus, they may not be well suited to following through on problems once identified. Although an historian itself captures a wealth of vital data, plant optimization efforts will struggle without feedback from operations to put information regarding process limits, excursions, upsets and other activity in proper context.

Typical Industry Applications

Process facilities are increasingly challenged with improving reliability and reducing the number and severity of incidents. While the need for manufacturers to protect their people, plant and community is ever-present, economic and political developments add new concerns. Plant safety and reliability relies on early detection of potential hazards and modern protective measures to mitigate them.

Operations monitoring has evolved into an ongoing process employing advanced applications to proactively leverage fewer experts—using better technology—to focus on overall performance, often with the help of external vendors and partners. Today's virtual environment allows the enterprise to monitor each plant in real-time to achieve continuous learning and sustained improvement.

The requirements for a successful operations monitoring program includes open connectivity with plant information systems; real-time process data reconciliation and validation; an efficient and friendly user environment; low maintenance requirements; and full automation capability.

How the Technology is Used

In a typical process plant, operations monitoring can be used to monitor measured and calculated process tags against operating, safety and corrosion limits, as well as other indications of reliability. Such engineering limits typically don't change often and may have safety, environmental, or maintenance implications if they are violated.

Another common use for operations monitoring is to evaluate process data and KPIs against planning limits. Planners frequently adjust operating ranges when production strategies, product grades, or feeds change in a process unit. These limits usually change frequently and can have economic implications. Violating planning limits can mean reduced product quality, the wrong production rate, missed shipments to customers, etc.

(See Fig. 3).



Fig. 3. Operations monitoring is commonly used to evaluate process data and KPIs against planning limits.

Operations monitoring helps automate tracking actual process performance every shift. Many plants benefit from improving how routine issues are handled, before they grow into problems. For example:

- A de-salter in a crude unit is designed to operate at up to 350 degrees, but the corrosion rate increases noticeably when operated above 300 degrees. Systematically tracking excursions above 300 degrees and fixing the root causes of the deviations will extend the life of the equipment.
- A reboiler gradually fouls, reducing heat transfer and eventually limiting production. An anti-foulant is available but expensive, and the ideal injection rate is poorly understood. Monitoring the energy efficiency can help determine when an operator should look at the injection rate.
- A purge rate needs to be temporarily increased to remove impurities from a column. Monitoring the purge rate and the yield helps ensure the purge valve will be reset at the right time, which will prevent an undesirable loss of production.

Latest Software Solution

Plant operations departments are re-thinking their approach to operational excellence in order to realize the maximum benefit from ongoing technology developments. Instead of simply managing the effects of operating outside established boundaries, they are seeking to expose the operating envelope to all appropriate plant stakeholders and ensure it is well understood across operations and related organizations.

A number of specialized software programs are available to handle operations monitoring tasks. However, these programs often suffer from unnecessary complexity and high cost. They may also have very high learning curves and require special skills—making them unsuitable for use by frontline managers and plant floor operators.

Technology providers have historically offered operations monitoring applications as part of an overall operations management portfolio. However, previous generation solutions employed technology requiring users to accommodate a large hardware footprint, complex and costly server infrastructure and licensing, and extensive programming effort. This situation drove up the cost of operations monitoring programs and forced plant engineers to rely on less complicated “homegrown” monitoring techniques.

Alternative to Spreadsheets

Honeywell Process Solutions has now introduced a cost-effective operations monitoring tool known as **DynAMO[®] Operations Monitoring**. This powerful and versatile software application puts advanced operations monitoring capabilities within the reach of all types of end users—for both large and small implementations.

DynAMO Operations Monitoring is the first offering from a comprehensive operations management suite currently under development by Honeywell. Provided on a new, streamlined platform, the application builds on Honeywell’s experience in the operations management arena and will be followed by additional tools for setting daily operating instructions, managing electronic shift logs and alarms, and analyzing alarm performance.

The operations monitoring tool helps industrial organizations transition from labor-intensive, legacy plant performance spreadsheets to an automated and standardized system for facility-wide data collection, analysis, and reporting. This allows the enterprise to move beyond disjointed spreadsheets and difficult scripting languages, non-standard and inefficient processes, and inconsistent calculations requiring significant manual input.

Employing versatile Microsoft SQL Server technology, and providing a user-friendly web browser interface for plant personnel, DynAMO Operations Monitoring is designed to systematically monitor process plant performance data and summarize deviations from the operating plan. The application is ideally suited for tracking operating performance against targets and highlighting problem areas. It is designed to fit into existing work processes and help operations teams institutionalize those procedures.

Integrated with Plant Data Sources

With Honeywell’s approach, the operations monitoring infrastructure typically resides at level 3 or 4 of the plant network hierarchy, utilizing OPC data access to establish multiple connections for retrieving real-time data from historians and various other sources. Browser-based displays provide plant-wide access to monitoring results. An equipment hierarchy and status symbols help navigation (See Fig. 4).

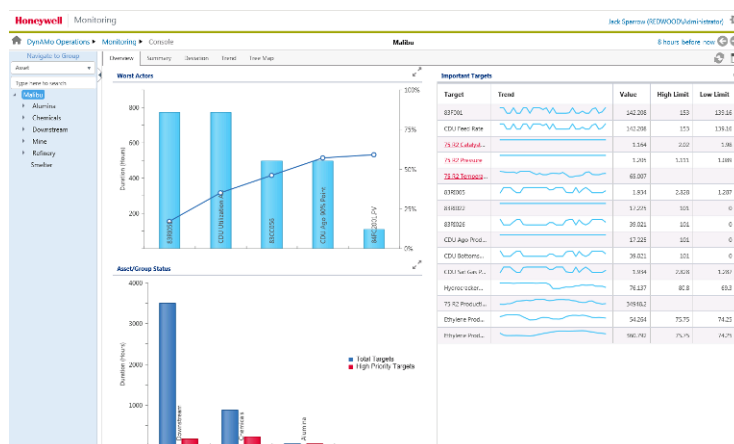


Fig. 4. DynAMO Operations Monitoring solution systematically monitors process plant performance and summarizes deviations from the operating plan.

A typical process plant might use the operations monitoring solution as follows:

- Engineers, head operators, and other staff meet every few weeks or months to review reports and comments entered by operators when considering updates to safe operating limits throughout the plant.
- Process data are monitored every few minutes. Any deviations outside operating limits are recorded.
- Operators enter comments about important deviations by the end of the shift.
- Monthly stewardship reports are available with information such as the total number of deviations, the top ten tags in each unit with the most problems, and the top reasons why deviations occurred.

End User Benefits

In a highly competitive business environment, plant operators are asked to do more than just watch over production processes and respond to alarms. They are required to have a greater business focus, which means assuming responsibility for everything from quality to cost issues. Operators must ensure units remain within energy boundaries, production targets are met, and raw materials are not wasted.

Effective operations monitoring tools enabling better decision-making are a growing necessity to meet current operational demands. Even experienced operators may not know the best operating range for throughput or may fail to realize the consequences of operating outside of targets. Furthermore, operations monitoring solutions help industrial plants move to the next level of operational excellence by leveraging the inherent benefits of alarm management initiatives.

Operations monitoring benefits come from a variety of sources, including:

- Reduced number and severity of incidents
- Reduced operating and maintenance costs through increased asset reliability
- Better safety and environmental compliance
- Increased operating margins through better fidelity to the operating plan

Honeywell's operations monitoring solution delivers these benefits by supporting a structured, systematic monitoring program. It can monitor thousands of process values—anything outside of the normal range is recorded. These deviations, or potential problems, can be quickly scanned, filtered, and considered in context. Operators and engineers are then able to assign reasons and comments to the deviations. Managers can assess actual performance and set priorities based on periodic reports.

In addition, IT professionals can take advantage of the operations monitoring solution as part of an integrated plant information system allowing them to:

- Minimize administration costs with a web user interface
- Reduce integration costs by utilizing built-in integration with other Honeywell operations and alarm management solutions
- Access process data from Honeywell and third-party plant historians
- Reduce capital and implementation costs with a common architecture across current and future Honeywell business applications

Real World Examples

Risks prevail wherever hazardous or toxic materials are stored, processed or handled. In the process industries, these risks are compounded because of their potential to impact numerous people. A spill of a toxic agent or explosion could be hazardous to a population within a plant or the surrounding area.

In recent years, there has been an increased focus on industrial safety across the globe. The need for improved understanding and harmonization of risk reduction approaches became evident with the occurrence of such major catastrophes as Seveso (Italy), Bhopal (India), Flixborough (U.K.), Piper Alpha (U.K.) and Chernobyl (Ukraine).

Refining and petrochemical operations must be particularly diligent about operations monitoring for productivity, reliability and safety reasons. Refineries process large volumes of crude oil into a vast array of fuels and materials on a 24/7 basis. Nearly all of these are volatile, combustible, toxic, and hazardous. Not surprisingly, refineries have been the sites of some of society's worst industrial accidents (See Fig. 5).



Fig. 5. Refining and petrochemical facilities must be particularly diligent about operations monitoring for productivity, reliability and safety reasons.

A major global energy industry leader implemented a comprehensive approach to operations management at its facilities worldwide. It initiated an innovative business process based on safe production techniques and partnered with Honeywell on the deployment of tools to deliver significantly improved human and equipment reliability, integrity and plant performance. From an initial installed base of six refineries in the US, the company has deployed this solution at more than 20 refineries and chemical plants across the globe.

Through the use of advanced operations monitoring technology, the energy company has sought to improve the efficiency of operators and increase the knowledge and understanding of transfers from one operator to the next, and from one shift to another, in the hopes of improving safety and overall efficiency. Key to this effort is recognition and understanding of operating limits by stakeholders across the plant enterprise.

The outcome of the safe production program has been improved reliability, increased process safety, fewer incidents and less unplanned downtime.

In another case, a major Asian energy producer was looking for new solutions to avoid incidents and improve personnel productivity. This company also partnered with Honeywell on an ambitious program to implement operations management strategies—including the latest operating monitoring application—across its large-scale refining facilities. The undertaking has resulted in significantly improved plant reliability, fewer unanticipated shutdowns, and greater overall productivity. The company expects to realize between \$12 to \$14 million dollars in annual operational improvements.

Conclusion

Now, more than ever, process manufacturers require a step-change in the timeliness and quality of decision-making in plant operations. The day when they could rely upon off-line analysis alone for competitive advantage is rapidly vanishing.

Improving operational performance and reliability requires a team effort by operators, engineers, and various other specialists within the facility. These people will benefit from advanced software tools that build on alarm management efforts and improve their ability to monitor the performance of processes and operating assets to make profitable operational decisions for both the short and long term.

For More Information

Learn more about how Honeywell's DynAMo Operations Monitoring software can improve plant performance, reliability and safety, visit our website www.honeywellprocess.com/software or contact your Honeywell account manager.

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