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Alarm Management...or *'Which button do I press when they all flash at once?!'*

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Presentation outline

- Scope and context
 - Control philosophy
 - Wider control environment & system interface
- Accident history on alarm management
- HID strategy on alarms



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Outline (2)

- Inspection experience
- What COMAH¹ requires & HSE expects to see

1. The Control of Major Accident Hazard Regulations 1999, implementing Seveso 2



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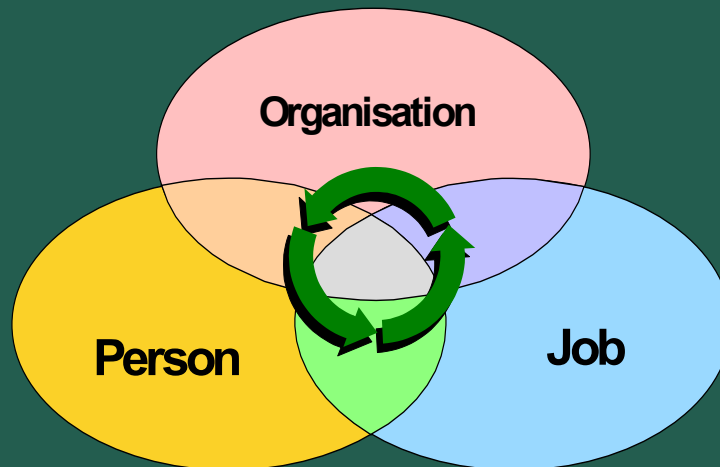
Why focus on alarm management?

- 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

What Do We Mean by 'Human Factors?'



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Mental health

Musculo-
skeletal
disorders

Personal injury
frequency

Major accident
probability

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



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Key issues – The ‘Top Ten’

From site visits/COMAH Safety Reports

- Organisational change
- Staffing levels and workload
- Training and competence
- Procedures
- Fatigue from shiftwork & overtime



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Key issues (cont.)

- Integration of HF into risk assessment and investigations
- Communications/interfaces
- Organisational culture
- Human factors in design
- Maintenance error



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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



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Context

- Alarms are linked to several of the Top Ten issues
- What is the overall control philosophy?
 - Manual control vs automatic control
 - But what is automated and why?
 - *Beware – what is hardest to automate is often what gets left for operator to do!*
 - Take opportunity offered by alarm review to check wider control & environment/interface issues (eg see EEMUA Publication 201)



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Context (2)

Even fully-automated trip/ESD systems can fail or part-fail

- How do you assure operator decision making in or after a major upset & on restart?
 - Competence assurance should cover all foreseeable operating conditions
 - Role of simulators/simulation for upset/abnormal conditions



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Context (3)

Wider control room design issues
ISO11064 'Ergonomic design of control centres'

- Seven principles for human-centred design &
- ergonomic design framework
 - Control suite arrangements
 - Control room layout
 - Workstations layout
 - **Displays, controls & interactions**
 - Environmental ergonomics



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Context (4)

Alarm management is essentially a design issue:

- Trying to put matters right later is much more difficult

And:

- Alarms need continuous management (eg MOC) and improvement



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Texaco Incident, Milford Haven 1994



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Figure - 1

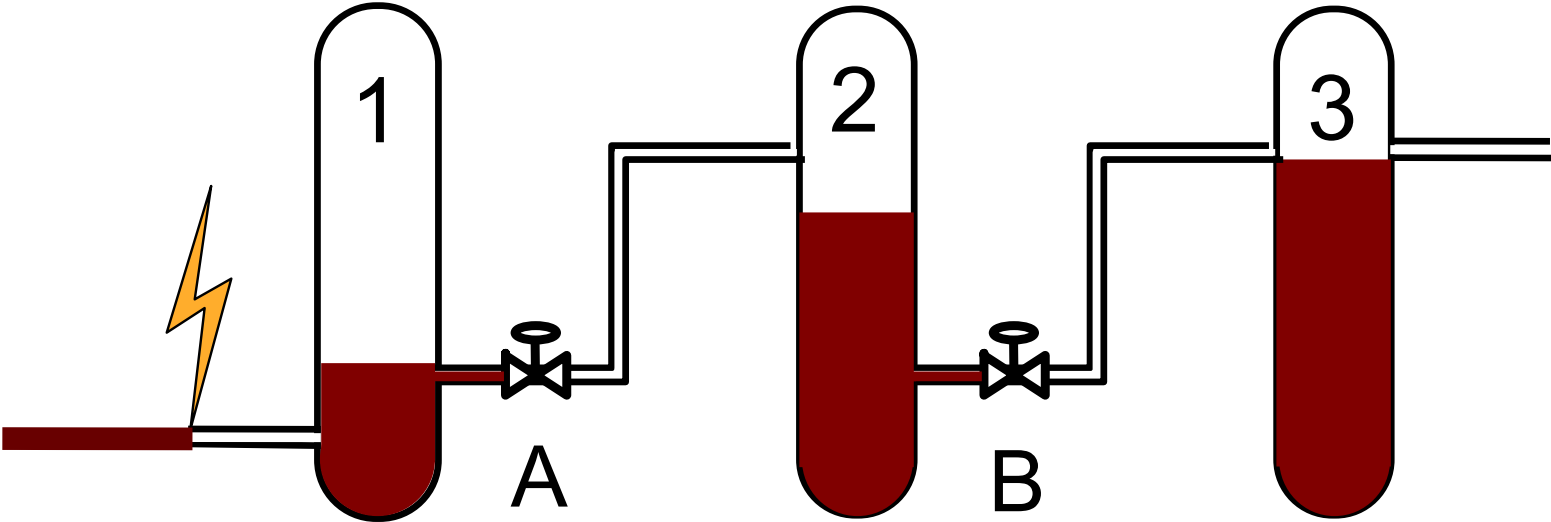


Figure - 2

flare stack knock-out drum

pressure relief valve

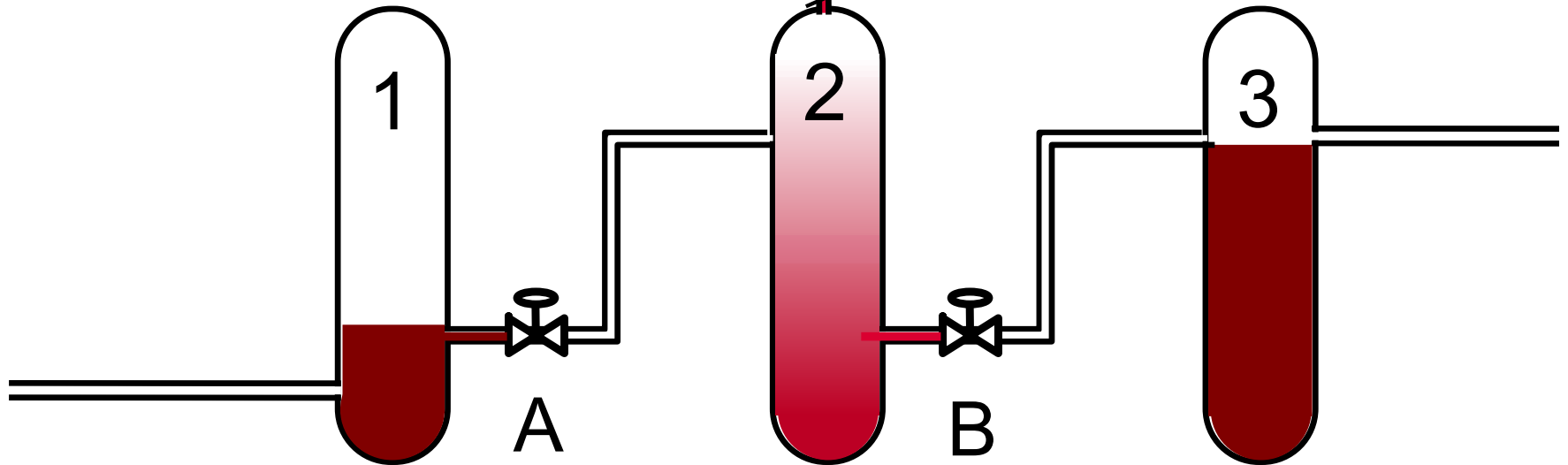


Figure - 3

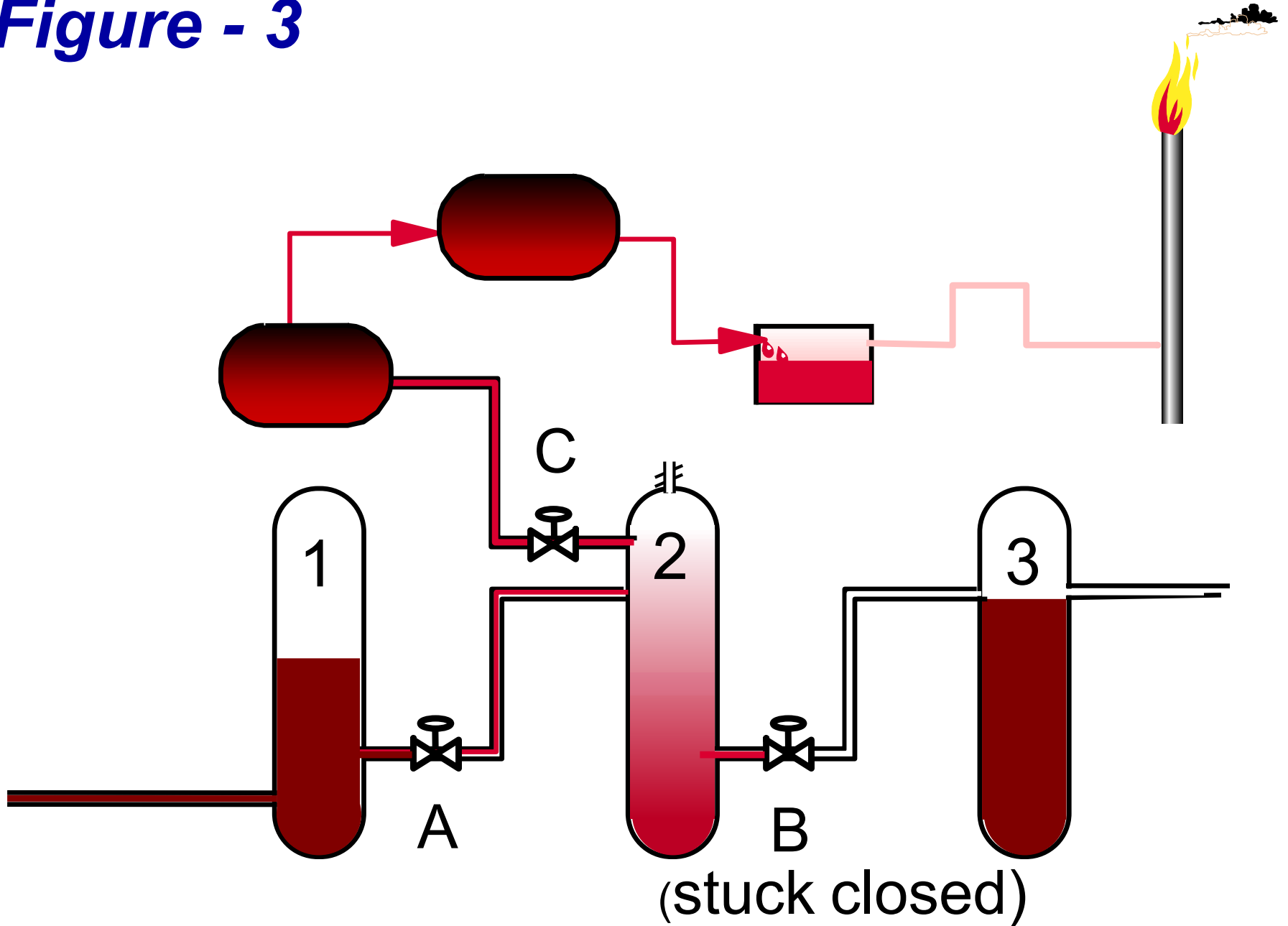
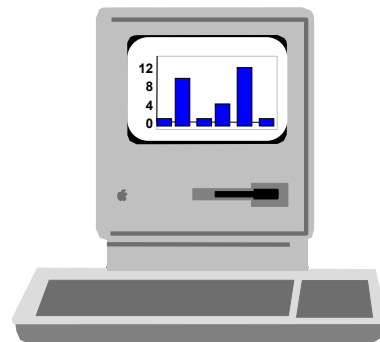
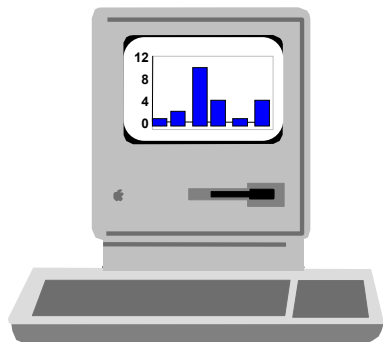
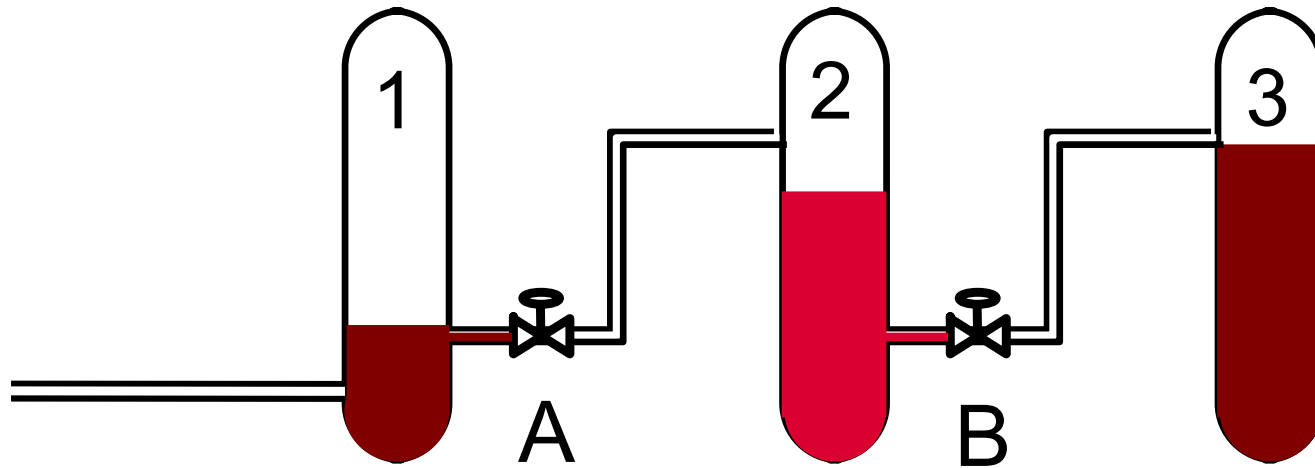


Figure - 4



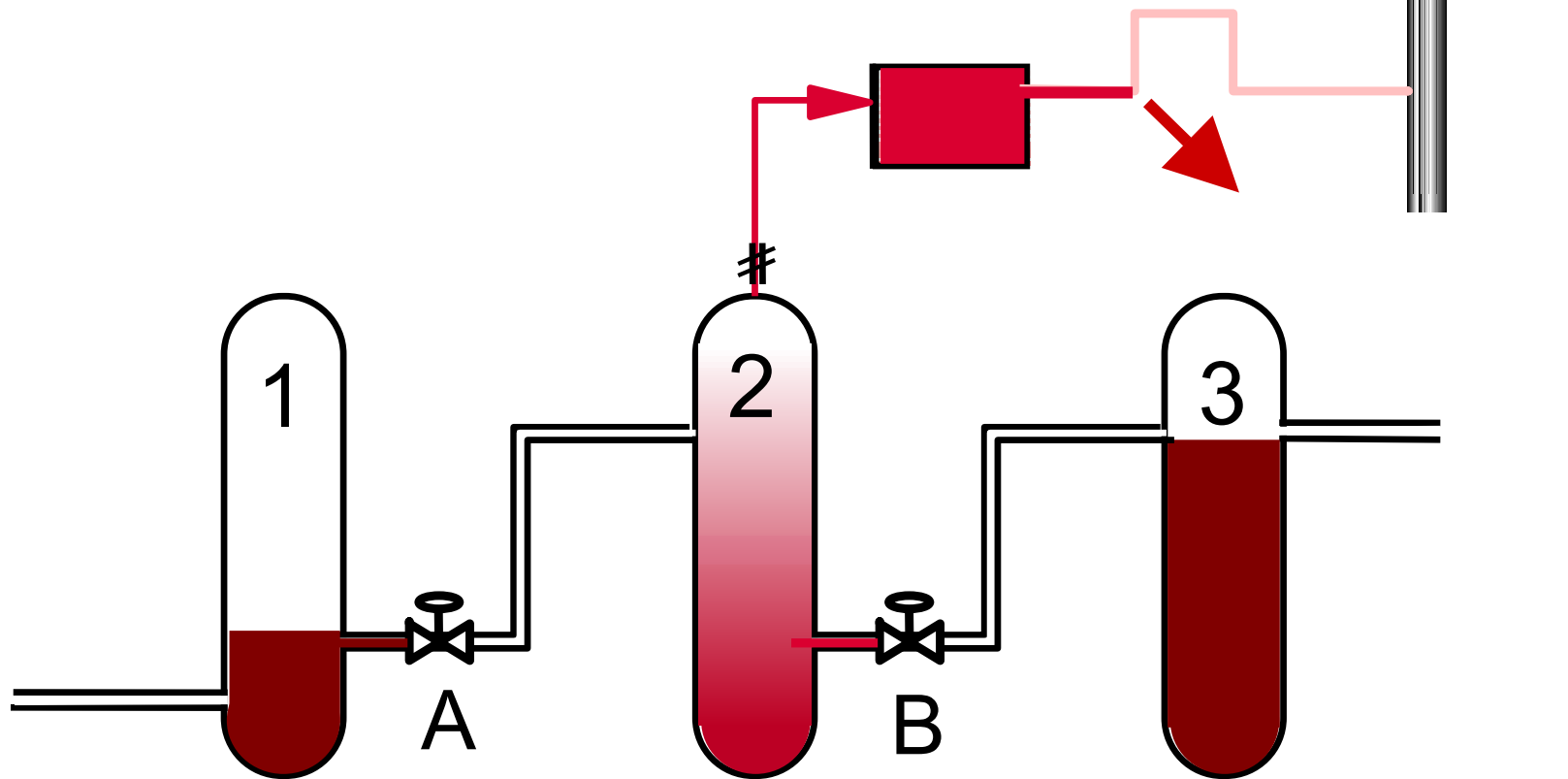
plant DCS displays



alarm displays

Figure - 5

k.o. drum overfills,
outlet pipe fills with liquid and fails





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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



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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 and when to shutdown
 - clear authority to initiate shutdown
- Ultimate plant safety must not depend on operator response to an alarm.



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Esso Longford

Longford:

- 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)



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HSE Alarms Strategy

- Derived from Texaco report recommendations;
- The EEMUA Guide¹; and
- Experience so far from inspection & assessment



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1. The Engineering & Equipment and Materials Users Association



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HSE Alarms Strategy

- Following Texaco investigation report recommendations:
 - Initial research - resulting in the Bransby & Jenkinson Report (HSE Contract Research Report 166/1998)
 - This concluded that the Texaco problems were widespread in industry; and
 - That they can be solved/prevented



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HSE Alarms Strategy (2)

- The EEMUA Guide
 - HSE funded and contributed to it
 - HSE regards it as nearest thing to a standard currently available
 - EEMUA bestseller (well over 3000 copies sold)
 - Written for engineers & managers but accessible more widely & includes useful tools
 - Intended to stimulate discussion and encourage industry to develop its principles to meet specific safety applications
 - Human factors are the key elements



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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



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Why?

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



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Why (2)?

- EEMUA Guide seen by some as 'specialist' - or sites unaware of it
- Alarm management:
 - Not seen as an ongoing issue
 - Or as part of wider control and environment/interface context



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Why (3)?

Upgrades/new projects

- The differing needs of users, suppliers, manufacturers etc not well understood for upgrades and new projects
- Often contracts & specifications are 'diluted down' by the contract, installation & commissioning process
- Low expectations & poor specification



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‘Better Alarm Handling’

HF Team strategy:

- Produce simple and practical guidance
 - promote it widely
 - improve training for inspectors and industry
- Raise profile of alarm management through inspection, assessment & intermediaries



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Guidance: 'Better Alarm Handling'

- Simple 3-stage approach:
 - find out if you have a problem
 - decide what to do and take action
 - manage and check what you have done
- Well over 10,000 copies distributed
- Available free on HSE website
- Written as a practical guide for a wide audience (including CROs & inspectors)
- Used to improve uptake of EEMUA guide & provide easy link to it



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Training & awareness

- Inspector training now includes alarm handling issues
- EEMUA independently set up industry training (HSE input)
- Issue being raised more at inspections, investigations & in assessment
- Promoted through conferences and papers by HSE & others



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HSE expectations

HID expects:

- a policy that recognises human factors of alarm handling as a management issue
- a 'championed' logical process in train which has assessed or is assessing the current situation
- 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

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Summary

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

- HSE has a clear strategy
- Guidance, tools & training are available
- Awareness of the issue increasing
- Some good practice emerging

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Position Statements

- Implementation and participation are key areas for improvement
- Wider control & environment/interface issues need to be considered



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Summary (2)

Upgrades/new projects:

- Remember that:
 - User, supplier and contractors' needs vary across design, installation, commissioning & operational stages for upgrades & new projects;

So:

- All parties benefit from understanding each others' needs



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References

Reducing error and influencing behaviour (HSG48), HSE Books 1999, ISBN 0 7176 2452 8

Free HSE information sheet *'Better alarm handling'* (Chemicals Sheet No. 6) is available free from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA (Tel: 01787 881165/Fax: 01787 313995) and via the HSE website at www.hse.gov.uk/pubns/chis6.pdf

'Alarm systems, a guide to design, management and procurement', Engineering Equipment & Materials Users Association Publication No 191. Available from EEMUA (Tel. 020 7628 7878/Fax 020 7628 7862).

The explosion and fires at the Texaco Refinery, Milford Haven, 24 July 1994: A report of the investigation by the Health and Safety Executive into





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References (2)

Process plant control desks utilizing human-computer interface: a guide to design, operational and human interface issues Engineering Equipment & Materials Users Association (EEMUA) Publication 201: 2002 available via EEMUA on 020 7628 7878 or sales@eemua.co.uk

Ergonomic design of control centres, Parts 1–7, ISO 11064
Covers design principles, control room arrangements and layout, workstations, displays, controls, interactions, temperature, lighting, acoustics, ventilation, and evaluation

Lessons from Longford: the Esso Gas Plant Explosion, Andrew Hopkins, CCH Australia Ltd, 2000, ISBN 1 86468 422 4 (Available quickest via e-mail: salescentre@cch.com.au or available in UK via Croner CCH, 145 London Road, Kingston upon Thames, Surrey KT2 6SR: email dmckail@cch.co.uk or Tel 0161 6436133 (or 0208547333 or 0845 2415719).



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