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SINGAPORE CHEMICAL INDUSTRY COUNCIL

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MHI Safety Knowledge Sharing

When everything is specified as High Priority, nothing is !!!

Alarm Handling In Chemical Process Industry

Major accidents like Longford Gas Production Facilities 1998 Gas Explosion (average of 300 alarms each day, 12 alarms every minute over a 12 hours shift during an incident) and the Milford Haven Refinery 1994 Explosion (1 alarm every 2 -3 seconds in 5 hours before the explosion and 275 alarms in 10.7 minutes just before the explosion) are painful lessons to remind the process industries on the importance of a good Alarm Handling.

LOPA diagram (EEMUA 191, 2013)

The **Primary Function** of an alarm system is to direct operators' attention towards the plant conditions that requires timely assessment or action. It should serve to help them to manage tasks and resources as well as to focus on the most critical issues at hand. For an alarm system to achieve this, EEMUA 191 recommends consideration of the following **Key Design Principles** during design:

- Each alarm should have the capability to **alert, inform and guide**
- Every alarm presented should be **useful and relevant** to the operator
- **Adequate time** should be catered for operator to carry out a defined response
- Alarm system design should **consider human limitations**

Characteristic of a Good Alarm recommended by EEMUA 191	
Relevant	Does the operator need to know this?
Unique	Is there another alarm with the same functionality?
Timely	Will the operator have enough time to respond?
Prioritised	Does the alarm highlights its relative Importance?
Understandable	Is the message delivered by the alarm understood by Operator?
Diagnostic	Does alarm identifies the concern that need to be addressed?
Advisory	Does alarm indicates the required action to be taken?
Focusing	Does alarms draw operator's attention to the most critical issues?

"Each and every alarm should be covered by a written (or on screen) 'alarm response procedure' which should assist the operator in identifying and carrying out the necessary response." (EEMUA 191, 2013)

Removing unnecessary distractions is key in alarm handling thus it is important that the site differentials between **Alarms, Alerts and Prompts**.

- **Alert**: Bring attention to a condition requiring heightened watchfulness or preparation for action and is usually not time-critical nor used as a formal layer of protection.
- **Prompt**: A request from the control system for the operator to manually perform some process action outside of the system's capability.

Alerts and Prompts are normally not displayed the same way as alarms which is inline with its relatively importance and are uncommon entries to the console's alarm list. This allows operators to focus on the things that matters which is critical especially during an emergency.

Other quick and relatively easier solutions for improving the Alarm handing includes the following:

- **Review and reconfigure alarms** which have no defined operator response or operators do not understand nor know how to respond to
- **Prioritise the alarms** and display them in accordance with their priority (for e.g., severity of consequences Vs. time to respond etc)
- **Adjust deadbands** on repeating alarms or reengineer nuisance alarms
- **Remove or Suppress alarms** from out-of-service facilities and equipment
- Higher Consequence Critical Alarm response actions may be reviewed using Safety Critical Task Analysis approaches

And to improve, the site needs to measure and know what does good look like. Therefore, it is important to set **Alarm Performance Targets** as it allows the site to monitor and assess how usable an operating alarm system is as well as to identify means of enhancing the system if necessary or detecting any potential deterioration.

Alarm Performance Targets recommended by EEMUA 191	
Distribution (%) of Alarm across different Defined Priority Level	80(Low)/15(Med)/5(High)
Average Standing Alarms	9
Average Alarms per day	144
Average Alarms per 10 mins	01
Peak Alarms per 10 mins	10

Expectation on Alarm Handling in Singapore Safety Case:

- Design Key Issue 9 on Human Factors under 5.3.2.2 (clauses 196) of Safety Case Technical Guide
- Section 8.3.1.5 iii of Appendix G of Safety Case Assessment Guide

Reference
- EMMUA 191, Alarm systems Guide to Design, Management and Procurement
- Energy Institute, Guidance for Optimising Operator Situational Awareness by Rationalising Control Room Alarms

An initiative of the SCIC Major Hazard Installation (MHI) Committee

With the implementation of Safety Case regime progresses into its operational phase, this bulletin aims to promote the effective sharing of information to support MHIs in a successful implementation that could deliver the expected safety performance improvement of our industry. For enquiries, please contact SCIC via secretariat@scic.sg