White Paper: Alarm Rationalization Bounded vs. Unbounded Approaches

Introduction

The term 'alarm rationalization' may conjure images of hours spent behind closed doors, laboring over the details of alarm activation points. Indeed, there was a time when industry in general felt that rationalization was essentially "all or none." Unless the entire system had been rationalized, you had not rationalized anything at all.

Under that precept, alarm rationalization demanded tremendous effort. For some manufacturers, a full-scale rationalization was out of the question. They simply did not have the resources, time, or justification for that magnitude of a commitment. However, they were unwilling to retreat from their alarm problems. Instead, they did what they could, correcting alarm problems on a case-by-case basis.

Logically, the two different approaches can arrive at the same result. In the wake of "fully rationalized" alarm systems that did not perform as expected, the value of alarm rationalization suffered increasing criticism. As more experiential data has been gathered, the concept of rationalization has changed. The activity of rationalizing, reviewing and redesigning an alarm, is now independent from the definition of a rationalized alarm system.

The Act of Rationalization

Rationalizing alarms is a simple activity that forms the kernel of an alarm management program. In its very basic sense, alarm rationalization is the process of determining the reason for an alarm (or absence of one) and its appropriate settings, essentially refining down to two basic questions:
- Does this issue require an operator response?
- If so, how should it be designed?

Other activities associated with alarm management projects simply serve to provide some structure to the process of circulating alarms through the rationalization workflow. Common activities associated with alarm management include:
- Creation of an alarm philosophy
- Benchmarking and analysis of alarm performance
- Managing changes made to alarm settings

Structuring Rationalization

Creation of an Alarm Philosophy

An alarm philosophy helps define how we answer rationalization questions. Who is involved in the process? What are our design considerations? How do we choose the alarms we are going to evaluate? What are our performance benchmarks?

A philosophy does not have to be written or typed to exist. If a person has made a decision about changing, keeping, removing, or adding an alarm, that person applied a philosophy to that decision. Their internalized understanding of the operation and the resulting decision criteria guided the outcome of the alarm review.

In contrast, a written philosophy is much better suited for more formal alarm management efforts because people from various departments are then able to review and comment on the philosophy contents. The final outcome is then available for application along the way and for nicely organized document review if necessary. In someone's mind or in an official site document, a philosophy functions as a guideline for alarm design decision making.

Benchmarking of Alarm Performance

Benchmarking alarm performance provides a way to identify alarms that need to be rationalized. How is our alarm system performing now? How does that compare to our performance expectations?

Benchmarking doesn't necessarily involve data. A benchmark can be completely subjective, amounting to no more than a quick email or scribbled note, "Please look into the HI-HI alarm on Tank 3 level sensor. It seems to be acting up." That simple note has identified an alarm that is not performing as it is expected to (or at least as someone expects it to).

Subjective identification of alarm performance problems can only be practical for so long. As an alarm management effort becomes more advanced, subjective identification and data analysis become partners in accurately locating alarm performance issues.

Managing Changes Made to Alarm Settings

Change management functions as a check and balance for the alarm system. What tags have we already rationalized? What changes need authorization before they can be implemented? Why are some alarms set differently than how the rationalized design says they should be?

Unmitigated changes to alarm settings can be counterproductive. A method of controlling modifications ensures the quality of updates and preserves alarm management efforts. More comprehensive alarm management programs usually involve more than one person, requiring collaboration and documentation. Where only a single person is involved, that person alone takes on responsibility for protecting the integrity of the alarm system. It can be a heavy burden, but sole ownership tends to foster strongly protective tendencies regarding alarm system settings and changes.

Degrees of Rationalization

While the activity of rationalization is straightforward, its application can range from simple to extremely complex depending on resources and objectives.

If you've ever reviewed or changed an alarm, you have "done" alarm rationalization. You singled out an alarm, reviewed it, made a decision based on some kind of logic, and implemented the result. You effectively cycled an alarm through the process of rationalization, applying all the necessary rules and procedures.

In contrast, a team effort could consist of a multi-department group meeting where an alarm is debated resulting in a final proposed design. That design passes through a formal approval process, implemented only after appropriate documentation is completed. The new design is monitored for its performance impact and becomes subject to standard configuration check procedures.

These two scenarios basically describe the extremes of alarm rationalization "methodologies". Although there are virtually infinite variations in the way alarm rationalization may be applied, methodologies essentially fall into one of two categories, Bounded or Unbounded.

A Bounded Rationalization has a conclusion – boundaries defined by time, an alarm analysis, a physical scope, equipment type, risk – even manual identification is a valid method of defining a rationalization project boundary.

Bounded Rationalization Examples

Alarm Analysis
- Top twenty alarms
- Alarms that activated in last 60 days

Physical Scope
- One unit operations

Equipment Type
- All reboilers

Risk
- High environmental discharge liability
- Shutdown potential if coolant or steam supply drops

Manual Identification
- Operator survey

Unbounded Rationalization

In contrast, Unbounded Rationalization has no conclusion, no end. It employs some kind of trigger that inserts an alarm into the rationalization process, and that cycle repeats indefinitely.

The best alarm management programs employ a mix of Bounded and Unbounded methodologies. Once you declare that a system has been rationalized, there is a paradigm shift in the way the system will be used by operations. If some alarms have been rationalized but some have not, how do they know which are which? The viability of your rationalization effort just went to zero. Therefore it is extremely important to properly bound your project.

It is not necessary to rationalize an entire plant to claim a rationalized system, it is necessary to properly define "system". Because the operator is the "consumer" of a rationalized system, the boundaries of a "system" should be distinctly oriented around an operator's field of responsibility. Therefore, one unit operations is the minimum scope required in order to claim that a system has been fully rationalized.

Understand, however, that other types of Bounded Rationalizations do have value. In fact, even a Bounded Rationalization is never really complete. A process control system is a dynamic entity. An alarm management program must allow for these dynamics or it will fail. There should be a mechanism in place for regular review as well as for feedback regarding future issues with alarm performance.

In order to ensure operations continued respect and utilization of a rationalized alarm system, three things must be in place: 1) Operators must be involved in the rationalization process, 2) They must be given the ability to continue to identify alarms for review after the bounded rationalization is complete, 3) They must see action being taken on suspect alarms.

The magnitude of an alarm management effort, large or small, is determined by the way the rationalization task is applied. Rationalization is the core activity that serves as the focal point for alarm management. Its output becomes the implemented alarm.

Alarm system performance can be improved with large or small efforts, but it is important to understand the limitations and differing degrees of impact that various techniques will achieve. Clarifying the meaning and position of rationalization frees us to incorporate the activity of reviewing alarm system design as appropriate for our environment, industry, process, available resources, and objectives.