SIS-TECH
12621 FEATHERWOOD, STE 120
HOUSTON, TX 77034
713-909-2100

SIS Management - Part 2: Maintenance and Repair

Eloise Roche, Senior SCAI Consultant, CFSE

You are about to design your plant's first Safety Instrumented System (SIS). So, what is some of the initial information that you need before you can efficiently start? No doubt you have the hazard and risk analysis document which describes the necessary safety instrumented function and other safety controls, alarms and interlocks (SCAI) used to protect against the same hazard. P&IDs which show the location of the proposed sensors and final elements? Certainly!
You even have the logic diagrams ready which show all the process automation functions for this unit operation, so you can easily verify independence.

But would you be surprised if I said that the facility maintenance and repair strategy for SCAI is also essential to have at the beginning of the SIS design?

Too often, the instrumentation mechanical integrity program is considered as an "after thought" to a project. Indeed, some may think that there will be plenty of time to develop maintenance procedures and spare part plans *after* the project is installed and returned to operations. Nothing could be further from the truth when it comes to this element of SCAI Management.

As all SCAI devices are subject to periodic testing, the facility instrumentation maintenance and repair plan is a necessary input to SCAI design. The following SCAI automation design decisions will be based on performance assumptions which will be dependent upon an effective instrument mechanical integrity program:

- Approving instrumentation to be used in SCAI, based on reliable performance and appropriately low dangerous failure rates
- Adding instrument redundancy to facilitate online testing and repair and to achieve desired test intervals
- Incorporating isolation valves, taps and bleeds into piping design as needed to facilitate planned preventive maintenance (PPM) and periodic device testing
- Laying out process equipment and piping so that failed SCAI devices are accessible in a timely fashion
- Designing compensating measures where necessary to manage risk while SCAI devices are undergoing testing or repair

Maintenance and repair must also be worked into the facility ongoing staffing plan. Competent resources must be available to perform the following activities:

- Production management which ensures equipment will be ready to test on schedule and to manage exceptions to plan
- PPM, proof testing and visual inspections
- Timely repair of instrument failures
- Management of an effective spare parts program which avoids unplanned instrument changes
- Capture and analysis of as-found/as-left data to ensure abnormal performance is promptly escalated
- Auditing of the mechanical integrity program to identify longer term systematic failures and discrepancies from the initial design failure rate and mean time to restore assumptions

Finally, there must be ongoing commitment from facility leadership to maintain the necessary staffing quantity and competency, to ensure testing occurs according to plan and approved procedure, and to take timely corrective action upon notification of undesirable results from the ongoing tests or the periodic audits.

Some spot-audit interview questions facility leaders may want of maintenance personnel:

- Is the maintenance and repair program clear on how "bad actors" should be escalated? Do they know who to go to and what information to provide?
- Do the maintenance procedures contain clear pass/fail criteria for inspecting the device?
- If the make/model/version/configuration of a SCAI device is being changed, does the maintenance program recognize that as a "change" which must be managed? Are ppm and test procedures updated and maintenance notified or retrained if necessary upon such a change?

In summary, whether the safety function is being performed by a SIS or whether it is performed by a safety control, alarm or interlock, having a robust mechanical integrity program for the associated devices is a crucial element of that safeguard's management program and is inseparable from any risk reduction claimed. The reader may refer to ANSI/ISA-84.91.01-2012 " Identification and Mechanical Integrity of Safety Controls, Alarms, and Interlocks in the Process Industry" and ISA TR84.00.03 " Mechanical Integrity of Safety Instrumented Systems (SIS)" for more guidance on this Safe Automation Management Practice.

Please visit this edition's Unsafe Automation Incident case study, to see an example of how failure in instrument maintenance and repair programs contributed to an explosive outcome