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SINGAPORE CHEMICAL INDUSTRY COUNCIL

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Issue 01 Oct 2020

# MHI Safety Knowledge Sharing

***Safety Is Presence of Effective Safeguards Not Absence of Accidents!***

## Safety Case – Human Factors Aspect

### Why is Human Factors an important aspect in Process Safety Management?

*"Data tells us that human failures contribute up to 80% of industrial accidents. Even in oil refineries, which are highly capitalised and automated, the figure is 50%."* (1). Further, whilst accidents can look very different, standard human factors issues recur as common causes/themes in many of them. To illustrate, let's compare 2 notable industry events.

| | ESSO Longford – 1998 (2) | Texaco Pembroke -1994 (3) |
|---|---|---|
| **Consequence** | • **Explosion killed 2, injured 8**<br>• Cut off Melbourne's gas supply for 2 weeks | • **Explosion injured 26 people; Windows broken 3km away**<br>• Rebuild cost £48 million; Fined £200,000 |
| **Human Factors issue- *Training and competence*** | • Operators unaware of cold metal embrittlement threat<br>• Competence testing was designed to pass the operators – not ensure their competence | • No training provided to operators in when to conduct an emergency shutdown<br>• Adopted an 'all hands-on deck" approach, No supervisory role |
| **Human Factors issue- *Design & Alarm Management*** | • Operators accustomed to alarms on - record of 8500 alarms occurred per 12hr shift (12/minute)<br>• Condensate level alarm frequently ignored - tackling it would mean reducing gas & threatening production | • Alarms were being presented at a rate of one every 2 – 3 seconds<br>• In the last 11 minutes, operators saw 275 alarms (majority high priority) appeared in the same place |

To reduce incidents related to human failures, Human Factors (HF) must be better understood and the knowledge more broadly applied, to ensure the process safety of MHIs.

### Human Factors Aspect of Safety Case in Singapore

The subject of "Human Factor" (HF) is well-established and can be systematically managed proactively. As per Safety Case Technical Guide, MHIs are expected to ***"demonstrate a structured and systematic approach to managing human performance…. based on a thorough understanding of human reliability and where the site is vulnerable to human failure."*** The key elements include:

**Human Reliability**

**It prevents foreseeable human failures** that could lead to major accidents with a **systematic approach** to:

- **Identify all Safety Critical Tasks -** that could initiate, prevent, control or mitigate major accident scenarios.
- **Analyse the tasks** for potential for human failure.
- **Identify & implement risk control measures** matched to human failure type
- **Identify Performance Influencing Factors** and optimise performance of:
  - **Management of organisational change**
  - **Manning / staffing level**
  - **Fatigue management, shift work & arrangements**

**Ergonomics**

- HF is included in the **design of equipment** and in the **operation, maintenance and modification of systems** (with consideration of how human errors can be reduced).
- Demonstrate how **systems which require human interaction,** have been designed based on needs of the user, and that they are reliable. This includes **manual control systems, control room and interface design and alarm handling**
- Consideration of design of task & **environmental effects** that affect human performance

- It is critical to incorporate human factors in risk assessment and incident investigations, leveraging established industry tools (e.g. Energy Institute Safety Critical Task Analysis), underpinned by keen learner mindset, to achieve the safety case objective.
- Given the broad application of HF and in recognition of the time required for full implementation, "*MHIs are allowed the flexibility to take a phased implementation approach towards human factors in the safety case*" (4), i.e. up to three 5-yearly submission cycles (~10 years).
- As a start, MHIs are required to develop a Human Factors Roadmap *(see Safety Case Technical Guide, Appendix 5B)*, followed by progressive implementation through the 10-years journey.
- **The ultimate benefit is not only to achieve compliance, but for MHIs to reap the benefit of a fit and competent work force, suitably designed man-machine interfaces, optimised work environment & tasks, to achieve lower incident rates.**

**Goal - Increase the likelihood to do the right thing and reduce the likelihood of doing the wrong thing!**

Reference

1. UK HSE PM/Technical/03 HID – Safety Report Assessment Guide: LPG
2. Hopkins, A (2000) Lessons from Longford: The Esso Gas plant explosion. CCH Australia Ltd.
3. HSE (1997) The explosion and fires at the Texaco Refinery, Pembroke, 24th July 1994:
4. Safety Case Technical Guide and Assessment Guide

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 effective sharing of information to support MHIs in a successful implementation that could deliver the expected safety performance improvement of our industry. For enquires, please contact SCIC via secretariat@scic.sg*