Overview of PAS

Alarm Management Industry Issues

Operator’s Role for Plant Safety

ISA 18.2 – Does it apply to you?

Strategies for Alarm Management
About PAS

Founded in 1993

- Provider of Human Reliability Software™ for safe production
- Serving Power, Oil & Gas, and Processing industries globally
- Sustainable and profitable growth

Business Strategy

- Innovative technologies inspired by domain expertise
- Strategic customer relationships
- Mission critical safety and environmental solutions
- 20% R&D Reinvestment

Thought Leadership & Strategic Partnerships

- Alarm Management and HP HMI Handbooks
- AICHE, NPRA, EPRI, ISA, EMMUA 191, OSHA
- Honeywell, Invensys, Intergraph and regional partners
PAS Solutions

Realize the Full Potential of Your *People and Automation Systems*

**Operations Effectiveness**

Achieve *Superior Operator Performance* and *Reduce Vulnerabilities* during abnormal situations and steady state operations.

- Improve Disturbance Rejection
- Minimize Operator Loading
- Optimize Situational Awareness
- Enable Accurate Operator Actions
- Expand Layers of Protection for Safety

**Automation Effectiveness**

*Map the Automation Genome* and expose new possibilities for knowledge retention, collaboration, and decision support.

- Retain Important Plant Knowledge
- Provide a Collaboration Platform
- Enable Change Tracking/Defect Detection
- Provide Disaster Recovery
- Ensure Accurate Documentation
Layers of Protection

1) PID Control – First line of defense
   - Steady state operation
   - Transition handling
   - Minor disturbances rejection
Layers of Protection

1) PID Control – First line of defense
   • Steady state operation
   • Transition handling
   • Minor disturbances rejection

2) Operator Intervention
   • Operator HMI
   • Alarms

Operator Support Systems

Often fail the operator when they are adding the most value (examples to follow)
Layers of Protection

1) PID Control – First line of defense
   • Steady state operation
   • Transition handling
   • Minor disturbances rejection

2) Operator Intervention
   • Operator HMI
   • Alarms
   • Dependent upon severity of event & operator competence

3) Safety Instrumented System
   • Last automated line of defense
   • Safe unit shutdown
   • No immediate point of return
Industrial Incident Examples

- Texaco Milford Haven
  - On July 24th, 1994, a tremendous explosion occurred at the Texaco Refinery in Milford Haven, Wales
  - A severe electrical storm early morning caused a system upset
  - An explosion occurred 5 hours later during a complex re-start
  - 26 injuries resulted from this explosion
  - HSE Cited Alarm Overload as a contributing cause
  - Over 275 alarms in the last hour before explosion

- BP Texas City
  - March 23, 2005, a series of explosions occurred during the restart of a hydrocarbon isomerization unit
  - 15 people killed, 170 injured
  - Alarms & HMI were cited by OSHA as a contributing factor
  - Over 130 alarms in the last hour before explosion
  - See www.chemsafety.gov and www.bpresponse.org
In this case, the alarm system was worthless when the operator was providing the most value to the process!
ANSI/ISA 18.2 Standard

- Management of Alarm Systems for the Process Industries
- A vital and essential next step for alarm management
- Began in 2003
- Released June 2009
- It includes “the WHAT”:
  - A framework of alarm management life cycle steps and activities
  - Mandatory and recommended practices
  - Additional content will be published in follow-up
- It does not have “the HOW”:
  - Detailed or specific “How to” guidance
  - Work practice examples
  - Specific method recommendations or details
ISA-18.2 Application

- **Does ISA-18.2 Apply to You?**
  - YES – if you have a DCS, SCADA systems, PLCs, or Safety Systems, or anything where an operator responds to alarms!
  - Petrochemical, Chemical, Refining, Platform, Pipelines, Power Plants, Pharmaceuticals, Mining & Metals. Also for continuous, batch, semi-batch, or discrete processes.

- **Grandfathering**
  - ISA-18.2 states: “The practices and procedures of this standard **shall be applied** to existing systems in a reasonable time as determined by the owner/operator.”
ISA-18.2 Regulatory Impact

- ISA-18.2 is a “recognized and generally accepted good engineering practice” (RAGAGEP)
- OSHA and other agencies have “general duty” clauses
  - “The employer shall document that equipment complies with recognized and generally accepted good engineering practices”
- Regulatory agencies ARE TAKING NOTICE
- A regulated industry can be expected to either comply or show they are doing something “just as good or better”
- The OSHA Regional PSM Coordinators and the CSB (Chemical Safety Board) now have approval to internally distribute ISA-18.2 to their inspectors. They specifically wanted to be able to easily cite it in investigations and for enforcement reasons.

Standards are “Backdoor Regulations!”
ISA-18.2 Regulatory Impact Examples

More examples:

**Comparison of NEP and Prior PSM Inspections**
- Citations in the NEP reflect the focus on PSI, Incident Investigation, and the various elements involving RAGAGEP in PSMs, and improved CSHO training.
- Refineries are not resolving PHA and audit findings and recommendations at a rate expected of large, sophisticated employers.

**j(4) Citation Examples**
- Process piping not inspected per facility's I&T program.
- I&T schedule on relief valves not adjusted when valves found to be heavily fouled.
- Cathodic protection system & process analyzers not tested per employers program requirements.
- No inspection data for critical process piping circuit.
- Monitored thickness measurements not resolved per RAGAGEP (e.g., API 570).
- Audits reading not documented.

**j(4) Requirements**
- **MI:** Inspection & Testing:
  i. Inspections and test shall be performed on all process equipment.
  ii. Procedures shall follow RAGAGEP.
  iii. I&T frequency consistent with applicable manufacturers’ recommendations & good engineering practices, and more frequently if determined to be necessary by prior operating experience.
  iv. Document each I&T performed, including:
     - Date of I&T
     - Serial number or identifier of equipment
     - Description of I&T performed
     - Results of I&T

**d(3) Citation Examples**
- P&ID's not accurate.
- Relief system design & design basis not documented.
- Failure to document that equipment follows RAGAGEP.

**d(3) Requirements**
- **PST:** Pertaining to equipment in the process:
  i. Information shall include:
    - Materials of construction.
    - P&IDs.
    - Electrical Classification.
    - Relief system design & design basis.
    - Ventilation system design.
    - Design codes and standards employed.
    - Safety systems.
  ii. Document that equipment complies with RAGAGEP.
  iii. When relevant codes no longer in force, document that equipment is designed, maintained, inspected, tested & operated in a safe manner.

OSHA takes RAGAGEP seriously!
ISA 18.2 – High Level

- The definition of an alarm is:
  - An audible and/or visible means of indicating to the operator an equipment malfunction, process deviation, or abnormal condition requiring a response

- Alarm systems should be reserved for items meeting this definition

- There is often confusion in alarm terminology
  - ISA 18.2 contains excellent definitions of terms to provide a common language for discussion of alarm system arcana

If it doesn’t call for an operator response, then it isn’t an alarm!
ISA 18.2 Life Cycle Stages

- Philosophy
- Identification
- Rationalization
- Detailed Design
- Implementation
- Operation
- Maintenance
- Monitoring / Assessment
- Management of Change
- Audit

This is a “requirements and document structure.” It is NOT an efficient step-by-step project plan – particularly for existing systems!
ISA 18.2 – Mandatory “Shall” Elements

- An Alarm Philosophy with:
  - Defined responsibilities
  - Criteria for determining and classifying alarms
  - Basis for alarm prioritization

- Alarm Rationalization shall be used to determine:
  - Alarm type and priority
  - Alarm setpoint or logical condition
  - Documentation requirements
  - Classification
  - The Master Alarm Database

- For Operators:
  - Initial training with documentation
  - Training for alarm modifications
  - Alarm response procedures
ISA 18.2 – Mandatory “Shall” Elements

- Alarm system testing requirements
- The HMI Interface has a variety of requirements about alarm depiction
  - Mandatory control of alarm suppression
  - Provision of alarm shelving
  - Provision of specific information about shelved and out of service alarms.

- Alarm System Performance
  Monitoring is required
  - Alarm System Performance Targets are provided (non-mandatory, with lots of wiggle room)
- Monitoring for unauthorized alarm change
- An MOC Process for alarms, with documentation
### Alarm System Performance Targets

#### Alarm Performance Metrics per Operating Position

**Based upon at least 30 days of data**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Target Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annunciated Alarms per Time:</td>
<td>Target Value: Very Likely to be Acceptable</td>
</tr>
<tr>
<td>Annunciated Alarms Per Day per Controller Position</td>
<td>Target Value: Maximum Manageable</td>
</tr>
<tr>
<td>Annunciated Alarms Per Hour per Controller Position</td>
<td>~150 alarms per day</td>
</tr>
<tr>
<td>Annunciated Alarms Per 10 Minutes per Controller Position</td>
<td>~300 alarms per day</td>
</tr>
<tr>
<td>Percentage of hours containing &gt; 30 alarms</td>
<td>~ &lt;1%</td>
</tr>
<tr>
<td>Percentage of 10-minute periods containing &gt;5 alarms</td>
<td>~ &lt;1%</td>
</tr>
<tr>
<td>Maximum number of alarms in a 10 minute period</td>
<td>10 or less</td>
</tr>
<tr>
<td>Percentage of time alarm system is in a flood condition</td>
<td>~ &lt;1%</td>
</tr>
<tr>
<td>Percentage contribution of the top 10 most frequent alarms to the overall alarm load</td>
<td>~&lt;1% to 5% maximum, with action plans to address deficiencies.</td>
</tr>
<tr>
<td>Quantity of chattering and fleeting alarms</td>
<td>Zero, action plans to correct any that occur.</td>
</tr>
<tr>
<td>Stale Alarms</td>
<td>Less than 5 present on any day, with action plans to address</td>
</tr>
<tr>
<td>Annunciated or Configured Priority Distribution</td>
<td>3 priorities: ~80% P3, ~15% P2, ~5% P1 or 4 priorities: ~80% P3, ~15% P2, ~5% P1, ~&lt;1%</td>
</tr>
<tr>
<td>Unauthorized Alarm Suppression</td>
<td>Zero alarms suppressed outside of controlled or approved methodologies</td>
</tr>
<tr>
<td>Improper Alarm Attribute Change</td>
<td>Zero alarm attribute changes outside of approved methodologies or MOC</td>
</tr>
</tbody>
</table>

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The PAS Seven Steps

- Step 1: Develop, Adopt and Maintain an Alarm Philosophy
- Step 2: Collect Data And Benchmark Your Systems
- Step 3: Perform “Bad Actor” Alarm Resolution
- Step 4: Perform Alarm Documentation and Rationalization
- Step 5: Implement Alarm Audit and Enforcement Technology
- Step 6: Implement Real Time Alarm Management
- Step 7: Control and Maintain Your Improved System

The “What” AND the “How”
A concise approach to optimizing alarm systems.
One Integrated Solution for Operator Effectiveness

PlantState Suite

- **Alarm & Event Analysis**
  - Categorize Nuisance and Problematic Alarms
  - Real Time Alarm Scanner
  - Process & Event Explorer
  - Alarm & Event Journal

- **Documentation & Rationalization**
  - Single & Multi-State Alarm Objective Analysis with Equipment Grouping

- **Alarm Audit & Enforce**
  - Master Alarm Database
  - Auditing & Enforcement, MOC
  - Event Triggered Audit

- **Dynamic Alarming**
  - Alarm Shelving
  - State Handling
  - Flood Suppression

- **Alert Director**
  - Configurable Operator Decision Support System

- **Loop Analysis**
  - Control Loop Performance Assessment
  - Loop Analysis & Tree Map
  - Process Analyzer

- **Loop Optimizer**
  - Loop Tuning, & Valve Diagnostics

- **MPC Analysis**
  - APC Performance Assessment

Software embodies our extensive operations experience
Summary

- Poorly performing alarm systems are contributing factors to major accidents and poor operating performance
- Proper Alarm System Management and Alarm System Performance is essential to maximum-efficiency operations
- Effective operator UI’s are a key factor in incident mitigation
- The solutions to the problems are well known and fully documented

"WHAT"
ANSI/ISA 18.2
Management of Alarm Systems for the Process Industries
PAS: Voting Member of the ISA18 committee

"HOW"
The Alarm Management Handbook
A Comprehensive Guide
Second Edition
Practical and proven methods to optimize the performance of alarm management systems
By Bill Hollstein & Eddie Habibi
PAS: Voting Member of the ISA18 committee
Questions