

THE TOP SEVEN CRITICAL SAFETY CHALLENGES OF OIL & GAS TURNAROUNDS

| Understanding Gas Hazards and Risks



Honeywell

INTRODUCTION

Oil and gas processing take place in some of the world’s most hazardous work environments. Plant sites can combine challenging site conditions with work in confined spaces, on slick surfaces, using dangerous gases and chemicals, involving numerous types of equipment and machinery.

However, when normal operations give way to planned or unplanned turnarounds or shutdowns for maintenance or repair— there are even greater risks of worker injuries and deaths despite significant planning. These risks also have an impact on productivity as they may decrease uptime and efficiency.

Third party-managed temporary contractor crews swarm the site; headcounts can triple. Work focus shifts to inspection, maintenance, repair, upgrades, or new equipment installation — all against unforgiving deadlines. Infrequent and “non-work” work is performed in both usual and unusual work areas. Jobs take place above, under, and within areas seldom accessed, or normally off-limits. New tools and equipment appear, along with gasses and chemicals not usually present or accessible.

When compared to day-to-day operations, there are more risks — and they are more frequently unexpected. Safety solutions, practices, and training must be adjusted accordingly. Given the ruggedness of turnaround work and the temporary nature of many contractor crews, safety solutions recommendations should favor personal protection equipment (PPE) that features increased ease of use, durability, reliability, serviceability, and compactness of design.

In these situations, gas hazards pose unique risks. If workers are to be kept safe from toxic and flammable gas exposure, seven key areas of safety risk demand special attention. They’re identified here as The Top Seven Critical Safety Challenges of Oil & Gas Turnarounds. Managers should consider how their safety practices and products match the unique mix of safety hazards they may face.



CRITICAL CHALLENGE #1: CONFINED SPACES – DANGER IN THE HOLE

Confined spaces can be found in a myriad of industries and applications and are one of the most prevalent applications for portable gas detection, particularly during shutdowns and turnarounds.

There are two types of confined space:

- **A normal confined space.** No permit required.
- **A permit-required confined space.** In addition to the criteria defining a standard confined space, a permit required confined space will also have one or more of the following attributes:
 - Is known to contain (or has contained) a hazardous atmosphere
 - Is known to contain a recognized safety hazard
 - Is known to contain material with the potential for engulfment
 - The design of the space itself has the potential to trap or asphyxiate the operator entering the space

During turnarounds, commonly found confined spaces include: shafts, trenches, manholes, tunnels, tanks, and vessels.

Additional hazards stem from the physical restrictions of working in a confined space. These include restricted movement, reduced lighting and line of sight, communications challenges, impact risks, limited monitoring and rescue options, and more.

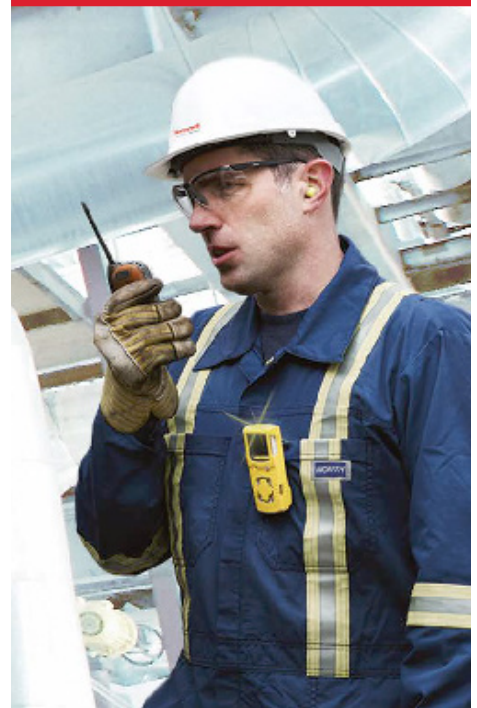
Due to the dangerous nature of confined spaces, in many cases a two-step portable monitoring procedure needs to be employed, at a minimum. The area must first be tested and then continuous monitoring of the space must take place for the duration that the operator is working within the confined space.

Example: Confined space stratified testing (Step 1)

Before entering the confined space, a portable gas detector combined with confined space entry accessories such as manual aspirator kits (if an integrated automatic sampling pump is not available), and a sample hose with probe should be used. This will allow the operator to be located outside of the confined space but be able to draw air from inside it so it can be tested by the portable gas detector. It's essential to sample the air at various levels from floor to ceiling - heavier-than-air gases will collect in low lying areas while lighter-than-air gases will collect at the highest levels.

A Confined Space is Defined as Being:

1. A space that has a limited or a restricted means of entry/exit
2. A space that is large enough for an operator to enter and perform certain tasks
3. A space that is not designed for constant worker occupancy
4. A space where ventilation may be poor, allowing gases to build up¹



- Pay special attention to uneven floors or ceilings that could allow high concentrations of gas to form
- Always sample at a distance from the opening; air can intrude into the confined space resulting in false readings and inaccurate Oxygen level data
- Once this full test has been conducted and no hazards have been found, a worker can enter the confined space

Example: Subsequent continuous monitoring (Step 2)

Even if no dangers are identified while performing the stratified testing, it is essential to monitor the confined space continuously to ensure the atmosphere remains safe. Always remember that the atmosphere can change quickly in a confined space.

- Use a 4-gas simultaneous portable gas monitoring solution; - 5 or 6 gas devices can be used for additional hazard coverage including Photoionization Detection (PID) sensors for the detection of low-level Volatile Organic Compounds (VOCs).

Depending on the application, numerous gases can be found in confined spaces. The atmosphere may contain a mix of flammable, toxic and oxygen-depleting gas hazard risks. The typical gases that may be encountered include but are not limited to:

- Oxygen (too high or too low)
- Carbon Monoxide
- Hydrogen Sulfide [all places]
- Methane
- Ammonia
- Chlorine
- Nitrogen Dioxide
- Sulfur [all places] Dioxide
- Hydrogen Cyanide

The Honeywell BW™ Ultra portable five-gas detector for confined spaces addresses the unique risks of this first critical safety challenge with extra detection and ultra protection. Explicitly designed for sampling and monitoring confined spaces, before and after entry, BW Ultra offers enhanced sensor technology, visibility on gas readings, comfort, and connectivity. This makes it more reliable and provides an intuitive user experience, helping prevent a potential gas safety incident within a confined workspace.

In use, the BW Ultra enables users to clear a confined space for entry and continual monitoring while workers are inside; regularly sample a confined space as part of permit requirements; and help protect personnel and operations. The BW Ultra simultaneously detects the four gases often required for monitoring confined spaces: oxygen (O2), hydrogen sulfide (H2S), carbon monoxide (CO), and combustibles at the lower explosive limit (LEL: % LEL or % vol). A fifth sensor monitors the user’s gas of choice, ranging from sulfur dioxide (SO2) to chlorine (Cl2) to volatile organic compounds (VOCs). It’s unique “Hole Watch Mode” includes a graphical representation of current gas conditions to facilitate quick decisions in critical situations. Moreover, an inert mode offers special provision for confined spaces monitoring of oxygen levels.



CRITICAL CHALLENGE #2: AREA GAS RELEASE – CLOUDS OF HAZARDS

The toxic nature of the many chemicals, solvents, and gasses utilized during maintenance operations in turnarounds/shutdowns represents a significant safety concern. While regular workers at the site may be adequately protected with risk-appropriate PPE, an area release of noxious gases, vapors, fumes, dust, or mists may present an unexpected airborne danger to personnel throughout the greater worksite – as well as to any surrounding population.

How can managers and workers provide a safe environment for all? Honeywell offers site-wide continuous area gas detection systems that ensure optimal safety during turnarounds and shutdowns by monitoring for airborne toxic or noxious gases – protecting onsite personnel and assets within a perimeter, while minimizing risk and annoyance to adjacent communities.

Portable wireless area monitors are an ideal solution for fenceline monitoring during turnarounds or shutdowns because they provide anywhere/anytime protection around the clock. Continuous area monitoring for airborne toxic or noxious gases can protect people and property inside a perimeter, and minimize risk and annoyance to the surrounding communities.

Honeywell's wireless area monitors are an ideal solution for fence line monitoring because they are cost effective to deploy, do not require wiring, have reduced upkeep, and provide around-the-clock protection. All systems offer visibility and simplified compliance by centralizing data collection and documentation.

Wireless gas detectors offer remote, real-time monitoring and data collection, aggregation, and data-logging for a permanent, time- and location-stamped, verifiable record. They can also provide real-time Internet-based alerts.

The Honeywell AreaRAE Plus and Honeywell BW™ RigRat detection systems provide superior detection of toxic and combustible gases and VOCs, plus wind speed, direction, and humidity – all in one easy-to-configure device. The unit details threats happening in real time to arm users with the information needed for quick action. Features include: monitors up to seven threats, including VOCs, combustibles, toxics, and oxygen; optional meteorological sensor for tracking toxic plumes; 7R+ photoionization detector (PID) for monitoring VOCs at parts per billion; secondary radio module (Mesh) to act as a communication hub for other wireless devices; and ruggedized, portable, and weather-resistant design for harsh environments.

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Colorimetric Gas Detection Tubes are a low-cost option for quick, accurate, on-the-spot, compound-specific measurement of a wide range of toxic and combustible gases and vapors. The spring-less piston design ensures precise draws. A wide assortment of tubes is available to detect over 300 gases and vapors. Results are easy to read with sharp, clear color changes. No calibration or other maintenance is required.

Finally, the Honeywell RAE MeshGuard system leads the industry in wireless gas detection for upstream oil and gas facilities. It combines the most advanced technologies available for both detection and connected data systems — via its field-ready intrinsically safe sensors, safe area Touch Point Plus Wireless controller, plus range extender (wireless router/repeaters), data readers, and alarms. Safety personnel get up-to-date information from a network that quickly relays data regarding dangerous gases to an easy-to-understand central system. Users get fast, cost-effective installation and deployment of real-time detection for both toxic and flammable gases. The MeshGuard system helps you save lives — as well as saving tens of thousands of dollars in regulatory compliance and information processing, with full support for the Safety Suite software platform.

Honeywell's fixed and portable wireless gas detection solutions help you maximize turnaround and shutdown efficiency, reduce downtime, and — in case of an area release incident — provide the critical information necessary to both notify and ensure the safety of workers and the public.

CRITICAL CHALLENGE #3: STAYING AHEAD OF BENZENE RISK

Benzene is a chemical commonly used in the production and processing of fuels and other chemicals. It is also a natural part of crude oil and gasoline. Benzene is a colorless, flammable liquid which the US Environmental Protection Agency (EPA) classifies as a known human carcinogen.

Federal regulations limit exposure to benzene in the workplace. Because of its toxicity and flammability, exposure to benzene can pose a significant risk to crews during turnarounds. BW Ultra is one of the first gas detectors on the market to isolate and give a direct reading for the presence of benzene.

The Honeywell RAE UltraRAE 3000+ portable, wireless advanced VOC monitor features benzene-specific technology. It's one of the world's most advanced compound-specific monitors — and one of the few that delivers accurate measurement of benzene from



10 ppb to 200 ppm, and of other VOCs up to 10,000 ppm. A 60-second response for a benzene measurement snapshot and a unique 15-minute benzene STEL measurement provide excellent versatility for entry prescreening, marine spill response, and refinery downstream monitoring.

The MultiRAE Benzene monitor combines the ability to make quick benzene-specific assessment (“snapshot”) measurements with the advantages of a versatile multi-gas monitor that can support approximately 20 intelligent interchangeable sensor options. Its optional wireless capability improves safety by providing real-time access to instrument readings and alarm status from any location, which delivers better situational awareness and faster incident response in a wide range of different applications, including planned shutdowns and turnarounds so workers can make a fast and accurate “go” or “no go” decisions.

The MultiRAE Benzene’s design and construction are ideal for turnarounds, boasting one of the largest display and one of the longest battery runtime in its class (with an optional extended battery), as well as an ergonomically contoured case that is rugged, dust-tight and waterproof (IP-65 rating (pumped)).

A compartmentalized design of the MultiRAE Benzene makes the replacement of its intelligent sensors, pump, and plug-and-play battery simple, even in the field, and the AutoRAE 2 Automatic Test and Calibration System ensures bump testing and calibration of up to 10 instruments is as easy as a press of a button.

When deployed on the Honeywell Dedicated Wireless Network, the MultiRAE Benzene provides safety officers wireless access to real-time instrument readings and alarm status for better visibility and faster incident response.

CRITICAL CHALLENGE #4: MANAGING AND MONITORING

Potential for Chaos (Realtime Monitoring)

The many, varied, and hectic tasks occurring during a turnaround/shutdown operation could easily look like organized chaos to an outsider.

In addition to all this activity, managers must perform site-wide PPE asset inventory management – do all contract workers, for example, possess and use the correct monitors for the task and the workspace? Moreover, managers must cope with the administration and supervision of the operation’s overall safety practices and regulatory/compliance requirements.

As a result, today’s safety managers use monitors as intelligent management tools rather than just compliance reporting instruments.

Honeywell Connected Worker Remote Monitoring Solutions combine wireless, wearable safety, health, and position tracking with complex yet easy-to-use software that reliably keeps safety managers and workers connected 24/7. Honeywell Safety Suite Safety Suite is the



one of the industry's first truly integrated site-wide safety solution. It couples fixed, portable, and threat detection monitors showing worker status and location information including software-based data logging, training, and inventory management tracking and integration to workflow and process software.

Honeywell Safety Suite delivers real-time safety awareness – to help you maximize safety, productivity, and compliance. The solutions combine a wide range of wireless portable gas detectors with real-time monitoring software. Vital safety data is no longer limited to the worker using the device. Instead, the data from each detector— such as threat readings, alarms, man-down status, compliance status, worker location, and other information – is sent instantly to a map-based display or handheld device. This gives managers centralized command and control of workers' safety, productivity, and compliance. Available with multiple options, Honeywell Safety Suite enables the remote monitoring of safety, productivity, and compliance – for a lone worker or the entire site.

The Honeywell Safety Suite wirelessly delivers real-time personal and point threat-detection data on toxic gases and radiation, plus workers'/responders' locations. It provides situational awareness; tracks and identifies toxic chemicals, radiation, and plumes; and enables faster data-driven decision making to protect workers and the public while reducing incident response times. Honeywell Safety Suite integrates instrument data and alarm status from hundreds of toxic gas and radiation monitors on a single dynamic map. It allows this information to be shared by multiple plant managers or responder teams through a secure Internet connection. The real-time data can be viewed remotely on a PC, smartphone, or tablet. Honeywell Safety Suite provides advanced device management that enables managers to oversee their fleet of monitors and track worker device assignments. Honeywell Safety Suite can automate common tasks and create custom alerts that improve worker productivity.

The Honeywell IntelliDoX® automated fleet management system combines smart docking modules and Safety Suite to provide automated instrument management for Honeywell BW™ Icon, Honeywell BW™ Flex, Honeywell BW™ Solo, Honeywell BW™ Ultra, Honeywell BW™ Max XT II, Honeywell BW Clip® Series, Honeywell BW™ Clip4 and Honeywell BW™ MicroClip Series gas detectors. IntelliDoX performs the quickest bump test in the industry for increased uptime and no wasted calibration gas.

It can perform five bump tests simultaneously from a single gas source helping to drive productivity, reliability and efficiency during shutdowns and turnarounds. Its ability to enable bump test tracking, sending email notices and easy record-keeping helps improve compliance.

Value-added visual status indication

The product 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. The visible flashing green IntelliFlash™ allow managers and supervisors to quickly verify compliance at a glance -even from distance- ensuring that all the gas monitors being worn on site are functioning properly. This feature also encourages self-policing among workers as they can easily see their own and their co-worker's signal. 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. This kind of simplicity has another important benefit: providing equipment that works consistently and is easy to use is the best way to ensure workers will use it consistently.



CRITICAL CHALLENGE #5: HOT WORK PERMITTING – UNCERTAINTY IN THE AIR

Between maintenance, repair, and new equipment installation, a turnaround often demands one or more “hot work” projects. OSHA defines the hazards of these tasks this way: “Workers performing hot work such as welding, cutting, brazing, soldering, and grinding are exposed to the risk of fires and explosions from the ignition of flammable or combustible materials in the space, and leaks of flammable gas into the space, from hot work equipment.”

Besides any local, state, or federal regulations, companies and contractors may (and should) develop their own safety procedures for hot work. This will include requiring an inspection of the area before the work starts for hazards and safety devices, and mandating that a permit be signed to show that the site has been cleared for this activity. One state defines this document as “a permit issued (by the authorizing individual designated by management) which shall not be valid for more than 24 hours. Information on the permit should include work location, type of hot work, the work to be done, the operator, duration, equipment, and controls to ensure safety.”

Because turnarounds often span shift changes. In many cases, each shift will necessitate writing a fresh safety permit, good only during that specific shift.

Hot work conducted in confined spaces takes special caution. Fire watch or safety personnel should ensure that sufficient time has elapsed to purge any vapors from the space before entry and hot work takes place. Gas detectors must conduct atmospheric monitoring during the event to make sure oxygen levels are too low to support combustion.. This requires “inerting” features, to ensure that workspace atmospheres are inert and present no danger from combustion due to the presence of oxygen.

The Honeywell BW™ Ultra has a patented Intelligent Inert mode which allows users to safely and simply measure low levels of oxygen (inert atmospheres). To do so, it automatically adjusts O2 alarm levels from descending alarms (needed for monitoring in normal environments) to ascending alarms (required for monitoring in inert environments).

For additional hot work safety, Honeywell offers products for wireless detection and reporting of worksite temperatures. The data can be monitored by safety managers at a central and remote location to make sure that workers are safe at every location on the site.



CRITICAL CHALLENGE #6: **QUALITY/RELIABILITY –** **HARSH REALITIES**

In the oil and gas world, shutdowns and turnarounds create high-stress environments that demand even more than usual from people and products. One harsh reality of these challenging times on the job site: during turnarounds, even critical safety devices can encounter issues.

When that happens, any resulting downtime for repairs or supply chain delays, or for re-monitoring or remediation of suspect areas, can be catastrophic for schedules already close to their own breaking points.

So for most contractors evaluating gas detection equipment, after fundamental concerns about safety, quality must be a paramount concern — because quality translates to reliability. A good product is a reliable asset. Will this product do the job? Will it provide trouble-free operation for years, to avoid downtime and ensure a proper return on investment? Is it covered by an adequate warranty, just in case? Is it from a reliable supplier? Can they adequately stock on-site inventory, and easily and quickly resupply in case of failure, damage, or an unplanned demand for additional units?

Experienced managers may equip their workers only with items from a shortlist of trusted products. The list would be limited to products that the manager knows have proven to meet all his or her specifications for ensuring safety, productivity, and profitability. Honeywell gas detection solutions offer longevity in the field.



CRITICAL CHALLENGE #7: DATA COLLECTION – BRINGING ORDER TO CHAOS

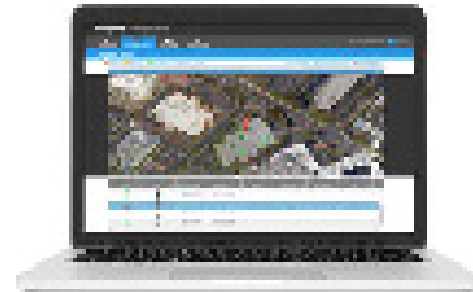
In a hectic turnaround situation, with contractor personnel scattered all over the site performing all sorts of work, proper handling of safety and compliance data is more important than ever. Managers must be prepared to meet any inquiries with the right information at any time.

Safety data may be requested by contracting company officials, auditors, regulators, and other compliance authorities. Thus comprehensive information must be collected, organized, stored, and kept available. Managers must be able to show that each worker or work area is protected with the appropriate and properly functioning PPE and safety solutions. Often, they must provide information about the equipment's specifications, certifications, and operating status. For example, with a gas detection device: Is it configured to monitor the appropriate gas or gases for the task or the worksite? Is its battery charged? Has it undergone a bump test (checking the functionality of sensors and alarms) at the beginning or end of each shift? Also, is each worker documented as receiving the appropriate training in its use?

Fortunately, modern safety equipment can help. The Honeywell Safety Suite fleet management offerings enable data collection and archival for a wide range of RAE Systems and BW portable gas detectors. Safety Suite provides both PC-based and cloud-based solutions for collecting, storing and analyzing the safety data from small and local to very large and distributed operations.

Many Honeywell gas detection products also operate with or connect to ProRAE Guardian Cloud software (see above). Its features of particular interest for compliance data handling include activity automation for calibration, bump test, and report generation; remote notifications via email and text messages; and worker-instrument association.

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ADDRESSING THE SEVEN CRITICAL CHALLENGES

Honeywell gas detection solutions can help you ensure optimal safety during turnarounds/ shutdowns. They're the best way for a management team to keep track of all aspects of the seven critical challenges of turnaround safety with confidence and ease.

When the situation includes on-site contractors, extensive confined space work activity, area gas release potential, expanded management and monitoring needs, license requirements for hazardous activities, data compliance demands, and an overall increased potential for incidents, Honeywell's fixed and portable gas detection solutions can help you maximize turnaround efficiency, reduce downtime, and follow the most direct path back to full production. The availability of wireless gas detection monitors delivers comprehensive detection that can be monitored anywhere/anytime. They help you protect employees, contractors and the facility, and offer visibility and simplified compliance by centralizing data collection and documentation.

1-<https://www.osha.gov/confined-spaces>

For More Information

For more information, visit the Honeywell:
<https://sps.honeywell.com/>

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