Examining control room operators’ work processes helps improve operational reliability and avoid incidents. Operators need to run their operations productively and safely, while avoiding costly mistakes.

For many companies, Honeywell’s Operations Management suite of tools and services enable best-in-class work practices for control room and field-based operators.
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Overview
The American Petroleum Institute and the American Chemistry Council have stated: “During the past 30 years, the 100 largest accidents in chemical and hydrocarbon processing facilities have severely injured or killed hundreds of people, contaminated the environment, and caused more than $8 billion in property damage losses. The actual cost of these accidents was in fact much higher when taking into account the associated business interruption costs, cleanup costs, legal fees, fines, losses of market share, etc.”

Unfortunately studies also show that human error is a significant factor in almost all of these accidents.

A practical definition of human error is any human action (or lack thereof) that exceeds the tolerances defined by the system with which the human interacts. Human error in processing plants, although not intended, does happen. This is not to say that processing plant employees are unskilled and error-prone, yet they do make mistakes. Why?

Studies by the Abnormal Situation Management® Consortium (ASM) have shown that 42% of abnormal situations or upsets in modern-day processing plants are caused by people or their work context. Thirty-six percent of the upsets stem from equipment problems, with half of the equipment problems attributable to operating equipment or process units outside of their “operating envelope.” To improve operational reliability and to avoid some of these incidents it is necessary to examine control room operators’ work processes. What tools do they need to run their operations productively and safely? And how do we avoid some of the costly mistakes?

For many companies, Honeywell’s Operations Management suite of tools and services answers this question by enabling best-in-class work practices for control room and field based operators. Operations Management helps operators:

- Establish operating limits for plant processes
- Validate that operating targets are within specified limits
- Monitor and control to these targets
- Communicate, report and analyze the results as part of a learning and continuous improvement effort.

Perhaps this is best summarized by the fact that Honeywell’s operations management suite of tools and services promotes People Effectiveness.
A Coordinated Approach for Managing Limits, Targets, Alarms and Information Access

Stop and think about control room alarms for a minute: How many alarms are currently configured in the systems or processes you manage? 25? 100? 1,000? How many of those alarms would go off in the first minute of a process disruption or system shutdown? Would your facility’s operators know which alarms to address first?

Now consider industry benchmarks and standards that say a typical operator can effectively deal with only one alarm per minute during a plant upset. It should be apparent that alarm management is essential in strengthening operational efficiency and averting costly disruptions and incidents. It has been estimated that the inability to diagnose and control abnormal situations has an economic impact of at least $10 billion annually in the U.S. petrochemical industry alone.

When alarms proliferate, their value as tools for diagnosing and preventing problems declines. Alarms become a nuisance to operators, who eventually will ignore or turn them off if the chattering continues. During normal operation, it’s not uncommon to have an alarm every one to two minutes.

The proliferation of alarms is a problem that technology—and those who manage technology—created. Manufacturing processes and equipment have become more complex, demanding and dangerous. The evolution of controls technology pushed process operators from single, distributed mechanical components toward a centralized, command-and-control electronic system. Over time, it became easier for operators to set alarms for system and process changes.

But consider the fact that alarms actually are single-dimension representations of what are often multi-dimensional problems. One must look at how these limits were derived. Typically, they are based on combinations of factors such as process unit capacity, equipment constraints, and environmental and safety considerations. Consequently, managing alarms is largely a matter of correctly monitoring and managing operating envelopes. It is a process in which operators and process engineers ensure alarms, operations monitoring, operating instructions and alerts are set consistently with process and equipment limits that are imposed by equipment and process design and by environmental and safety constraints.

In addition to managing these “operating envelopes,” the work process must include deployment of this information wherever it is needed in the plant. It must be available to operators via operating instructions; it must be embodied in the control system as a managed set of alarms and alerts that are consistent with constraints and limits of the operating unit; and as unified presentations of results that function as yardsticks for continuous improvement.

The effective management of this information and its dissemination constitute operations excellence and optimum people effectiveness.

Achieving people effectiveness requires that plants have the necessary tools. To meet these needs, Honeywell has developed an operational effectiveness portfolio known as Operations Management Pro (OM Pro). OM Pro is a suite of tools and services that aid the operator in maintaining multi-dimensional process operating limits, applying these limits while executing operating plans, schedules, and instructions in a consistent manner, and finally in reporting the results to their management. OM Pro is offered in conjunction with other products and services such as procedure automation tools, early event detection solutions, consulting and services for operator interface design, and advanced alarm management services—all aimed at increasing the effectiveness of the operator and the people that support them.
Functions of Operations Management Pro

The Operations Management Pro solution provides the following capabilities:

1. Establish and manage operating limits for plant processes.
2. Validate that operating targets are within specified limits.
3. Monitor and control to targets.
4. Report and analyze for continuous improvement.

Figure 1. The Operations Management Workflow
This functionality is shown as a plant site workflow in Figure 1. The steps of defining various constraints and managing them are shown as the *Define* stage. The *Plan* stage uses these constraints as it translates schedule and plan information into daily, weekly, and monthly operating targets and instructions, and the *Operate/Detect and Control* phases are where the instructions are in fact executed by the operators. *Analyze and Improve* is primarily a measuring and analysis process by which improvements can be fed back into the overall process.

The four subsequent sections of this paper correspond to each of the four workflow categories shown in the diagram above. As a site streamlines the process it uses to define operating constraints, boundaries and apply them to plant operation, Honeywell can provide the tools to enable this workflow and to ensure its success. Figure 3 summarizes the tools that make up the OM Pro software solution for the respective building blocks of the operational effectiveness workflow.
1. Establish Limits

Variables & Boundaries
The first step in a safe and reliable work process is to establish limits or operating envelopes. In OM Pro the critical, standard, and target boundaries (limits) are captured for every process unit variable or measurement and is subsequently stored in a database. Along with these limits, supporting information for the variables and limits, such as purpose of the measurement; P&ID reference; and equipment constraints (e.g., corrosion control limit, safety limit, environmental limit), are also captured. The result is a single source or complete repository for all variable and boundary information.

Alarm Documentation
For alarmed measurements, the system captures data on alarm thresholds and priorities and includes “help” information. U.S. Occupational Safety and Health Administration (OSHA) 1910.119 require that a qualitative assessment of the consequence of a deviation must be documented with safety-related limits. This information can be included in the alarm documentation database and made available online to operators. Figure 3 below shows some of the information that is entered in the initial setup.

Figure 3. Manage boundaries, alarms, limits
Mode-Based Alarms
Nuisance alarms often occur when an operating unit’s mode is changed during shutdown or startup or when the grade of the product being manufactured is changed. To avoid nuisance alarms, the system supports the definition of these various modes and the entry of multiple groups of alarm settings. At run time, the desired alarm settings can be written to the control system based on the context of the operating environment.

Management of Change (MOC)
OM Pro supports a MOC process for variable, boundary, and alarm information. This process uses change stages of in progress, proposed, approved, and released to indicate the status of a change being considered for a particular point or parameter in the system. In addition, the database includes an audit trail of variable changes and a location to store an “official” or site MOC reference number. The management of change process helps users to comply with OSHA 1910.119 requirements.

2. Validate
The next phase in the work process is the stage in which operating plans are validated against boundaries set in the “Establish Limits” phase.

Operating Instructions
In most process plants, a planning and scheduling group sets daily and weekly operating plans according to availability of feedstocks, committed product shipments, and plant constraints. But before those plans can be executed, they must be translated from planning vernacular (for example: “make so many tons of product X on Tuesday”) into operational terms (for example: “keep flows and temperatures in defined ranges”). OM Pro provides an infrastructure for converting operating plans into operating instructions complete with all the details of the plan, but in operational terms that an operator can use to execute the plan as required. Planning and scheduling staff can define numerical targets for process and quality data as well as include notes (such as standing orders) that may be important to know.

Shift personnel have full access to the complete set of instructions, and can compare the current operations to the plans. Operational changes can be highlighted, so personnel can quickly see changes that must be made. This coordinated approach to carrying out operating plan changes ensures that targets are communicated quickly, accurately, and in their entirety. The net result is consistent execution of scheduled and planned production.
Instruction Validation
A key element of this phase is the validation of targets entered in the operating instructions against the boundaries specified in the Establish Limits phase. These validation checks are performed when the instructions are created and again at run time. This process reduces the possibility of targets being set outside the safe operating range.

3. Monitor and Control
The Monitoring and Control phase of the work process includes both automated monitoring as well as manual monitoring and control functions.

Production Monitoring
Systematic performance monitoring of the process against expected targets enables operators to spot problems as they occur and make necessary corrections as required.

Deviations from operating boundaries and planning targets are automatically detected, recorded, and retained for analysis. An economic impact can be triggered automatically complete with calculated deviations ranked based on their economic impact. This also helps operators to prioritize steps to alleviate costly problems.

Operations Management performance information is web-based, making it readily available wherever it is needed. Information can be organized by shift area, equipment, target type, and economic impact. Process performance and deviations can be analyzed with Microsoft Excel, in conjunction with related process and quality data.
Proactive Process Monitoring

In many facilities the DCS alarm system has been misused to monitor the process for conditions that are not truly alarm conditions. Consider, for example, a young process engineer who feels that a reactor temperature is important to monitor on an on-going basis. The temperature is thought to have some effect on unit efficiency, but does not affect operation. The engineer has a low priority alarm configured in the DCS and sends a memo to the operators stating that they should watch for this alarm and correct as defined in the memo. As time passes the operators forget what the alarm was for, they see it on the alarm display from time to time and quickly acknowledge it, but do not act on it. The process engineer moves on to other bigger issues and problems and the alarm is forgotten. Over time, alarms like these contribute to the total number of alarms in the system and certainly are a contributing factor to operator alarm overload and to the problem of alarm flooding.

Operations Management Pro includes a proactive process monitoring function to monitor simple or complex process conditions and alert the operator when these conditions are detected. This capability can be used to monitor for process, environmental, equipment, and other types of conditions that are either monitored by the alarm system today or are left up to the operator to manually monitor. Alerts can be private (seen only by the person who created them) or public (seen by everyone). Additionally, if desired, e-mail and pager notifications can be sent when a configured condition has been detected.

The Proactive Process Monitoring function can be easily configured by the young process engineer mentioned above or by the operator.
Alarm System Performance Monitoring and Stewardship

To ensure that the benefits of the ‘establish limits’ phase are maintained, it is necessary to periodically monitor and compare the settings in the control system with those in the alarm system. It is not uncommon for temporary changes to the control and alarm systems to be forgotten, posing significant risk. In addition, OSHA 1910.119 mandates that temporary changes be monitored such that they do not become permanent.

Operations Management Pro has a monitoring and enforcement utility to compare the alarm system settings in the variable database with the control system settings and to present differences between the two. The user then can selectively enforce or write the desired settings back to the control system. This comparison function can be scheduled or done on demand. It can also be selective or automatic.

The system also maintains a complete audit trail on enforcement.

Operator Awareness

Operations Management Pro includes tools to improve the operator situational awareness. Control systems do not automatically monitor all operations; manual monitoring and operator awareness is essential to safe and reliable operations.
To improve the operator’s situational awareness OM Pro includes advanced trending tools such as ProTrend to provide the operator with easy access to superior trending right from operating graphics. ProTrend combines real time and historical trending to allow operators to create trends dynamically as Group Trends, high density 48 trend displays and specially configured traces accessible via a right click functionality from the operating graphic. Additionally, a coordinated display of trend or continuous process history and control system alarms and events is also available. Event Analyst is the tool that can be used by the operator to decipher quickly when events are recorded in relation to changes in the process.

Operators also can quickly access alarm help information defined during the “Establish Limits” phase and stored in the variable database. This information can quickly help direct the operator to the possible cause of the alarm, the recommended action, approximate time to respond, and the consequence of the alarm condition if it is not dealt with quickly.
4. Report & Analyze

The Report & Analyze activities help users maintain the benefits and make continuous improvements to their operations. This phase has a number of facets. Without this phase, the improvements made throughout the work process will not be sustained or further improved. In this phase of the operations management process the implemented system is monitored for improvement.

Alarm Metric Reporting

The solution includes an advanced alarm analysis package (Alarm and Event Analysis) for the analysis of system alarm configuration and performance. In addition to providing many pre-configured reports that can be scheduled and distributed via e-mail, the package features an application that enables users to “drill down” and analyze the alarm report information. Alarm metrics reporting tools provide reports on bad actors, standing alarms etc. will facilitate a continuous improvement program.

OM Pro’s production monitoring functionality enables users to monitor critical and standard alarms in order to capture comments and reasons for alarms. Collecting this information can help users avoid the situations in the future and improve alarm help documentation stored in the variable database and used by the operator.
Electronic Shift Report

Operators, shift supervisors, planners, and plant engineers must collaborate to optimize process operations. Getting the right information at the right time to make the right decision can be very challenging when data is not properly organized or widely accessible.

An electronic shift log (Operations Logbook) helps users optimize access and management of operations information by providing the operations staff with a common window to access operational information. Operators, supervisors, and engineers gain a consistent, up-to-date window on key operating data, problems, operating plans, the shift log and more. It can serve as an electronic logbook, recording comments and showing daily task lists and shift summaries.

Figure 10. Capture information from all OMPro sources in a comprehensive logbook
Give Me The Limits And I Will Stay Within Them!

Operations Management Pro is the solution that enables a facility to achieve the previously incompatible goals of operating within their limits (thereby ensuring the safety and health of employees, equipment and the environment) while reducing costs and improving profits. Combined with Honeywell services to assist your site in effectively deploying this software, you can capture these Operational Effectiveness benefits at your site.

An operator was quoted once as saying “Give me a target and I’ll hit it” … but more importantly from a safety standpoint they also went on to say “Give me the limits and I will stay within them!” Unfortunately, if the operator does not know these limits or if these boundaries are poorly communicated, documented, maintained or controlled then the operator will have little chance of success in this quest for excellence.

Operational excellence is the application of people, processes, and technology to consistently and reliably run at (or near) operating constraints while staying within the limits. The things that you need to provide across your operating teams are work practices, best practices, and technologies that support:

- A clear view of operating plan and targets
- A clear view of operating constraints, limits, and boundaries
- Optimized alarm system with priorities, alerts, and associated help
- Alarm system mgt. (config, monitoring and enforcement)
- Deviation monitoring and reporting (alarms, alerts, targets)
- Situational Awareness
  - Proactive monitoring of the process
  - Complete Shift turn-over log/report
  - Ergonomic Graphics designs
  - Early Event Detection
- Operator Guidance (alarm response and proc. automation)
- Deviation and Performance reporting and analysis

With these items in place then your site will be poised to optimize production & achieve the economic targets as desired. By ensuring that operations are within prescribed limits this not only aids in the goal for maximum site efficiency, but at the same time it safeguards plant equipment as well as safe, healthy and environmentally friendly production.

For More Information
Learn more about how Honeywell's Operations Management Pro can improve operations, visit our website or contact your Honeywell account manager.

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