



OpreX™ Asset Operations and Optimization

Exaquantum Safety Function Monitoring

INDUSTRY LANDSCAPE

Continuous monitoring and evaluation of operational safety data to highlight deviations or deficiencies in safety system design and optimize performance.

Exaquantum Safety Function Monitoring (SFM) is a software solution to help manage and oversee the operational safety performance throughout the lifecycle of the safety system.

Safety Instrumented Systems (SIS) are critical to protect workers (including surrounding community), production assets and the environment. SIS are designed to take the plant into a safe state in the event of a process going out of control.

- **Do they perform as expected when called upon?**
- **Is safety performance problematic to manage and maintain?**

CHALLENGE

Regular assessment of safety system performance is critical

Since much depends on the effectiveness of a SIS, facilities must have the means to verify their SIS can perform the required protective tasks under a variety of regulations and standards. Incorrect safety system design assumptions can compromise the effectiveness of safety equipment during operations, and in some instances, safety devices are unable to perform their intended function when called upon during an incident.

Safety systems degrade over time, increasing the potential for hazards

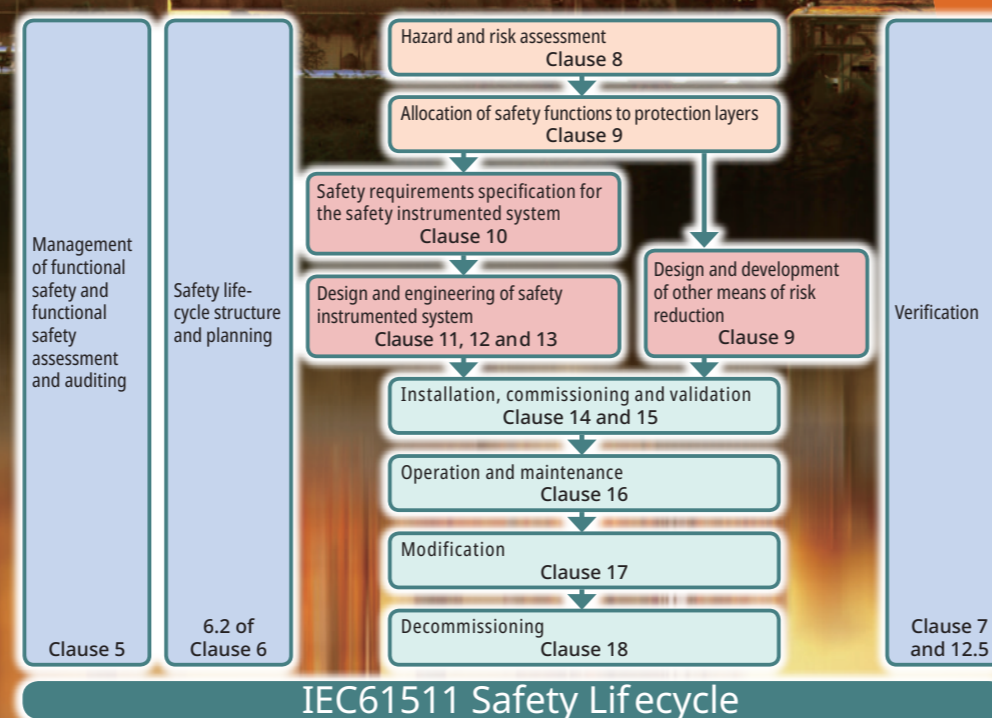
All portions of the safety loop can degrade over time, which can affect the performance levels of safety equipment and hardware and expose the plant to increased levels of risk. Plant personnel must ensure that operational risks are not neglected and provide evidence that SISs are maintained within acceptable limits throughout the lifecycle.

Analysing raw safety data is labor-intensive

Collecting and organizing all safety related data in a format acceptable to technical authorities and regulatory bodies is a time consuming and highly labour-intensive task. These are predominantly manual procedures which are therefore prone to errors, inaccuracies, and scheduling problems, making it difficult for operational data to be compared against the original safety design targets as required by IEC 61511 standards.

Response to evolving standards

With the release of the IEC 61511 Edition 2 (2016), new challenges are compelling safety engineers and managers to re-evaluate their approach to the collection, measurement, and analysis of all safety related data. A stronger focus on SIS performance, requires a balanced approach that complies with safety regulations, while remaining maintainable throughout its lifecycle at an affordable cost.



SUSTAINABLE SIS

Performance Monitoring

SFM continuously monitors performance data from the safety system during operations that is compared to the original safety design targets. Any incorrect design assumptions of the safety system are highlighted, to ensure the integrity of the SIS is managed effectively and consistently throughout the lifespan of the safety system.

Proof Testing

To help maintain the validity of the safety system, SFM monitors the expiration dates of proof tests on SIFs and Final Elements. Proof test credits can also be claimed based on actual demand on the SIS during operation, to minimize disruption to plant availability by not having to initiate a periodic proof test, if an actual demand meets the necessary criteria for a SIF.

Yokogawa recognizes the continuous challenges for plant owners to efficiently maintain process safety integrity throughout the whole life cycle of their plant. Yokogawa's Sustainable SIS solution is a holistic approach to ensuring that optimum safety performance is realized and maintainable throughout the lifetime of your plant.

From a monitoring and analysis standpoint, the quantity of data to be analysed increases with time and it's important to gather critical SIS performance information that does not consume vast quantities of time and resource.

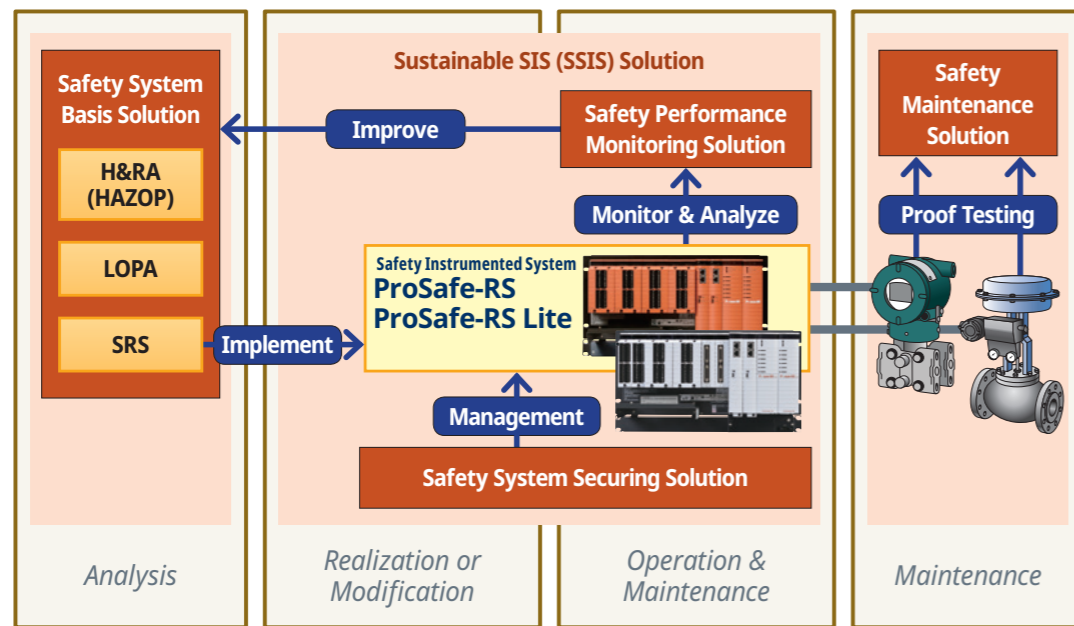


Figure Overview of Sustainable SIS (SSIS) solution in the process plant life cycle



Exaquantum Safety Function Monitoring

BENEFITS

Improve Safety

To provide the data and tools necessary to improve the safety design philosophy or make changes to the safety philosophy throughout the plant lifecycle.

Streamline Safety Compliance

To automatically collect and present safety performance information via a single access point that reduces manual overheads and errors, which simplifies compliance to safety standards.

Optimize Costs

To reduce OPEX costs of maintaining safety excellence; an over-engineered SIS may exceed safety requirements but not be cost-effective, similarly an under engineered SIS maybe cost effective but may compromise safety.

Reduce Operational Risk

To highlight factors that impact safety operations, such as device failure rates, demand and availability, safety procedures and bypasses.

VALUE

According to a multinational developer and operator of ultra-deepwater oil production platforms, a key operational benefit is the reduction of unplanned platform shutdowns.

From an operational standpoint, their SIS installation in Southern Africa was deemed a sound business decision due to it maximising productivity where each day equates to 160,000 barrels of oil.

SFM conveniently records and collates historical data which is used to update their layer of protection analysis (LOPA) every 5 years. Generation of validated reports whenever any shutdown occurs means that period proof testing is reduced. As part a sustainable SIS implementation, it presents a strong indication of the operator's corporate responsibility to its shareholders and stakeholders.

Source: Frost Sullivan White Paper Sustainable SIS

WHAT SFM DOES



Safety Function Monitoring

A dynamic software tool to conveniently measure safety system performance, to identify SIS that have exceeded or underperformed against expected design targets and to benchmark safety performance.

Collect

Automatically collects safety data from existing control and safety systems via OPC.

Identify

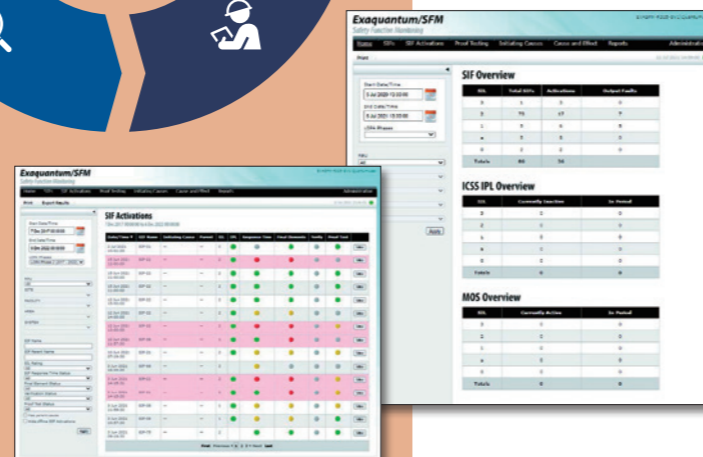
Compare safety performance data from operations to identify deviations from their original safety design targets.

Validate

Reliable and dependable safety data to help validate safety design for the next HAZOP or LOPA.

Improve

Manage safety systems more effectively and improve safety system integrity with the convenience of having all your safety data in one place.



Automatic Collection of Safety Performance Data

Move away from time consuming and problematic assessments of raw safety data with convenient and automated collection of safety events to monitor safety system performance. SFM provides quick and accurate access to critical safety data and is the foundation for effectively monitoring safety performance.

Easily identify when safety devices fail to meet design targets

Safety personnel have increased awareness when safety devices deviate from their design targets. For example, SIF initiating causes will be monitored against the HAZOP data to identify unforeseen hazards. Valve travel times are compared to the design values to help identify early signs of performance degradation of critical safety devices.

Enhanced Proof Testing

Claim a proof test credit due to shutdowns from actual demand on the SIS during operations in certain conditions. SFM automatically detects if any SIF activations have met the criteria to be used as a proof test, so you can avoid having to initiate a periodic proof test shutdown, if an actual demand meets the necessary criteria for that SIF and increase plant availability. This proof test can replace the scheduled or periodic proof test and extend the validity period for the SIF proof test.

Compliance to Safety Standards

Companies are required to produce detailed reports and to demonstrate demand rates and reliability parameters of their safety systems. SFM automatically captures safety events, compares operational performance against design targets with a convenient set of reports that provides evidence of critical safety performance data in a single location.

Compare operational safety data against expected design targets

SFM gathers safety performance metrics (SIF Activations and Final Element Actuators) during operations that are constantly compared to their expected design performance targets to highlight issues, validate safety design, optimize test scheduling, and help users improve safety and availability of the plant.

"Procedures shall be implemented to evaluate the performance of the SIS against its safety requirement to compare the demand rate on the SIF during actual operation with the assumptions made during risk assessment when the SIL requirements were determined."

IEC 61511 Ed. 2.0, Clause 5.2.5.3

Revalidate safety system design with reliable data based on actual operations

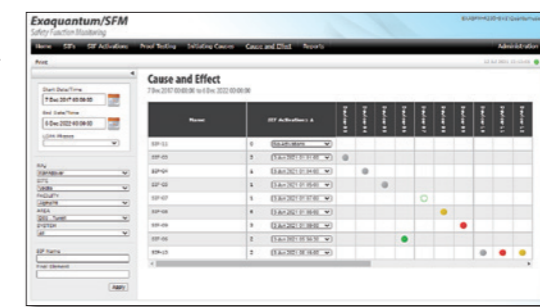
Strike the right balance between safety performance and cost by gathering safety data during operations that is readily available to intercept any performance problems. SFM collects demand frequency data to help revalidate the safety design for the next HAZOP or LOPA.

Out-of-the-box Reports

Reduce manual overheads with SFM's standard set of reports, providing fast, convenient and consistent access to safety data records in a single location that is accurate and reliable. Evidence related to the ongoing performance of the safety system is documented to satisfy the requirements of external regulatory authorities.

Cause and Effect

Enables logic verification of SIF activations with associated Final Element actuators. SIFs can be easily cross-checked to identify if recorded SIF activations and Final Elements actuators match the configured or intended safety design in the current SFM LOPA configuration data.



KEY FEATURES

- Automatic collection and display of safety events
- Capture safety device transitions and travel times
- Assumptions during design phase are validated with operational data
- Visualise safety device performance that fail to meet design targets
- Capture SIF availability to help identify safety gaps
- Cause and effect enables quick logic verification of SIF activations with associated final element actuators to see if they match their intended safety design
- Claim proof test credit based on actual demand on the SIS during operation
- Record when proof tests have taken place and their expiry date
- Easily generate safety performance reports that conform to standards
- Analyse safety performance data to highlight areas for safety design improvements for re-HAZOP and re-LOPA.
- Companion to ProSafe-RS – one of the worlds premium safety system
- Proven to increase plant availability
- Integration with PHA-Pro Software
- Create value with Sustainable SIS solution from Yokogawa

Revalidate safety system design with reliable data based on actual operations

SFM is Yokogawa's software tool to monitor and collect all safety related data in a single location. It provides the necessary information required by regulations without any additional manual overhead costs. By efficiently keeping track of safety systems, it helps to uphold the overall consistency of safety system information throughout the safety lifecycle and addresses the following key questions:

- *Did I get the safety design right?*
- *Is the safety system still performing as designed?*
- *Should I make some adjustments to optimize safety performance and cost?*
- *Can I prove it?*

OpreX™ Through the comprehensive OpreX portfolio of products, services, and solutions, Yokogawa enables operational excellence across the enterprise.

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