

# *Gas Detection Issues and Answers for the Manufacturing Industry*

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## GfG Instrumentation

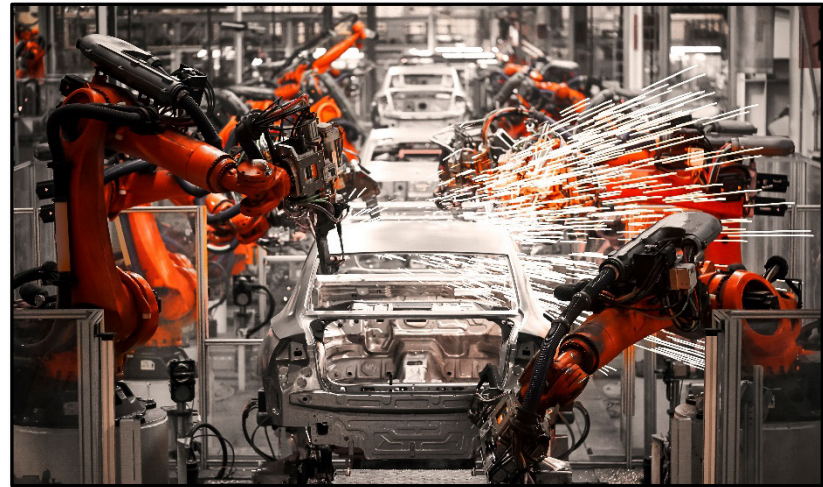


*World-wide manufacturer of fixed  
and portable gas detection solutions*



# Manufacturing Industry Gas Detection Self Assessment Questions

- “Manufacturing” is a very broad category!
- Manufacturing safety managers deal with an extremely wide range of atmospheric hazards, monitoring applications and activities.
- Atmospheric hazards can be generally present or associated with specific activities (like CS entry).
- Each facility needs to be individually evaluated.
  - Hazard assessment is critical!



# What are your most urgent concerns and problems?

- Start with a detailed assessment of activities and risks that involve atmospheric hazards.
- Drill down to make sure you understand what is most important.
- Are you currently meeting all requirements?
- Are the instruments you are currently using fit for purpose?
- Where do you need to make improvements?
- Gas detection issues are not necessarily limited to safety!
- Gas detection solutions are definitely not limited to portable instruments!



# *Manufacturing managers are involved with many types of safety and hygiene gas detection*

- Personal exposure monitoring
- Confined space
- Construction
- Hazmat and emergency response
- Hot work
- Other activity-based monitoring



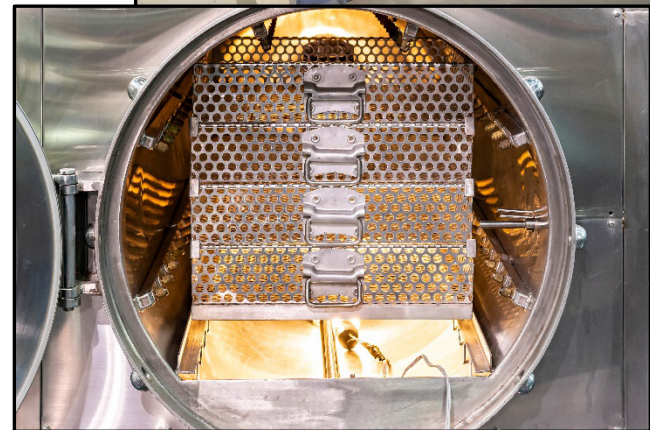
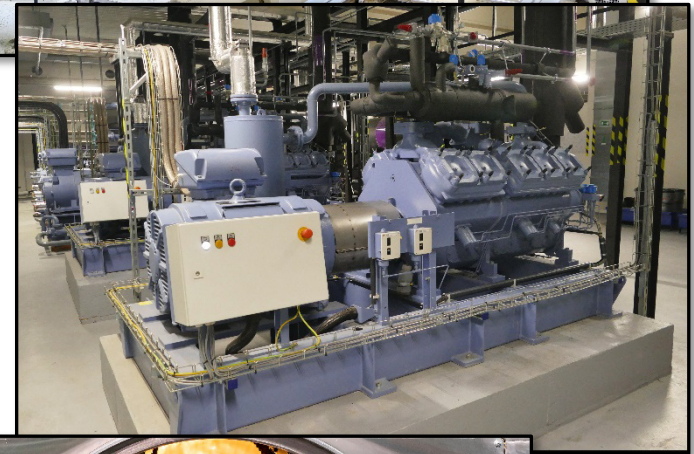
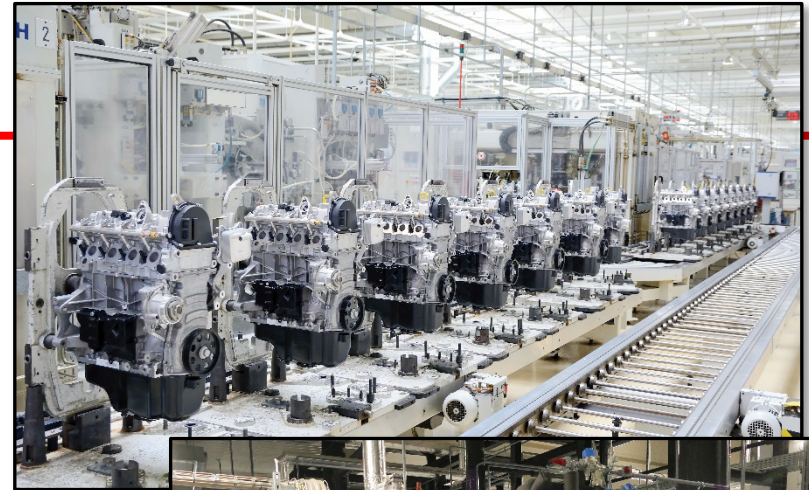
# *Manufacturing gas detection requirements include*

- Production
- Process
- Facilities
- Industrial hygiene
- Community (such as fence line or nuisance odor)
- Regulatory (EPA)
- Disaster response (such as train wreck)
- Construction



## *Presence of dangerous atmospheric conditions may be due to:*

- Materials used in production
  - Resins
  - Sealants
  - Polymers
  - Solvents
  - Degreasers
  - Industrial gases (natural gas, nitrogen, argon, sulfur dioxide, chlorine, hydrogen, hydrides like arsine)
- Refrigeration gases
  - Ammonia
  - Propane
  - Freons and halocarbons
  - Nitrogen
- Process(es) used to transform raw materials into finished goods
  - Chemical reactions
  - Curing / drying



# *The presence of dangerous atmospheric conditions may be due to (continued):*

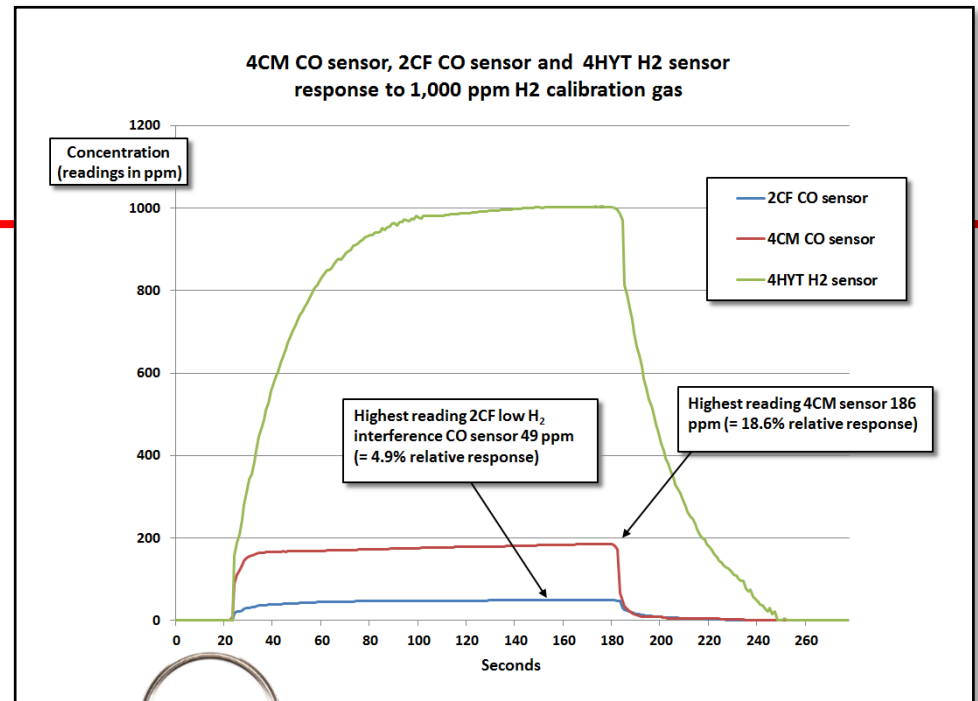
- Facilities
  - Battery charging (generation of hydrogen)
  - Combustible liquid cabinets
  - Gas storage areas
  - Spills
  - Leaks
  - Fueling stations (hydrogen or propane)
- Combustion
  - Stack gas ( $\text{SO}_2$ , acid gas,  $\text{NO}_2$ ,  $\text{NO}$ ,  $\text{CO}$ ,  $\text{CO}_2$ )
  - Engine exhaust ( $\text{CO}$ ,  $\text{NO}_2$ ,  $\text{NO}$ ,  $\text{CO}_2$ )
- Deliberate creation of potentially dangerous atmospheric conditions
  - Nitrogen purging
  - Curing ovens
  - Inert gas actuation
  - Shielding (hydrogen used to shield dynamos and generators)





# Hydrogen is an issue at many facilities

- Hydrogen is used in many manufacturing processes, as shielding gas in generators and dynamos, in semiconductor fabrication, and used or produced in many chemical processes.
  - Also used as a commercial fuel.
  - Can be generated during battery charging.
- Hydrogen is explosive, but the most common concern is often the interfering effect of hydrogen on CO sensors.
  - Whenever hydrogen is a concern make sure to discuss using “hydrogen nulled” CO sensors.
- Hydrogen cannot be measured by IR LEL sensors!
  - Consider equipping instruments with “hydrogen nulled” CO sensor
  - Use an electrochemical sensor for directly measuring H<sub>2</sub> when the instrument is equipped with an IR LEL sensor



*The presence of dangerous atmospheric conditions may be due to (continued):*

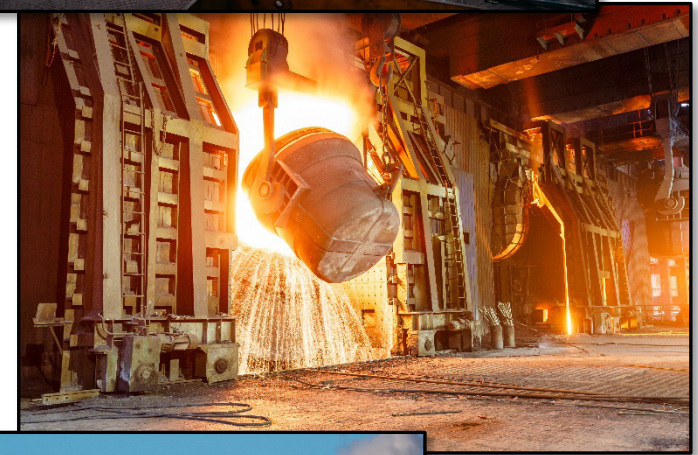
- Chemical reactions
  - Synthesis
  - Electrolysis
  - Sulfurization
  - Hydrogenation
  - Doping
- Natural process(es)
  - Fermentation (CO<sub>2</sub> as well as O<sub>2</sub> deficiency)
  - Decomposition
  - Oxidation
- Confined space entry activities
  - Hot work
  - Scraping
  - Mucking
  - Paints and sealants



# *What about stack gas, exhaust and combustion byproducts?*

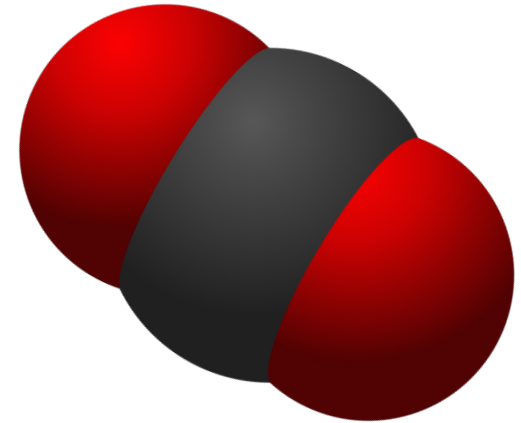
*CO, SO<sub>2</sub>, NO<sub>2</sub>, NO and CO<sub>2</sub>?*

- CO is a byproduct of combustion, and potentially present in engine exhaust, stack gas and any combustion process.
- CO<sub>2</sub> is a byproduct of combustion, and great quantities are produced during industrial combustion processes.
- NO<sub>2</sub>, also a byproduct of combustion, is present in engine exhaust, near boilers, furnaces, welding and in flares.
- NO is present in engine exhaust, (but rapidly turns into NO<sub>2</sub>).
- SO<sub>2</sub> combustion by-product of burning coal and other fuels that contain sulfur.
  - Especially prevalent at foundries and steel mills



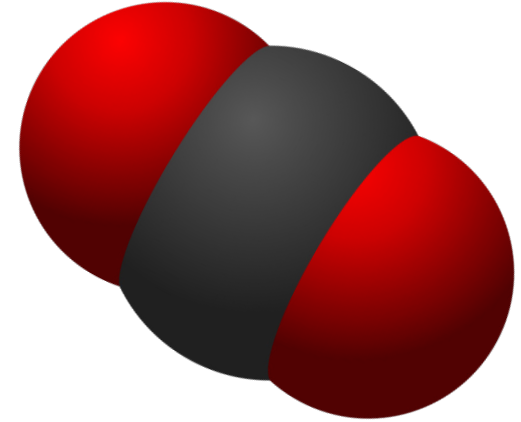
## What are the properties of CO<sub>2</sub> ?

- Present as a natural component in fresh air (approximately 420 ppm)
  - Colorless
  - Odorless
  - Tasteless
  - Heavier than air (density of 1.5 times that of fresh air)
  - When released into enclosed space it tends settle to bottom
  - Because of tendency to settle, as CO<sub>2</sub> produced it can reach higher and higher concentrations



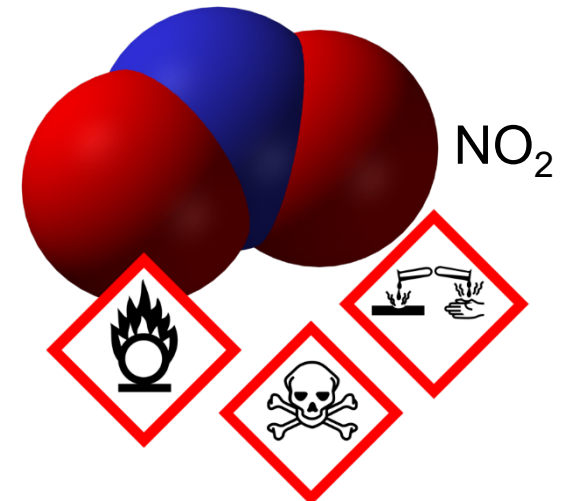
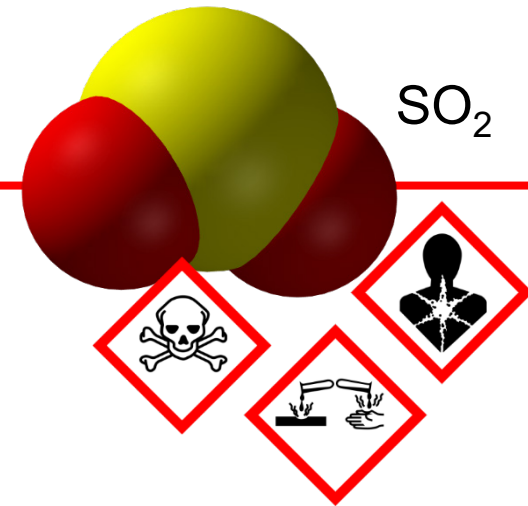
# What are the symptoms of exposure to CO<sub>2</sub> ?

- Besides displacing oxygen in fresh air, high concentrations may worsen symptoms related to oxygen deficiency, and interfere with successful resuscitation
- Exposure Symptoms include:
  - Headaches
  - Dizziness
  - Shortness of breath
  - Nausea
  - Rapid or irregular pulse
  - Depression of central nervous system
- Even moderate exposure can be serious
  - Normal indoor fresh air concentration: 420 – 1,000 ppm
  - 1,000 – 2,000 ppm: complaints of drowsiness
  - OSHA / NIOSH / TLV: 5,000 ppm TWA limit
  - IDLH: 40,000 ppm
  - Exposure to very high concentrations (30% volume CO<sub>2</sub> for 20-30 seconds) linked to losing consciousness and permanent heart damage



# Are there problems with certain combinations of exhaust gas sensors?

- Do CO and CO<sub>2</sub> sensors show a response to other exhaust gases?
  - Electrochemical CO and infrared (IR) CO<sub>2</sub> sensors do not show a meaningful response to the other common combustion byproduct gases.
- Do you need to measure both NO and NO<sub>2</sub>?
  - You can, but most hygienists focus on NO<sub>2</sub> because,
  - NO rapidly oxidizes in air to form NO<sub>2</sub> and,
  - Exposure limit for NO<sub>2</sub> is much lower than limit for NO.
- Can you have SO<sub>2</sub> and NO<sub>2</sub> sensors in the same instrument?
  - You can, but is not recommended
  - NO<sub>2</sub> causes SO<sub>2</sub> sensors to read negative, and SO<sub>2</sub> causes NO<sub>2</sub> sensors to read negative.
  - Leading to confusion, and it makes calibration difficult.
  - Better to keep SO<sub>2</sub> and NO<sub>2</sub> sensors in different instruments.

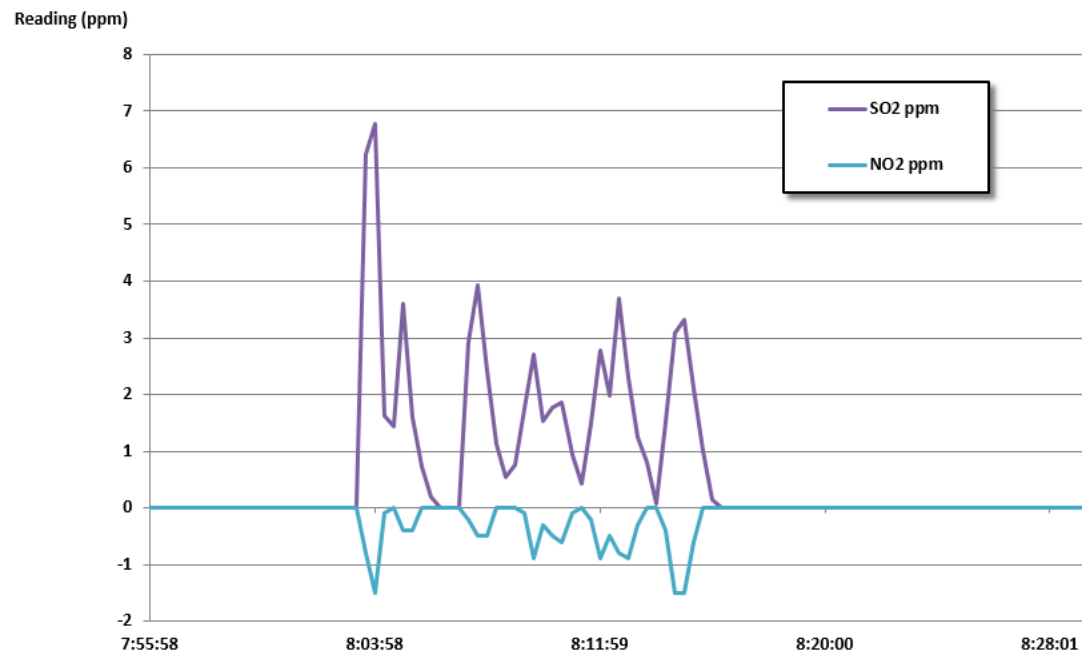




## *Do you face any potential cross sensitivity issues?*

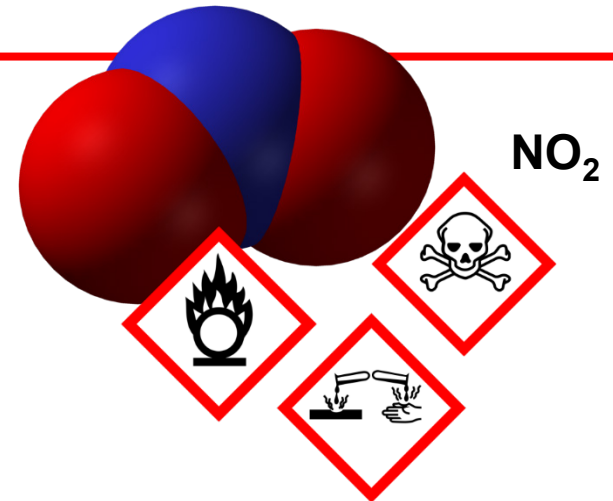
- Incompatibility issues may make calibration difficult or impossible.
- Sometimes better to install incompatible sensors in different instruments.

G460 instrument #3, readings from coal seam vent, SO<sub>2</sub> and NO<sub>2</sub>



# Does your instrument have the correct capabilities to accomplish what you need to do?

- Make sure your instruments are “Fit for purpose!”
- Consider NO<sub>2</sub>
  - What exposure limits do you follow?
    - US OSHA PEL: Ceiling = 5 ppm
    - US NIOSH REL: 15 min. STEL = 1 ppm
    - ACGIH TLV (since 2012): 8 hr. TWA = 0.2 ppm
  - If you follow the OSHA PEL 0.1 ppm resolution is fine, if you follow the TLV you need much better resolution (0.02 ppm would be advisable).
  - Are you required to report exposure history?
    - Does the instrument have datalogging?
    - How much information can the instrument retain?
    - How easy is it to download?
    - Do you depend on (or would you prefer) a third-party service?





## *There are many new developments in gas detection!*

- New products
- New sensors
- Wireless communication
- Integrated fixed and portable networks
- Third party support through call centers
  - Emergency response
  - Record keeping and notifications
  - Internet based maintenance programs



# *What brand(s) and model(s) of gas detection equipment do you currently use?*

- Before making a change or investigating new products, make sure you understand your current products and requirements
  - If you are not sure, make sure to find out the brands and models currently in service.
  - Make sure you understand the strong points as well as the weak points of the products you are currently using.
- Ask the manufacturers or distributors of the products you work with (or are interested in) for help.
  - Download specifications and comparison charts if the manufacturer has them.
  - Discuss ways the manufacturer and distributor can help meeting your needs with regards to product, capabilities or support.



# How well is your current equipment performing?

- This is a critical starting point in the assessment.
  - Are you generally happy?
  - Are you experiencing problems?
  - How old is your current equipment?
  - What features have you heard about that you are interested in?
  - What brand(s) and model(s) of gas detectors are you considering?
  - What are the alternatives?
- Distributors are a great source for product information!
- When in doubt, or with regards to advanced technical questions, ask the manufacturer!



# Avoid being overly focused on price!

- Eventually, the decision of whether to proceed involves price and affordability.
- However, there is a difference between the initial purchase price and the true cost of ownership.
  - The questioning process is designed to uncover your needs, and what would provide the optimal solution.
  - Once you fully identify the problems and how the new product is going to help, it's easier to understand the costs.
  - Once you have clarified the tradeoff between benefits and costs is when to widen or restrict choices as a function of price.

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Portable Gas Detection and  
Respiratory Airline Monitors

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Worldwide Manufacturer of Gas Detection Technology

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## Identify “cost of ownership” issues

- Are you spending a fortune keeping your current equipment in service?
- Are you being charged a monthly fee for reports and factory support?
- Do you have many sensor failures?
  - If so, what kinds of sensors are failing?
- Do you have battery problems?
  - Do the instruments run long enough on a single charge or set of batteries?
- How often do you test and calibrate your instruments?
  - Do you do it yourself or use a service?
- Are there any special conditions or contaminants that are causing problems?
- Do you trust your gas detectors?
- Do you feel you are currently getting a good deal?



## Who is currently looking after your instruments?

- Do you do it yourself, use a third-party service, or work directly with the factory?
- If you like your current instruments, and want to keep them in service, you might want to talk about maintenance agreements or refurbishment programs.
- Ask your local distributor whether they offer calibration or repair services.
- Ask your current manufacturer whether they have factory maintenance programs, or a loaner or replacement instrument policy.
- You should expect excellent after the sale support!



## *Do you have any plans to update, expand, replace or change the equipment they are currently using?*

- If you have relationships with gas detection manufacturers and distributors you trust, get them involved!
  - Gas detection manufacturers are happy to discuss issues directly with end-user customers.
  - The Internet and social media are terrific tools for finding out what's new, and what customers have to say.
  - You have multiple sources of information!
- Gas detection decisions are typically made by a group of individuals who have different roles in the decision process, including process or facilities management, safety, hygiene, purchasing, and (often) union representatives.
  - Make sure you don't leave anyone out!
  - The same issue often looks considerably different to a manager with different responsibilities.



## Fixed or Portable solution?

- When hazards are generally present or associated with specific activities (like CS entry) gas detection solutions focus more on portable instruments.
- When hazards are chronically present, or present in specific areas, fixed gas detection should be considered as well.
- Optimal solution often includes both fixed and portable instruments!





## Don't be afraid of considering fixed system solutions!

- Many common solutions based on small standalone single point systems, or small systems with 1 to 4 points of detection.
- Larger systems can be complicated, but your manufacturer partners are there to help you through the specification process.
- Make sure to include everyone with a stake in the outcome in the discussion and selection process!




## *Make sure you understand company policies and procedures for fixed systems*



- Specification and purchase of fixed gas detection systems can be complicated
- Are fixed system decisions made by a third-party design firm or contractor?
- Are fixed system decisions made by managers at the site?
- Are there any open projects?
- Who is involved in the specification and evaluation process?
- Who is responsible for calibration and routine maintenance?

# Example Fixed System Questionnaire

- Simple information but critical to know
- The questionnaire will help you to ask the right questions
- Vital to provide the best solution!



**FIXED SYSTEMS APPLICATION QUESTIONNAIRE**

Company: \_\_\_\_\_  
Name and title: \_\_\_\_\_  
Phone: \_\_\_\_\_  
E-mail: \_\_\_\_\_  
Address: \_\_\_\_\_  
City/State/Zip: \_\_\_\_\_  
Date: \_\_\_\_\_  
Salesperson: \_\_\_\_\_

The information requested on this survey is for GfG Project Engineers.  
Exact specifications will help insure proper equipment for your application.

**APPLICATION DATA**

Describe your application: \_\_\_\_\_


Is the area considered  Hazardous/Classified  General purpose  
Is the area currently being monitored?  No  Yes, list technology: \_\_\_\_\_

**TRANSMITTERS**

Output  4-20 mA  Modbus  Two wire  Three wire  Other: \_\_\_\_\_  
Gas detecting  CO  NH<sub>3</sub>  O<sub>2</sub>  CH<sub>4</sub>  Other: \_\_\_\_\_  
Calibration gas  Standard  Special  
Range required: \_\_\_\_\_ to \_\_\_\_\_  PPM  %LEL  %volume  \_\_\_\_\_  
Temperature range: \_\_\_\_\_ to \_\_\_\_\_  °F  °C Humidity: \_\_\_\_\_ %  
Possible background gases / sensor poisons  No  Yes, please list: \_\_\_\_\_  
Climate  Indoor  Outdoor  
Voltage input: \_\_\_\_\_ VDC  
Interfacing with PLC?  No  Yes, load: \_\_\_\_\_ ohms  
Display required?  No  Yes

Modifications: (explain) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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**CONTROLLERS**

2-1 mA  Modbus  N/A

MA \_\_\_\_\_  
door \_\_\_\_\_  
dbus  Two wire  Three wire  Other: \_\_\_\_\_

Inductive load Current required: \_\_\_\_\_ amp  
open  Normally closed

Yes  
 Network, what interface is required? \_\_\_\_\_

\_\_\_\_\_ Threshold  Ascending  Descending  
\_\_\_\_\_ Threshold  Ascending  Descending  
\_\_\_\_\_ Threshold  Ascending  Descending  
\_\_\_\_\_  O<sub>2</sub>  CH<sub>4</sub>  Other: \_\_\_\_\_  
\_\_\_\_\_  °F  °C Humidity: \_\_\_\_\_ %

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## *Do you use your portable gas detectors for general protection for workers at the site, or specific activities (like CS entry), or both?*

- Portable instruments are not limited to use in confined spaces!
- Many facilities require use of personally assigned gas detectors by every employee or contractor on-site; or when working in specified areas.
- The most common personal instruments are single sensor H<sub>2</sub>S or CO “Clips” as well as compact 4 gas instruments that measure O<sub>2</sub> / LEL / CO and H<sub>2</sub>S.
- Many facilities that in the past have only monitored for H<sub>2</sub>S are in the process of moving to multi-gas instruments.



## *In terms of units sold, personal protection is still the largest gas detection segment*

- For personal protection instruments do you mostly use:
  - Single gas H<sub>2</sub>S?
  - 4 gas meters?
  - Other single gas meters?
- Some of the other most commonly used personal single gas instruments include:
  - NO<sub>2</sub>
  - SO<sub>2</sub>
  - Ozone
  - NH<sub>3</sub>
  - As well as many others!



# What sensor configurations do you currently use for confined space entry?

- How many / what kinds of sensors are installed in your instruments?
  - Traditional 4-gas (LEL / O<sub>2</sub> / CO / H<sub>2</sub>S)?
  - 5-gas with PID?
  - Some other sensor configuration?
- What type of sensor are you using (or interested in using) for LEL?
  - Traditional CC LEL?
  - IR LEL?
- What type of O<sub>2</sub> sensor are you using?
  - Fuel cell?
  - Lead free?
  - How long does it last?
- Do you use different multi-sensor instruments for different activities or types of CS entry?
  - Confined spaces that contain VOC vapors?
  - CS entry into inerted vessels?



## Multi-gas portable instrument considerations

- Do you have other gases of concern beyond the basic four most common atmospheric hazards (O<sub>2</sub>, LEL, CO and H<sub>2</sub>S)?
  - SO<sub>2</sub>?
  - VOCs?
  - Benzene?
  - Hydrogen?
  - CO<sub>2</sub>?
  - NO<sub>2</sub>?
  - Other gases?
- Do you use pump equipped or diffusion for toxic gas measurement?
  - Is it possible to equip your single-gas meters with a pump?



# How do you sample the atmosphere from within the confined space?

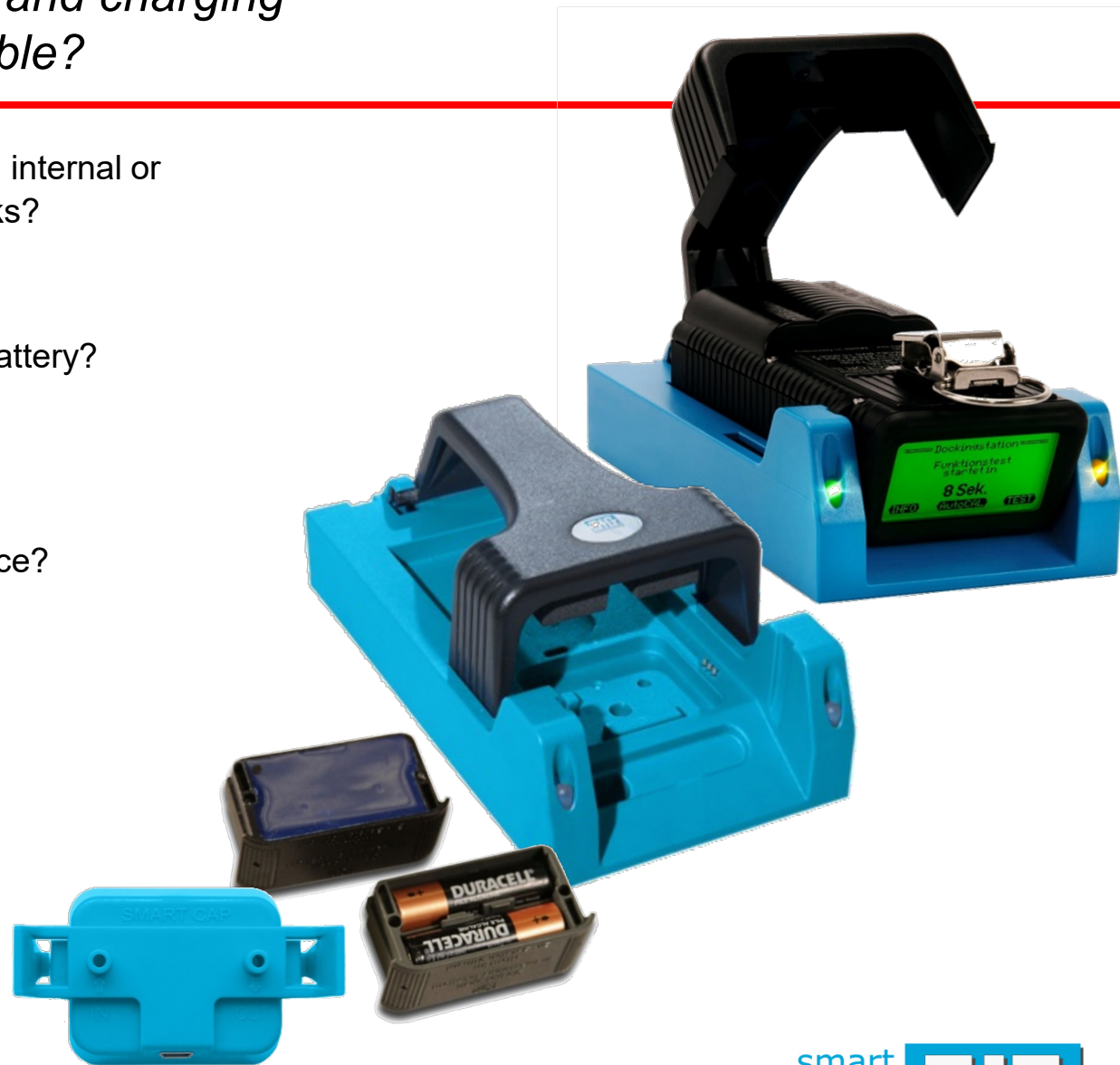
- Is the instrument a diffusion only design?
- Does the instrument have an attachable sample pump?
- Does the instrument have a built-in pump?
- Does the instrument have the option of switching from diffusion to sampling by means of the built-in pump?





# What types of battery and charging technology are available?

- Does the instrument have an internal or interchangeable battery packs?
- Alkaline option?
- What type of rechargeable battery?
  - Li Ion?
  - NiMH?
- Cold temperature performance?
- Charging options
  - Cradle?
  - Wall power / USB adapter?



# What about periodic testing and calibration?

- How often do you perform a bump test?
  - Before each day's use?
  - Do you keep bump test kits (with gas) with the instruments?
  - How do you prove your instruments have been bumped?
  - What do you do if you fail a bump test?
- How often do you perform a full calibration?
  - Do you use a docking station for bump tests and calibrations?
  - How do you prove your instruments are properly maintained and calibrated?
  - How do you retain maintenance and calibration records?
- Is your current strategy working?
  - Is it easy?



## *Consider kits that provide for testing / calibration for your instruments*

- Complete G450 ecoBump kit with G450 with O<sub>2</sub>, LEL, CO and H<sub>2</sub>S sensors, push-button regulator, cylinder of test gas and foam lined carrying case.
- Each compact ecoBump cylinder provides up to 250 daily bump tests!
- Available with alkaline AA or rechargeable NiMH battery packs



*G450 Alkaline ecoBump Kit*

# Are your gas detectors wirelessly enabled (or are you considering this option)?

- Most manufacturers now offer a “wireless” communication option.
  - Each manufacturer has its own strategy, with its own benefits and limitations.
  - Make sure you understand the wireless options and competitive benefits!
- Common communication methods:
  - Blue Tooth
  - Cellular
  - ISM RF
- Do you intend to use wireless communication during CS entry?
  - How do you get the information out of the space?



# Have you addressed “third-party” issues?

- Do you intend to use a remote call center service to coordinate emergency response?
- Do you intend to use a third-party rescue service (such as a corporate emergency response team, or the local fire department)?
- How will you coordinate real-time emergency information with all involved parties?



# What about after the sale support?

- Satisfaction is a function of ongoing support.
  - Atmospheric monitors and systems are life critical safety equipment.
  - Customers should expect excellent after the sale support.
- Don't forget to consider:
  - Warranty
    - Sensors
    - Instrument
- Technical support
  - Is your vendor there to provide help?
- Training
  - Videos?
  - In person?
  - Internet resources?



## Take advantage of free gas detection needs assessment!

- Finding out ways to improve worker safety
- Recognizing what's needed to for regulatory compliance
- Confidence you know the best solution!



### Request a **FREE** gas detection safety assessment from the experts at your local AD – Safety Network Distributor

Find out if your current gas detection program is up to date, safe and compliant

Whatever your application, chances are your Safety Distributor experts have seen it and solved it. They are here to help.

#### What's in it for you?

- A yours-to-keep listing of recommendations
- Knowing what's needed to keep your workers safe
- Knowing what's needed to ensure compliance
- Confidence you know the best solution
- Special savings on the industry leading gas detectors from GfG Instrumentation

Signup for your no-obligation assessment today!

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Personal safety and gas sampling

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## Questions?

Thank you!

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For additional information or gas detection help:

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