Honeywell

TENAQUIP

INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS

Information Webinar

2016.06.07

PORTABLE SAFETY GAS DETECTION

Experts in Gas Detection

AGENDA

- Atmospheric Gas Hazards
- Gas detector requirement considerations
- Calibration – Bump Testing
- An important life safety device
- A safe workplace is the law
- Q & A

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

What is Gas?

Gases are all around us

- The air we breathe is made up of several different gases including Nitrogen, Oxygen and Carbon Dioxide – simply put, gas is a state of matter characterised by randomly diffused molecules with no definite shape or volume – in Grade 2 science we begin to learn about the states of matter – solid, liquid, **gas,** plasma
- Gases can be created naturally or through anthropogenic activity
- Gases are used everyday to cook, heat our homes, barbeque...
- A vapour is the gaseous phase of a substance that, under ordinary conditions, exists as a liquid or solid.

A Breath of Fresh Air

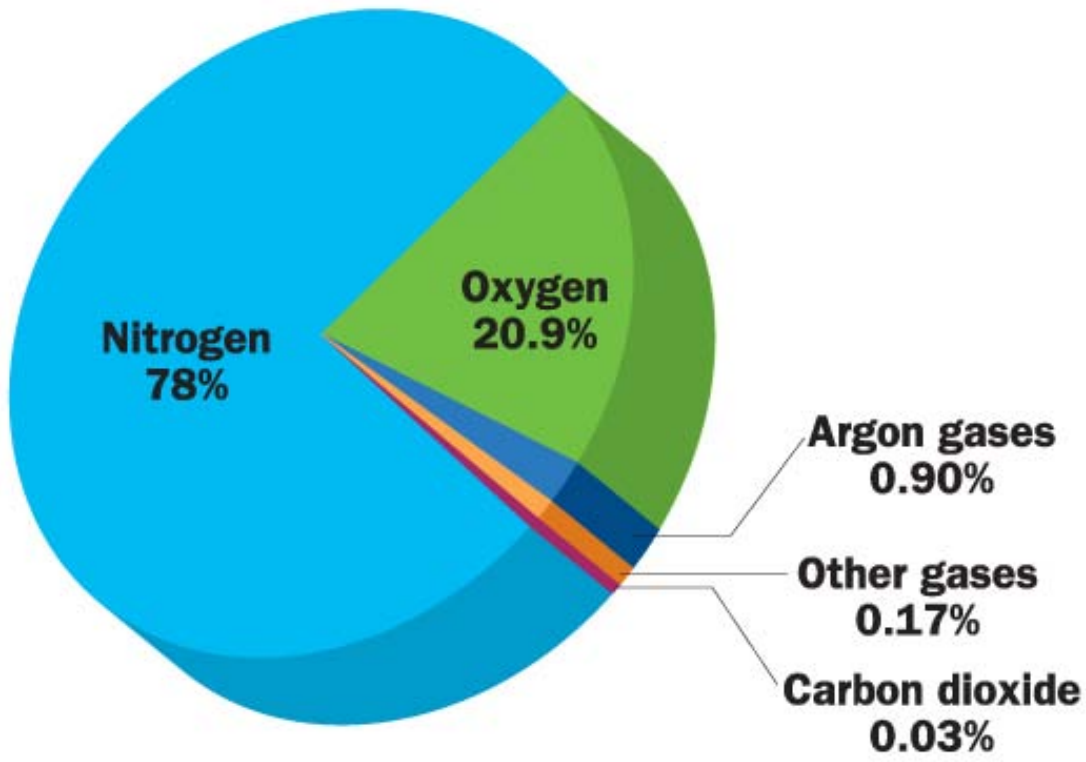
Average molecular weight of dry air is 28.97g/mol

Composition (Mole percent):

N_2	78.084
O_2	20.947
Ar	0.934
CO_2	0.0400
Ne	0.001818
He	0.000524
CH_4	0.00017
Kr	0.000114
H_2	0.000053

Other trace gases include:

O_3, CO, Xe, SO_2, NO_2, NH_3



Honeywell

TENAQUIP

INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS

Information Webinar

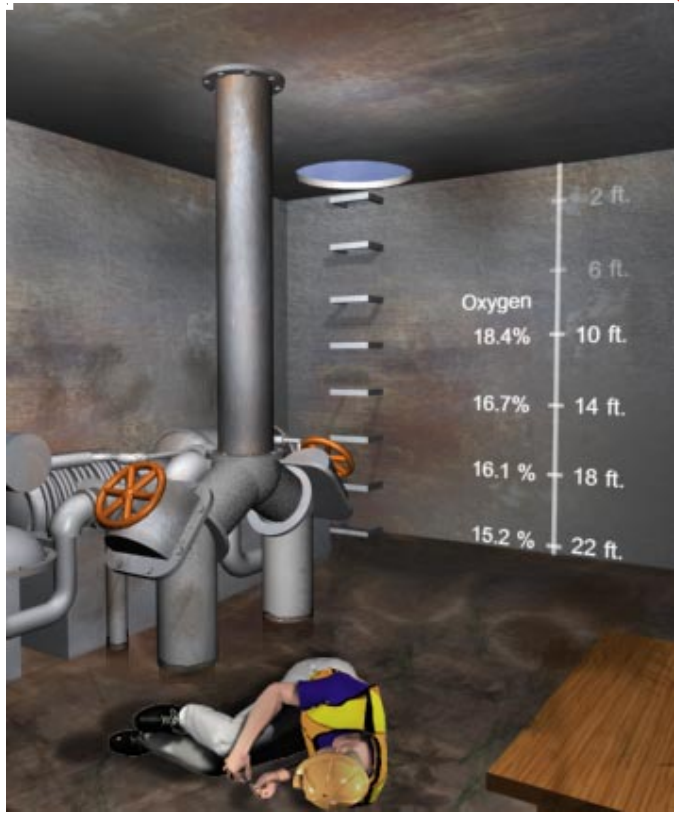
2016.06.07

WORKPLACE ATMOSPHERIC GAS HAZARDS

Experts in Gas Detection

3 basic atmospheric gas hazards

- Oxygen (deficiency and enrichment)
- Flammable gases and vapours
- Toxic contaminants



Hazardous Atmosphere: any atmosphere that is oxygen deficient or oxygen enriched, exceeds relevant occupational exposure limits, presents a fire or explosion hazard, or contains an airborne toxic or disease-producing contaminant in concentrations deemed hazardous by a competent person.

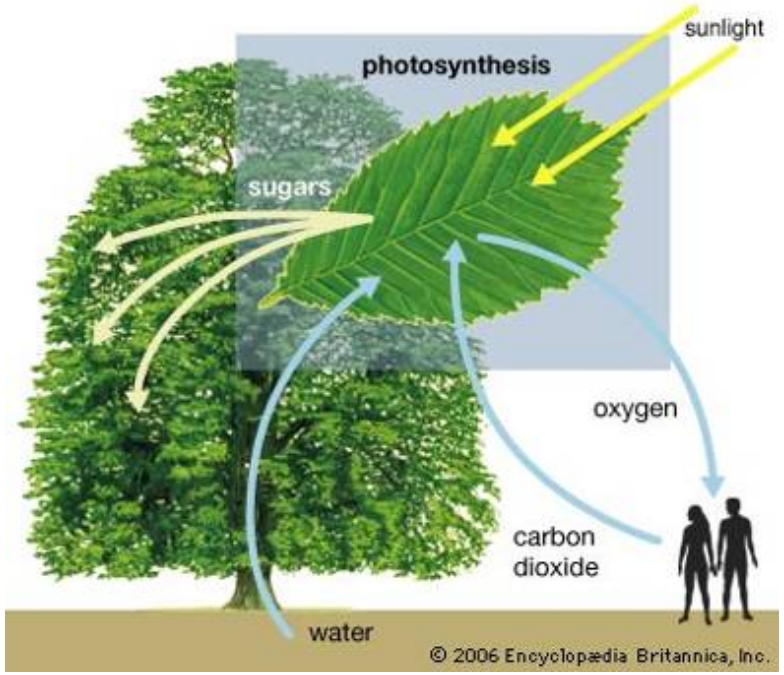
TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Oxygen Hazards

Oxygen measurement to warn of changes in oxygen concentration from 20.9% v/v

Depletion:

- Oxygen supports life
- Concentration <10% v/v O_2 fatal
- Alarm will activate at *19.5% v/v O_2



Enrichment:

Concentrations of O_2 above 20.9% v/v change properties of combustion

Combustible gases/vapours can ignite in concentrations lower than the LEL and explosions can be more violent

Alarm will activate at *23.5% v/v O_2

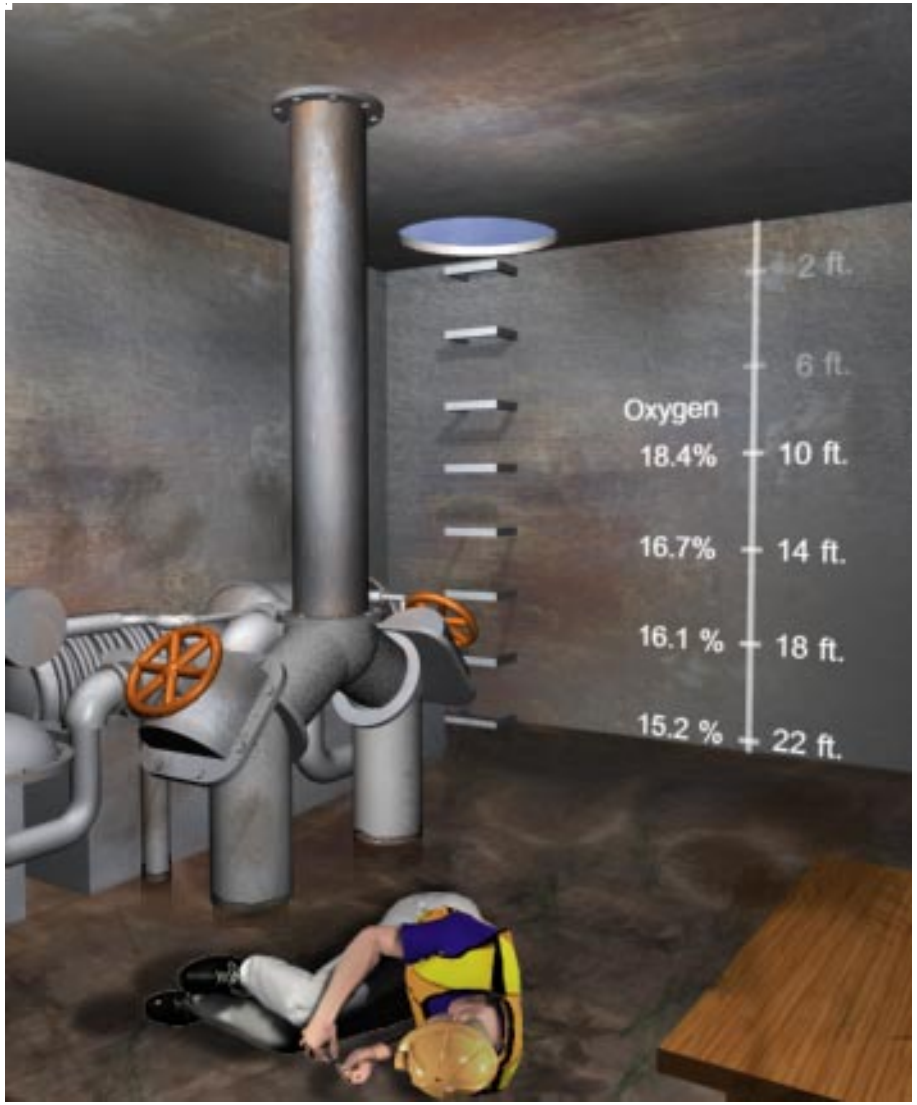
*** Typical alarm values**

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Oxygen Deficiency

IMPORTANT:

- the oxygen concentration may vary within a confined space
- monitoring the space at all levels prior to entry is essential
- ideally, for adequate warning of changes in atmospheric conditions each worker will be wearing a multi-gas monitor while working



TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Apollo 1 Oxygen Enrichment Tragedy

- January 27th 1967 Flash fire due to 100% Oxygen environment inside the Apollo 1 Command Module

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Combustible gas hazards

West Texas fertilizer plant explosion 2013.04.18 – industrial fires and explosions are often catastrophic

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Its rotten egg smell is easily detected…

Excerpt from a Toronto Star article 2011 May 01

RCMP say three workers were doing maintenance on a gas line off Highway 47 near Fox Creek on Saturday evening when hydrogen sulphide began to leak. Firefighters from Fox Creek donned breathing packs and were able to get the two workers out, but one of the workers died at the scene.

Hydrogen sulphide is extremely toxic and occurs in natural gas as a result of decaying organic matter that contains sulphur. **Its rotten-egg smell is easily detected at low concentrations, but at higher levels can paralyze the olfactory nerves, meaning a person may be in the most danger when they can no longer smell it.**

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

The source of the deadly gas was a car…

Excerpt from the Calgary Herald 2014 July 01

A fatality inquiry report into a senior's death from carbon monoxide poisoning calls for better public education of Albertans about the dangers of the toxic gas. Carbon Monoxide is often referred to as the "Silent Killer"!

Susannah Klassen died and seven occupants of Sunshine Villas were hospitalized in 2008 after the **odourless** fumes entered their condominium complex. The source of the deadly gas was a car that had been left running in a parking garage, producing levels that were more than 10 times above those needed to trigger a detector and high enough to cause convulsions and coma.

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Honeywell

TENAQUIP

INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS

Information Webinar

2016.06.07

WHAT TO LOOK FOR IN A GAS DETECTOR

Experts in Gas Detection

What is this Device?

Portable Safety Gas Detector

- Portable safety gas detectors are designed to detect and alarm workers to the presence of potentially life threatening ambient atmospheric gas hazards.
- Detects gas in the immediate atmosphere - target gas molecules diffuse into the sensor - the detector experiences what the person wearing the detector is experiencing.
- When using a sample draw system the readings will be representative of the atmosphere at the end of the sampling tubing

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Gas Detector Selection Considerations

Ease of use	• One button operation • Simplified training
Compliance	• Compliance at a glance • Tamper-proof settings
Quality	• ≈ 1% COPQ • World-class manufacturing
Durability	• Rugged design • Designed for harsh environments
Low cost of ownership	• Automated fleet management • Low or zero maintenance

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

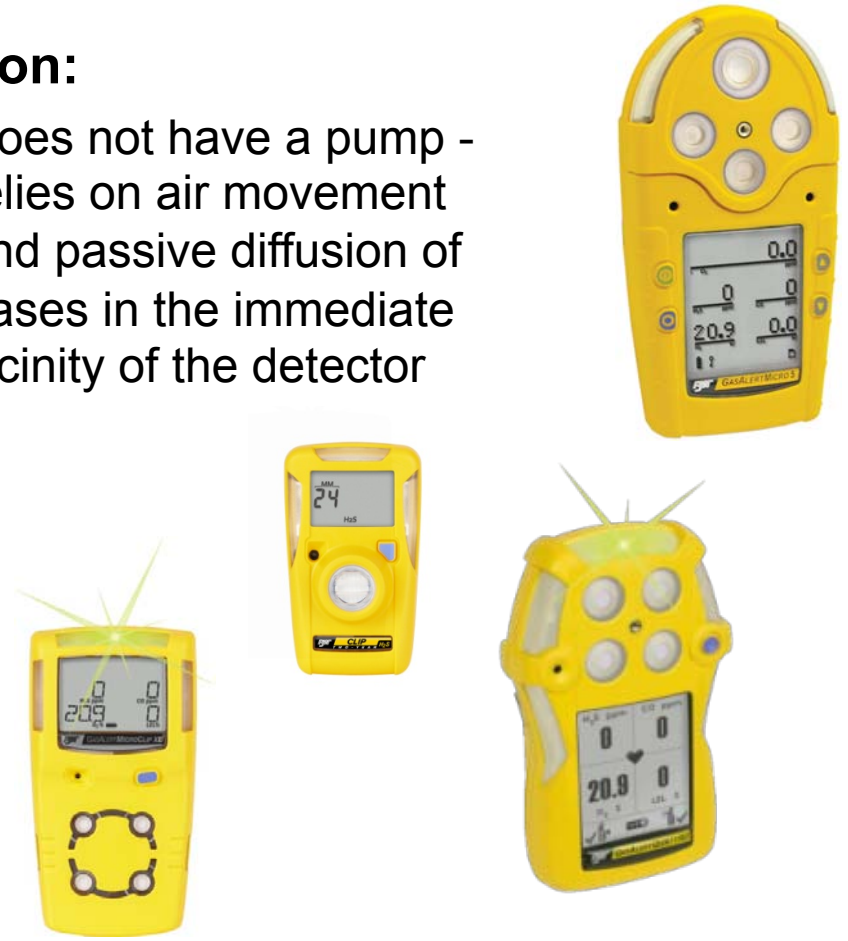
Sample-Draw or Diffusion

Sample-Draw:

- actively draws air to the sensor(s) through the pump inlet from the immediate atmosphere, or from a remote location using appropriate sample tubing and accessories

Diffusion:

- Does not have a pump - relies on air movement and passive diffusion of gases in the immediate vicinity of the detector



TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Sensing Technologies

At the heart of every gas detection measurement is a sensor - Honeywell Portable Safety Gas Detector Sensing Technologies

- Electrochemical - oxygen; toxic gases
- Catalytic bead – combustible gases
- Photoionization (PID) – toxic gases; VOCs
- Non-dispersive infrared (NDIR) – CO_2 ; combustible gases

CITY TECHNOLOGY

AT THE HEART OF GAS DETECTION

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS

Honeywell

Honeywell

TENAQUIP

INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS

Information Webinar

2016.01.25

CALIBRATION AND BUMP TESTING

Experts in Gas Detection

Calibration – Bump Testing?

- How often do I need to calibrate our portable safety gas detectors? Once a month; once every 3 months; once every 6 months; never???
- How often do our portable safety gas detectors require a bump test? Every day; once a week; more than once per day???
- What is the difference between calibration and bump testing?

I'm so confused!

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Calibration, BUMP Testing and Verification

Calibration: The adjustment of sensor response accuracy to a known concentration of target gas.

Bump test: A *qualitative* test confirming sensor response to target gas and verification of alarm function

Calibration Verification: A *quantitative* test with a known concentration of target gas to confirm sensor response accuracy and verification of alarm function

DOCUMENT ALL TESTING……IF IT WASN'T DOCUMENTED IT DIDN'T HAPPEN

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Calibration and Bump Testing

- BW Technologies by Honeywell recommend calibrating prior to first time use and then at least every 180 days
- Bump test all “direct reading” portable safety gas detectors prior to each day’s use at a minimum
- Calibrate if the portable safety gas detector fails a Bump test or Calibration Verification
- It does not harm the portable safety gas detection sensor(s) if calibration or Bump Testing is done more frequently

Calibration and Bump Testing

So, is it dangerous to use a cylinder that contains 25 ppm H_2S?

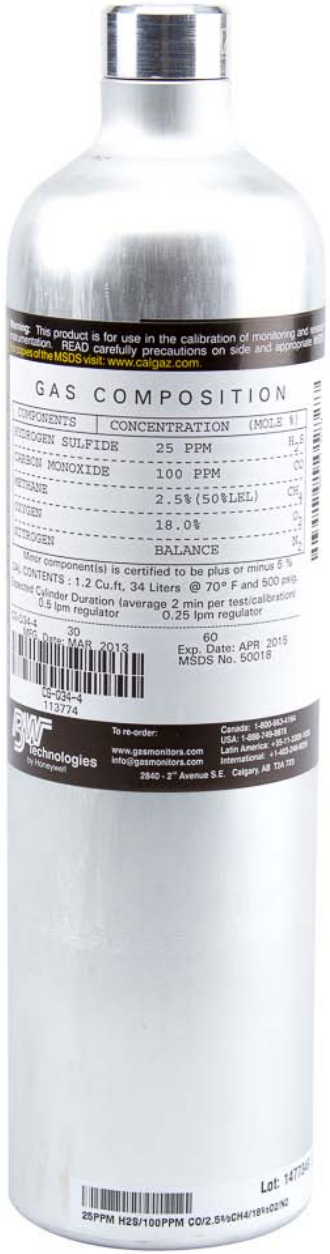
34 liters = 1.2 cubic feet

10 X 10 X 10 room = 1,000 cubic feet

1.2 cubic feet = 0.12% of the volume of the entire room

25 ppm X .0012 = 0.03 ppm H_2S

In a 10 x 10 x 10 room 25 ppm H_2S dissipates to a concentration of 0.03 ppm



TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Substances that may affect sensors

Quick Reference Guide

Sensor Poisons and Contaminants

Several cleaners, solvents, and lubricants can contaminate and cause permanent damage to sensors. Before using cleaners, solvents, and lubricants in close proximity to the detector sensors, read and adhere to the following caution and table.

⚠ Caution

Use only the following BW Technologies by Honeywell recommended products and procedures:

- **Use water based cleaners.**
- **Use non-alcohol based cleaners.**
- **Clean the exterior with a soft, damp cloth.**
- **Do not use soaps, polishes, or solvents.**

The following table lists common products to avoid using around sensors.

Cleaners and Lubricants	Silicones	Aerosols
Brake cleaners	Silicone cleaners and protectants	Bug repellents and sprays
Lubricants	Silicone based adhesives, sealants, and gels	Lubricants
Rust inhibitors	Hand/body and medicinal creams containing silicone	Rust inhibitors
Window and glass cleaners	Tissues containing silicone	Window cleaners
Dishsoaps	Mold releasing agents	
Citrus based cleaners	Polishes	
Alcohol based cleaners		
Hand sanitizers		
Anionic detergents		
Methanol (fuels and antifreezes)		

Inadvertent combustible gas sensor poisoning?

- Volatile silicones:
  - Lubricants such as WD-40
  - Rust inhibitors
  - Plastic and rubber revival products such as ARMOR ALL
  - Waxes and polishes
  - Personal care products with ingredients such as cyclomethicone & polydimethylsiloxane
  - Heat transfer fluids
  - Silicone greases and oils
  - Caulking materials…
- Hydrogen sulphide and other sulphur containing compounds
- Phosphates and phosphorus containing substances
- Lead containing compounds (especially tetraethyl lead)
- Over Exposure to combustible gases

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

A simple test that could save your life!

Bump Test

- The safest course of action is to expose the sensors to a concentration of target gas that is capable of initiating a low alarm condition before each day's use!
- Even a manual Bump Test is very simple and takes only a few seconds to accomplish
- While in operating mode simply apply a concentration of gas that is capable of activating the alarms and meeting CSA criteria for the LEL sensor
- Automated BUMP test, calibration and record systems make the test even simpler and eliminate any human subjectivity

The only thing worse than a portable safety gas detector that you know doesn't work, is a portable safety gas detector that you don't know doesn't work!

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

ISEA Statement Excerpt

Validation of an instrument's operability should be conducted if any of the following conditions or events occurs during use:

i. Chronic exposures to, and use in, extreme environmental conditions, such as high/low temperature and humidity, and high levels of airborne particulates.

ii. Exposure to high (over range) concentrations of the target gases and vapors.

iii. Chronic or acute exposure of catalytic hot-bead LEL sensors to poisons and inhibitors. These include volatile silicones, hydride gases, halogenated hydrocarbons, and sulfide gases.

iv. Chronic or acute exposure of electrochemical toxic gas sensors to solvent vapors and highly corrosive gases.

v. Harsh storage and operating conditions, such as when a portable gas monitor is dropped onto a hard surface or submerged in liquid. Handling/jostling of the monitors that can create enough vibration or shock over time to affect electronic components and circuitry.

vi. Change in custody of the monitor.

vii. Change in work conditions that might have an adverse effect on sensors.

viii. Any other conditions that would potentially affect the performance of the monitor.

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Do you want fries with that?

Gas Detectors

Single-gas or multi-gas?

Pumped or diffusion?

Power requirements?

Regular Maintenance

Calibration gas?

Regulator?

Tubing?

Accessories

Carrying cases?

Power options?

Spares?

TENAQUIP

INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS

Honeywell

Honeywell

TENAQUIP

INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS

Information Webinar

2016.01.25

AN IMPORTANT LIFE SAFETY DEVICE

Experts in Gas Detection

Prior to use

- Understand the operation of the detector
- Understand and Follow appropriate regulations and/or corporate safety procedures
- Visually inspect the gas detector to ensure there are no cracks in the display or housing – cracks may compromise intrinsic safety and ingress protection
- Ensure sensor and alarm ports are clean and unobstructed
- Verify sensor response and alarm activation before each day's use at a minimum – BUMP test
- Calibrate as required
- Be aware of the operating specifications for the detector
- Only turn the detector on, or zero sensors in "**fresh air**" – (0 ppm toxic gases; 0% LEL combustible 20.9% O_2)

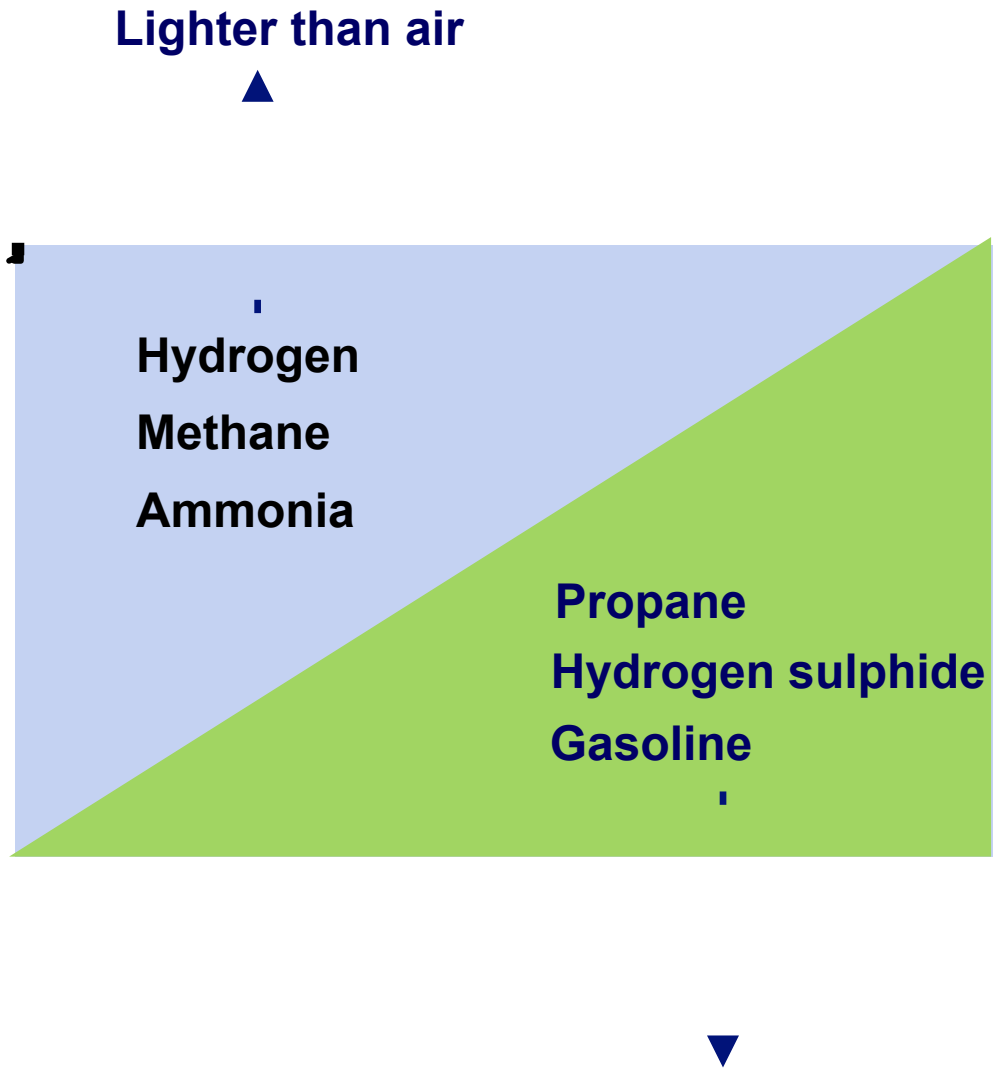
Cautions

- Over exposure can damage sensors permanently – anytime a sensor goes OL (Over Limit) the sensor performance should be verified – these are not leak detectors
- Avoid exposing sensors to airborne compounds that can affect sensor performance – eg: alcohols such as methanol; volatile citrus vapours; volatile silicone vapours…see slide “Substances to Avoid”
- These are not H_2O detectors
- Do not leave portable safety gas detectors in vehicles 24/7/365
- Take appropriate action to an alarm condition – do not ignore alarms if you don’t believe what the gas detector is telling you
- Minimize use of detectors under conditions that exceed the operating specifications
- Use only recommended battery types

Understand the Hazards!

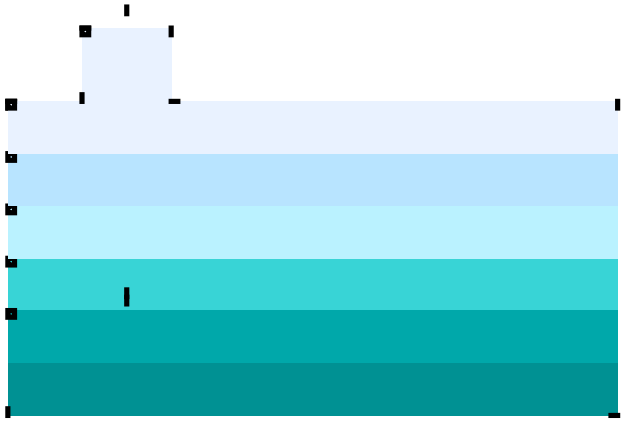
Gases are not ideal; they have different properties

- Molecular weight of air: 28.966
- Gases lighter than air tend to rise; gases heavier than air tend to sink
- Know as much as possible about the hazards you are dealing with
- Always assume the worst case scenario



Confined Spaces are Dangerous Places!

Understand the hazards – be aware of gas stratification



- Atmospheric hazards in a confined space can be found at various levels
- **CHECK ALL LEVELS**! Atmosphere tested (at least) approximately every 4 feet (1.22 m) in the direction of travel and to each side
- Allow sufficient time for all sensors to react to each sample per level tested. Key response factors are hose length (typical 2 seconds per foot flow rate) plus T90 sensor(s) response time
- **Example:** 10 feet hose x 2 seconds = 20 seconds plus most significant T90 of monitor's sensors (approximately 30 seconds for standard 4 gas detector). (10 x 2) + 30 = 50 seconds per level minimum
- If any gas is present during sampling it is essential to continue testing until readings remain stable (T100 response)

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Guidelines for Remote Sampling

- It is essential to verify the integrity of the sampling train before use; any leaks in the sampling equipment can dilute the sample resulting in readings that may understate an existing hazard.
- Always allow sufficient time for sample to reach sensors and then at least 60 seconds for readings to stabilize; or, continue sampling until readings stabilize.

::

Instrument	Max Tubing Length	Sec/foot or pumps/ foot
GasAlertMax XT II	23 m/75 feet	2 sec
GasAlertMicro 5 Series	20 m/66 feet	3 sec
Impact PRO	20 m/66 feet	2 sec
PhD 6	30 m/100 feet	2 sec
MultiPro	15 m/ 50 feet	2 sec
Manual Hand Aspirator Pump	3m/10 feet	1 squeeze/foot

Methane is lighter than air!

How **not** to obtain a pick hole sample!

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

A better option for a pick hole sample

Integral sampling pump

Hand Aspirator Kit

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Monitor and Ventilate Continuously

- Many accidents result from changes in the CS atmosphere which occur after the entry is initiated
- Monitoring determines the air is safe, ventilation helps keep it that way
- The only way to pick up changes before they become life threatening is to monitor continuously!

Prior to any entry it is essential to determine that the CS atmosphere is safe! Continuous monitoring ensures workers remain safe!

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Am I Safe?

- Most workplace gas hazards are invisible to human senses
- You don’t know whether it is safe until the atmosphere has be tested with a **properly working** portable safety gas detector
- Once the atmosphere has been determined to be safe it is important to monitor continuously during occupancy to ensure conditions do not change
- Take appropriate action at alarm activation to stay safe!

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Honeywell

TENAQUIP

INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS

Information Webinar

2016.01.25

A SAFE WORKPLACE IS THE LAW

Experts in Gas Detection

Legal Responsibility for Workplace Health and Safety

- Bill C-45: aka – Westray Bill: created in response to the Westray Mine disaster in 1992 that took the lives of 26 miners in Nova Scotia
- Federal Legislation – part of the Criminal Code of Canada since 2003 (Section 217.1)
- Independent of Provincial OH&S regulations
- No statute of limitations on filing a charge
- Corporate management and employees responsible for a safe work environment
- OH&S infractions are subject to criminal persecution

Bell fined $280K in death of 2 workers

Bell Canada has been handed the largest fine ever under the Canada Labour Code for health and safety violations in the deaths of two men in an Oakville manhole in 2007.

Bell has three months to pay the $280,000 penalty.

Representative Jean-Clement Drolet pleaded guilty last week on behalf of the telecommunications giant for failing to keep health and safety records, to keep a copy of the hazard assessment report at the employer's place of business nearest the worksite and ensuring the victims were properly trained to use protective equipment.

The payout comes nearly two years after Binbrook resident Greg Gauthier, 52, and Rodney Metcalfe, 33, of Brampton died at the bottom of a Bell manhole near Third Line and North Service Road in Oakville on June 28, 2007.

The men, employed by Wesbell Communications Technologies of Mississauga, were "fishing" fibre optic cable between manholes nearly five metres underground at the time of the accident.

Subsequent investigations revealed the air quality had about half the normal oxygen level.

As well, it was revealed the air monitor used by the men at the time of the incident was not lowered deep enough into the hole.

The record payout came as cold comfort to many of the teary-eyed family and friends, one of whom described the fine as insulting.

"They got a slap on the wrist for killing two men," said Priscilla Metcalfe, whose brother Rodney was one of the victims. Priscilla said she expected a penalty closer to $2.5 million and called yesterday's decision a "crock."

"My brother's gone, their father's gone and $280,000 just doesn't cut it."

The court heard yesterday that Bell has instituted a number of policy and procedure changes following the deaths, including a review of the confined space hazard assessment report and the development of training requirements for all contractors.

Michael Gauthier, Greg's brother who is in the same line of work, said he didn't care much about the financial penalty because it is impossible to put a value on human life.

"You can fine anybody $10 million, it's not going to make any difference."

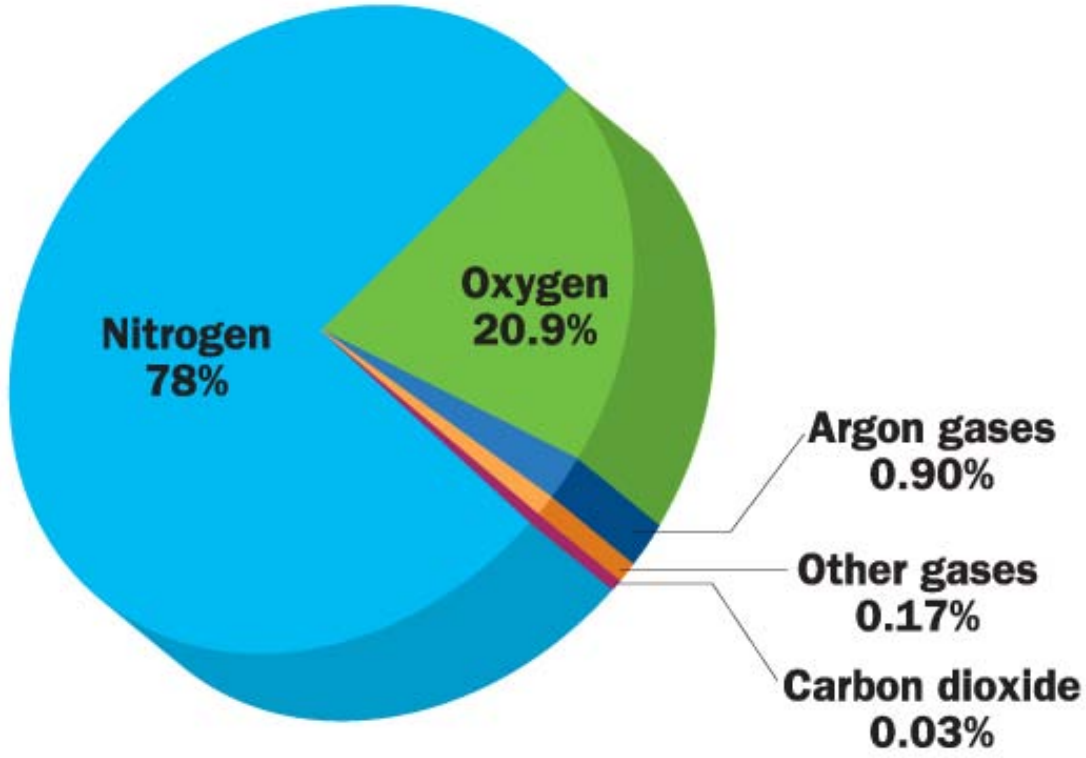
He said the policy changes touted by Bell have been implemented and have made a difference but he is just sorry it had to come at the cost of his brother's life.

Burlington Post 2009.04.01

A Breath of Fresh Air

Portable safety gas detector reading in “fresh air”:

20.9% v/v oxygen
0 ppm toxic gases
0% LEL combustible gases



TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Types of Alarms

Alarm indication:

Visual red LED alarm bars

Audible alarm

Vibrating alarm

Type of Alarms:

Instantaneous gas exposure

STEL gas exposure

TWA gas exposure

Over Limit (OL) sensor alarm

Low Battery Warning

*** Remember: gas alarm set points are set very conservative to provide early warning so workers can evacuate an area safely.**

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Typical Alarm Values

	TWA	STEL	Low	High
Hydrogen Sulfide	10 ppm	15 pm	10 ppm	15 ppm
Sulfur Dioxide	2 ppm	5 ppm	2 ppm	5 ppm
Hydrogen Cyanide	4.7 ppm	10 ppm	4.7 ppm	10 ppm
Carbon Monoxide	35 ppm	200 ppm	35 ppm	200 ppm
Chlorine	0.5 ppm	1.0 ppm	0.5 ppm	1.0 ppm
Nitric Oxide	2 ppm	2 ppm	2 ppm	2 ppm
Nitrogen Dioxide	2 ppm	5 ppm	2 ppm	5 ppm
Ammonia	25 ppm	35 ppm	25 ppm	50 ppm
Phosphine	0.3 ppm	1.0 ppm	0.3 ppm	1.0 ppm
Ethylene Oxide	1 ppm	5 ppm	1 ppm	5 ppm
Chlorine Dioxide	0.1 ppm	0.3 ppm	0.1 ppm	0.3 ppm
Ozone	0.1 ppm	0.1 ppm	0.1 ppm	0.2 ppm
Oxygen	N/A	N/A	19.5% v/v	23.5% v/v
Combustible	N/A	N/A	10% LEL	20% LEL
Carbon Dioxide	5,000 ppm	30,000 ppm	5,000 ppm	30,000 ppm

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Understanding Exposure Limits

Time Weighted Average (TWA)

Short Term Exposure Limit (STEL)

Instantaneous LOW

Instantaneous HIGH

CANADIAN STANDARDS ASSOCIATION

ACGIH
American Confederation of Governmental Industrial Hygienists

ISEA
INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

OSHA®
Occupational Safety and Health Administration

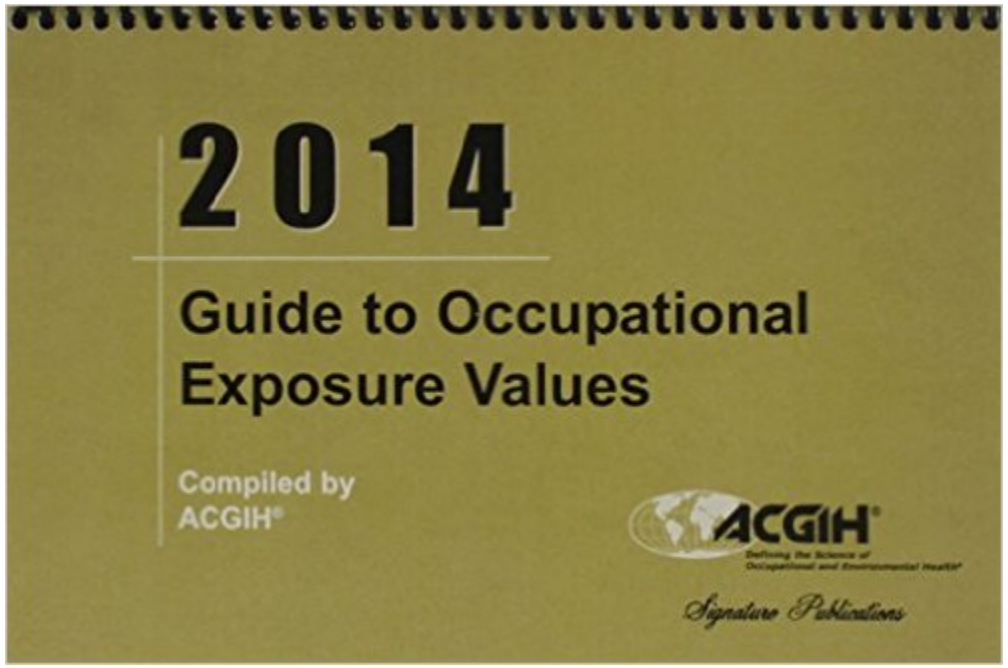
NIOSH
The National Institute for Occupational Safety and Health

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS

Honeywell

Threshold Limit Value (TLV)

- Determined by American Conference of Governmental Industrial Hygienists (ACGIH)
- Guidelines for control of potential health hazards
- Intended as recommendation – only becomes law when adopted by government bodies



TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Record Keeping

- Automated BUMP testing, calibration and record keeping system
- With an automated testing and record keeping system combined with proprietary software it is easy to produce VTC compliance records
- Without good records you cannot defend your procedures

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Why is Gas Detection Important?

- ✓ Protect Personnel
- ✓ Confirm an area is safe to occupy
- ✓ Protect Infrastructure
- ✓ Protect the Environment
- ✓ Gather Evidence
- ✓ Maintain Legal Compliance
- ✓ Improve Productivity

Every year millions of workers depend on portable safety gas detectors to alert them to the presence of potentially life threatening atmospheric conditions. Our job is to help workers go home safe.

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell

Thank You

TENAQUIP
INDUSTRIAL EQUIPMENT, SUPPLIES & SOLUTIONS
Honeywell