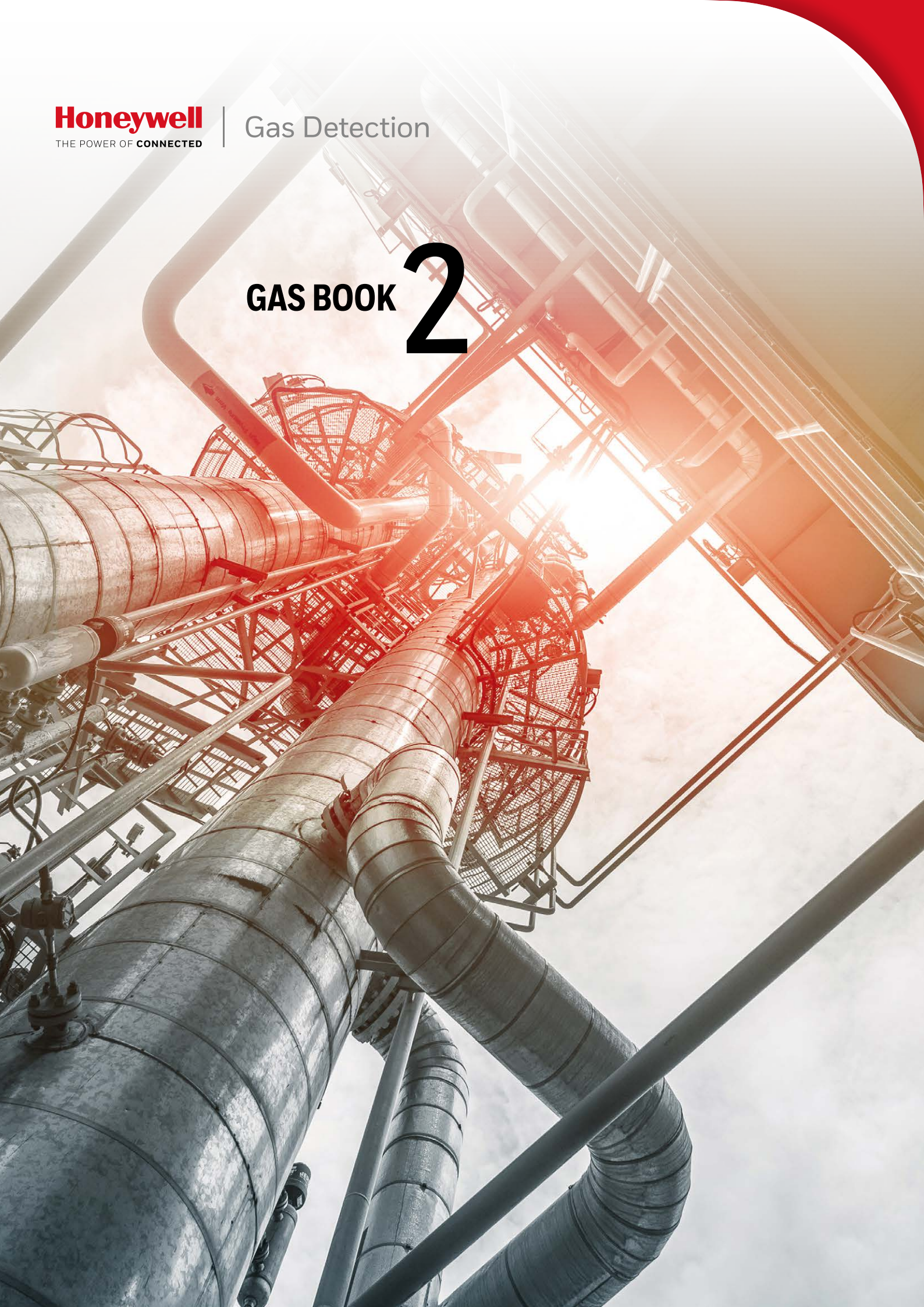


GAS BOOK 2



Typical Areas that Require Gas Detection

There are many different applications for fixed and portable gas detection. Industrial processes increasingly involve the use and manufacture of highly dangerous substances, particularly toxic and combustible gases. Inevitably, occasional escapes of gas occur, which create a potential hazard to the plant, its employees and people living nearby. Worldwide incidents involving asphyxiation, explosions and loss of life, are a constant reminder of this problem.



Oil and gas (drilling and production)

The oil and gas industry covers a large number of upstream activities from the on and offshore exploration and production of oil and gas to its transportation and storage. The Hydrocarbon gases involved are a serious explosive risk and toxic gases such as Hydrogen Sulphide are often present.

Typical Applications:

- Exploration drilling rigs
- Production platforms
- Onshore oil and gas terminals
- Facility turnarounds/shutdowns
- LPG storage areas
- Offshore and onshore drilling and service rigs
- Offshore production platforms
- Personal Protective Equipment (PPE)

Typical Gases:

Flammable: Various Hydrocarbon gases including Methane
Toxic: Hydrogen Sulphide, Carbon Monoxide
Oxygen: Depletion

Refineries and petrochemical facilities

Refineries take crude oil mixes and convert them into various blends of Hydrocarbons for use in a wide variety of subsequent products.

Typical Applications:

- Flanges and pump seals for Hydrocarbon detection
- Catalytic cracking process monitoring
- Bulk storage areas
- Water drains, run-off gullies and trenches
- Confined space entry
- Loading areas
- Ventilation systems
- Perimeter/fence-line monitoring
- Planned maintenance and shutdown/plant modification

Typical Gases:

Flammable: Various Hydrocarbon gases including Ethylene, Kerosene, Propane and Methane
Toxic: Hydrogen Sulphide and Sulphur Dioxide
Oxygen: Depletion

Chemical plants

Chemical plants manufacture a myriad of products and feedstocks. The nature and diversity of chemicals used and produced on site provide considerable danger to assets and personnel. These plants often use a wide range of both flammable and toxic gases in their manufacturing processes.

Typical Applications:

- Raw material storage
- Process areas
- Laboratories
- Pump rows
- Compressor stations
- Loading/unloading areas

Typical Gases:

Flammable: Various Hydrocarbons including Petroleum and resins
Toxic: Hydrogen Sulphide and Sulphur Dioxide
Oxygen: Various including Hydrogen Sulphide, Hydrogen Fluoride and Ammonia

Power generation (traditional and renewable)

Traditionally fossil fuels like coal, oil and Natural Gas have been used to generate electricity. Today renewable energy is becoming a key aspect of power generation with wind power and biogas becoming more prevalent forms of power generation.

Typical Applications:

- Around boiler pipework and burners
- In and around turbine packages
- Working near landfill gas pipework
- Surface emissions monitoring in landfills
- Blade production and welding of steel parts (wind energy manufacture)
- Confined spaces (in the tower and nacelle)
- Working near landfill leachate pools and perimeter boreholes

Typical Gases:

Flammable: Natural Gas, Hydrogen
Toxic: Carbon Monoxide, Sulphur Oxide, Nitrogen Oxide, Hydrogen Sulphide, VOCs
Oxygen: Depletion

We have produced various technical documents regarding applications for gas detection. If you would like to access this information, please visit www.honeywellsafety.com



Water treatment

Water treatment is a large industry comprising of many processes and aspects from the production and distribution of clean water to the collection, treatment and disposal of waste such as sewage.

Typical Applications:

- Purification plant monitoring
- Sewage digesters
- Plant sumps
- Plant intakes and penstocks
- Plant power generation monitoring
- Hydrogen Sulphide scrubbers

Typical Gases:

Flammable: Various Hydrocarbons including Methane

Toxic: Hydrogen Sulphide, Carbon Dioxide, Chlorine, Sulphur Dioxide and Ozone

Oxygen: Depletion



Marine

Marine gas hazards are numerous. Liquid gas, fuel, chemicals and other fossil fuels harbour a risk of explosion. There is a danger of suffocation from Oxygen displacement when using Nitrogen or other gases for inerting. Toxic gases like Hydrogen Sulphide also pose considerable risks.

Typical Applications:

- Fuel storage tanks (including inspection)
- Transportation (particularly of fuel)
- Vehicle refuelling
- Aircraft tank inspections
- Submarine septic tanks and Hydrogen build-up
- Naval vessels engine room monitoring and septic tanks
- Equipment and vehicle maintenance

Typical Gases:

Flammable: Various blends of Aviation Kerosene, Diesel and Gasoline

Toxic: Carbon Monoxide, Carbon Dioxide, Hydrogen Sulphide and Volatile Organic Compounds (VOCs)

Oxygen: Depletion



Military and national security

The World's militaries require gas detection monitoring and due to their mobility, portable gas detection forms a key part of protection against dangerous gases.

Typical Applications:

- Fuel storage tanks (including inspection)
- Transportation (particularly of fuel)
- Vehicle refuelling
- Aircraft tank inspections
- Submarine septic tanks and Hydrogen build-up
- Naval vessels engine room monitoring and septic tanks
- Equipment and vehicle maintenance

Typical Gases:

Flammable: Various blends of Aviation Kerosene, Diesel and Gasoline

Toxic: Carbon Monoxide, Carbon Dioxide, Hydrogen Sulphide and Volatile Organic Compounds (VOCs)

Oxygen: Depletion



Pulp and paper production

This vast industry includes both mechanical and chemical pulping methods that turn wood into a variety of paper based products. Toxic gas threats are present from bleaching agents, whilst fuels used to drive mechanical pulping create flammable gas risks.

Typical Applications:

- Digesters (in chemical pulping)
- Chlorine during bleaching
- Fuel monitoring in mechanical pulping

Typical Gases:

Flammable: Methane

Toxic: Chlorine, Chlorine Dioxide and Ozone

Oxygen: Depletion

(Typical Areas that Require Gas Detection Continued)



Landfill monitoring & Biogas generation

Landfills are designed to promote and accelerate the decomposition of organic material and may also contain sorting and storage areas for inorganic material. Landfill gas (known as Biogas), is often collected at these sites so care should be taken when personnel are working close to potential sources.

Typical Applications:

- When working near leachate pools
- When working near perimeter boreholes
- When working near landfill gas pipework
- When monitoring surface emissions
- When working near weighbridges
- When handling waste

Typical Gases:

Flammable: Methane
Toxic: Carbon Dioxide, Hydrogen Sulphide, Benzene and Toluene
Oxygen: Depletion



Semiconductor

Manufacturing semiconductor materials involves the use of toxic and flammable gas. Phosphine, Arsenic, Boron Trichloride and Gallium are commonly used as doping agents. Hydrogen is used both as a reactant and a reducing atmosphere carrier gas. Etching and cleaning gases include Ammonia and other perfluoro compounds.

Typical Applications:

- Wafer reactor
- Wafer dryers
- Gas cabinets
- Chemical Vapour Deposition

Typical Gases:

Flammable: Hydrogen, Propane, Silane and Methane
Toxic: Hydrogen Chloride, Arsine, Boron Trichloride, Phosphine, Carbon Monoxide, Hydrogen Fluoride, Ozone, Dichlorosilane, Tetraethyl Orthosilicate, Hexafluorobutadiene 1,3, Octafluorocyclopentene, Germane, Ammonia and Nitrogen Dioxide
Oxygen: Depletion



Photovoltaics

With more focus on renewable energy, the photovoltaic (PV) industry is experiencing considerable growth. PV applications use semiconductors that exhibit the photovoltaic effect in order to convert solar radiation into direct current electricity, and therefore use a semiconductor manufacturing process.

Typical Applications:

- Wafer reactor
- Wafer dryers
- Gas cabinets
- Chemical Vapour Deposition

Typical Gases:

Flammable: Hydrogen, Propane, Silane and Methane
Toxic: Hydrogen Chloride, Arsine, Boron Trichloride, Phosphine, Carbon Monoxide, Hydrogen Fluoride, Ozone, Dichlorosilane, Tetraethyl Orthosilicate, Hexafluorobutadiene 1,3, Octafluorocyclopentene, Germane, Ammonia and Nitrogen Dioxide
Oxygen: Depletion



Confined spaces

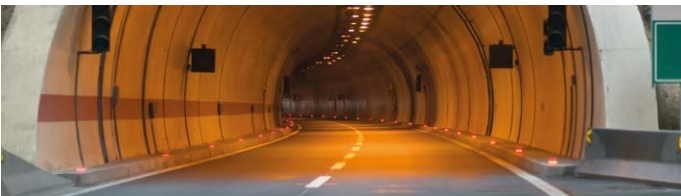
These locations provide one of the key application uses for portable gas detectors, owing to their ability for dangerous gases to build up.

Typical Applications:

- Shafts
- Trenches
- Sewers and manholes
- Pits
- Boilers
- Tunnels
- Tanks
- Vessels (including marine vessel tanks)
- Pipelines
- Containers

Typical Gases:

Flammable: Methane
Toxic: Carbon Monoxide and Hydrogen Sulphide
Oxygen: Depletion



Tunnels and car parks

Exhaust fumes can build-up in car parks and tunnels, creating toxic gas hazards. Gas detection is used to monitor the build up of gases like Carbon Monoxide and Methane and also control the ventilation systems.

Typical Applications:

- Car tunnels
- Underground and enclosed car parks
- Ventilation control
- Access tunnels

Typical Gases:

Flammable: Various Hydrocarbons including solvents and Methane



Mining

There is an abundance of mineral and fossil fuel reserves being mined globally, leaving personnel at risk from dangerous gas build-ups in the enclosed spaces of mine shafts. This makes portable gas detection an essential component of mining safety.

Typical Applications:

- Excavation
- Continuous monitoring whilst working in shafts

Typical Gases:

Flammable: Methane
Toxic: Carbon Monoxide,
Oxygen: Depletion



Ammonia Refrigeration

Many industries use refrigeration as part of their processes – from food and beverage manufacture, gas liquefaction and chemical manufacture to cryogenics and Liquid Natural Gas shipping. It is essential to ensure that Ammonia does not build-up, causing potentially explosive atmospheres.

Typical Applications:

- Ammonia storage areas
- Plant room valves, joints and seals
- Chiller and refrigerator monitoring
- Air conditioning systems

Typical Gases:

Flammable: Ammonia
Toxic: Ammonia



Printing

Depending on the materials being printed, processes within the printing industry use various solvents, inks and dangerous chemicals, which are often dried in very hot ovens, creating the need for robust gas detection to ensure process safety.

Typical Applications:

- Bulk storage of inks and varnishes
- Dryers and ovens
- Exhaust monitoring

Typical Gases:

Flammable: Various Hydrocarbons including solvents and Methane



Laboratory and medical

Laboratories and medical facilities like hospitals may use many different flammable and toxic substances. Very large installations may also feature their own on-site utility supplies and back-up power stations.

Typical Applications:

- Laboratories
- Cryogenics and refrigeration
- Boiler rooms

Typical Gases:

Flammable: Methane and Hydrogen
Toxic: Carbon Monoxide, Chlorine, Ammonia and Ethylene Oxide
Oxygen: Depletion/enrichment



Commercial buildings and public facilities

Commercial and public facilities like swimming pools, shopping centres and schools use integrated safety systems, which can include gas detection. Large visitor numbers can increase the risk of Carbon Dioxide build-up and heating systems may also need to be monitored for flammable gas leaks.

Typical Applications:

- Mechanical rooms
- Swimming pools
- Schools
- Heating pipework monitoring
- Indoor air quality monitoring

Typical Gases:

Flammable: Methane
Toxic: Carbon Dioxide, Carbon Monoxide, Chlorine
Oxygen: Depletion



Agriculture and live stock

When it comes to keeping livestock, Methane and Ammonia can build-up to dangerous levels in cattle sheds. Agricultural stores where fertilisers and pesticide stocks are held can also pose additional explosive dangers.

Typical Applications:

- Cattle shed monitoring
- Agricultural fertiliser and chemical stores



Building & construction

Various dangerous chemicals are used during construction work and due to the mobility of operatives in these applications, portable gas detection forms an integral part of on-site Personal Protective Equipment (PPE)

Typical Applications:

- Trenching and shoring

Typical Gases:

Flammable: Methane
Toxic: Carbon Monoxide and Hydrogen Sulphide
Oxygen: Depletion



Steel Mills

Due to the large number of furnaces and processes that subject metals to extreme heat, Carbon Monoxide detection is essential throughout the plant.

Typical Applications:

- Furnace monitoring
- Oven monitoring

Typical Gases:

Toxic: Carbon Monoxide



Turnarounds, plant shutdowns and planned equipment modifications

No matter what the industry and application, planned shutdowns and maintenance schedules create additional risks on site because they represent deviations from standard processes. Gas detection in the form of portable monitoring solutions should always be used to limit these risks when modifying aspects or processes of the plant.

Selecting Gas Detection

There are many gas detection products on the market that might appear to be the same, but a closer inspection of specification, functionality and features reveals major differences in what products can do and the potential value they can offer. Similarly, individual applications are also unique in their respective designs, needs and processes undertaken.

Know your site risks

Before beginning to consider gas detection equipment, a risk assessment needs to be conducted. Any company employing staff has the obligation to conduct risk assessments to identify potential hazards and these can include potential gas, vapour or Oxygen deficiency risks. If gas hazards are identified, gas detection is applicable as a risk reduction method.

Identifying the prime objective

Depending on the processes being undertaken and the gases being detected, remote or off-site alarm notification plus event datalogging/reporting may also be required for Health and Safety management records. Another factor impacting on the need for enhanced reporting functions might be regulatory compliance or a condition of insurance.

Knowing the prime objective and motivation for having gas detection is the first step in selecting the best solution.



Ask the right questions

Having identified the primary objective, the suitable equipment is selected by asking a number of key questions. These fall into three broad categories:

- The gases to be detected and where they may come from
- The location and environmental conditions where detection is to take place
- The ease of use for operators and routine servicing personnel

The answers to these questions will have a direct impact on the proposed solution and the associated costs to supply and maintain equipment.

The gases to be detected and where they may come from

The gases to be detected should be identified by the risk assessment, however experienced gas detection equipment manufacturers and their approved distributors are often able to help in this process, based on their experience of similar applications. However, it is important to remember that it is the end-user's responsibility to identify all potential hazards.

The gas detection vendor uses published data to identify whether a gas is flammable, toxic or an asphyxiant and the relative levels at which it could cause a hazard. An ideally suited gas detection solution aims to detect and alarm prior to dangerous levels being reached. The same published data gives information as to whether the gas or vapour is lighter or heavier than air, as this will affect the selection of sensor positioning at the points of detection.

It is also essential to identify the potential source of a gas release as this helps determine the number and location of detectors required

for a fixed gas detection system.

In instances where the source of gas release is not known, portable gas detection equipment, worn by site personnel may offer a better solution.

Some typical gas sources include:

- Natural occurrence, e.g. Methane and Hydrogen Sulphide from the decomposition of waste
- Leakage for a supply pipe or storage tank, e.g. piped Natural Gas supplies
- Emissions from a combustion process, e.g. Carbon Monoxide from an exhaust or a boiler flue
- Emissions from a production process, e.g. solvents in the printing and coating industry
- Emissions from a manufacturing plant, e.g. Ammonia from a refrigeration plant or Nitrogen from a Nitrogen supply plant

Product functionality

The next area of consideration relates to additional product functionality. Aspects like wiring configuration are important, especially when retro-fitting into an existing application. If the apparatus is being integrated into a separate safety system, certain communication protocols may also be required such as HART®, Lonworks or Modbus®.

Attention also needs to be given to the requirement for local displays on transmitter units and local configuration of the unit and gas displays may also be a useful addition. A holistic approach needs to be adopted when looking at the functionality of a device. There are a large number of variations with products and as you would expect, there is often a cost implication with increased functionality. Again, this is where working with a gas detection specialist can help by identifying the additional spec that could be valuable. Things like local displays, local user interfaces, software compatibility, the number of relays and outputs required, remote sensor mounting capabilities, on-board diagnostics, cartridge hot swapping and event logging abilities provide additional benefits to the user and make one product more applicable than another.

The ease of use for operators and routine servicing personnel

Routine maintenance is another important consideration. Some gases and vapours can be detected with a number of different sensing technologies, e.g. Hydrocarbon gases with catalytic beads or Non-dispersive Infrared NDIR. Catalytic beads do not provide fail-to-safety operation and therefore can require a high frequency of routine maintenance, however NDIR based solutions tend to have a higher initial purchase price, but may require less routine maintenance. In-house resource to undertake such routine maintenance needs to be identified and in the absence of such a resource, budgeting for third party maintenance is an important factor in selecting the right equipment.

Detection equipment downtime during routine sensor replacement can lead to the loss of production. If this is a concern, some solutions can provide a fast, simple and safe method of sensor exchange without needing to down-power the system or the plant.

A good gas detection equipment supplier should be able to offer a range of service packages to help maintain equipment.



Consider the environmental conditions

The performance, accuracy and reliability of any gas detection equipment will be affected by the environmental conditions it is subjected to. Temperature, humidity and pressure levels at the location have a direct bearing on the type of equipment that should be selected. Additional factors such as potential variations resulting from a production process itself, diurnal/nocturnal fluctuations and seasonal changes may also affect the type of device which is suitable. It is important to consider whether the equipment will be used indoors or outdoors, as this can greatly affect the design of the device. For example, an indoors or outdoors location that is exposed to elements such as wind, rain and salt spray, will require equipment which is resistant to the corrosive effects of that environment.

Although indoor locations typically require less robust housing, consideration should be made for internal areas which are hosed down on a frequent basis. In locations where water/moisture, dust and dirt are prevalent it's important to get a device that is protected by water/dirt ingress.

Aside from natural environmental conditions such as weather, there may be other materials in the environment that can have a potential affect on the type of equipment that is chosen. For example, there may be other elements such as Hydrogen Sulphide, which have corrosive properties or other airborne compounds which could have an adverse affect upon the reliable operation of some sensing technologies, e.g. Silicones poisoning catalytic bead sensing technologies. Another important consideration is a device's suitability for use in certain hazardous locations. Hazard areas are classified according to their perceived likelihood of gases being present. It's important that a device cannot ignite a gas cloud. With this in mind equipment that is Intrinsically Safe (Ex ia/Ex ib) or Explosion-Proof (Ex d) has been created to provide enhanced safety. A competent gas detection equipment supplier will have a range of different sensing technologies available that can be applied to a given application. In addition, the environmental conditions start to determine the best mechanical configuration of the final solution.

Portable Gas Detectors

Flammable and toxic gas detection instruments are generally available in two different formats: portable, i.e. 'spot reading' detectors and 'fixed', permanently sited monitors. Which of these types is most appropriate for a particular application will depend on several factors, including how often the area is accessed by personnel, site conditions, whether the hazard is permanent or transitory, how often testing is needed, and last but not least, the availability of finances.

Portable instruments probably account for nearly half of the total of all modern, electronic gas detectors in use today. In most countries, legislation also requires their use by anyone working in confined spaces such as sewers and underground telephone and electricity ducts. Generally, portable gas detectors are compact, robust, waterproof and lightweight and can be easily carried or attached to clothing. Portable gas detectors are available as single or multi-gas units.

Single gas units contain one sensor for the detection of a specific gas, whilst multi-gas units usually contain up to six different gas sensors (typically Oxygen, flammable, Carbon Monoxide and Hydrogen Sulphide). Products range from 'Simple Alarm' disposable units to advanced fully configurable and serviceable instruments with features such as datalogging, internal pump sampling, auto calibration routines and connectivity to other units.

Recent portable gas detector design advances include:

- The use of more robust and lightweight materials for construction
- The use of high power microprocessors, enabling enhanced datalogging and self-checking etc
- The employment of modular designs that allow simplified routine servicing and maintenance
- Battery advancements providing extended operating time between charges and a smaller battery pack



'Fixed', permanently sited monitors.





GAS FACT

Hydrogen Sulphide bubbling up from the sea may have caused a global extinction of flora and fauna nearly 250 million years ago.

Portable gas detectors are compact, robust, waterproof and lightweight and can be easily carried or attached to clothing.

Why are portable gas detectors so important?

Portable gas detectors are classed as a type of Personal Protective Equipment (PPE), designed to keep personnel safe from gas hazards and allow mobile testing of locations before they are entered.

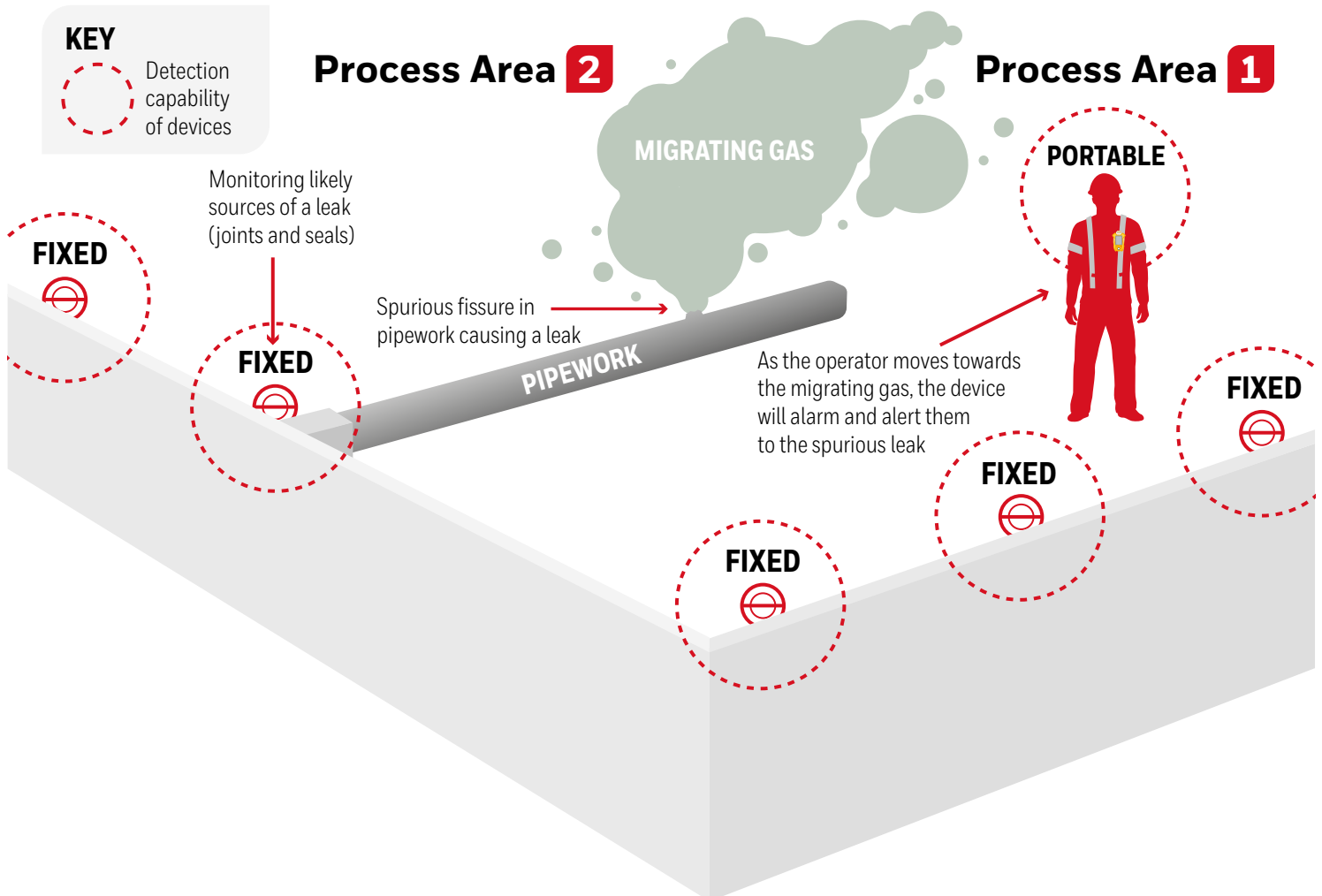
These small devices are essential in many areas where gas hazards could occur, because they are the only means of monitoring an operator's breathing zone continuously, whilst stationary and moving.

Although fixed gas detection does provide personnel protection in its own right, it cannot move with the operator, and this creates the possibility that the operator could enter an area beyond the detection perimeter of the fixed detector.

Many sites employ a mix of both fixed and portable gas detection, but sometimes portable gas detection is used on its own.

This choice may be made for the following reasons:

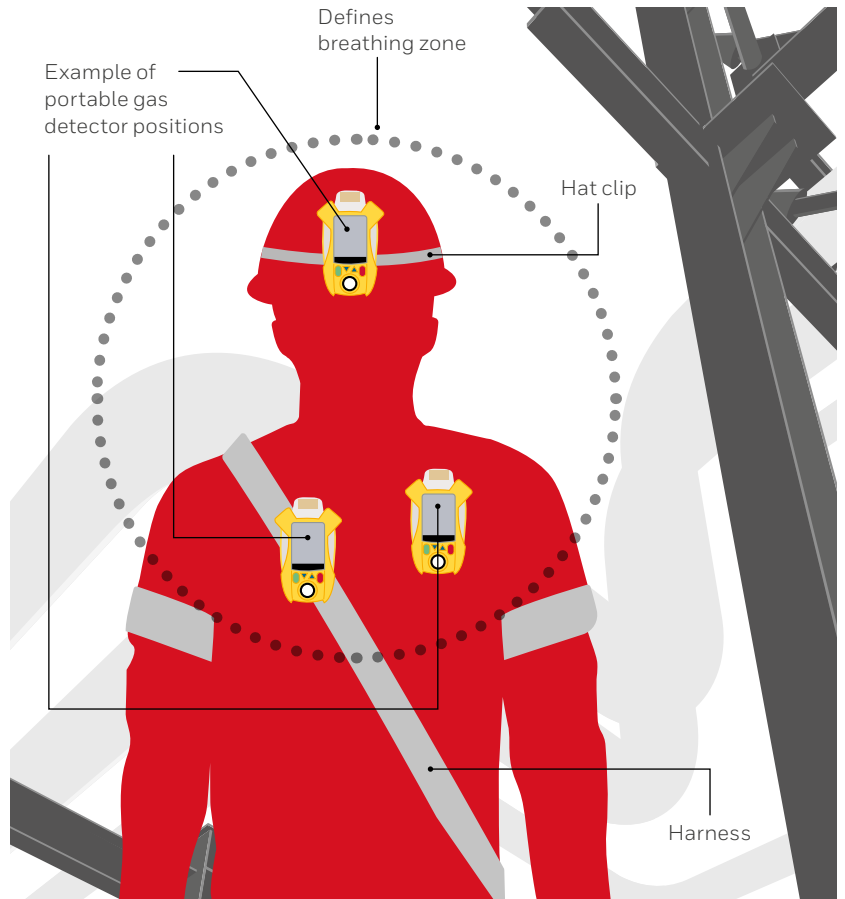
- The area may not be entered by personnel very often, making the addition of fixed gas detection cost-prohibitive
- The area may be small or hard to reach, making the placement of fixed gas detection impractical
- The application requiring detection may not be stationary itself. For example, when a Liquid Natural Gas tanker is offloading its cargo at the dock, the dock will be stationary, whilst the tanker itself will be moving due to the motion of the sea



Breathing zone

The breathing zone is defined as the 25 cm/10 inch radius of an operator’s mouth and nose.

A portable device can be fixed in various locations within the breathing zone including being fastened to jackets or to breast pockets (but never inside a pocket), or held in place by a harness/hat clip. It’s essential that the device is secure at all times.



Typical gases requiring portable detection

There are diverse applications and environments that require portable gas detection monitoring and numerous toxic and flammable gases may be encountered.

The most commonly detected gases include:

- Carbon Monoxide
- Carbon Dioxide
- Hydrogen Sulphide
- Oxygen depletion
- Flammable gases such as Methane, Liquid Petroleum Gas and Liquid Natural Gas
- Ammonia
- Sulphur Dioxide
- Chlorine
- Chlorine Dioxide
- Nitrous Oxide
- Nitrous Dioxide
- Phosphine
- Hydrogen Cyanide
- Ozone
- Various Volatile Organic Compounds (VOCs) including Acetone, Benzene, Toluene and Xylene

Due to the variety of applications and different processes undertaken, many additional gases may also be detected by portable devices.



Enhancing safety with portable gas detectors



Changing legislation and regulatory compliance, combined with evolving insurance pre-requisites are making the use of portable gas detectors more prevalent in many industries. There is a big drive within many sites to “enhance safety” and the integration of a portable gas detection fleet on site is one way of assisting with this.

In addition to legislated requirements (where compliance is mandatory), many sites also choose to implement site-specific rules; for example bump testing a portable gas detector before it is used by any operative.

Portable gas detector types

There are two primary types of portable gas detector:

- **Single gas** – devices that are designed to detect one gas.
- **Multi-gas** – devices that can detect multiple gases. Variants usually range from 4 gases up to 6 gases and tend to employ various detection principles in one unit.

When it comes to ongoing device operation and maintenance, portable detectors fall into two further groups:

- **Serviceable:** this means that the device is a long-term solution, requiring ongoing maintenance, which the operator can choose to carry out in-house or via a third party service provider.
- **Disposable:** this means that the device is a short-term solution (2 or 3 year) and does not require any maintenance during its operational life. This type of device is often continuously operational from first activation until its expiry.

Operational modes of a portable gas detector

Portable detectors can draw air in (known as sampling) or they can allow air to diffuse into the sensor, depending on the application needs:

- **Diffusion:** This is the mode that the portable device will be in the majority of the time it is being used for personnel breathing zone monitoring. As an operator enters an area where a concentration of gas is located, the gas will need to reach the sensor and diffuse into it for the detector to “see” the gas.
- **Sampling:** An integrated motorised pump or sample kit, which includes a hand aspirator, can allow a device to draw air towards the sensor. The ability to sample the air - either manually or using a motorised pump - is safety-critical when an area may contain hazards, because it allows an operator to check the air for gases before entering and breathing the air in.

The following picture shows two examples of Honeywell’s portable solutions – a single gas disposable device and also a multi-gas detector.





Features and functionality

Due to the diversity of applications and the hazards that are contained within them, the specification for portable gas detectors varies considerably.

The key functionality/specification aspects a portable device delivers and its associated value is detailed in the table below:



ASPECT	DESCRIPTION	VALUE
Display	The addition of a display allows the operator to see the monitoring results of the detector. Many devices feature a real-time display and this means that the device visually shows gas values to the operator as well as other operational icons.	Safety can be enhanced because an operator can see a rising gas value before the alarm is sounded. A display can also provide peace of mind to an operator, through the display of "correct operation" icons and aspects like the gases being detected and how many days until the next calibration. When it comes to disposable devices, a display can also advise of how many operational months are left.
Device protection (also known as Ingress Protection)	The Ingress Protection (IP) rating and impact resistance of a device indicates its suitability in challenging environments where water, dust, dirt and other materials may be located.	A device that is impact resistant and capable of being submerged in water will provide a flexible monitoring solution that can adapt to many application needs on site. In fact, water treatment and offshore applications require this protection. It also helps to ensure the longevity of a device.
Button operation	Some devices (including those provided by Honeywell), use large, single button operation designed to provide simplified interaction. Other devices may feature multiple buttons.	Large, single button operation allows an operator to work with the device more easily and also means that he/she does not need to remove gloves to activate the buttons. This can save considerable time over product life.
Integrated datalogging	An integrated datalogging capability means that any event (such as an alarm), is automatically stored in the device and can be downloaded later and used for reporting purposes by a portable fleet manager. The amount of data that can be logged will vary from device to device.	Integrated automatic datalogging helps to simplify and assist time-effective event reporting. It is also important to remember that many insurers stipulate detailed reporting.
Battery performance	Battery type, run time and also charge time can vary considerably from device to device.	A high performance, quick charge battery can provide the flexibility to cover long shifts or multiple shifts without needing to be re-charged. A shorter charge cycle can also reduce the number of portables required on site and the power consumption required over product life to charge devices.
Sensor integration types	Some devices allow individual sensors to be added or removed, whilst others use an integrated sensor cartridge.	Both aspects have their merits: the former allows flexibility in terms of being able to update one sensor if needed, but keeping other sensors intact. Conversely, an integrated sensor cartridge provides a quick and simple means of replacement, thus reducing the time and cost of maintenance over product life.
Motorised sampling pump	A motorised pump allows a device to draw air from a potentially hazardous area without having to enter it. Some devices feature integrated motorised pumps, whilst others don't.	Applications like confined spaces need to be tested before they can be entered. Testing using a device that can switch between diffusion and sample mode can save time over using a manual sample kit, which needs to be fitted to the device. The flow of air is also regulated with a motorised pump.
Alarms	Most devices feature visual, audible and vibrational alarms to alert operators to hazards.	It's essential that a device can get attention – even in high noise locations – so the use of multiple alarm types helps to ensure that an alarm event is never missed. Honeywell's portable gas detectors feature ultra-bright, wide angled alarms that can be seen easily, supported by loud audible and vibrational alarms that are guaranteed to demand attention in any application.
Visual compliance indicators	Some devices, like those from Honeywell, feature special visual indication LEDs that are automatically de-activated when the device is overdue for calibration or bump testing.	This aspect can improve site safety and assist considerably with fleet management activities because it makes non-compliant devices easier to spot, prompting operators to ensure their device is maintained in accordance with site standards.

Accessories

Portable gas detectors come with a wide range of accessories, which fall into the following categories:

Accessories designed to secure portable devices:

It's essential a portable gas detector is always securely fastened within the breathing zone. Many jobs demand the use of both hands, and there are various options available that allow a unit to be securely fastened comfortably.

- Lanyards/neck straps in various lengths, which allow the operator to wear a portable securely around his/her neck
- Hard hat clip allowing the device to be secured to the side of a hard hat
- Harnesses securing the device to the chest or other area of the body



Accessories designed to protect devices against water, dust and dirt ingress

Many applications requiring gas detection may be dirty, full of airborne particulates, dusts and water. If the unit is not properly protected, these elements can get into the device's sensor and prevent it being able to detect gas properly, which can be very dangerous. Additional protection can be provided by filters designed to prevent debris and water from getting into the unit and compromising its detection capabilities.

- Sensor protection filters (including hydrophobic and particulate)
- Water floatation aids



Accessories for power and charging

Sites can have varying shift lengths so it's important to choose the right power solutions that can meet requirements. Sometimes a number of operators may share a device, so there might not always be time to fully charge between shifts. Car charging kits and cradles provide easy charging on the move for operators who travel.

- Various battery options including Alkaline or Lithium batteries
- Rechargeable battery packs
- Vehicle charger adapters
- Cradles and accompanying chargers



Accessories designed to protect devices

Although many units are designed to be "concussion proof" an accidental drop can cause damage which could either compromise the unit's ability to detect gas and alert to a danger or could limit the operational life of the unit and make ongoing maintenance difficult. Additional protection can be used when working in challenging locations.

- Concussion proof boot
- Carrying holster
- Vehicle attachment



Accessories designed to facilitate air sampling

If a gas hazard could potentially be present in an area that an operator is planning on entering, the air should be sampled first, using a kit or pump that allows the air to be drawn. Entering an area without carrying out this test could result in death; especially when highly toxic gases could be present. Just one breath of 1000ppm of Hydrogen Sulphide is enough to kill.

- Manual hand aspirator
- Probe and flow tubing
- Test cap (allowing only sampled air to be drawn into the sensor)
- Pump module (a device that fits over the unit's sensors and allows air to be drawn)
- Honeywell produces integrated sampling kits and confined space entry kits for its full range of portable gas detection products



Accessories for datalogging

When datalogging directly to a PC or laptop is required, USB-based readers provide a quick and simple means of downloading data. Multi-media cards also allow additional data to be stored and held on compatible devices.

- USB memory card readers
- Multimedia cards



Alarms and status indication

Alarm types

A portable gas detector can be configured to alarm in various conditions, so that it can alert operators to certain hazard states.

The purpose of an alarm is to indicate an impending danger before it becomes safety-critical or dangerous to health.

- **Short-term exposure limit (STEL)**
(15 min duration)
- **Long-term exposure limit (LTEL)**
(8hr duration)
- **Low level alarm:**
This defines the low alarm set point
- **High level alarm:**
This defines the high alarm set point

Most portable gas detectors feature three alarm types – audible, visual and vibrational – designed to alert the operator to an alarm event, even in high noise areas, or when the portable gas detector is attached somewhere that the visual alarms cannot be seen (such as fixed to a hard hat).

As previously mentioned, a portable unit can be used in two key ways; to monitor the breathing zone of an operator (diffusion mode) or to pre-check an area before an operator enters a location that could contain hazardous gases.

Portables are particularly important when operators are working in areas where toxic gases are present that they can be exposed to for limited amounts of time and in limited concentrations. STEL and LTEL alarm types provide this protection and alert the operator when maximum exposure levels are reached.

Value-added visual status indication

The range from Honeywell also provides an additional value-added visual indicator that can enhance site safety considerably. IntelliFlash™, provides a clearly visible green LED indicator to show device compliance to site-standards.

When a device is not maintained correctly, the IntelliFlash™ indicator will switch off, highlighting device non-compliance to the operator and also the fleet manager.



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