



WHY WE NEED EFFECTIVE ALARM MANAGEMENT

Paul Garnham

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We have moved from relatively low numbers of hardwired alarms to an unlimited interpretation of signals to warn of potential issues. Over the years systems have evolved to sites with multiple control systems and added IoT, AI etc. All of which are increasing the frequency, complexity and volume of alarms and events, which can potentially create an unsafe environment in control rooms and remote operations centers when alarms are designed to do the exact opposite.

Mismanagement of Alarms are reported as potential incidents every year in process industries. Alarms without any action is a liability but this can be addressed through a proper Alarm Management System. An alarm should create an action by an Operator to prevent potential operation of an automated Safety Instrumented System which can lead to downtime and potential damage to equipment.

An alarm management program is about, mitigating, preventing and minimizing the impact of abnormal situations. Management of alarms including processes and practices for identifying, recording/documenting, designing, monitoring and maintaining triggered alarms from process automation system including automated Safety Instrumented Systems.

THE PURPOSE OF ALARMS

Alarms define the boundary between normal and abnormal conditions of a process. Alarms alert operators to take corrective action to return the process/control loop to normal conditions and provide a layer of protection against hazardous scenarios. Typically, corrective actions are based on human intervention and as such are limited by factors such as knowledge of operators, training, and standard operating procedures. This corrective action must be taken within a certain time before it leads to process upsets or endangers safety of the plant or personnel.

The ultimate layer of protection are automated process safety systems (SIS/ESD). These safety systems are designed to act without human intervention. The process

systems/control loops are provided with alarms to take action by operators as a part of typical process control system, however if the process cannot be recovered to normal operating conditions then the next action is automatically taken by the process safety system to avoid a hazardous event taking place.

ALARM SYSTEM PROBLEMS

Nuisance alarms

Indicates an abnormal condition when none really exists or no consequential change in process conditions irrespective of such triggered alarms to operators. These alarms enforce a casual approach of operators over the time and desensitize them. Good examples are instrument generated alarms within normal operating conditions. Nuisance alarms should be immediately investigated and corrected; reduction of nuisance alarms is a continuous process until a stable, steady-state operation is achieved.

Stale Alarms

Stale alarms are those that remain in annunciated for more than 24 hours. These may be alarms that do not require a response or alarms that once did require a response, but the response is no longer needed. These alarms clutter the alarm summary and desensitize the operator.

Operator Response

Clarity of what response is required by Operators for all alarms plays a crucial role in effective operation of assets. Therefore, Operators need to be well trained regarding all types of alarms and the action required and supported by relevant information to assist such as Standard Operating Procedures (SOP's).

Alarm Floods

Alarm floods are a temporary high rate of alarms, usually associated with an event such as a process upset which floods and overwhelms the operator. Floods mask the decision-

making process on critical or important alarms reducing the operator's ability to correctly respond to the upset. Alarm floods are measured by the rate of alarms in the given time of interval with a threshold. Alarm floods are one of the more difficult problems to solve and arrive at a conclusive decision. A good Alarm Management System should provide an accurate time stamp of events to solve such issues and provide this within the context of the process hierarchy. This is particularly important for more complex and cascaded control loops. The main objective of alarm rationalization is not reducing the number of alarms but to reduce unnecessary alarms and provide tools to quickly understand the root cause and action for any situation. However, it is good idea to avoid and reduce the duplication of alarms during alarm rationalization process.

Frequent Alarms

An indication of potential failure and should be an indication to proactively maintain equipment before its fails. Urgent attention is required if alarms are too frequent. (Top 10 & Chattering are example of this). If alarms are set incorrectly then a reevaluation of the setting may be required.

Suppressed / Disabled / Shelved Alarms

Preventing indication of the alarm to the operator.

Master Alarm Data / Variable Table

These are generally tabular (Excel) and details all the possible process alarms with their potential impacts, consequences, and suggested Operator responses.

A good Alarm Management system can highlight where the issues are, what the causes of the issues are and provide the right amount of information for the operator to make the right decision.

WHAT CONSTITUTES POOR ALARM MANAGEMENT?

- No alarm despite indications of an event
- Alarm suppressed or disabled

- Poorly set alarms causing nuisance alarms
- Regular flooding of alarms creating confusion and poor decision making
- Slow response due to alarm fatigue or missing alarms in flood events
- No clear cause of alarms

WHAT CONSTITUTES GOOD ALARM MANAGEMENT?

- Identifies real problems in a timely manner
- Identifies the right information to enable an operator to act safely
- Improves Operator effectiveness
- Protects the plant equipment and process
- Reduces losses and downtime
- Enables better understanding of plant condition and how it is operated
- Collect data and benchmark your system
- Perform alarm documentation and rationalization
- Implement alarm audit and enforce technology
- Implement real time alarm management
- Control and maintain your improved system

Alarm Management begins at the design of the process system itself and is reflected in P&IDs. The challenges begin once a plant is running and problems become more evident and they must be met with a good Alarm Management strategy. The next important step is analyzing, classifying and making decisions around alarm rationalization.

ALARM RATIONALIZATION

"Alarm Rationalization" plays a key role as a part of the Alarm Management cycle, it is the process of examining one alarm at a time against the principles and design of safety standards within the plant. Rationalization starts with identifying the right alarm level for the right signal and associated action. The alarm is then prioritized based on severity of consequence and response time (at all not to be underestimated).

Abnormally high process alarm rates can usually be traced back to a few “bad actor” alarms. These alarms are the result of instrument faults, poor DCS/SCADA configuration or process design. Excessive alarms to the operators create an active hindrance to their ability to act effectively as well as an operational culture of alarm acknowledgement without proper analysis.

PERFORMANCE METRICS

A popular approach to Alarm Management is to use the following performance metrics

- Alarms per day
- Alarms per 10 minutes
- Alarm flood analysis
- Most frequent alarms
- Chattering alarms
- Alarm Priority Distribution
- Stale Alarms

These days a very high emphasis is given for process safety analysis but at the same time alarm management must be part of the overall strategy to operate in a safe manner and can be benchmarked as follows:

- Less than one alarm per 10 minutes: very likely to be acceptable
- One alarm per 5 minutes: Manageable
- One alarm per 2 minutes: Likely to be very demanding
- More than one alarm per minute: Very likely to be unacceptable

ALARM IMPROVEMENTS

Many companies will periodically re-examine every alarm configured on the system and identifying points where improvements can be made.

- Identify and rectify misconfigured alarms

- Create proper alarm settings
- Ensure consistency in alarm settings
- Eliminate duplicate & nuisance alarms
- Ensure meaningful alarm priorities
- Document alarm information for operators
- Create master alarm database
- Adjust alarm dead band settings

ALARM MANAGEMENT SYSTEM

An Alarm Management System will identify alarm problems to implement corrective strategies. Preventing a single un-planned shutdown can provide the justification to implement an Alarm Management System.

A good management system should provide the tools to analyse all this information with tools for extracting high level data right through to event by event analysis to understand the underlying cause. It should simplify the ongoing maintenance of alarms from simple systems right through to an advanced alarm management system.

- Configurable data to multiple sites and plants
- Use existing data infrastructure
- Data reporting to determine top alarms, priority distribution, alarm rates, etc.
- Alignment to the ISA TR 18.2 alarm management standard
- Correlate operator logs, notifications, analytic results and alarms into one searchable log
- Chronological log of plant events with correlation to process data
- Full search features
- Alarm grouping
- Post event and ad-hoc analysis
- Trend process data against associated alarms
- Fast and easy rollout without requiring client-side deployment
- Fully configurable
- Integrate documents SOP's.

- Add comments, operator response, probable cause etc.
- Provide documentation for consequence of deviation
- Suggested corrective action or SOP's
- Integrate to Maintenance systems



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