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# Automating SIS Performance Metrics with OSI-PI Using SLM

SLM®
Safety Lifecycle Manager

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## Meeting the Industry Standard: IEC 61511, Edition 2

**Clause 16.2.9: Operations and Maintenance**

- **Demands on the functions of the SIS**
- **Actions taken following a demand on the SIS**
- **Cause of demands**
- **Failures and failure modes of the SIS equipment, including safe, dangerous, incipient, and degraded.**
- **Failures of instrumentation and controls that are implemented as compensating measures**

Since the standard was first issued in 2003, PSM-covered operating sites have been working hard to get to the point where all SIS functions are kept up to date with SIL Verification, SRS per function, and the regular proof testing. Edition 2 now requires that historical performance of implemented SIS systems be fed back into PHA processes to validate assumptions which has cascading effects into SIS Design/SRS and to field instrumentation. This is a complex, multi-disciplined process to manage even if there are no major changes to an existing process between safety and operability re-validations.

Operating sites are now faced with an increasing compliance burden using existing staff. To remain competitive, organizations must find new ways to do more with less. This white paper presents a proven solution to:

1. Streamline safety lifecycle work processes into a single platform to free engineering resources
2. Automation SIS KPIs using through data historians

### Challenge #1: Integrating Disparate Engineering Tools

Table 1 shows the work processes aligned with the tools that a typical site might use to document PHA, specify SIS design and track performance. IEC 61511, Edition 2 is to be the standard by which the Site will close the loop on the Safety Lifecycle to ensure that existing systems are providing the appropriate level of mitigation on high-risk processes that are constantly changing.

*Table 1. Site X - Safety Lifecycle Work Processes and Typical Industry Tools*

| Lifecycle Work Process | Tool | Responsible | SLM |
|---|---|---|---|
| Process Hazard Analysis | PHA Pro | PSM | ✓ |
| Layer of Protection Analysis | PHA Pro | PSM | ✓ |
| SIL Verification | ExSILentia | Capital Projects SIS Engineers | ✓ |
| SRS | ExSILentia | Capital Projects SIS Engineers | ✓ |
| Implement Proof Test Program | Word | Capital Projects SIS Engineers Site Maint | ✓ |
| Proof Test Scheduling | SAP | Operations and Maintenance | ✓ |
| Capture Proof Test Results | Word/Excel | Maintenance | ✓ |
| Capture Demands | Word/Excel | Operations | ✓ |
| Bypass Management | Paper based | Operations | ✓ |

Tools to assist engineers in performing safety life cycle work processes are typically narrow and lack integration capabilities with other tools. For example, an increase in a SIF's SIL requirement from 1 to 2 in PHA Pro will not propagate to ExSILentia and flag a SIF for compliance. Nor will a high demand rate on a SIF tracked on a site-specific Excel spreadsheet flag a SIF for re-design and shortening of component test intervals. In order to achieve the objectives outlined in IEC 61511 for verification of SIS performance, engineers must consolidate and analyze the data manually to provide management reports to drive decision making.

**Solution: Consolidate Tools**

Over the last decade, the industry has recognized that emerging software technologies can be leveraged to consolidate engineering activities from several disciplines into one. SLM is such a tool, implemented at the Enterprise level since 2014, covering all critical phases and work processes of the Safety Lifecyle from PHA through automated tracking of statuses of safety critical devices. The result is integration of data that can directly tie:

- Field device test, bypass, and demand events to SIFs (SIL Verification and SRS)
- SIFs to their PHA Barriers
- Barriers to PHA Scenarios

**Challenge #2: Data Entry Overload and Resource limitations**

Using a single platform to achieve the SIS performance validation requirements in IEC 61511, Ed 2 is surely possible, but is it sustainable? In today's environment where engineering and operations teams run lean to remain competitive, time cannot be spent on activities that can be automated. Simply moving work process from various tools and platforms to one does not eliminate the day to day collection of data for ongoing events:

- Documentation of Demand Events on safety functions and results
- Management and documentation of SIS bypasses/overrides

The common end state: Data collection, analysis, and reporting cycle is too burdensome to maintain…perhaps until an incident occurs.

**The Solution:**

Automate the collection of operational data through Integration. Most sites in operation today have data historians such as OSI-Pi that track data from field devices giving engineers and managers access to real time activity of processes without having to be physically at the DCS. By reading the data that gets logged in the Pi database, engineers can identify important events in the Device tag's history and categorize them as Demand, Spurious Trips, and Bypass events. The events can automatically populate performance KPIs tools such as SLM Device data is tracked by "points" which are programmed into PI to track status changes. The key is moving relevant "point" data from OSI-PI to an external tool such that human input is not required.

**Building the Solution: (Answering Challenge #1)**

Current industry solutions such as SLM can convert SIS demand and bypass activity into usable metrics that indicate the health of functions compared to their design intent starting with the PHA process. The graphs below show a SIL 2 SIF that needs to be modified due to:

- Low availability: The SIF is now likely a SIL 1.
- High demand rate: The SIF has far exceeded its PHA-assumed demand rate and is causing outages
- High spurious trip rate: The SIF has too many nuisance trips which further contributes to outages


*Figure 1. KPI: Availability Using Time in Bypass/Service Time*

*Figure 2. KPI: Demand Rate (/yr) using Demand Event Count/Service Time*

*Figure 3. KPI: Spurious Trip Rate Using "Spurious" Demand Count/Service Time*

These statistics can be rolled up to the Equipment, Process Unit, and Site level to compare installed system across a Plant or Enterprise. As shown below, a Process Unit health report documents the status of IPL types against pre-set thresholds.

Tier 3 Summary for 01-GASSTAB1: Gasoline Stabilizer 1 — Export to Excel

Drag a column header and drop it here to group by that column

| Function Type | Demand Rate (/yr) | Fail on Test Rate (/yr) | Failed to Operate Rate (/yr) | Availability % |
|---|---|---|---|---|
| Alarm | Emergency 50.0 % | Normal 0.0 % | Emergency 50.0 % | Normal 100.0 % |
| BPCS | Normal 0.0 % | Normal 0.0 % | Normal 0.0 % | Emergency 0.0 % |
| HIPS | Normal 0.0 % | Normal 0.0 % | Normal 0.0 % | Emergency 33.3 % |
| Interlock | Normal 0.0 % | Normal 0.0 % | Normal 0.0 % | Normal 100.0 % |
| Relief System | Normal 0.0 % | Normal 0.0 % | Normal 0.0 % | Normal 100.0 % |
| SIF | Normal 4.9 % | Normal 7.3 % | Caution 7.3 % | Emergency 28.9 % |

1 | 10 items per page | 1 - 6 of 6 items

*Figure 4. Process Unit-Level Health Rollup of Operational Metrics based on IPL Function Type*

**Automating the Solution: (Answering Challenge #2)**

Data "points" in the Pi Server can connect through the CGI-API linkages to the web based SLM platform. Data is maintained per the function on the "Historian" configuration tag. These parameters can be updated by engineers through the web-based platform and imported en masse saving time.

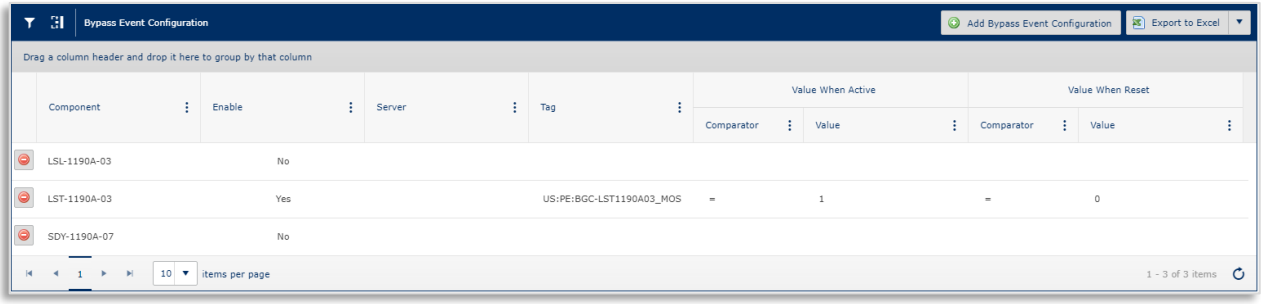



*Figure 5. Function Bypass Configuration*

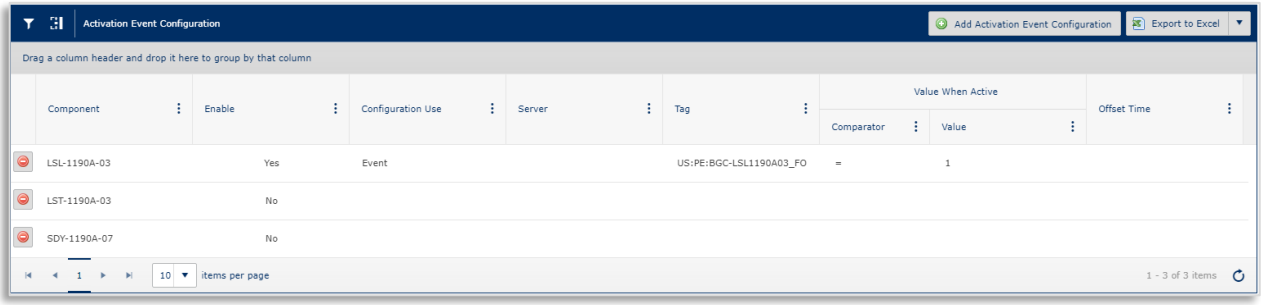
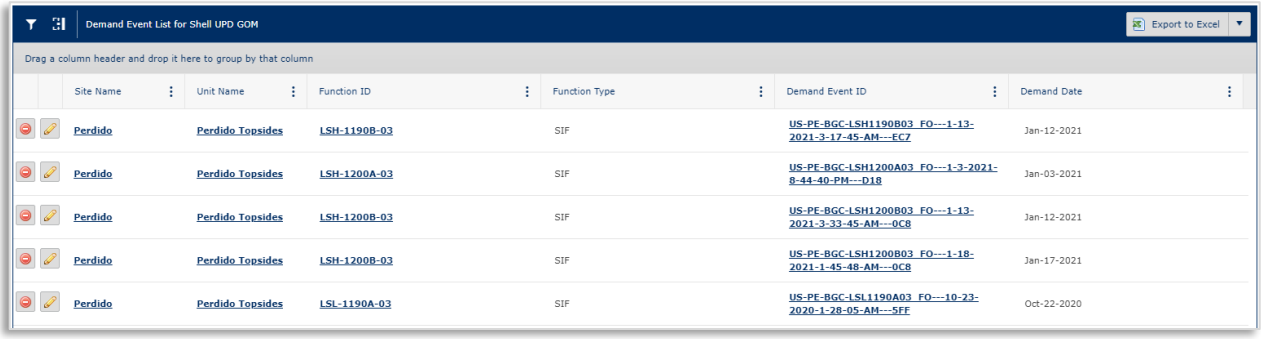



*Figure 6. Demand Event Configuration*

Data populates the instance based on safety-critical tags/points and triggers the automatic creation of Demand Events and Bypass data.




Bypass Events populate KPIs automatically removing the burden from Engineering and Operations. When events come into SLM, an Automated Event Record is created alerting engineers to review the demand for root cause and possible categorization as a spurious or test trip. Test Trips do not affect metrics.

From this point, all IPLs/Functions can be rank ordered based on health putting the power into the hands of site managers.