

Is your safety system performing as designed, and can you prove it?

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Pioneering Safety Management Solution

Operating in ultra-deep waters presents a number of safety and performance challenges for many offshore oil and gas projects. There has been increase in concern regarding potential incidents that can affect people, assets and the environment. With deeper drilling depths comes increased danger with higher risks of accidents, spills and fires, combined with the complex equipment needed to drill at such depths. Functional safety is intended to guarantee that the system or equipment operates correctly in response to its inputs, irrespective of operator errors, hardware failures and environmental changes. Safety Instrumented Systems (SIS) can dramatically reduce the risks of accidents through an engineered set of hardware and software controls.

But how do you really know if the safety system is performing against its original safety design, and can you provide evidence to support it that satisfies regulators?

Measure Safety Performance against Design

A tool to monitor and record all safety KPIs was identified as a requirement that formed part of a much wider safety solution package for an ultra-deepwater project. The customer wanted a way of recording safety and performance information that was aligned to their reporting structures and principles. It was important to provide a repository for all trips and operational statistics, covering all safety instrumented systems (SIS) that could measure actual performance against the original safety design. Yokogawa was asked if it could develop a safety monitoring solution that would fulfill the criteria and deliver a product that adds value to their safety system throughout its entire operational lifecycle.

The main requirement of this solution was to feedback all safety related performance data into their Layer of Protection Analysis (LOPA) requirements. LOPA is a semi-quantitative tool for analyzing and assessing risk on a process plant and evaluates the adequacy of existing or proposed layers of protection against known hazards.



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Benefits of Monitoring Safety

The monitoring of safety functions provides two main benefits which were aligned to both the business requirements and the technical expectations.

Layers of Protection Analysis (LOPA)

LOPA is a risk assessment method used to determine and hence demonstrate the ability of existing and proposed safeguards to protect against identified hazard scenarios and to meet predetermined risk based criteria. In this project, the statistical data and reports which are required to support LOPA are available in a single location and are crucially important. Without this tool, it would be very difficult and time consuming to provide this information.

Platform Availability

This solution delivers increased levels of operational excellence, safety excellence and improved platform availability. For each safety case, safety systems are based around a statistical need to provide a proof test interval (at a time dictated by the safety case) to demonstrate the system is still operational. If there has been a safety trip, a report is generated automatically and includes all statistical data relating to that event. This report proves the safety system is working correctly and further proof test shut down activations are not required to meet the safety case. This helps to minimize the number of plant start-up and shut downs required for scheduled testing.



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A Ground breaking Project

A product for monitoring safety instrumented systems was something new and unique in the industry. This was new ground for Yokogawa and required a huge amount of collaboration with the customer to define the requirements, specifications, details and configuration for this solution.

Developed as a reporting tool, safety function monitoring provides all information relating safety performance in a single location. It also includes specific KPI and reporting functionality that was required to support their safety instrumented systems. One of the key outcomes of using this tool provides the ability to optimize proof test intervals in-line with the original safety case design, to ensure the safety systems is available and working as it was originally intended.

The information provided by this unique safety monitoring solution delivers significant value for the customer. Once the details of the project specification had been agreed, the Safety Instrumented Functions (SIFs) had to be defined for the entire safety system of the plant. This information would then be entered in the solution to provide the monitoring, KPI and reporting functionality and required shared input from both parties.

Why Yokogawa?

This project to secure the safety monitoring solution formed part of a much wider scope of supply including a mix of hardware and software solutions. The customer invited open bids from a number of vendors. The criteria consisted of both technical and commercial requirements which were equally important and Yokogawa were able to provide a commercially attractive offer that met all the technical requirements.

It was from the technical specifications that the safety function monitoring package evolved. It was a concept solution, meaning that no product currently existed that fulfilled the criteria. Yokogawa were able to develop an agile and effective solution, utilizing the existing knowledge and expertise, delivering added value for the customer.

It was important as well that this development solution would become part of the vendor standard product offering and made available to the customer for future projects and possible expansion schemes.

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The Full Safety System Package

Yokogawa were able to deliver a full and wide ranging safety solution that consisted of the following hardware, software and instrumentation equipment that met the technical requirements of this turnkey project, including:

- Distributed Control System (DCS)
- Safety Instrumented Systems (SIS)
- Emergency Shutdown Systems (ESD)
- Fire and Gas Systems (FGS)
- Data Historian
- Alarm Reporting and Analysis
- Safety Function Monitoring
- Field Instrumentation
- 2 x Operator Training System (OTS)
- Life-cycle support contract

Because the deep-water environment, and operating conditions, these safety solutions were mission critical systems, both from an operational, commercial and lifecycle management standpoint.

Configuring the Safety Data

The safety function monitoring tool was developed as part of the technical requirements of the project. No solution existed at the time, so an initial Front End Engineering Design (FEED) study was committed which enabled the safety function monitoring tool to be developed.

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It required specialist configuration for the safety information, including the design and definitions relating to the safety instrumented functions (SIFs). Once this information had been collected, the full product development could then be completed. Due to the complexities and configuration requirements it relied upon a close working relationship with the customer, working collaboratively towards a common objective that delivered real value.

Key Takeaways

Increased levels of platform availability

This solution was developed in close partnership between Yokogawa and the customer, providing increased platform availability and eliminating unnecessary shutdowns to meet proof test intervals. For each safety case, safety systems are based around a statistical need to provide a proof test interval (at a time dictated by the safety case) to demonstrate the system is still operational. If there has been a plant shut down, a report is generated automatically and includes all statistical data relating to that event. This report proves the safety system is working correctly and further proof test shut down activations are not required to meet the safety case.

All safety data in a single location

The Safety Function Monitoring application stores all relevant safety related data and presents clear information for the user. All key safety related KPI and statistics are validated and available in a single location. It enables true field demand rates to be used as a way to validate the safety case and original design assumptions. This statistical data allows better future design input (LOPA and safety case update) and shows the true demand rates experienced. Without this tool, it would be a manual process which is difficult to manage and prone to error and inefficient

Layer of Protection Analysis (LOPA)

Provides data for LOPA in one location, for easy access that saves time by presenting all relevant safety related data in a clear and easy to use package. The ongoing value of this data enables better future design input for LOPA and safety case updates showing the true demand rates experienced and helps identify significant scenarios and the frequencies of events. For each safety loop, statistical data and reports illustrate the true demand placed on that loop over a number of years. This historical data provides real field demand rates that can be used to validate the safety case against the original design assumptions that were based on experience and calculation only.