Leaders in Risk Engineering and EHS Solutions

Chola MS
RISK SERVICES

FUNCTIONAL SAFETY

CHOLAMANDALAM MS RISK SERVICES LTD
An ISO 9001:2008 Certified Company

The World

has continued to witness many industrial disasters since the beginning of the industrial age.

Many of them like the Piper Alpha Oil platform incident , the Buncefield fire or the Deep Water Horizon tragedy have cost us dearly. These incidents have also caused many safety practices to come into play. In India IOC Sanganer (Jaipur) Fire caused legislative changes in the process industry in India. Some huge industrial disasters in India include the Bhopal Gas Tragedy in 1984 & the IOC Sanganer (Jaipur) Fire in 2009.

Bhopal Gas Tragedy is termed as the worst industrial accident globally from which important lessons were learned and was a turning point in introducing safety standards.

Piper alpha oil platform incident

IOC Sanganer (Jaipur) Fire

Bhopal Gas tragedy

Post a series of tragedies across the world, in 1998 the IEC, which stands for International Electrotechnical Commission published a document: IEC – 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems". This document sets the standards for safety-related system design of hardware and software. IEC 61508 is a generic functional safety standard, providing the framework and core requirements for sector specific standard. Sector specific standards have been released using the IEC 61508 framework.

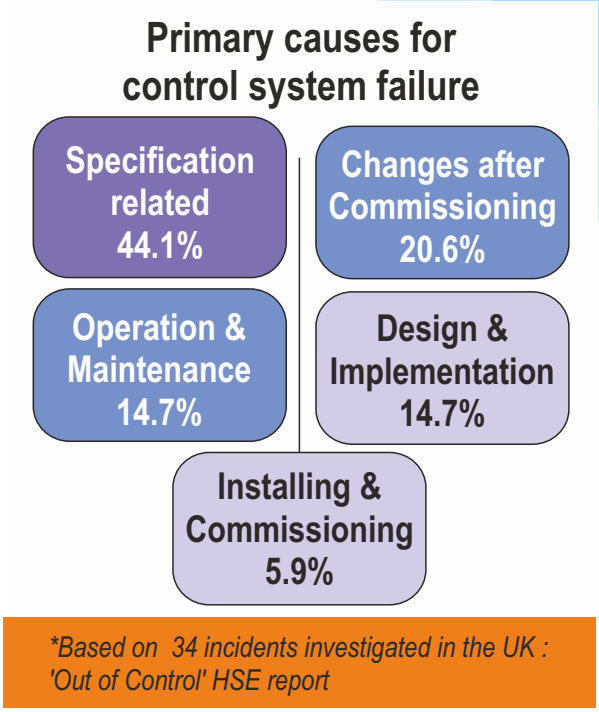
FUNCTIONAL SAFETY SERVICES

Functional Safety

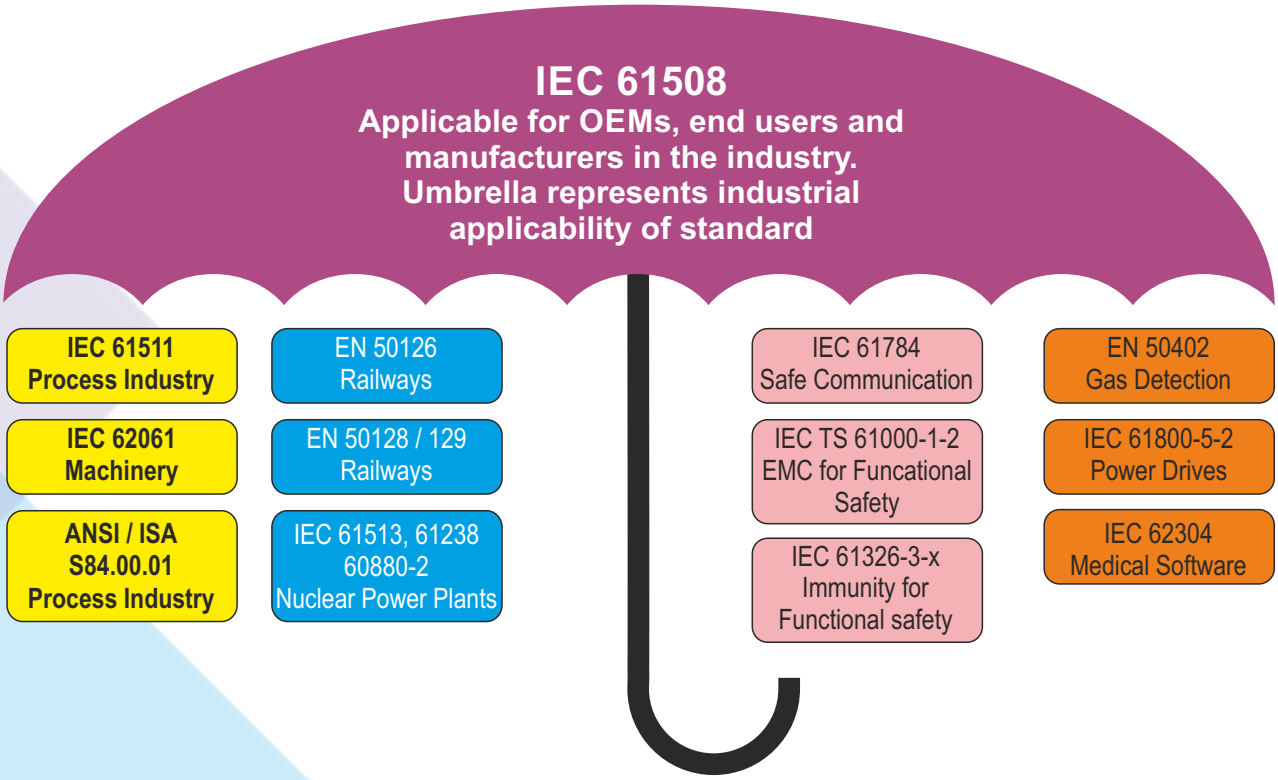
is part of the overall safety of a system or piece of equipment that depends on the system or equipment operating correctly in response to its inputs, including the safe management of likely operator errors, hardware failures and environmental changes. Functional Safety provides an opportunity to focus on specific risks and help prevent the consequences in a manner that process is driven to a safe state without human intervention. This strengthens the ability of the control system to deal with identified unacceptable risks with the desired level of reliability and integrity.

WHY FUNCTIONAL SAFETY

Failure to reduce unacceptable risks could lead to catastrophic losses -- loss of life, injuries, damage to property and the environment. Besides these, the end-user, OEMs and Integrators need to manage the unacceptable risks to demonstrate compliance to legal and statutory requirements & key standands like OSHA.



**Based on 34 incidents investigated in the UK : 'Out of Control' HSE report*

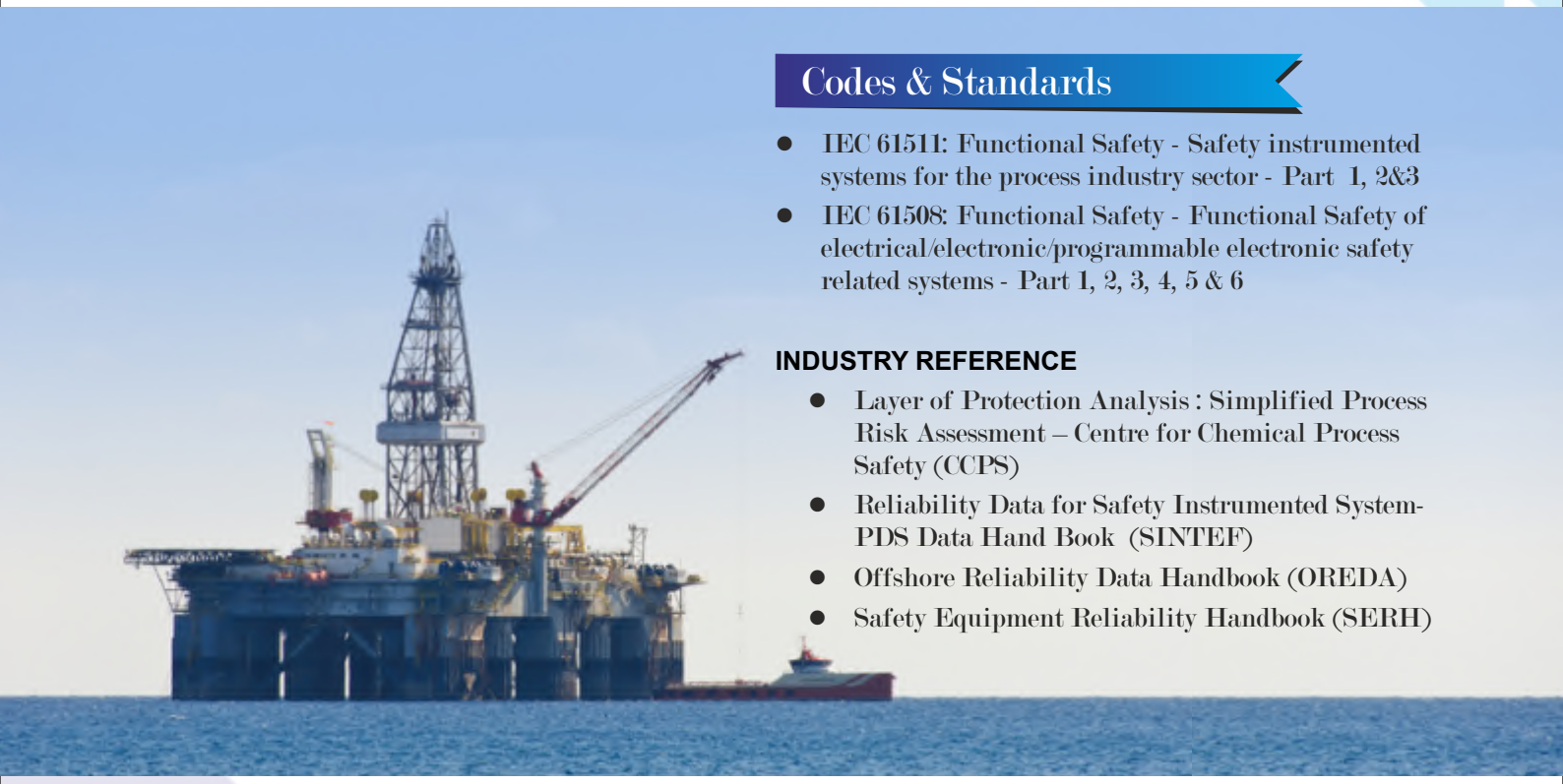


WE OFFER FUNCTIONAL SAFETY LIFE CYCLE SERVICES FOR THE PROCESS INDUSTRY. THIS INCLUDES SIL DETERMINATION, SRS, SIL VERIFICATION, SIL VALIDATION, FUNCTIONAL SAFETY ASSESSMENTS (FSA:5 Stages) AND FUNCTIONAL SAFETY AUDITS.

FUNCTIONAL SAFETY SERVICES

Safety instrumented systems have been used for many years to perform safety instrumented functions in the process industry. It is therefore essential that this instrumentation achieves certain minimum standards and performance levels.

Safety Instrumented Systems (SIS) is one of the most important layers of protection against accidents in a chemical process industry. OSHA warrants that the design and implementation of such systems meet good engineering practices. Safety performance criteria for SIS should be defined by Safety Integrity Levels (SIL). The determination of the SIL required for the SIS will help in its configuration to meet or exceed the required SIL and in turn the reliability of the system.

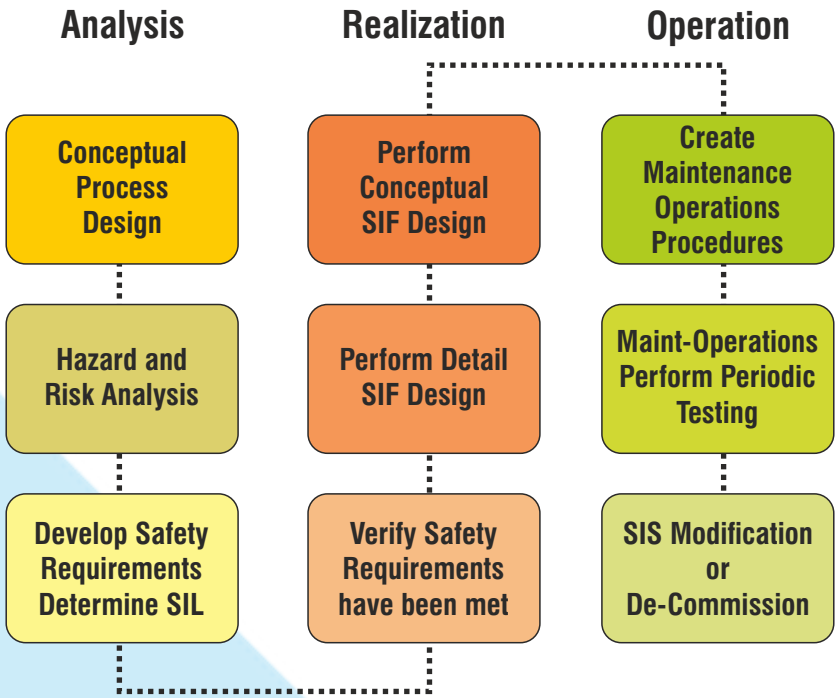


Codes & Standards

- IEC 61511: Functional Safety - Safety instrumented systems for the process industry sector - Part 1, 2&3
- IEC 61508: Functional Safety - Functional Safety of electrical/electronic/programmable electronic safety related systems - Part 1, 2, 3, 4, 5 & 6

INDUSTRY REFERENCE

- Layer of Protection Analysis : Simplified Process Risk Assessment – Centre for Chemical Process Safety (CCPS)
- Reliability Data for Safety Instrumented System-PDS Data Hand Book (SINTEF)
- Offshore Reliability Data Handbook (OREDA)
- Safety Equipment Reliability Handbook (SERH)



SIL Identification

TARGET SIL DETERMINATION/CLASSIFICATION/ASSESSMENT

Safety integrity level classification is performed to establish a "fit for purpose" design of safety measures which are able to mitigate hazards with respect to safety, environment, image (reputation) and economic losses.

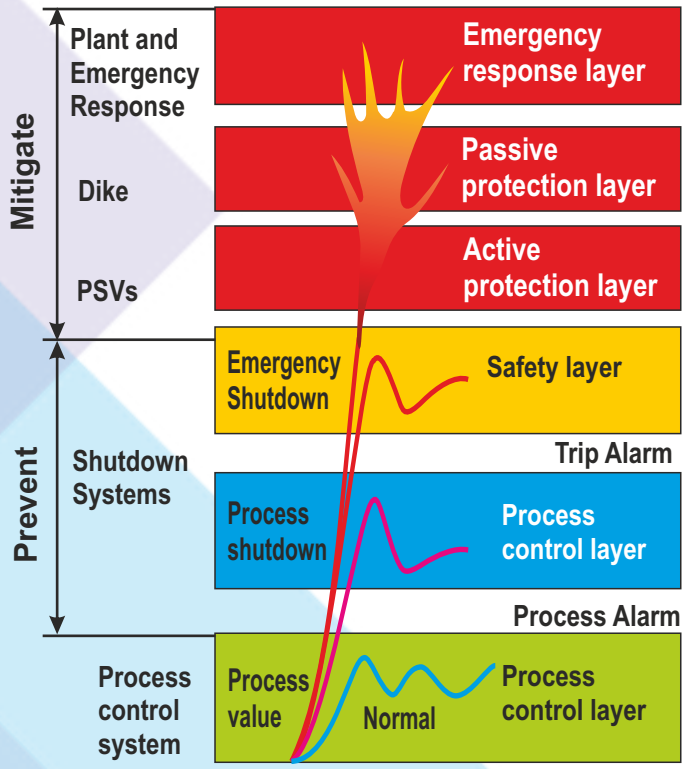
We can help you in the SIL determination which will be performed by a multi-disciplinary team who are knowledgeable of the design being evaluated, and IEC61508 / IEC61511 standards. The team will consist of people qualified to review the process, identify potential hazards and recommend actions.

We will facilitate you through out the SIL Determination process. The outcome will help you determine the target SIL value for every Safety instrumented function

- Allocate safety functions to protection layers
- Determine the required safety instrumented functions
- Determine for each safety instrumented function the required safety integrity level

Methods Of SIL Determination

1) Risk Graph
2) Risk Matrix
3) LOPA
4) Customized Company specifice Methodology



Importance of Safety layer

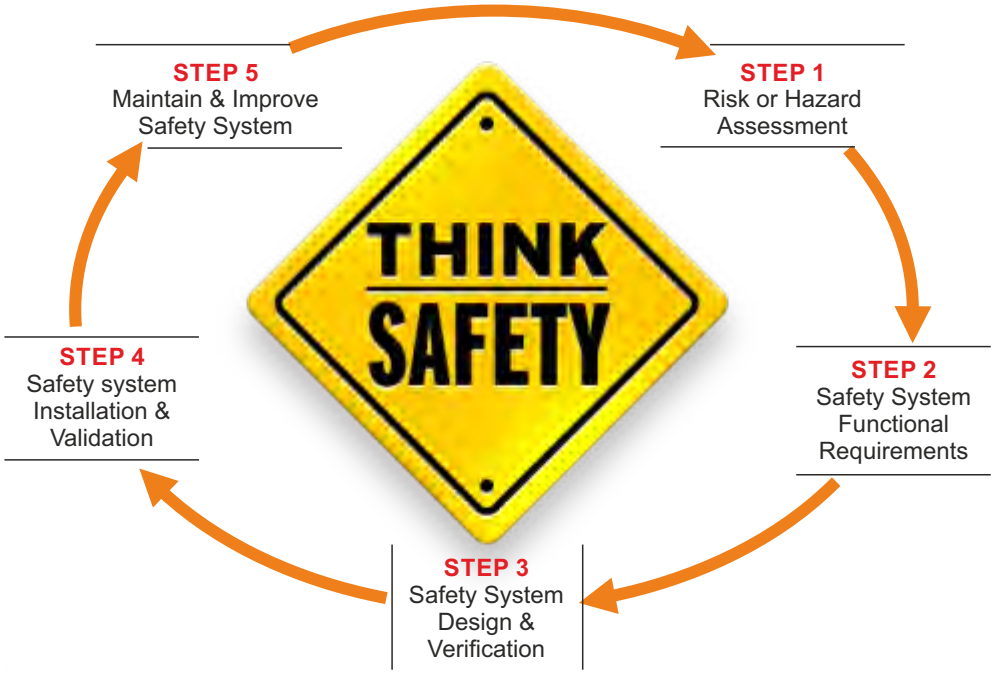
The safety instrumented system gives the end user an opportunity to design a highly reliable, fully automated, state-of-the-art safety instrumented system to deal with identified risks in a controlled fashion. A SIS is defined as a system composed of sensors, logic solvers & final elements designed for the purpose of:

1. *Automatically taking a system to a safe state when specified conditions are violated*
2. *Permit a process to move forward in a safe manner*
3. *To prevent/mitigate the consequences*

FUNCTIONAL SAFETY SERVICES

Safety Requirement Specification

- the objective is to specify the requirements for the safety instrumented function
- to define the safe state of the process for identified safety instrurmented function
- the assumed sources of demand and demand rate on the safety instrumented function
- requirement for proof-test intervals
- regarding requirements for the SIS to bring the process to a safe state
- the safety integrity level and mode of operation (demand/continuous) for each safety instrumented function
- a description of SIS process measurements and their trip points
- requirements relating to energize or de-energize to trip
- requirements for resetting the SIS after a shutdown
- maximum allowable spurious trip rate
- other functional requirements and integrity requirements for each SIF



SIL Validation

The objective of the requirements of this stage is to validate through inspection and testing, that the installed and commissioned safety instrumented system and its associated safety instrumented functions achieve the requirements as stated in the safety requirement specification. Some of the check points include: Verify that SIS performs under normal and abnormal operating modes as defined in SRS. Confirm that interaction between Basic Process Control System (BPCS) and other connected systems do not affect the SIS.

Confirm that the sensors, logic solvers and final elements perform as defined in the SRS. Verify that proof test intervals are documented in maintenance procedures etc.

SIL Verification

SIL verification is a key step in the conceptual design process of SIF. After the preparation of Safety Requirement Specification based on SIL determination exercise the SIF subsystem (sensor. logic solver, final element) technology is chosen. Subsequently the redundancy for sub system (like 1001, 1002, 2003 etc) is decided. Test methods for all equipment (automatic proof test etc) are determined. The SIF design is verified whether it meets functional and integrity requirements and the target SIL as was specified during SIL determination.

Functional Safety Assessment

Several new functional safety standards require an independent safety assessment to be carried out in parallel with the development of components or systems. It is done to ensure the following:

- the hazards arising from the process and its associated equipment are properly controlled
- the dangerous failure rates of the safety instrumented system are in accordance with those assumed during the design
- the recommendations from HAZOP and other safety related studies that applies to safety instrumented system have been implemented or resolved
- the safety instrumented system is designed, constructed and installed in accordance with SRS
- safety, operating, maintenance and emergency procedures pertaining to the safety instrumented systems are in place
- validation planning is appropriate and Validation is done adhering to IEC 61511

Stages of FSA

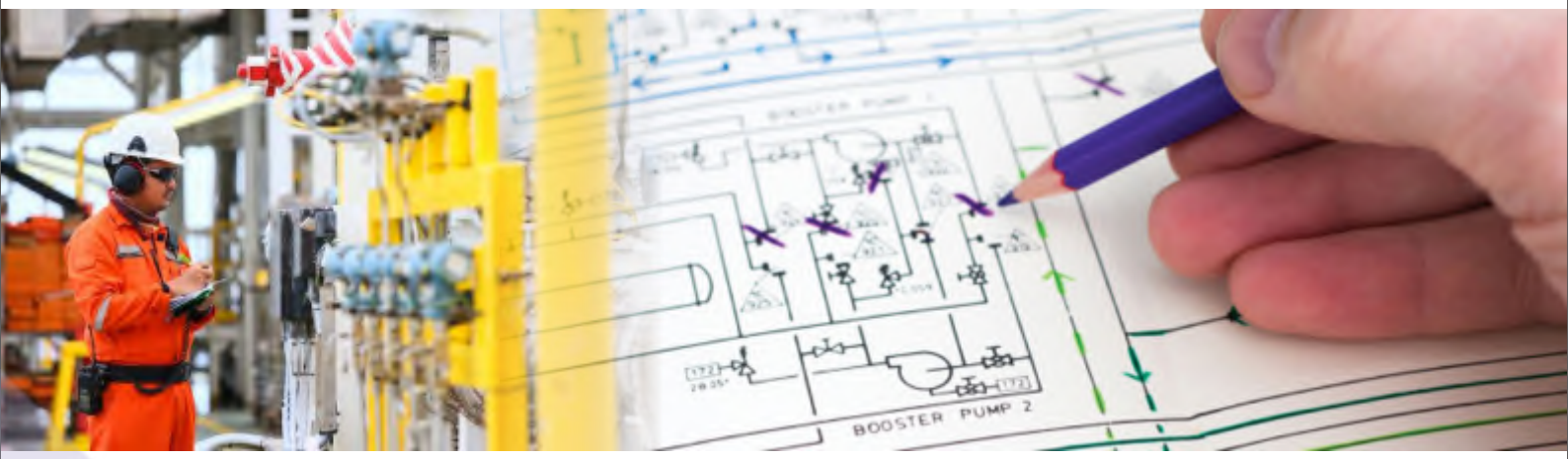
Stage I -	After the hazard and risk assessment has been carried out, the required protection layers have been identified and the safety requirement specification has been developed.
Stage 2 -	After the safety instrumented system has been designed.
Stage 3 -	After installation, pre-commissioning and final validation of the safety instrumented system has been completed and operation and maintenance procedures have been developed.
Stage 4 -	After gaining experience in operations and maintenance.
Stage 5 -	After modification and prior to decommissioning of a safety instrumented system.

Safety Instrumented Systems Audit

We will help you assess the reliability of your Safety Instrumented System by conducting a safety instrumented systems audit. It will verify whether the functional safety management program is implemented according to IEC 61511 requirements. This is applicable to the process industry where such systems are used to contain unacceptable risks, and bring it to ALARP levels.

Process industries that should undertake such audits are Oil and Gas, Petrochemical, Chemical Specialty , Thermal power plants & Engineering facilities where the impact of operations could result in unacceptable impact on health, safety, environment, asset and the reputation of the organization.

SIS Audit is generally done during long duration lifecycle activities such as operations maintenance and repairs. During the operational phase of lifecycle the system undergoes many intervals of proof testing, modifications, repairs. Hence it is necessary to restore the system back to the designed reliability throughout the lifecycle. SIS Audit gives you a methodic opportunity to overcome any deviations that are existing in the system and helps you to continually sustain / improve the reliability.



SCOPE

- The Audit scope is limited to the safety instrumented system of the operations/ facility under consideration. It covers;
- Functional safety management plan
- Proof Testing procedures
- Modification management
- Safety instrumented system documentation
- Training records

BENEFIT

- The Audit will help the organization to assure /improve the reliability of the safety instrumented system. The Audit team will share the industry best practices in the process industry thus providing the opportunity to benchmark with the world leaders in functional safety.
- It will also enable easy integration with the existing standard if sustained across the lifecycle of the facility.

TEAM

- Audit Team Comprises of functional safety experts who have been involved closely with the process industry with implementation of activity such as assessment, process safety requirement specification, verification, validation, functional safety assessment.
- The audit would be lead by proven experts who have in depth understanding of the IEC 61511 standard and can help identify the minor, major non conformances.

Duration of the Audit : This is a two day duration audit and also includes a two hour presentation on industry best practices .

1) Single day audit for depots / small sites / storage facility
2) Two day audit for medium size facility
3) Three day audit for large facility.

Number of team members will depend on the complexity of the facility and area to be covered during the audit.

Safety Instrumented Systems Training

From the Chola Safety Academy we offer high end programs on a wide variety of HSE topics. Because of our rich experience in consulting we are able to address complex problems and convey solutions using simple and easy to comprehend techniques. So if you have got a group of people to be trained on this subject why not let us come to you and transform your classroom training into an extraordinary experience.

Functional safety introduction

- Definitions
- Concept of Safety Instrumented System
- Concept of Safety Integrity Level
- Differentiation SIS/BPCS
- Types of Devices

Safety Life Cycle for Process Industry as per IEC 61511

- Lifecycle concept for Process Industries
- 4 phases of the Lifecycle
- Functional Safety Management Concept
- Assessment overview
- Verification overview
- Safety requirement specification overview
- Validation overview
- Functional safety assessment overview

SIL Assessment Overview of Methods and Techniques.

- SIL Assessment
- Criterion for SIL Assessment
- Methods of Assessment Overview
- SIL Gap Identification
- Layers of Protection
- LOPA Overview
- Risk Matrix

SIL Verification & Validation

- Verification Overview
- Validation Overview
- Validation / Verification key differentiators
- Example of verification
- Importance of Field testing

Importance of Functional safety Assessment in Lifecycle

- Functional safety assessment
- Importance of Each stage
- Non Technical requirements of standard.
- Stages of FSA
- Criterion for FSA

The above 5 programs can be customised into single day, two day, three day programs depending on the requirement of the learner. The learner also has the opportunity to attend online webinars for the programs mentioned above.The depth of the program can be customized depending on the user needs.

☑ *E-learning courses* ☑ *Classroom Training* ☑ *Virtual Classrooms [Webinars]*

We are a leading provider of professional training and education in Risk Engineering and Safety Management. Our training modules are based upon a number of years of cumulative experience of our domain experts and engineers.

Our consulting experience and up-to-date knowledge about the statutory regulations, standards etc. form the basis of our programs. These learning modules are ***meticulously developed by our domain experts in consultation with Instructional designers to ensure maximum learning and retention of concepts learnt in the least amount of time.***

We have a passionate team of trainers and consultants, who have the combined experience of delivering more than 5000 classroom training hours across the globe. All of whom are very experienced in the delivery of training modules and can bring out the best outcomes and participation.

Chola MS Risk Services
SAFETY ACADEMY
Competency Building and Assessment

About us

Cholamandalam MS Risk Services Limited is a joint venture between the Murugappa group, India and Mitsui Sumitomo Insurance Group (MSIG), Japan, with a technical collaboration with InterRisk (Risk Management arm of MSIG). With an experience of over two decades, we specialize in risk management services & assisting businesses in assessing various risks through a highly structured review process. Through our strategic partnership with Arcadis - a global leader in design. engineering & consultancy and association with Inogen, our services are designed to suit a wide spectrum of sectors, extending technical assistance & delivering quantifiable results that lead to effective risk mitigation measures. Headquartered in Chennai with global footprints, we offer best in class safety engineering solutions.

Credentials

Cholamandalam MS Risk Services Ltd. is joint venture of the diversified US $ 4.4 billion Indian business conglomerate, Murugappa Group, India and Mitsui Sumitomo Insurance group, Japan one of the largest insurance groups in the world and biggest in Asia.

- An ISO 9001:2008 Certified organization
- Team of qualified functional safety specialist who are trained by CFSE, EXIDA and functional safety engineers certified by TUV Germany.
- We use some of the best software for our studies. For e.g., exSILentia – an integrated safety life cycle suite, PHA PRO and PHAST
- We have executed over 8000 consulting assignments in HSE across domestic and international markets over the last two decades
- We work in 42 sectors including the best names in Oil & Gas, Pharmaceuticals, Retail, IT, Logistics, Cement, Construction, Power, Automobile, Petrochemicals etc.
- We have worked with over 100 clients in the Oil & Gas industry and done more than 300 studies for KOC alone.
- We are an accredited training partner for Kuwait Petroleum Company
- We have been accorded approval by DGFASLI, Govt. of India to conduct safety audit studies in India. We are the first institution to be awarded this recognition.
- A QCI Accredited EIA Consulting Organization

Chola MS
RISK SERVICES

Cholamandalam MS Risk Services
Parry House, 3rd Floor, No. 2, NSC Bose Road, Chennai 600 001.
Tel: + 91 4430445620 - 30 Email: inquiry@cholams.murugappa.com
Visit: http://training.cholarisk.com | www.cholarisk.com

161, Solitaire Corporate Park, Bldg # 1, 6th Floor,
Andheri Kurla Road,
Andheri East, Mumbai-400059, India
Phone : + 91 022 39502610 | +91 9920627622