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## **AVOID CATASTROPHIC SITUATIONS: EXPERT FIRE AND GAS CONSULTANCY OPTIMIZES SAFETY**

World-class services help reduce incidents, protect the environment, and keep people and plants safe

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White Paper



## Introduction

Industrial fire & gas systems play a critical role in protecting people, processes and the environment. They continuously monitor fire and toxic or combustible gas levels within process plants, and can provide early warning of an abnormal situation before it becomes a significant threat. Efficient early detection enhances safety by reducing escalation of hazardous events, improves system reliability by reducing spurious activation, and provides financial benefits by optimizing the costs of detectors in the plant lifecycle.

Honeywell's Process Fire and Gas Consultancy was developed to meet the unique requirements of the process industries. This world-class fire and gas service offering helps industrial organizations mitigate operational incidents, keeping people and plants safe. The services collectively provide optimal detector coverage in a facility by quantifying and modeling the required number of gas and flame sensors. The modeling strategically addresses detector placement to mitigate or avoid catastrophic situations in high-risk process environments.

With Honeywell's consultancy services, plants benefit from an enhanced layer of protection, better resource allocation, improved design accuracy and engineering efficiency. This results in a lower lifetime operating costs and significantly increases level of safety.

*A fire and gas safety system continuously monitors for abnormal situations such as a fire, or combustible or toxic gas release, and provides early warning to prevent escalation of the incident and protect the process or environment.*



Fire and gas detection systems are key to maintaining the overall safety and operation of industrial facilities. They are commonly employed for offshore petroleum exploration and production, onshore oil and gas facilities, refineries and chemical plants, marine operations, pipelines, power plants, mining sites, and paper mills.

Industrial processes often involve the use or manufacture of dangerous flammable or toxic gases, which can escape, and threaten those working within plants or living nearby. Incidents may escalate, resulting in environmental damage, explosions and/or loss of life – not to mention serious reputational damage. Industrial companies are therefore under significant pressure to minimize the impact of potentially hazardous events.

A state-of-the-art fire and gas system combines a wide variety of detectors, fire alarm panels, controllers, and final elements like fire suppression systems into a consistently designed and executed solution.

Thanks to advancements in detector technology, fire and gas systems can detect early warnings of explosive conditions and health hazards, including fire and combustible or toxic gas releases. They also provide audible and visual alarm indications helping to ensure operators and personnel are informed of potentially hazardous situations.

## **Understanding Today's Challenges**

Throughout the process industries, plant operators are faced with a host of critical demands. They must cope with business challenges ranging from increased accident and incident costs, to compliance with strict prescriptive standards and codes such as NFPA 72, EN 54, UK HSE API, OSHA and CSA.

Insurance companies may not provide coverage to businesses that cannot prove they have taken appropriate measures for detection

of hazardous and toxic gases and fire in process facilities.

Correct and proven connection of fire and gas detectors to plant safety systems is an important factor in reliable performance of the fire and gas system and for establishing the desired safety integrity level (SIL).

At industrial sites, most failures of fire and gas systems can be attributed to inadequate detector coverage. Incorrect detector placement alone, along with poor environmental conditions, can prevent the device from detecting a hazardous gas leak or flame, even when the device is functioning properly. When a safety hazard is undetected, then the appropriate mitigating safety action (alarm, shut down, deluge, venting, etc.) cannot be initiated.

In many cases, plants have an insufficient number of detectors, and as a result, hazardous events are not identified and losses are incurred. Some facilities have more detectors than required – leading to higher installation and maintenance costs. This can also increase spurious activation of fire and gas devices.

Plant engineers are often left to ask, “Are there enough sensors strategically placed to actually detect the problem? Does voting of sensors mean that it takes more than one sensor to detect a problem?”

An effective fire and gas system design must be based on the unique needs of each facility, as well as the operating requirements and constraints of detection equipment. It is vital that the strengths and weaknesses of the



*Fire and gas detection devices have developed greatly over recent years. Using new techniques and adding intelligence to these instruments to reduce the number of spurious alarms has greatly improved the effectiveness of fire and gas system.*

equipment are assessed and appropriately applied to the plant application to ensure optimal protection, coverage, and safety.

According to ISA-TR84.00.07 *Guidance on the Evaluation of Fire, Combustible Gas and Toxic Gas System Effectiveness*, besides the required safety evaluation of the flame & gas hardware and software, “the mapping calculation for fire and gas detection coverage performance relating to their locations, positions, and settings must be evaluated as well.” To ensure system integrity and effective performance, the detector type, range setting, quantity, and angle/position allocation must be considered within the context of the overall system design.

Without question, there is a need to understand an industrial site’s real fire and gas vulnerabilities, and then optimize detector coverage and system availability. Fire and gas systems must be designed to provide early detection so that personnel can respond on time when there is a demand in any area of the plant.

## Comprehensive Service Strategy

Process plant owner/operators should partner with a fire and gas consultancy service provider who brings together all necessary expertise in fire and gas detection for developing an appropriate solution based on the site’s individual requirements. A comprehensive service and support strategy can improve reliable performance of the overall mitigation function.

Honeywell, as a leading automation and safety system supplier, provides integrated fire and gas hardware and software solutions. It also delivers customizable service offerings around fire and gas detector mapping and product selection to assist customers with reducing industrial incidents, protecting the

environment, and keeping people as well as plants safe.

Honeywell’s Process Fire and Gas Consultancy services include assistance in all phases of the fire and gas system lifecycle. They are based on Honeywell’s expertise in not only fire and gas solutions, but also process knowledge and overall risk analysis capabilities. This expertise is then deployed using best-in-class tools and detector mapping software.

Consultancy teams help customers identify potential hazards, understand their risks and contribute to improving safety performance. The diverse backgrounds of team members assure they are able to advice on the complex safety and risk issues throughout all facilities, no matter their complexity.

Honeywell’s comprehensive service offering includes:

### 1. Area of Concern Assessment

Process areas often contain different industrial applications that involve the use or manufacture of dangerous flammable and toxic gases. An area of concern assessment segregates process areas based on the fire and gas hazards present in the process unit. Conversely, a fire and gas zoning assessment identifies areas requiring a fire and gas detection system. The assessment includes areas with process equipment handling flammable or toxic material, as well as areas that may need detection to prevent ingress of hazardous gas, such as electrical rooms and control rooms. The process areas and non-process areas are also identified in this step. Typically, Honeywell will request plot plans, process information and hazardous area classifications. Based on review of these documents, the customer will be provided with

*Honeywell's process fire and gas consultancy services collectively provide optimal fire and gas detector coverage in a facility by quantifying and modeling the required number of sensors.*

a custom list of fire and gas zones along with the process equipment that requires fire and gas detection in each zone.

## **2. Fire and Gas Performance Target Selection**

Proper design of fire and gas systems involves the selection of a performance target for key functions. Performance is primarily characterized by the systems' ability to detect hazardous events (detector coverage) and detect reliably (safety availability). Target selection can help identify proper coverage and availability using semi-quantitative and fully quantitative approaches.

The semi-quantitative approach uses calibrated risk assessment tables that define factors associated with the frequency and magnitude of hazardous events related to equipment in a given zone. The ranking procedure provides three risk categories (low, medium and high) for establishing the coverage required for gas detection.

The fully quantitative approach is a detailed methodology in which potential hazardous events are identified, the consequences of hazards are modeled in site-specific atmospheric conditions, and the likelihood of those consequences is determined in the selected fire and gas zone. Customers are provided with performance targets for the fire and gas system in the form of hazard frequency values.

Honeywell will request risk assessment reports like Quantitative Risk Analysis (QRA), Hazard and Operability (HAZOP) study for performing the fire and gas performance target selection.

## **3. Fire and Gas Instrumented Function (FIF) Development**

During Fire and Gas Instrumented Function (FIF) development, consultants specify the inputs, logic solver and outputs of the fire and gas system. They also define the ability of the fire and gas system to detect, alarm and, if necessary, take action to mitigate the consequence of a fire or gas release upon a demand condition.

All of the requirements developed during risk analysis and conceptual design, are collected

and presented for subsequent FIF development, which establishes detector type, set points, voting logic, and executive control action. The fire and gas function development provides the functional and integrity requirements for fire and gas system elements.

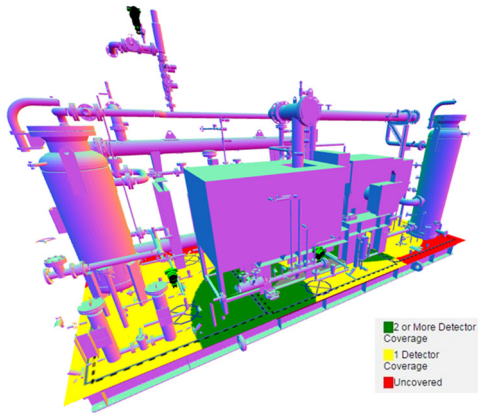
Honeywell will request for fire and gas specific company standard or customer interactions to develop the FIF list.

## **4. Fire and Gas Detector Coverage Assessment**

A detector coverage assessment seeks to determine the degree of detector coverage with respect to a given area or a specific hazardous event. The assessment involves placement of sensors in different layout configurations to maximize the detection coverage. There are two primary options for performing detector coverage assessment – geographic coverage assessment and scenario coverage assessment.

A geographic coverage assessment provides information on the fraction of the geometric area (at a given elevation of analysis) of a defined monitored process area. If a gas release/fire were to occur in a given geographic location, the geographic coverage would offer information on whether the gas release or fire would be detected by the gas/flame detection equipment considering the defined voting arrangement. The geographic coverage assessment provides coverage for a particular area.

A scenario coverage assessment identifies the fraction of the release scenarios that would occur as a result of the loss of containment from equipment in the monitored process area that can be identified by detection equipment considering the frequency, magnitude of the release, and the defined voting arrangement. The scenario coverage assessment provides coverage for particular scenario like a gas release or fire.



Geographic coverage assessment indicating areas covered by one detector or two detectors, as well as blind spots.

The assessment is detailed and provides information on the consequence of hazards. It can also compare the cloud concentration with detector sensitivity to confirm whether sensors have detected the hazardous cloud. This method can be done through advanced techniques, which incorporate all external parameters like wind affecting the gas cloud characteristics.

## 5. Fire and Gas Availability Assessment

Honeywell consultants provide the service of conceptual design review and availability verification. The conceptual design review includes calculations of performance parameters for each FIF. The availability calculation evaluates the proposed voting arrangement to determine if minimum levels of fault tolerance have been achieved. In addition, the consultants can identify FIFs that are not compliant with the site's requirements, and both provide recommendations to achieve their compliance and deliver supporting calculations to verify that the recommendations will result in a compliant system.

## 6. Fire and Gas Requirements Specification

Honeywell can create a Fire and Gas Requirement Specification (FGRS) document set based on its templates, which have been designed and reviewed to assure compliance with functional safety standards and complete specification of the system, allowing detailed

design activities to be performed without any intermediate design documents.

The Fire and Gas Requirements Specification (FGRS) is a set of documents that describes how the fire and gas system should perform from a functional and integrity perspective. This document is the basis for all detailed design of the fire and gas system.

## 7. Fire and Gas System Validation and Support

The FGS Validation involves validation testing of installed fire and gas assets. The Functional Test Procedures (FTP) document will provide testing procedure for each fire and gas loop through a well-defined methodology.

Honeywell provides support for installed fire and gas assets to troubleshoot issues such as insufficient coverage and spurious trips.

### Standard Project Management and Core Services

*For all projects, a project manager and/or lead engineer is assigned to assure that the fire and gas project is implemented according to the specified requirements and within the desired schedule. This individual is responsible for the coordination of all project resources and serves as a single point of contact for the customer.*

## Benefits to Industrial Organizations

A comprehensive strategy for process fire and gas optimizes business performance parameters through enhanced safety, reliability and sustainability during the entire lifecycle of the plant.

Honeywell's Process Fire and Gas Consultancy services can help industrial organizations to:

- Understand the scope of fire and gas engineering and the myriad standards, regulations, and requirements
- Identify and define fire and gas zones along with the hazards contained in those zones
- Determine the likelihood of fire and gas system relevant events

*A systematic approach to industrial fire and gas consultancy services includes an assessment of future or existing system performance according to functional safety standards.*

*Proper placement of detectors is critical in the design of a fire and gas system to ensure that coverage is adequate to identify hazardous events at their incipient stage.*

- Assess the risks posed by inadequate fire and gas detection and suppression capabilities
- Define the strengths and limitations of technology options for fire and gas detection sensors
- Apply fire and gas detection coverage mapping using system performance assessments
- Identify the proper number of detectors for a designated coverage area
- Design a robust fire and gas system by understanding the implications of various inputs and outputs
- Improve safe operations by optimizing the layout of fire and gas detectors to eliminate issues such as insufficient coverage and spurious trips

By enlisting an experienced and knowledgeable consultancy service provider, industrial operations can also develop an IEC 61508-, IEC 61511- and ISA 84.00.01-, and ISA 84.00.07-compliant fire and gas detection capability, and meet desired international standards such as NFPA or EN.

## Conclusion

For the process industries, the safety of facilities, personnel, production processes and surrounding communities is a crucial concern. Plants must meet their safety needs while optimizing operational and business performance. Faced with this reality, they are seeking expert service and support to help ensure the lowest risk, and highest value protection, from their fire and gas systems.

### For More Information

To learn more about Honeywell's Process Fire and Gas Consultancy, visit [www.hwll.co/FnGService](http://www.hwll.co/FnGService) or contact your Honeywell account manager.

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