Ask the Experts
Abnormal Situation Management

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Q. How can I improve abnormal situation management (ASM) in my plant?

Two key areas for improvement are the operator displays and the alarm system. A challenge to the designer of the displays is providing appropriate information to keep the operators aware of the overall plant situation and, at the same time, provide adequate detail to take appropriate action. This requires designs with the proper hierarchy of displays, information content and style of presentation, as well as the tools for navigation between windows. This is achieved via appropriate user-centered design of the screens. This assures that operator's displays are consistent with human-factors and that all interfaces are designed for the tasks they support. Scenario-based design, including both normal and abnormal situations, assures that the content and navigation are appropriate for the operator's tasks.

An interface that allows the operator to understand the control scheme offers a chance for improved operator effectiveness. Not only does this assist in routinely using an advanced control operation, but it also helps in understanding advanced control strategy — enabling effective monitoring and intervening when appropriate. It can be challenging to understand the controls well enough to diagnose the need for intervention, especially for complex multivariate-control schemes. Further, when an advanced control application fails, the operator is expected to initiate automatic control, where possible, and manual control, if necessary.

Providing information to assist operators in making the right decision in a given abnormal situation is helpful. This can be as simple as assuring that procedures, plant documentation and alarm-related information captured during the alarm rationalization process (discussed below) are available. This information can also be obtained directly from the operator displays via context-based access of supporting information and applications.

Alarm system design must also take into account human factors, particularly those related to the operator's ability to process information. This is the underlying principle behind the frequently discussed concern for alarm floods and standing alarms, and the motivation for improving the alarm system to minimize these problems. Alarm floods occur when an incident causes many alarms to occur in a relatively short period, making it difficult to understand the root problem and take appropriate action. Standing alarms are those that remain active for a long time, possibly, days. If many alarms are standing at a given time, then any new alarms are less obvious to the operators, delaying their response to them. The desired situation is that the alarm summary is usually "black," that is, no alarms are displayed.

Distributed-control-system (DCS) alarm systems have too often been configured without being driven by a reasonable and appropriate philosophy. The overarching principle is using the alarm system to provide a unique indication of the need for urgent action to avoid an incident. Typically, the concern is safety, health, environment or major economic impact. All too often, many alarms are configured because it is easy enough to do so in the typical modern DCS, and the alarm seems to be of value.

A comprehensive alarm improvement program can remove unneeded and redundant alarms, as well as eliminate standing alarms that also reduce operator effectiveness. Alarm rationalization, a key part of improvement, assures that all risks deserving alarms have one with a priority consistent with the philosophy and a trip point that provides enough time to respond, but not so much that the alarm can initially be ignored and potentially forgotten.

Ensuring alarm-system effectiveness is helped by managing the system's configuration and monitoring its performance. A source of potential confusion can be eliminated by starting every shift with identifying any alarms with nonstandard configurations and making it simple for the operator to return exceptions to the standard setup. Also helpful is assisting in adjusting the alarm configuration to changing plant situations. This could include help in removing standing alarms from out-of-service equipment, as well as providing more effective alarms by adjusting settings for varying feedstocks, different times of the year, or other conditions. A tool that captures the desired alarm configuration for each plant situation during the rationalization process and the associated design rationale, and actively manages the alarm system configuration, simplifies the work process and improves the likelihood of keeping the system consistent with the intended plant state.

Early event detection — finding problems before they become alarms — provides additional time to diagnose and respond to impending events. A variety of techniques is available for doing this, including simple ones such as: an auxiliary notification method with operator-configurable alerts based on process variables; algorithms to identify conditions such as sticking valves and oscillating signals; state estimator technology that compares current conditions to signatures of normal operation using multivariate statistics; and expert systems configured to identify abnormal process conditions. Use of state estimator technology in broader-scope situations, such as an entire process unit, is being explored.