2014 Honeywell Users Group EMEA

Alarm Management Workshop
Defining and Implementing Best Practices to take you Beyond the Acceptable

Jay Marsh/Jens Hecker
Workshop
• When things go wrong they can go wrong **badly**!
• However most incidents are minor and result in reduced production or increased costs
• Mainly due to bad **Operational Awareness** resulting in process deviations from the desired production ‘envelope’
• Alarm Management focus’ on the ability to ensure all alarms are relevant, meaningful and targeted, so that incident impacts can be reduced
• However we should be aiming to **go beyond the acceptable**

• Lets start by looking at **Abnormal Situations**
What is an *Abnormal Situation*?

**Definition**

- Any unexpected event or situation that confronts the operator during the course of his/her duties that causes the plant operation to be upset or disturbed to the point of concern.

- The normal plant control systems cannot cope with the disturbance or fail to do so... so operator intervention is then required.
### What is an Abnormal Situation?

<table>
<thead>
<tr>
<th>Operational Modes:</th>
<th>Plant States:</th>
<th>Critical Systems:</th>
<th>Operational Goals:</th>
<th>Plant Activities:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency</td>
<td>Disaster</td>
<td>Area Emergency Response System</td>
<td>Minimise Impact</td>
<td>Fire-fighting, First Aid, Rescue</td>
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<tr>
<td></td>
<td>Accident</td>
<td>Site Emergency Response System</td>
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<tr>
<td>Abnormal</td>
<td>Out of Control</td>
<td>Physical and Mechanical Containment Systems, Safety Shutdown, Protective Systems</td>
<td>Bring to Safe state</td>
<td>Evacuation</td>
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<tr>
<td></td>
<td>Abnormal</td>
<td>Hardwired Emergency Alarms, DCS Alarm System</td>
<td>Return to Normal</td>
<td>Manual Control &amp; Troubleshooting</td>
</tr>
</tbody>
</table>
Cost Impacts of an Abnormal Situation

A significant number of unforeseen situations cause large numbers of small (but cumulatively expensive) losses:

- Direct economic losses due to equipment damage
- Product losses
  - loss of production
  - decreased or uneven quality
- Schedule/delivery disruptions
- Personnel injuries
- Environmental damage
Cost Impacts of an Abnormal Situation
Target of Abnormal Situation Management

- Unexpected Upsets Cost 2 - 8% of Capacity
How Does ASM Work?

• Monitor the *true state* of the plant
• Determine normal operating *envelope*
• Assess the *degree* of abnormality

• Propose realistic, effective actions
  – Return to normal
  – Move to a safe state
  – Safely shut down
The Abnormal Situation Management Joint Research and Development Consortium conducts research and shares experiences on factors contributing to the successful reduction of abnormal situations in petrochemical processes, and develops, evaluates and proves new solutions to reduce risks even further.

The ASM Consortium was informally established in 1992 as an outgrowth of an effort to define improvements to current DCS alarm system technologies.

Realizing that the alarm system was simply a part of the larger issue of the management of unexpected process upsets, a number of companies teamed with Honeywell to develop a problem statement and a vision for the solution.

The ASM Consortium is now celebrating its 20th year!
Understanding Abnormal Situations

• It is important to understand the factors that cause or influence abnormal situations
• Root and contributing causes may appear in isolation or in combination with each other

• There are four principal types of sources or causes of abnormal situations
  – People and work context factors
  – Equipment factors
  – Process factors
  – Physical environmental antecedents
    • Such as lightning, earthquakes, storms; are infrequent and usually obvious as a root cause and will not be discussed here
Understanding Abnormal Situations

Categories
- People
  - Defective Installation
  - Failure to Follow Procedure/Instruction
  - Failure to Recognise Problem
  - Inadequate/Incorrect action
  - Inadequate Work Practices
  - Inadequate or No Procedure
- Equipment
  - Defective Equipment
  - Equipment Design Flaw
  - Equipment/Mechanical Failure
- Process
  - Operation Beyond Original Design Limits
  - Process Design Flaw

Frequency
Understanding Abnormal Situations

• The frequency distribution shows the relative contribution of root cause categories

• People and Work Context Factors
  – largest contributors
    • Inadequate or no procedure
    • Inadequate or incorrect action
    • Failure to follow procedure/instruction

• Equipment Factors
  – largest contributor
    • Equipment or mechanical failure

• Process Factors
  – largest contributor
    • Operating beyond the original design limits
People and Work Context

• Humans will always be part of the decision-making process in plant operations
  – Human error can thus contribute to abnormal situations, by
    • Not responding with appropriate actions
    • Responding with inappropriate actions which cause or escalate process upsets

• The consequence of human error varies
  – Depending on the nature of the abnormal situation
  – The point at which the upset is detected
The Paradox of Automation

- Better automation leads to more sophisticated processes
- More sophisticated processes lead to more opportunities for error
- We “fix” the increasing errors with still more automation
- This distances the operator from the normal operation of the plant, hence…
- When things go wrong, people have difficulty intervening to correct the problem because of the high complexity!

“And this is where the workflow design team went insane.”
Impact of Operational Awareness

- E.g. Failure Occurrence in the Process or in the Safeguarding System

With typical alarm systems, orienting begins after an event creates an abnormal plant state.

The extent of the problem can impact operator’s ability to be fully aware of the locations of process disturbances.

As disturbances propagate the number of conditions to be aware of increases as well as the response requirements and the likelihood of missing important information.
Effectiveness of Response

- Good Operator Decision Support is paramount to success!

- Reduces errors
- Decreases time to implement response
- Manages side effects
- Increases awareness
Good Alarm Design

- Clearly a well designed Alarm System is key to identifying Abnormal Situations and reacting appropriately within an adequate time.

- So what guidance is there for Good Alarm Design?
WE BELIEVE THIS APPLIES TO ALL DISCIPLINES:
"IF YOU THINK GOOD DESIGN IS EXPENSIVE, YOU SHOULD LOOK AT THE COST OF BAD DESIGN"

DR. RALF SPETH, CEO JAGUAR
There are numerous sources which give guidance on good alarm system design, here is a partial list:

- IEC 62682 “Management of alarms systems for the process industries” 2014
- In the UK: the HSE guidance note “Better Alarm Handling”.
- In the USA: ANSI/ISA-S84.01 … “Application of Safety Instrumented Systems for the Process Industries”.
- In the USA: OSHA 1910.119 “Process safety management of highly hazardous chemicals”.
- In the EU: The Seveso II Directive … concerning “Safety Cases” for hazardous plants.
Included in the questionnaire sent out to you before this year’s HUG we asked

- *Which industry standard does your company best align with?*

Here are the results:
The Main Sources of Guidance

• Lets take a look some of the most well-known sources, including the latest standard from the IEC and the ASM guidelines:

• **EEMUA 191**
  – most widely-applied

• **ANSI/ISA-18.2**
  – likely to be heavily-used in the USA, although it’s style (as a “standard”) is less “user-friendly”

• **IEC 62682**
  – Likely to have a better acceptance as an international “standard”

• **ASM**
  – probably the easiest to use but not as widely known outside of the ASM Consortium
EEMUA Publication 191

- Guidance (first published in 1999) partly based on an extensive review of alarm system practices and performance in a range of UK installations
- Major operating company active participation – experienced people!
- Reviewed, endorsed (and financially supported) by the Honeywell-led ASM Consortium - which includes many of the major refiners and several large chemical companies
- Human factors emphasis
- Now at the Third Edition
EEMUA Publication 191

• Main document with 6 sections:
  – 1. Alarm System Philosophy
  – 2. Principles of Alarm System Design
  – 3. Implementation Issues
  – 4. ‘HCI’ Management Techniques
  – 5. Alarm Configuration
  – 6. Buying a New Alarm System

• 20 Appendices which include:
  – Examples of poor alarm management
  – Prioritization methods
  – Alarm processing methods
  – Questionnaires/Checklists
  – KPI’s
ANSI/ISA-18.2-2009

- Large focus on an Alarm System Lifecycle
- Details Alarm System KPIs

- Sections on
  - Compliance
  - Alarm Philosophy
  - Alarm System requirements
  - Identification
  - Rationalization
  - Advanced Methods

- Less examples are given
- Complimentary to EEMUA 191
IEC 62682

- Very recent! Issued in October 2014
- As ISA-18.2 written as a Standard
- Organized in 2 parts; introductory sections and the main body covering the standards
- Acknowledges both ISA-18.2 and EEMUA 191

- Provides requirements for alarm management and alarm systems, for those who:
  - Manufacture/implement alarm systems
  - Manufacture/implement alarm system software
  - Design/install alarm systems
  - Operate/maintain alarm systems
 ASM Consortium Guidelines

- Perhaps the easiest of the 4 main guidance/standards documents to use in practice.

- Organized under three categories:
  - **Management Practices** guidelines describe the effective practices for managing and continuously improving the alarm system.
  - **Alarm System Design and Implementation** guidelines include processes and methods for creating an effective alarm system.
  - **Training guidelines** cover understanding site policies, design team preparations, adequate training for alarm changes, certification, and simulator-based training solutions.

- Each category contains descriptions of its Objective and its Rationale.
• The relative importance of each guideline is indicated in terms of priority ratings:
  – **Priority 1** - rated as one of the *minimum* set of guidelines for achieving an ASM *good* quality practice.
  – **Priority 2** - one of the *comprehensive* set of guidelines for achieving an ASM *high* quality practice.
  – **Priority 3** - one of the *advanced* set of guidelines for achieving an ASM *best* practice.

• Covers 42 guidelines in total
• Each guideline contains
  – explanations for **Why** this is recommended, **How it works** and **Examples** of compliance.

• Also contains examples and Appendices
### Key Performance Indicators

<table>
<thead>
<tr>
<th></th>
<th>EEMUA 191</th>
<th>ANSI/ISA-18.2</th>
<th>ASM</th>
<th>Oil &amp; Gas</th>
<th>Chemicals</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average alarms per day</strong></td>
<td>&lt;144 (&lt;up to 288 may be manageable)</td>
<td>~150 (~300 may be manageable)</td>
<td>&lt;144 (&lt;up to 288 may be manageable)</td>
<td>1200</td>
<td>1500</td>
<td>2000</td>
</tr>
<tr>
<td><strong>Average standing alarms</strong></td>
<td>&lt;10</td>
<td>&lt;5 per day</td>
<td>&lt;10</td>
<td>50</td>
<td>100</td>
<td>65</td>
</tr>
<tr>
<td><strong>Peak alarms per 10 minutes</strong></td>
<td>&lt;10</td>
<td>≤10</td>
<td>&lt;10</td>
<td>220</td>
<td>180</td>
<td>350</td>
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<tr>
<td><strong>Average alarms per 10-minute interval</strong></td>
<td>1</td>
<td>~1 (~2 may be manageable)</td>
<td>1</td>
<td>6</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td><strong>Distribution % (low/med/high)</strong></td>
<td>80/15/5</td>
<td>80/15/5</td>
<td>80/15/5</td>
<td>25/40/35</td>
<td>25/40/35</td>
<td>25/40/35</td>
</tr>
</tbody>
</table>
Key Performance Indicators

- Included in the questionnaire sent out to you before this year’s HUG we asked
  - How many alarm KPI's do you regularly monitor?

- Here are the results:
During the America’s HUG in 2011 Luc De Wilde (Total Petrochemicals) and Dal Vernon Reising (Human Centered Solutions) discussed the on-going alarm management problems, highlighted which ASM Guidelines were **Critical to Success** and reflected where many companies may be situated today.

Included in the **questionnaire** sent out to you before this year’s HUG are a list of ASM Guidelines and we asked if you have considered each of these and which ones you believed Critical to Success.

Let’s take a look at the results
Management Practices

ASM Guideline definition

• **Objective:** Strong management practices are necessary to develop and maintain a good alarm management program.

• **Rationale:** The following are guidelines for ensuring that the alarm management program has the required management support and the management practices to be successful.
## Management Practices

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</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Have you established support for alarm management from your company management?</td>
<td>Yes</td>
<td>Yes</td>
<td>67%</td>
<td>17%</td>
<td>17%</td>
</tr>
<tr>
<td>1.2</td>
<td>Have you developed a plant-wide philosophy for alarm management?</td>
<td>Yes</td>
<td>Yes</td>
<td>50%</td>
<td>33%</td>
<td>17%</td>
</tr>
<tr>
<td>1.3</td>
<td>Have you established an owner for the alarm system and ensured adequate staffing?</td>
<td>Yes</td>
<td>Yes</td>
<td>17%</td>
<td>50%</td>
<td>17%</td>
</tr>
<tr>
<td>1.4</td>
<td>Do you use a Management of Change (MOC) process for alarm changes?</td>
<td>Yes</td>
<td>Maybe</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
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<tr>
<td>1.5</td>
<td>Do you capture and integrate alarm requests generated from plant reviews?</td>
<td>Yes</td>
<td>Yes</td>
<td>33%</td>
<td>50%</td>
<td>17%</td>
</tr>
<tr>
<td>1.6</td>
<td>Have you established an alarm system’s worst actors monitoring program?</td>
<td>Yes</td>
<td>Yes</td>
<td>33%</td>
<td>17%</td>
<td>50%</td>
</tr>
<tr>
<td>1.7</td>
<td>Do you ensure that plant personnel understand and comply with the alarm management philosophy?</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>83%</td>
<td>17%</td>
</tr>
<tr>
<td>1.8</td>
<td>Do you run frequent backups and inspections of electronic journals?</td>
<td>No</td>
<td>Yes</td>
<td>50%</td>
<td>17%</td>
<td>33%</td>
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<tr>
<td>1.9</td>
<td>Do you ensure that alarm management is a part of an integrated safety program?</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>50%</td>
<td>50%</td>
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<tr>
<td>1.10</td>
<td>Have you established an alarm system performance monitoring program?</td>
<td>Yes</td>
<td>Yes</td>
<td>17%</td>
<td>50%</td>
<td>33%</td>
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<tr>
<td>1.11</td>
<td>Do you periodically validate/enforce alarm settings?</td>
<td>Yes</td>
<td>Yes</td>
<td>17%</td>
<td>33%</td>
<td>50%</td>
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<tr>
<td>1.12</td>
<td>Do you perform periodic alarm rationalization revalidations?</td>
<td>Maybe</td>
<td>Yes</td>
<td>17%</td>
<td>17%</td>
<td>67%</td>
</tr>
<tr>
<td>1.13</td>
<td>Do you perform periodic alarm impact assessments?</td>
<td>No</td>
<td>Maybe</td>
<td>0%</td>
<td>33%</td>
<td>67%</td>
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<tr>
<td>1.14</td>
<td>Do you ensure that incident reviews include alarm system impact?</td>
<td>Maybe</td>
<td>Yes</td>
<td>33%</td>
<td>17%</td>
<td>50%</td>
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</table>
ASM Guideline definition

- **Objective:** Develop the processes and methods to create and configure an effective alarm system.

- **Rationale:** An effective alarm system notifies operators of problems without distracting them with irrelevant and non-instructive alarms. Well-designed alarms are meaningful, relate directly to operator action, and tell the operator what action is required.
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<tr>
<td>2.1</td>
<td>Do you ensure instrument reliability and accuracy?</td>
<td>Maybe</td>
<td>Yes</td>
<td>Work In Progress</td>
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<td>2.2</td>
<td>Have you developed design rules to accommodate all common alarm types?</td>
<td>Yes</td>
<td>Yes</td>
<td>Work In Progress</td>
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<td>2.3</td>
<td>Do you use common alarms for groups of instruments that have common responses?</td>
<td>Yes</td>
<td>Maybe</td>
<td>Work In Progress</td>
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<td>2.4</td>
<td>Do you provide access to the alarm rationalization information?</td>
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<td>Work In Progress</td>
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<td>2.5</td>
<td>Do you minimize chattering alarms?</td>
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<td>2.6</td>
<td>Do you integrate alarms into process graphics?</td>
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<td>2.7</td>
<td>Do you provide effective alarm annunciation?</td>
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<td>2.8</td>
<td>Do you ensure alternative support is available for alarm response?</td>
<td>No</td>
<td>Maybe</td>
<td>Work In Progress</td>
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<td>100%</td>
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<tr>
<td>2.9</td>
<td>Do you integrate multiple alarm systems?</td>
<td>Maybe</td>
<td>No</td>
<td>Work In Progress</td>
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<td>100%</td>
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<tr>
<td>2.10</td>
<td>Have you installed an alarm and event historian?</td>
<td>Yes</td>
<td>Yes</td>
<td>Work In Progress</td>
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## Alarm System Design & Implementation #2

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<tbody>
<tr>
<td>2.11</td>
<td>Have you established an alarm improvement project plan?</td>
<td>Yes</td>
<td>Yes</td>
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<td>83%</td>
<td>17%</td>
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<tr>
<td>2.12</td>
<td>Do you perform a comprehensive alarm rationalization review?</td>
<td>Yes</td>
<td>Yes</td>
<td>17%</td>
<td>33%</td>
<td>50%</td>
</tr>
<tr>
<td>2.13</td>
<td>Do you provide an alarm configuration database?</td>
<td>Yes</td>
<td>Yes</td>
<td>33%</td>
<td>17%</td>
<td>50%</td>
</tr>
<tr>
<td>2.14</td>
<td>Have you established a new project execution protocol?</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>17%</td>
<td>83%</td>
</tr>
<tr>
<td>2.15</td>
<td>Do you provide safety system design and safety-related alarm handling?</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>17%</td>
<td>83%</td>
</tr>
<tr>
<td>2.16</td>
<td>Do you segregate diagnostic information and notifications from annunciated alarms?</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>17%</td>
<td>83%</td>
</tr>
<tr>
<td>2.17</td>
<td>Have you implemented an alarm shelving-disabled application?</td>
<td>Maybe</td>
<td>Yes</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
</tr>
<tr>
<td>2.18</td>
<td>Do you provide online access to alarm rationalization information?</td>
<td>No</td>
<td>Yes</td>
<td>0%</td>
<td>17%</td>
<td>83%</td>
</tr>
<tr>
<td>2.19</td>
<td>Have you defined operating targets and limits appropriate to the mode of operation?</td>
<td>Maybe</td>
<td>Maybe</td>
<td>0%</td>
<td>33%</td>
<td>67%</td>
</tr>
<tr>
<td>2.20</td>
<td>Do you provide dynamic alarm management?</td>
<td>No</td>
<td>Yes</td>
<td>0%</td>
<td>33%</td>
<td>67%</td>
</tr>
<tr>
<td>2.21</td>
<td>Do you provide a system for user-initiated notifications?</td>
<td>Maybe</td>
<td>Maybe</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>2.22</td>
<td>Do you provide advanced applications to support situation awareness?</td>
<td>No</td>
<td>Maybe</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>
ASM Guideline definition

• **Objective:** To ensure that operators are trained to use the alarm system effectively and that all plant personnel follow the alarm management practices.

• **Rationale:** To use the alarm system effectively, operators need to be up-to-date and trained on alarm configuration basis and changes, how to respond to alarms and new alarm management support tools.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>3.1</td>
<td>Do you provide operators with information and training on alarm system changes?</td>
<td>Yes</td>
<td>Yes</td>
<td>17%</td>
<td>67%</td>
<td>17%</td>
</tr>
<tr>
<td>3.2</td>
<td>Do you ensure alarm rationalization team members understand the alarm management philosophy?</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>3.3</td>
<td>Have you established scenario reviews and what if training?</td>
<td>Maybe</td>
<td>Maybe</td>
<td>0%</td>
<td>33%</td>
<td>67%</td>
</tr>
<tr>
<td>3.4</td>
<td>Have you enhanced training programs to include situation support tools?</td>
<td>Maybe</td>
<td>Maybe</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>3.5</td>
<td>Have you enhanced training programs to include process control operators’ routine alarm management duties?</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>3.6</td>
<td>Do you educate process design personnel in alarm management?</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>3.7</td>
<td>Do you use dynamic simulators as alarm management training tool?</td>
<td>No</td>
<td>Maybe</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>
What are the Takeaways?

Alarm Management needs to be seen as a Continuous Improvement commitment – that is always done as part of a Lifecycle Maintenance work process

Being successful requires a systems approach, not a pick-and-choose approach to what guidelines are practiced

Being successful also means going beyond ‘minimum practices’
Improving Alarm Design

• We have seen that Abnormal Situation events need to be identified by suitably designed alarms to Operators

• We have reviewed where we can find good guidance for alarm system design and which are Critical to Success

• Now let’s examine processes to Improve Alarms as a part of a Continuous Improvement program
Get the Basics Right First!

- Engineering of signals:
  - Make sure the installation practice for sensors does not propagate disturbances into the DCS

- Good instrumentation practice:
  - Proper signal ranging
  - Proper match of transducer type to process application

- Filtering:
  - Add or set filtering to ensure valid PV signal reception to DCS

- Etc...
• 3 jointing points identified to the Alarm Management Lifecycle

• **Philosophy**
  – Generally an entry point for new installations.
  – Can be used as the basis for the alarm system requirements specifications.

• **Monitoring & Assessment**
  – Begin monitoring the existing alarm system and assessing performance.
  – Problem alarms can be identified and addressed through maintenance or management of change.

• **Audit**
  – Reviewing processes, etc in use.
**Philosophy**

- Alarm philosophy documents the site approach to alarm management
- Includes the definitions and principles
- Details of the practices and procedures for each of the remaining life cycle stages
- The philosophy provides a lasting reference to sustain an effective alarm system

- This defines your “Target” and how you intend to reach it!
• **Identification**
  – Many methods utilized
    – *Process hazard analysis*
    – *Incident investigations*
  – Important step in the life cycle
    – *Methods are not detailed in SP18.2*
    – *Except the identification of alarms from routine monitoring*
  – This stage in the life cycle is a holding point for possible alarms to be processed in the next stage
• **Rationalization**
  - Reconciling each individual alarm against the principles and requirements of the alarm philosophy
  - Documenting the alarm to support the other stages of the life cycle
  - Include operator action, response time, and consequence of deviation
  - Critical to improve alarm clarity for the operator
  - Consequences and the response time have been documented
  - Assign the alarm a priority based on a matrix of consequences and priorities.
The Rationalization Team

• **Possible members**
  – Operator and/or Supervisor from the plant concerned
  – Process or Mechanical Engineer
  – Instrumentation and/or Control Engineer

• **It may help to use a “Facilitator” whose functions are:**
  – To gather information “up front” including analysis reports that show alarm rates, “Bad Actors”, standing alarms etc.
  – To manage the meeting and take notes
  – To follow-up after the meeting where additional information required etc.

• **Others may be required (part-time) for additional input:**
  – Maintenance personnel
  – Operator trainer
  – SHE
Steps in Alarm Rationalization

• Assemble all the data prior to the team meeting
• At the start of the meeting:
  – Review alarm philosophy with any new team members
  – The alarm philosophy is your ‘target’

• Use a HAZOP-like process:
  – Identify area of plant to be rationalised to the team
  – Review the way in which the plant is operated
  – Redesign each alarm in the area (see next slide)
  – Review a group of alarms where appropriate
  – Document each alarm

• Ordering often follows the main Process flow path
• You should ensure that each alarm works well with other alarms in the same plant area – this may require iteration
Steps in Alarm Rationalization

• For each alarm:
  – Review the data analysis
  – What is the cause(s) of the alarm event?
  – What is the consequence(s) of no action?
  – What **Action**(s) is required? (No Action means No Alarm!)
  – Is the alarm **Type** correct?
  – Is the **Trip Point** correct? (May relate to other alarms etc.)
  – Is the **Priority** correct? (As per the Philosophy)
  – Is the **Dead Band** (if used) appropriate for this alarm?
  – Identify any housekeeping changes required
  – Document the results

“Every computer has been equipped with a compass to help keep our team on course.”
Attention Points!

• **Safety-related alarms need special treatment**
  – E.g. typically require extra care checking of Safety Cases, HAZOPs, interlocks etc.

• **Trip points must be set to recognise a specific, understood problem or concern** PLUS provide sufficient reaction time for normal corrective actions

• **Dead bands must be “tuned” on a per-point class**
  – Point classes: flow, temperature, pressure, level
  – Each type of “analyser” will need separate consideration
  – Usually less than 5% of span

• **Ensure that trip points and dead-bands do not interact**
  – Watch H/HH & L/LL

• **Priority assignment is on a per alarm basis, not per tag**
• **Duplicate results to similar equipment items/process “trains”**
• Detailed Design
  – Basic configuration of alarms
  – Human machine interface (HMI) for alarms
  – Advanced methods of alarm management
  – Should be control system specific
  – Usually separate from the alarm philosophy
  – Nuisance alarms and stale alarms can be eliminated with good basic configuration practices
• **State-based Alarms & Dynamic Alarm Suppression**
  - These are 2 very powerful methods of alarm management, but for different purposes.
  - **State-based Alarms** are alarm configurations which relate to different *States* or *Modes* within a process asset, for example a Compressor in Recycle or a Production Train in an offline condition. The requirement is that the alarm settings are changed to reflect the state of the process asset. This method often helps with reducing Standing Alarms.
  
  - **Dynamic Alarm Suppression** is the process of masking consequential alarms from the key initiator alarm, so the Operator can react to the cause and not distracted by alarm *noise*. The reaction time for dynamic suppression is key to the success of this function so should always be engineered within the DCS. Care should be taken in identifying the consequential alarms from the initiator and understanding when these alarms should be unsuppressed!
• **Implementation**
  - Stage where the design is put into service
  - Training for the operator included
  - Initial testing of the alarm system functions
• **Operation**
  - Alarm is in service
  - Reporting abnormal conditions to the operator
• **Maintenance**
  - Process measurement instrument may need maintenance
  - Other components may need repair
  - Repair frequency can be scheduled or determined by monitoring
  - Periodic testing is a maintenance function
  - During the maintenance stage, the alarm is not in operation.
• Monitoring & Assessment
  – Periodic collection and analysis of data from alarms
  – Without monitoring almost impossible to maintain an effective alarm system
  – Should take place frequently (daily or weekly)
  – Primary method to detect problems; nuisance alarms, stale alarms, and alarm flood
• **Management of Change**
  – Structured process of approval and authorization
  – Make additions, modifications, and deletions of alarms from the system
  – Change process should feed back to the identification stage to maintain consistency with the alarm philosophy
• **Audit**
  
  – Periodic audit of the alarm system and the processes detailed in the alarm philosophy
  
  – May determine the need to modify processes, the philosophy, the design guidance
  
  – Organization’s discipline to follow the processes may need improvement
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Alarm Management Workshop
Defining and Implementing Best Practices to take you Beyond the Acceptable

Thank you