# *Managing Gas Detection Programs in Manufacturing and Transportation*


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# GfG Instrumentation

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

smart GasDetection Technologies

# *Manufacturing and Transportation Industry Self Assessment Gas Detection Questions*

- "Manufacturing and Transportation" is a very broad category!
- Safety and facilities managers deal with extremely wide range of atmospheric hazards, monitoring applications and activities.
- 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!

# *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?
- 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 and transportation managers are involved with all types of safety and hygiene gas detection*

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

# *Manufacturing and transportation 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

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

- Materials used in production
  - Resins
  - Sealants
  - Polymers
  - Solvents
  - Industrial gases (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 ($SO_2$, acid gas, $NO_2$, NO, CO, $CO_2$)
  - Engine exhaust (CO, $NO_2$, NO, $CO_2$)
  - Accidental or intentional release of contaminants
- Deliberate creation of potentially dangerous atmospheric conditions
  - Nitrogen purging
  - Curing ovens
  - Inert gas actuation
  - Shielding (hydrogen used to shield dynamos and generators)

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


- Chemical reactions
  - Synthesis
  - Electrolysis
  - Sulfurization
  - Hydrogenation
  - Doping
- Natural process(es)
  - Fermentation ($CO_2$ as well as $O_2$ deficiency)
  - Decomposition
  - Oxidation
- Confined space entry activities
  - Hot work
  - Scraping
  - Mucking
  - Paints and sealants

## *There are <u>many</u> 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 capabilities; 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 conversation.
  - 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, if possible, it's better to bring price into the conversation later, not at the beginning of the process.
  - Once you have clarified what you need and understand the tradeoff between benefit and costs is the time to widen or restrict choices as a function of price.
  - The questioning process is designed to uncover what you need, and what would provide the optimal solution.
  - There is a difference between the initial purchase price and the true cost of ownership.
  - Once you fully identify the problems and how the new product is going to help, it's easier to understand the costs.

# *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 trust your gas detectors?
- 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?
- <u>Do you feel you are currently getting a good deal?</u>

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

- If you have relationships with gas detection manufacturers and distributors you trust, get them involved!
  - Distributors generally have more than one manufacturer option.
  - Gas detection manufacturers are happy to discuss issues directly with end-user customers.
  - The Internet and social media are marvelous tools for finding out what's new, and what customers have to say.
  - You have multiple sources of information!
- Gas detection decisions are often 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.

## *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 the equipment you are currently using, and want to keep it in service, you might want to talk about maintenance agreements or refurbishment programs.
- Ask your local distributor whether they offer calibration or repair services.
- As your current manufacturer whether they have factory maintenance programs, or a loaner or replacement instrument policy.
- You should expect excellent after the sale support!

# *Don’t be afraid of fixed system products and solutions!*

- 60% of total gas detection market consists of fixed and process control equipment.
- Most common solution is often small standalone system with 1 to 4 points of detection.
- Larger systems can be complicated, but your manufacturer and distributor partners are there to help you through the specification process.

# *How and who should you work with on fixed and process control gas detection needs?*


- 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?

## *Do you have a "Fixed System Questionnaire" from the manufacturer you are working with?*

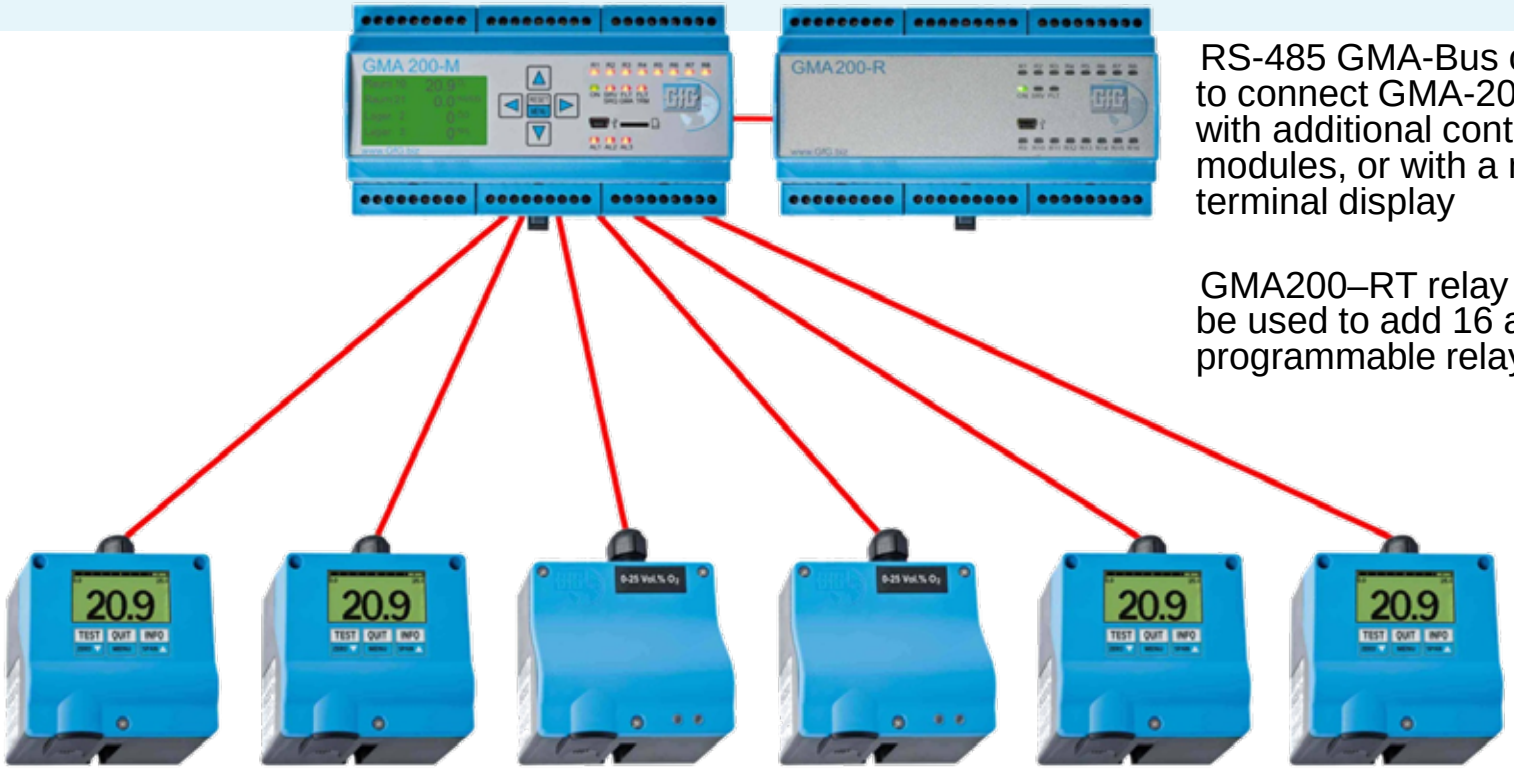
- To provide the best solution, manufacturers and venders need the information in this usually simple form.
- If you do not have a copy, contact the manufacturer BEFORE they visit your facility, or provide a quote!
  - Clarifying what you need by means of a detailed questionnaire reduces the chances for specifying or purchasing the wrong equipment.
  - Don't be afraid to ask the manufacturer for help with the answers.
  - Answer as many questions as you can, but don't worry if you can't answer them all.
  - The manufacturer will tell you if there is something that must be nailed down before you can generate a quote.
- Don't go it alone!
  - Don't be afraid to ask the manufacturer for help.
  - Make sure the manufacturer reviews your requirements before you finalize the bid specification.

## *Fixed gas detection system components*

- Transmitters
- Controllers
- Stand-alone systems

# *GMA200-MT/16 DIN Rail Mounted Controller*

Connect controller via 4-20mA or digital RS-485 BUS

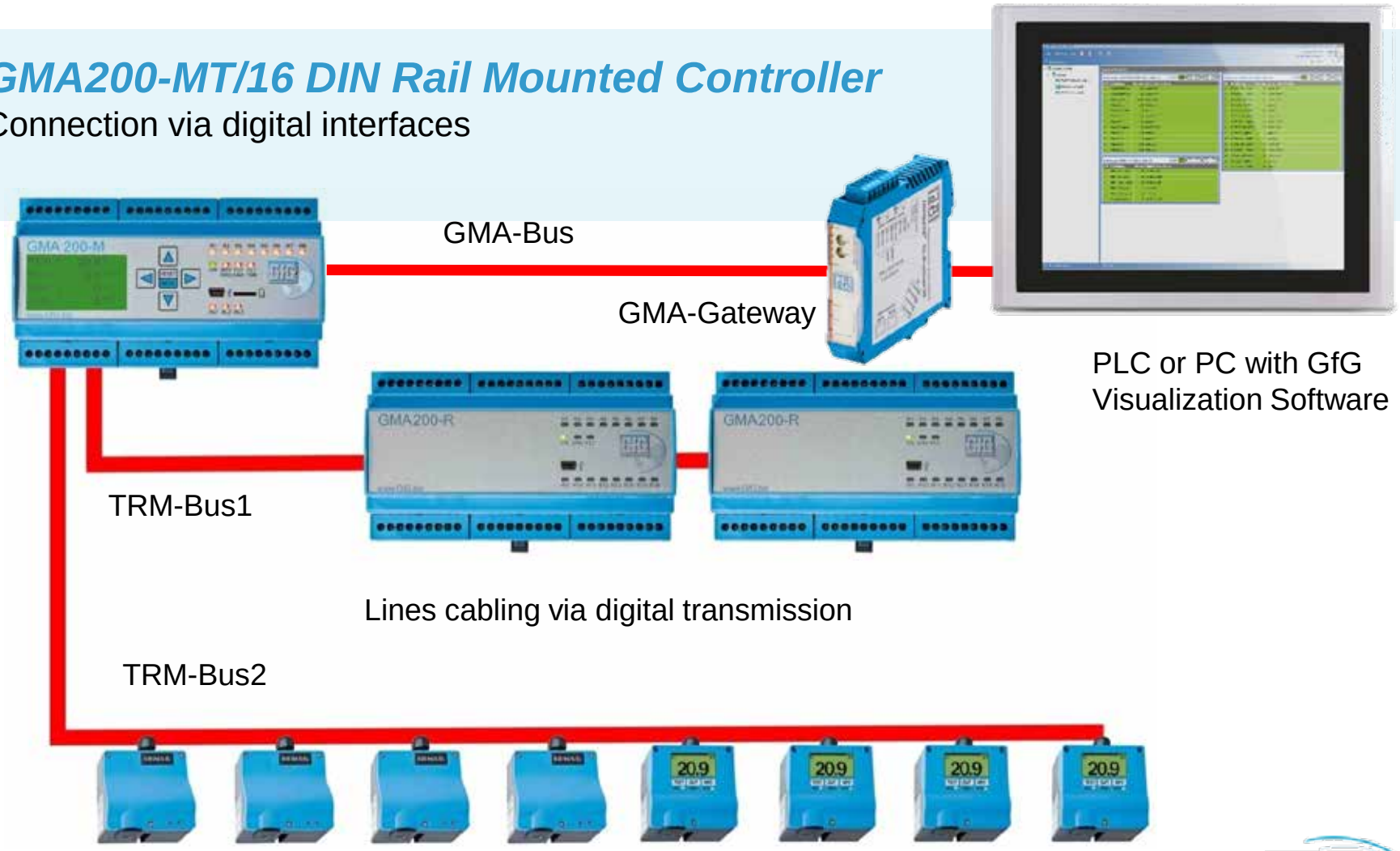



RS-485 GMA-Bus can be used to connect GMA-200 controller with additional control or relay modules, or with a remote terminal display

GMA200–RT relay module can be used to add 16 additional programmable relays to system

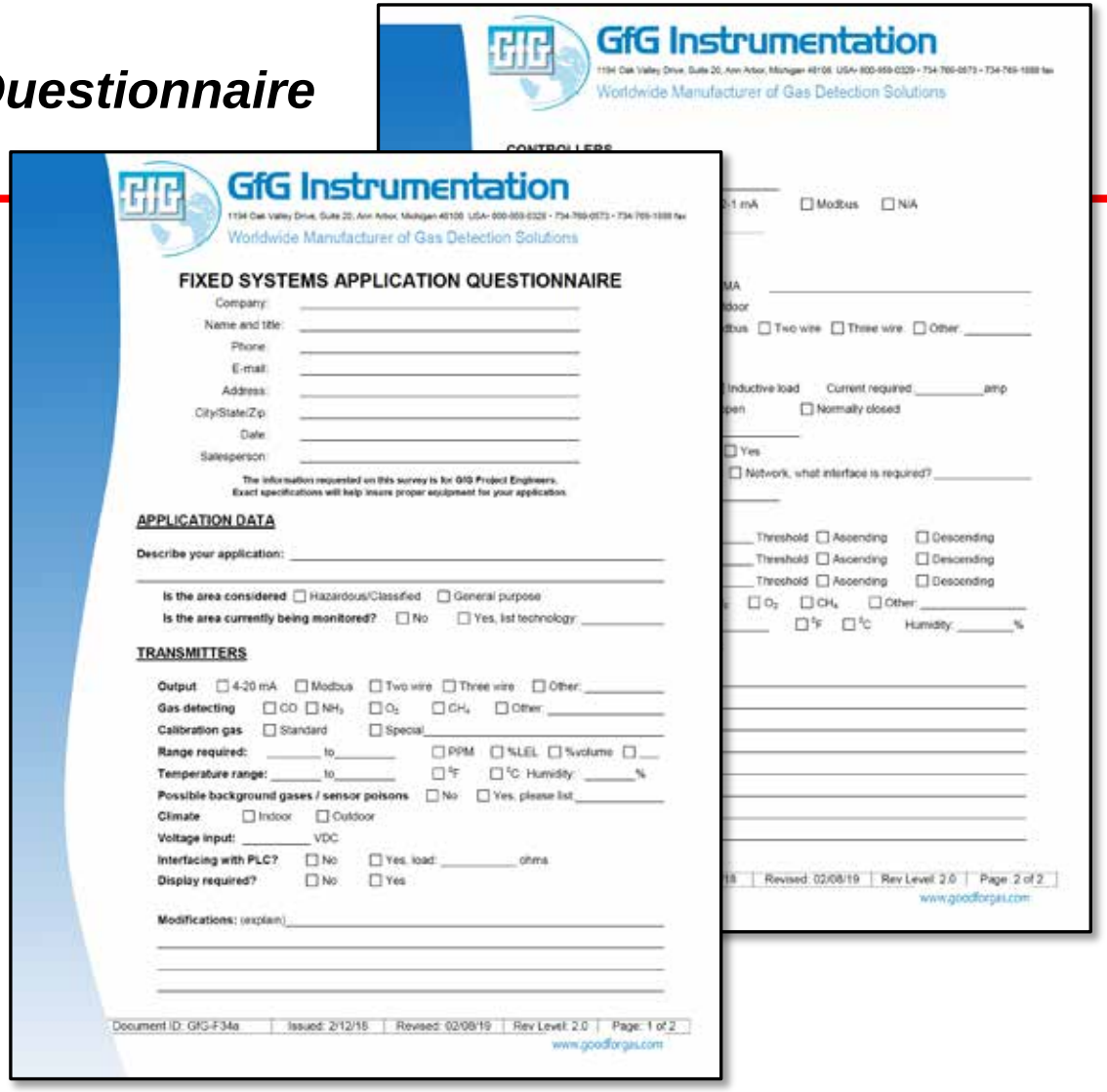
# GMA200-MT/16 DIN Rail Mounted Controller

Connection via digital interfaces



# *Example Fixed System Questionnaire*

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



GfG Instrumentation

Worldwide Manufacturer of Gas Detection Solutions

**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 ☐ $NH_3$ ☐ $O_2$ ☐ $CH_4$ ☐ 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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# *Do you use your portable gas detectors for general protection for workers at the site, or confined space 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 $H_2S$ or CO “Clips” as well as compact 4 gas instruments that measure $O_2$ / LEL / CO and $H_2S$.
- Many facilities that in the past have only monitored for $H_2S$ 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 $H_2S$?
  - 4 gas meters?
  - Other single gas meters?
  - $H_2S$ is still the most common single gas instrument, with CO a distant second, but don't overlook other toxic gases that may be present at a particular site.
- Some of the other most commonly used personal single gas instruments include:
  - $NO_2$
  - $SO_2$
  - Ozone
  - $NH_3$
  - As well as many others!

# *Multi-gas portable instrument considerations*

- Do you have other gases of concern beyond the basic four most common atmospheric hazards ($O_2$, LEL, CO and $H_2S$)?
  - $SO_2$?
  - VOCs?
  - Benzene?
  - Hydrogen?
  - $CO_2$?
  - $NO_2$?
  - 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?

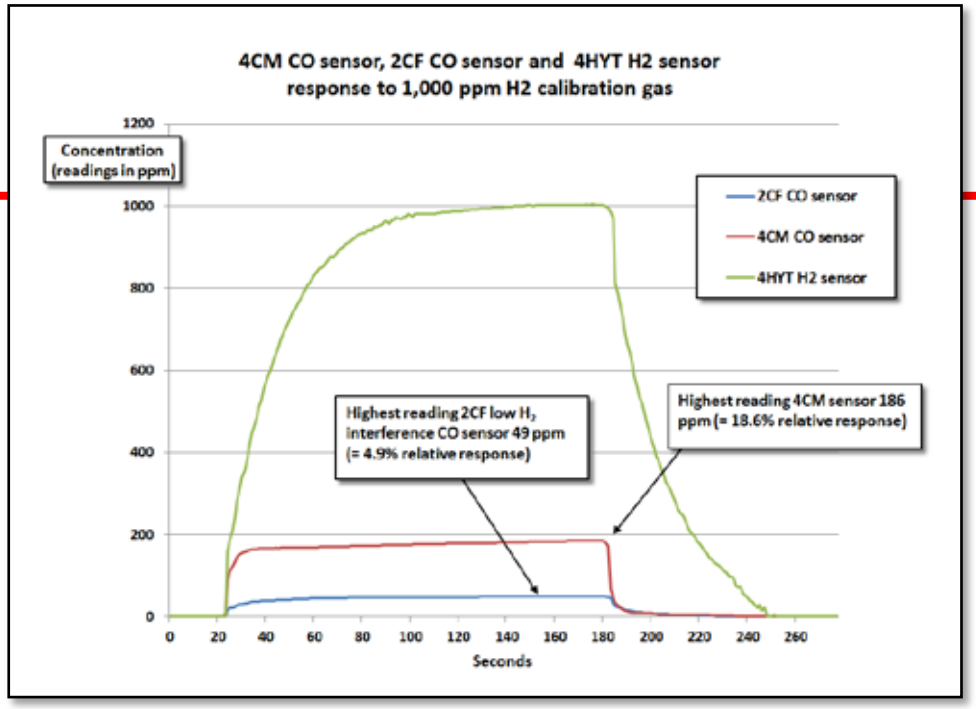
# *Further multi-gas considerations*

- Do you have any other contaminants or toxic gas concerns?
  - Manufacturing and transportation industry sites have a long list of potential contaminants.
  - Consider including additional sensors in the multi-gas instrument, or
  - Use specialty sensors in separate instrument.
  - Watch out for compatibility issues!

# *Even more multi-gas questions*

- Do you have alcohol, heavy fuels or VOCs on site?
  - VOC vapors are potentially explosive, but toxic at much lower concentrations.
  - Especially true for VOCs like benzene, hexane, toluene and xylenes.
  - Consider including a PID sensor in multi-gas instruments used to for fuel spills and other situations that involve VOC vapor.
- Do you encounter VOCs during confined space entry?
  - If so, your CS instruments should have PID sensor as well

# *And even more multi-gas questions*



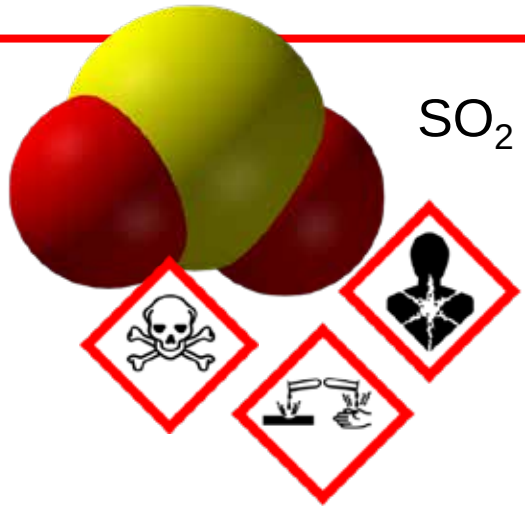

- Do you ever have problems with hydrogen?
  - Hydrogen is explosive, but the most common concern is often the interfering effect of hydrogen on CO sensors.
  - Whenever hydrogen is a concern make sure to discuss using "hydrogen nulled" CO sensors.
- <u>Hydrogen cannot be measured by IR LEL sensors!</u>
  - Consider equipping instruments with IR LEL sensors with a sensor for directly measuring $H_2$.
- Hydrogen is very common!
  - Hydrogen used in many manufacturing processes, used as shielding gas in generators and dynamos, in semiconductor fabrication, and used or produced in <u>many</u> chemical processes.
  - Also used as a commercial fuel.
  - Can be generated during battery charging.

# *What about engine exhaust: CO, $SO_2$, $NO_2$, NO and $CO_2$?*

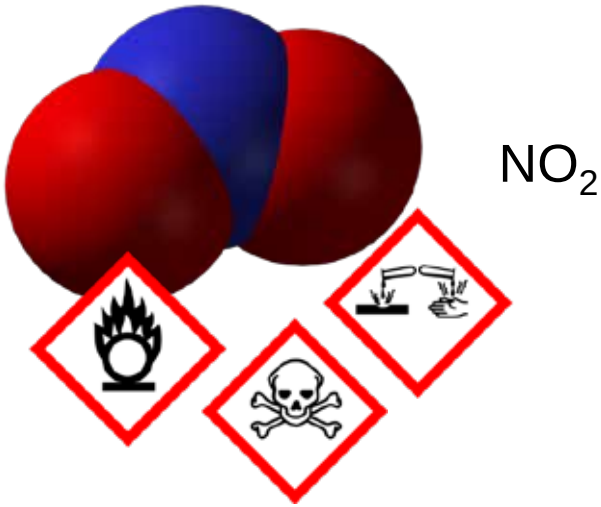
- CO is a byproduct of combustion, and potentially present in engine exhaust and stack gas.
- $NO_2$, also a byproduct of combustion, is present in engine exhaust, near boilers and in flares.
- NO is present in engine exhaust, (but rapidly turns into $NO_2$).
- $CO_2$ is a byproduct of combustion, and great quantities are produced during industrial combustion processes.
- $SO_2$ combustion by-product of burning coal and other fuels that contain sulfur.

# *Are there problems having all these exhaust gas sensors in the same instrument?*

- Do CO and $CO_2$ sensors show a response to other exhaust gases?
  - Electrochemical CO and infrared (IR) $CO_2$ sensors do not show a meaningful response to the other common exhaust gases.
- Do you need to measure both NO and $NO_2$?
  - You can, but most hygienists focus on $NO_2$ because,
  - NO rapidly oxidizes in air to form $NO_2$ and,
  - Exposure limit for $NO_2$ is <u>much</u> lower than limit for NO.
- Can you have $SO_2$ and $NO_2$ sensors in the same instrument?
  - You can, but is not recommended
  - $NO_2$ causes $SO_2$ sensors to read negative, and $SO_2$ causes $NO_2$ sensors to read negative.
  - Leading to confusion, and it makes calibration difficult.
  - Better to keep SO2 and NO2 sensors in different instruments.



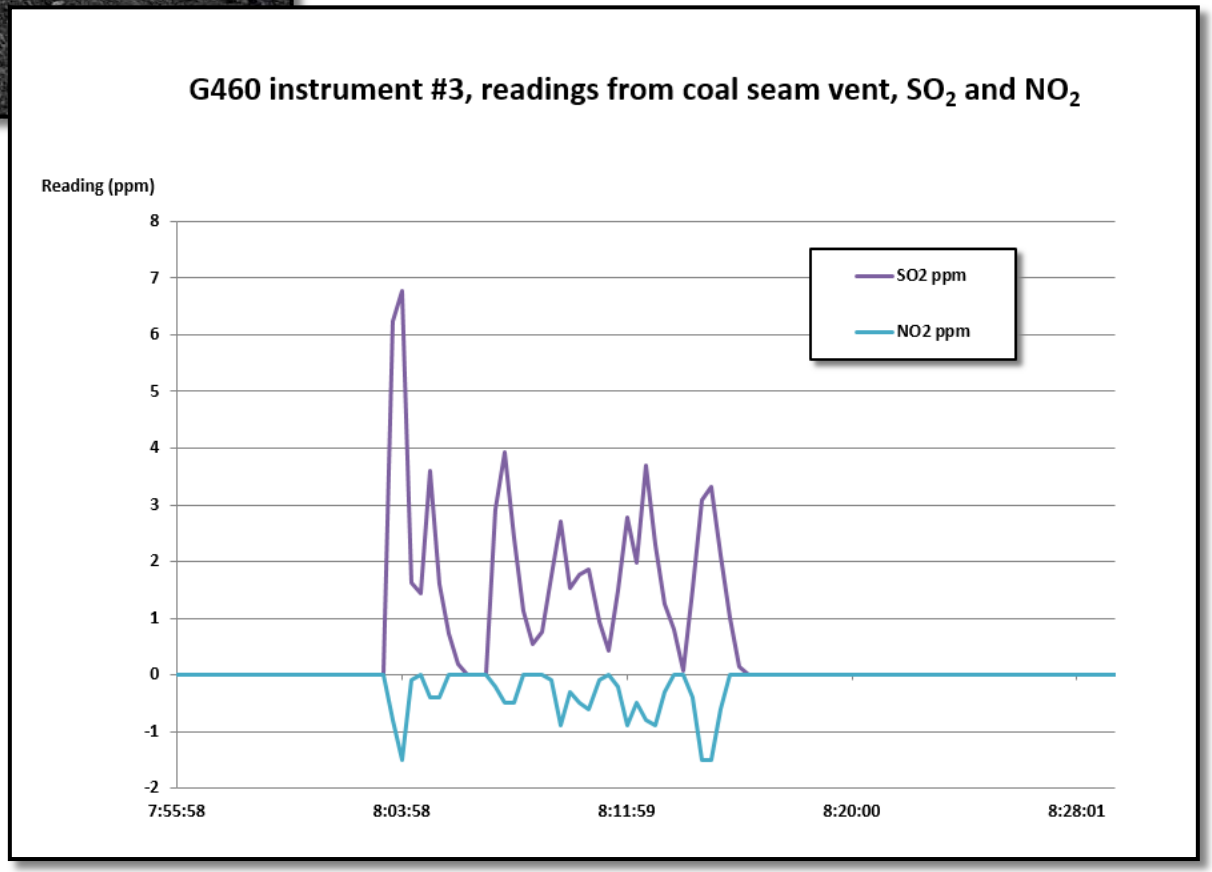
$SO_2$



$NO_2$

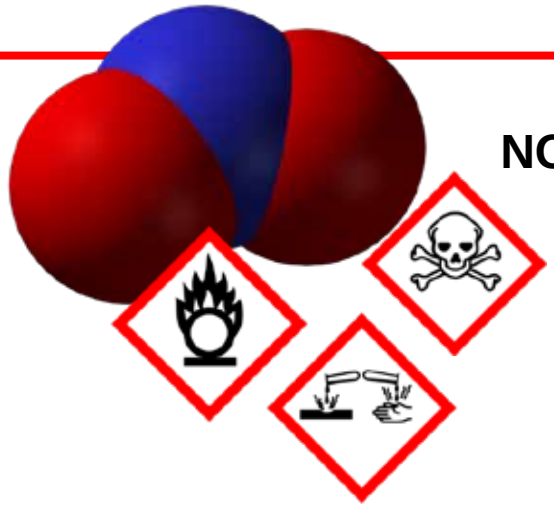
# *Do you face any potential cross sensitivity issues?*

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



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

- Consider $NO_2$
  - 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?




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

- Do you have the right configuration, or are you thinking about a change?
- How many / what kinds of sensors are installed in your instruments?

# *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?

# *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?

## *Questions?*

*Thank you!*

*For additional information or gas detection help:*

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