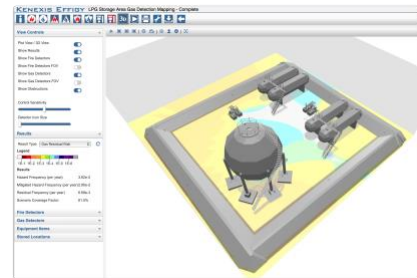


FGM-FSA Service Description

The objective of the FGM-FSA (Fire & Gas Mapping – Functional Safety Assessment) is to determine if the scope of work that is subject to the assessment was performed in compliance with the ISA 84.00.07 Technical Report. This will include the following tasks.

- Assessment of analysis results and documentation in the scope of the project in order to determine if FGM functional safety requirements have been implemented
- Preparation of FGM-FSA plan and safety case database



The project scope will be limited as follows:

- The FGM-FSA will proceed to check the implementation of requirements on a spot check basis, reviewing a selection of all required items to ensure compliance. This assessment is not a complete verification of all work activity, as it is expected that verification has already been completed by the project team during project activities.
- FGM-FSA activities that will be audited include:
 - Identification of the Areas of Concern
 - Identification of Hazard/Risk Scenarios
 - Analysis of Consequences of Loss of Containment Scenarios to be Detected by FGS
 - Analysis of Hazard Frequency (if Applicable)
 - Analysis of Unmitigated Risk
 - Identification of FGS Performance Targets
 - Qualitative Aspects of FGS Conceptual Design
 - Quantitative Verification of Detector Coverage
 - Quantitative Verification of FGS Safety Availability and Effectiveness (if applicable)

Task 1 Preparation of Functional Safety Assessment Plan

Kenexis will begin this project by preparing a functional safety assessment protocol that is suitable for use for the project. The protocol will include a list of requirements along with auditor notes and weighting and scoring factors. The FGM-FSA protocol will be based on the Kenexis FGM-FSA protocol template that is derived from the requirements of ISA 84.00.07, directly from the technical report, and other Kenexis developed requirements that have been compiled over many years of performing functional safety assessment for our world-wide group of process industry clients. Collection of requirements will be performed using the *Kenexis Open Audit* software application. The application is a data analysis engine with a customizable audit protocol that contains both the text of the requirements (with links to the relevant technical report clause locations), along with Kenexis explanations of the requirements and common methods by which the requirements are achieved in industry. In addition to the listing of the requirements, the toolkit contains a worksheet for each requirement that allows auditing using

the regulatory agency approved PQV (i.e., Program, Quality, and Verification) style of auditing. The Kenexis toolkit employs this method by providing, for each requirement clause, a description of how conformance with the program is assessed, explanation of assessing the quality of the program in comparison with the text of the requirements and benchmarking against the practices of industrial peers, and methods for verification that the program is indeed being followed through data checks and interviews. The scope of requirements that will be assessed is a function of the scope of the project for which a functional safety assessment is being performed. All the requirements that are relevant to the project that is being assessed will be collected into the database.

After preparation of the FSA protocol, Kenexis will prepare an FSA plan. The FSA plan will define the activities that are required to be carried out along with the persons that are required to be involved. The FSA plan will include a list of information (required documents list) that the Kenexis auditors expect to review and provides a timeline for the review process. In addition, the plan will list out dates and times of interviews with project personnel and project teams for those interviews (interviews will occur via web conference (MS Teams, or equal). Upon completion of this task, Kenexis will forward a copy of the plan and the preliminary FSA protocol to Purchaser for review, along with a complimentary copy of the Kenexis Open Audit Standard Software.

Task 2 Fire and Gas Mapping Functional Safety Assessment

After receiving the Purchaser documentation defining the implementation of the subject FGS project, as defined in the functional safety assessment plan, Kenexis will review the documents in detail to correlate the listed requirements against the data confirming that those requirements have been achieved during the SIS implementation project via “spot check” of the data. Each requirement in the FSA protocol will be reviewed against the documentation to determine whether the document provides evidence that the requirement was appropriately implemented as part of project execution. The assessment will consider auditor notes and provide a scoring to demonstrate how well the task was implemented in comparison with industrial peers. The key tasks that will be reviewed include:

- Identification of the Areas of Concern
- Identification of Hazard/Risk Scenarios
- Analysis of Consequences of Loss of Containment Scenarios to be Detected by FGS
- Analysis of Hazard Frequency (if Applicable)
- Analysis of Unmitigated Risk
- Identification of FGS Performance Targets
- Qualitative Aspects of FGS Conceptual Design
- Quantitative Verification of Detector Coverage
- Quantitative Verification of FGS Safety Availability and Effectiveness (if applicable)

The documents that will be reviewed to determine whether the requirements have been achieved include:

- Plot Plans / Process Flow Diagrams of Equipment in Scope
- FGS Grading (Risk Analysis) Reports



- Dispersion Modeling / Consequence Modeling Reports
- FGS Mapping Outputs/Reports/Data Files
- Final FGS Mapping Reports

The documentation review and site visit will proceed as follows:

Review of the hazard and risk analysis includes verification of the performance of a Process Hazards Analysis (PHA) study with appropriate documentation. The PHA study will be reviewed to ensure that its methodology was acceptable, the scope of the study was adequate for the level of hazards involved and the type of plant, that the study team was adequately composed of persons of sufficient experience and all relevant specialties were addressed.

Task 3 Presentation of Results

After completion of the FGM FSA Kenexis will submit a draft report, and prepare for a close-out web conference, which will include a summary of findings and a discussion of any recommendations in the report. Time will also be allotted for a question-and-answer session regarding the results of the assessment.

Deliverables

The project scope described in the previous section will result in the following deliverables

FSA Report; including:

- FSA Worksheets
- FSA Findings
- Recommendations
- Assessment Findings and Recommendations Presentation

About

Kenexis, an independent consulting engineering firm that provides technical safety services, performance-based fire and gas mapping, and risk analysis for industries that manage risks related to chemicals or stored energy.

Phone +1-614-451-7031

Email info@kenexis.com

