ARC STRATEGIES

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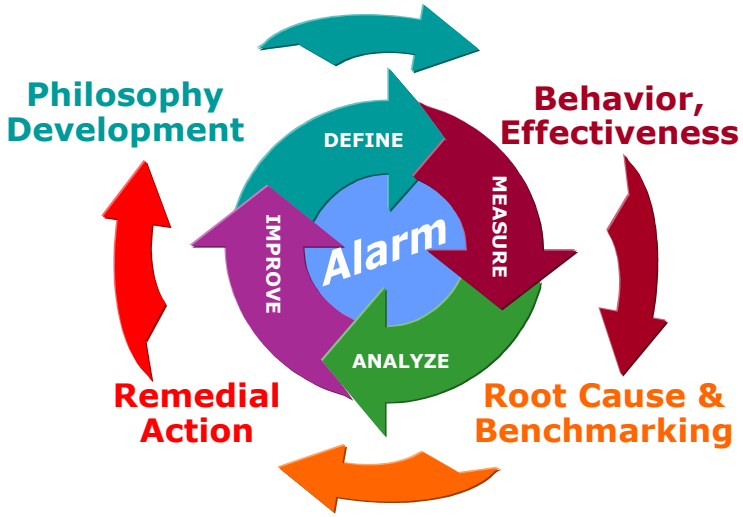
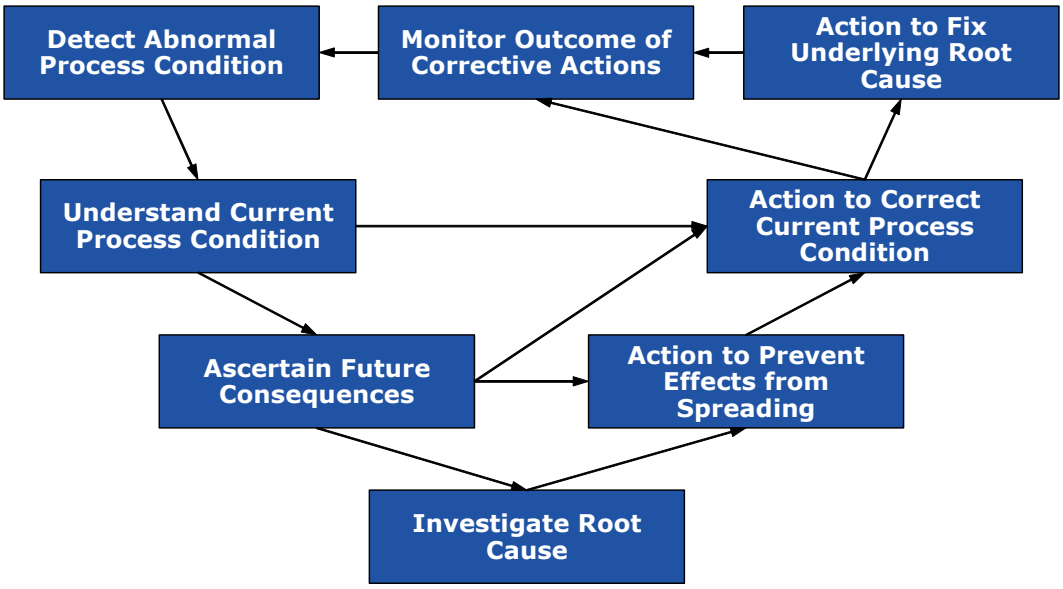
Alarm Management Strategies

ARC Advisory Group



Relating OpX to Alarm Management



EEMUA Map of Operator Response to Pending or Current Abnormal Event
Source: EEMUA Publication 191

Executive Overview

Alarm management is one of the most undervalued and underutilized aspects of process automation today. In most cases, alarm systems do not receive the attention and resources that are warranted. This is understandable, because alarming appears to be a deceptively simple activity. Many plants still use the alarm management philosophy developed by the engineering firm when the plant was built.

Alarm management is one of the most undervalued and underutilized aspects of process automation, with many plants still using the alarm management philosophy developed when they were originally built. As alarm systems become less effective, they diminish the effectiveness of all automation.

An effective alarm management implementation is dynamic. For this reason, alarm best practices and the application of a continuous improvement rationale are central to this important activity. As alarm systems become less effective, they diminish the effectiveness of all automation.

Developing a continuous improvement model for alarm management is also critical. Good alarm management practices are essential in Operational Excellence (OpX) and can have a direct impact on mitigating and preventing abnormal events as they develop. ARC has come up with a simple OpX alarm management process model to help us better convey an understanding of how OpX can provide a basis for continuous improvement.

Justifying the cost of an alarm management system can be a challenging task. Operations and engineering realize that alarm management is a serious issue, but often have trouble convincing senior level plant management that they should invest in an advanced alarm management strategy. Justification should be approached from a business case standpoint and alarm management should be looked at not as a technology, but as a risk management investment. When implementing an alarm management strategy, the goals and objectives of that strategy must be clearly communicated to all the staff who are involved, including operations, engineering, and plant management.

ARC has always advocated the implementation of standards in automation, and alarm management is no exception. Several existing and emerging standards for alarm management can help users implement a more effective strategy. Organizations currently working to provide a standardized

approach to alarm management include the Engineering Equipment and Material Users Association (EEMUA), ISA, NAMUR, and many others.

Definitions and Current Reality

Alarms are a signal to the operator that they should intervene in the process operation to correct a condition in the plant and return the process to a normal state or to prevent the process from going into an abnormal/unsafe condition. It is the first hard layer in a multilayered safety strategy. Operators should view alarms in the context of the overall plant operation. It makes no sense, for example, for an operator to have to respond to an alarm for low flow when the pump controlling the flow is shut down for maintenance. Alarms that function as they should alert the operator to a change, inform the operator of the nature of the change, and guide the operator toward a course of corrective action.

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Best practices for alarm management require distinctions between alarms and alerts. Alerts provide a warning mechanism, but do not necessarily require immediate action. Alarms should never be used as a warning, and should always require operator action. In short, alarms are not alerts. Alarms are not alarms unless they require operator action.

Alarm Management solutions consist of a bundle of best practices and tools that enhance operational performance by improving the effectiveness of alarm systems. Most modern Process Automation Systems (PASs) contain alarm management software that allows for grouping of alarms. Not all suppliers offer equally comprehensive alarm management functions. Some alarm management strategies, while comprehensive, may be extremely complex to use. Some systems are so complex they approach the abstraction of a video game. The user should make sure that alarm management functionality is on the checklist for their next PAS purchase.

Proliferation of Alarms in Process Control Is Epidemic

The age of digital process control transformed the role of the alarm. In the days of hardwired controls and alarms, engineers were very stingy with alarms, in part because each alarm point had a cost. The primary issue with

alarm systems is there is too much information for an Operator to assimilate and act on. Ten years ago, it cost about one thousand dollars to add an alarm. Current automation systems have essentially eliminated the cost of adding more alarms and, therefore, the incentive to limit or rationalize their number. With the potential for every measured point to have a high alarm, low alarm, and other variations, there are often more alarm points then there are measured variables in the process. In many cases, it is easier to add another alarm rather than rationalize existing alarms. Safety and Regulatory requirements have also added to the alarm load. Advances in automation can also trigger alarm issues. A proliferation of alarms is generated in the form of defaults with standard fieldbuses such as Foundation Fieldbus.

According to the Engineering Equipment and Material Users Association (EEMUA), for example, the DCS operator can effectively address up to 150 alarms a day, which averages out to an alarm every ten minutes. An alarm every five minutes or 300 alarms a day is still considered manageable. Of course, the reality is much different. Typical alarms for a large refinery could average over 14 thousand per day.

Long Term Average Alarm Rate in Steady Operation	Acceptability
More than 1 per minute	Very likely to be unacceptable
One per 2 minutes	Likely to be over-demanding
One per 5 minutes	Manageable
Less than one per 10 minutes	Very likely to be acceptable

EEMUA Criteria for Steady State Operations
(Source: EEMUA Publication No. 191)

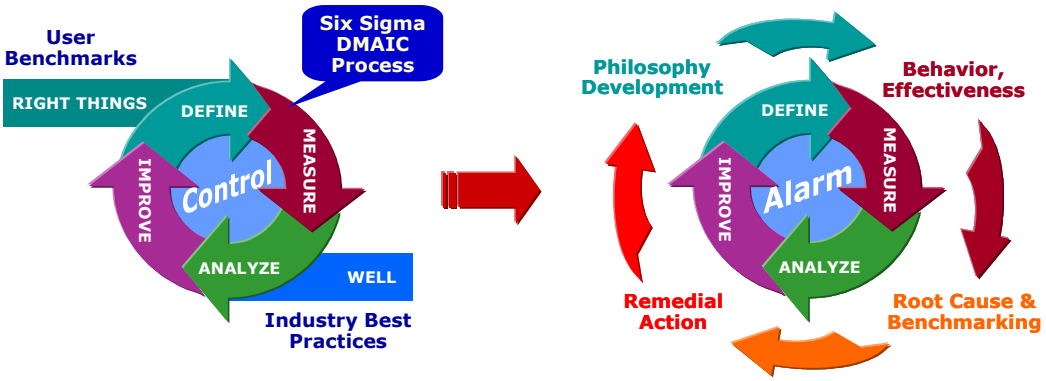
Many of the alarms in existence today are often related only to the process variable they are connected to, they are not aware of other alarms. This can result in a phenomenon called alarm showers or cascading alarms. These occur when one failure causes many process variables to trip their preset alarms. The result can be catastrophic when the quantity of alarms masks the real source of the problem and causes delays in operator corrective actions.

Multiple Sources of Alarms and Alerts Compound the Issue

Alarms and alerts in today's plants come from many sources, not just the PAS. Quality systems, Plant Asset Management (PAM) systems, and condition monitoring systems are all examples of sources that provide their own unique set of alarms that must be managed in the context of the entire automation schema.

Drive toward OpX Requires Advanced Alarm Management Strategies

The push for operational excellence (OpX) in plants today is also driving the need for more effective alarm management. Plants are operating closer to their limits than ever before, and users are continuously looking for new ways to increase OpX by reducing downtime, increasing productivity, and implanting real time performance management (RPM) strategies for their plants. Effective alarm management strategies are a key component in achieving all of these goals. The need for effective alarming is increasing dramatically in spite of the fact that most alarm systems are not effectively used. As alarm systems become less effective, they diminish the effectiveness of all automation.



The Correlation of Operational Excellence to Alarm Management

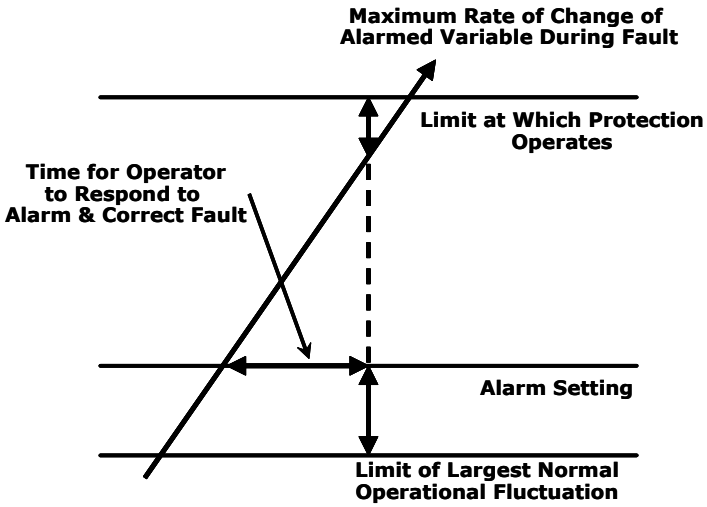
Manufacturing is moving from a demand-limited situation toward a capacity-limited situation. This forces manufacturing assets to run close to or at their design limits, which means there is not much time to respond when there is a problem. A growing void of experienced Operators who understand the process well enough to know when there is a problem and how to

react also exists. Even experienced Operators are finding it difficult to track the condition of the process because of levels of abstraction introduced by increased levels of automation complexity and sophistication.

Developing an Effective Alarm Management Strategy

The first step toward an effective alarm management solution is to develop a sound Alarm Management Philosophy. Next, there needs to be a recognized best practice for alarming, and a methodology that provides a framework to execute these best practices and facilitate continuous improvement. Many plants still use the alarm management philosophy developed by the engineering firm when the plant was built.

Finally, there needs to be a suite of tools to help manage the alarm system. At a minimum, these tools should support alarms from disparate sources, provide the ability to measure, track, and archive performance, provide quality analysis such as six sigma, and finally provide either ad-hoc or programmatic web-enabled access.



Alarm Settings Must Give Operators Appropriate Time to Respond to Faults
Source: EEMUA Publication 191

EEMUA advocates a "Culture of Improvement" when it comes to implementing an alarm management strategy. Good alarm management practices are essential in Operational Excellence (OpX) and can have a direct impact on mitigating and preventing abnormal situations as they develop. ARC has come up with a simple OpX Process model to help us better convey the concept of OpX.

OpX correlates nicely to a five-step DMAIC alarm management process. Specifically: **D**efine relates to Philosophy Development, **M**easure relates to determining Alarm Behavior and Alarm Effectiveness, **A**nalyze relates to Root Cause Analysis and Performance Benchmarking, and **I**mprove relates to the Remedial action necessary

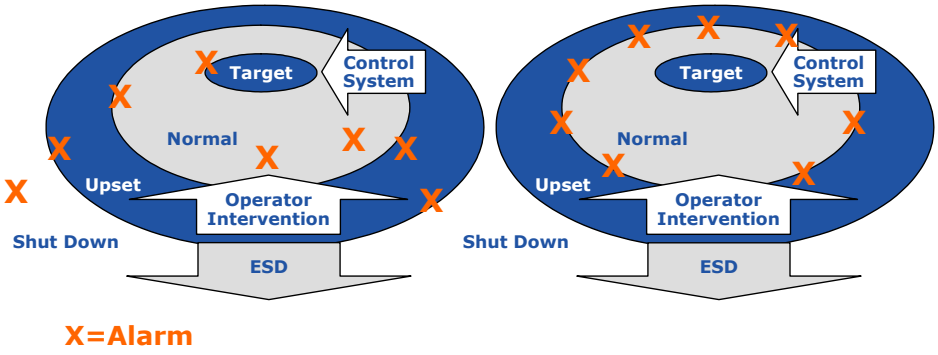
to align the prevailing implementation with the Alarm Philosophy. Finally, Control relates to Alarm execution. A more detailed discussion of this process follows:

Philosophy Development and Rationalization

There are actually two parts to this step. The first is the development and maintenance of the alarm philosophy. This document needs to cover everything anyone needs to know about this alarm system implementation. It should be considered the design definition.

The second part is the alarm rationalization. This systematic process optimizes the alarm database for safe and effective operation. It usually results in a reduction of the number of alarms, alarm prioritization, validation of alarm parameters, evaluation of alarm organization, and the number of alarms assigned to an operator, and finally alarm presentation.

Selection of alarm settings is one topic to which the EEMUA guidance devotes a significant amount of time. EEMUA's position is that alarms should be set at the point where the operator must take action. If alarms are set too conservatively, then they are triggered within normal operating parameters. Conversely, if alarms are set outside the normal operating range of the plant, it is too late for the operator to take action.



An Effective Alarm Should Mark the Point Where the Operator Should Take Action
Source: EEMUA Publication 191

Behavior and Effectiveness

This step measures what is working and what is not. Behavior is determined by auditing the current archive to determine "bad players", relative duration of states to determine variability, standing alarms, and which alarms or events trigger floods. Effectiveness is measured to determine ef-

fectiveness of administration, whether management of change is working, operator readiness to process requests, and comprehensiveness of operator interventions.

Root Cause Analysis and Benchmarking

Once problems have been identified, causes need to be determined and remedial actions defined. In this step, quantitative root cause analysis identifies problematic areas. Benchmarking, tracking, and analysis provide a basis to determine the reasons for alarm and operational problems. The analysis also provides a perspective on how well the control system is operating, the effect the alarm system is having on the Operator, and the key causes of operational problems. This step can also be used for spot incident reviews.

Remedial Action

Some examples of remedial action include implementing conformance to the alarm philosophy, elimination of nuisance alarms, tune alarm priorities, elimination of alarms with the same root cause, and recalibration or elimination of standing alarms.

Purpose of the Alarm System	Alarm Ownership
Alarm Design Principles	Assumptions
Key Performance Indicators	What Is Abnormal and Normal
Approved Alarming Techniques	Breadth of Solution (Single or Disparate Sources)
Priority Assignment	Organization and Presentation
Operator Roles	Associate Data with Events, Alarms, and Work Processes (Methods)
Documentation of Procedures after an Alarm Occurs	Meaningful and Intuitive Alarm Script that Relates to KPIs
Training	Unique Alarm Sets to Particular Asset States such as Start-up, Shut-down, Grade Changes, or Load Changes
Maintenance	Automatic Suppression of Alarms
Management of Change	Standardization and Enforcement of the Criteria to Determine Alarm Priority
Escalation Policy	

A Good Alarm Philosophy Document Should Include These Elements

Alarm Management Guidance and Standards

ARC has long advocated the value of standards and this is no different when considering your alarm management strategy. Standardization activity around alarm management is increasing. Organizations currently working to provide a standardized approach to alarm management include the Engineering Equipment and Material Users Association (EEMUA), ISA, NAMUR, and many others.

EEMUA Guidance on Alarm Systems

EEMUA Publication 191 is a recognized best practice and is considered a de facto standard for alarm system design, management, and procurement. It is well recognized and considered a "good industry practice" by OSHA. Based in the UK, the EEMUA is an organization comprised of "substantial purchasers and users of engineering products" from industries such as oil and gas, power, refining concerned with reducing costs through the sharing of knowledge and resources. EEMUA is not a standards-making body, but they do want to further the development of existing standards by sharing their knowledge with the rest of the world.

ABB	AEA	Associated Octel
Astra Zeneca	BASF	BP
Conoco	DC Mercon	Dow Corning
ExxonMobil	Flexsys	Foster Wheeler
ICI	Innogy	Lindsey
Norsk Hydro	OIS	Phillips
Pilkingtons	Powergen	Shell
Syngenta	Texaco	Transco
TXU Power	UOP	Vopak

EEMUA Members

The four core principles that EEMUA espouses throughout its document on alarm management include Usability, Safety, Performance Monitoring, and Investment in Engineering. Usability ensures that the design of the alarm system can adapt to the needs of the user and operate within the constraints of the user. According to EEMUA, a usable alarm system must "be relevant

to the user's role at the time, indicate clearly what response is required, and be presented at a rate the user can deal with, and be easy to understand.

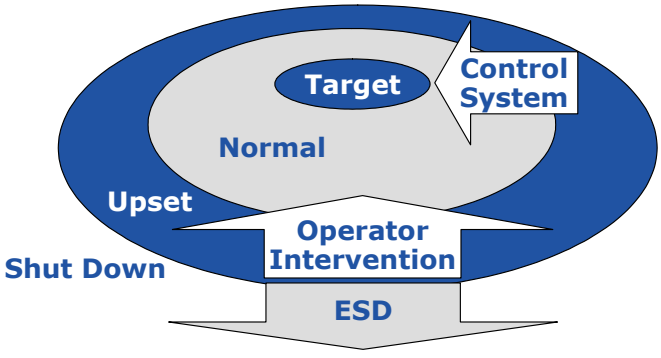
The EEMUA definition of safety means that the "contribution of the alarm system to protecting the safety of people, the environment, and plant equipment should be clearly identified." In Performance Monitoring, EEMUA states that the "performance of the alarm system should be assessed during the design and commissioning to ensure that it is usable and effective under all operating conditions".

The group advocates regular auditing throughout the lifecycle of the plant to ensure good performance. Investment in Engineering is defined as the system following a "structured methodology in which every alarm is justified and properly engineered".

EEMUA also offers valuable guidance in the role of the operator, design principles, types of alarms, alarm prioritization, and alarm system procurement. The EEMUA web site is at http://www.eemua.co.uk/indexflash.htm.

ASM Consortium

It should be noted that the EEMUA developed its alarm systems guidance with a considerable amount of input from the Abnormal Situation Management Consortium (ASM), an organization consisting of BAW Architecture, Celanese, ChevronTexaco, ConocoPhillips, ExxonMobil, Honeywell, Nova Chemicals, Shell, TTS Performance Systems, UCLA, and User Centered Design Services.



EEMUA Outlines the Role of the Operator in an Alarm Management System
Source: EEMUA Publication 191

The ASM Consortium was formed in 1992 as an extension to work that several companies were doing jointly to define improvements for DCS-based alarm systems. A number of the companies expanded this research to include management of abnormal situations and teamed up with Honeywell to form the ASM. The ASM web site is at http://www.asmconsortium.org/asm/dashboard.nsf?Open.

ISA Standards

ISA is also involved in creating standards that influence alarm management. ISA Publication RP77.60.02-2000 Fossil Fuel Power Plant Human-Machine Interface: Alarms provides guidance on development and design of alarm systems for fossil power plants, which can also be translated to other process industries. The recommended practices outlined in the documents are targeted primarily at design engineers, but can ultimately be translated to plant operators. The best practices outlined in this document are designed to reduce alarm discrepancies, rationalize alarms, eliminate excessive noise levels, and so on. Alarm grouping, prioritization, color codes, displays, and other elements are also discussed. The document can be ordered from ISA at http://www.isa.org/template.cfm?template=Ecommerce/ProductDisplay.cfm&ProductID=3000.

ISA SP18's goal is to provide a useful set of guidelines for developing and maintaining alarm systems.

The proposed ISA standard ISA-SP18 Instrument Signals and Alarms covers aspects of processor-based alarm and annunciation management as well as safety, environmental protection, equipment protection, maintenance activities, product quality, and cost-effective operations. ISA SP18's goal is to provide a useful set of guidelines for developing and maintaining alarm systems.

NAMUR

NAMUR, a European organization of users of process automation technology, offers a worksheet that sets out procedures for designing alarm management systems in process control applications. The worksheet is designed to be used as a guide during DCS specification, and serves as a maintenance and service guide during plant operations. Further information can be obtained at http://www.namur.de/.

Justification of Alarm Management

Justifying the cost of an alarm management system can be a challenging task. Operations and engineering realize that alarm management is a serious issue, but often have trouble convincing senior level plant management that they should invest in an advanced alarm management strategy.

Justification should be approached from a business case standpoint and alarm management should be looked at not as a technology, but as a business enabler and risk management investment. When implementing an alarm management strategy, the goals and objectives of that strategy must be clearly communicated to all the staff who are involved, including operations, engineering, and plant management. Commitment from plant management is especially crucial to a successful alarm strategy implementation.

Area	Benefits
Safety	Reduced risk of human injury and incidents.
Unplanned Downtime	Avoid plant shutdown, lost product, and associated costs.
Information Management	Avoid nuisance alarms, improved fault tracing.
Role of the Operator	Give operator more time to focus on the process, creating knowledge workforce.

Key Areas of Alarm Management Justification

Process alarm management is a critical topic not only for health and safety but also for business performance. For example, in the regulated industries a deviation alarm can represent a very significant accumulated cost of typically $2K to $6K per alarm or can serve as cause to destroy a batch. In the heavy process industries, an emergency alarm that escalates into an incident can ultimately result in a shutdown. Unscheduled shutdowns cost the industry between 2 percent and 5 percent of production annually. A sound alarm management philosophy also allows users to capture critical events during process upsets without being overwhelmed with nuisance alarms.

Costs associated with poor alarm management strategies include quality, lost production time, damage to assets, and endangerment to human life. The single biggest reason for unscheduled shut down is operational error at an average cost of $10M in damages per incident.

Transforming the Role of the Operator

Operators are underutilized, and the Operator of the future will play a pivotal role in operations decision making. This requires information empowerment. Alarm management is a perfect example of this empowerment.

An alarm management system has the potential to transform the role of the operator. A good alarm management system can free the operator from doing tedious or repetitive tasks and give them more time to focus on the process and make intelligent decisions that affect productivity and plant performance.

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As the EEMUA guidelines state, if an operator has to respond to an alarm every 2 minutes and it takes one minute to adequately respond to that alarm, then 50 percent of the operator's overall 's time is spend responding to alarms. The huge amount of alarms added to today's control system also mean that the operator cannot respond effectively to an abnormal situation when it does arise because they are overwhelmed with alarms.

Supplier Selection

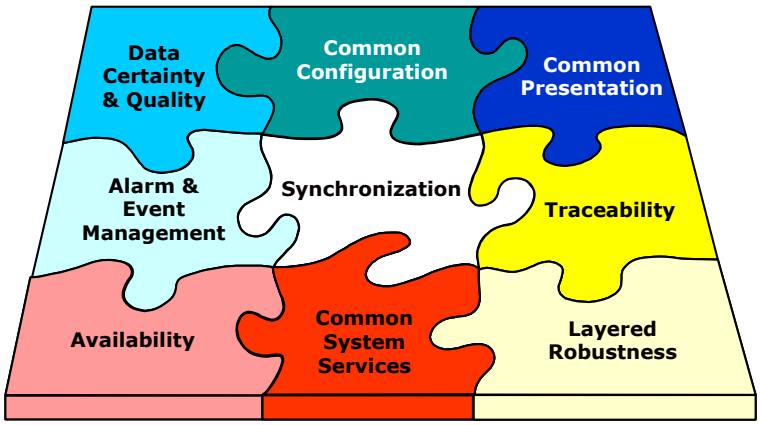
Many solutions are available today for alarm management, from fully integrated suites of alarm management applications available from the DCS suppliers to best in class applications that can be placed on top of the DCS. Services related to the deployment of alarm management solutions are available from DCS suppliers, some third party software suppliers, and engineering contractors.

ARC does not advocate either a best of breed or single source supplier approach. User must make their choices based on a sound alarm management strategy development process based on a six sigma DMAIC process discussed later in this report.

Alarm Management in Context of CPAS and CCM

One of the primary objectives of ARC's Collaborative Process Automation System (CPAS) framework is to remove the operator from an implicit involvement in the control of the process and make that close involvement explicit to the automation system. Alarm Management is a tool that supports this objective. Alarm Management also supports operators and maintenance staff by allowing them to become involved on an exception basis in a planned way.

Alarm Management is a supervisory application that users can choose to integrate into the CPAS infrastructure. Its primary function is as a tool to improve the performance of the legacy alarm systems and the process. From a functional view, it aggregates process alarms and events from disparate sources into an abstracted view then uses analytics to provide a higher level of understanding about the performance of the alarm systems and process respectively. This abstracted view provides a basis for proactive issue resolution and continuous improvement.



Alarm and Event Management Is Part of the Core CPAS Functionality Requirements

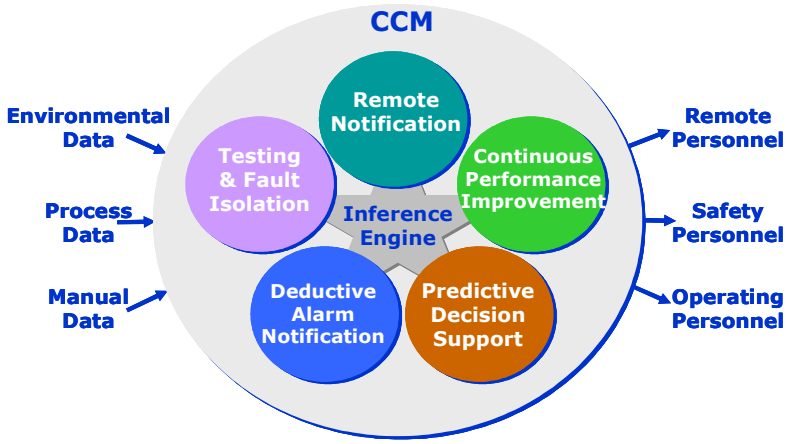
From a logical view, it interfaces to the Common Information Infrastructure (Control LAN) and subscribes to process alarms and events. Periodically an analysis is performed either manually or programmatically and the results are published to the appropriate recipients.

Alarm Management in Context of Critical Condition Management (CCM)

ARC introduced its Critical Condition Management (CCM) concept in 2002. A manufacturing plant may already have multiple layers of protection, such as a process control system, a safety shutdown system, and a fire and gas protection system. These protection layers generally work in reactive mode and provide little guidance to operators. Critical condition management, on the other hand, is usually the first soft layer, and works in an anticipatory mode across the protection layers, providing guidance to the operating and safety personnel. The major CCM functions can be categorized as deductive alarm notification, predictive decision support, personnel guidance, remote notification, and disaster recovery guidance. These functions usually operate in a knowledge base environment with an inference engine. In the past, major manufacturers pursued custom implementation of critical condition management functions. That is now changing, as suppliers are offering software packages that address CCM functions.

Deductive Alarm Notification in CCM

A critical condition is a state in a manufacturing process that is beyond normal but has not quiet reached the level of an emergency. An effective alarm strategy plays a critical role in CCM. Alarm management and alarming is primarily a tool for the operator, but is CCM a tool that utilizes artificial intelligence and expert system capability to anticipate an alarm for a critical event and alert the operator that this is the case and suggest solutions to the problem. Slowly CCM will become an integral part of operational excellence strategies and the appropriate place for it to reside is the CPAS framework.



Key Functions of ARC's Critical Condition Management Model

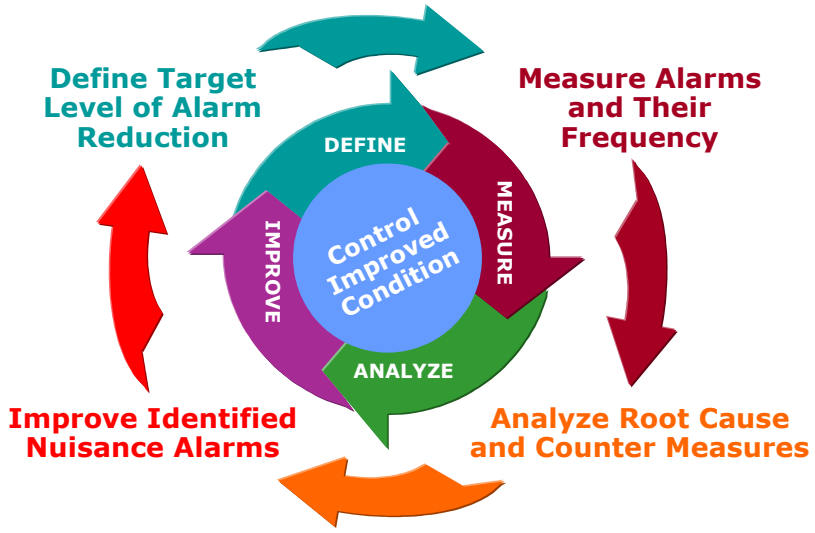
The alarm strategy must be owned by Operations. A best practice for developing an alarm strategy is to commit your best operator and your best control engineer to the project. Defining each alarm will require five to ten minutes. Bringing in a hired gun

and letting him work in a vacuum usually fails. However, critical condition management functions should always be active in the background to reduce the possibility of transition from a normal to a critical state and to minimize the effects of an emergency.

EVALCA Benefits from Alarm Management Implementation

EVAL is a major manufacturer and marketer of Ethylene Vinyl Alcohol copolymer resins. With corporate headquarters in Belgium, EVALCA is the business unit for EVAL in the Americas. Founded in 1983, EVALCA started up its Texas plant for polymer production in 1986. The plant includes three polymer lines and distillation sections with regular product grade changeovers. The plant operates continuously 24X7 with four shifts of operators per day and two board operators per shift.

EVALCA's Texas plant features a control system with 6,900 I/O points per operator, which averages out to 5,000 I/O per DCS board technician and 1,900 PID control loops per DCS board technician. Like any large continuous process plant, however, EVALCA realized that it had some issues with alarms. The plant was averaging close to 20,000 alarms per day, well beyond the benchmarks set out by EEMUA.



EVALCA's Six Step DMAIC Process for Continuous Improvement of Alarm Management

Because of the sheer volume of alarms, audible alarms had been disabled, leading to operators missing critical alarms, alarms disappearing from the display, and increased overall safety hazards. Many controllers were controlled to within 1 percent of the setpoint for high and low alarm settings. Other controllers were controlled within 5 percent of the setpoint. EVALCA believed that this unacceptably high rate of alarms posed a significant risk. The company made the decision to implement an alarm management strategy based on products and services from Yokogawa.

Business Drivers Leading to Alarm Management Selection

The company's primary reasons for choosing to implement an alarm management strategy included avoidance of potential safety or environmental incidents due to alarm overload or missing critical alarms. EVALCA also wanted to capture critical events during plant upsets, such as power outages, without being overwhelmed with nuisance alarms. The company also wanted to change the role of the operator by relieving them from the tedious and repetitive tasks of addressing thousands of alarms and give them more time to focus on improving and controlling the process.

Implementation

From a philosophy standpoint, EVALCA wanted to implement their alarm management scheme based on a six-sigma DMAIC process. EVALCA also used the EEMUA guidelines for making alarm management a culture of improvement. To do this, the company needed to make the objective of improving the alarm systems clear to all the plant personnel involved. Much of the project's success was credited to obtaining a real commitment from senior plant management in this regard.

EVALCA then proceeded to implement its alarm philosophy and rationalization program in the plant. Key people, including operators, DCS and instrumentation engineers, and machinery and maintenance engineers, were assigned to every section of the plant to identify nuisance alarms and their causes. All the staff involved were assisted and encouraged to develop a coherent and coordinated strategy for achieving their goals.

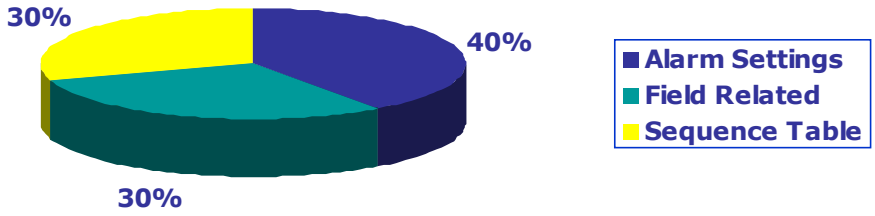
The company also took advantage of the consultancy services offered by the supplier. Tools used in the process included alarm KPI reporting and interactive analysis. The online execution engine used provided EVALCA

with automatic alarm repetition suppression, dynamic alarm optimization, re-notification alerts, and predictive alerts.

Keeping with the six-sigma DMAIC philosophy, EVALCA began with the process of defining the target level of alarm reduction it wanted to reach. Alarms and their frequency were then measured, and the root causes and countermeasures were than analyzed. Identified nuisance alarms were then subjected to an improvement process, and the improved condition is then controlled.

In the definition process, EVALCA set a target for itself to reduce the number of alarms per operator from 33.4 alarms every five minutes per operator. This metric is consistent with the EEMUA guidelines, which define one alarm per operator every five minutes as "manageable". The new benchmark would mean an overall reduction of alarms of 97 percent. In the measure step, the company discovered that there were a few tags that generated many alarms. Using their toolkit, EVALCA could identify these problem tags and take corrective action in the improvement step.

In the analysis step, the top 40 alarms in the plant were analyzed and the root causes were identified. About 40 percent of the top 20 alarms in the plant were related to alarm settings and control strategies, while about 30 percent were field-related. The additional 30 percent of the top 20 alarms were related to sequence tables. An improvement solution for these alarms was then determined based on difficulty, labor, and cost. Where practical, alarms were completely reengineered or automatically suppressed by the alarm management application suite.



Root Causes of the Top 20 Alarms at EVALCA

In the control step, the company continues to use the alarm management suite of applications and continues to tune the setting of the alarm management application to suit the process. The next highest set of 40 alarms were then evaluated and improved. Alarm settings were also reevaluated for control loops, and instrumentation is repaired where problems were

identified with instrument-related alarms. The company then evaluated dynamic alarm settings for control loops so they can adapt to process changeovers.

Achieved Benefits Are Significant

EVALCA achieved many benefits from the implementation of its alarm management strategy. Alarms are more meaningful, and operators no longer need to turn alarms off, and the problem of important alarms being turned off has substantially reduced the risk of a major process upset and unplanned downtime, as well as associated safety and environmental concerns. Operators have more time to attend to true process concerns instead of nuisance alarms. The alarm analysis application that was deployed reduced the paper trail that was previously required to track alarm events.

Ultimately, the company achieved a 93 percent reduction in alarms. While the ultimate goal of one alarm per five minutes per operator was not reached, EVALCA did achieve the goal of 2.28 alarms per five minutes per operator – a substantial improvement. Once the dynamic alarm settings for control loops are implemented, the company does expect to achieve the one alarm per five minutes goal. The company realizes that alarm management is an ongoing process, and the continued support from management will ensure the success of the program as a continuous improvement process.

Recommendations

- End users need to explore the benefits of developing, implementing, and managing an alarm management philosophy.
- Alarm Strategies should be viewed as a continuous improvement process with guidelines and procedures for periodic review and evaluation of alarms.
- Utilize the EEMUA guidelines as a best Practice and OpX as your methodology for continuous improvement.
- Manufacturers with older legacy systems with inadequate alarm functionality should either look to automation system suppliers to replace or upgrade their systems or look for third party software suppliers that

can provide add-on alarm management functions to meet their alarm management strategies

- Supplier selection is a crucial step in the process of implementing an alarm management strategy. Choose a comprehensive toolset up front.
- Suppliers need to provide their users with alternatives that fit their specific alarm management requirements. Above all, alarm management should be made as easy as control strategy management is.

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ARC analysts and consultants have extensive, first-hand experience in all types of technologies and applications. They constantly expand their knowledge base through supplier interviews, user surveys, and customer visits. The ARC database contains the latest information on technologies, standards, products, and capabilities of thousands of software and solution providers.

About Yokogawa:

Yokogawa's global network of 18 manufacturing facilities, 91 affiliate companies, and over 500 sales and engineering offices spans 28 countries. Since its founding in 1915, the US$3 billion company has been engaged in cutting-edge research and innovation, securing more than 4,500 patents and registrations, including the world's first distributed control system and the first digital sensors for flow and pressure measurement. Industrial automation and control, test and measurement, information systems and industry support are Yokogawa's core businesses. Please visit Yokogawa's web site for more information at www.yokogawa.com.

Yokogawa's AAASuite is an integrated alarm management solution and provides EEMUA No.191 compliant functions of alarm systems. Its automatic alarm suppression function identifies typical nuisance alarms online based on embedded diagnostic logic, and suppresses alarm repetition automatically. If process condition is recovered after the suppression, AAASuite automatically returns the suppressed alarm to its original state. This eliminates the need for operators to turn off nuisance alarms manually, and enables important alarms to remain online. Please visit Yokogawa's web site for alarm management solution at www.AAASuite.com.

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Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/Community/terms/terms.htm

API Application Program Interface
ASM Abnormal Situation Management
BPM Business Process Management
CAS Collaborative Automation System
CCM Critical Condition Management
CMM Collaborative Manufacturing Management
DMAIC Define, Measure, Analyze, Improve, Control
CPAS Collaborative Process Automation System
CPM Collaborative Production Management
DCS Distributed Control System
EAM Enterprise Asset Management
EEMUA Engineering Equipment & Material Users Associations
ERP Enterprise Resource Planning
ESD Emergency Shutdown
HMI Human Machine Interface
ISA Instrumentation, Systems, and Automation Society
KPI Key Performance Indicator
MRP Materials Resource Planning
OpX Operational Excellence
OEE Operational Equipment Effectiveness
PID Proportional Integral Derivative
PAS Process Automation System
PLC Programmable Logic Controller
PLM Product Lifecycle Management
RFID Radio Frequency Identification
ROA Return on Assets
RPM Real-time Performance Management
WMS Warehouse Management System

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