



**Gas Monitor Training Kit
With Train-the-Trainer Component**



www.gpcah.org

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Introduction and Background for Trainer

The Gas Monitor outreach kit was developed to help present information on guiding livestock producers on how to select and use hydrogen sulfide (H₂S) monitors when performing tasks that are known to release deadly concentrations of hydrogen sulfide.

This introduction is provided to train-the-trainer and help presenters understand

(A) the hazard, including high-risk tasks

(B) why gas monitors are helpful and what they cannot do

(C) specific information regarding how to train on responding to the alarm, and

(D) how to recommend storing, using, and maintaining monitors.

(A) Hazardous Manure Gases

Hydrogen sulfide (H₂S) is generated whenever anaerobic (no air) conditions are present. On the farm, H₂S is known to be generated in manure storage areas, including in under-floor manure pits, storage lagoons and tanks.

In some conditions, particularly if the manure is “foaming”, methane may also be a concern: foaming manure contains trapped methane which, if broken, can release methane and cause an explosion. This kit does not contain hands-on tools for measuring methane, only hydrogen sulfide.

TASKS: Ag tasks with known high concentrations of H₂S include:

- Agitating and pumping manure in pits
- Pressure washing a room containing under-floor manure pits
- Hauling and land-applying manure
- Air in manure pits, even after emptying

The H₂S is often trapped in the liquid manure. When manure is agitated, (e.g., when pumping, moving air through it or when water falls onto the manure during pressure washing) the H₂S gas is released. While it is known to be “heavier than air”, when we are actively mixing these materials, the hydrogen sulfide moves with the air currents and enters the spaces occupied by animals and people, which can result in fatalities.

CONCENTRATIONS: What level of hydrogen sulfide is dangerous?

Livestock operations that are well managed typically have concentrations below 1 ppm. Health-based guidelines for H₂S recommend safe exposures to be **1 ppm** averaged over an 8-hour day and that short-term (15-minute) exposures less than **5 ppm**, both of which will prevent upper respiratory track irritation and central nervous system impairment. Note that we can often smell hydrogen sulfide at concentrations much smaller than 1 ppm, but at higher concentrations, we develop “fatigue” in our sense of smell and cannot detect H₂S at higher concentrations, when health effects are more severe and deadly.

When activities begin to disturb manure, worker exposures increase. When breathing concentrations in the range of **2 – 20 ppm**, people begin to develop symptoms of headaches, nausea, or dizziness over the course of the exposure period.

For H₂S, however, when concentrations rise, the main concern is a fatality. At **100 ppm**, the level becomes immediately dangerous to life and health (IDLH), and humans should immediately leave the area. At and above concentrations of 100 ppm, severe eye and lung irritation begins and pulmonary edema (a potentially fatal lung condition) may occur. Most importantly, at **high concentrations (800 ppm and above)**, the respiratory system is paralyzed and the exposed person loses consciousness, with typically fatal outcomes. Concentrations well above 1000 ppm have been measured during manure agitation (ASABE, standard EP470.1).

(B) Why Gas Monitors Are Helpful

Because we cannot sense (smell) H₂S when the concentrations become deadly, we can use gas monitors to alert us to hazards. Monitors are used to test the air quality inside the manure pit or to be worn by workers who are conducting high-risk activities. These monitors will “alarm” to let the wearer know that concentrations are reaching levels that are dangerous.

There are single gas monitors that measure one gas at a time – for example H₂S. This kit will demonstrate how to use a single gas H₂S monitor. This kit will recommend or include examples of inexpensive gas monitors to measure and warn of dangers of H₂S.

In addition to single gas monitors, there are monitors available to measure multiple gases at the same time (“multi-gas monitors”). If foaming manure is an issue (methane), you should recommend the multi-gas monitor that has sensors for oxygen (O₂), hydrogen sulfide (H₂S), and methane or explosion (LEL or Lower Explosive Limit). Since these monitors typically have the capability for monitoring four gases at once, we recommend farmers select carbon monoxide (CO) as the fourth gas sensor, which is a product of combustion (e.g., gasoline powered equipment and natural gas heaters. Ammonia (NH₃) sensors are also available, but these are expensive to purchase and calibrate, and a separate single-gas monitor is recommended for testing ammonia.

Understanding the limitations of these monitors can save a life.

- The sensors respond to only the gas as indicated by the manufacturer. (a CO monitor cannot be used to measure H₂S.)
- The sensors for H₂S include chemicals, which react with H₂S to display as a concentration. THE CHEMICAL in the SENSOR get used up over time, so they will not last forever.
- If stored unprotected in areas that contain H₂S, the H₂S in the room will react with the sensor and reduce the lifespan of the monitor.
- If the user does not check to see that the unit reacts to H₂S, there is no way to know if the sensor still has the ability to report the concentration.

Section (D) contains details on how to maintain monitors to address some of these issues.

(C) Responding to the Alarm

This kit will help you to demonstrate how and when to use these monitors in livestock operations. However, it is extremely important to understand that the monitor is useless if the wearer doesn't know

how to react to the alarms. The H₂S monitors typically have two alarm set points. The “Low” alarm typically is set to alarm when the concentration reaches an 8-hour exposure limit. The “High” alarm typically is set to alarm when the concentration reaches the 15-minute short-term exposure limit. There are many organizations that set exposure limits, so monitors are available in a variety of pre-set exposure limits. The commonly available H₂S alarm set points are based on recommended exposure limits:

OSHA (1970): Low 10 ppm, High 15 ppm

ACGIH (2011): Low 1 ppm; High 5 ppm

As you can see, these concentrations are WELL below the 100 ppm IDLH and the 800 ppm level in which one breath can incapacitate someone. These monitors are used in industries in which workers are required to comply with regulations, and if the “high” alarm goes off, people are instructed to leave the area.

When working with agricultural workers, many do not decide to leave the area when alarms signal at 15 ppm. Concentrations inside vehicles during manure application have been known to make these units alarm. Because farmer workers do not sense immediate threat of death at these alarm set points, established for non-fatal health outcomes, it is important to recommend that farmers purchase monitors that DISPLAY concentration so they can understand what is going on to help get them to react. When the units display the high alarm, and the concentration on the monitor is rising above 15 ppm, farmers need to know that this is a dangerous situation. First, these monitors take up to 1 minute to respond to the H₂S, so the concentration may be above what is being displayed. Second, these monitors do not report concentrations above 100 ppm: the monitor will overload at 100 ppm and could be much higher. Why can't we get more information on concentrations above 100 ppm? Because people SHOULD NOT BE IN AREAS when H₂S concentrations are this high. Period.

- If the monitor is at “high” alarm **but** the display is low and steady, we are likely NOT approaching deadly concentrations of H₂S.
- If the monitor is at “high” alarm **and** the display shows concentrations increasing, we may be very soon at fatal concentrations and the farmer needs to leave the area, relying on the monitor to determine when in an area with background levels of H₂S (<1 ppm)

(D) Maintaining Monitors

This will discuss key points on what to do when receiving a single-gas H₂S monitor, how to store it, and how to test to make sure it is still reliable.

Receiving: Single gas monitors are widely available today, ranging from \$100-150. Monitors in this price range are designed to be disposable, which include an automatic “expiration” feature after 24 months following its activation. This is because the sensor does not last forever and most of the cost of these monitors is in the price of the sensor.

It is important to know that when you purchase one of these units, there is an “activate by” date on the box. If you do not turn the unit on by that date, it will not activate. You can't send this back to the manufacturer, so turn it on by the activation date. I recommend using a Sharpie to write the real activation date on the back of the monitor – this will help you track how long the monitor worked for you.

Storing: These monitors should be stored in areas where there is not hydrogen sulfide present. Any sulfur compounds in the air will continue to react with the sensor in the device, whether on or not, so protecting the monitor will help make the unit last the 2-years recommended by the manufacturer. An easy way to do this is to take the monitor and a plastic bag to an area that has no H₂S and place the unit in the bag and seal it. This approach protects the sensor over time.

Some models have a way to hibernate the monitor. The BW Clips by Honeywell have a \$15 hibernation case; if you store these monitors in the case for at least 2 weeks at a time, it pauses the countdown clock for the monitor. Other devices don't have this feature as inexpensively. However, good practice would still store this hibernated monitor in an area that does not have H₂S, to protect the sensor from sulfur compounds.

Testing: Before using any gas monitor, you want to test it to make sure it will react when it sees H₂S. Think about it: If the monitor doesn't alarm, is it because the instrument is broken or because there is no H₂S present? You really want it to be the later. The Gas Monitor Training Kit has tools and instructions on how to perform "bump testing" which is what we call this test procedure. The test is simple: expose the instrument to gas that has H₂S to ensure the monitor responds to H₂S. Videos to demonstrate how to do this (shown with SGC Plus and BW Clip Real Time monitors) are on <https://gpcah.public-health.uiowa.edu/outreach-2/topics/manure-gas-safety-2-0/>. Cylinders of gas are needed to do this testing, and options are presented in the training package.

The question of "when" to do this testing is important to convey to users. They want to do it before they need put their life on the line with the monitor – that is, before every use. But, in some cases, what if it doesn't work? What if they need a new one? You can't easily pop down the road and pick one up – many stores don't keep these in stock. So, we recommend that the instruments are bump tested two weeks before they might need to be used. Typically, farmer managers know when manure pits need to be pumped and when pressure washing is scheduled, so adding H₂S instrument testing to the preparation list is recommended. If the unit doesn't "pass", then there is time to order a replacement.

(E) Wearing Monitors

Lastly, we provide guidance on how to wear these monitors. We want to put these monitors up by the head, where we breathe. These come with clips to mount high on the front of your chest (near the seam on top of the shoulder). Make sure the sensor is facing away from the chest so it sees air in front of the person wearing the monitor. It should hang freely so that the wearer can look at the display easily, so have people practice putting it on and looking at the display.

Some people say that since H₂S is heavier than air, we should monitor it at the floor level. This is not where we want to put these personal monitors. Further, this "heavier than air" thing only works if there is no air movement. When we are pumping manure, we have fans going. When we are outside, there is usually some wind going (there should be when pumping... don't pump on a dead calm air day). So, small changes of wind will keep the H₂S from pooling on the ground.

Kit Contents and Additional Materials Needed

These materials correspond to video demonstrations and handouts located at <https://gpcah.public-health.uiowa.edu/outreach-2/topics/manure-gas-safety-2-0/>

Videos to link to during demos and preparation



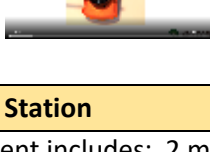
BW Clip Real Time with Calibration Cylinder Test Gas: <http://bit.ly/342tfbk>



BW Clip Real Time with Spray Can Test Gas: <http://bit.ly/2Xv9yGQ>



SGC Plus with Calibration Gas Cylinder Test Gas: <http://bit.ly/2D06tFg>



SGC Plus with Spray Can Test Gas: <http://bit.ly/341YrY1>

Display Station

Equipment includes: 2 monitors, gas regulator, balloon assembly for spray-can gas, 4x9" cards, wooden box for display, banner.

NOT INCLUDED: We cannot ship compressed gas. Picked up displays can include a gas cylinder and/or spray can of gas (if available at time of request), otherwise should be purchased by team. Display station should look like the image, below. Slot for personalized "survey" or other materials.



Other materials to display

- Banner
- Handouts
- Manure gas warning sign <https://bit.ly/2GgWS1l> and <https://amzn.to/2S8ibFp>



Banner Display: (24x36" each) You may print yourself or order from GPCAH (p. 18)

Airborne Hazards

Hydrogen Sulfide (H₂S)
Toxic, Flammable, Irritant

Methane (CH₄)
Flammable, Asphyxiant

Ammonia (NH₃)
Toxic, Irritant

Carbon Monoxide (CO)
Toxic, Asphyxiant

Carbon Dioxide (CO₂)
Asphyxiant

Dusts
Toxic, Irritant

Endotoxins
Toxic, Irritant

DANGER

**DEADLY MANURE GASES POSSIBLE
DEATH
MAY BE IMMEDIATE!**

ENTER PIT ONLY WITH

- SELF-CONTAINED AIR SUPPLY
- VENTILATION
- RESCUE HARNESS, MECHANICAL LIFT, STAND-BY PERSON

SmartGas.com • 800-853-3457 • 5-7874

Gas Monitor Use

Single Gas Monitor

- Measures only one gas
- Manufacturers:

Multiple Gas Monitor

- Measures four gasses
- Manufacturers:

Operation: Testing Order and Key Decisions

1) Oxygen Pass: N/A (Default) with 100% O ₂ if low oxygen hazard 21% O ₂	2) H ₂ S: 10 ppm (100% LEL or more) Get out!	3) LEL: 10 ppm (100% LEL or more) Get out!
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Visit www.gpcah.org/ to view banners.

Handouts:

- Two-sided cards, 4x9" (inform how many desired if you order from GPCAH ((p. 18))

Manure Gas Safety

Why should I be concerned about manure gas hazards?

- Hydrogen sulfide can cause fatal health effects.
- People cannot smell when concentrations are dangerous.
- Hydrogen sulfide can cause eye irritation.

What can I do to reduce H₂S risk?

- Monitor to ensure hydrogen sulfide concentrations remain below 10 ppm.
- Remove the hydrogen sulfide gas from the air.
- Plan to do tasks outdoors.
- Post your monitor in the area near your head or danger area collar.
- Turn on with at least 15 minutes before manure handling activities.

Monitor Types

Low-Maintenance H₂S Monitors:

- BW Clip Real Time:** 10 ppm range, 1 year life.
- Boc Plus:** 10 ppm range, 1 year life.

Monitor Use

High concentrations have been identified:

- When pumping manure, inside and outside of buildings
- After pumping is complete, inside buildings during pressure washing
- Inside full and empty manure storage pits
- In unventilated spaces with decaying manure
- When hauling and land-applying manure

Wear H₂S monitor in high concentration areas

Monitors **alarm** when concentrations reach levels that cause long-term health effects.

- If monitor is alarming, ventilate the area and pay attention to concentration displayed on screen.
- Leave area immediately at 50 ppm.
- Concentrations may be deadly if monitor reads 100 ppm.

What Do the Numbers Mean?

2 - 20 ppm	Irritation, Headache, Dizziness
>100 ppm	Altered breathing, Collapse, Death

For more info visit www.gpcah.org/

- Equipment specific bump-check handouts (one of four shown below; inform how many desired ((p.18))

Hydrogen Sulfide (H₂S) Monitor Bump Test:

for SGC Plus[®] with calibration gas and regulator

Why Use A Monitor?

Hydrogen sulfide (H₂S) gas released from manure when agitating, pumping manure, and when power washing inside a livestock building. Concentrations above 100 ppm are immediately dangerous to life and health. An inexpensive monitor that alerts you before H₂S concentrations become lethal. It is important to test to ensure safety for you and the animals on the farm. To make sure your equipment will warn you of the danger of H₂S gas, plan to check your monitor's functionality by bump testing or other high-risk areas. This gives you time to get a replacement if you need one. Then, perform this check again at the start of every day you use the monitor. In the case of an immediate bump test, the monitor will test a second time. If it will need to be replaced.

1. You will need:
 - Calibration gas: 25 ppm
 - Regulator: 2.0 liter per minute
 - Masking
 - Calibration cap
2. Attach regulator to the 1/4" valve.
3. Confirm alarms at 10 ppm, audible, visual, and vibrating.
4. Confirm alarms at 25 ppm; upward of each alarm will increase.
5. Close the regulator valve.
6. Do not use monitor if:
 - Alarms do not go off
 - Calibration does not match the calibration gas (25 ppm)
 - Takes longer than 60 seconds to reach target concentration (25 ppm)

For more information visit: GPCAH.org





Equipment used in Gas Monitor Display:




- Example gas monitors currently included in the kits are: SGC Plus and BW Clip Real time (both with 10 ppm low alarm; 15 ppm high alarm)
- We cannot ship kits with any compressed gas cylinders.
- The following pages summarizes equipment and bump test log that can be used

Bump test log:

- To place on display top, for recording personal bump tests performed at the station
- In full on following pages, print as needed

Equipment List for Gas Monitor Display

Equipment	Description	Price	Websites for ordering
 <p style="text-align: center;">SGC Plus H₂S Monitor SGC-P-H</p>	<ul style="list-style-type: none"> • Shows months left on monitor until H₂S gas has been detected • Low alarm set at 10 ppm and high alarm set at 15 ppm • May last longer than 2 years if hibernated with IR-link accessory 	\$150-\$200	<p>baselineequipment.com gasdetectorshop.com Envirosafetyproducts.com</p>
 <p style="text-align: center;">BW Clip Real Time H₂S Monitor BWC2R-H</p>	<ul style="list-style-type: none"> • Shows concentration of H₂S gas present • Lasts 2 years except when used with hibernation case then can last longer • Low alarm set at 10 ppm and high alarm set at 15 ppm • May last longer than 2 years if hibernated with hibernation case 	\$150-\$200	<p>Pksafety.com TEquipment.net</p>
 <p style="text-align: center;">25 ppm H₂S calibration gas</p>	<ul style="list-style-type: none"> • H₂S gas will be balanced with air, methane, or nitrogen • Allow extra time for your order to be made (1 week) • Hazardous materials fee will be added to order (~\$85) • Different volumes of gas will be different prices • Used with regulator and can see when the cylinder is almost empty • Gas can be used for calibration of monitor as well as bump testing 	\$30-\$200 17L- 34L	<p>Pksafety.com Calgasdirect.com Grainger.com</p>
 <p style="text-align: center;">10 liter H₂S gas 25 ppm with aerosol trigger</p>	<ul style="list-style-type: none"> • H₂S gas will be balanced with air, methane, or nitrogen • Allow extra time for your order to be made (1 week) • Hazardous materials fee will be added to order (~\$85) • Used with spare balloon assembly kit adaptor for bump gas • Cannot tell when cylinder is almost empty • Shorter shelf life than regular calibration gas 	\$30	<p>Calgasdirect.com</p>

<p>BW Clip Hibernation case, \$15-26</p> 	<ul style="list-style-type: none"> • Can increase the life span of the BW Clip Realtime to over 2 years • Monitor must be in case for 2 weeks before time stops on the monitor • Store this and the monitor in an area with low hydrogen sulfide gas presence 	<p>Pksafety.com Grainger.com</p>
<p>Gas Clip Technologies IR Link, \$87-100</p> 	<p>NOT IN KIT:</p> <ul style="list-style-type: none"> • Communications Link for Gas Clip • To reset alarm set points and download event logs and data • Works on PC computers 	<p>baselineequipment.com pksafety.com</p>
<p>Demonstration station</p> 	<ul style="list-style-type: none"> • Available for use at GPAH • Designed to keep monitors and gas stable at demonstration events. 	<p>n/a</p>

Example Script for Table Display

Hydrogen Sulfide (H₂S)

- High concentrations of H₂S are documented:
 - During agitating or pumping manure
 - When pressure washing inside animal building with under-floor manure pits
 - When hauling and land-applying manure
 - In buildings and pits after manure pumping is complete
 - In unvented spaces when decaying materials are present
- Livestock producers have died during these tasks
 - Find and bring copies of **local** news stories to the show – or –
 - Select from those compiled at <https://gpcah.public-health.uiowa.edu/outreach-2/topics/manure-gas-safety-2-0/>)

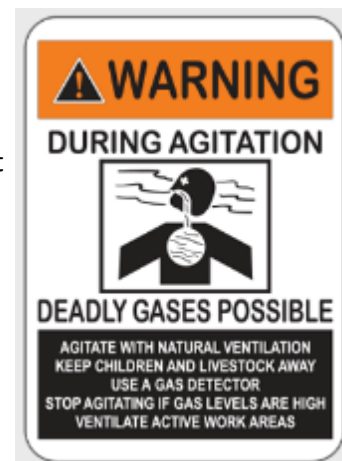
H₂S Concentration Dangers

- <1 -5 ppm can smell it, minimal upper respiratory track irritation
- 2 – 20 ppm, symptoms of headaches, nausea, or dizziness
- 100 ppm, ppm, severe eye and lung irritation begins and pulmonary edema (a potentially fatal lung condition) may occur.
- ~> 800 ppm respiratory system paralysis, stop breathing, lose consciousness, with typically fatal outcomes

Can typically smell H₂S at low, non-lethal concentrations. Cannot smell it when in the range that it can kill you. Monitors can let you know it is present.

Before Pumping

- **Prepare for emergency** prior to starting agitation
 - Test and provide monitors
 - Communicate hazards of H₂S and how to respond to alarms
 - Maintain communication with those in hazard zone
 - Have contact information and method to call emergency responders at the ready
 - DO NOT rescue anyone without knowing the concentration is safe (monitor; self-contained breathing apparatus)
- Take steps to take to protect worker and animal health
 - **Move animals out** of immediate area before agitating manure
 - **Prevent people from entering** during or after manure handling activities: Communicate to all employees and post signs
 - **Ventilate**
 - Turn on exhaust fans and mixing fans
 - If agitating, cover agitator inlet



After Pumping

Follow formal plans for entry after pumping

- Check air with monitor before letting others in – wear monitor
- Maintain communication with person inside building

Before Using Your Monitor

- Give it a bump test
 - Make sure the monitor will respond to the gas as it is supposed to
 - **Must bump test before you trust it with your life**
 - Check to make sure alarms to vibrate, flash, and sound at both low and high settings
- When to check?
 - Check at least 2 weeks before (gives you time to buy new)
 - Every day you perform high-risk activities
- H₂S monitors on display: BW Clip Real Time and the SGC Plus
 - They both last about 2 years
 - Both cost approximately 150-200\$
 - They both come with a calibration cap for bump testing
 - Need to purchase test gas (consumable) and regulator (one time)
 - Extension or coop may be able to help out by setting up local cal center
 - Low and high alarm set points - 10 ppm and 15 ppm (OSHA values)
 - Alarms well below concentrations that can kill you (100 ppm and up): this gives you time to get to safety
- Other monitors are available, these have performed well:
 - BW Clip Real Time
 - SGC Plus
 - Industrial Scientific T40 Rattler (will need extra AA batteries)
- *Always bump test before using monitor*

Frequently Asked Questions

Q: I don't like to throw out things. Can't I get a monitor that will last longer than 2 years?

A: You can, but it will be more expensive by about \$300, and you will have to do **more** expert-level maintenance on it. All sensors fail over time, so you'll have to spend about \$100 just to replace the sensor in this unit. Electrochemical sensors simply go bad over time; they won't last forever.

Q: I have foaming manure. Is this single-gas H₂S monitor good enough for me?

A: No, you actually need to get a monitor that measures H₂S **AND** methane. The "methane" monitor is sometimes called an "explosion" monitor, and measures "LEL" (Lower Explosive Limit). Measures of LEL read in percent of the explosive limit for, in this case, methane. The lowest concentration in air at which methane is combustible is 50,000 ppm. Thus, a monitor measuring methane would display "5% LEL" when the concentration of methane reached 2500 ppm. Best practice to avoid exploding a workplace is to not do work in concentrations that have 5% LEL or more. To figure out if you are at this concentration, you would want a multi-gas monitor (you would need to measure oxygen, LEL and H₂S).


A monitor with similar maintenance to the low cost ones on display here would be the BW Honeywell GasAlert MicroClip XL Multigas monitor (\$460-595). Note that for most LEL meters to work, there must be sufficient (20.9%) oxygen present for the LEL sensor to be correct.



Q: The instruction manual for these monitors say “no calibration” is required. Why do I need to bump test?

A: While there are internal checks / “self-tests” that perform diagnostics, there is no substitute for ensuring that the sensor actually responds to the gas you think it is supposed to protect you from. While you are not doing a full calibration (which resets the voltage signal response that adjusts the output to true concentration), you are making sure you understand whether the unit will, indeed, alarm when you and it are in hazardous environments. If you look into the manual deeper, you will see this recommendation clearly spelled out. Examples given here:

BW recommends performing a bump test prior to each day's use to confirm sensor response and alarm activation by exposing the detector to a concentration of target gas that exceeds the low alarm set point. BW also recommends performing a bump test if the detector has been subjected to physical impact, liquid immersion, an Over Limit alarm event, custody changes, or anytime the detectors performance is in doubt. Calibrate the detector after a failed bump test. Always bump test and calibrate in a fresh air environment.

 Bump Test the detector periodically by challenging the sensor with a known concentration of the target gas to be detected. Recommended target gas concentrations (H₂S: 25 ppm, CO: 200 ppm, O₂: 18%). Bump Test can be performed either manually or through the Clip Dock. If a manual test is to be performed make sure to test in a clean air environment.

Q: Can't I just put a monitor in my barn and leave it there to let me know if there is a problem?

A: Sure, but you have to figure out where to put it. Since you would put these monitors near the floor to alarm with the first sign of rising H₂S concentration, there will be a problem keeping it clean. There are fixed area monitors, but these require substantially more maintenance (weekly sensor checks) that will add to the burden at the farm. Since we know that concentrations rise during specific tasks, using monitors for these infrequent but high-risk task is probably more economical and effective. But, we do realize that this will add an increased burden of supervision to make sure people are using monitors and know how to respond appropriately.

Presentation Checklist and Order Form

ORDER ITEMS FROM GPCAH

- Print 4"x9" manure gas safety cards
needed _____
- Print poster
needed _____
- Print equipment specific bump check handouts
needed _____
- Print bump testing log
needed _____

MAKE YOUR OWN PRESENTATION

- Order one SGC Plus H₂S or BW Clip Real Time H₂S Monitor baselineequipment.com or gasdetectorshop.com or Envirosafteyproducts.com
- Order one regulator with a flow rate of 0.5 l/min or one H₂S gas 25 ppm of 0.5 l/min with tubing calgrasdirect.com
- Order one 10 l H₂S 25 ppm with aerosol trigger or balloon assembly kit and adaptor for bump gas calgrasdirect.com
- Print 4"x9" manure gas safety cards [LINK](#)
- Print poster [LINK](#)
- Print equipment specific bump check handouts [LINK](#)
- Order manure gas warning sign <https://bit.ly/2GgWS1l> and <https://amzn.to/2S8ibFp>
- Print bump testing log [LINK](#)

Please fill out this order form, copy it, and paste it into an email to cph-greatplainscenter@uiowa.edu. Alternatively, you may call Marsha at (319) 335-6871. Thank you.

Last updated 9/30/2020