Safer Industry through Industry Engagement, Undergraduate Education and Training

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Singapore Institute of Technology

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Process Safety

Process safety is the prevention and mitigation of unintentional releases of potentially dangerous materials or energy through the use of robust processes and equipment reliability

- Identifying and understanding potential hazards
- Evaluating consequences, safeguards, and risks
- Adding layers of protection (safeguards) to prevent and / or mitigate incidents
- Protecting employees, the public, the environment and assets through these safeguards

Various Safety Management Systems

- **OSHA** Process Safety Management (PSM) 29 CFR 1910.119 (published in 1992; 14 elements)
- **EPA** Risk Management Plan (RMP) (per the Clean Air Act; 16 elements)
- **American Chemistry Council** (ACC) Responsible Care (18 elements)
- **CCPS Risk-Based Process Safety** (RBPS) (introduced in 2007; 20 elements) – the most comprehensive and rigorous system
- **API** Recommended Practice 1173 Pipeline Safety Management System (API 1173) (introduced in 2015; 11 elements)

OSHA Process Safety Management Elements

OSHA 29 CFR 1910.119

1. Employee Participation
2. Process Safety Information (PSI)
3. Process Hazards Analysis (PHA)
4. Operating Procedures
5. **Training**
6. Contractors
7. Pre-Startup Safety Review (PSSR)
8. Mechanical Integrity
9. Hot Work Permits
10. Management of Change (MOC)
11. Incident Investigation
12. Emergency Planning and Response
13. Compliance Audits
14. Trade Secrets

Training as CCPS Process Safety Leading Indicators

Training for PSM Critical Positions

(Number of Individuals Who Completed a Planned PSM Training Session On-time) / (Total Number of Individual PSM Training Sessions Planned)

Definitions:

PSM Critical Position: Any facility position that includes key activities, tasks, supervision, and / or responsibility for component procedures critical to the prevention of and recovery from major accident events

Planned PSM Training Session: A specific exercise designed to enhance an individual's knowledge, skill, and / or competency in a PSM critical position for areas that directly influence the prevention of and recovery from major accident events. A single individual may have multiple training sessions during a reporting period. A single exercise may involve multiple individual training sessions (e.g., a training class with multiple individuals)

Training as CCPS Process Safety Leading Indicators

Training Competency Assessment

(Number of Individuals Who Successfully Complete a Planned PSM Training Session on the First Try) / (Total Number of Individual PSM Training Sessions with Completion Assessment Planned for that time period)

Definitions:

Successful Completion: A passing grade on an exam or competency assessment for which there is no requirement to repeat/redo the training, exam, competency assessment or any part thereof.

Training Session with Completion Assessment: A planned PSM training session for which there is a required demonstration of knowledge or skill through an examination or competency assessment

Training as CCPS Process Safety Leading Indicators

Failure to follow procedures / safe working practices

(Number of safety critical tasks observed where all steps of the relevant safe working procedure were not followed / Total number of safety critical tasks observed) x 100%

To determine by work place observation of tasks identified as being safety critical that have a relevant safe operating procedure, whether all of the relevant steps are followed

Knowledge and Competence by IChemE Safety Centre

The percentage conformance metric is based on the following equation:

(Number of process safety related roles assessed as competent) / (Total number of process safety related roles) x 100 = % conformance

This metrics should trend toward 100% conformance. The number of process safety roles assessed as competent refers to a formal assessment process against predefined competency requirements. A process safety related role is one that has an impact on the process safety outcomes at a facility. As roles differ across different organisations, there is no specific definition referenced here. However, ISC has published a guidance document called Process Safety Competency – a model (ISC, 2015)

Knowledge and Competence by IChemE Safety Centre

This document defines a generic process safety competency model which could be used as a benchmark for this metric. The determination of roles and competency will vary between organisations.

The suggested frequency of capture is based on the concept of weekly roster planning and review. This is especially required where the workforce work in a fly-in fly-out roster. It is important have the right people on site at any point in time where site-based roles are concerned. Where roles are non site based, this frequency could be extended to monthly capture and annual analysis.

Frequency of capture: Weekly
Frequency of analysis: Monthly

Training as WSHC Process Safety Performances Indicators

- Process safety training and competency plan - Percentage identified training completed as per plan Ensuring that employee knowledge & skills are refreshed / kept up to date

- Process safety training and competency evaluation procedure - Percentage of training evaluated for its effectiveness. Effectiveness means that the training provides the employee with the necessary skills to carry out their assigned tasks in a safe and competent manner

Training as WSHC Process Safety Performances Indicators

- Process safety training needs analysis - Percentage of jobs with identified training needs and plan - Training plan includes:
  - Both initial and refresher training for employees, suppliers, contractors and others who interact with the processes
  - Competency requirements of the job task
- Knowledge and competence is about ensuring the workforce has the relevant awareness and familiarity to understand the impact of their actions, as well as the ability to perform tasks consistently on a sustainable basis. This is a combination of practical experience and thinking skills

Initial Training

Implementation of an effective training program is one of the most important steps that an employer can take to enhance employee safety

- An overview of the process
- In its operating procedures

Training must include

- Emphasis on the specific safety and health hazards of the process
- Emergency operations including shutdown; and
- Other safe work practices that apply to the employee's job tasks

Refresher Training

Refresher training must be provided at least every 3 years or as necessary to each employee involved in operating a process to ensure that the employee understands and adheres to the current operating procedures of the process

Must consult with employee on the frequency of refresher training

Training Documentation

Employer must determine whether each employee operating a process has received and understood the training required

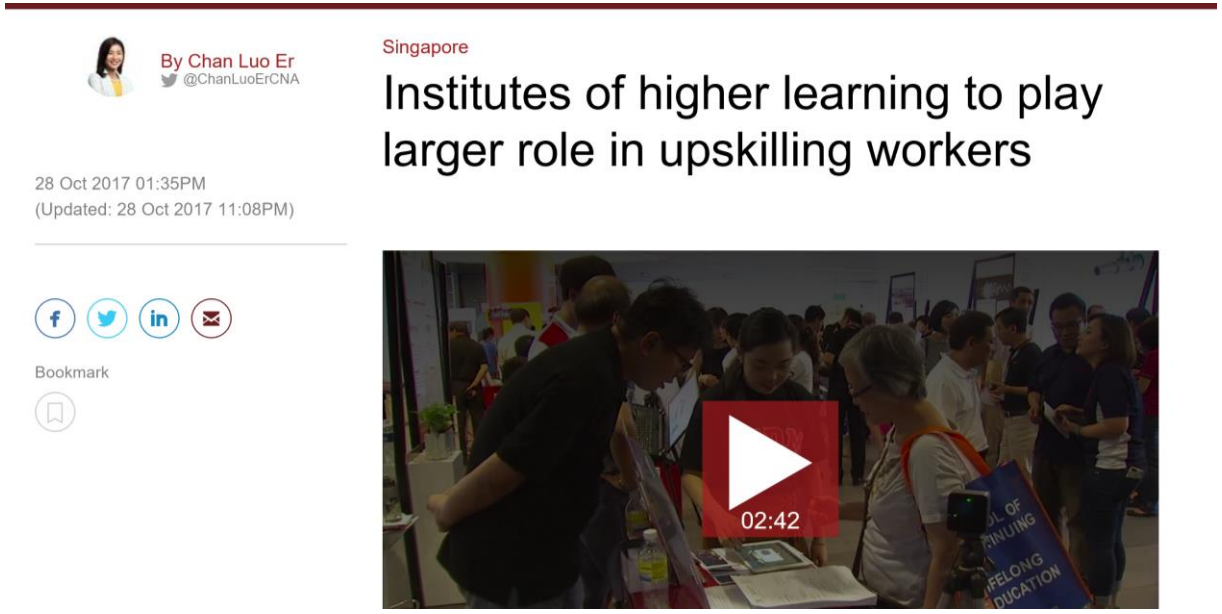
Record must be kept containing the identity of the employee, date of training and how the employer verify that the employee understood the training

Employees should also be able to demonstrate the necessary skills needed to safely complete PSM procedures

Roles of Institute of Higher Learning

Need for IHL to work with industry to understand their needs

- help to upskill existing workforce
- ensure graduates are work ready



Work with Industry on Their Needs

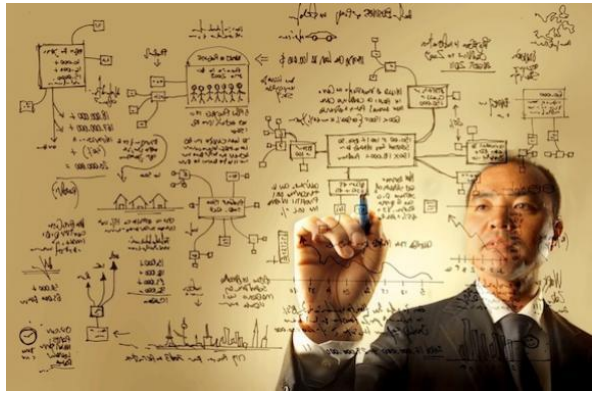
- Need to build technical know-how of MHI personnel for Safety Case regime from 2017 onwards
- Ensure that competent personnel continue to upskill
- Systematic training framework to ensure harmonised skills for competent personnel

Development of Industry Relevant Process Safety Workshops - Postgraduate / In House Training

Specialist Certificate in Process Safety comprises the following

- Workshop 1 – Process Safety Concepts
- Workshop 2 – Fire and Explosion Prevention
- Workshop 3 – Design & Engineer For Safe Operation
- Workshop 4 – Relief Systems Type and Characteristics Design Consideration
- Workshop 5 – Process Hazard Analysis
- Workshop 6 – Layer of Protection Analysis
- Workshop 7 – Human Factor in Process Safety
- Workshop 8 – Quantitative Risk Assessment

Applied Learning



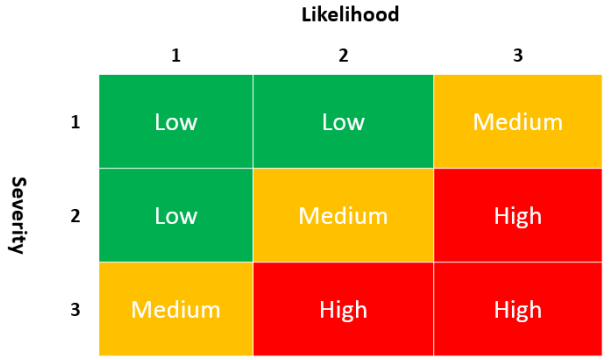
Classroom Knowledge

Conduct Plant Walk Through

Hazard Evaluation

Case Study

Hands-on Exercise



Risk Assessment

Support from Top Management / Sharing of Company Examples

Opening speech

VIP: Mr Kenneth Bradley, VP, API Operations, Pfizer Global Supply

Launch of Workshop on 26 October 2016

Practice in Action

Work with industry partners to host workshop as far as possible to include plant walk through for application exercise

Safety briefing before workshop

Safety briefing before plant walk through

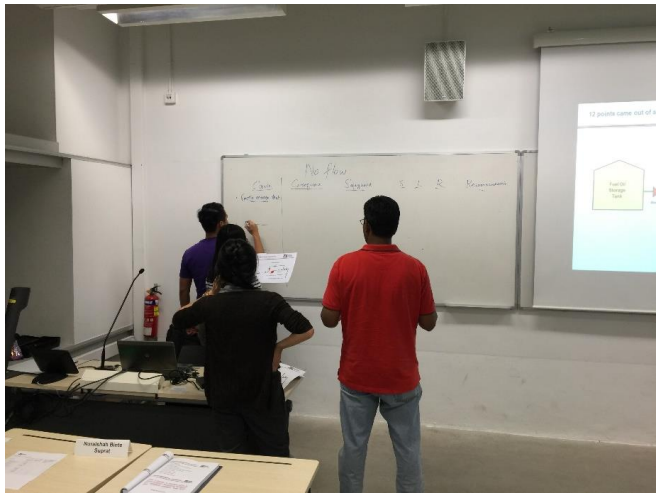
Case Studies

Discussion over lunch
for application exercises

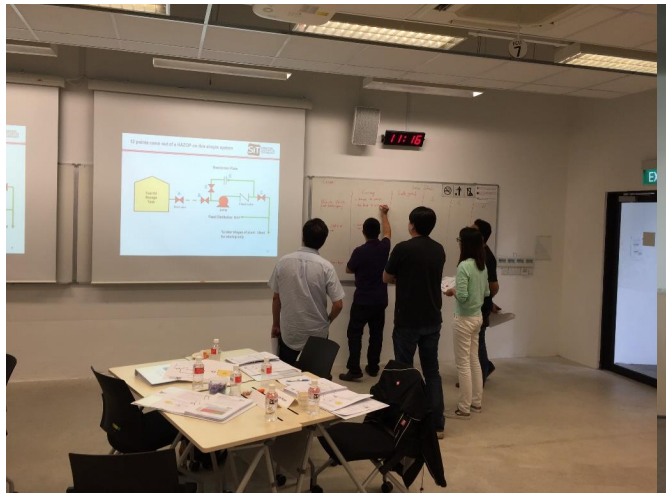
Case study for application exercises

Participants actively taking down notes
during the workshop

Hands-on Exercise



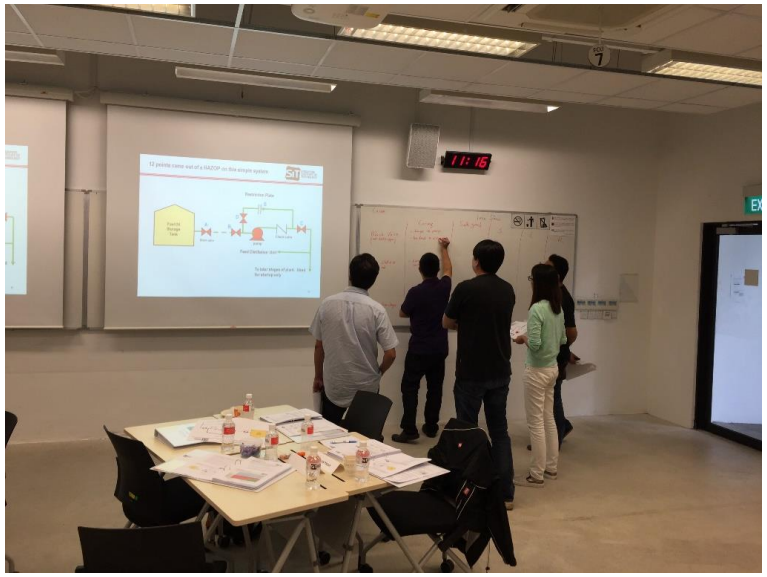
Workshop held in company with plant walk through



Case Study Discussion by participants

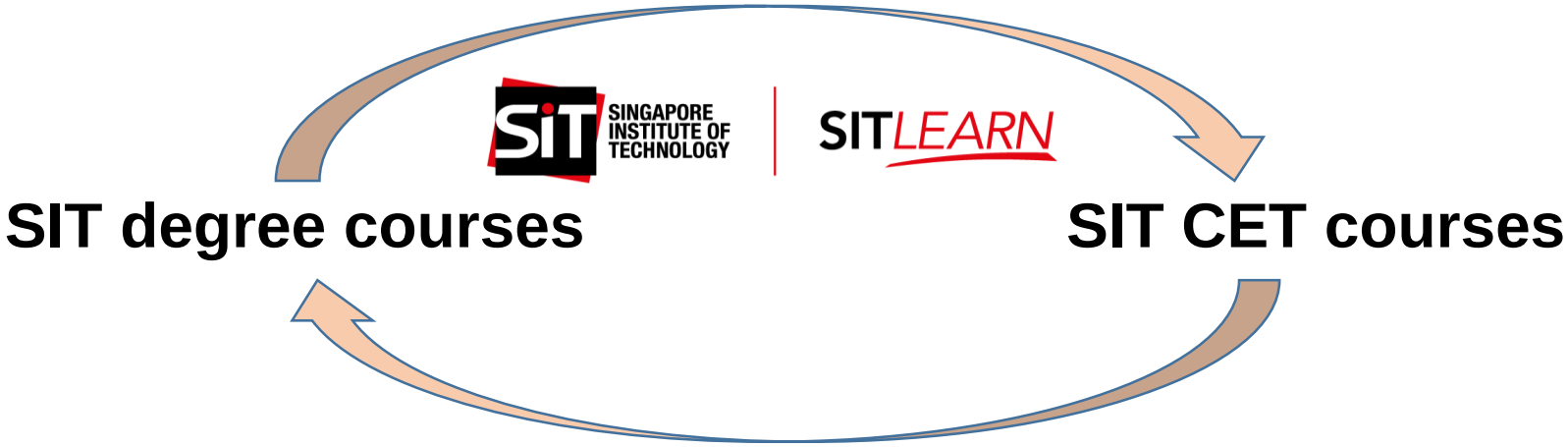
Assessment / Competency

- Quiz during workshop
- Case Study / Hands-on exercises
- Portfolio (write-up on how the participant is able to apply the materials taught in their work) + interview if necessary



Future-Proof Tomorrow Engineers / Undergraduate Degree Training

Meet industry needs through applied learning pedagogy



Reinforce UG programmes by incorporating industry feedback on the current gaps + Integrated Work Study Program (IWSP)

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Thank You!

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