Chilworth Technology
the experts in process safety

IEC 61508/61511 Safety Integrity Level (SIL) Assessment

Datasheet

In many applications dedicated instrumented trip and alarm systems are essential for plant safety. In order that we can identify a suitable Basis of Safety for a plant the functionality and reliability requirements of such instrumented safety systems need to be determined and recorded. This can be done most effectively by using the safety lifecycle strategy described within IEC 61508/61511.

Introduction

All operating plants handling hazardous materials are expected to comply with stringent regulations that call for a Basis of Safety to be developed. Such regulations often refer to utilising several 'Layers' of prevention or mitigation safety systems, one of which will be the dedicated instrumented trip system. A recognised methodology for the design and maintenance of such instrumented systems should be implemented by the use of the benchmark standard IEC 61508 and its Process Sector variant, IEC 61511 (current industry best practise).

IEC 61508/61511 safety lifecycle calls for the identification of risk reduction measures associated with the plant processes and operating equipment. The methodology for instrumented safety systems requires that the required factors of risk reduction be identified *(Termed as a SIL Determination Exercise)*. This factor is represented by a Safety Integrity Level (SIL).

SIL Methodology

A common misconception of the SIL determination process is that it is the Instrument Engineers' sole concern to undertake this activity in conjunction with any hazard studies. In fact to specify adequately the 'Target SIL' of any intended trip (Safety Instrumented Function or 'SIF'), a detailed input is required from a study team comprising of plant process engineers, operations staff, safety management and engineering. Such a team using an appropriate method (i.e. Risk Graph, Layer of Protection Analysis or Full QRA) for SIL determination should identify and document the following requirements before any hardware or software design is considered:-

- Description of each hazardous event – normally highlighted within earlier hazard studies.
- Description of the consequences and likelihood of each hazardous event.
- Details of all existing or proposed risk reduction or mitigation measures (e.g. relief systems or other process protection, control systems, fire and gas detection systems, deluge systems, alarms, emergency procedures, etc).
- Management and operational actions taken to reduce or eliminate the hazards as far as reasonably practicable.
- A description of the key assumptions made during the SIL assessment, including the expected interfaces with the plant operating teams.
- A description of the required trip functionality and associated safety reliability requirements.

The first part of any assessment will be to ascertain the tolerable risks associated with the operation or specific plant area. For this, in-house risk/consequence matrices are usually employed to calibrate the intended SIL determination method e.g. a Risk Graph covering Safety, Environmental and potential Asset loss.

The SIL determination process benefiting from the design / operational knowledge of the study team can be harnessed to identify the required level of risk reduction for any given SIF. At this stage it is often expressed as the 'Target' safety integrity level.

The SIF can also be specified in terms of the reliability required of the instrumented safety equipment. This is

expressed as the average Probability of Failure on Demand (PFD_{avg}).

The required risk reduction or required PFD_{avg} figure can be inserted into one of four risk reduction levels (SIL 1 to SIL 4) found within IEC 61508/61511. This value can then be taken forward for the correct design of the instrumented architecture in order to meet both the performance and reliability specified during the SIL determination process.

SIL Determination Issues

As will be appreciated inappropriate SIL determination can cause risk reduction measures to be overly specified or alternatively inadequately designed. Such errors result in increased capital spend for unnecessary equipment, or a flawed overall Basis of Safety from underrated instrumented systems. Qualified SIL determination provides a focus for what is important for safety whilst ensuring the overall cost of safety is optimised.

How Chilworth can Help

Chilworth can offer quality SIL determination in accordance with the functional safety requirements of the IEC61508/61511 lifecycle phases, including:-

For New Projects:-

- Hazard Studies for the necessary Lifecycle Phases.
- Development of Risk Matrices to ensure risk reduction values as determined meet ALARP principles.
- SIL Determination studies and supporting documentation.
- Development of the overall Basis of Safety including contribution from other layers of protection e.g. Mechanical Relief.
- Technical reviews of proposed new Instrumented Architectures and Proof Test Frequencies.
- Functional Safety Assessments and/or verification of Basis of Safety assumptions.

For Existing Plants:-

- Review of the current operating Basis of Safety.
- Identification of PFD_{avg} values for existing trip and alarm loops.
- Verification between existing risk reduction measures and corresponding analysis of existing hazards expressed as a required SIL for the existing trip systems.
- Re-design or improvements to meet necessary levels of risk reduction covering all layers of protection, i.e. Trips, Relief Valves, Bunds and Emergency Procedures.

faxback

Please faxback to Marketing on +44 (0)23 8076 7866

Dr/Mr/Mrs/Ms/Miss:..... Job Title:.....

Company Name:.....

Address:.....

..... Postcode: ..... Country:.....

Telephone: ..... Fax:.....

Email: .....

My particular interests are:-

Hazardous Area Classification ..... ☐ IEC 61508/11 Functional Safety ..... ☐

Safety Management System Benchmarking ..... ☐ ATEX/DSEAR Compliance ..... ☐

Electrostatic Hazards / Problems ..... ☐ HAZOP ..... ☐

Incident Investigation / Expert Witness ..... ☐ Training ..... ☐

I would like a FREE and confidential telephone call with a consultant about a process safety matter ..... ☐

I would like a FREE visit from a consultant next time one is in my area ..... ☐

Chilworth Technology Ltd., Beta House, Chilworth Science Park, Southampton SO16 7NS UK