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August 24, 2009

Improved Process Performance Using “Best Practices” in Alarm Management



Honeywell

Agenda

- Alarm Management Explained
- Organizations Making a Difference in Alarm Management
- Alarm Management Targets
- Metrics Benchmarking Research
- Results and Summary

What is Alarm Management?

- Wiki Definition

- Alarm management is the application of [human factors](#) along with [instrumentation engineering](#) and [systems thinking](#) to [manage](#) the [design](#) of an [alarm system](#) to increase its [usability](#).

- And this is important because.....

- A small process unit may easily have 5,000 or more alarms
- An offshore platform may have 20,000 alarms
- A refinery complex can have 250,000 alarms

Poor Alarm Management can Contribute to Incidents!

The Pembroke Accident



An HSE report quotes: -

- **275 alarms** in the **11** minutes before the explosion
- “ ... warnings of the developing problem were lost in the plethora of instrument alarms triggered in the control room, many of which were unnecessary and registering with increasing frequency, so operators were unable to appreciate what was actually happening ...”

Too Many Alarms Can Contribute to Incidents

Texas City Incident

15th Body Pulled from Refinery Rubble

By KEVIN MORAN

Copyright 2005 Houston Chronicle

TEXAS CITY - The only worker still missing after the explosion of BP's Texas City refinery was found dead in the plant's rubble today, bringing the death toll to 15. At least seven other blast victims, meanwhile,



ISA-The Instrumentation, Systems, and Automation Society



ISANetwork - Your Online Connection

www.isa.org

InTech
with Industrial Computing

Alarms weren't working at Texas City plant

18 August 2005

Federal investigators say managers authorized the start-up of a unit in March despite knowing key alarms weren't working. That start-up killed 15 people. The Wall Street Journal reported the

Missed and Malfunctioning Alarms Cause Problems Too!

panel immediately to review safety across its U.S. refining operations.

www.eemua.org

www.asmconsortium.org

EEMUA - Engineering Equipment & Materials Users' Association

ASM – Abnormal Situation Management



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The Abnormal Situation Management (ASM) Consortium is a group of leading companies and universities involved with process industries that have jointly invested in research and development to create knowledge, tools and products designed to prevent, detect and mitigate abnormal situations that affect process safety in the control operations environment.

Abnormal Situation Management® A Joint Research and Development Consortium

In The News

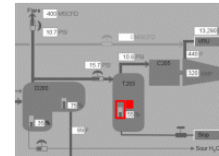
August 2009 - Chemical Processing.com
Make the Most of Your Summer Reading
 Aug 6 - Two new books provide important insights and guidance about plant safety.

August 2009 - The Galveston County Daily News
USW walks out on safety talks
 Aug 5 - The union that represents the bulk of the nation's oil refinery workers walked out of talks with oil industry representatives on worker safety issues stemming from federal findings in the 2005 explosion at the BP-Texas City refinery that killed 15 people.

August 2009 - Courthouse News
Shareholders Sue BP Execs for Fatal Fire
 Aug 5 - GALVESTON - BP America (fka British Petroleum) and its directors cost shareholders millions of dollars by their flagrant violations of safety and environmental laws that led to

ASM Consortium

Going Beyond The Obvious to Achieve Excellence
 A theme of this paper is to go beyond the obvious sources of requirements to understand all of the console operator's interface needs necessary to effectively support their work activities. This paper introduces four methods that can be used to identify console operator interaction requirements from four sources, including collaboration and communication requirements, procedural operations requirements, monitoring and control strategies, and equipment limits, operating envelopes, and functional relations between critical process variables.



Webinar Recording Available: Effective Operator Display Design
 Gain a better understanding of the contents of the ASM Consortium Guidelines: Effective Operator Display Design, including: The sixteen guideline categories (from display content to display layout to use of color to alarm annunciation to management of change) and Specific design guidelines to address to avoid significant pitfalls. PDF of the slides and the Recording are both available for viewing.

→ Recording of the workshop presented July 14, 2009.

Available Now! Effective Alarm Management Practices
 The ASM Consortium Guidelines for Effective Alarm Management Practices (ISBN: 987-1442184251) are available for purchase at Createspace.com at the link below, or from Amazon. These guidelines can be used to assess the quality of a company's alarm management practices and develop an improvement plan.

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Incidents

August 2009 - Charleston Gazette
Chemical leak at DuPont plant calls out fire department
 Aug 19 - CHARLESTON, W.Va. -- A chemical leak at the DuPont plant in Belle on Tuesday released less than one pound of monomethylamine into the atmosphere, said Roger Hess, DuPont's human resources manager.

August 2009 - Reuters
Explosion at Czech Unipetrol refinery injures 4
 PRAGUE, Aug 18 - An explosion in an empty storage container at a refinery of Czech downstream oil group Unipetrol on Tuesday injured four people, three seriously, the company said in a

Organizations Addressing the Alarm Management Challenges

EEMUA Publication 191

- Practical guidance with specific goals
- Heavy focus on redesign (“rationalisation”):
- Recommends areas to target
- Calls for other improvements
 - MOC – (Management of Change)
 - Alarm suppression
- Adopted and followed in many countries

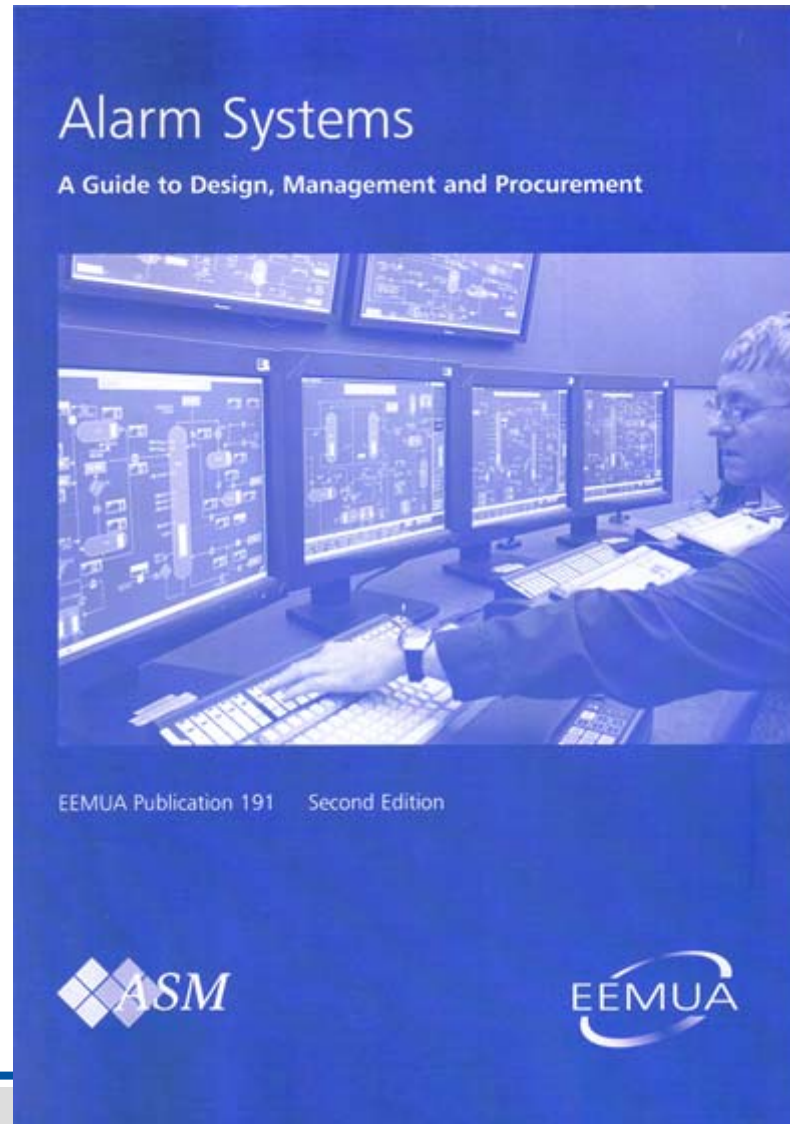
A Huge Step Forward in Practical Alarm Management Advice

EEMUA Publication 191

**Best practices
for design,
management
and
procurement of
Alarm Systems**

**Setting goals
for Industry**

EEMUA - Engineering Equipment &
Materials Users' Association



**Often referred to
as the 'defacto-
standard'**

**Endorsement by
UK HSE and
ASM
Consortium**

**Second Edition
Published in
2007**

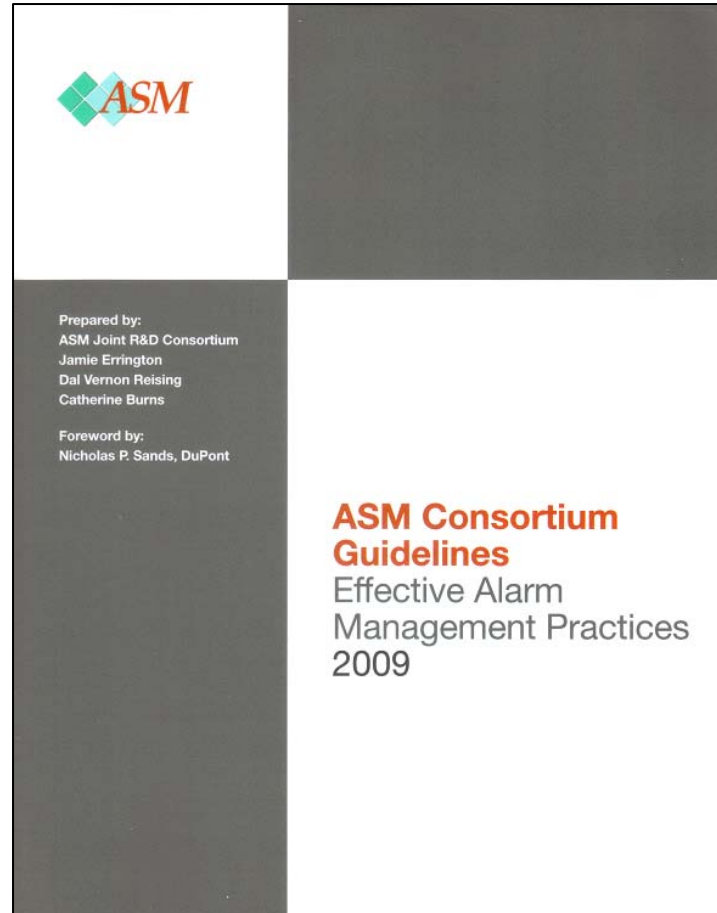
ASM Consortium Publication

- Recently published *Effective Alarm Management Practices*
- Specific criteria to assess “health” of alarm management systems
- Guidelines & examples on how to achieve compliance to standards and goals.
- The guidance is prioritised so that users with limited resources can easily identify the most appropriate recommendation

Proven Techniques Provide Specific Directions and Priority

Effective Alarm Management Practices

Complements the EEMUA document by explaining why and how to do effective alarm management.



Learn how to assess Alarm Management capability.

Written with collaboration of end users!

**First Edition
Published 2009**

EEMUA Alarm Targets

- The EEMUA guidance includes 2 very significant metrics
- These 2 metrics and their respective targets had been the focus of much discussion – with some experienced Engineers stating that neither was realistic.
- ASM Consortium Research to determine

Metric	Value
Average Alarm Rate	< 1 per 10 minutes
Rate of alarms in first 10 minutes following an upset	< 10 per 10 minutes

Are EEMUA Alarm Targets Realistic?

ASM Performance Metrics Benchmarking Project

- Approach:
 - Surveyed 37 consoles at ASM Members' sites
 - Each console represented a portion of a plant that was managed by a single console operator under normal conditions
 - 90 months of data overall
 - Collected static alarm configuration information plus dynamic alarm information and operator actions
 - Also collected anecdotal data that related impact from applying best practices for alarm management

Actual End User Data Used in Research

ASM Performance Metrics Benchmarking Project

- Purpose:
 - Determine if EEMUA alarm recommendations are achievable
 - Determine what factors influence alarm performance
- Possible performance shaping factors:
 - Scope of control
 - Number of configured alarms
 - Degree of rationalization
 - Degree of automation
 - Type of process etc.



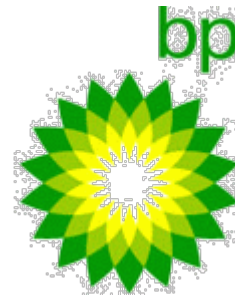
Research seeks to validate if goals are attainable

ASM Member Research

Honeywell



ConocoPhillips



ExxonMobil



DRIVING EXCELLENCE

sasol
reaching new frontiers



Human Centered Solutions
Helping People Perform

UCLA



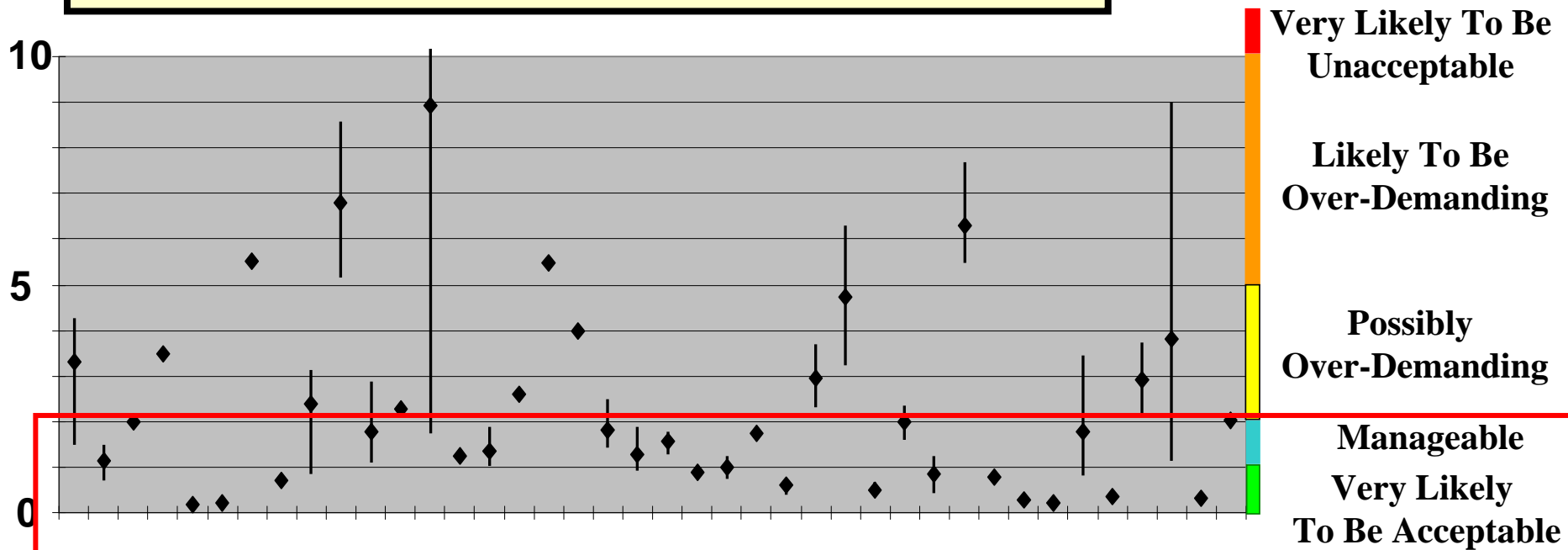
UOP

A Honeywell Company



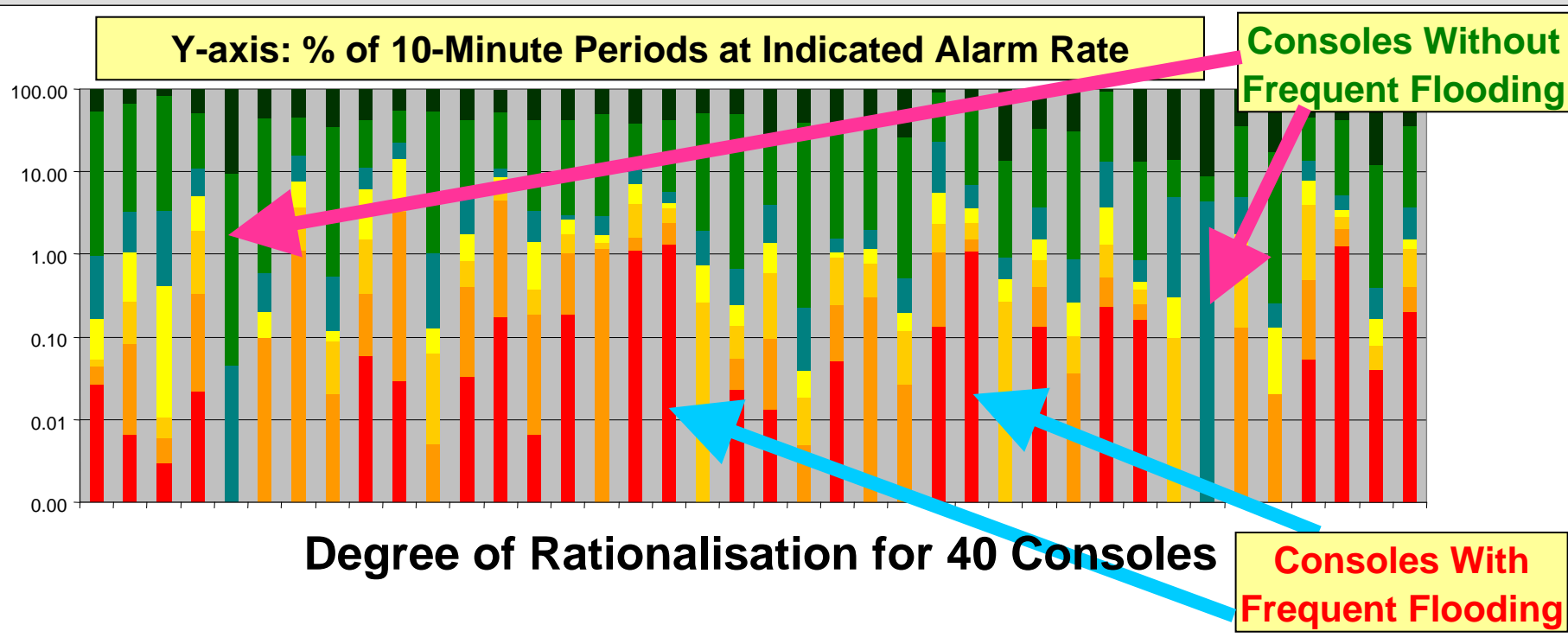
Results: Average Alarm Rates

- Sites can meet and sustain the EEMUA 191 “Manageable” and “Very likely to be acceptable” levels of overall average alarm rate performance



Actual Configured Alarms vs. EEMUA Recommendation for Configured Alarms

Results: Percentages of Time at High Alarm Rates



- **None** of the consoles met the EEMUA flood target (of < 10 alarms per 10 minutes) for the entire duration of data collection
- The peak alarm rate is not closely correlated with the degree of rationalization
- Peak alarm rates exceeding 100 alarms per 10 minute window were experienced at least once by 60% of the consoles

Benchmarking Project - Results

- Performance does not correlate well with any one factor
- In general, huge improvements in the “normal” alarm rate have been made in the last few years – mostly due to the application of the EEMUA 191 guidance.
- Peak alarm rates are still higher than recommended by EEMUA
- System performance depends on many factors – including issues like access to “Alarm Help” – which hasn’t been covered here.

Alarm Management Performance Varies Widely

Summary

- Considerable progress has been made in Alarm Management
- The ASM Consortium & EEMUA Guidance can help
- The potential improvements are huge – a big accident can cost > US \$ 100 Million.
- Good graphics – with integrated functionality for “alarm help” give real benefits.
- Much remains to be done, particularly in the challenging area of “alarm floods”. (Scope for more academic involvement?)

Good progress due to rationalization

Metric	Value
Average Alarm Rate	< 1 per 10 minutes
Rate of alarms in first 10 minutes following an upset	< 10 per 10 minutes

The most difficult problem. More work needed!

Contact for Further Information

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