



Honeywell Users Group 2011

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**Alarm management : Wasn't that problem
already solved years ago?**

Honeywell

Outline

- The Historical context
- What is the state of Alarm System performance today?
- The ASM *Effective Alarm Management Practices* Guidelines
 - Critical guidelines vs. State of practice
 - Review of ‘Critical Few’ guidelines
- Current ASM Consortium alarm management research
- Conclusions

Some history



1975 : the first DCS was born

With the DCS came Endless Possibilities

- We can actually see the Process Value, the Setpoint, the Output Value
- We can control much more accurately the process
- We can reduce the number of operators
- We can give the operator all the information he needs
- We can give the operator all the alarms he needs, and moreover : they are free of charge

The hangover



- Help, we are drowning in information (even without alarms)
 - Needed a better HMI approach than single screen-single display, drill-in approach
- Help, we are continuously bombarded with alarms, even when the plant is stable
 - *Still need a better approach to alarm design*
- Help, we are swept away by alarm floods when the plant is not stable
 - *Still need a better approach to alarm design*

The taskforce

- Review alarm limits
- Fix instrumentation errors



Don't spend too much time on it :
“Operators will get used to it”

It got worse

- New units, expansions => more alarms
- Larger control centers
- Several accidents related to alarm floods, missed alarms



The solution (?)

- Structured approach, laid out in guidelines and industry standards :
 - ASM Consortium Guideline : Effective Alarm Management Practices
 - EEMUA 191
 - ISA 18.02
- **ALARM MANAGEMENT PROJECTS :**
 - Alarm rationalization
 - Advanced techniques
 - Based on the guidelines and standards



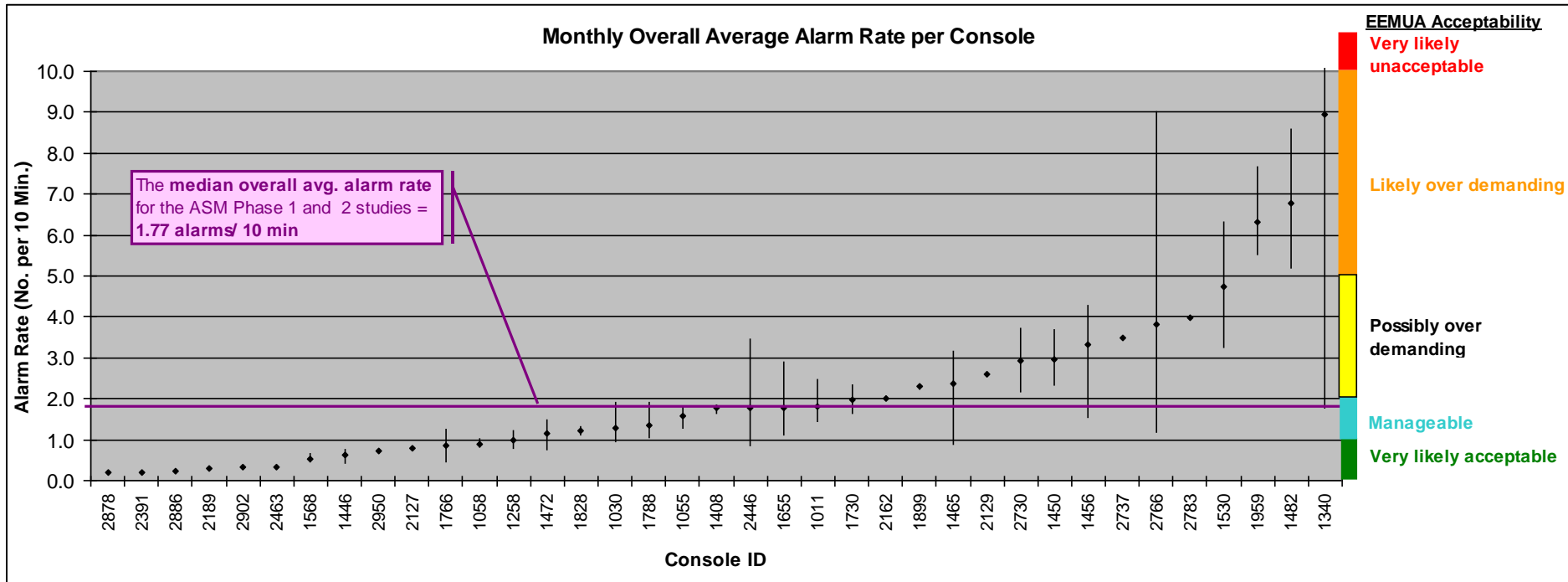
Still problems : some quotes

- “Each department has their own ideas about the alarm system”
- “Alarm rationalization only has impact on standing alarms, we still experience alarm floods”
- “Very soon after the alarm management project, the number of alarms went up again”
- “Alarm management is a problem for the DCS engineer”

Still problems : some quotes

- “Does anybody still know why the alarm limit of that tag is set on that value ?”
- “Every time we expand the unit, we are again drowned in alarms”
- “We think our operators don’t always act on alarms”
- “The operators are still feeling uncomfortable : they rather prefer to see too many alarms than to have an alarm removed”

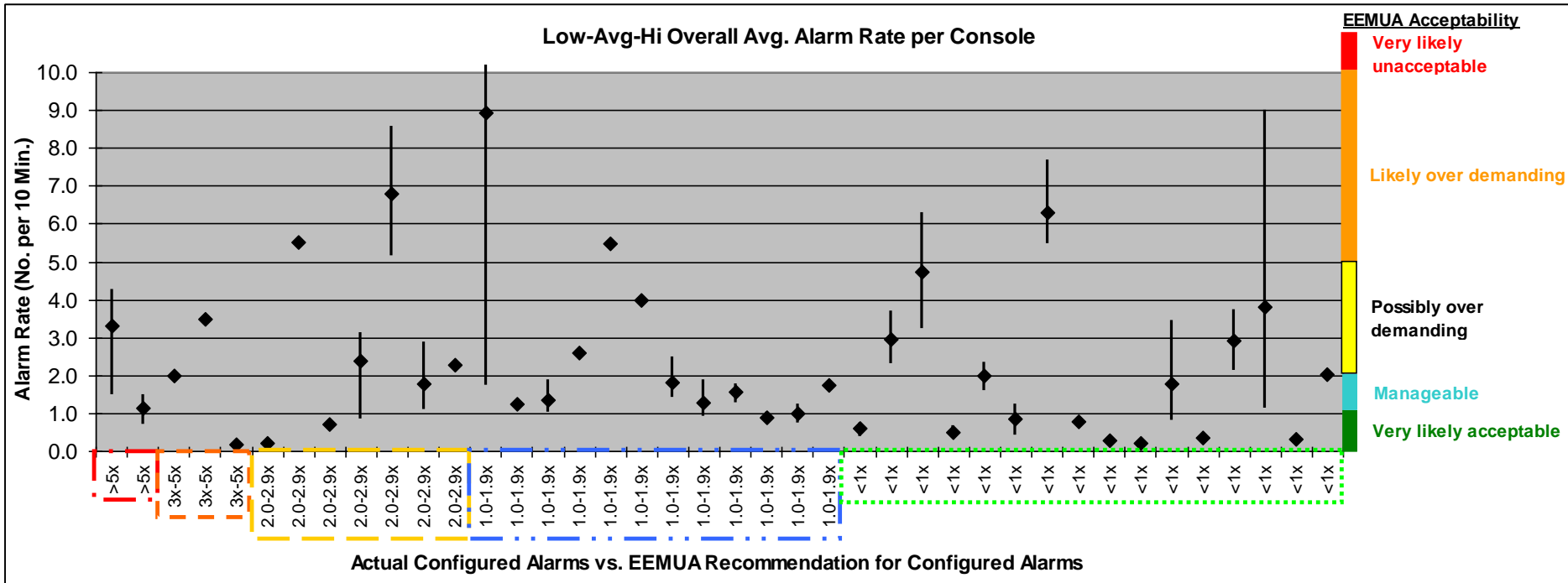
ASM Alarm System Performance Benchmarking



- **Overall Average Alarm Rates**

- The overall average alarm rate across the ASM studies' was 2.3 alarms per 10 minute window; the median was 1.8 alarms per 10 minute window
- Sites can meet and sustain the EEMUA “Manageable” and “Very likely to be acceptable” levels of overall average alarm rate performance

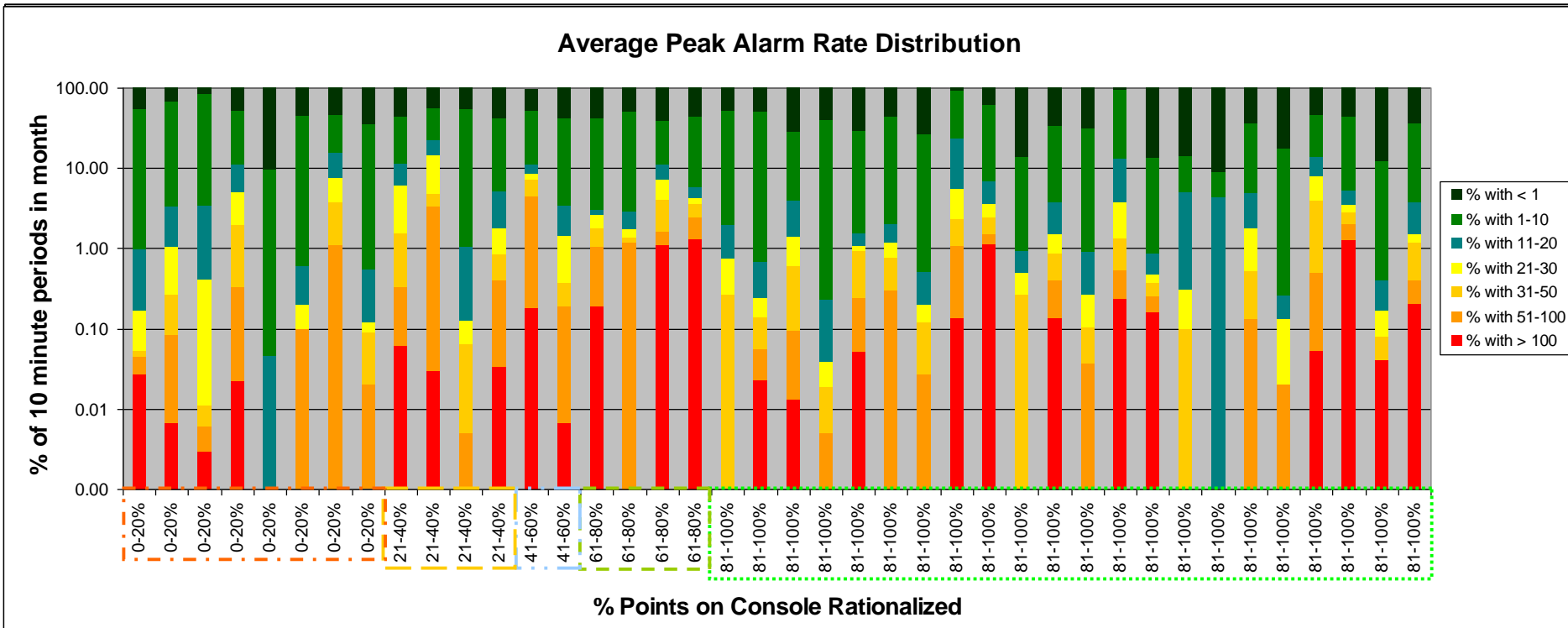
ASM Alarm System Performance Benchmarking



- **Overall Average Alarm Rates**

- The average alarm rate was not closely correlated with the number of configured alarms

ASM Alarm System Performance Benchmarking



- **Overall Average Peak Alarm Rate Distributions**

- Peak alarm rates exceeding 100 alarms per 10 minute window were experienced at least once by 60% of the consoles
- The peak alarm rate is not closely correlated with the degree of rationalization

ASM Alarm System Performance Benchmarking

- Performed a Best-subsets (i.e., multivariate) regression for *Overall Average Alarm Rate* with 14 metrics (out of the more than 30 collected)
- The resulting multivariate regression model accounted for only ~50% of the variance in the data
- The factors considered significant were:
 - Degree of rationalization (negative coefficient)
 - Frequency of monitoring average alarm rate (positive coefficient; a surprising result)
 - Degree of control sophistication (negative coefficient)
 - Frequency of monitoring worst actors (negative coefficient)
 - Average number of standing alarms (positive coefficient)

There is no single “Silver Bullet” to alarm system performance



“We have been working on alarm management since years. Why do we then still feel that we haven’t solved the problem ...?”



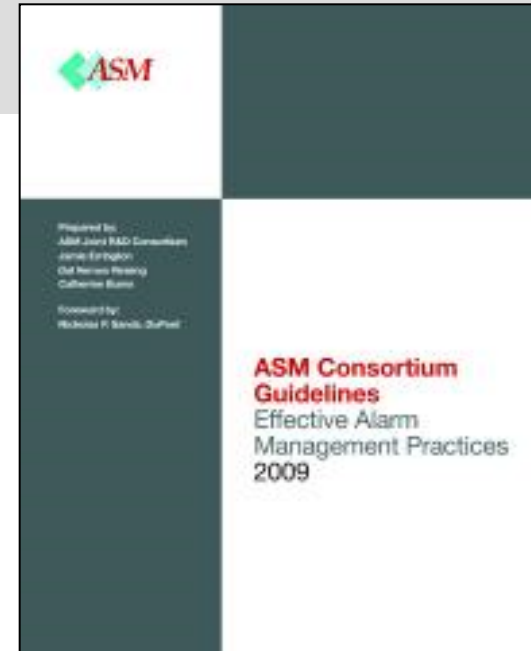
“We have been working on alarm management since years. Why do we then still feel that we haven’t solved the problem ...?”

Are we taking a systems-approach to our Alarm System Performance problems?

Or, are we only doing a subset of the recommended practices?

Effective Alarm Management Practices ASM Guidelines document

- Three main practice areas
 - Management Practices
 - Alarm System Design & Implementation
 - Training
- 42 guidelines in total across these practice areas
 - Priority “1” – 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.



Which are Critical for Success and which are Sites Practicing today?

(The following slides are based on presenter experience & opinion, not a scientific survey.)

ASM Guidelines – Critical to Success

* Management Practices *

GL #	GL Priority	GL Statement	Critical to Success		
			Yes	Maybe	No
Management Practices					
1.1	1	Establish company management support for alarm management.	1		
1.2	1	Develop a plant-wide philosophy for alarm management.	1		
1.3	1	Establish an owner for the alarm system and ensure adequate staffing.	1		
1.4	1	Use a Management of Change (MOC) process for alarm changes.	1		
1.5	1	Capture and integrate alarm requests generated from plant reviews.	1		
1.6	1	Establish an alarm system's worst actors monitoring program.	1		
1.7	1	Ensure that plant personnel understand and comply with the alarm management philosophy.	1		
1.8	1	Run frequent backups and inspections of electronic journals.			1
1.9	2	Ensure that alarm management is a part of an integrated safety program.	1		
1.10	2	Establish an alarm system performance monitoring program.	1		
1.11	2	Periodically validate/enforce alarm settings.	1		
1.12	2	Perform periodic alarm rationalization revalidations.		1	
1.13	3	Perform periodic alarm impact assessments.			1
1.14	3	Ensure that incident reviews include alarm system impact.		1	

ASM Guidelines – Critical to Success vs. Site Practices

* Management Practices *

GL #	GL Priority	GL Statement	Critical to Success			Sites Doing It		
			Yes	Maybe	No	Most	Some	Few
Management Practices								
1.1	1	Establish company management support for alarm management.	1				1	
1.2	1	Develop a plant-wide philosophy for alarm management.	1				1	
1.3	1	Establish an owner for the alarm system and ensure adequate staffing.	1					1
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ASM Guidelines – Critical to Success

* Alarm System Design & Implementation *

GL #	GL Priority	GL Statement	Critical to Success		
			Yes	Maybe	No
Alarm System Design & Implementation					
2.1	1	Ensure instrument reliability and accuracy.		1	
2.2	1	Develop design rules to accommodate all common alarm types.	1		
2.3	1	Use common alarms for groups of instruments that have common responses.	1		
2.4	1	Provide access to the alarm rationalization information.		1	
2.5	1	Minimize chattering alarms.	1		
2.6	1	Integrate alarms into process graphics.	1		
2.7	1	Provide effective alarm annunciation.	1		
2.8	1	Ensure alternative support is available for alarm response.			1
2.9	1	Integrate multiple alarm systems.		1	
2.10	1	Install an alarm and event historian.	1		

ASM Guidelines – Critical to Success vs. Site Practices

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ASM Guidelines – Critical to Success

* Alarm System Design & Implementation *

GL #	GL Priority	GL Statement	Critical to Success		
			Yes	Maybe	No
Alarm System Design & Implementation					
2.11	2	Establish an alarm improvement project plan.	1		
2.12	2	Perform a comprehensive alarm rationalization review.	1		
2.13	2	Provide an alarm configuration database.	1		
2.14	2	Establish a new project execution protocol.	1		
2.15	2	Provide safety system design and safety-related alarm handling.	1		
2.16	2	Segregate diagnostic information and notifications from annunciated alarms.	1		
2.17	2	Implement an alarm shelving/disabled application.		1	
2.18	3	Provide online access to alarm rationalization information.			1
2.19	3	Define operating targets and limits appropriate to the mode of operation.		1	
2.20	3	Provide dynamic alarm management.			1
2.21	3	Provide a system for user-initiated notifications.		1	
2.22	3	Provide advanced applications to support situation awareness.			1

ASM Guidelines – Critical to Success vs. Site Practices

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2.21	3	Provide a system for user-initiated notifications.		1				1
2.22	3	Provide advanced applications to support situation awareness.			1			1

ASM Guidelines – Critical to Success

* Training *

GL #	GL Priority	GL Statement	Critical to Success		
			Yes	Maybe	No
Training					
3.1	1	Provide operators with information and training on alarm system changes.	1		
3.2	1	Ensure alarm rationalization team members understand the alarm management philosophy.	1		
3.3	1	Establish scenario reviews and what if training.		1	
3.4	2	Enhance training programs to include situation support tools.		1	
3.5	2	Enhance training programs to include process control operators' routine alarm management duties.	1		
3.6	2	Educate process design personnel in alarm management.	1		
3.7	3	Use dynamic simulators as alarm management training tool.			1

ASM Guidelines – Critical to Success vs. Site Practices

* Training *

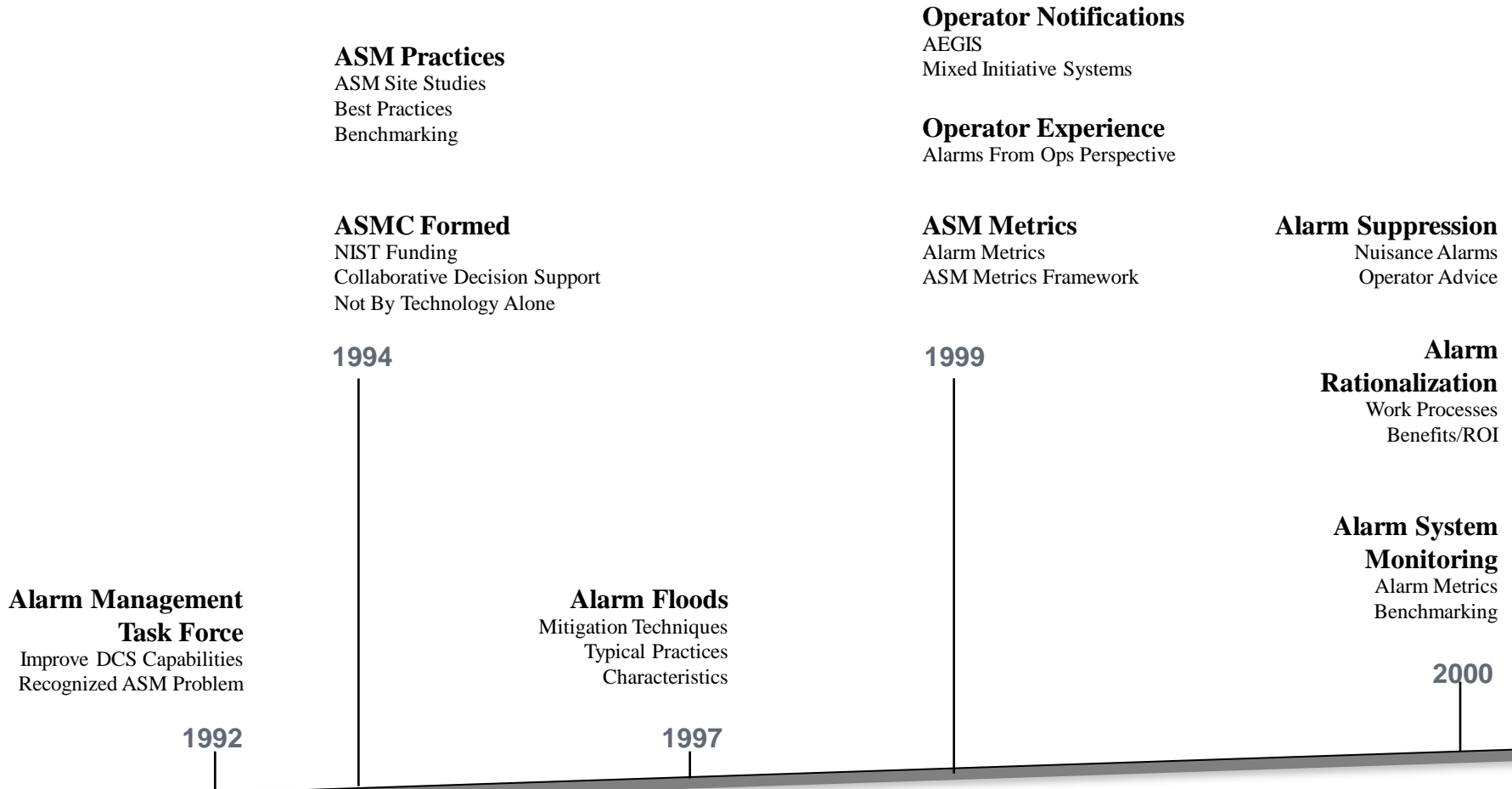
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3.6	2	Educate process design personnel in alarm management.	1					1
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So what are the Take-Aways?

- There is no one magic thing that can be done to fix your alarm system performance problems
- 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’

ASM Alarm Management Research History

ASM Member Sharing Sessions



ASM Alarm Management Research History

ASM Member Sharing Sessions 

Operator Display Guidelines

First Publication
Visualizing Alarms
Alarm Summary Displays

Mobile Devices

Mobile Alarming
Work Flows

2002

Audible Alarm Design

Alarm Acoustics
Alarm Sounds

Alarm Management Guidelines

First Publication
Best Practices

2003

Human Performance

Models for Alarm Response

ISA SP18 Committee

ASM Representation

Operator Cockpit

Integrated User Interface
Work Processes
Proactive Monitoring

2004

Visual Thesaurus

Visualizing Limits
Situation Awareness

Alarm Floods

Mitigation Techniques (Config)
Typical Practices
Characteristics

2006

Interactive Alarm System

Analysis

Workflows
Interaction Requirements
Correlated Alarms Algorithms

Addressing Alarm

Flooding

Mitigation Techniques (UI)
Alarm Throttling

2008

Information Integration

Methods for Information Cohesion

Alarm Tuning

Deadband/Timer Algorithms

Addressing Alarm Flooding

Mitigation Techniques (Real-Time)

2010

Alarm Rationalization

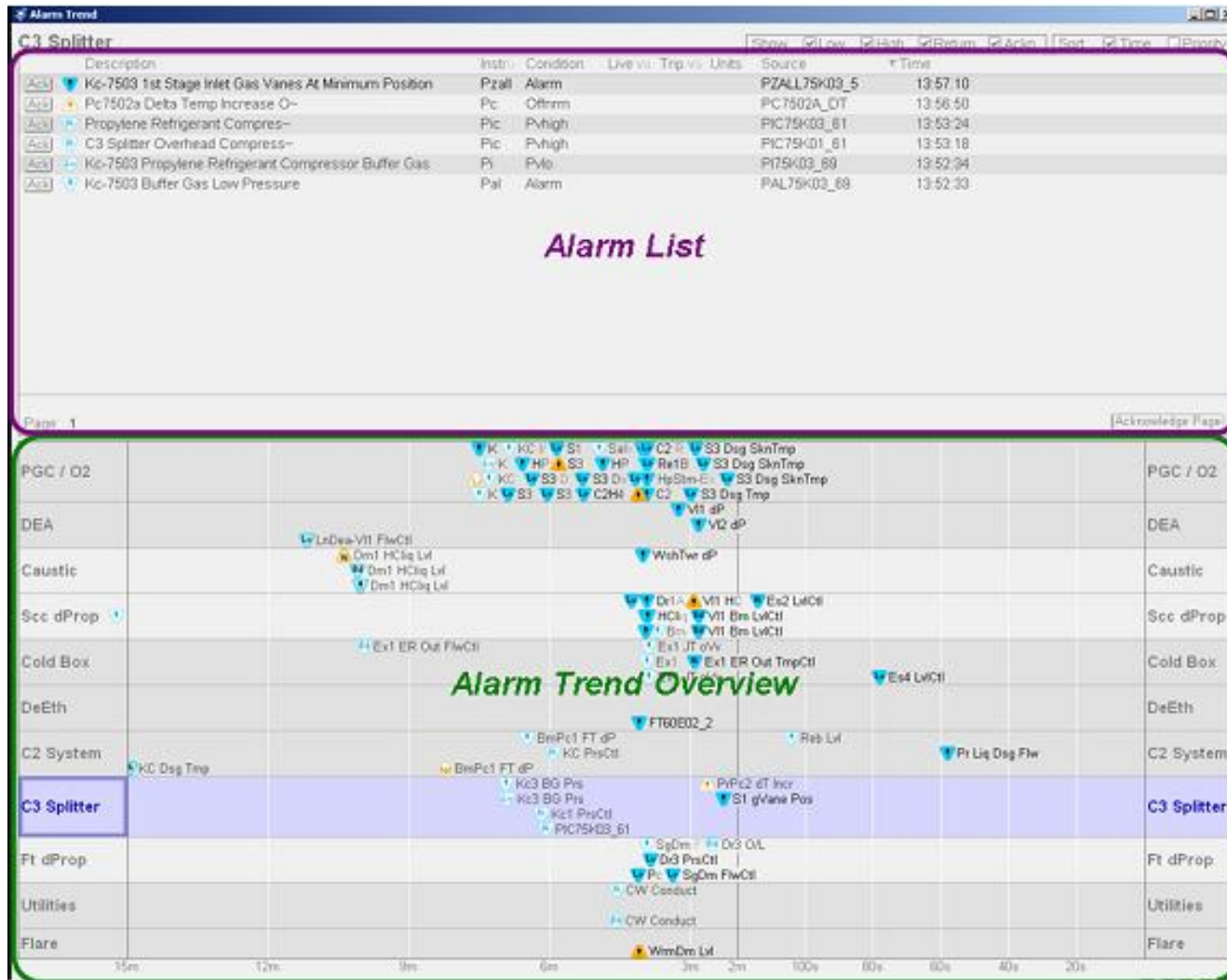
Work Processes
Tools
Guidelines

Alarm Flooding

Mitigation Techniques (Real-Time)
Continued from 2010

2011

ASM 2008 Addressing Alarm Flooding UI Mitigation Technique example



Conclusions

- We all know that the Alarm System Performance problem is not solved yet
- Good alarm system performance – in terms of Average Alarm Rate and Alarm Flood Rates – is a continuous improvement commitment
 - Therefore, Alarm Management is a DCS Lifecycle Maintenance activity
 - e.g., it's not a one-shot rationalization effort
 - Addressing Average Alarm rates likely requires different practices than addressing Alarm Flood rates
- To be successful, sites cannot pick and choose recommended practices and expect to achieve good alarm system performance

The ASM Consortium continues to research alarm problems and pioneer solutions for Alarm Management