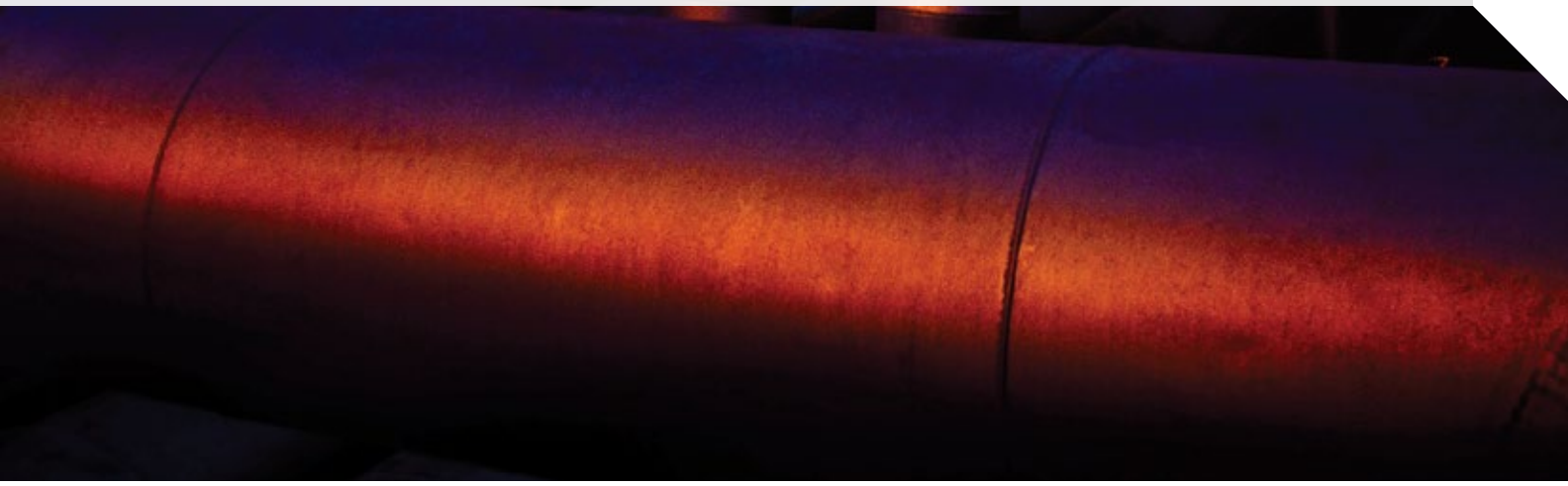
Flame & Gas **Mapping Solutions**

for Fixed Gas & Flame Detectors

MSA
The Safety Company



Design detector layouts **for highest detection coverage**



WE KNOW WHAT'S AT STAKE.

Flame & Gas **Mapping Solutions**

Why Perform Flame & Gas Mapping?

Fixed flame and gas detection systems are designed and installed to protect large and complex areas filled with process equipment from risks of combustible or toxic gas leaks, explosions and flames. For these systems to be effective, it is important that they offer a high likelihood of detecting the presence of any flame and gas hazards within monitored process areas. Determining optimal quantity and location of flame and gas detectors is therefore critical to ensure the detection system's effectiveness.

Detector placement however, has largely relied upon past experiences, common practice and prescriptive standards. Though not necessarily incorrect, these approaches typically do not offer a systematic method of assessing flame and gas risk under different gas release scenarios, wind conditions and obstruction scenarios. In addition, these traditional approaches do not offer a simple method of measuring risk reduction performance and effectiveness of detection systems when varying detector technologies, locations and quantities are deployed. Limitations of traditional approaches make it difficult for users to optimize their flame and gas detection assets, or to quantify effectiveness of their current detection in meeting their safety performance objectives.

MSA Flame & Gas Mapping

MSA flame and gas mapping is a solution that assists in the evaluation of flame and gas risks within a process facility and in the reduction of these risks towards an acceptable risk profile. Flame and gas mapping includes placing of detectors in appropriate locations to achieve best possible detection coverage. Through design iterations, the effects of different detector arrangements or detection technology on detection coverage are quantified and assessed, stopping when the desired performance target is met. The approach used is based upon recommendations outlined in ISA's TR84.00.07 Technical Report. Upon conclusion, a mapping report that includes graphical maps of residual risks, recommended detector placements and numerical estimates of detection coverage is provided to the client.

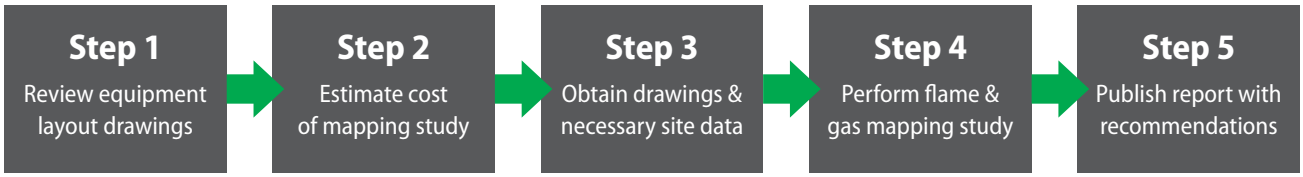


Figure 1 : MSA flame and gas mapping service sequence



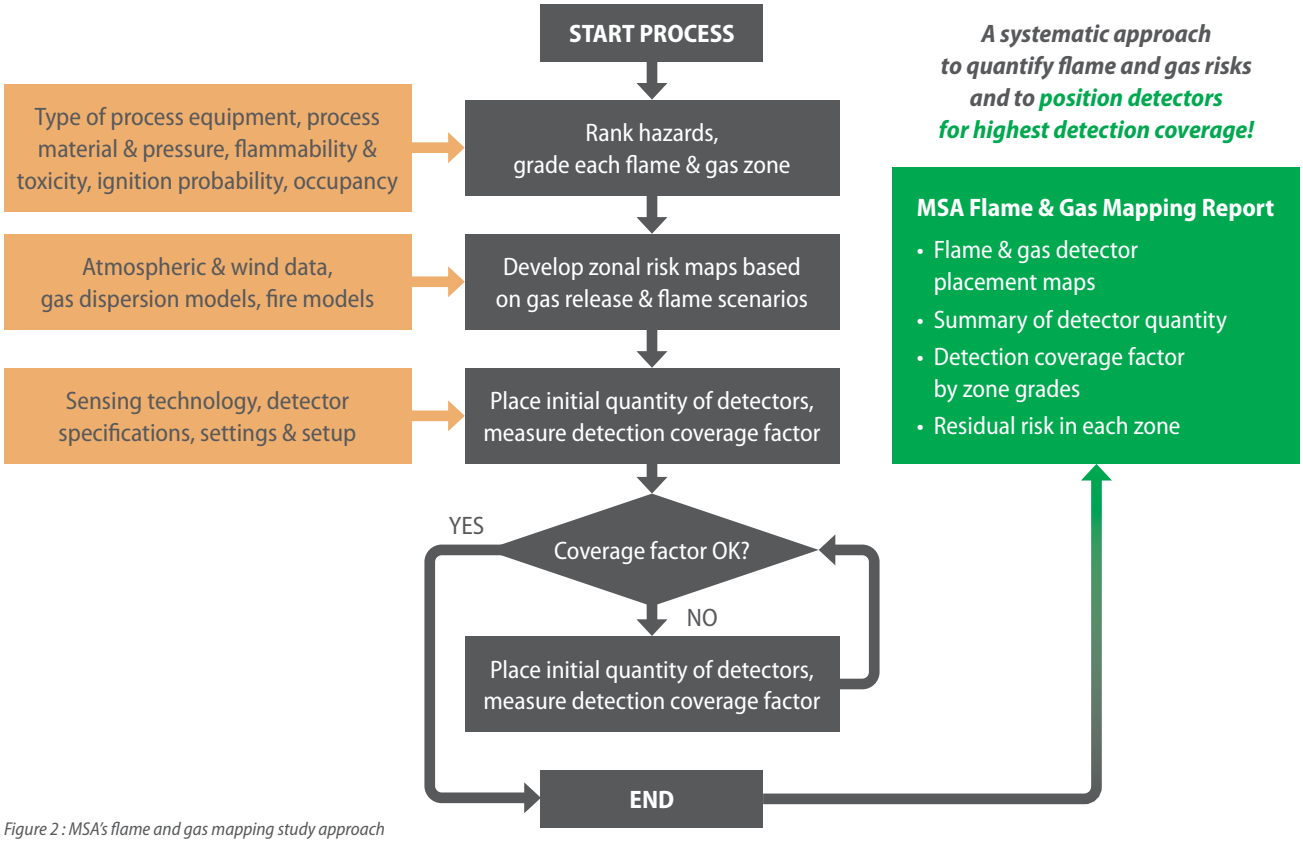


Figure 2 : MSA's flame and gas mapping study approach

MSA's mapping process supports latest generation detection technologies, allowing users to tailor their detector mix to specific applications. These detection technologies include:

Combustible Gas	Toxic Gas	Flame
• Point Catalytic Bead	• Electrochemical (ECC)	• MSIR
• Point IR	• Solid State (MOS)	• UVIR / UVIR-H2
• Open Path IR	• Photoacoustic-IR (PAIR)	• UV
• Ultrasonic		

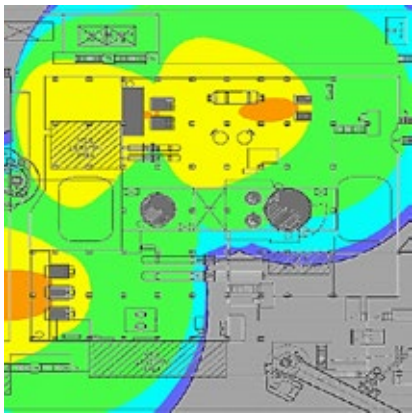
Effigy Flame & Gas Mapping 3D Software Tool

MSA uses the Effigy Flame and Gas Mapping 3D Software tool developed by KENEXIS for flame and gas mapping studies. This ISA TR84.00.07-compliant software tool identifies areas of gas release or flame risk by quantifying risk likelihoods via modelling. Resulting models provide a deterministic method of ascertaining the type and quantity of detectors needed, detector placements, detection coverage provided by installed detectors, and remaining flame and gas risks after detector installation. Effigy's powerful modelling algorithms calculate geographic- and scenario-based detection coverage for both flame and gas mapping studies.

In calculations of detection coverage for gas mapping, algorithms combine hundreds of gas release and dispersion scenarios that could occur in the area of study, and gas detector sensitivity. In mapping for flame detection, algorithms consider the flame detector's field-of-vision, sensitivity settings, radiant heat output (RHO) of the target flame, obstructions, and obstructed flame plumes. Effigy displays these modelling results in graphical color-coded coverage maps that indicate the extent of flame and gas coverage.

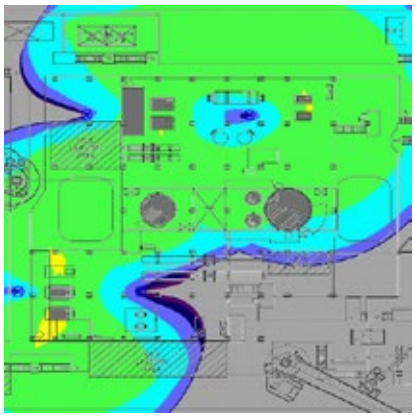
Improving Gas Detection Coverage with MSA Gas Mapping

Case study: Modelling volatile liquid hydrocarbon release from 7 pumps



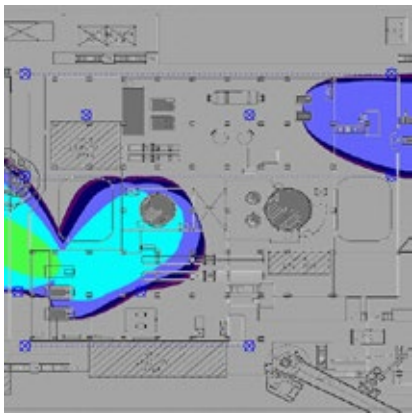
Stage 0 Analysis

- *2D gas map with no gas detectors*
- *Map showing initial gas risk with 0% scenario detection coverage*



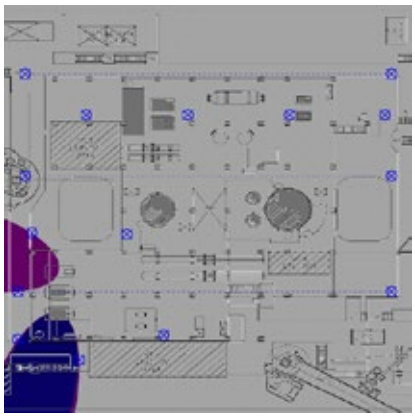
Stage 1 Analysis

- *2D gas map with an initial placement of 4-point gas detectors*
- *Map showing reduction of gas risk with 60% scenario detection coverage*



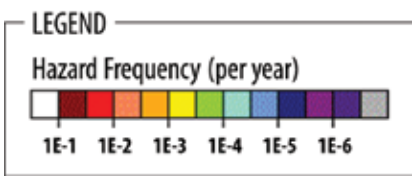
Stage 2 Analysis

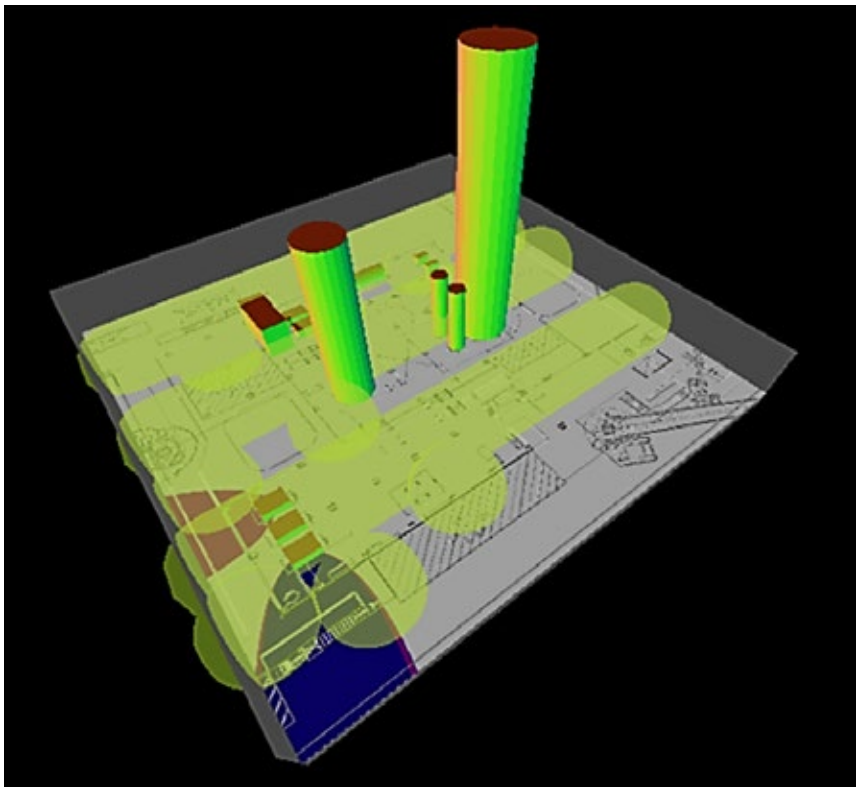
- *2D gas map with 4-point and three open path gas detectors*
- *Map showing significant reduction of gas risk with >90% scenario detection coverage*



Stage 3 Analysis

- *2D gas map with final placements of three open path and 9-point gas detectors*
- *Map showing negligible residual undetectable gas risk with >99% scenario detection coverage*



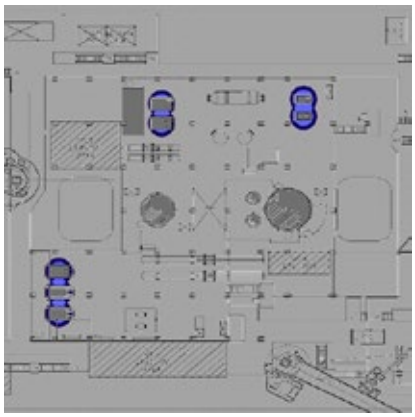


Final Stage

- *3D rendering of gas map with final detector placements*

Improving Flame Detection Coverage with MSA Gas Mapping

Case study: Modelling volatile liquid hydrocarbon release from 7 pumps

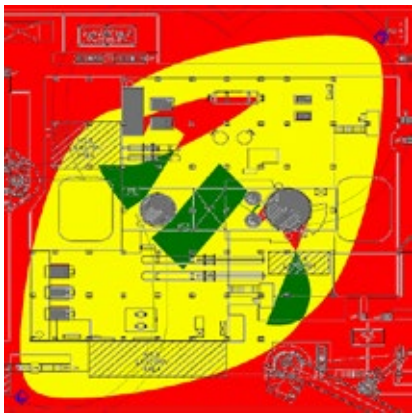


Stage 0 Analysis

- *2D flame map showing undetected flames around pumps*

LEGEND

- *2ooN detection coverage*
- *n 1ooN detection coverage*
- *n No coverage*



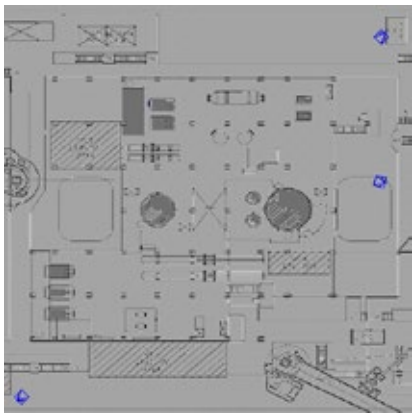
Stage 1 Analysis

- *2D flame map with an initial placement of 2 MSIR flame detectors*
- *Incipient flames at 2 pumps may be blocked from detection view*
- *Flame coverage for Grade A zone:*
  - *4%*
  - *68%*
  - *28%*



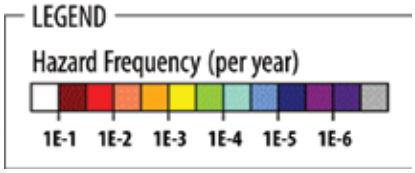
Stage 2 Analysis

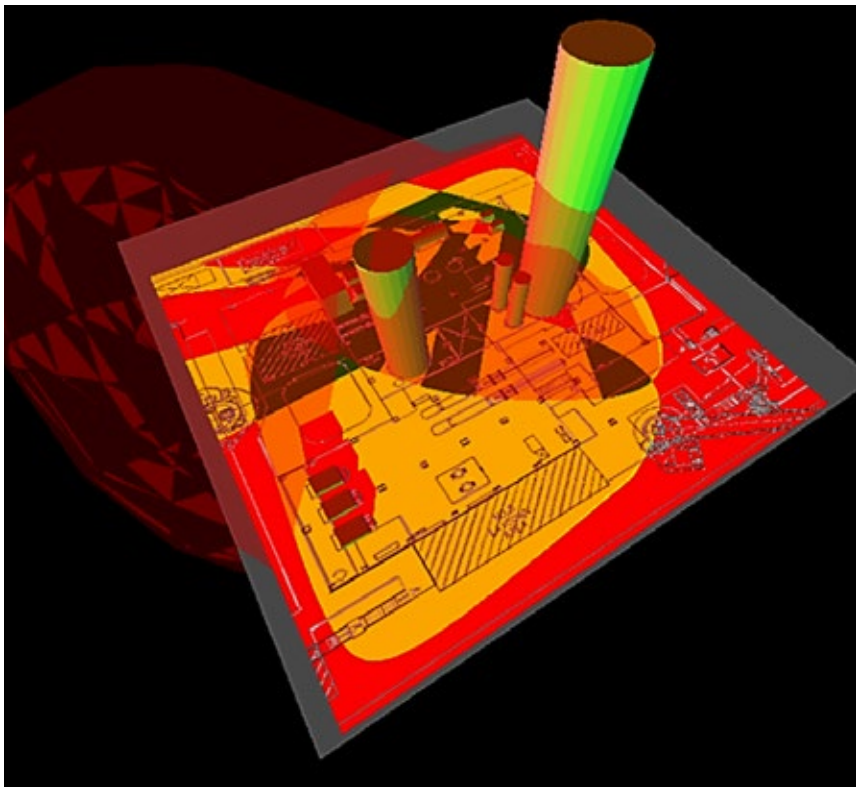
- *2D flame map with three MSIR flame detectors*
- *All areas around pumps are now in the view of at least one flame detector*
- *Flame coverage for Grade A zone:*
  - *34%*
  - *47%*
  - *19%*



Stage 3 Analysis

- *2D flame map with final placements of three MSIR flame detectors*
- *Map showing no risk of undetected flames around pumps with >99% scenario detection coverage*





Final Stage

- *3D rendering of fire map with final flame detector placements*

MSA—**The Safety Company**

Our business is safety. We've been the world's leading manufacturer of high-quality safety products since 1914. MSA products may be simple to use and maintain, but they're also highly sophisticated devices and protective gear—the result of countless R&D hours, relentless testing and an unwavering commitment to quality that saves lives and protects millions of hard working men and women each and every day. Many of our most popular products integrate multiple combinations of electronics, mechanical systems and advanced materials to help ensure that users around the world remain protected in even the most hazardous of situations.

Our Mission

MSA's mission is to see to it that men and women may work in safety and that they, their families and their communities may live in health throughout the world.

MSA: WE KNOW WHAT'S AT STAKE.

Note: This Bulletin contains only a general description of the products shown. While product uses and performance capabilities are generally described, the products shall not, under any circumstances, be used by untrained or unqualified individuals. The products shall not be used until the product instructions/user manual, which contains detailed information concerning the proper use and care of the products, including any warnings or cautions, have been thoroughly read and understood. Specifications are subject to change without prior notice.

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