



## Safety Integrity Level (SIL) For Safety Critical Systems

Safety Integrity Level (SIL) is the discrete level for specifying the integrity requirements of safety functions to be allocated to the “Electrical/Electronic/Programmable Electronic Systems” safety related systems where SIL 4 has the highest level of safety integrity and SIL 1 the lowest.

### Why SIL?

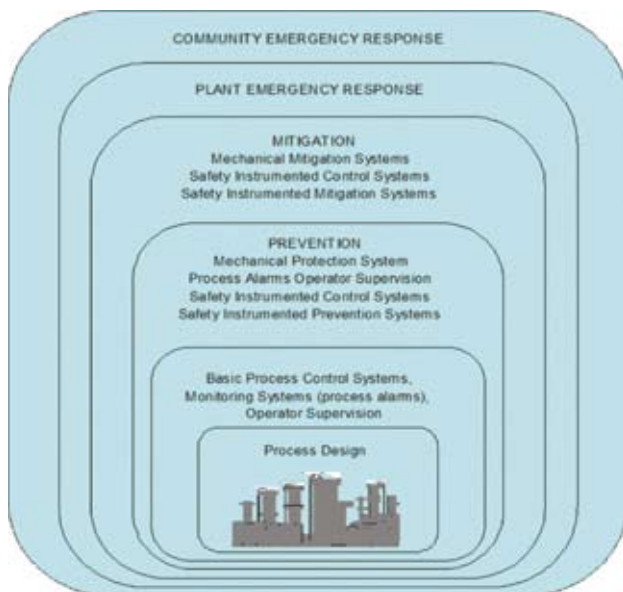
Process plants are operated with many sophisticated process control systems. These systems are required for safe and reliable operation of the plant and address the safety functions such as process sectioning, fire & gas detection, process protection and blow down. These safety functions are often designed combining various E/E/PES technologies and other external risk-reducing devices. In addition, computer and software intensive systems are increasingly being used as part of the system. A malfunction of these systems can lead to loss of life, damage to assets and impact to the environment.

Optimize the management of your safety critical system & instrumented protective function inline with the industry best practices with compromising safety.

### Methodology

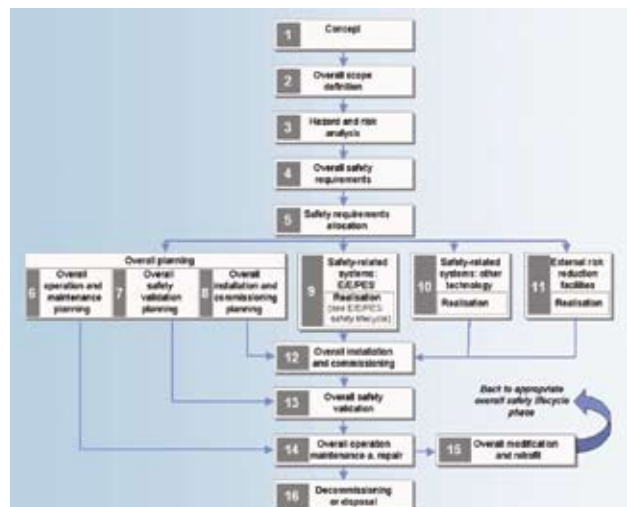
VELOSI uses a number of techniques assisted by software tools and models to manage safety critical equipment. These are organized according to the Life Cycle model recommended for the safety critical equipment by IEC 61508. This Life Cycle model covers the project phases from concept to decommissioning and can be grouped into three distinct phases:

1. Design
2. Maintenance planning
3. Operation & Monitoring



Layer of protection in a process model

IEC-61508 Process Model



### VELOSI Services for Managing Safety Critical Systems

- Design
- Maintenance Planning
- Operation & Monitoring

## SILS versus reliability

While the main focus of the SIL ratings is the interpretation of a process' inherent safety, an important by-product of the statistics used in calculating SIL ratings is the statement of a product's reliability. To determine if a product can be used in a given SIL environment, it must be shown to 'BE AVAILABLE' to perform its designated task at some predetermined rate. In other words, how likely is it that the device in question will be up and functioning when needed to perform its assigned task?

## Reliability numbers: What do they mean?

It seems that every organization has its own special way of characterizing reliability. However, there are a few standards in the world of reliability datum, as indicated below:

- **Probability of Failure on Demand (PFD)**

The Probability to Fail on Demand is a statistical measurement of how likely it is that a process, system, or device will be operating and ready to serve the function for which it is intended.

DEMAND MODE OF OPERATION		
Safety Integrity Level (SIL)	Average Probability of Failure on Demand	Risk Reduction
4	$\geq 10^{-5}$ to $< 10^{-4}$	$> 10,000$ to $\leq 100,000$
3	$\geq 10^{-4}$ to $< 10^{-3}$	$> 1000$ to $\leq 10,000$
2	$\geq 10^{-3}$ to $< 10^{-2}$	$> 100$ to $\leq 1000$
1	$\geq 10^{-2}$ to $< 10^{-1}$	$> 10$ to $\leq 100$

Table: Safety Integrity Level : Probability of Failure on Demand

- **Safe Failure Fraction (SFF)**

The maximum rated SIL environment in which the device(s) can be used.

- **MTBF**

A statistical representation of the likelihood of a component, device, or system to fail. The value is expressed as a period of time (i.e. 14.7 years).

- **MTTR**

Mean Time To Repair is the average time to repair a system, or component, which has failed. This value is highly dependent upon the circumstances of the system's operation.

## Software tool used for SIL study

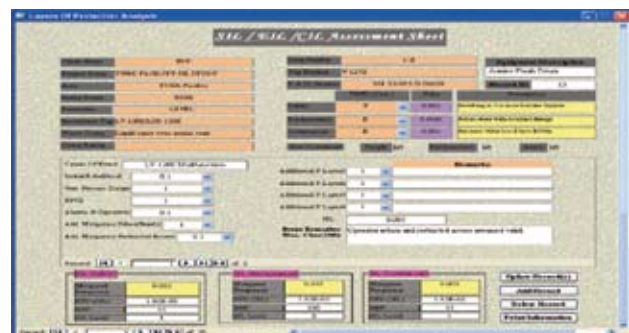
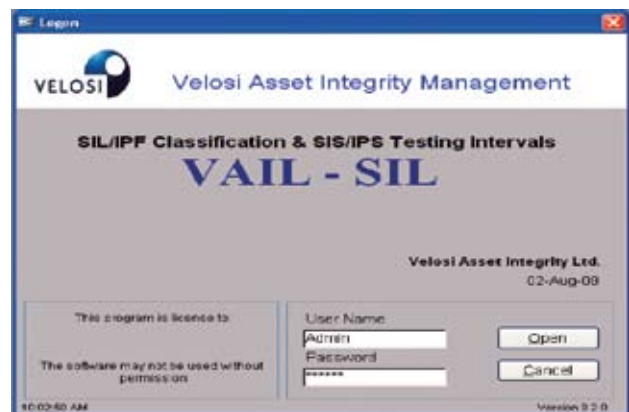
VELOSI can provide customized RCM training technology transfer for both management and nominated RCM team. Training sessions include:

VAIL-SIL is a VELOSI in-house developed Safety Integrity Level calculation tool with a unique and versatile identity. This software product was developed by using the Standard ANSI/ISA S84.01, IEC - 615011, IEC – 61508 as reference documents. Various methodologies are available for assessment of target SILs. VELOSI has implemented three different methodologies:

- Layer of Protection Analysis (LOPA)
- Risk Matrix
- Risk Graph

VAIL-SIL is not limited to calculating or finding out target SILs only - it also includes:

- Dynamic SIL reporting
- Comparison summary of SILs with respect to all three above mentioned methodologies
- Target PFD calculation(s),
- Testing interval calculation(s),
- Mean Time Between Failure (MTTR),
- Mean Time To Repair (MTBR),
- SIL Study Session Team's Record Management



LOPA study overview screen