The Importance of Alarms for Functional Safety

THE 61508 ASSOCIATION
Guidance in Compliance

Our Members

Who Are We?

- **We are a cross-industry group of organisations with a common interest in functional safety, particularly in applying IEC 61508 and related standards (e.g., IEC 61511, IEC 62061) correctly in order to demonstrate compliance and improve safety for all.**

- Our members include end-users (from many industry sectors), EPC companies, systems integrators, product manufacturers, consultants and certifiers. We also have active relationships with related industry organisations and safety regulators who often attend our meetings.

- We develop and publish many useful and informative guides and assessment tools which are available to all (not just our members) and are free of charge.

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T6A Symposium

The Importance of Alarms for Functional Safety

Presenter info

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14 years of experience in Power Generation across the design, construction, commissioning and operation of plants.

Promotions Officer, The 61508 Association

Presentation aims

In this presentation, I will cover;

1. What is an alarm and alarm management?

2. Why should I care about alarms on my process?

3. What standards are relevant to alarms and functional safety?

4. The alignment and differences between standards.

5. Key information to remember

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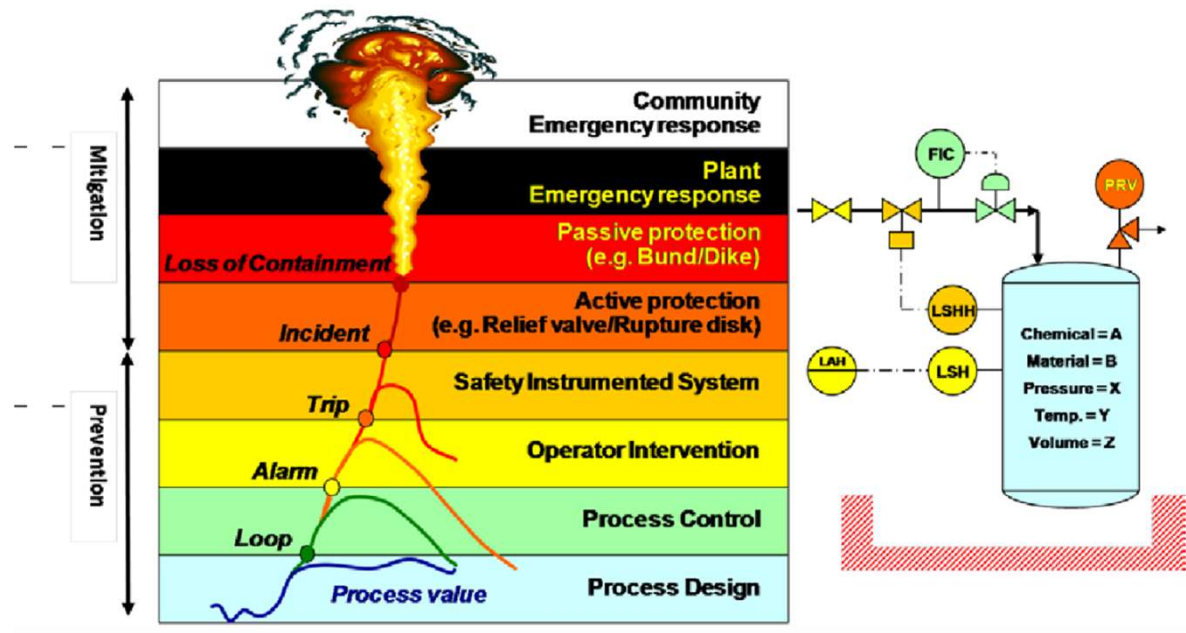
Alarm basics

What is an alarm?

In process safety, an alarm is a visual or audible indication that a process is abnormal, equipment is malfunctioning, or there is a deviation.

Alarms are used to alert operators and control systems to potential threats to the environment or personnel. Alarms shall have an associated operator action.

What is alarm management?

Alarm management is the process of designing, implementing, operating, and maintaining alarm systems in industrial facilities to improve safety and operational efficiency.

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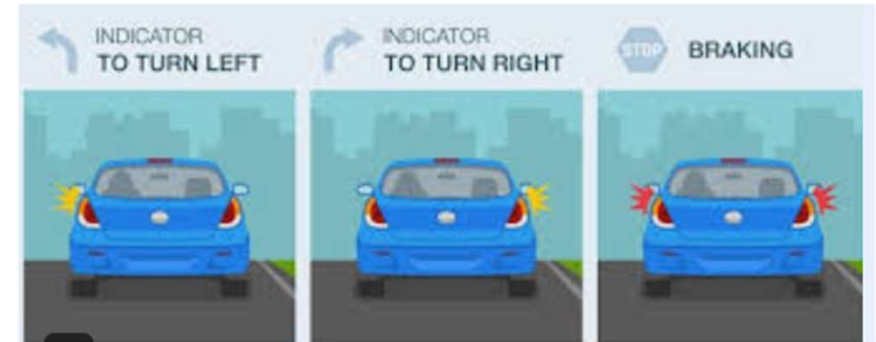
Importance of alarms in process safety

Alarms are important for process safety because they help operators monitor and control processes, and alert them to abnormal conditions.

Improve safety: When deployed properly, alarms can help plant operators ensure process safety and profitability.

Facilitate fault diagnosis: Alarms can help operators accurately and timely diagnose faults.

Improve plant management: Alarms can lead to more effective plant management.

Ensure efficient operations: Alarms can help ensure efficient operations.

Maintain quality: Alarms can help maintain quality.

Poorly designed alarm systems can hinder operators. This may lead to a failure to identify a need to act or select an effective course of action to mitigate a dangerous occurrence.

Deepwater Horizon

Disabled fire alarm and venting "bypass" not alarmed

Alarm standards and more information

BS EN 62682

This specifies general principles and processes for the lifecycle management of alarm systems in the process industries.

ANSI/ISA- 18

The standard specifies general principles and processes for the lifecycle management of alarm systems. It covers all alarms presented to the operator through the control system, which includes alarms from basic process control systems, annunciator panels, packaged systems and safety instrumented systems.

EEMUA 191

This is primarily concerned with alarm systems provided for people operating industrial processes. Including alarm systems in industries such as chemical manufacture, power generation, oil and gas, etc.

HSE website

https://www.hse.gov.uk/humanfactors/topics/alarm-management.htm

Basic alarm design

SIL rated alarms

The equipment delivering the alarm, the equipment needed for the correct response and the operator response activity are **ALL** part of the safety system.

Functional safety standards

IEC 61508

F.6.3 Alarms

The last item in column 5 of Table F.1 takes credit for alarms that alert the operator and utilize operator intervention. Credit for alarms should only be claimed under the following circumstances:

– Hardware and software used are separate and independent of that used for the control system (for example, input cards and processors should not be shared).

– The alarm is displayed with a high priority in a permanently manned location. Credit claimed for alarms should take into account the following:

  • the effectiveness of an alarm will depend on the complexity of the task that needs to be performed in the event of the alarm and the other tasks that need to be performed at the same time;.

  • the credit should be limited to a minimum PFD_{avg} of 0,1;

  • the operator needs to have sufficient time and independent facilities to be able to terminate the hazard. Normally, credit should not be claimed unless the time available between the alarm and the hazard exceeds 20 min.

IEC 61511

IEC 61511. Where such claims are made, the human factor issues should be carefully considered. Any claims for risk reduction from an alarm layer of protection should be supported by a documented description of the necessary response for the alarm and justification that there is sufficient time for the operator to take the corrective action and assurance that the operator will be trained (initially and recurring) to take the preventive actions.

Independent Protection Layer properties

SPECIFIC

- The system acts directly to prevent the source of, or the consequence of, the hazard

INDEPENDENT

- If all the normal controls fail, you can still depend on this to keep you safe
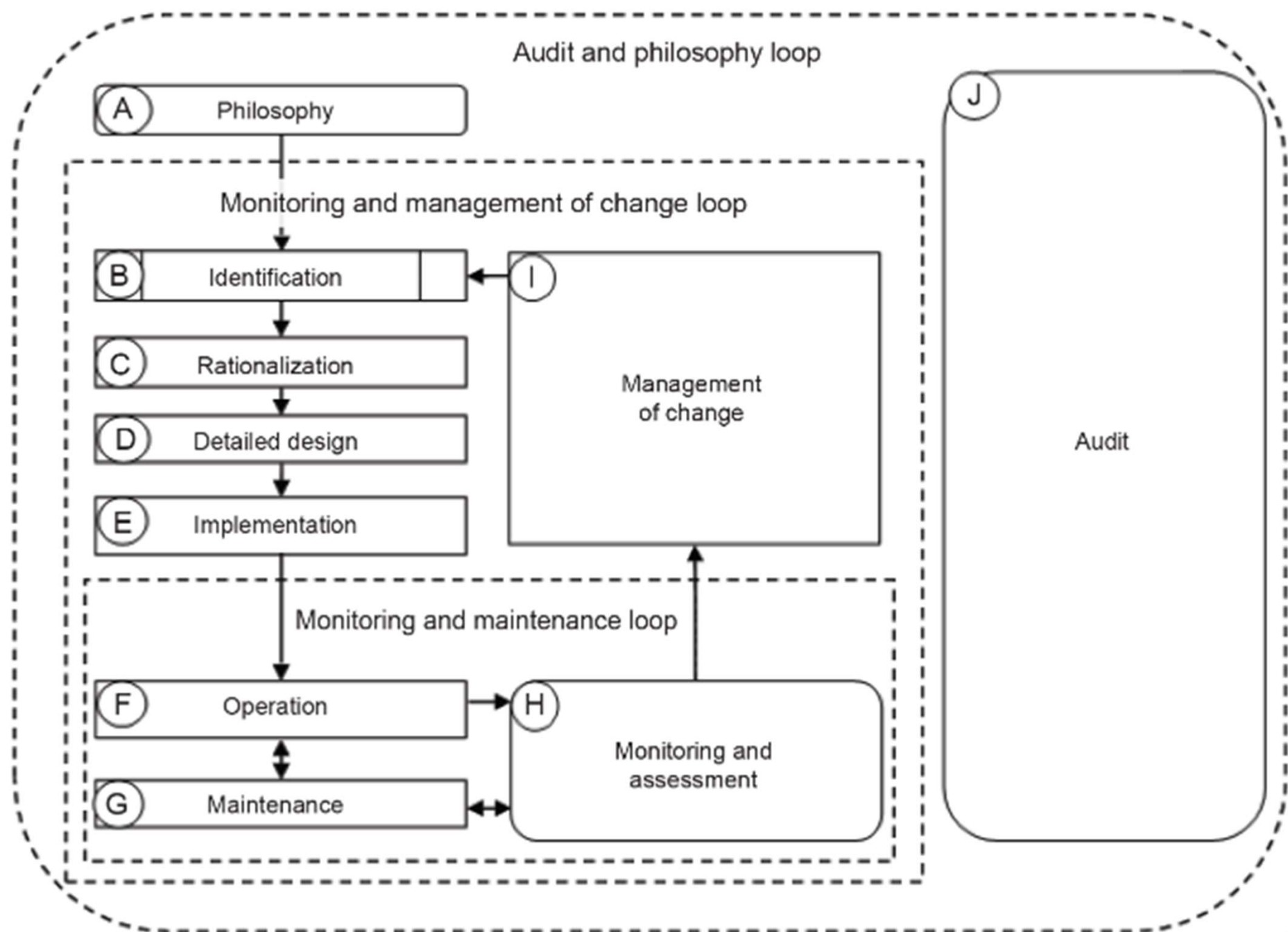
DEPENDABLE

- The system is highly reliable

EFFECTIVE

- The system must be capable of handling the full enormity of the hazard

AUDITABLE

- You must be able to check and prove that the safety system is in place

Audit and philosophy loop

Monitoring and management of change loop

A — Philosophy

B — Identification

I — Management of change

C — Rationalization

D — Detailed design

E — Implementation

Monitoring and maintenance loop

F — Operation

G — Maintenance

H — Monitoring and assessment

J — Audit

IEC

Alarm rationalisation

Justify

- Is there definitely a need for the alarm?

Prioritise

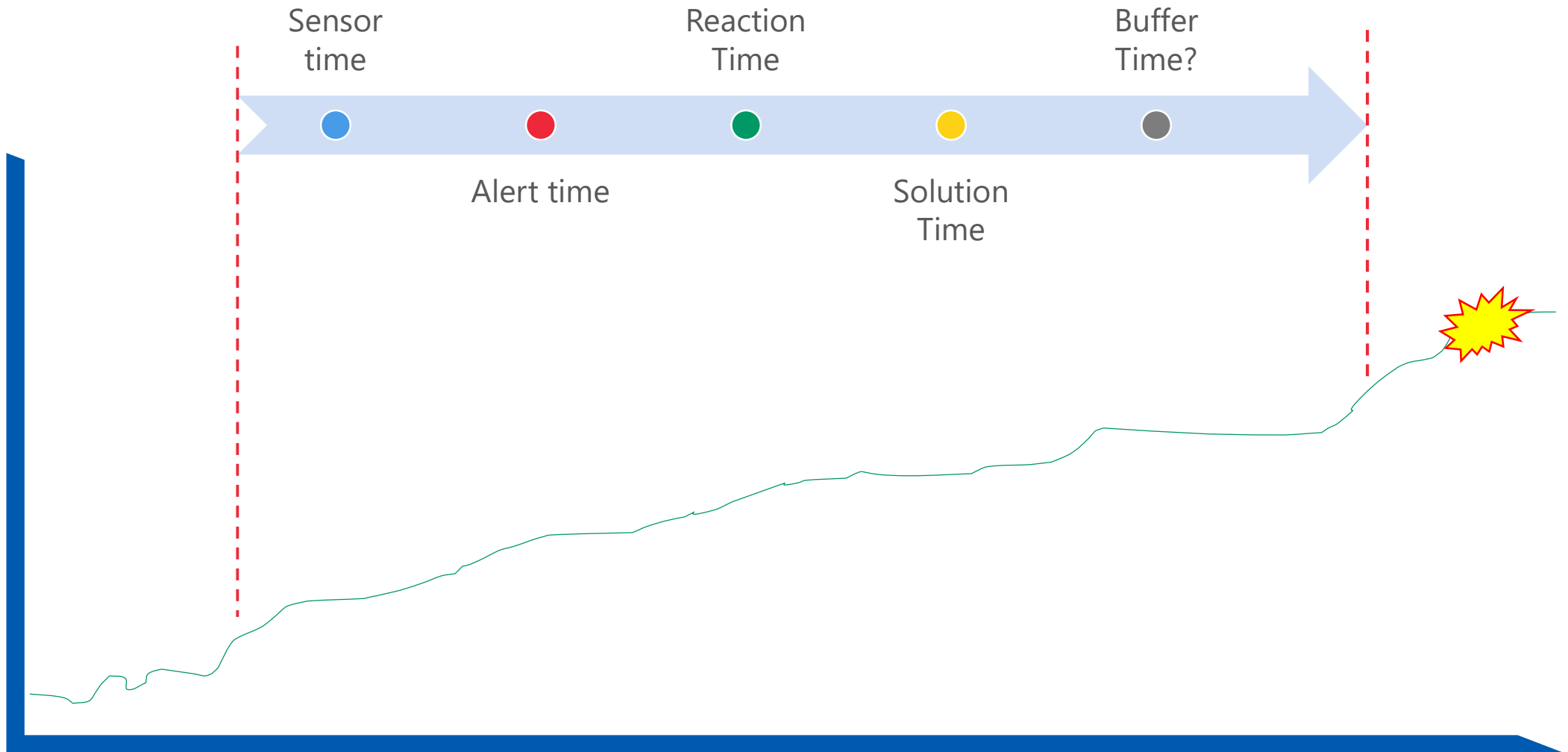- If this alarm activates, what is its importance?

Classify

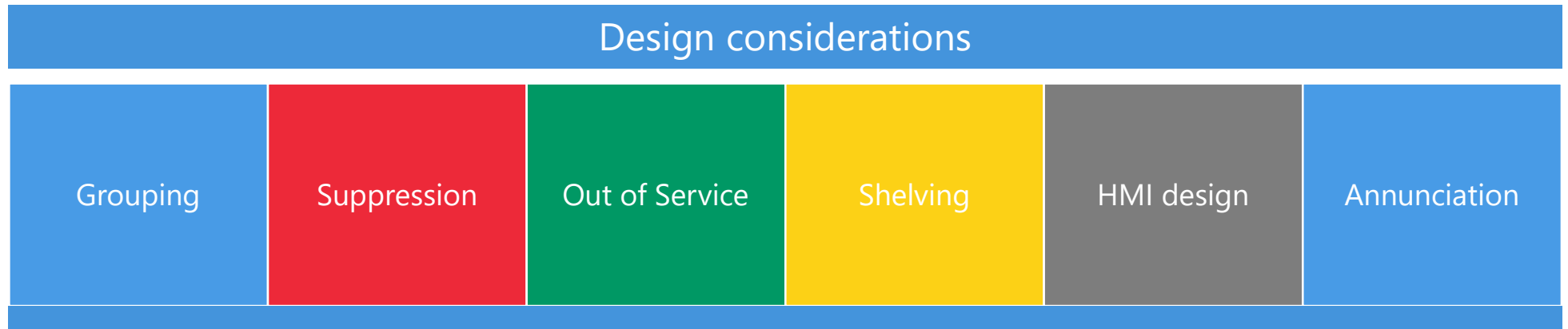- Different classifications have different response times

Review

- Essential to ensure a consistent approach is documented

Alarm design

Alarm design

Design considerations					
Grouping	Suppression	Out of Service	Shelving	HMI design	Annunciation

- Implementing this well takes buy in from the team and management.

- It takes time and money to do it well, considering each alarm on the plant is a lot of work.

- A well implemented alarm system can save lives.

Continuous management

Table 5 – Average alarm rates

Very likely to be acceptable	Maximum manageable
~144 alarms per day	~288 alarms per day
~6 alarms per hour (average)	~12 alarms per hour (average)
~1 alarm per 10 minutes (average)	~2 alarms per 10 minutes (average)

Table 6 – Annunciated alarm priority distribution

Priority designation	Percentage distribution
3 priorities: low, medium, high	~80 % low, ~15 % medium, ~5 % high
4 priorities: low, medium, high, highest	~80 % low, ~15 % medium, ~5 % high, ~<1 % highest

SIL rated alarms

- Use sparingly on a Safety Instrumented System, where ever possible remove the need for human interaction to activate a Safety Instrumented Function.

- In my opinion, a SIL rated alarm should always be the highest priority alarm on the system. It needs to inform the operators of urgent action.

- When designing and maintaining SIL rated alarms, a team of individuals with suitable training, knowledge and experience of the process, need to be part of the management of change process.

- No one should be able to silence, shelve or remove a SIL rated alarm except system administrators.

Case study A

Texaco Pembroke Disaster, Milford Haven, 1994

Common pitfalls of alarm system management

Operator response

System response

System design

System capabilities

Conclusions

Alarms are important for functional safety because they can help to reduce the risk of accidents by alerting operators when a process is outside of its normal operating range. This allows the operator to take corrective action in a timely manner, which can potentially save lives and minimize damage.

Investing in the management of your alarm system, will strengthen the integrity of your plant and reduce dangerous occurrences.

Ultimate safety should not depend on operator response to an alarm

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Thank you
for listening

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Any Questions?

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Slot	Start Time	Paper	Workshop	Finish Time
11	16:00	A-11: *Functional Safety and Communication Links* (Peter Brown – Lloyd's Register)	B-11: Blank	11:50
-	16:30	**CLOSE** / Informal Post Symposium Questions / Discussions		17:30

We would be more than happy to discuss membership with you (https://61508.org/membership/)

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