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Fire and gas sensor mapping

Study of effectiveness, coverage and location of fire and gas detectors

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DESCRIPTION

The effectiveness, coverage and location studies of fire and gas detectors ("F&G sensor mapping") provide a tool for the design of detection systems to ensure optimal coverage and minimize the number of detectors.

Fire and gas detection (F&G) systems represent one of the most widely used safeguards in process plants that handle dangerous substances. These systems constitute a security layer that allows the early detection of flammable and/or toxic gas leaks, as well as fires in their incipient stage, to take actions in a timely manner.

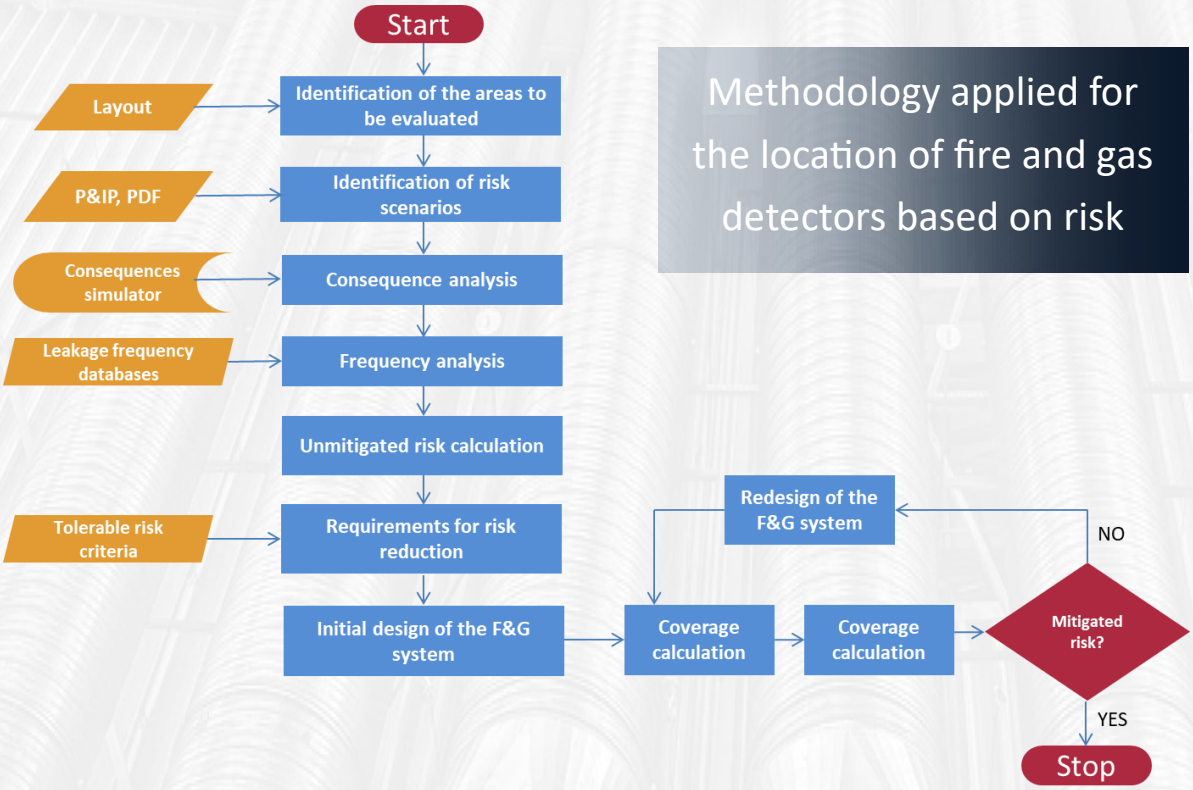
The risk-based approach to detectors location offers a systematic method that uses mathematical models that allow establishing the most probable areas in which leaks and fires can occur. Unlike the traditional methods of locating detectors based on geographic coverage based on experience and common practice, the risk-based method allows optimizing the number of detection equipment guaranteeing the correct location of detectors in the places where they are really required.

BENEFITS

The studies of the location of fire and gas detectors (F&G) provide a tool for the design of detection systems, allowing to determine the right amount and adequate location of detectors, optimizing the amount of investment.

SCOPE OF THE STUDY

The study includes a simulation of the consequences to determine the magnitude of the events associated with leaks of flammable and / or toxic gases / liquids, risk calculations and determination of the required effectiveness of the F&G detection system following the guidelines of international standards (ISA-TR84.00.07). The final product consists of a recommended location map for F&G detectors, detector technology recommendations, voting schemes, and geographic and risk-based coverage maps.



Methodology applied for the location of fire and gas detectors based on risk

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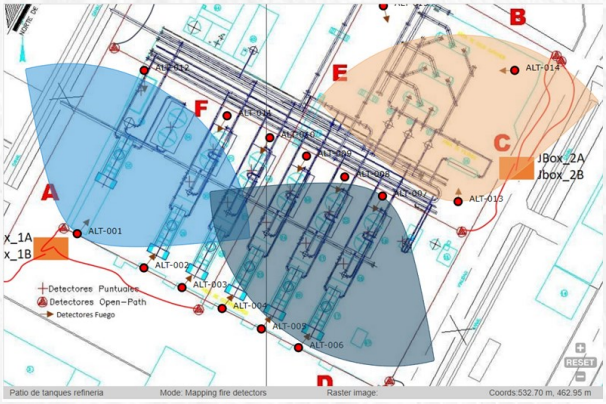
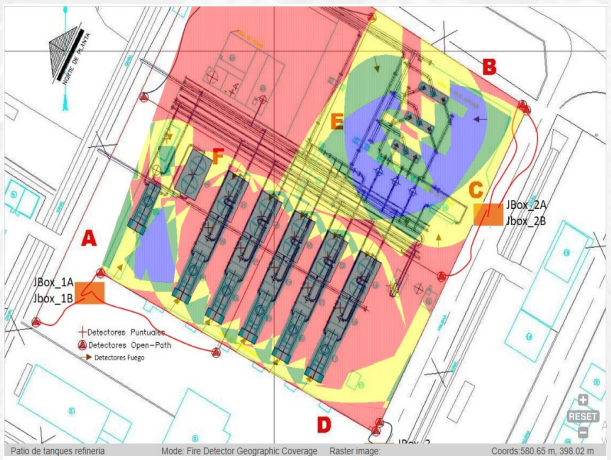
Fire detection - Geographical coverage

Step 1: The coverage area is delimited and the areas occupied by equipment and/or facilities that create obstacles to the fields of vision of the flame detectors produced by equipment are established.



Step 2: The vision cones of the flame detectors are projected according to the manufacturer's specifications and the configuration of the installation.



Step 3: The geographical coverage graph of the coverage area is generated, considering the projection of all the vision cones of the flame detectors. With the use of a powerful calculation tool, each cone of vision intersects with the obstacles present in the area, in such a way to consider the shadows generated in the fields of vision. Depending on the convergence of the various vision cones, the voting areas marked with a color code and percentage of coverage are established.

COLOR CODE	DETECTION	COVERAGE
	No detectors	59.59 %
	1 Detector	21.46 %
	2 Detectors	10.43 %
	3 Detectors	8.52 %

The geographic coverage map is a powerful tool to determine the level of coverage of an area.

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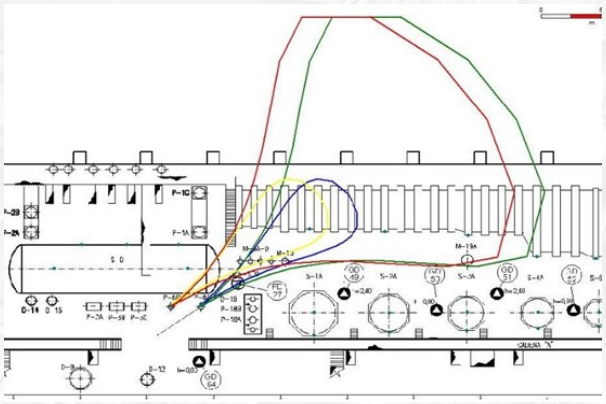
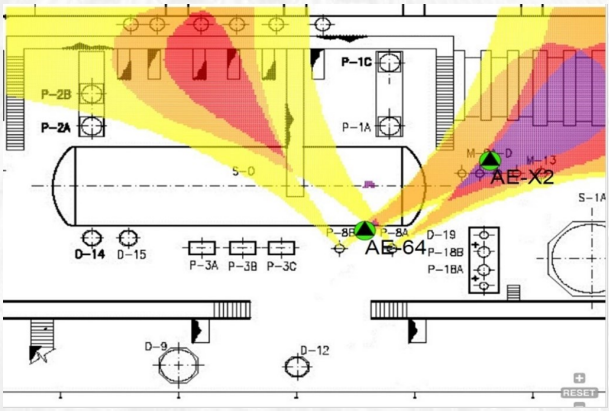
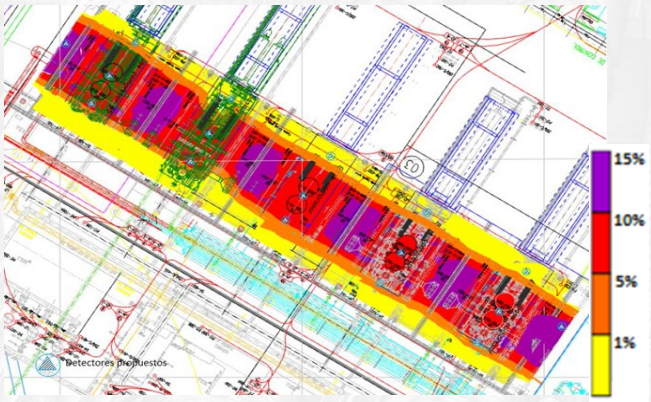
Gas detection - Risk based coverage



Step 1: The consequences of gas dispersion are simulated in the scenarios previously defined in the plant. Preliminary, only small leaks are considered.



Step 2: The consequences are projected on the floor plan considering the value of the leakage frequency and the probabilities of weather and wind direction.



Step 3: The flammable gas cloud density map is generated considering all gas leak scenarios. Each event has an associated frequency. The overlapping of the clouds generates areas of higher frequency concentration (ranking), which will allow visualizing the optimal zones for detectors' location.

Step 4: Finally, the gas detectors are located and the cloud density map is generated again only considering the events that are not detected. The result allows observing the risk reduction achieved. This process can be iterative until the target coverage is achieved based on the desired risk reduction.

Risk-based coverage allows you to reduce the risk level of an installation using an optimal number of detectors. It has the advantage of ensuring the required risk reduction with a significant cost reduction.

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