Risktec

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Functional Safety: A Proportional Approach to Legacy Safety Systems

The requirement for identification, specification and maintenance of Safety Instrumented Systems (SIS) is contained throughout legislation, with the industry-wide good practice standard being IEC 61508, Functional safety of electrical/ electronic/ programmable electronic safety related systems. SIS are specific electrical or electronic systems that prevent or mitigate the effect of a hazard.

Practical problems

For sites with legacy SIS in place there is a burden of responsibility on the site operator to demonstrate these systems are being managed actively and are fit for purpose. However, there are a number of practical difficulties:

1. Requirement for quantitative or semi-quantitative assessment – previous assessments may have been qualitative only, therefore the additional data requirements and techniques involved may be unfamiliar.

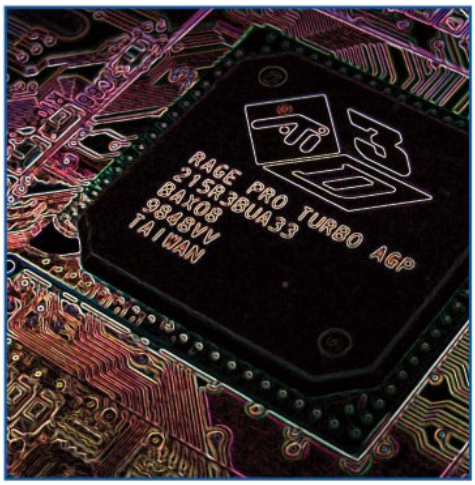
2. How to assess all the relevant faults for each system? The list of potential faults leading to the hazardous event can be extensive.

3. Some requirements of IEC 61508 may be difficult and expensive to retrofit to existing systems or to demonstrate retrospectively.

A proportional approach

These difficulties may be overcome by adopting the proportional approach described in Box 1. Using this high level, order of magnitude methodology allows a result to be obtained using a relatively simple methodology. The first and second stages are applied to screen out low risk hazards, leaving only the significant risks. These are assessed using Layers of Protection Analysis (LOPA) to reveal whether the existing SIS is required to provide a Safety Integrity Level (SIL) rated safety function. The assessment can be largely based upon existing documentation and can quickly identify any weaknesses in protection.

The fifth step is a review of whether the overall risk can be regarded As Low As Reasonably Practicable (ALARP), or if there are further, or alternative safeguards that could be put in place.



Conclusion

A high level approach is often sufficient to identify any weaknesses in legacy safety instrumented systems. Where weaknesses are identified through LOPA, applying an ALARP review can often highlight simple procedural or non-electrical/electronic engineering controls, thus avoiding unnecessarily onerous SIL requirements altogether.

Box 1 – Case study: Assessment of legacy plant

The client company operates sites with multiple legacy Safety Instrumented Systems (SIS) that required assessment to demonstrate that they are fit for purpose. Risktec developed a simple, high level order of magnitude assessment to determine whether these systems were required to provide a SIL rated safety function, and whether other simple, non-SIS safeguards would be more appropriate. The stages of the methodology are:

Identify Hazards → Screen Hazards → Identify Safety Controls → Determine SIL → Review ALARP

Stage 1 - Identify Hazards
A hazard identification exercise was carried out, utilising existing documentation including HAZOPs, HAZIDs, safety reports, etc.

Stage 2 – Screen Hazards
A simple risk matrix was applied to the identified hazards to assign likelihood and consequence scores. Where possible, existing hazard assessment documents were used to facilitate this stage. A screening exercise was then used to identify major accident hazards to be carried forward for further assessment. The majority of hazards were discounted at this stage.

Stage 3 - Identify Safety Controls
For each major accident hazard, all existing prevention and mitigation safety measures were identified, not just the legacy SIS. Key data were derived from existing information sources, operational procedures and site walkdowns.

Stage 4 - Determine SIL Requirement
The LOPA desktop technique was used to identify any risk shortfalls and the associated SIL requirements to address those shortfalls. This also identified the reliability and integrity requirements of the legacy SIS.

Stage 5 – Review ALARP
Each shortfall was reviewed using a 'Hierarchy of Protection' strategy to identify additional risk reduction measures to be implemented. This avoided the use of a complex SIL-rated system in favour of a more appropriate or simpler technology option.

UK Principal Office
Wilderspool Park
Greenall's Avenue
Warrington WA4 6HL
United Kingdom
Tel +44 (0)1925 611200
Fax +44 (0)1925 611232

Europe
Aberdeen
Alderley Edge
Ashford
Bristol
Crawley
Derby
Edinburgh
Glasgow
London
The Hague

Middle East
Abu Dhabi
Dubai
Muscat

North America
Calgary
Houston (South East)
Houston (Energy Corridor)

For further information, including office contact details, visit:
www.risktec.com
or email:
enquiries@risktec.com

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