


Evaluating HMI (Alarms) for Safety Improvements

WorkSafeBC. Risk Analysis Unit

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Purpose

- WorkSafeBC is supporting the pellet industry in the management of Process Safety for which HMI is a component
 - Effective monitoring and controlling are critically important to plant safety, integrity and for quality production
(BP Texas City, Milford Haven, Three Mile Island)
 - Risk-based approach – there is no worker claim data for HMI related incidents.
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Human Machine Interface (HMI)

The collection of hardware and software used by the operator and other users to monitor and interact with the control system and with the process via the control system

An alarm

Is an audible or visual announcement that is initiated by a process parameter because it has passed a defined limit. Often it is approaching an undesirable or unsafe state and requires action

What's the benefit of evaluating alarms?

Alarms are symptoms of the system not performing as optimally as it should be

If the process is working **well**, there should be no reason for alarm/s to activate

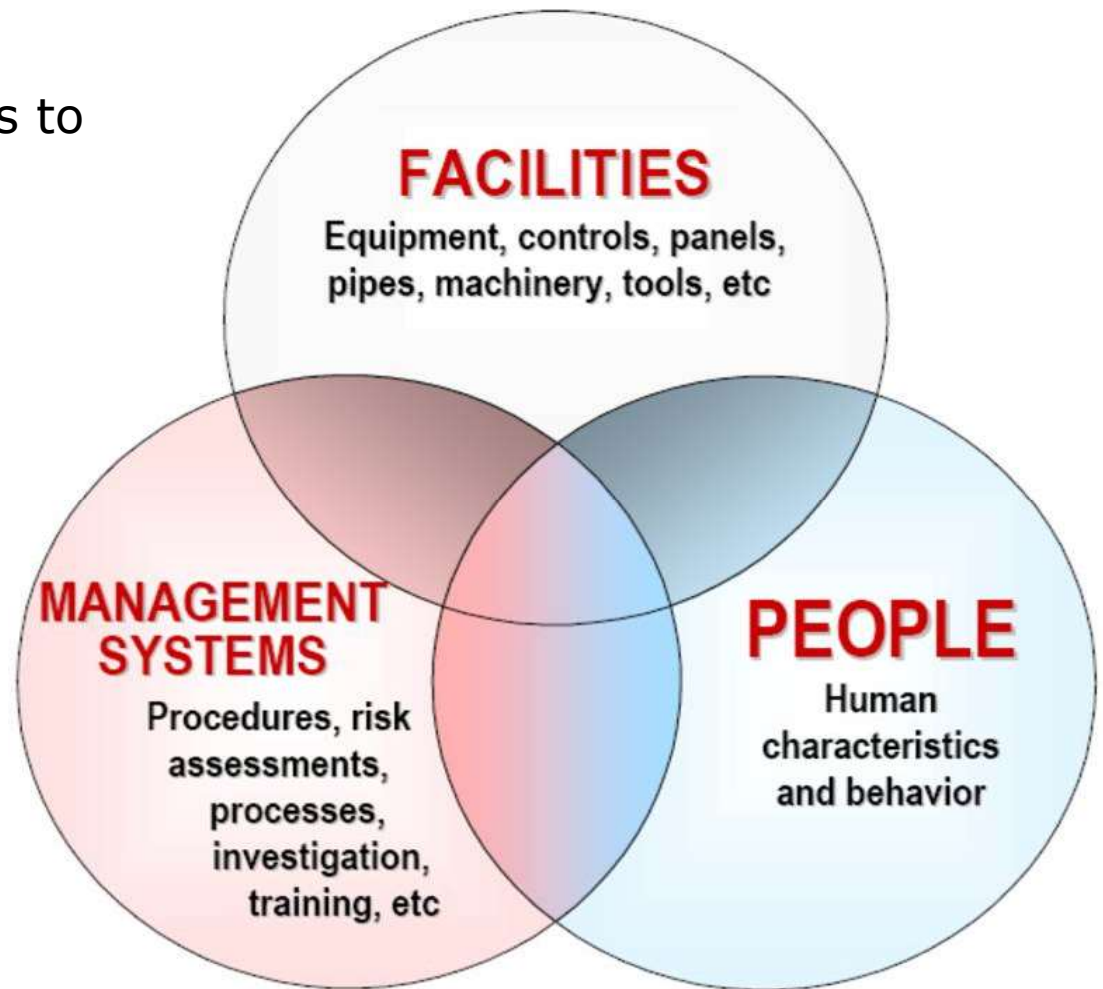


Creating optimal performance

Having an *optimal* system helps to optimize the process

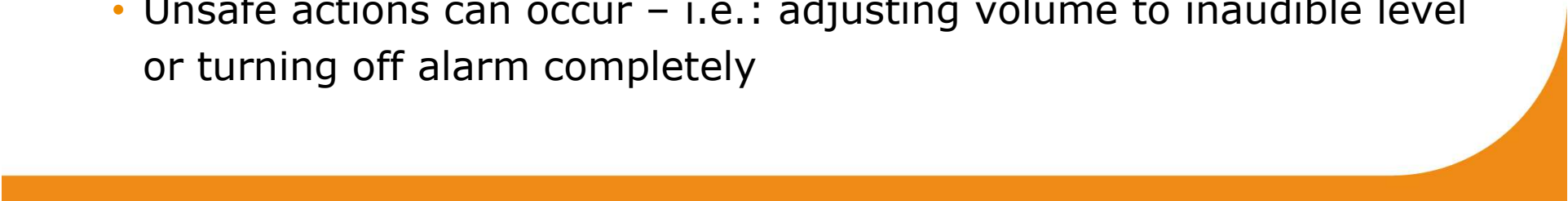
Human Factors Engineering
(HFE/Ergonomics)

*Making it easy for people
to do the right thing'*



“ALARM FATIGUE”

Economic Cycle Research Institute published annual list of top-10-technology related safety hazards – in Patient Care – “alarm hazard” comes out on top.


- 86%-99% of alarms are non-actionable
 - Become overwhelmed, unable to respond to all alarms or to distinguish among alarms sounding simultaneously.
 - Can be distracted with alarms interrupting their thought process or diverting their attention from other important activities.
 - Caregivers becoming desensitized
 - Noise creates stressful working environment
 - Unsafe actions can occur – i.e.: adjusting volume to inaudible level or turning off alarm completely
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An Alarm System – The 4 Fundamentals:

- 1. Does the alarm require action?** Every alarm requires timely operator action, and that action must be necessary
- 2. Does the alarm provide enough time for success?** Every alarm activation must occur in time to permit the operator to successfully remedy the situation
- 3. Does the alarm provide information?** Adequate information must be provided to the operator to work the alarm
- 4. Are alarms attached only to important things?** Only alarm important conditions/situations

Evaluate

Make alarm evaluation part of your regular safety review

- Identify any nuisance alarms
 - Standing alarms: alarms that take too long to acknowledge or clear
 - Are these process problems or gaps in training?
 - Does the alarm system work as intended?
 - Do the alarms help or hinder the operators?
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SUDA: See, Understand, Decide, Act

Alarm systems need to be transformed into process values:

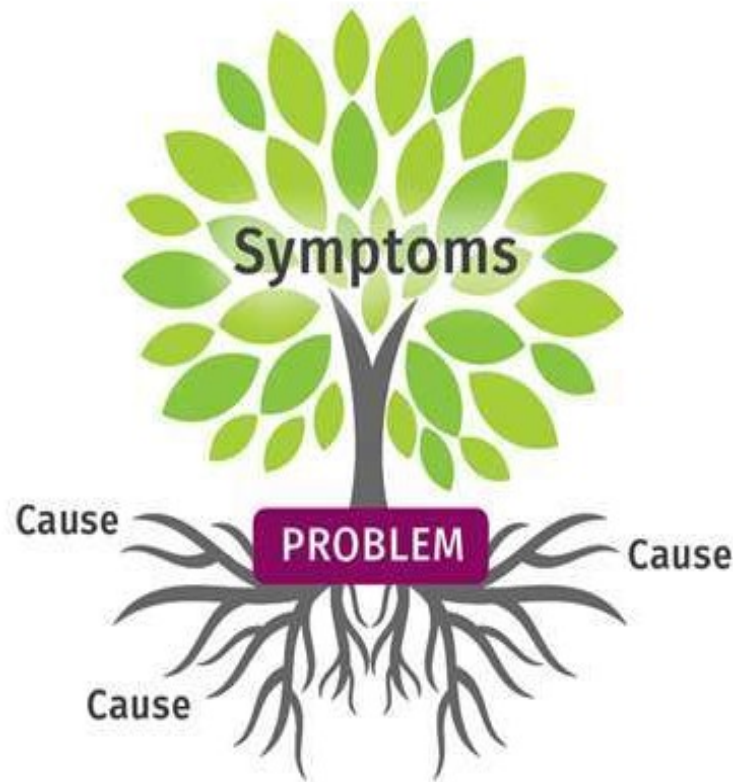
Currently in **time** values: e.g.: 6 degrees per minute increase
– operator needs **process** values – how long does it take to manage?

Alarm activation point = [Process trouble point] – {[Time to manage] + [Cushion]} x [Process Change]

Time to acknowledge


Action	Possible reasons
Alarms acknowledged quickly	<ul style="list-style-type: none">• Operator is focused elsewhere• Alarm is important or noise is annoying• Operator is over or under-loaded• Operator prioritizes acknowledgement over other duties
Alarms acknowledged slowly	<ul style="list-style-type: none">• Alarms generally of very little importance• Operator is consistently overloaded• Plant has de-emphasized the importance of alarms or the entire alarm system in general

Starting point - Identify the 'worse actors'




- Average number of alarms in a 10-minute period
- Peak number of alarms in a 10-minute period
- Proportion or percentage of time in alarm upset (more than 5 alarms in a 10-minute period)
- Number of standing alarms (alarms that remain active for a significant period of time)

Collection of Data

- Operator's journals and log data
 - Alarm data
 - Plant production data
 - Incident reports
 - New equipment or replacement equipment placed into service
 - Plant modifications
 - New operating procedures
 - Recent Management of Change orders (MoC)
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Opportunities

Every alarm is an opportunity to explore:

- Equipment that is broken or degraded
 - Process / alarm thresholds have changed
 - Raw material has changed
 - Incorrect or outdated procedures
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- A situation not properly trained for
 - A situation that was not fully understood
 - A situation that was not expected
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Every alarm activation is diagnostic

The plant did not perform as expected – opportunity for investigation

Periodic assessments keep alarm system performing

Some 'slippage' always occur

Interpreted results from periodic assessments are **Leading indicators** for plant problems

Careful analysis of alarm and operator performance can be a powerful tool to uncover problems

Day to day temporary modifications must be managed

Use a formal process to revert temporary changes back to approved design

Chemical plant improvements - rationalization process

Out of 154 alarms:

- ☐ 62 were deleted outright
- ☐ 59 had documentation errors
- ☐ 54 changed to alerts
- ☐ 50 had activation points changed
- ☐ 26 had their priority changed

Rothenberg pg. 38

- Your process operators are essential to the safety and reliability of your plant
- They can detect evolving trends and problems before they arise
- They know how to balance the system to ensure consistent and quality outcomes in a safe way.

**Increase the ability to manage alarms =
a known return on investment**

Going forward...



- Scenario based training for experts and novices
- Unusual, infrequent, unexpected situations
- Use 'what if' scenarios or HAZOPS to determine what could potentially go wrong
- Share incident investigations with industry
- Have operators share 'good catches'

How do we help them:

Respond, **M**onitor, **A**nticipate and **L**earn? (RMAL)

References

- ANSI/ISA 101.01-2015 Human Machine Interfaces for Process Automation Systems
- Rothenberg, D. H., (2009) Alarm Management for Process Control. Momentum Press, USA.
- ASM Consortium Guidelines. Effective Console Operator HMI Design. 2nd Ed. Revised. ASM Joint R&D Consortium.

