

# Safety Integrity Level (SIL) Training

CHEMICAL ENGINEERING TECHNICAL DIVISION



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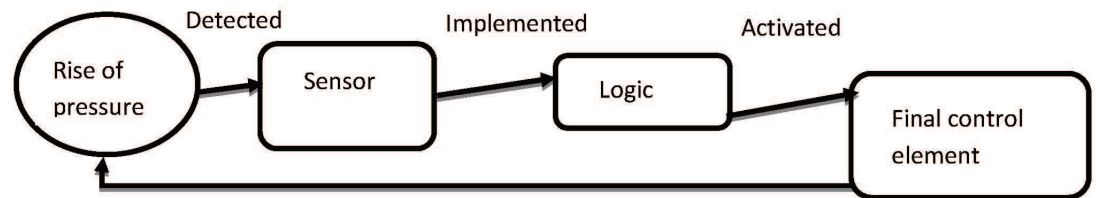


SIL workshop group photo

The Chemical Engineering Technical Division (CETD) held a one-day training programme on the various aspects of safety requirements in the Oil & Gas Industry in September 2015. It was conducted by Ir. Razmahwata Mohamad Razalli, who had

20 years of working experience in the industry.

Ir. Razmahwata introduced the qualitative and quantitative assessment methods to measure risk, based on frequency and target mitigated event likelihood (TMEL) concepts respectively. He discussed the differences



Preventing the event

Figure 1: The pressure build-up in a vessel with top event of over-pressure of vessel, resulting in rupture, loss of containment, fire, explosion, environmental contamination.

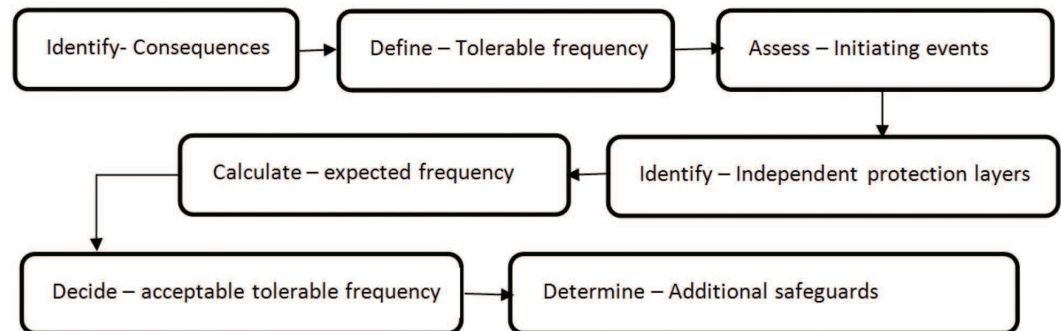


Figure 2: A typical LOPA process

between Safety Instrumented System (SIS) and Safety Instrumented Functions (SIF) requirement. The SIF is called Instrumented Protective Function (IPF) and is implemented by SIS in order to achieve or maintain a safe state. The SIS is made up of safety functions with sensors, logic solvers and final control elements. The pressure build-up in a vessel is used as an example to show how SIF functions work (Figure 1).

Ir. Razmahwata also presented a tolerable failure table of a given SIF and said: "It is important to take note of the user demands and vendor confirmations

Table 1: SIL level classification

SIL	*PFD <sub>AVG</sub>	*RRF
4	$<10^{-4}$ to $10^{-5}$	10,000 to 100,000
3	$<10^{-3}$ to $10^{-4}$	1,000 to 10,000
2	$<10^{-2}$ to $10^{-3}$	100 to 1000
1	$<10^{-1}$ to $10^{-2}$	10 to 100

\*PFD (probability of failure on demand) and RRF (risk reduction factor)

for SIL classification/determination and SIL verification respectively."

He used a case study to discuss the two SIL classification methods. Each participant was given a copy of the Term of Reference (TOR) to conduct the SIL classification using risk graph and risk matrix analysis (Table 1).

He later discussed the seven steps in "Layer of Protection Analysis" (LOPA) as shown in Figure 2.

He used a case study of a reboiler condensate pot in an over-pressure condition which led to vessel rupture and which resulted in a single fatality. "The major challenge prior to conducting LOPA is to obtain the frequency number," added Ir. Razmahwata.

In the last part of the programme, Ir. Razmahwata discussed the components required in the TOR, including objectives, scopes, participants, technical and procedural boundaries of the SIL study, extent of review and Process Hazard Analysis (PHA) method used (whether the team is doing risk ranking, persons required, time and date). ■