“Better Alarm Handling” is OPEN from 09.30 hours Welcome

Thursday 21 June 2007

Hilton Manchester Airport Hotel
Manchester UK

Welcome

Bill Swift

Chairman of Council, EEMUA

Corporate Project Manager, Innospec

Welcome

- Safety and Housekeeping
- Programme for the Day
- Exhibits and Literature Displays
- Speakers' Presentations
- Questions and Comments

Morning Session – from 10.15

- Introduction
- The HSE's view on management of alarm systems
- About the updated 2nd Edition of EEMUA Publication 191
  - Overview of the changes
  - Understanding some specific aspects
- Networking and Displays

Lunch served from 12.30

Afternoon Session starts 13.30

- Measuring performance
- Batch manufacturing
- Running an improvement programme
- Panel Review – Question time
- Summary and Future Plans
- Networking and displays

Close: 16.15 hours

Introduction

Clive Tayler, Executive Director

The Engineering
Equipment and Materials
Users' Association

Introduction

- About EEMUA
- Origins of Publication 191
- The 2007 Edition
- Some points to note

EEMUA

A European based, non profit distributing, ***industry Association*** run for the benefit of companies that that own or operate industrial facilities

EEMUA

Aims to improve the safety, environmental and operating performance of industrial facilities in the most cost-effective way

EEMUA Members pursue these aims by:
Sharing engineering experiences and expertise and by the promotion of their distinct interests as ***users*** of engineering products

EEMUA

Governing Council of Members

Council Management Committee (CMC)

External Representatives (e.g. IEC 61511)

Collaborators

Committees and Forums (e.g. INC)

Working Groups (e.g. 191 WG)

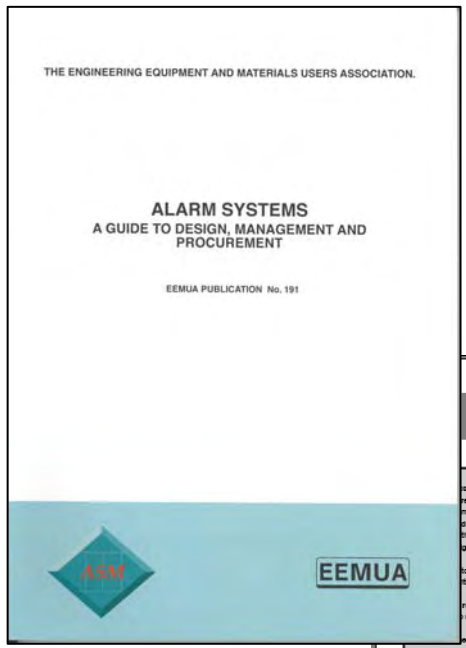
EEMUA Executive

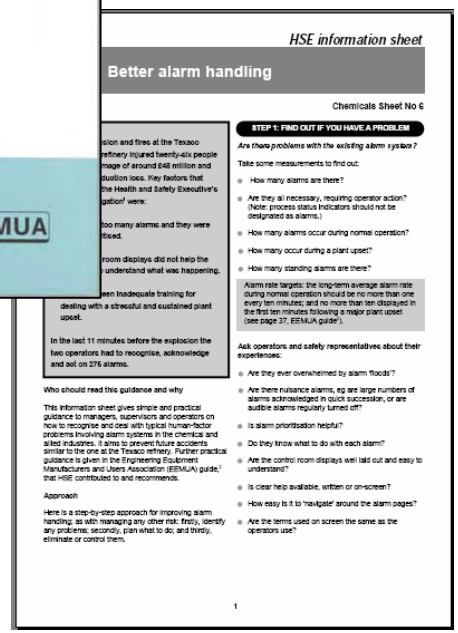
Origins of EEMUA 191

- 1979 – Three Mile Island
- 1984 – Bhopal
- 1987 – Herald of Free Enterprise
- 1994 – Milford Haven
- 1996 – Channel Tunnel

Origins of EEMUA 191

- **EEMUA**
  - Provide Guidance
  - Develop consensus on what is good and best practice
- **HSE**
  - "Better alarm handling"
    - Investigate
    - Plan, do, check and …
    - Manage
  - *Realise the benefits!*





EEMUA 191 - 2007 Edition

- Core principles and Roadmap (pages xvii – xix)
- Alarm system philosophy (1 – 6)
- ★ Design principles (7 – 22)
- ★ Implementation issues (23 – 34)
- ★ Performance measurement (35 – 42)
- Managing an improvement programme (43 – 47)
- Buying a new alarm system (49 – 52)
- ★ Appendices (53 – 167)
- Feedback form; list of other EEMUA Publications

★ – *New part or significant revision*

Some points to note …

- EEMUA Publication 191 provides “clear, and now tried and tested, guidance” (HSE – see page v)
- Key changes in 2007 Edition listed (page xiv)
- There’s no substitute for tools and techniques, expertise, and direct experience (see page 40 – and meet with attendees at this event)
- Measuring performance is key to improvement (page 35)

Some more points to note …

- Generic guide: needs interpretation by application sector: e.g. batch (page 153)
- Alarm system improvement is a journey not a finish line (page 160)
- *And finally …*
  the new 3rd Edition starts here! See and use the EEMUA 191 feedback form (page iii); listen and participate in the Summary session (later today)

End of Introduction

Clive Tayler, Executive Director

The Engineering
Equipment and Materials
Users' Association

Health and Safety Executive

HSE view on alarm management

Revised EEMUA 191 Guide

John Wilkinson, Team Leader
Human & Organisational Factors Team, HSE HID Onshore

Human & organisational factors team
Hazardous Installations Directorate

Aim:

To drive continuous improvement in the management of human performance in the control of major accident hazards (MAHs) in the chemical and allied onshore industries.

Wide range of activities

Inspection, investigation, assessment, expert witness, advice, guidance, training, research etc.

What do we mean by ‘human factors?’

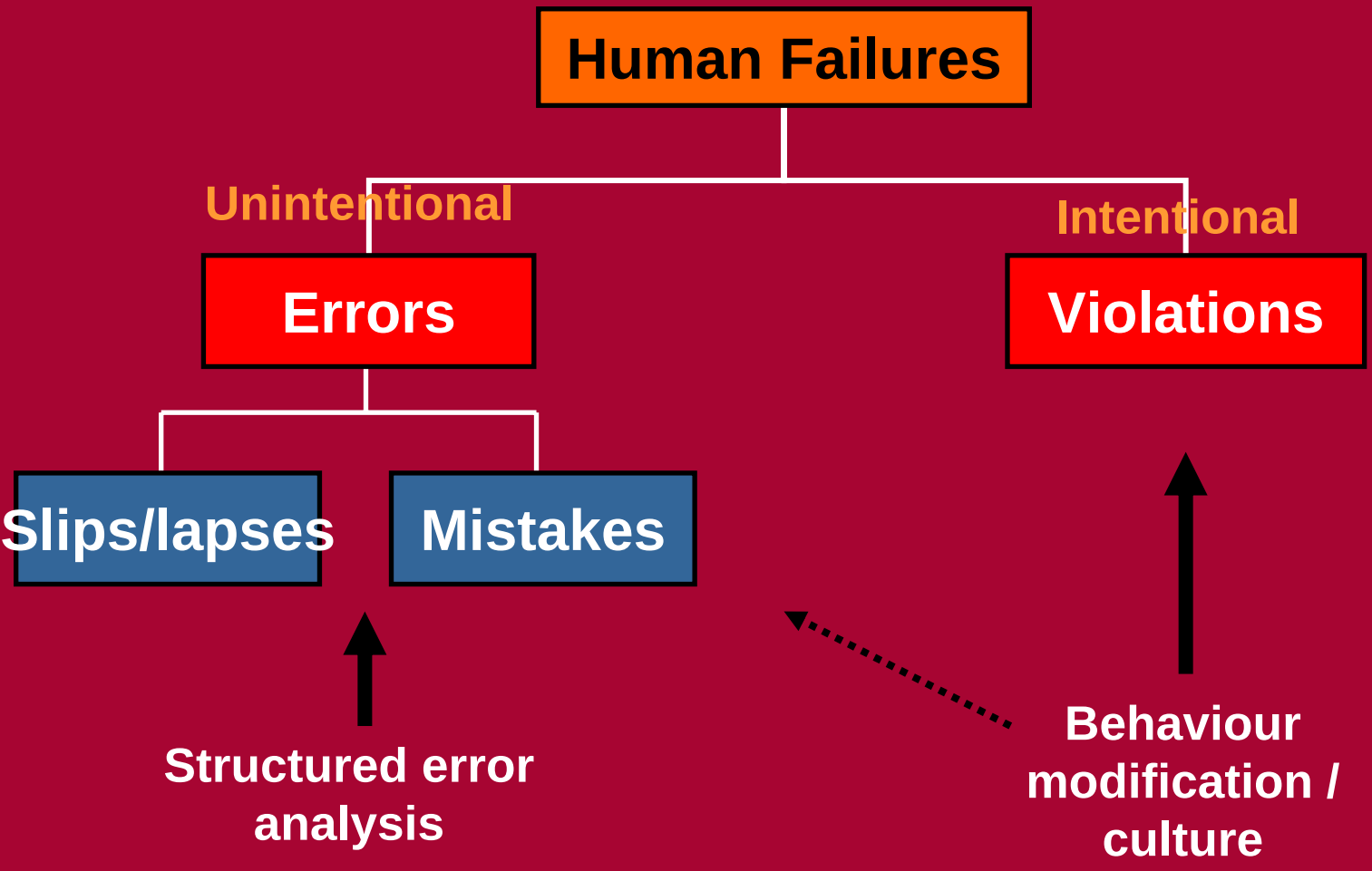
Key human factors issues for COMAH sites

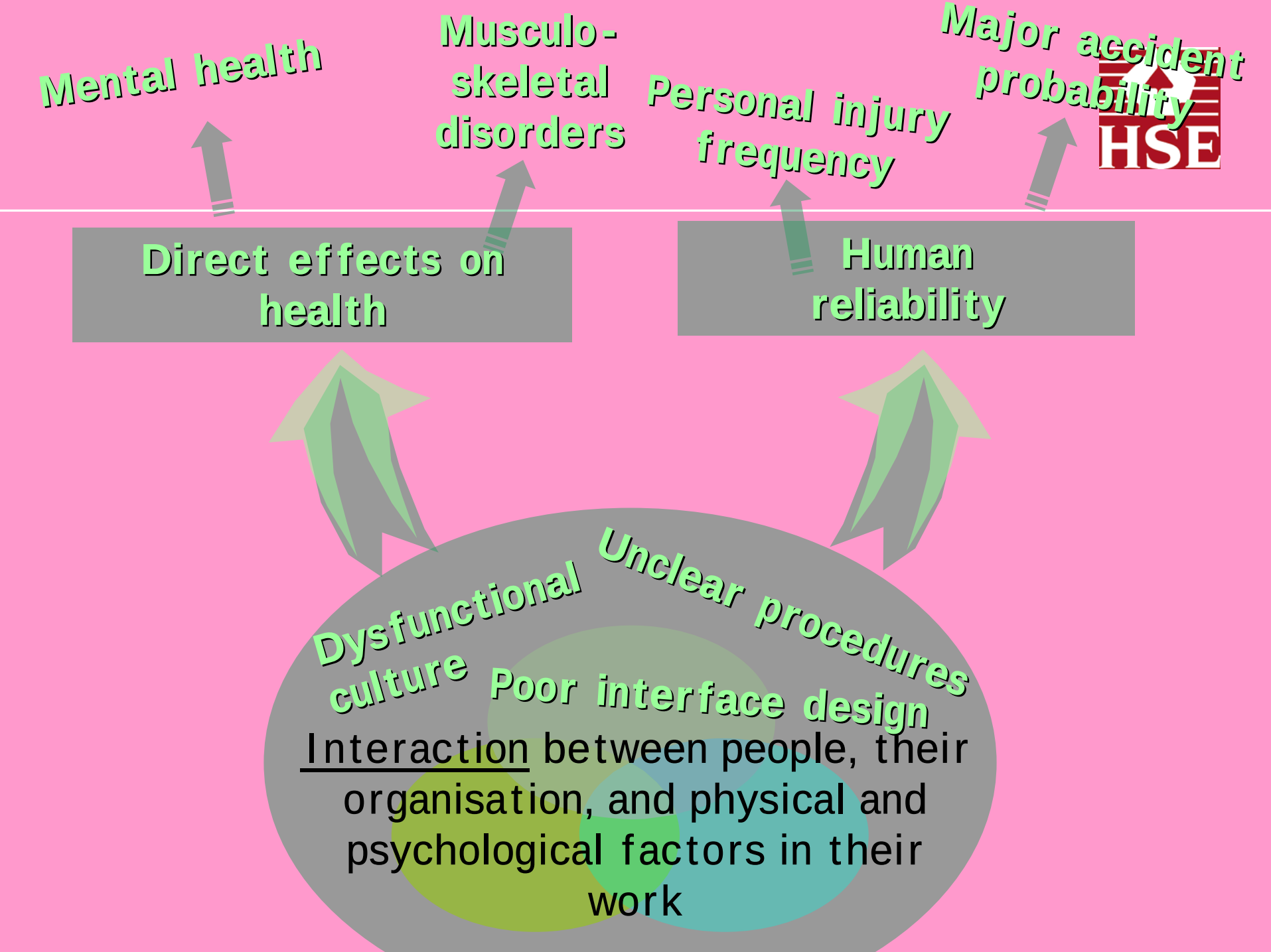
- Organisational change
- Staffing arrangements
- Training & competence
- Procedures
- Fatigue & shiftwork
- Behavioural safety
- Managing human failure
- Organisational culture & management style
- Human factors in design
- Communications & interfaces
- Integration of HF into risk assessment & investigations

Outline

- Why bother?
- Incidents
- HSE approach
- Barriers
- Key issues

Are you managing human failures?
Are you sure?




Mental health
Musculo-skeletal disorders
Personal injury frequency
Major accident probability
HSE
Direct effects on health
Human reliability
Dysfunctional culture
Unclear procedures
Poor interface design
Interaction between people, their organisation, and physical and psychological factors in their work

Why focus on alarm management?

- We consulted inspectors, industry & intermediaries
- Texaco and other major incidents
- Lack of apparent progress at the sharp end
- Recognition that there was work still to do to facilitate change

SO:

- Selected as one of the original ‘Top Ten’ issues & first for guidance (2000)

Scope

- Alarm management is a wide issue about assuring the human response to an alarm
  - Not just for continuous processes with distributed control systems
  - Applies equally to small major sites where reliance is placed on human response to alarms eg tank storage
  - *Calls for human-centred design*

Control philosophy & wider issues

- What is the overall control philosophy?
  - Manual control vs automatic control
  - But what is automated and why?
- Alarms are linked to many of our key human factor issues
  - Check wider control, environment & interface issues - *EEMUA Publication 201*

Outline

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- Barriers
- Key issues

Texaco Incident, Milford Haven 1994: Lessons

- Alarm floods; too many standing alarms
- Control displays and alarms did not aid operators:
  - No process overview to help diagnosis *(& see EEMUA Publication 201)*
  - Alarms presented faster than they could be responded to
  - 87% of the 2040 alarms displayed as "high" priority, despite many being informative only
  - Safety critical alarms not distinguished

Other lessons

Alarm system has to be set in Safety Management System (SMS) context. The SMS failures at Texaco included:

- Plant mod procedure
- Instrument maintenance system
- Operator training/competence
- Lack of clear guidance on managing unplanned events & when to shutdown
- Lack of clear authority to initiate shutdown

– Ultimate plant safety should not depend on operator response to an alarm.

Esso Longford

Alarm issues:

- 300-400 alarms daily
- Up to 8500 in upset
- Alarm numbers accepted as ‘normal’
- No engineering support on site
- Operators did their best to meet perceived company priorities
- Flawed decision to restart (compare: Three-Mile Island)

Outline

- Why bother?
- Incidents
- HSE approach
- Barriers
- Key issues

HSE Alarms Strategy

- Derived from Texaco report recommendations
- HSE research
- The EEMUA Guide; and
- Experience so far from inspection, assessment & accidents
- IEC61508/11

The EEMUA Guide

- HSE supported the original & was closely consulted on the revision
- HSE regards it as nearest thing to a standard currently available
- Useful, accessible and used - EEMUA bestseller
- Human factors are key elements…
- …key C&I issues also present

‘Better Alarm Handling’

www.hse.gov.uk/humanfactors/comah/index.htm

HSE produced simple and practical guidance to underpin the EEMUA Guide:

- Promoted it widely
- Improved training for inspectors and industry
- Continue to raise profile of alarm management through inspection, assessment & intermediaries
- Developed WebPages – eg CHIS6,HF Briefing Note No. 9 & Toolkit

HSE expectations

HID expects:

- A policy that recognises human factors of alarm handling as a management issue
- A ‘championed’ logical review process
- A sensible, timed, and tracked action programme to deal with issues found
- For COMAH - *rigorous demonstration that human factors have been addressed adequately where operator response to alarms claimed as defence against incidents*

Progress

- Encouraging signs of progress appearing now:
  - Emerging good practice in some areas
  - Safety reports beginning to tackle alarm handling
  - Training, support or guidance for field inspectors and industry now available
  - Users becoming more aware of the issue

  But:
  - Implementation often poor or ‘stuck’
  - Some sites assume silence means all is well
  - It’s not just large DCSs that need attention
  - Entropy….

Outline

- Why bother?
- Incidents
- HSE approach
- Barriers
- Key issues

Existing systems

It can be a hard issue to tackle:

- The ‘I wouldn’t start from here’ syndrome
- Addressing it requires resource, persistence & good project management
- Need good – and early - workforce participation
- Failure to address ‘quick wins’
- Contribution of alarm handling to upsets, emergencies & incidents not always seen
- Often not considered in investigations
- Operators, managers & engineers often accept alarm floods & nuisance alarms as the status quo

New/upgraded systems

- The differing needs of users, suppliers, manufacturers, designers etc not always well understood for upgrades and new projects
- Often contracts & specifications are ‘diluted down’ by the contract, installation & commissioning process
- Low expectations & poor user specifications
- Overuse of increased flexibility ie more alarms
- Inadequate linking to major hazards & risk assessments

Outline

- Why bother?
- Incidents
- HSE approach
- Barriers
- Key issues

Alarms: key principles

- Usability
  - Consider users needs & capabilities.
- Safety
  - Realistic human performance/ reliability claims
- Performance monitoring
  - Initial design, commissioning, audit.
- Engineering investment
  - Justify and engineer all alarms.

Users

Users need to:

- Review: evaluate, prioritise and modify
- Ensure new designs meet EEMUA principles
- Remember other key elements eg
  - Wider design issues
  - Control room environment
  - Workload and numbers
  - All foreseeable conditions - normal, upset, shutdown/start-up, maintenance and emergency

Designers/manufacturers

They need to:

- Be able to demonstrate that their standards and approach meet EEMUA
- Follow a human-centred design approach

Summary

The right stepping stones have been put in place over the last 10 years:

- Guidance & training available
- Solutions available by design/modification
- Awareness of the issue increasing
- Some good practice emerging
- *Continuing focus required though, incidents are still occurring*

HSE expects to see the EEMUA guide used

www.hse.gov.uk/humanfactors/comah/index.htm

EEMUA 191

Andrew Lichnowski

RWE npower

Tribute to Matthew Bransby

- Matthew Bransby made a major contribution to the development of Alarm Systems.
- Contracted as a ‘Technical co-ordinator and author’ of the original EEMUA 191 document
- Tragically, Matthew died 5th August 2000 in a climbing accident in Greenland
- Sadly missed by family, friends and work colleagues
- Matthew would be delighted that the work goes on

Texaco Refinery 1994

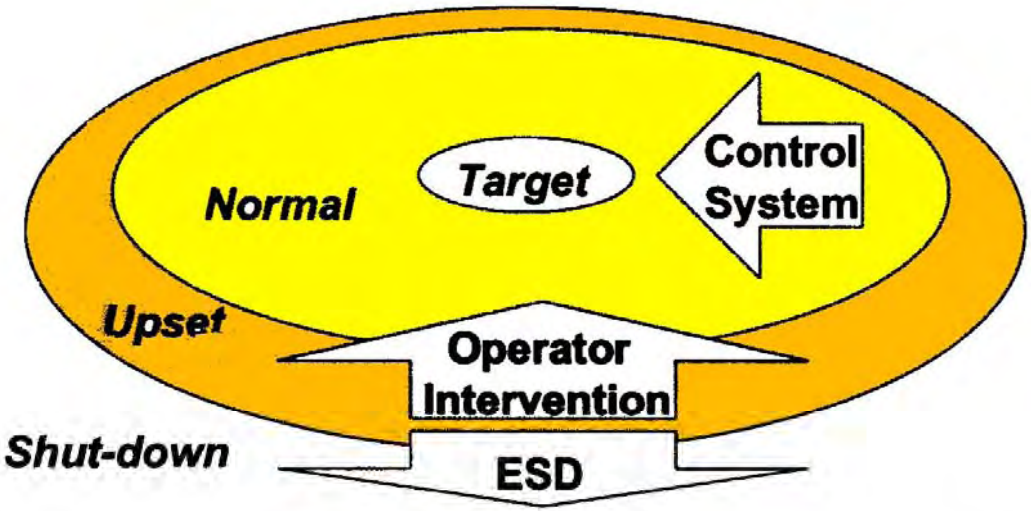
EEMUA 191 History

- EEMUA Alarms Work Group formed 1993
- Texaco Milford Haven 1994, incident report led to
- HSE Research Report (Bransby & Jenkins 1998)
- Contribution to the EEMUA guidance
- Co-sponsored by ASM Consortium
- EEMUA 191 published 1999
- Chemical Industries Information Sheet 6
- High profile at industry conferences & publications
- Quoted by many as the ‘de-facto’ standard

Consortium

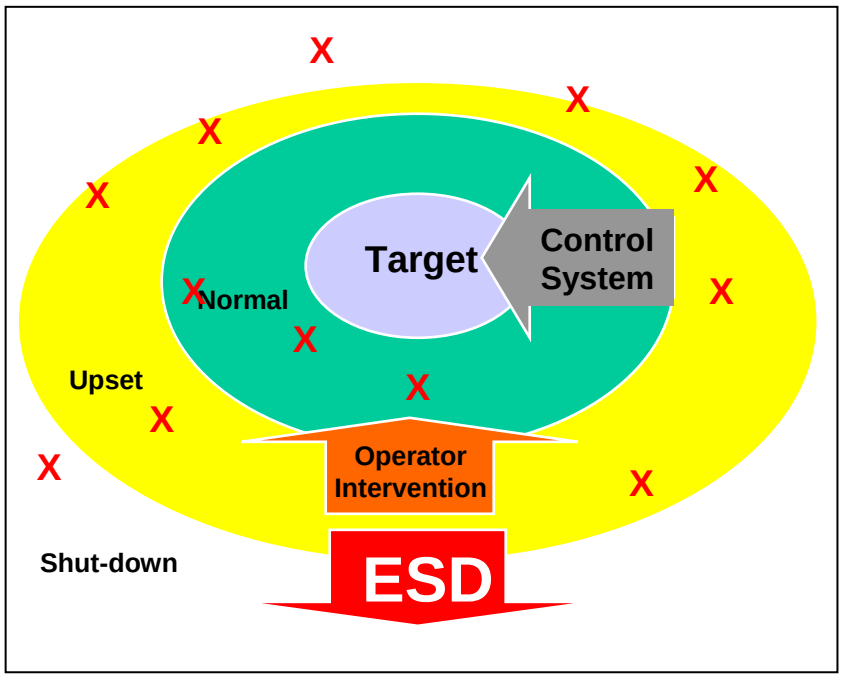
- Abnormal Situation Management
- USA Industrial Plant Consortium
  - Site Assessment Methodology
  - Effective Operations Practices
- Solutions
  - Alarm Management
  - Collaborative Decision Support
  - Operator Display Design and Tools
  - Training for Operations and Maintenance
  - Workplace Design

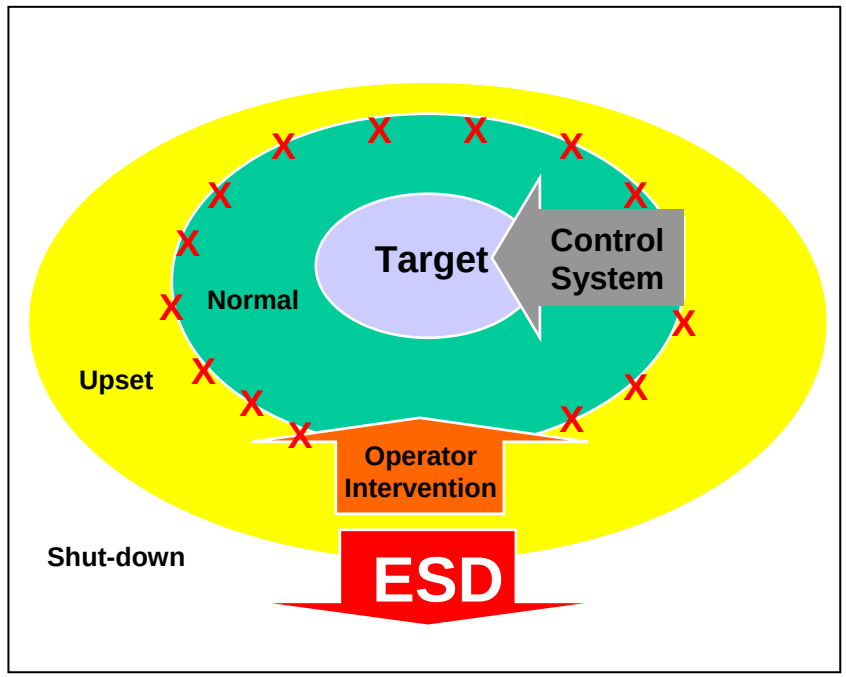
Alarm Objectives



Plant state	Operator's primary role	Key alarm information
Normal	monitoring & optimisation	minor operating adjustments needed
Upset	situation management	operator intervention needed
Shut-down	ensure safe shut down	safety actions needed

Alarm Objectives





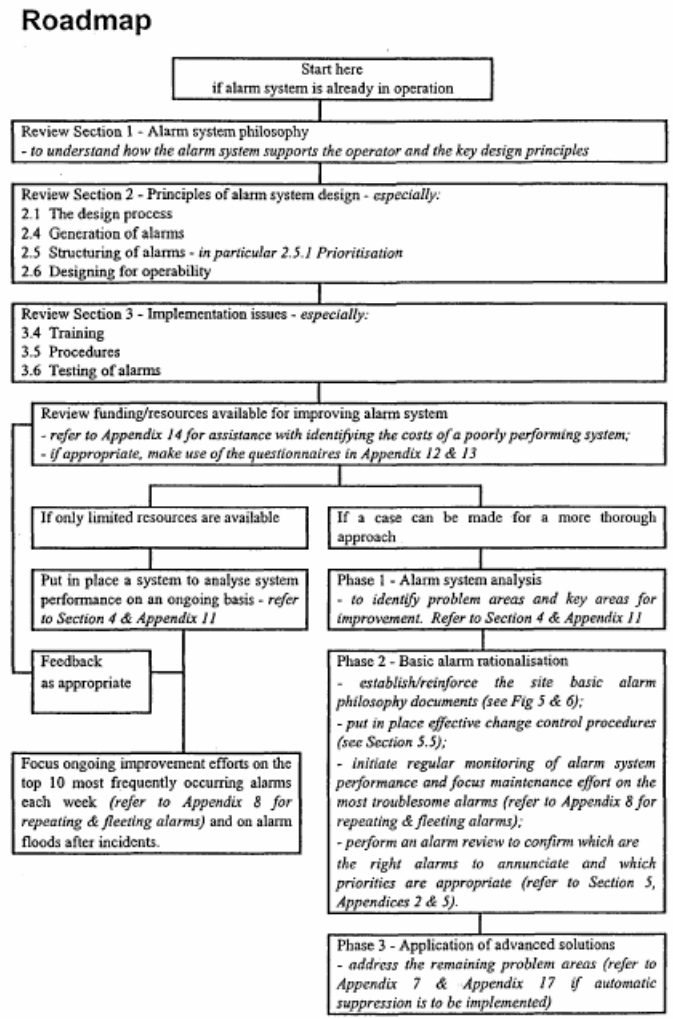
Ineffective Alarm system

Effective Alarm system

Four Core Principles

1. Ensure usability of the alarm system
2. Identify safety-related aspects
3. Monitor system performance
4. Reduce overall cost of ownership by initial engineering investment

EEMUA 191 Roadmap



Alarm Key Attributes

- Alert, inform & guide
- Useful and relevant
- Have a defined response
- Adequate time should be allowed for the operator to carry out a defined response
- The alarm system should be designed to take account of human limitations

Characteristics of a Good Alarm

CHARACTERISTICS OF A GOOD ALARM	
• Relevant	i.e. not spurious or of low operational value
• Unique	i.e. not duplicating another alarm
• Timely	i.e. not long before any response is needed or too late to do anything
• Prioritised	i.e. indicating the importance that the operator deals with the problem
• Understandable	i.e. having a message which is clear and easy to understand
• Diagnostic	i.e. identifying the problem that has occurred
• Advisory	i.e. indicative of the action to be taken
• Focusing	i.e. drawing attention to the most important issues

EEMUA 191 Review Process

- EEMUA Instrumentation and Control Committee
- Invited comments
- Considered by Alarms Working Group
- Characterised into
  - Accepted & included
  - Rejected
  - Deferred for 3rd Edition
- Nov 2006 presented to HSE for comment
- Comments incorporated as above
- Endorsed by ASM Consortium
- Published June 2007
- 3rd Edition process starts

EEMUA 191 Review Process

- Minor changes throughout document
  - Spelling
  - Grammar
  - Consistency of Style
  - Gender he/she etc
  - Acronyms

EEMUA 191 Overall Structure

1. Alarm System Philosophy
2. Principles of Alarm System Design
3. Implementation Issues
4. Measuring Performance
5. Managing Improvement Programme
6. Buying a New Alarm System

Revision

EEMUA 191 Appendices

1. Glossary
2. Design of individual alarms
3. Risk Assessment
4. Examples of Risk Assessment
5. Setting of Priority
6. Types of Alarms
7. Alerts

New Section

Revision

EEMUA 191 Appendices

8. Logical Processing of Alarms
9. Repeating and Fleeting Alarms
10. Design of Field Alarm Sensors
11. Design of Alarm List Displays
12. Performance Metrics
13. Performance Levels
14. Operator Questionnaire

New Section

Revision

EEMUA 191 Appendices

15. Usefulness Questionnaire
16. Costs of Poor Alarm Performance
17. Specification Checklist – Large
18. Specification Checklist – Small
19. Alarm Suppression Hazard Study
20. Alarm Management in Batch Plants ★
21. Alarm System Improvement Process ★

★ New Section

Introduction

- Complete Revision
- Alarm system performance is still being cited in continuing major incidents as a contributory factor (for instance, see the Australian Longford refinery incident).

1.2 The Role of the Operator

- Added to context (p3)
  - "The types of operational state to be considered include start-up/shutdown, normal, abnormal/upset, emergency and maintenance (see EEMUA 201 [REF H] and Appendix 8.3.4)"

2.3.3 Risk Assessment

- 2.3.3 Safety Related Alarms (p12)
  - Reemphasis on IEC 61508/11
  - Separate system if PFD_{avg} 0.1-0.01
- 2.3.4 Reliability Claims (p13)
  - No human response alarms if PFD_{avg} <0.01

2.3.3 Safety Related Alarms

IEC 61508 - Standard

An alarm is safety related if :

- It is claimed as part of the facilities for reducing the risk from hazards to people to a tolerable level
- And the claimed reduction in risk provided by the alarm system is “significant”

“Significant” means a claimed Average Probability of Failure per Demand of less than 0.1

2.3.3 Safety Related Alarms

If an alarm system (or part of it) is considered as safety related :

- It should be designed, operated and maintained in accordance with IEC 61508.
- It should be independent & separate from the process control system, unless the process control system itself is safety-related and conforms to IEC 61508

Traditional DCS are not engineered to IEC61508 specifications and should not be used for safety-related alarms.

3.4 Training

- 3.4 Training (p31)
  - Processes should be in place to regularly review the training content and identify the need for refresher training.

3.6 Testing of Alarms

- 3.6.1 Management of Testing (p33)
  - Strategy for Safety Related Alarms
  - Testing of higher priority where financial or environmental concerns
  - Regular normal operation may adequately demonstrate correct functionality

4 Measuring Performance

- 4.1.1 Key Performance Indicators (p36)
- 4.1.2 Performance Levels (p38)
- 4.2 Data Analysis Tools (p40)
- 4.2.1 Specification of Alarm Logging and Analysis Tools (p41)
- Further detail in presentation by Donald Campbell-Brown

Appendix 1 Glossary

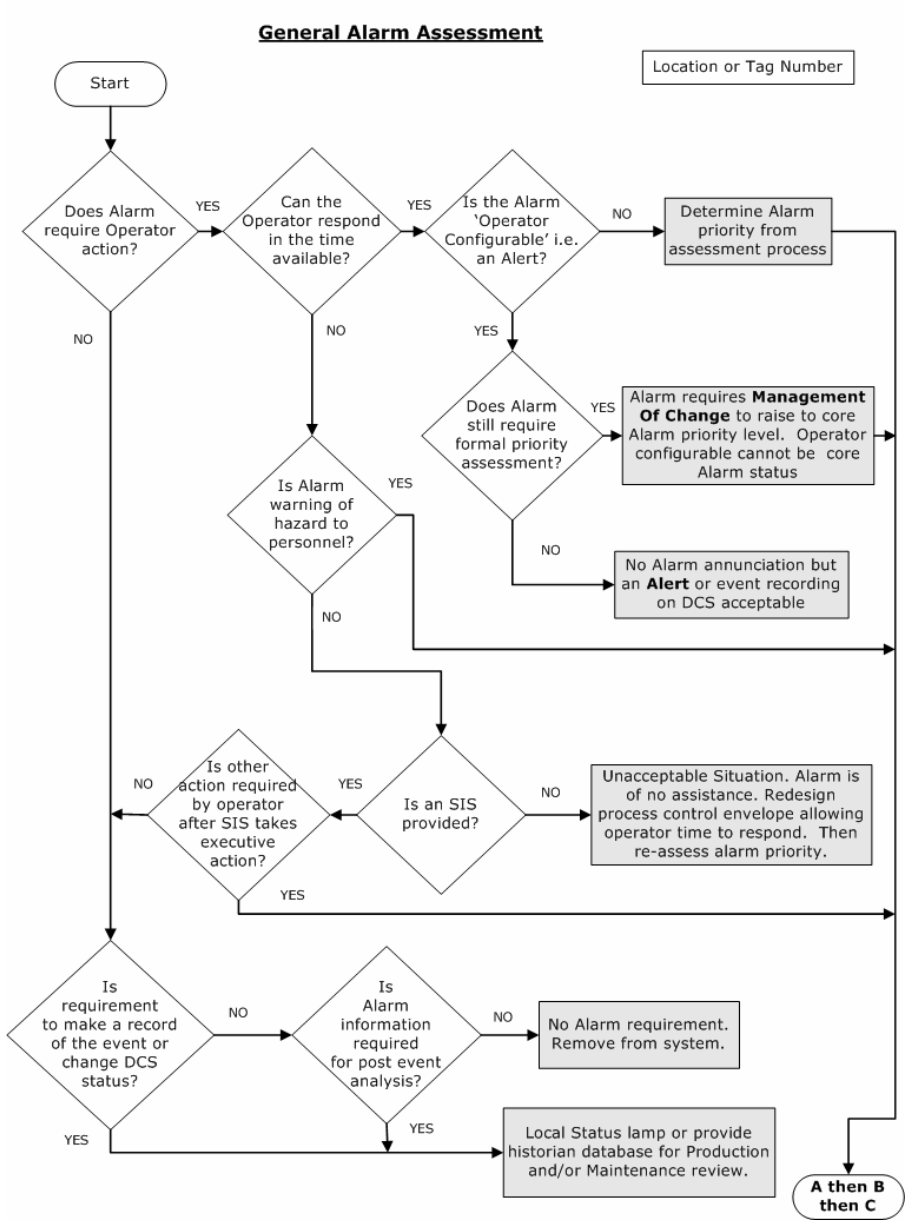
- Significant Revision (p55)
  - 65+ Terms defined
  - Acronyms included

A4.1 Qualitative Risk Assessment

- Example: High current alarm on an electric motor driving a large pump
- A4.1.1 Identification of Risks (p65)
  - Section revised

Appendix 5 Priority Setting

- A5.5.3 Method 3: Flow Chart Assessment
  - General Alarm Assessment (p77)
  - Safety Assessment (p78)
  - Environmental (p79)
  - Commercial Loss (p 80)
- A5.6 Record Keeping
  - Example of recording information and data (p82)


General Alarm Assessment
Location or Tag Number
Start
Does Alarm require Operator action?
YES
Can the Operator respond in the time available?
YES
Is the Alarm 'Operator Configurable' i.e. an Alert?
NO
Determine Alarm priority from assessment process
NO
NO
YES
Does Alarm still require formal priority assessment?
YES
Alarm requires Management Of Change to raise to core Alarm priority level. Operator configurable cannot be core Alarm status
Is Alarm warning of hazard to personnel?
YES
NO
No Alarm annunciation but an Alert or event recording on DCS acceptable
NO
Is other action required by operator after SIS takes executive action?
NO
YES
Is an SIS provided?
NO
Unacceptable Situation. Alarm is of no assistance. Redesign process control envelope allowing operator time to respond. Then re-assess alarm priority.
YES
Is requirement to make a record of the event or change DCS status?
NO
Is Alarm information required for post event analysis?
NO
No Alarm requirement. Remove from system.
YES
YES
Local Status lamp or provide historian database for Production and/or Maintenance review.
A then B then C

Appendix 7 Alerts

- New Section (p86)
  - Deliver automatic notification capability
  - Process conditions that require attention
  - Annunciated on separate display
  - Not on standard alarm display
  - Always of lower priority than alarms
  - Ignoring does not have serious consequences
  - May replace lower priority alarms

Appendix 9.8 Shelving

- Critical Alarm Shelving (p101)
  - Nuisance Critical Alarms
  - Use single line annunciation if possible
  - Temporary shelving to limit nuisance
  - Formal authorisation from a technically competent authority
  - Automated reminders
  - Prevent permanent shelved status

Appendix 13 Performance Levels

- New Section (p123)
  - Defining Performance Levels
  - Validation of Metrics
- More detail in presentation by Donald Campbell-Brown
  - ‘Measuring Performance’

Appendix 20 Batch Plants

- New Section (p153)
  - Batch Plant operation
  - Operator information
  - Alarm Rates
  - Application of Alarm Priorities
  - Design of Alarms
- Presentation by Peter Bruce
  - ‘Batch manufacturing’

Appendix 21 Improvement Process

- New Section(p160)
  - Alarm Management Improvement Process
- Presentation by Chris Dicken
  - ‘Running an improvement programme’

HSE Foreword

- Inspectors carrying out assessment and inspection activities may look, when necessary, for evidence that the principles and recommendations in the EEMUA 191 guide (or an equally effective equivalent) are being, or have been, applied to alarm system design and management.

Kevin Allars
Deputy Director,
Hazardous Installations Directorate
Health & Safety Executive
UK 2007

ASM Consortium Foreword

In the opinion of the ASM Consortium, this guide continues to currently represent the best publicly-available benchmark of accepted industry good practice for alarm system design, management and procurement.

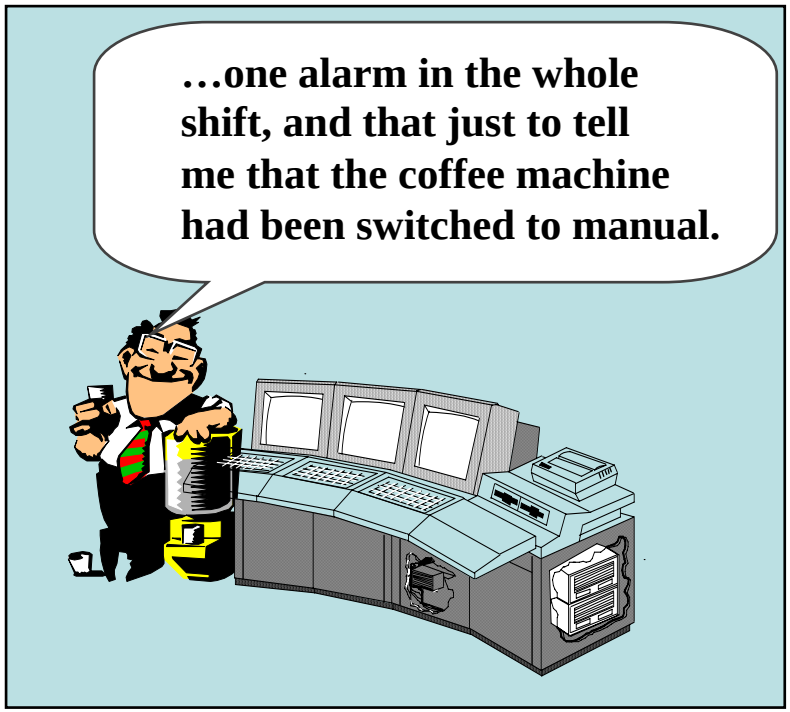
Kevin R. D. Harris
Director, Abnormal Situation Management Consortium
Phoenix
Arizona
USA
March 2007

Measuring Alarm Systems Performance

Donald Campbell Brown

Alarm Management - Introduction

The Image:



The Reality:

….What goes wrong?:

- *Floods of alarms during plant upsets*
- *Long lists of standing alarms during normal operation*
- *Upsets/incidents due to missed alarms*

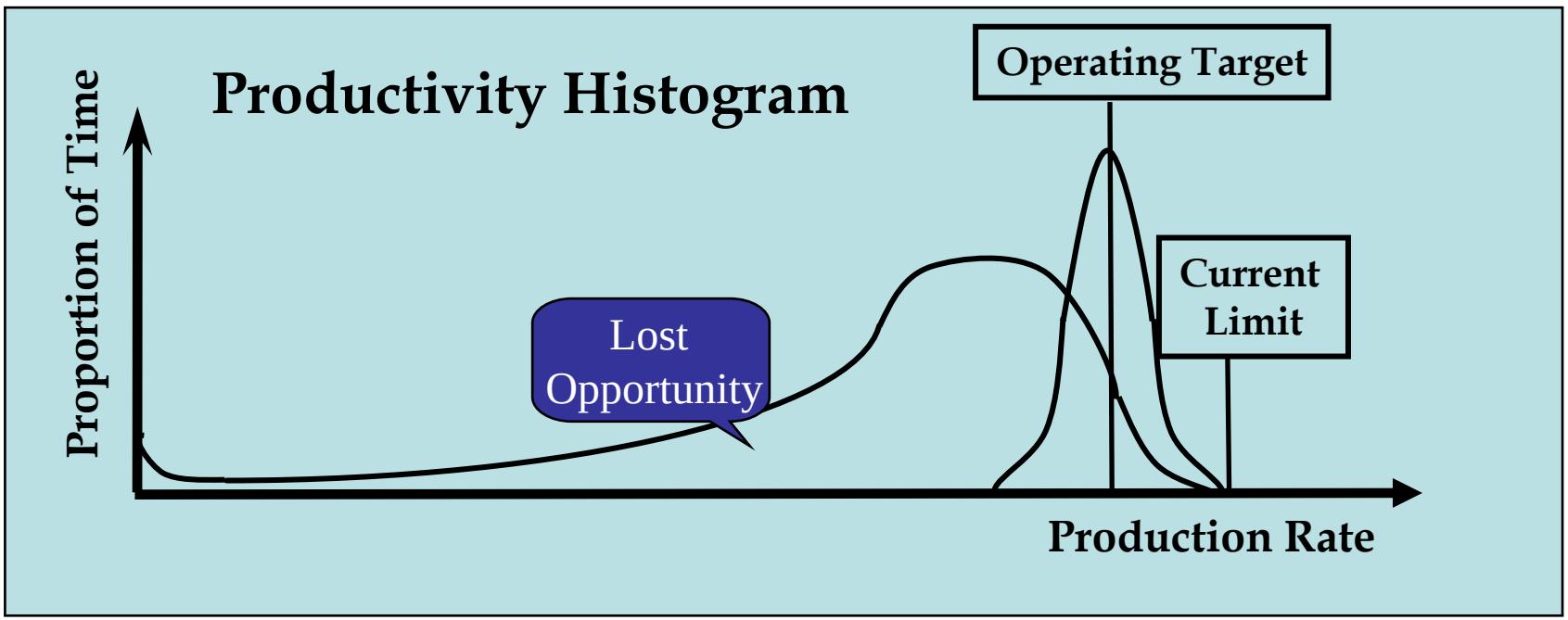
Overview

- Where is the value from investment in OSS?
  - *Alarm system improvement*
- What is the purpose of the alarm system?
  - *Definition of an alarm*
- Performance of alarm systems
  - *Key performance indicators*
  - *Alarm system benchmarks*
- Conclusions

Business Value

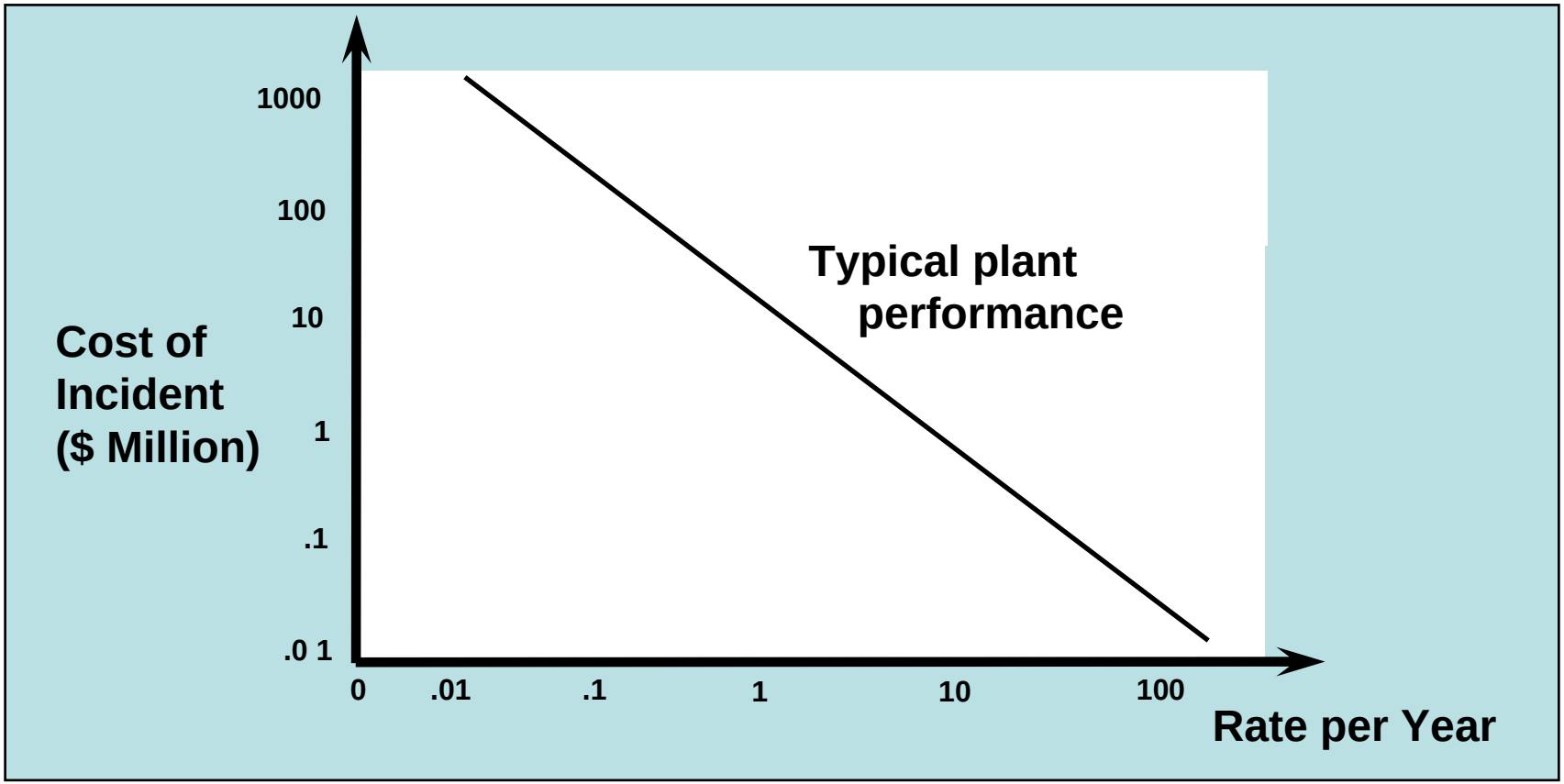
Impact Areas for Operator Support Tools :

(1) Rate of occurrence of 'abnormal' situations
(2) Rate of 'escalation' of abnormal situations
(3) Operator 'Confidence' - related to size of 'comfort margin'



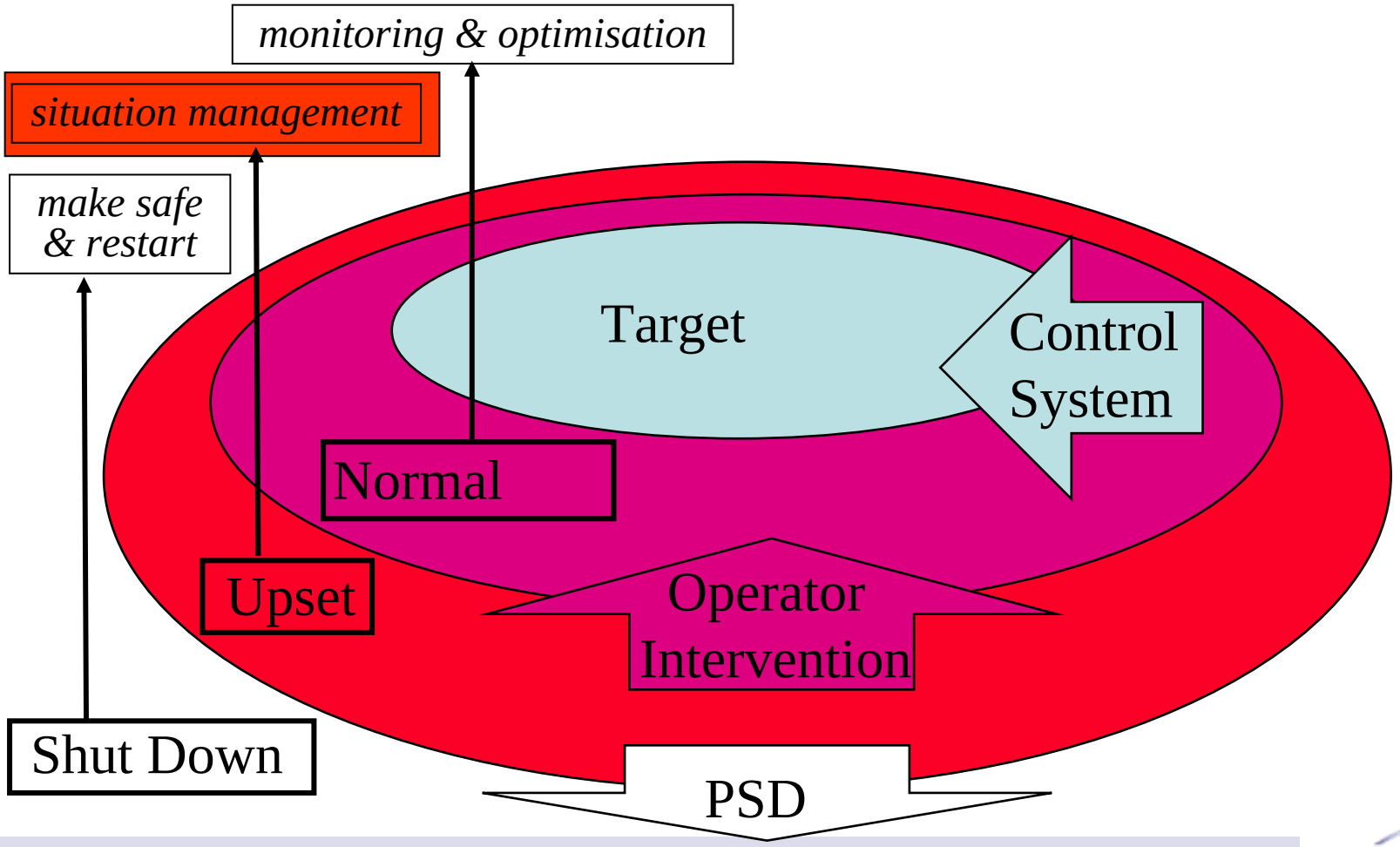
- *3 - 8 % of plant throughput*
- *Lower bound (does not count utilities, chemicals usage etc)!*

Cost of Abnormal Situations



- Historical data = only the more frequent low-cost incidents
- Low frequency but high cost incidents?

Alarm System Objectives



Operator tasks during plant upset

- **Situation Management:**
  - Problem Identification
    - *what's wrong?*
  - Situation Assessment
    - *what else is happening to affect what I do?*
  - Immediate Action
    - *minimise consequences*
  - Follow-up Actions
    - *restoring normal operations*

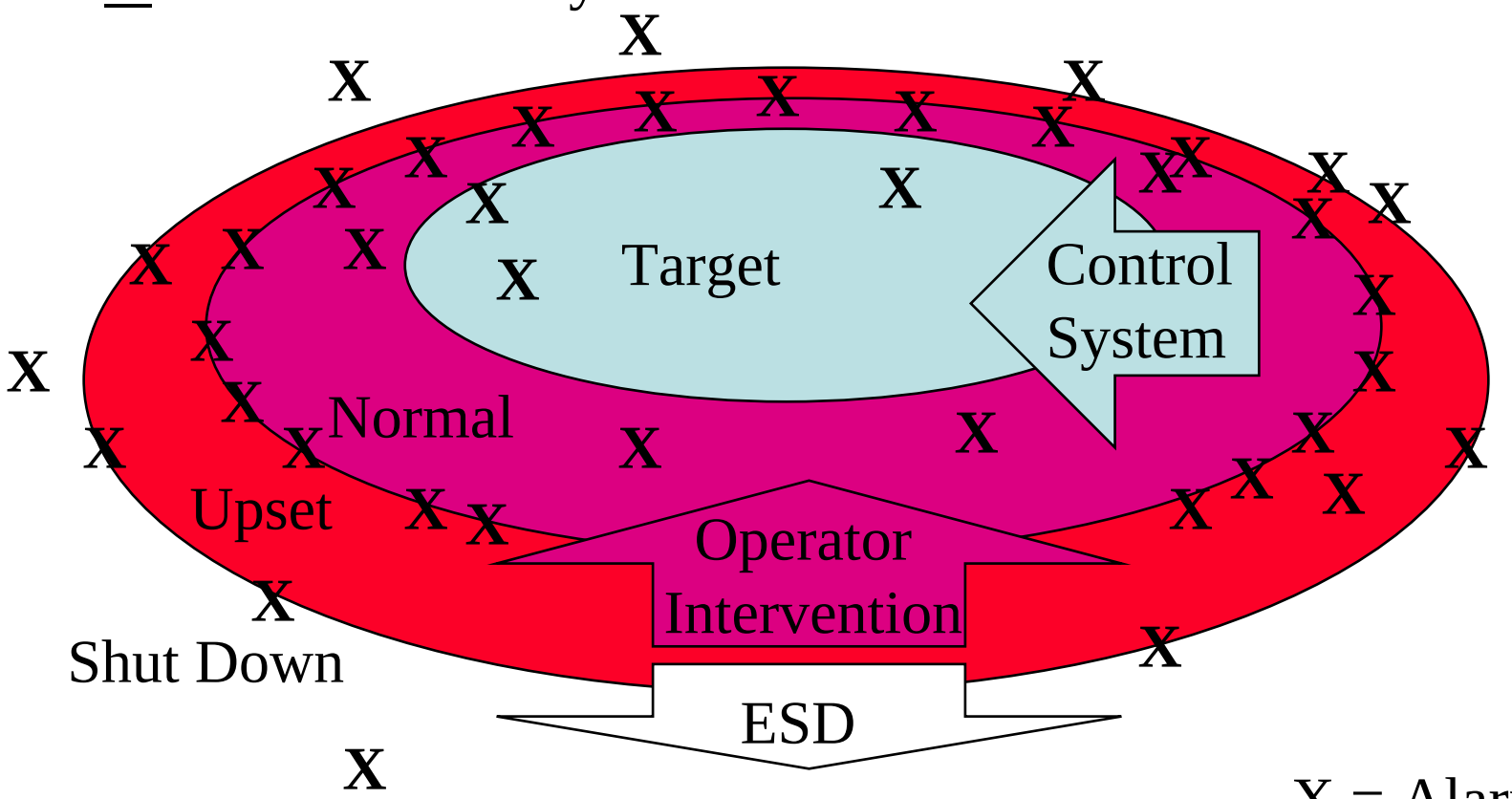
This is where alarm systems can be most helpful

The purpose of the alarm system is to direct the operator's attention towards conditions requiring <u>timely</u> assessment or <u>action</u>

What Makes an Alarm System Effective?

An effective alarm System:

An ineffective alarm System:

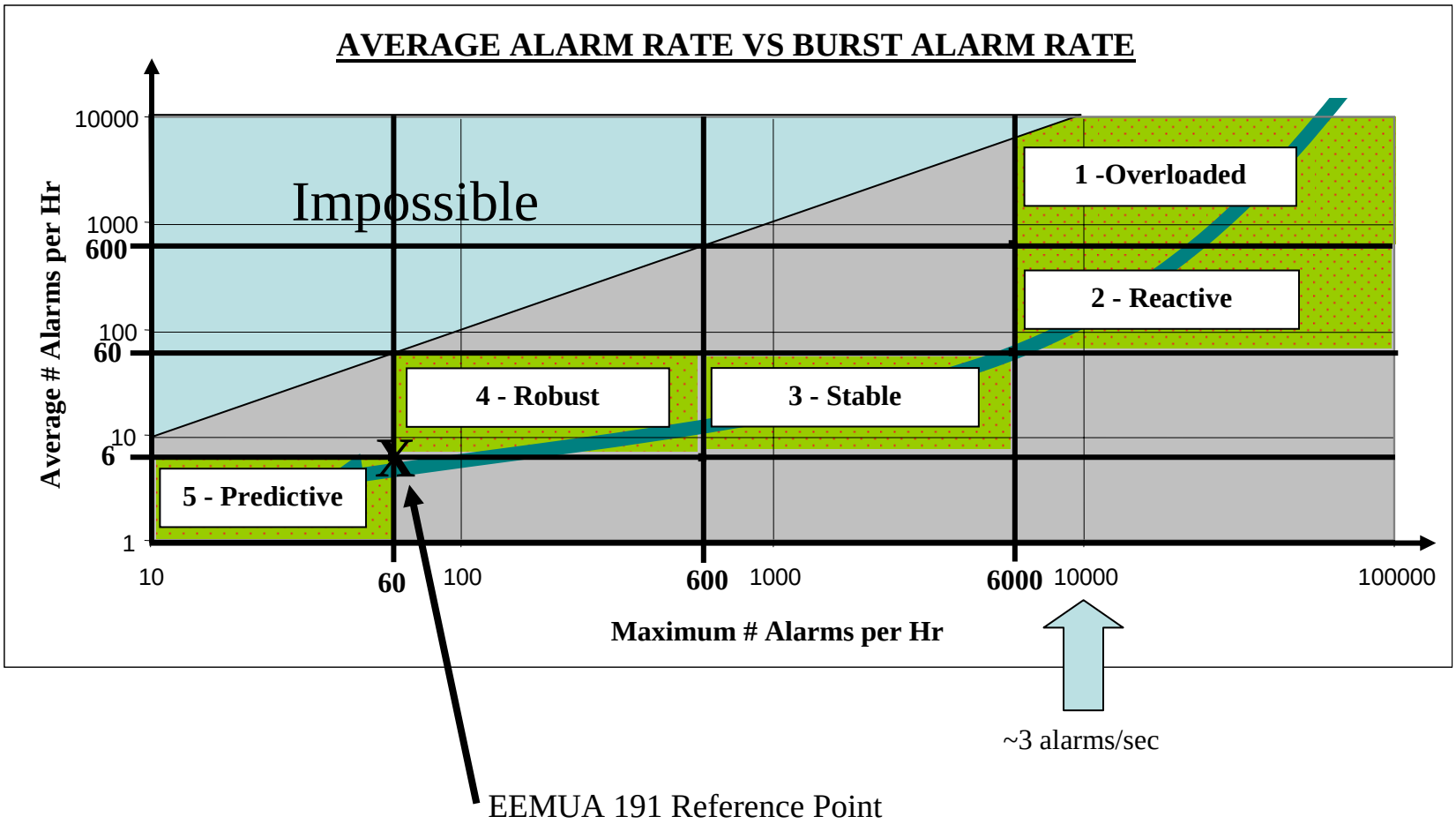


Alarm System Metrics

- **Value:**
  - *Acceptability targets (new system)*
  - *Adequacy (existing system)*
  - *Effectiveness (ongoing improvement effort)*
  - *Identify specific nuisance alarms*
  - *Demonstrate performance (to auditor)*

(1) Average number of alarms per hour
(2) Maximum number of alarms per hour
(3) % hrs where alarm rates outside acceptability target

Alarm System Performance



Secondary Metrics

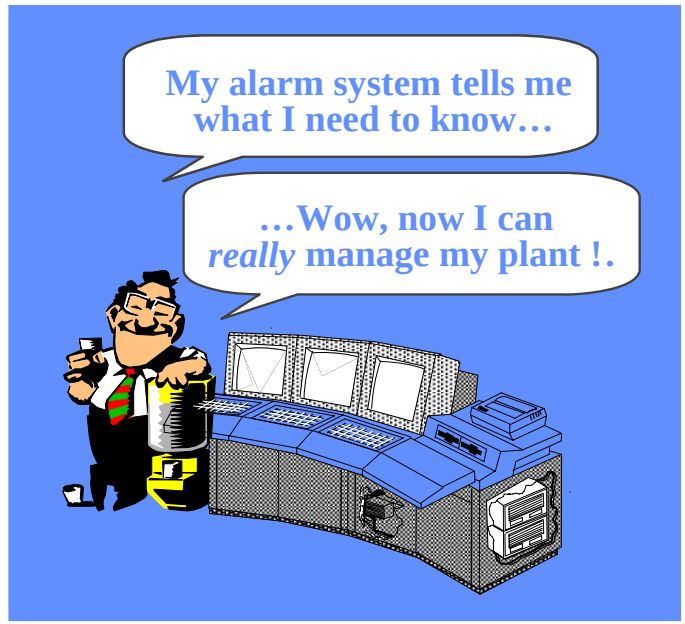
- % hrs where alarm rates outside extreme target
- Shelved alarms
  - *Number*
  - *Average/Maximum time shelved*
- Standing alarms
  - *Number*
  - *Average /Maximum time standing*
- Top 10 load percentage

Alarm System Improvement

- Use KPIs to determine current Performance Level
- Identify Target level of performance
  - *Range of CRO Tasks*
  - *Complexity*
  - *Consequences of failure to act*
  - *Required speed of response*
  - *Centrality*
  - *Level of automation / fallback*
  - *Cost*
- Implement appropriate tools/processes to close the gap

Alarm Management Conclusions

- Value of Alarm System Improvement
  - *Rate of occurrence of 'abnormal' situations*
  - *Rate of 'escalation' of abnormal situations*
  - *Operator 'Confidence'*
- Role of the alarm system
  - *Definition of an alarm*
- Performance of alarm systems
  - *Key performance indicators*
  - *Alarm system benchmarks*



Alarm Management in Batch Plants

Peter Bruce

ABB Engineering Services

EEMUA 191 and Batch

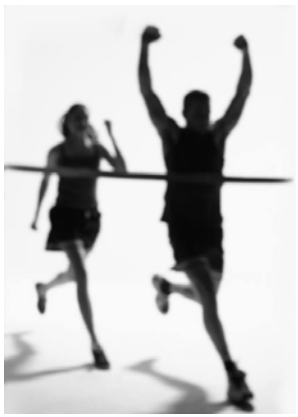
- EEMUA 191 currently very good for continuous processes.....
- .....But not so good for batch
- What is different about batch plant?
- What has changed in EEMUA 191?
- Some things to consider

Remember, management of alarms is applicable to all types of production plant.

Differences

Continuous

- Fixed alarm values,
- Alarm flood due to cascade of events



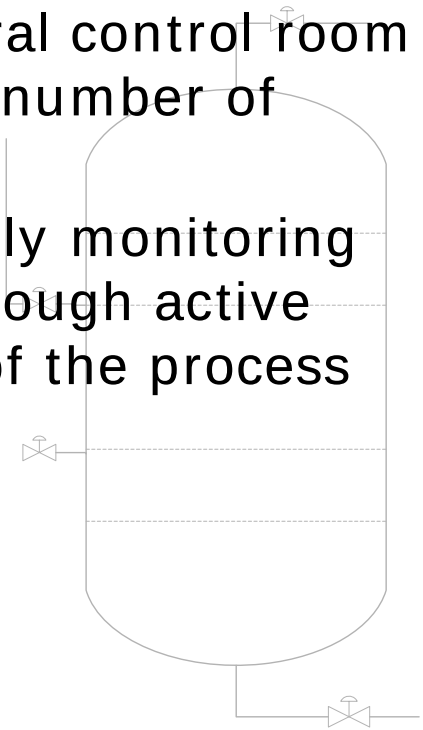
Batch

- Alarm limits change with recipe
- Alarm limits change with plant state
- Alarms enabled/disabled with change of plant state
- Minor alarm floods from services
- Alarms directly from sequences.

Differences - Plant control

Continuous

- Permanently manned control room
- Often central control room covering a number of plants
- Continuously monitoring process through active patrolling of the process graphics



Batch

- Large variation of control concepts and operation of production
- Central operator with field operators similar to continuous plants
- Mobile operators moving in and out of control room
- Use of local workstations,
  - who is in control? who accepts alarms?.

EEMUA 191 Appendix 20

- New appendix 20 on Alarm Management in Batch Plants
- Checklists in the form of “things to consider” - Does not give definitive answers
- Intended to assist batch plant personnel to define their own philosophy.

Contents of Appendix 20

- Batch plant operation
- Operator information
- Alarm rates
- Application of alarm priorities
- Management of alarm thresholds
- Sources of nuisance alarms
- Alarm floods
- Getting information to remote operators.

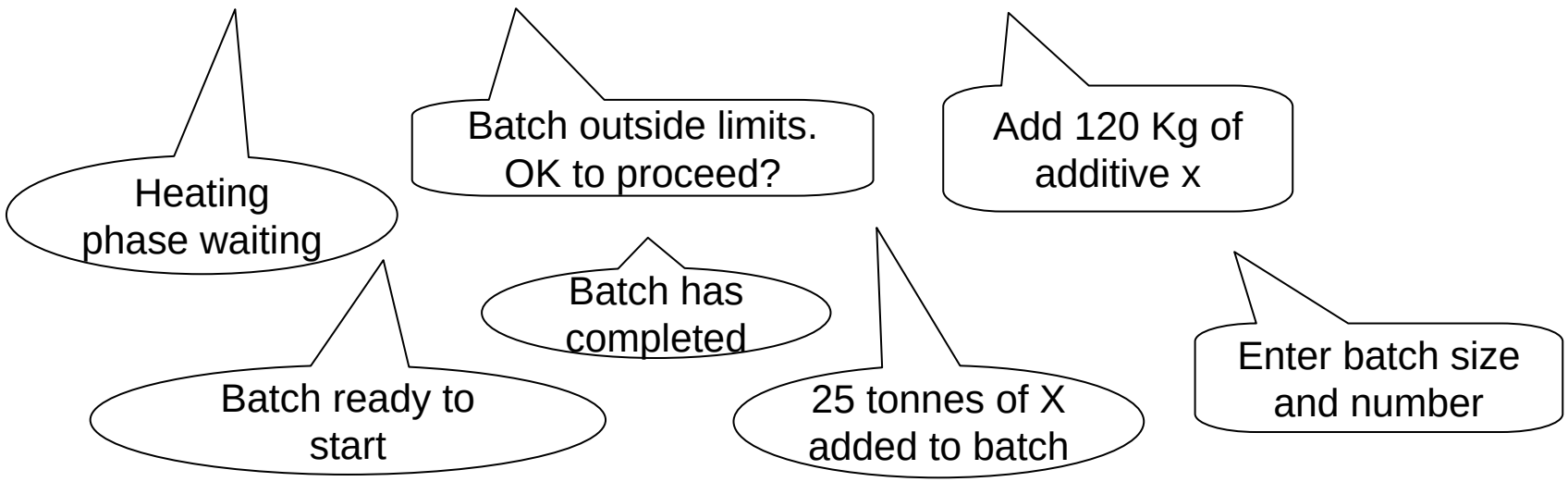
Example Considerations

- What happens when CR unmanned?
- How is the alarm information passed on?
- Can critical alarms be missed?
- Alarms from equipment not in use
- How is information such as batch events segregated from alarms?
- Who is in control?
- How can alarms be viewed when outside the control room?

Operator Information

An **Alarm** is an **unexpected event** that requires **timely operator action**

An operator **Prompt** is an **expected event** that may require operator action but is **not necessarily time critical**

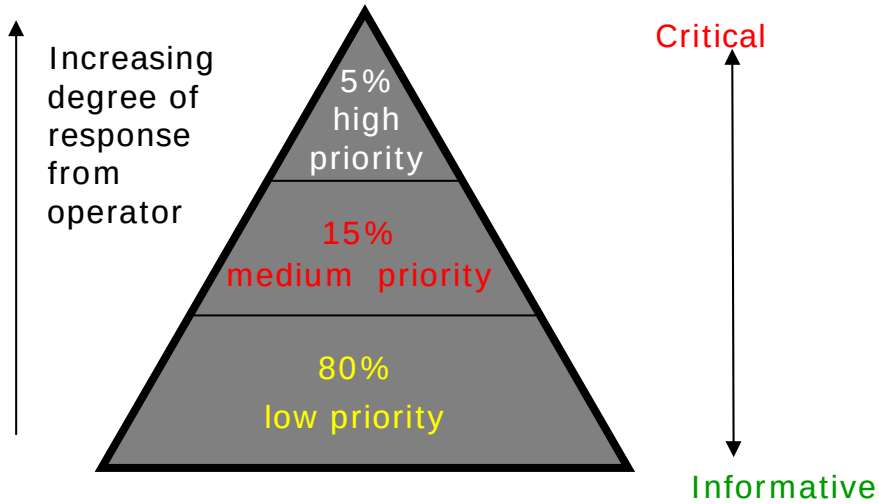


Alarm Rates

- Target for alarm rates should consider human factors too
  - Time outside the control room
  - Time responding to operator prompts

Alarm Priorities

Less likely to have large numbers of alarms therefore could segregate into types



Safety – alarms of most importance, e.g. emergency showers

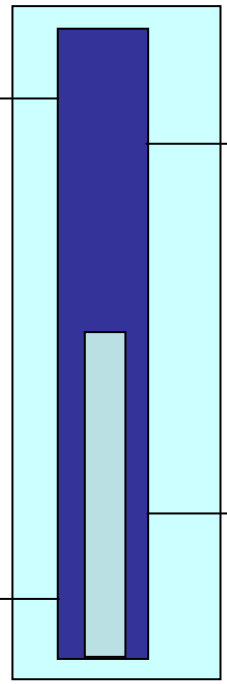
Equipment Protection – these are not product related

Sequence-Generated Alarms – can be more descriptive, a form of intelligent alarm handling

Design of Alarms

Equipment alarm limits

Phase logic alarm limits



- Take care when inhibiting alarms
- Prevent inappropriate, legacy alarms from previous product runs

Summary

- Batch and continuous plants have different alarm considerations
- EEMUA 191 now recognises this
- New Appendix 20 gives guidance on applying EEMUA 191 in a batch environment
- Interpret this guidance to best suit your requirements and your users – but write it down so others can follow
- Good alarm management is just as important in a batch plant!.

Running an Alarm System Improvement Programme

Chris Dicken

Technology Services – Engineering Division

RWE Power International

EEMUA 191 – Second Edition

- **Appendix 21**

  Alarm System Improvement Process – why has this been added ?

- EEMUA 191 First Edition :
  - Lots of very good information
  - Lots of what to do ….

    …. but a bit lacking in “how does it all fit together”

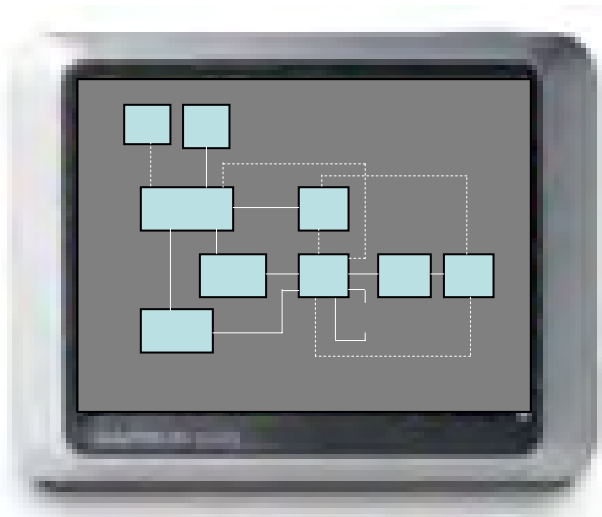
EEMUA 191 – Second Edition

- Appendix 21 – The “SAT NAV” chapter of EEMUA 191

Here I am with a “badly functioning Alarm System”

How do I get to an improved system ?

From
“Alarm Hell”



To
“Alarm Happiness”

Appendix 21- Alarm System Improvement Process

- Use a formal and methodical approach
- Appendix 21 **outlines** the process, helps (you) to stitch together various parts of the existing guidance

- It is not prescriptive
- The process will need tailoring to your specific process / site
- The detail still has to be assembled for your site
- Advocates the use of tools to help ease the process

(See also 191 Section 5)

Appendix 21- Alarm System Improvement Process

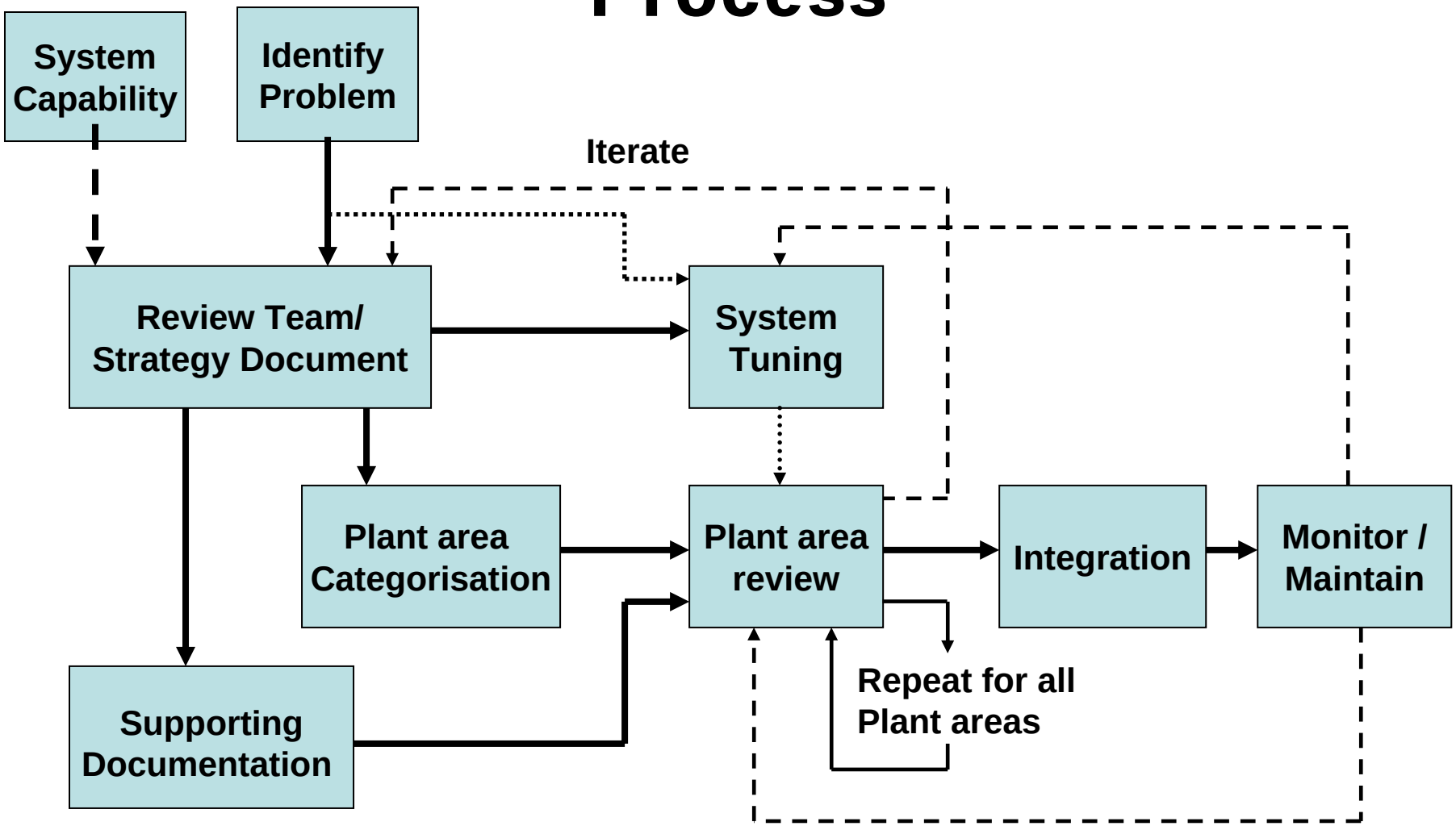
- Four Main parts to the Process
  - The up-front considerations
  - The Philosophy / Strategy document, supporting documentation & tools
  - Performing the actual Alarm Rationalisation
  - Monitor, Maintain & Manage

Appendix 21- Alarm System Improvement Process

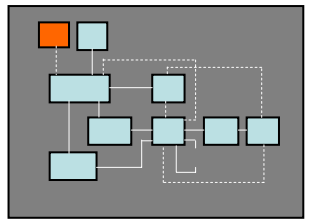
"A good scare is worth more to a man than good advice".

Edgar Watson Howe
American novelist, essayist 1853 - 1937

Alarm System Improvement Process

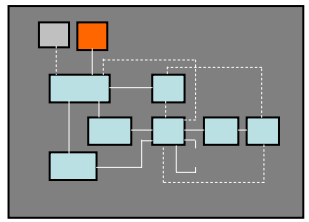


Alarm System Capabilities



- Alarm processing functionality
  - Types of alarm
  - Logic
  - Suppression
  - Shelving, auto-shelving
  - Priorities
  - Categorisation
- Display functionality
  - Message format
  - List capabilities
  - Integration with HMI formats

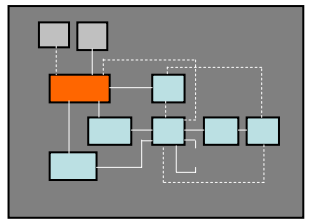
Identify the problem



- Talk to the operator
  - "Useless alarms"
- Perform Alarm analysis
  - Alarm rates – in normal conditions
  - Alarm rates – in abnormal conditions (floods)
  - Number of standing alarms
  - Number of shelved alarms
  - Ratio of priorities

Too many Alarms → **Operator Overload**

Create the Team

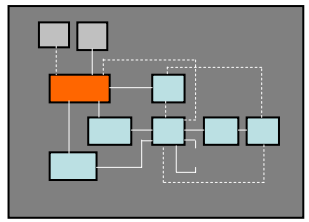


The review team will consist of individuals from such disciplines as

Operations staff
C&I staff
Process Engineers
Safety Engineers

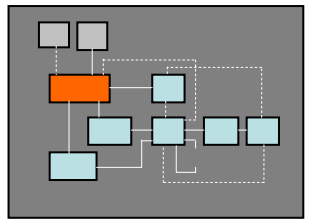
Typically will be made up of 4 or 5 people.

Objectives of the Review

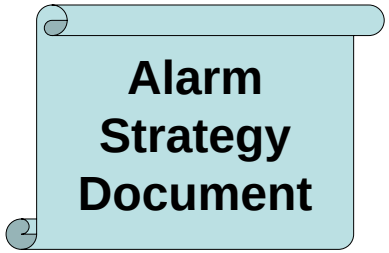


- To minimise no of alarms consistent with proper protection of people, plant & environment
- To ensure all alarms are relevant and understandable at all times
- To ensure that alarm rates are manageable at all times
- To ensure all alarms have defined responses
- To ensure that alarms are properly prioritised

Alarm Strategy Document



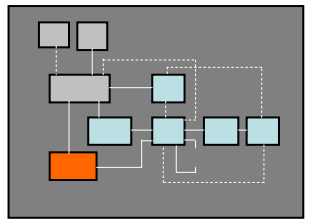
- Roles and Responsibilities
- Alarm System users
- Safety role
- Alarm Design principles
- Alarm information checklist
- Generic alarm logic
- System performance (KPI)
- System testing
- Change control



(191 Table 3)

- Format of Messages
- Checklists
  - Alarm types
  - Hazard severity definitions
  - Rules for Prioritisation
  - Terms & abbreviations
- Monitoring / management (191 Table 4)

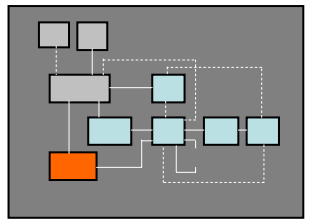
Supporting Documentation



Example - Alarm Priority Algorithm

Likely Urgency	Most Likely Severity of Consequence			
	Large	Medium	Small	Not Sig
1	High	High	Medium	Event
2	High	Medium	Medium	Event
3	High	Medium	Low	Event

Supporting Documentation

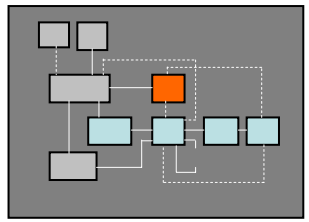


Prioritisation - example criteria

Alarm priority	Heuristic Measure
Low	Negligible risk of environmental breach
Medium	Remote possibility for environmental breach
High	Possibility for environmental breach
Critical	Potential for serious environmental breach

Environment

Tuning the system



Alarm Analysis Tool

Weekly Top 10

Individual alarms
Plant areas

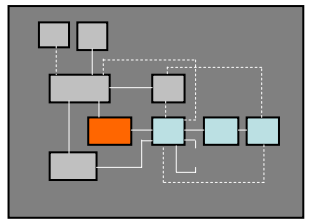
Chattering

Basic Improvement Techniques:

Equipment Maintenance
Scan rates
Setpoints
Deadbands

Also logic, 'irrelevant' alarms, software, duplicates

Plant area categorisation



Review :

Existing Plant Categories

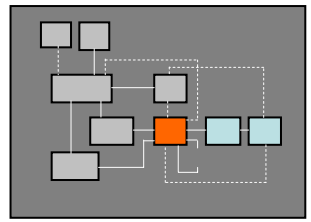
Create new list of Plant area categories

Break the alarm database into manageable chunks

Assign each alarm to a category

List by new category and Review

Plant area review



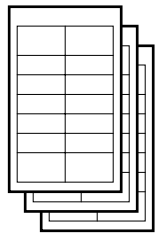
Existing Alarm data

Info from 'supporting' documentation:

Severity defns.
Operator response time.
Priority criteria.

Checklist

Plant area operation



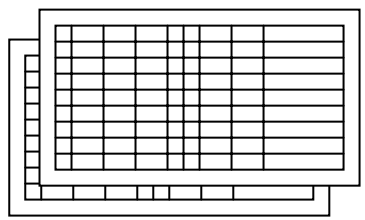
Alarm description
Priority
Setpoints
Deadband

Types of alarm for this Plant area

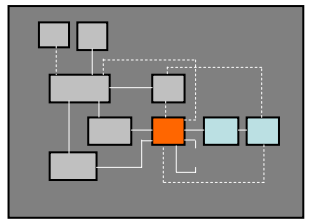
Data sheet for each alarm
(191 Appendix 2)

Plant area spreadsheet

Additional techniques:
Out of service suppression
Dependency suppression
Eclipsing
Timers



Alarm Data Sheet

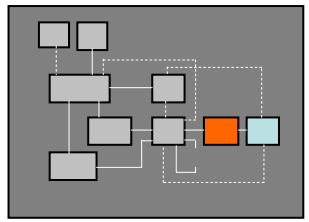


Minimum Design documentation :

- What is the purpose of the proposed alarm
- What is the operator response
- What are the consequences of not responding
- What time is available for the operator to respond to the alarm

Provides a consistent approach.

Integration



Look at the relationship between plant areas

and the overall plant operation

Plant Trips:

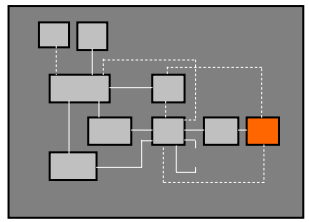
Dependencies
Expected events
Identification of missing events

Operating mode of plant:

Starting up
Shutting down
Change in operation

“Alarm flood” prevention

Monitor / Maintain / Manage



- Use an Alarm Analysis tool if possible
- Look for statistics as in “Identify the problem”
- Weekly ‘top 10’ focuses attention (often 90% of alarms)
- Alarm system performance targets
- Establish responsibilities & change control mechanisms
- Use the established tuning and review mechanisms
- Regular review strategy
- Alarm system test procedures

Feedback from site

- A dauntingly large & dull task
- Followed the process – works well
- Had to review existing alarms (wanted a clean sheet)
- Used generic rules
- Applied logic, but had some difficulties with suppressing offload
- Only used two levels of alarm priority
- Overview screens with alarms on - excellent
- Four units refurbished – no major problems

Observations

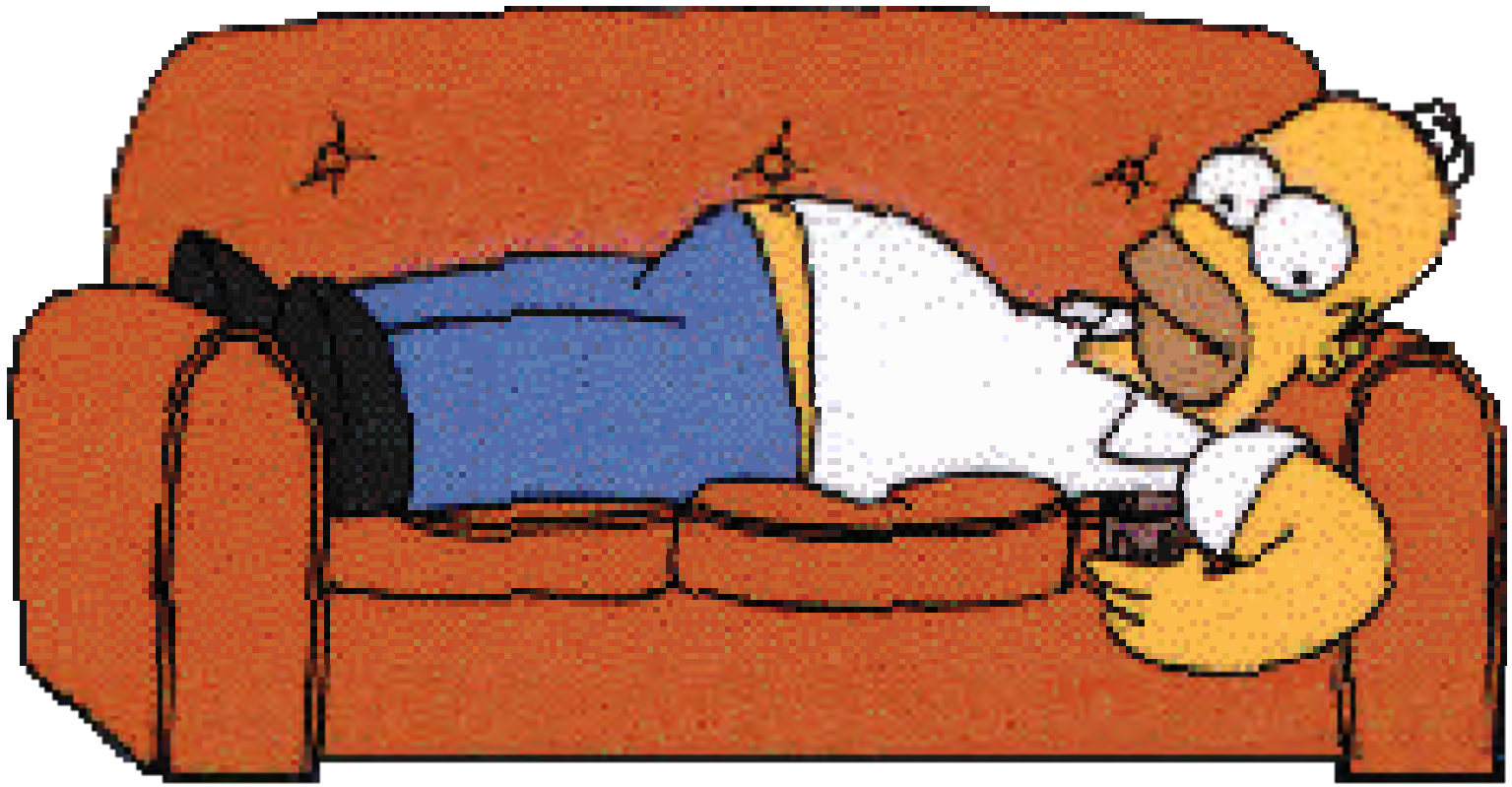
- Long winded and boring
- Needs dedicated chairman / project manager
- Generic decisions can be highly impactive
- Alert / Alarm / Trip can be a useful structure
- Ensure key alarms are from diverse sources
- Can have a significant impact on alarm load
- Many alarms may never have appeared in history

(Source: D Campbell-Brown - BP Upstream Technology Group)

Alarm Improvement Process - Summary

- Obtain management sign on
- Assemble well defined review team
- Produce strategy documentation
- Use the “tuning” techniques
- Divide into plant areas
- Use the checklists
- Monitor & maintain

Relaxed operators are happy people



Running an Alarm System Improvement Programme

Chris Dicken

Technology Services – Engineering Division

RWE Power International

Panel Review

Bill Swift

Chairman of Council, EEMUA

Corporate Projects Manager, Innospec

Better Alarm Handling

Peter Huggon

Shell U.K. Oil Products Ltd, Stanlow

Question Time

- Andrew Lichnowski – Chairman INC (EEMUA)
- Chris Dicken – RWE npower
- Clive Tayler – EEMUA
- Donald Campbell-Brown – BP
- John Wilkinson – HSE
- Peter Bruce – ABB Engineering Services
- Peter Huggon – Shell UK

Summary and Future Plans

Andrew Lichnowski

RWE npower

Summary of 2nd Edition

- **Revisions**
  - Introduction
  - Chapters 1-4
  - Appendices 1, 4, 5, 12
- **New Sections**
  - 7 Alerts
  - 20 Batch Plants
  - 21 Alarm System Improvement Process
- **Fundamental principles unchanged**

Plans for EEMUA 191 Third Edition

- Work on 3rd Edition will begin immediately after the launch of the 2nd Edition:
  - EEMUA Members (users) remain the **core** authoring group
  - Close liaison with concerned **Authorities** expected to continue and be extended
  - Liaison with **ASM and other industry bodies** expected to continue and be extended
  - Other **new Work Group(s)** may be established to contribute to the Third Edition
  - Target publication 2008/09

Likely for 3rd Edition

- Incorporate lessons from recent incidents, such as Buncefield and Texas City
- Further development of the concept of performance levels
- Advanced Alarm Management
- Other topics deliberately parked during development of the 2nd Edition

EEMUA 191 Third Edition

2. EEMUA Board Members

3. Concerned **Authorities**

1. EEMUA Primary Authoring Group

6. EEMUA Executive
(Primary Coordinator)

4. EEMUA Primary Industry Review Group
Industry consultants, equipment vendors, suppliers, 3rd-party inspection bodies, etc.

5. Others
Other users of alarm systems and/or EEMUA 191, and other interested parties

EEMUA 191 Third Edition

- Questions or Comments?

Related EEMUA work

- EEMUA Publication 201

  "Process plant control desks utilising human-computer interfaces – A guide to design, operational and human interface issues" Due to be revised and updated

Conclusion

Andrew Lichnowski

RWE npower

Final Networking Session

Through until 16.15

Bill Swift

Chairman of Council, EEMUA

Corporate Projects Manager, Innospec

“Better Alarm Handling” is now

CLOSED

Thank you for your participation

We wish you a safe and pleasant journey.