

SIS Design Basis Revalidation

Process industry users of safety instrumented systems (SIS) have made great strides in implementing SIS that are compliant with international standards, such as ANSI/ISA 84.00.01-2004 and IEC 61511. Although the original design basis for these systems was consistent with the standards, and assumptions about how the process would operate, equipment and process modifications may have invalidated the original design bases, potentially resulting in higher risk levels than originally expected. Causes of an invalidated SIS design basis include:

- Process changes have increased levels of risk
- SIS equipment changes have been made
- Process and equipment modifications have removed or invalidated non-SIS independent protection layers
- Testing programs have been modified or ignored
- Demands on the SIS are occurring significantly more frequently than assumed during the design phase
- SIS equipment is not performing as well as assumed during the design phase



Regulations governing process safety (in the US) require that process hazards analyses (PHA) be updated at least every five years. SIS design basis documentation has a similar form and purpose. Moreover, the standards that define SIS design good practice require that systems be periodically reviewed to ensure their design is valid. The issues that the standards require to be reviewed on a periodic basis include:

- Review the actions taken following a demand on the system
- Review the failures of equipment forming part of the SIS
- Review the causes of demands on the SIS
- Review the causes of false trips
- Verify the actual demand rate against design assumptions

The **Kenexis SIS Design Basis Revalidation Solution™** helps to ensure the ongoing integrity of an SIS by identifying and correcting gaps between actual operation and design assumptions

✓ **Review MOC Documentation**

Modifications to process plants other than like-in-kind replacement should be performed and documented in accordance with management of change (MOC) procedures. Kenexis reviews the MOC document packages to determine if the changes: 1) modify SIS equipment including SIS software/logic, 2) significantly increase risks, or 3) modify or invalidate independent protection layers. Any issues are evaluated to identify any impact on the SIS design basis.

✓ **Review Piping and Instrumentation Diagrams**

Unfortunately, some modifications fail to get reviewed per the MOC process. Therefore, Kenexis performs a review of the most current P&IDs against the set used for developing the design basis. Any modifications identified that were not included in the MOC documentation are reviewed to identify any SIS design basis impacting changes.

✓ **Review Actual SIS Demand Rate**

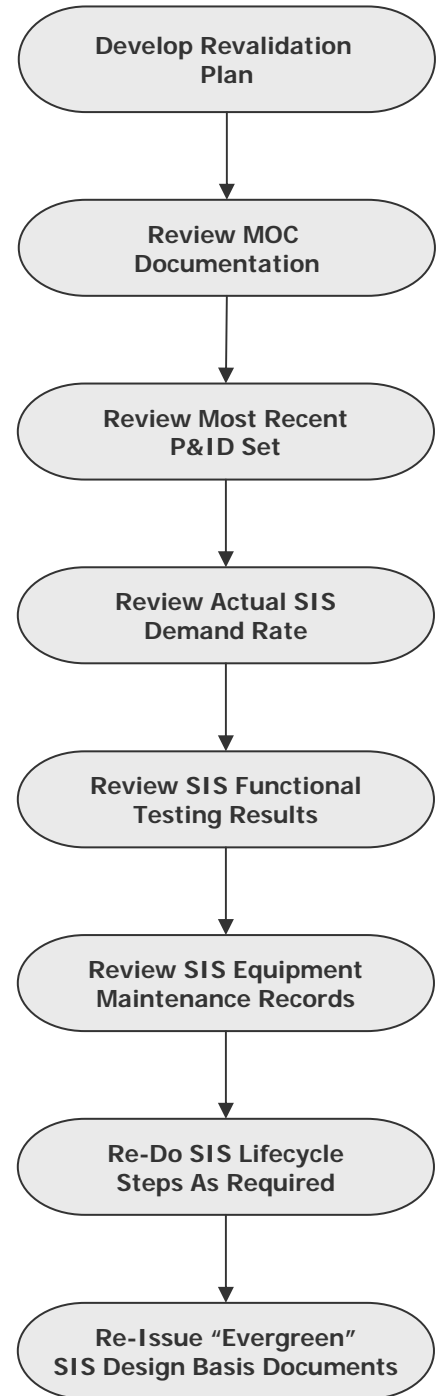
The selected safety integrity level (SIL) is a function of an assumed demand rate. Kenexis reviews the actual demand rate by analysis of historical data on trips and process conditions, and operator interviews. If deviations from design basis are identified, the Safety Instrumented Functions (SIFs) are evaluated to determine the impact on the SIS design basis, such as identifying high (or lower) SIL requirements.

✓ **Review SIS Functional Testing Results and SIS Equipment Maintenance Records**

Kenexis reviews the SIS functional test results, maintenance records, self-diagnostic test results, equipment repair times, and interviews instrument maintenance technicians to verify that testing is being performed at the necessary test intervals. All failures identified during the tests and through the maintenance records are reviewed to identify an correct issues related systematic application errors and properly account for random hardware failures in the SIL verification calculations.

✓ **Re-Do SIS Lifecycle Steps (As Required)**

For all SIF where design basis issues are identified, Kenexis returns to the appropriate step in the safety lifecycle and re-performs all subsequent design basis tasks in the safety lifecycle, potentially including, SIL selection, conceptual design / SIL verification, and Safety Requirements Specifications. Upon completion, Kenexis updates and re-issues "evergreen" SIS design basis documentation.



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