Industrial May/June 2022 Hygle Morkplace in the Workplace





ALSO IN THIS ISSUE:

Gas Detection 12, 16 & 18

Combustible Dust 24, 28

Hearing Protection 38, 42

...and more

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COVER STORY: THE HEAT IS ON

8 Technology to Help Predict and Prevent Heat-Related Injury & Illness

One thing that we can expect from climate change is that extreme weather will continue, bringing more extreme heat. Using technology to prevent heat-related occurrences can help to improve worker health and productivity.

GAS DETECTION

12 IIoT in Gas Detection: Bridging Gaps with Technology

Implementing a gas detection solution is as simple as connecting gas detectors to the IIOT with cloud-based software.

16 Gaseous Hydride Hazards& High-Tech EV Revolution

Batteries that power the EV revolution can produce toxic hydrides. This article explores the safety and measurement challenges that arise from these compounds.

18 Bump Test & Calibration Answers to technical questions about bump testing and gas detection.

COMBUSTIBLE DUST

24 Mitigating Combustible Dust Risk: Where to Start? Ensure proactive, effective dust-mitigation efforts.

28 Combustible Dust Explosions: Are You at Risk?

All employees should have a basic awareness of the hazards of dust explosions and know how to mitigate risks.

VISION PROTECTION

34 Vision Protection: The Past Can Change the Future

A vision protection PPE program is more impactful if issues are addressed at a personal level.

HEARING/NOISE PROTECTION

38 Custom-Molded Hearing Protection in Hearing Conservation Programs

Advantages and limitations of custom-molded hearing protection devices.

42 Listen Up! Hearing Protection: Critical, but Often Unused

> Many workers are not wearing their hearing protection when they are exposed to noise on the job.

SENSORS/WEARABLES

44 Moving Safety Up the Hierarchy of Controls

The IIoT and the Industrial Internet of People work best with an understanding of where equipment and people are; requires a connection between operations and IT; and delivers information to make better decisions.

THOUGHT LEADERSHIP

48 What to Put into an Anti-Bullying Policy

A good anti-bullying policy should cover certain key elements.

CONFINED SPACES/ VENTILATION

50 Controlling Atmospheric Hazards in Confined Spaces

Understanding the principles of ventilation when controlling atmospheric hazards in a confined space is critical.

RESPIRATORY PROTECTION

54 Breathing Safely: FDA's Reissued EUA of NIOSH-Approved Respirators

> The latest updates on FDA's Emergency Use Authorization of various types of personal respiratory protection for healthcare workers.

ENVIRONMENTAL COMPLIANCE

56 Industrial Wastewater:
Eliminating Pipe
Obstructions

Speed pipe cleaning and prevent process disruptions.

BEFORE YOU GO ...

6 Note from the Editor

A note from Barbara Nessinger, Editor-in-Chief

60 Product Spotlight

61 Ad Index

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"In this heat every extra gesture was an affront to the common store of life."

-F. Scott Fitzgerald, The Great Gatsby

F. Scott Fitzgerald's magnificent novel is somehow never out of style, nor does it lack relevance—even almost 100 years after its publication. Although Gatsby became synonymous with the roaring 20s and the decadence, decay and corruption of that era, the novel never seems dated. Perhaps it's due to its themes or larger-than-life characters. For me,

it's always been about how Fitzgerald could, with one sentence like the above quote, so succinctly encapsulate a feeling.

Heat, as a literary symbol, can indicate the universe's indifference to human life. Nature is, after all, the one thing we have yet to control. If the past few decades of ever-growing climate chaos are any indication, we have not seen the last of weather extremes, including record-breaking heat.

Our cover story addresses the problem of heat stress through the lens of climate change and offers useful information about how technology can help predict and prevent heat-related injuries or illnesses in the workforce.

Technology as a tool to protect workers is a theme that runs throughout this issue, in fact. Multiple articles—from combustible dust to gas detection to hearing protection to wearables/sensors to air purification—all highlight how the latest technological advances can be used to enhance worker safety.

In addition to the above topics, we have an exclusive Thought Leadership piece on the components of a robust, workable anti-bullying policy, taking workers' emotional wellbeing into consideration as an integral part of workplace safety management.

There is also an article on how to get workers on board with wearing the proper vision protection PPE by changing their mindset—and providing the right protection for the right job environment. Finally, we take a look at industrial wastewater elimination through the use of the latest pipe-obstruction nozzles and solutions.

I hope you enjoy this jam-packed issue. As always, we strive to provide state-of-the-industry information to your doorstep. I hope it assists you in your respective positions within the industry and that you continue to keep your workers safe, healthy and injury-free—and try to keep cool this summer.

Regards,

Barbara Nessinger, Editor-in-Chief

P.S. If you are interested in contributing an article, Thought Leadership or Perspectives piece, feel free to contact me at bnessinger@workplacemhs.com.



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P.O. Box 80915 Rochester, MI 48308 586-227-9344

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PRESIDENT/GROUP PUBLISHER

Randy Green

EDITOR-IN-CHIEF Barbara Nessinger

SENIOR ACCOUNT EXECUTIVE

Jacob Swindell

ACCOUNT EXECUTIVE

Lydia Stewart

ACCOUNTING MANAGER

Kristin Green

SYSTEMS ADMINISTRATOR

Angi Hiesterman

OPERATIONS/CUSTOMER SERVICE

Jody Kirchoff

PUBLICATION COORDINATOR

Lacey Scanlan

WEB DESIGN

Josh Scanlan

LIST RENTAL

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By: Elizabeth Foster, Contributor

Climate Change:

How Technology Can Help **Predict and Prevent** Heat-Related Injury & Illness

The World Health Organization estimates that heat exposure will directly lead to 38,000 unnecessary deaths during the 2030s and more than 100,000 additional deaths per year in the 2050s. Each year, we are experiencing an escalation of extreme weather.

This past summer brought record-breaking heatwaves across the globe. July is notably the hottest month of the year, and July 2021 carries the distinction of being history's hottest recorded month." The record-breaking heat in the Western U.S. and Canada sparked catastrophic wildfires and had humans battling the growing flames which then left land desolate. Due to the ongoing climate crisis, we can expect continuing extreme heatwaves of increasing magnitude that will impact essential workers due to high heat exposure.

Core Body Temperature

The human brain will maintain a core body temperature (CBT) within 1 or 2 degrees of 98.6F (37C). Body temperature control is vital, because many of the body's essential processes require a



temperature within a particular range. ** When faced with rising temperatures, the body utilizes two critical functions to cool down. The person will begin to sweat, and the evaporation of that sweat will cause the body to start the cool down process. Also, the body will send blood to the extremities to allow heat to escape.

If the body fails to cool itself, CBT will continue to rise. An increasing CBT puts you at risk for heat cramps, heat exhaustion and heatstroke. While all three conditions can be detrimental and lead to heat illness, they can also lead to heatstroke, which can be life-threatening. Another symptom of rising CBT is diminished work capacity, as the worker begins to feel discomfort and fatigue. Errors will start to occur, due to reduced power in judgment and perception, and the body can exhaust and collapse. iv

Fortunately, tech companies are developing tools using technology to prevent such heat-related occurrences, improving

worker health and productivity.

ID #356 100.4° Overheat Warning Risk Level 1

Tools using technology to prevent heat-related occurrences can help to improve worker health and productivity. (photo courtesy Kenzen)

Smart PPE: Wearable Technology

Some companies, such as Kenzen, provide smart PPE by using proprietary algorithms and wearable technology to bring actionable insights to the worker, supervisor and corporate EHS decision-makers. A wearable device worn on a worker's upper arm contains sensors that monitor the individual's physiological responses to heat in real-time. Kenzen incorporates additional information, such as the individual's height, weight, age, pre-existing conditions, history of heat injury or illness, and environmental factors (humidity and temperature) to track heat risks for the worker. This information is used to calculate an individual's heat susceptibility.



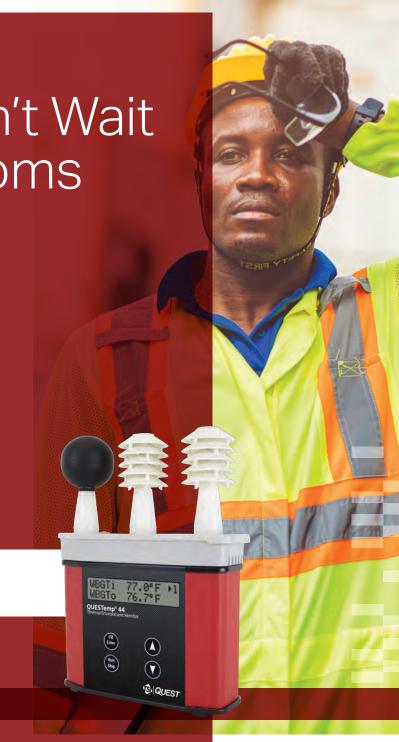
When it comes to worker exposure to heat, don't wait for heat stress symptoms to drive your decisions.

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Heat susceptibility is how sensitive an individual is to heat and therefore more at risk for a heat-related injury or illness. Workers can be classified into low, moderate or high heat-risk. Heat susceptibility allows managers and safety personnel to identify who to watch closely on scorching hot days and better adjust workloads for those at varying risk levels.

Hydrate, Hydrate, Hydrate

Drinking enough fluids helps to combat potential heat-related illness on hot, humid days by replenishing the body's fluids lost through sweating and lowering CBT. Some modern monitors have a sweat rate monitoring feature that calculates and predicts the amount of sweat loss an individual will have on a given day. Through an analytics dashboard, management can see how much water their teams will need each day and how much water each person needs to drink per hour based on their sweat rate. This sweat rate feature provides critical data. It enables management to bring an adequate amount of water to worksites and empowers them to structure worker breaks and encourage proper hydration—with data to back their decisions.

Heat-monitoring technology comes at a valuable time, as the Biden administration is calling on OSHA to protect workers against heat-related injury and illness. On September 20, OSHA announced the implementation of an enforcement initiative addressing heat-related hazards, the development of a heat inspections program and an impending workplace heat standard.

Climate change makes it difficult to predict what the future holds for our environment. One thing that we can expect is extreme weather to continue, which brings extreme heat. Now that enforceable safety regulations are on the way for heat-related work hazards, technology will play a greater role in managing to the standards and, ultimately, keeping employees safe and productive as conditions change around them.



One thing that we can expect from climate change is that extreme weather will continue, bringing more extreme heat. (photo courtesy Kenzen)

About the Author

Elizabeth Foster is a Product Manager for Kenzen, the smart PPE innovator focused on physiological monitoring and the prevention of heat injury and death among workers. Foster has experience in wearable technology, delivering software, SaaS, IoT and IaaS, including Kenzen's real-time heat monitoring system, used by companies to keep workers safe from heat-related injuries on the job—while maintaining productivity.

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When it comes to keeping your employees safe from gas hazards, creating a reliable gas detection, maintenance and safety program might feel as daunting as climbing Mount Everest. If you have the right tools in place and are properly prepared, you'll ascend the mountain successfully and with ease. But, if you don't have the right equipment, not only will it quickly become an overwhelming task—you're also likely to fail.

However, unlike climbing Mount Everest, implementing a complete gas detection solution for your team doesn't need to be the most difficult challenge you ever face. It's as simple as connecting gas detectors to the Industrial Internet of Things (IIoT) with cloud-based software that can provide real-time analytics and status updates on gas hazards and worker safety.

When building an IIoT-connected gas detection program, ensuring your people are safe from gas hazards is the number-one priority. However, it's important to consider how other aspects, such as communication, day-to-day operations, visibility into site hazards and more, impact your gas detection program and the overall safety of your workers.

Closing Gaps in Communication

Gaps in communication between operators and safety managers can happen at any facility, but to what extent? In some facilities, gaps in communication can mean not being able to easily share gas hazard alarms between operators and safety managers working near one another. It can extend further, however, when safety managers can't access real-time data, such as gas readings or emergency alerts, from another building on the other side of the facility—leaving workers stranded without help. Either way, you need to close any gaps in communication to ensure the safety of workers.

By implementing an IIoT-enabled gas detection program, you can easily share alarms and gas readings between operators

and safety managers, making it easier to quickly respond to gas hazards, panic alarms or man-down alarms. Depending on how robust your safety program is, safety managers can even receive this information directly to their own gas detector or can implement remote live-monitoring options to see readings instantly on a phone or laptop.

Seeing Site Hazards Like Never Before

Another important component of an IIoT-enabled gas detection program is clear visibility into site hazards, so you not only know who has been exposed to gases, but where.

Here, facilities can add IIoT technologies in areas where they believe they're getting hit with the most exposure. For example, if a worker is wearing a gas detector in a high-exposure area and it detects a hazardous gas, it will connect to pre-placed beacons and mark the location. The information from the beacon is sent to the cloud in real time to alert safety managers of hazards.



Gas detection management software provides clear visibility into your process, so you can easily manage hazards, people and equipment from anywhere, with one dashboard. (Photo courtesy Industrial Scientific Corporation)



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Gas monitors with datalogging capabilities, meanwhile, allow data from a pre-placed beacon to be stored on the monitor, and it's automatically uploaded to the cloud when the device is docked for the day. This enables safety managers to look more deeply into what's happening around their site by generating alarm reports with information like who had the gas monitor; if or when they were exposed to gases; how much gas they were exposed to; and where the exposures came from. This historical data is particularly useful for incident investigations.

With cloud-based gas detection software linked directly to workers' gas monitors, you can get real-time alerts when workers enter restricted areas or are exposed to hazards, as well as identify high-risk areas with visual summaries of gas alarms by type, location, user and more. This allows you to manage your team from anywhere, even if they're in different locations.

Streamlining Operations

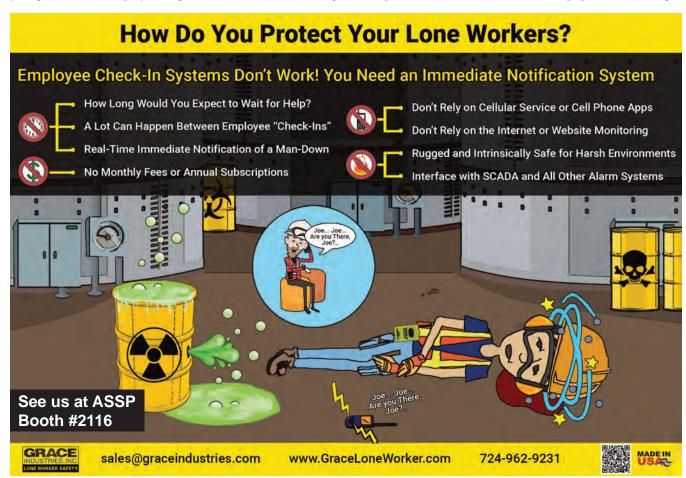
No matter how you slice it, lost gas monitors are inevitable; trying to find the equipment you need can cause unnecessary stress, harm your bottom line or create unsafe working conditions.

While deciding on the right IIoT-backed gas detection solution for your facility, it's important to keep a few questions in mind—such as "how are you losing monitors?" or "who exactly is using your gas detectors: employees or general contractors?" —among



Keeping teams connected through IIoT-enabled gas detectors and robust, cloud-based software options helps create a reliable gas detection, maintenance and safety program. (Photo courtesy Industrial Scientific Corporation)

many others. Knowing exactly how you're losing monitors is critical in determining both what type of equipment you need (and how much) for your gas detection program. To streamline operations and cut down on lost equipment, turn to gas



detection maintenance tools that show your entire fleet in real time—making equipment tracking and management easy—so you lose fewer monitors.

Certain solutions, for example, include gas detection management software that provides clear visibility into your process so you can easily manage hazards, people and equipment from anywhere, with one dashboard. Additionally, by managing all equipment from one dashboard, you can see who is assigned to each gas monitor and find out what happened if it isn't returned.

Ensuring Seamless Production and Reliability

A robust, full-service gas detection and maintenance program goes beyond keeping your team safe and, while it can help streamline operations, it can also improve production uptime and reliability. When you go into work, you expect your gas monitors to be calibrated and ready to use. So, when monitors are broken or calibration gas is empty, you can't do your job effectively (or in some cases, at all).

Gas detection programs backed by cloud-based services ensure that you always have the equipment you need—when you need it—to keep production up and running without any hiccups. A standard oxygen sensor, for example, is typically only good for 18-24 months. Once the sensor goes down, who is going to repair it? With IIoT technologies supporting your gas detection and maintenance program, you can use predictive analytics to know when sensors will fail. This service option will then automatically ship out a new sensor, so you have a replacement ready to go before you even know there's a problem with the original sensor. This helps you minimize production downtime.

Overall, keeping teams connected through IIoT-enabled gas detectors and robust, cloud-based software options helps create a reliable gas detection, maintenance and safety program that ensures teams can successfully conquer their own Mount Everest. Whether you're responding quicker to gas hazards with real-time visibility and alerts; identifying high-risk areas with visual summaries of alarms; or simply knowing which monitors have been bumped and calibrated—gas detection programs backed by IIoT networks and applications are the key to staying connected and safe no matter where workers are. **IHW**

[Dante Moore is an Applications Engineer at Industrial Scientific Corporation, specialized in helping companies find the right gas detectors for their applications. He can be reached at dmoore@ indsci.com.]

Let us focus on your thoughts! Industrial Hygiene in the Workplace's "Thought Leadership" column is a great way to get the word out about a new process, technology or approach that serves the industrial hygiene space.

For more information or to talk about participating in an upcoming issue, contact Barbara Nessinger, Editor-in-Chief, bnessinger@workplacemhs.com.





The manufacturing of chips and other high-tech electronics has helped drive the electric vehicle (EV) revolution. Common gas hazards monitored in electronic production processes include toxic hydrides, such as arsine (AsH₃) and stibine (SbH₃). Batteries provide the energy storage to power EVs, making them a key technology underlying the revolution.

Although the use of batteries is considered more environmentally friendly than fossil fuels, in terms of a carbon footprint, their use also gives rise to familiar environmental hazards such as hydride gas emissions—amongst others. In what is perceived to be a "green" revolution, let us explore this key power source and the toxic hydrides produced during the production and recycling of batteries.

Both AsH₃ and SbH₃ become toxic at quite low levels. AsH₃ has a TWA exposure value of 0.05ppm and an IDLH of 3ppm and SbH₃ a TWA of 0.1ppm and an IDLH of 5ppm. Both substances target organs such as the blood, kidney and liver. Additionally, arsine is linked to certain cancers. This article discusses the measurement challenges that arise as the TLV values for these compounds are in the sub-ppm concentration range.

These gases arise during processes used to produce and recycle important nonferrous metals used in batteries, such as zinc and copper. Normally, a key part of the refining and purification processes is the addition of the ore or dirty recovered metal to sulfuric acid (H₂SO₄) solutions. The ores or refined metals have trace

amounts of arsenic (As) and antimony (Sb) contaminant in various chemical forms. The addition of sulfuric acid can cause a reaction to produce (AsH₃) and/ or (SbH₃).

Measurement and Monitoring

Measuring these substances is quite challenging under the best of conditions. The toxic hydrides must be monitored at quite low values due to their toxicity at sub-ppm levels. When batteries are being produced and processed for recycling, these hazards are present in a demanding environment that is potentially very corrosive and dirty—and might have elevated temperatures plus high humidity.

There are highly effective technologies for measuring low-level hydrides that have been in use for some time in semiconductor manufacturing. The technology most often utilized for this is colorimetric tape analyzers. These colorimetric tape analyzers are able to measure hydrides down to low-ppb concentrations and have proven themselves to be quite dependable for these types of measurements over the years. However, implicit in semiconductor manufacturing are carefully controlled ambient conditions. Most semiconductor hydride measurements are recorded in environmentally controlled "clean rooms" with little or no dust, moisture or excess temperature.

Overcoming Challenges in Battery Production

The key challenge to overcome for battery production and recycling is deploying precision colorimetric analyzers designed

for clean, dirt-free environments, in less pristine sampling conditions associated with metal refining and recycling. To make these measurements without destroying the analyzer, the use of sample conditioning systems is required. The sample must be conditioned to ambient conditions of temperature, pressure, particulate concentrations and humidity so the analyzer is not destroyed.

A typical sample system that reduces dust and excess humidity, and provides sample cooling, is shown in the photo below. Although these systems can be quite complex, the underlying goal is straightforward. You need to draw a non-ambient gaseous sample and convert it to an ambient one in a reproducible



Shown here is a colorimetric analyzer in combination with a sample system for gas sampling in a harsh industrial environment. (photo courtesy DOD Technologies, Inc.)

 $1 \quad \text{See the NIOSH Pocket Guide to Chemical Hazards} \ \text{available online at the CDC website and in printed format.} \\$

way, so it can be measured by precision analyzers designed for clean, ambient atmosphere environments. This combination of ambient colorimetric analyzers and sample systems is being effectively utilized at battery manufacturing and recycling facilities; several high-profile players in this field have successfully implemented these types of solutions to address hydride hazards.

Based on current market trends, the requirement to monitor hydride emissions from battery production and processing will increase rapidly. For example, there are over 1,000lbs of batteries in a typical EV.2 Driven by EVs and other consumer electronics, the global market size for rechargeable batteries is expected to grow from \$44.49 billion in 2021 and is projected to reach \$193.13 billion by 2028. That translates into a compounded annual growth rate of 23.3% during the forecast period from 2021-2028.3

The number of facilities that produce and recycle batteries will have to rapidly grow to keep up with the demands for manufacturing and recycling of rechargeable batteries. CATL, LG and Panasonic, estimated to control about 70% of the EV battery market, are currently planning capacity and plant expansions.⁴

In summary, hydride emissions from battery production and recycling are increasing in the workplace, driven by strong

- 2 Tesla Model 3, Wikipedia.org
- 3 Fortune Business Insights February 21, 2022
- 4 Spectrume.ieee.org, The Top 10 EV Battery Makers, August 25, 2021

demand for the batteries used in EVs and other applications. The same colorimetric tape technologies that have been effectively utilized in the semiconductor industry, primarily in clean rooms, are effective at measuring these toxic hydrides. The technical challenge is that the conditions associated with battery production are often quite dirty and might have elevated temperatures and moisture associated with them. These issues are addressed with sample conditioning systems, bringing the sample to ambient conditions that will not harm the analyzer and allow accurate hydride measurements to be made—even under harsh sampling conditions. **IHW**

About the Author

Dr. Blaise Champagne has 30+ years of experience in gas detection and related fields. He is the Business Development and European/Southern Territory Manager at DOD Technologies, Inc., a gas detection manufacturer specializing in low-level, colorimetric-based gas-detection technologies.





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Gas Detection: Bump Testing

By: Bob Henderson, Contributor

Bump Test and Calibration Issues and Answers

Manufacturers and regulatory agencies agree the safest and most conservative approach is to perform a functional bump test or calibration check by exposing your gas detector to gas before each day's use. But instrument users still have questions.

Oxygen deficiencies, explosive atmospheres, and exposure to toxic gases and vapors injure hundreds of workers every year. The atmospheric conditions that lead to these accidents and fatalities are usually invisible to the workers who are involved. The only way to ensure atmospheric conditions are safe is to use an atmospheric monitor. The only way to know whether an instrument is capable of proper performance is to expose it to test gas. Exposing the instrument to known concentration test gas verifies that gas is properly able to reach and be detected by the sensors. It verifies the proper performance of the instrument's alarms, and (if the instrument is equipped with a real-time display), that the readings are accurate. Failure to periodically test and document the performance of your atmospheric monitors can leave you open to regulatory citations or fines, as well as increased liability exposure in the event that a worker is injured in an accident.

OSHA recommends developing procedures for calibrating and using DRPGMs that include documentation to verify the proper maintenance and calibration of the instruments.

There has never been a consensus among manufacturers regarding how frequently direct reading portable gas detectors need to be calibrated. However, manufacturers do agree that the safest and most conservative approach is to verify the performance of the instrument by exposing it to test gas before each day's use. Performing a functional "bump test" or "calibration check" is very simple and takes only a few seconds to accomplish. It is not necessary to make a calibration adjustment unless the readings are found to be inaccurate.

Several OSHA standards require the use of gas monitors and include guidance on testing and maintenance. For instance, OSHA 1910.146 "Permit-required confined spaces" paragraph (c)(5)(ii)(C) explicitly states (in part) that, "Before an employee enters the space, the internal atmosphere shall be tested, with a calibrated direct-reading instrument." OSHA Compliance Directive CPL 2.100, "Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146" explains what is meant by calibrated: "A testing instrument calibrated in accordance with the manufacturer's recommendations meets this requirement. The best way for an employer to verify calibration is through documentation."

It is up to the manufacturer to determine the methods, as well as how frequently the instrument should be calibrated. The manufacturer's requirements are spelled out in the owner's manual. Using small high-pressure cylinders of test gas makes it possible to package complete kits that include the instrument, regulator, gas and accessories in a compact carrying case. Each compact cylinder provides up to 250 daily bump tests. (photo courtesy GFG Instrumentation)

Instrument users are held accountable to these requirements. If you fail to follow

the instructions in the manual it means the instrument is not being properly used and maintained. This could be grounds for an OSHA citation, but even more importantly, it could lead to dangerously inaccurate readings. The cautions and warnings in the manual are there for a reason!

For instance, if the instrument includes a sensor for measuring percent LEL explosive gas, one of the cautions at the very front of the manual is that the LEL sensor should be tested by exposure to known concentration gas before each day's use. This is to guard against using the instrument if the LEL sensor has been damaged or has lost sensitivity. Why is this important? Standard catalytic type LEL sensors, the most common type of sensor used to measure percent LEL explosive gas, can be easily damaged by exposure to vapor that contains silicones or other LEL sensor poisons and inhibitors. There is no way to tell if the sensor has been affected except by exposing it to gas.

ISEA Statement on Validation of Operation for Direct Reading Portable Gas Monitor

The International Safety Equipment Association (ISEA) is the leading international organization of manufacturers of safety equipment, including environmental monitoring instruments. The ISEA has developed a "Statement on Validation of Operation for Direct Reading Portable Gas Monitors" that provides additional guidance. OSHA has incorporated these recommendations into their own Safety and Health Information Bulletin on "Calibrating and Testing Direct-Reading Portable Gas Monitors."

The ISEA statement emphasizes the importance of verifying the calibration of instruments used to monitor the atmosphere in potentially hazardous locations, and clarifies the methods used to validate the operational capability of portable gas monitors. The statement defines the differences between a bump test (function check), calibration check, and a full calibration, and clarifies when these validation methods are to be performed. The ISEA statement applies to all of the sensors installed in the direct reading gas detector, not just the combustible sensor, and is designed to be applicable to personal as well as multi-gas instruments. It is not limited to instruments used in confined space entry.

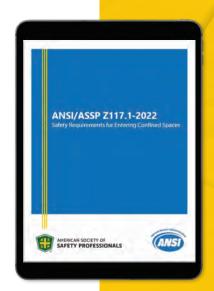


WORKING SAFELY IN CONFINED SPACES

Confined spaces are found in nearly every work environment. These spaces can expose workers to hazards related to oxygen deficiency and toxic or combustible atmospheres.

Safety professionals can use the ANSI/ASSP Z117.1-2022 standard to help establish procedures that protect the safety and health of employees who work in, and in connection with, confined spaces.

The standard covers a wide range of topics, including atmospheric testing, isolation and lockout/tagout, ventilation, cleaning and decontamination, protective equipment and rescue.







Gas Detection: Bump Testing

What causes an instrument to lose accuracy?

Single-sensor instruments are designed to focus on a single toxic contaminant or hazardous condition (such as H2S or O2 deficiency), or the presence of a class of atmospheric hazard (such as the presence of combustible gas). "Zero maintenance" single-sensor instruments may or may not include a meter for the display or real time readings, and they may or may not be capable of calibration adjustment while exposed to test gas. Confined space and other types of multi-sensor instruments include several different types of sensors. The type of sensors installed depends on the specific monitoring application.

The atmosphere in which the instrument is used can have profound effect on the sensors. Each type of sensor uses a slightly different detection principle. Sensors may be poisoned or suffer degraded performance if exposed to certain substances. The kinds of conditions that affect the accuracy of sensors vary from one type of sensor to the next.

While the electrochemical sensors used to measure toxic gases like carbon monoxide and hydrogen sulfide are not worn out or consumed by exposure to CO or H2S, they still eventually need to be replaced when they are no longer able to detect gas. Although the sensors may last for years, the loss of sensitivity at the end of life may be sudden. Incidental exposure to other substances may also reduce sensitivity. For instance, many electrochemical sensors can be permanently affected by exposure to organic solvents and alcohols.

Combustible sensors are prone to damage due to exposure to poisons or substances that inhibit the sensor's response to combustible gas. Combustible sensors may be affected by exposure to volatile silicones, chlorinated solvents (such as methylene chloride), sulfides (including H2S), hydrides (such as phosphine and arsine), or even exposure to high concentrations of combustible gas. Sensors may also suffer loss of sensitivity due to aging, mechanical damage due to dropping or immersion, or loss of sensitivity due to other causes.

Even if a sensor is internally healthy, if gas is not capable of reaching and diffusing into the sensor because of blockage or leakage in the pump or sampling system, or because the external filter has become clogged or contaminated, the sensor cannot properly respond. Thus even "zero maintenance" single-sensor instruments should be periodically exposed to gas to ensure that the instrument is capable of proper response. Even if the sensor response and readings are correct, if the alarms are not properly activated, or if the instrument fails to operate properly in other ways when exposed to gas, the instrument must be serviced to restore proper function before it can be used.

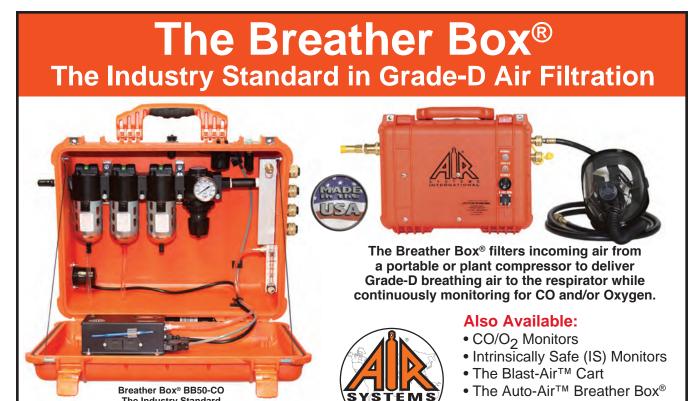
Validation of Operability

The ISEA protocol begins by clarifying the differences between a "bump test", a "calibration check" and a "full calibration".

A "bump test" (function check) is defined as a qualitative check in which the sensors are exposed to challenge gas for a time

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Gas Detection: Bump Testing



Docking Stations are designed to perform bump tests or calibration checks, full calibrations, and automatically store the testing records. (photo courtesy GfG Instrumentation)

> and at a concentration sufficient to activate at least the lower gas measurement alarms. The test confirms that the gas is capable of reaching

the sensors, that when they are

exposed to gas the sensors respond, the response time (time to alarm) after gas is applied is within normal limits, and that the alarms are activated and function properly. However, a qualitative function test does not verify the accuracy of the readings or output of the sensors when exposed to gas.

A "calibration check" is a quantitative test using a traceable source of known concentration test gas to verify that the response of the sensors is within the manufacturer's acceptable limits. For instance, a manufacturer might specify that readings in a properly calibrated instrument should be within $\pm 10\%$ of the value of the gas applied. If this is the pass / fail criterion, when 20 ppm H2S is applied to the instrument, the readings must stabilize between 18 ppm and 22 ppm in order to pass

the test. It should be stressed that these pass / fail criteria are manufacturer guidelines. Different manufacturers are free to publish different requirements.

A "full calibration" is defined as the adjustment of an instrument's response to match a desired value compared to a known traceable concentration of calibration gas. The calibration procedure, including the concentration of gas applied, method used to apply gas, and method used to adjust the readings are determined by the manufacturer.

The ISEA statement recommends that a "bump test" (functional test) or "calibration check" of direct reading portable gas monitors should be made before each day's use in accordance with the manufacturer's instructions using an appropriate test gas. Any instrument that fails the test must be adjusted by means of a "full calibration" procedure before further use or taken out of service. If environmental conditions that could affect instrument performance are suspected to be present, such as sensor poisons, verification of calibration should be made on a more frequent basis.

A "full calibration" should be conducted as required by the manufacturer, or whenever testing indicates that adjustment is required. Even if the instrument is not yet "due" for a "full calibration", if the instrument fails a "bump test" or "calibration check" it must be calibration adjusted before further use.



The ISEA Protocol provides a list of conditions that can adversely affect the sensors and trigger a need for more frequent validation. Make sure to test the instrument after any event like dropping or submerging the instrument, or if the instrument changes hands during the course of the workday.

Docking stations make CS instruments even easier to use and maintain.

Most data logging direct reading instruments automatically update and store dates as well as monitoring and calibration information. Even non-data logging instruments usually store the date, or number of days since the last time the instrument was calibrated.

Most gas detector manufacturers offer automatic calibration or "docking" stations that automatically tests or calibrates the instrument, and updates and stores the test results. Docking stations usually go beyond the minimum requirements for bump test and calibration checks. Most docking stations verify that the alarms are activated, the time it takes for the sensor to reach the alarm after exposure to gas, and the accuracy of the reading. Docking stations can also alert users to overdue maintenance procedures and may be able to communicate directly with the factory or service center.

While there are strong advantages, there is no requirement to use a docking station. Performing a manual bump test is fine! But make sure you keep good records. Many users keep a notebook or journal in the same case as the instrument and test gas, or periodically download the test and exposure results from the instrument.

What is the best concentration of gas to use for the daily bump test?

Use a concentration of gas for each sensor that is at least 50% higher than the lower alarm setting that is being tested. Be careful not to use a concentration of gas that is close to the concentration needed to trigger the alarm. Most common sensors, like the ones used to measure LEL, O2, CO and H2S reach at least 50% of their final reading (T50) within the first 10 seconds after exposure to gas. But it can take over a minute for the same sensors to reach 100% of their final stable reading (T100). If the low alarm for your CO sensor is set at 50 ppm, and you use 50 ppm to test the sensor, it may take 80 - 90 seconds for the reading to finally reach and trigger the alarm – if it ever does. On the other hand, if you use 200 ppm CO to test the sensor, it will probably take less than 5 seconds to trigger the alarm.

Does the bump test have to include all of the sensors?

OSHA recommends developing standard procedures for calibrating and using instruments that include documentation to verify the proper maintenance and calibration, but the guidance does not include the requirement to test all of the sensors during the bump test.

In general, with 4-gas O2 / LEL / CO / H2S instruments it is so easy and convenient to test the sensors that there is nearly universal acceptance that all of the sensors should be tested during a bump test or calibration check. But when the instrument includes certain other types of sensors, or when the exposure to gas has negative consequences for some of the sensors, it may be necessary to take a different approach.

Direct reading gas detectors are designed to help keep workers safe in potentially life-threatening environments. Verifying the proper performance of your gas detectors is a mandatory part of every program that requires their use. But more importantly, it's an essential part of keeping your workers safe. IHW



By: Andy Thomason, Contributor

Maximize Safety When Working With Combustible Dust

All it takes for a dust explosion to occur at your facility is for oxygen, an ignition source, and a combustible dust cloud to come together in a confined space. If your operation generates dust, you probably already have some mitigation processes in place. However, to ensure that your efforts are effective enough, it is important to understand the nature of a dust explosion; what to include in your safety plan; regulatory requirements; and how to safely maintain your dust collection system.

Explosion Event

After the initial explosion or deflagration event, elastic rebound shockwaves occur, which cause more dust clouds. Secondary deflagrations and explosions are caused by these dust clouds jarred loose from the primary explosion. The explosion pentagon repeats itself until one of the five elements is no longer present. All this happens in an average time span of less than 500 milliseconds.



After an initial explosion or deflagration event, elastic rebound shockwaves occur, which cause more dust clouds. Secondary deflagrations and explosions are caused by the dust clouds jarred loose from the primary explosion. The explosion pentagon repeats itself until one of the five elements is no longer present. (Image courtesy Camfil APC)

Combustible Dust Safety Planning

Some accidents are unpreventable, but the consequences can be limited. Many accidents can be avoided with the proper education, planning and equipment.

Training: A vital component to a combustible dust safety program is educating personnel to recognize unsafe conditions. Training ideally should include what conditions to watch out for; how to report them to management; when it is necessary to take preventative action; and what steps to take to mitigate possible disaster. This means, in addition to OSHA-required training in work safety applicable to their specific jobs, workers should learn about facility programs for controlling ignition sources and dust. This includes pre-employment training and ongoing education, especially if their duties or processes change. Managers and supervisors also need to know how to process information received from workers, so unsafe practices can be addressed immediately.

<u>Key Safety Program Components:</u> Although the specifics of a combustible dust safety program depend on the processes taking place, it should include the following core elements:

- Facility analysis to identify open and hidden areas where combustible dusts might accumulate; ways in which the dust could be dispersed into the air; and potential ignition sources
- Process hazard analysis, which OSHA requires on each process point generating dust
- Dust hazard analysis, which the National Fire Protection Association (NFPA) requires, to determine if the process-generated dust is explosive
- Plan detailing how to remove the dust hazard from each process
- Housekeeping policy describing cleaning processes to control the buildup of combustible dust
- Maintenance and inspection schedule to keep equipment operating properly and in compliance with relevant regulations
- Detailed plan on how to execute, manage and adjust the elements of the combustible dust program



This image shows dust accumulation at an industrial facility. (Image courtesy Camfil APC)

NFPA Standards

The NFPA sets safety standards for managing combustible dust. NFPA standards are not laws, but you should take them very seriously, because failure to comply puts your facility and workers at risk for devastating combustible dust fires and explosions. In addition, OSHA uses these standards to evaluate risk and cite safety violations. Noncompliance can also lead other authorities having jurisdiction (AHJ) to withhold permits or insurance companies to deny coverage.

These are the main NFPA standards you need to know if your facility handles combustible dust:

NFPA 652 Combustible Dust Standard provides requirements for managing combustible dust fires and explosions across industries, processes and dust types. As noted above, owners or operators of a facility that generates combustible dust must conduct a dust hazard analysis; develop a plan for managing fire and explosion dangers; and provide training for workers who potentially could be affected by the hazards. A dust hazard analysis includes the process machinery that produces dust and the dust collection system itself.

NFPA 654 Standard for Preventing Fire and Dust Explosions from Combustible Particulates applies to all phases of the manufacturing, processing, blending, conveying, repackaging and handling of combustible particulate solids or hybrid mixtures, regardless of concentration or particle size. It defines requirements of facilities for process hazard analysis, management of process change, performance-based design requirements, facility and system design, and process equipment explosion protection.

The performance-based design option specifies that, if the AHJ approves of another method for protecting your dust collector from explosions, you can use that method instead of one



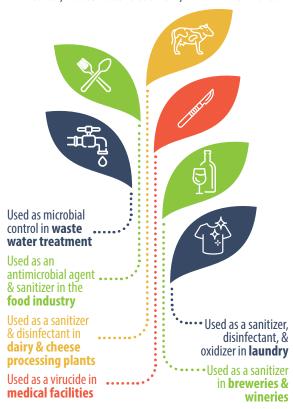
The NFPA sets safety standards for managing combustible dust. While they are not laws, they should be taken seriously; failure to comply puts the facility and workers at risk for devastating combustible dust fires and explosions. (Image courtesy Camfil APC)



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specified in the standard. An example of an AHJ is a local or regional public safety authority, such as a fire marshal.

NFPA 68 Standard on Explosion Protection by Deflagration Venting covers all prescriptive and performance-based design requirements and calculations for deflagration venting. These systems vent combustion gases and pressures resulting from a deflagration within an enclosure in order to minimize structural, mechanical and physical damage.

NFPA 69 Standard on Explosion Prevention Systems prescribes the design of prevention controls including inlet and outlet ducting, spark-extinguishing systems and methods for preventing an explosion from traveling back into the building or to process locations upstream of inlet ductwork.

NFPA 484 Standard for Combustible Metals magnifies the level of attention needed for applications dealing with metal dust types because of the severity of explosions and ease of ignition of metal dust. It also applies to processing or finishing operations that produce combustible metal powder or dust.



Dust collection systems should include protection equipment, such as explosion venting. A dust explosion in an unprotected dust collector produces a high-pressure wave that can fragment the housing and send heat, flames and dangerous projectiles into the surrounding area. (Image courtesy Camfil APC)

NFPA 61 Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities covers requirements for operations that handle, process or store dry agricultural bulk materials, including grains, oilseeds, agricultural seeds, legumes, sugar, flour, spices, feeds, starch and other related materials.

Safe Operation of the Dust Collection System

Using a dust collection system that is properly designed for your specific operation can significantly reduce combustible dust in the work environment. However, the dust collection system itself can be a source of an explosion—if it is not protected. This is because dust collectors are closed vessels full of dry particles that can form a dust cloud and become ignited if the fan draws in a spark or flame from outside of the collector. Therefore, it is imperative to outfit the dust collection system with protection equipment, such as explosion venting. A dust explosion in an unprotected dust collector produces a high-pressure wave that can fragment the housing and send heat, flames and dangerous projectiles into the surrounding area.

If your facility produces or processes combustible dusts, your collection system must be equipped with deflagration protection as set by the applicable NFPA Standards. You can add prescriptive controls to protect the system or performance-based controls. Camfil's integrated safety monitoring filter is an example of a performance-based control device.

An integrated safety monitoring filter (also called an iSMF) installed on the top of a dust collector protects the downstream equipment and work area, because it acts as a flame front barrier. Flameless vents can be installed over a standard explosion vent to extinguish the flame front as it exits the vented area, stopping it from leaving the device.

Mitigating Risk

Dealing with combustible dust is a challenging but necessary duty. Fortunately, combustible dust is a hazard that can be managed, to a great extent, with thorough planning and attention to detail. Understanding the recipe for an explosion; developing a safety program; and incorporating the appropriate NFPA-compliant explosion protection devices on your dust collector can help you manage the risk of personnel injury and damage to your equipment and facility.

About the Author

Andy Thomason is the Senior Applications Specialist at Camfil Air Pollution Control (APC), where he provides application support to the sales and customer base and technical support to new product development. For information, contact 800-479-6801 or 870-933-8048; email filterman@camfil.com; or visit www.camfilapc.com.



By: Tim Turney, Contributor

Combustible Dust Explosions: Are You at Risk?

Between 1980 and 2005, the U.S Chemical Safety and Hazard Investigation Board (CSB) identified 281 combustible dust incidents that ultimately led to the death of 119 workers and 718 injured workers, on top of extensive damage to the respective facilities. In many of these incidents, both managers and workers were unaware of the associated safety and health risks that extensive amounts of dust in the air posed, with prolonged exposure to airborne dust associated with health conditions such as chronic breathing, lung problems and possibly heart disease.¹

Combustible dust explosions are one of the largest and most fatal potential accidents when working with materials that produce large quantities of fine dust particles—posing a threat to the health of those working in these environments. For many, coal dust, grain storage and flour mills are immediately associated with dust explosions, as they make primetime news. However, any workplace that generates dust is potentially at risk of dust explosions, including agriculture, woodworking facilities, paper, plastics, textiles and pharmaceuticals. Materials that do not normally burn in larger pieces are also still at risk of becoming explosive in certain conditions, such as aluminum and iron.

What Creates Dust?

Dust is created when materials are transported, handled, processed, polished, ground and shaped. Dust can also form from abrasive blasting, cutting, crushing, mixing, sifting or screening dry materials. The build-up of dried residue from the processing of wet materials can also generate dust.

Levels of dust in the workplace continuously rise from such daily activity, which is why employers need to stay vigilant to the amounts of dust in the workplace to protect workers from hazardous incidents and potentially detrimental consequences to their health.

A dust explosion can only occur when the following five factors are present:

- 1. Combustible dust (fuel)
- 2. Ignition source (heat)
- 3. Oxygen in the air (oxidizer)
- 4. Dispersion of dust particles in sufficient quantity and concentration
- 5. Confinement of the dust cloud



There are several ways dispersion can occur, such as a dry filter being pulse-cleaned or from an initial (primary) explosion in processing equipment, causing a blast wave that disturbs accumulated dust that, if ignited, causes a secondary explosion. The latter is often far more destructive than a primary explosion, due to the increased quantity of dispersed dust.

Monitoring Dust

Employers have been reminded of the importance of efficiently monitoring dust levels from the severity of combustible dust explosions over the last few years. In February 2003, a Kentucky acoustics insulation manufacturing plant suffered several dust explosions because of a small fire from an unattended oven, igniting a dust cloud nearby that resulted in a cascade of explosions throughout the plant. Seven people were killed in the accident; 38 were badly injured.

The following are all contributors to ineffective dust control in an environment:

- · Hazard assessment
- Hazard communication
- Maintenance procedures
- · Building design
- Investigation of previous fires

 $^{1\}quad Combustible\ Dust\ in\ Industry:\ Preventing\ and\ Mitigating\ the\ Effects\ of\ Fire\ and\ Explosions\ (osha.gov)$



Mitigate the risks of combustible dust

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All employees should have a basic awareness of the hazards of dust explosions and the best way to mitigate those risks. (Photo courtesy Adobe Stock)

What can employers and managers do to protect their workers, and what can workers do to protect themselves from combustible dust explosions?

The Hazard Communication Guidance for Combustible Dusts, 2009, as set out by OSHA, names the requirements needed to improve and safeguard the health and safety of those working around and with dangerous substances. Employers need to identify where explosive atmosphere conditions occur; assess the risk; and record what actions are being taken to prevent an explosion and fire.²

One of the most important, life-saving measures that an individual can take to protect themselves is through high-quality dust monitoring equipment. Undertaking a walk-through survey using a hand-held, real-time sampler would give an instantaneous indication of concentration. It could also be used to check the effectiveness of control measures such as local exhaust ventilation, for example, both pre- and post-filter.

Industrial hygienists may already be undertaking personal monitoring for toxic or sensitizing dust. The same air-sampling pump could be used in combination with a real-time sampler when housed in a robust, portable case on an unattended, short-term basis. Such a system can provide concentration using a gravimetric filter but

also a time-history profile, which could help identify the source of the problem.

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2 Hazard Communication Guidance for Combustible Dusts | Occupational Safety and Health Administration (osha.gov)

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Fixed, AC-powered solutions could also be used continuously for high-risk areas. These have the advantage that the data can be made available remotely using a web-based interface. These systems provide real-time alerts via text message or email should limits be exceeded. Reports can easily be automated and sent to multiple users, which allows early intervention to avoid a potential problem.

Great care should be taken in hazardous atmospheres that may require instrumentation to be intrinsically safe or require a hot-work permit, and action thresholds should always be set at a fraction of the Lower Explosion Limit (LEL) for the dust in question. However, if there is any doubt whatsoever, businesses must speak to the relevant site manager or supervisor that has responsibility for risk assessment and permitting—and who can advise accordingly.

Dust explosions continue to be a persistent problem for many industries, resulting in loss of life, injuries and destruction of property. Even those individuals most highly trained, including government enforcement officials, insurance underwriters and company safety professionals often lack awareness of combustible dust hazards. Material Safety Data Sheets (MSDS) are also ineffective in communicating to employers and workers the hazards of combustible dust explosions and ways to prevent them. This is further reasoning for all employees to have a basic

awareness of the hazards of dust explosions and the best way to mitigate those risks. **IHW**



Dust is created when materials are transported, handled, processed, polished, ground or shaped. Dust can also form from abrasive blasting, cutting, crushing, mixing, sifting or screening dry materials. (Photo courtesy Adobe Stock)

About the Author

Tim Turney is a Technical Product Manager at Casella and graduated as an engineer from Queen Mary and Westfield in London. Since starting at Casella in 1998, Tim has been involved in the acoustics and air sampling industry, specializing in measurement and instrumentation technologies. To find out more about Casella, please visit www.casellasolutions.com or follow @CasellaHQ on Twitter or @Casella on LinkedIn.

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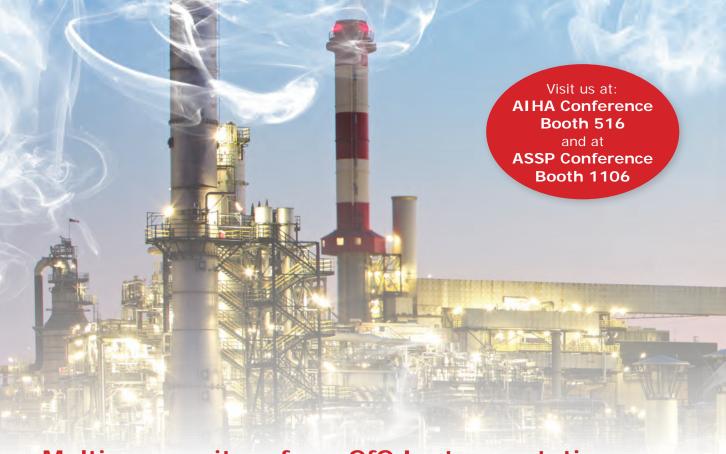
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By: Robin Marth, Contributor

Vision Protection:

Using the Past to Change the Future

Wearing safety glasses isn't rocket science. The rewards far outweigh the risks. So why are we still fighting with employees to follow a simple company policy? Maybe we need to take a step back and realize what employees have been trying to tell us for a while now.

In 2009, a study was conducted to identify and describe the array of factors that influence a worker's decision to wear PPE and the barriers that exist in preventing their use. A series of focus groups enrolled workers and supervisors, ranging from 19-64 years old. They came from a variety of industries, including manufacturing, construction and service/retail that had potential exposure to eye injury hazards in their job tasks. Most workers (78%) were required to wear PPE on their worksite. For what it's worth, only 55% had a dedicated safety officer. Most were highly experienced in their occupation (>10 years) and had received some safety training in the past (82%).

The results identified the decision-making factors influencing the use (or non-use) of PPE:

- · Perceptions of hazards and risks
- Barriers to PPE usage
- Enforcement and reinforcement

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Some working conditions may include multiple eye hazards. Safety glasses may be the employer's only means of protecting the employee whose eyes are exposed to flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.



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Fast forward to 2022, and safety professionals are still struggling to get their employees to consistently wear appropriate PPE. OSHA's Eye and Face Protection standard (29 CFR 1926.102) has made the top 10 most frequently cited OSHA violation's list in 2018, 2019, 2020 and 2021. In general industry, most safety professionals have needed to address failures to wear eye protection as well. The big question is why?

Perception of Hazards and Risks

Perception, in simple terms, means "the way you think about or understand something." An employee's perception of hazards and risks may not reflect the actual risk if they never experienced an eye injury or a near miss before.

Some working conditions may include multiple eye hazards. Safety glasses may be the employer's only means of protecting the employee whose eyes are exposed to "flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation" [1910.133(a)]. When identifying hazards, think about what

could be present: projectiles, chemicals, radiation, bloodborne pathogens—even digital eyestrain.

The risks of not wearing PPE are both direct and indirect. They can have a negative ripple effect on many lives and the business.

Direct costs are measurable. OSHA estimates the yearly cost of occupational eye injuries to be about \$300 million. These costs include medical expenses from doctor visits, treatments and surgery; compensation for damage; and lost wages—not to mention potential legal expenses.

The indirect costs can be even more detrimental and long-lasting, yet they cannot be easily measured. Pain and suffering by the employees and their families; customer quality decline; loss of business; an increase in overtime costs; and a decreasing employee morale can all negatively impact workers' lives, as well as your safety program and your company's bottom line.

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To illustrate the impacts, present real-life examples to your employees. You don't need to show gruesome photos or share details that may sour someone's stomach, but you can talk about experiences they may miss or life events that may be altered if they don't take the hazard and risk seriously.

Barriers to PPE Usage

Benjamin Franklin once said, "He that is good for making excuses is seldom good for anything else." Knowing in advance what excuses employees are likely to offer for not wearing required PPE helps you develop a better strategy to change behaviors.

The 2009 study didn't uncover anything new or predict anything revolutionary. In today's work environment, lack of comfort, poor fit, and lens fogging or scratching are still the most common barriers to PPE usage.

Addressing these barriers will make for a more compliant PPE program. While all safety glasses may look similar, all are not created equal. Having a variety of vetted options available is key.

 <u>Comfort and fit</u>: A very basic pair of safety glasses may meet the regulatory requirements but may not have the features that will encourage wearing them for long periods. Look for eyewear with a rubber nosepiece,

In trying to encourage workers to wear proper PPE, recognizing and rewarding positive behaviors is more effective than disciplining violations and is less uncomfortable for the manager delivering the feedback.



rubber on the temples and varying sizes for different head shapes— then offer a variety of options. Don't forget about employees with prescription glasses either. Wearing safety glasses over prescription glasses is an easy fix, but it is not a long-term solution. Investing in a good prescription safety glasses program is best.

• Lens fogging and scratching: Employees working in hot or humid environments have typically experienced issues with fogging glasses. In the age of COVID and mask-wearing, fogging safety glasses has become more of a concern. To address this, invest in PPE that offers anti-fog coating. Providing lens wipes offers a short-term solution but may require the employee to remove their PPE, which can put them at



increased risk of injury. Like anti-fog coating, scratchresistance lenses are also an option to consider.

Enforcement and Reinforcement

Enforcing compliance with OSHA standards and regulations is one of the least-favorite parts of a safety professional's job. Still, the employer must make certain those requirements are adopted and, more importantly, enforced.

In a forward-thinking work environment, the notion of enforcement (for example, a reprimand for insubordination) may be superseded by the idea of positive reinforcement for more desirable behaviors. Recognizing and rewarding positive behaviors is more effective than disciplining violations and less uncomfortable for the manager delivering the feedback.

While reprimand should not be disregarded, it should be carefully managed. There will, unfortunately, always be instances when blatant disregard for company policy carries personal responsibility and potential termination. But steering your safety program towards one of ongoing positive feedback can work wonders for compliance. Encouraging supervisors to provide this type of feedback for the continuous use of PPE by workers will reinforce positive behaviors, increasing compliance without enforcement.

As a safety professional, don't dismiss past studies, but rather look to them for historical reference and a means of guidance

for continual improvement. Humans are creatures of habit, and history tends to repeat itself, unless an impactful shift is made to change the narrative. You must be able to effectively portray the importance of wearing eye protection, but also explain the why behind that importance. While it's easy to repeat OSHA standards and write policies, your PPE program will be more impactful if you address the issue at a personal level. That involves illustrating the risks and effects to ensure accurate perceptions; responding to concerns about personal fit and comfort; and giving positive reinforcement to encourage compliance. **IHW**

About the Author

Robin Marth, CSP, joined J. J. Keller & Associates, Inc. in 2021 as an Editor on the Environmental, Health & Safety Publishing Team. She is an experienced EHS Specialist with a demonstrated history of working in the management consulting



and manufacturing industry. Robin's professional skill set includes Workplace Safety Administration, Ergonomics, Environmental Management and Motor Vehicle/Fleet Safety. Her editorial responsibilities include researching and creating content for several publications, including Employee Safety Management Today and the OSHA Compliance for California manual. Robin holds both an ASP and a CSP designation from the Board of Certified Safety Professionals and is also an OSHA Outreach General Industry Trainer.



By: Garry Gordon, MS, and Robert M. Traynor, Ed.D., MBA, F-NAP, Contributors

Custom-Molded Hearing Protection in Hearing Conservation Programs

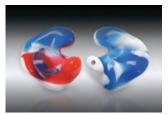
In the workplace, when noise levels and exposures exceed OSHA guidelines, industry is required to provide adequate hearing protection as part of a comprehensive hearing conservation program. Several providers now offer custom-fit hearing protection devices (HPDs).

These options present questions and, sometimes, concerns from safety managers, hearing conservation providers, workers and corporate executives responsible for those managing hearing impairment as a byproduct of device production. These concerns are amplified when deciding among hearing protection styles, especially when considering custom-molded products. This article will discuss the advantages and limitations of custom-molded hearing protection devices (CMHPDs).

Benefits of CMHPDs

There are numerous advantages to CHMHPs:

- When properly fit with high-grade silicone material, there is a high acceptance by users, as they can be worn comfortably for extended periods of time.
- CMHPDs provide dependable attenuation.
- Independent and military laboratories have reported fewer recordable standard threshold shifts using CMHPDs.
- When properly made with high-grade silicone materials, CMHPDs can be used for at least three years and, under some conditions, even longer.
- CMHPD options are numerous and may be designed to provide full occlusion of the ear with estimated NRRs of 30-32dB across the frequency spectrum or with filters for situational awareness (NRRs 7 -21dB).
- CMHPDs offer improvement for communication systems, including noise-reduction features that enable better hearing in noise while attenuating loud sounds.





While these products are cost-efficient and beneficial, there are some variables that must be evaluated seriously before their adoption.

Variables of Using CMHPDs in Hearing Conservation Programs

Successful fittings of CMHPDs that ensure maximum comfort and attenuation characteristics are conducted by individu-



als specially trained in the best practice methods of taking ear impressions. Ear canal shapes and sizes are as unique as fingerprints; no two are exactly alike. Ear impressions must be taken safely with no artifacts impeding the fabrication of the CMHPD.

Some companies choose CMHPD providers that offer an on-site ear impression service with a traveling, professionally trained staff that has verification of liability insurance. Others prefer to use members of their own staff, such as nursing or safety employees properly trained to obtain ear impressions. Either of these options allow for significantly less worker down time, as they simply go to a central position within the plant for

the impressions. There are also "do-it-your-self" kits. While a less expensive option, these may be dangerous and result in ill-fitting CMHPDs, injury to the ear, reduction of comfort and a reduction of the NRR ratings.



Once the impressions are obtained, the next concern is making sure the CMHPD will be used by the worker. The most popular choices use high-grade silicone and do not shrink over time. They are also water repellant (hydrophobic) and, in many cases, float on water. These products offer two options:

- The use of a two-part silicone that, when properly mixed can be cured in the ear as the impression sets up. Once removed from the ear, it can be inspected for fit and fabricated on-site.
- An alternative is to simply deliver the impressions to the laboratory in the form of a digital file. The data in the file is then used to fabricate the CMHPD. An additional benefit: if the worker loses their set of

Images courtesy of E.A.R. Inc.

CMHPDs, a new set can be manufactured immediately without the need for new ear impressions.

Technology is on the horizon that will scan the ear, ear canal and tympanic membrane (eardrum) via 3D-scanning, computerized techniques—thus eliminating the need for ear impressions. This technology will be able to supply all the information required to fabricate CMHPDs.



Another concern is the acceptance of CMHPDs. Most companies offer CMHPDs to employees who do not like or cannot use the generic or disposable earplugs or earmuffs. Workers who are exposed to the most noise and need

HPDs all day find CMHPDs are very comfortable and provide the most efficient attenuation available.

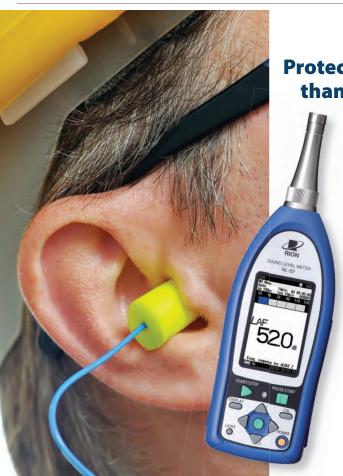
NRR vs. Personal Attenuation (PAR)

The critical measurement of HPDs is the amount of protection the worker obtains. A common perception is that, if the NRR is 33dB, then the worker is obtaining a 33dB attenuation from the HPD. The NRR is an earplug attenuation measurement that is taken in a laboratory under controlled conditions. The PAR is the actual amount of attenuation in dB provided by the HPD within an *in situ* or in-use situation. Thus, the NRR laboratory measures and the PAR individual user measures do not correlate well.

To complicate the direct use of the NRR further, Berger, Voix & Harper (2008) found that many individuals using disposable and reusable HPDs were significantly under-attenuated, relative to the noise levels present, due to insertion variations. Thus, they were non-compliant according to OSHA standards.

To ensure compliance for HPD use in high-noise areas, the data of Berger *et al* (2008) was used by the Council for Accreditation in Occupational Hearing Conservation (CAOHC) to derive a formula to allow for the use of the NRR in predicting the PAR measurement. This formula for estimating the PAR, or derating, is the label's NRR-7dB/2. For example, if the NRR was 31dB on the label, the predicted PAR for that device would be 12dB. In this example, if the noise level was 95dB, 95dB-12dB = 83dB, the facility would be OSHA-compliant at 83dB.

We now have audiometers that can measure PAR as part of a baseline or annual hearing test. The most common technique is a program that is incorporated into most computerized audiometers. Essentially, the hearing is tested without the HPDs,



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then HPDs are inserted, and another hearing test is conducted. These programs then conduct calculations on both the threshold measurement and the assessment with the HPDs to obtain the PAR. This method offers an *in situ* PAR rating which allows direct reduction of the PAR from the noise levels to arrive at the amount of actual hearing protection for the worker.

In actual fit-checking of workers using HPDs, a Salt Lake City (2012) study found, in PAR testing of 40 subjects, variability for reusable/disposable HPDs ranged from 5dB PAR to 39dB PAR, while testing CMHPS devices achieved a consistent PAR of rating 35.8dB. Conducting a PAR test allows for accurate

assessment of the amount of protection offered by various HPDs and the ability to predict how much protection is derived from a particular HPD on a specific individual.

Cost can be an issue in the use of CMHPDs. While more expensive than generic plugs, CMHPDs are often more cost-efficient, as they may be used for three or more years by a worker that uses hearing protection all day, every day. Depending on the



type of CMHPDs selected, costs can range from \$7-10 for room temperature-cured molds, fabricated on-site by professionally trained company staff or, when hiring an outside professionally trained provider, approximately \$65-95 per set.

As with many other product purchases, the volume of the CMHPDs required by the company to outfit its workers affects the discount price offered by outside, professionally trained



providers. Pricing for digitally recorded laboratory molds begin near \$110 per set and increase in price if filters and/or radio communications are added.

The variables in hearing protection are not simply the size of the ear canal, but a combination of size and geometry, which varies significantly in the noise-exposed employee population. Often, when using the CMHPDs, companies have found their on-going cost for disposable hearing devices is dramatically reduced, and employee acceptance of hearing protection is much higher than with the disposable products. For example, if an employee uses two pairs of disposable plugs per day at \$0.18 per set, or \$0.36 per day at roughly 260 workdays a year, this results in an expenditure of \$93.60 each year, per employee, for disposable hearing devices. The average price of a set of CMHPDs for a worker is \$75, and they have a duration of three years. Thus, for 100 workers using two sets per day, the price of disposables for a three-year period would be \$28,080, while the cost of CMHPDs for the same period would be \$7,500 for the three-year period. Further, the workers would be protected more comfortably with better attenuation, reducing the possibility of standard threshold shifts. Ultimately, the use of CMHPDs becomes a smart business decision.

For safety managers and occupational hearing conservationists concerned with the efficiency of HPDs within their hearing conservation program, the use of CMHPDs augmented by fit-checking is an effective method of providing the most comfortable, accurate noise reduction, as well as cost-efficient hearing protection. **IHW**

[Editor's Note: This article first appeared in the April 2022 issue of Workplace Material Handling & Safety.]

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About the Authors

Robert M. Traynor, Ed.D., MBA, FNAP, is an Adjunct Professor of Audiology at the University of Arkansas for Medical Sciences and Salus University and a Fellow of the National Academies of Practice. He also consults and does forensic audiology. https:// roberttraynor.com

Garry Gordon, MS, is the CEO/Owner and Audiologist/Instructor at E.A.R Inc. Gordon has served well over 4,000 major medical, audiological and industrial accounts and trained a network of 500+ recreational and industrial providers who market high-quality hearing protection. https://earinc.com.



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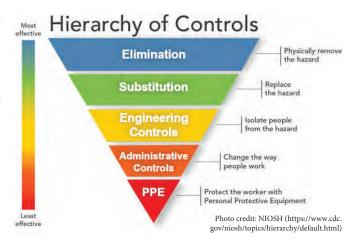
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Hearing Protection: Critical, but Often Unused

About 14% of U.S. workers are exposed to hazardous occupational noise each year. The best way to reduce worker noise exposure is to follow the Hierarchy of Controls, beginning with eliminating the noise hazard; replacing the loud equipment or process; and using engineering controls to reduce noise levels at the source. These are considered the most effective methods, because they remove or reduce the hazard for all affected workers. However, when these options are insufficient to reduce noise to safe levels, hearing protection is necessary.

Hearing protection is only effective when worn consistently and correctly. Unfortunately, many workers report not wearing their hearing protection when they are exposed to noise on the job. A recent study indicates that across all occupations, more than half of noise-exposed workers don't wear their hearing protection (53%). The three occupation groups with the most workers not wearing their hearing protection during noise exposure were healthcare support occupations (94%), food preparation and serving-related occupations (90%), and education, training and library occupations (87%). [See chart, below]

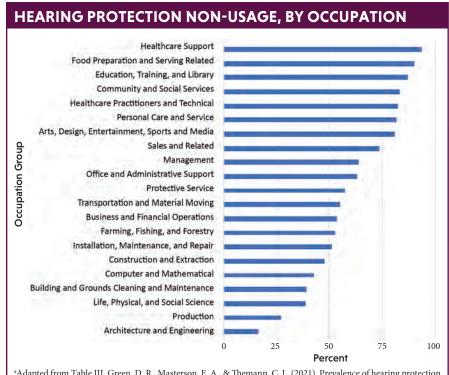


To reduce these percentages, the five critical barriers to wearing hearing protection must be addressed, including communication with others, comfort, convenience, climate (safety culture) and cost. Interventions include increasing awareness in industries and occupations with smaller proportions of noise-exposed

> workers; performing repeated trainings on the risks of noise and proper use of hearing protection; providing a variety of hearing protection device choices for workers; fit-testing to ensure proper fit and to increase self-efficacy in using hearing protection; and providing management support for compliance. **IHW**

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

Elizabeth A. Masterson, is a National Institute for Occupational Safety and Health (NIOSH) Research Epidemiologist and National Hearing Conservation Association (NHCA) Expert. Visit NHCA at: https://www.hearingconservation.org/.



^aAdapted from Table III, Green, D. R., Masterson, E. A., & Themann, C. L. (2021). Prevalence of hearing protection device non-use among noise-exposed U.S. workers in 2007 and 2014. American Journal of Industrial Medicine, 64(12), 1002-1017.

This chart shows the percentage of workers not wearing their hearing protection when exposed to occupational noise by large occupation group.

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By: Doug Matthews, Contributor

Moving Safety up the Hierarchy of Controls

Safety is prerequisite to success. Having the right systems and controls in place improves workforce productivity while safe-guarding worker health and well-being. But, if you want safety to improve business outcomes and ensure success, it must move up the hierarchy of controls.

Safety and the Hierarchy of Controls

The best means of protecting workers is by controlling occupational hazards. The hierarchy of controls helps determine how to do that—what is the most effective and feasible way to control exposure to risk. This is helpful when talking about how technology implementations can change worker safety, as new tech impacts both efficacy and feasibility. (See chart, "Tech Driven Progress")

At the top of the hierarchy, the aim is to eliminate or substitute the hazard. This is often difficult. Organizations can't eliminate the weather. For example, it's difficult to reduce heat from production processes or air condition an entire steel plant, mine or construction site.

The middle are the engineered controls that reduce workers' exposure to the hazard without asking them to change their behavior. In hot environments, you might increase air flow or use reflective or heat-absorbing shielding or barriers to protect workers from heat-induced incidents.

At the bottom of the hierarchy is PPE and administrative control. Continuing with the heat stress example, PPE can mean wearable garments, or personal or auxiliary cooling systems. Administrative controls include intermittent breaks, mandatory hydration, buddy systems, etc., and the signage, communications, shift meetings and inspection rounds that remind and enforce these controls. These controls require worker action

and compliance, along with continued investment, to prove effective.

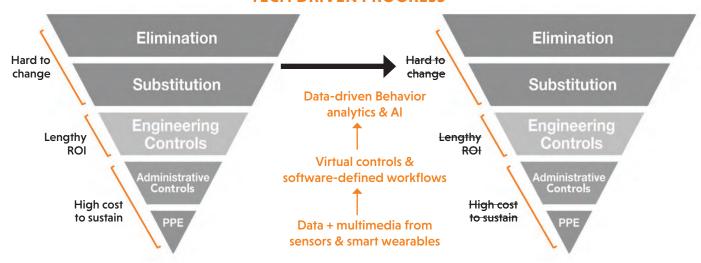
Advanced technology changes the pyramid, putting the goal of hazard elimination within reach through a robust set of engineering controls.

Challenges for Adopting Connected Worker Solutions

Connected solutions allow more dynamic and virtual engineered controls—such as restricting areas and workflows by role or certification. It provides data to better make decisions on how and where organizations can substitute or eliminate hazards. But there are obstacles that have stalled adoption and rollout, such as:

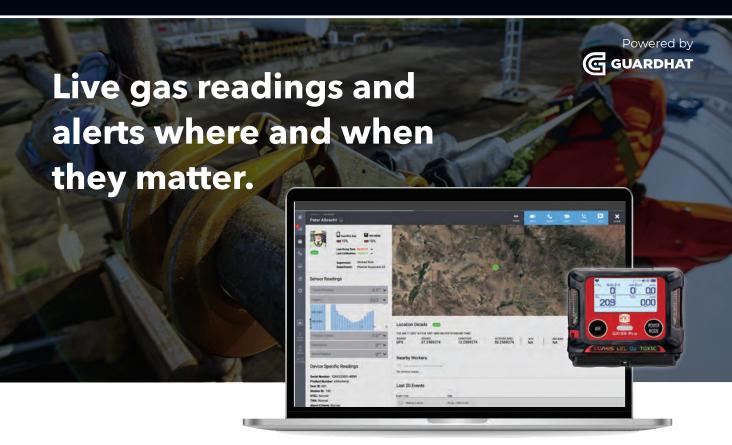
- Remote Locations: Many production environments are rural and remote, without WiFi or even solid cellular coverage.
- Machine Focused: Most companies are focused on digitizing machine data—which is highly structured and static—and they are better at managing and using that data. People, however, make highly unstructured data, i.e., audio, visual, mobile, biometric, etc., and most companies aren't good at collecting or leveraging this data yet.
- Data Privacy: Workers are nervous about technology and sharing their data, but it's not insurmountable. In fact, 92% are open to having their data collected, if it improves their performance and well-being or provides other personal benefits. Therefore, deployments must share information on how this data is used for the worker and make sure workers are informed on who sees their data; how it is displayed; and how the data is kept safe.
- **Ruggedization:** Devices must be tough—able to stand up to weather, heat, cold, harsh environments and, in

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Many production environments are rural and remote, without WiFi or even solid cellular coverage. Connected solutions allow more dynamic and virtual engineered controls. (photo courtesy Guardhat)

- many cases, even explosive atmospheres. In this case, they must carry an intrinsically safe certification.
- **Digital Readiness:** IT complexity is an issue for many production sites and facilities. The more data that needs to be real-time, managed for privacy and security, and the more devices to charge and maintain, the more deployments become a major undertaking.

While these obstructions are difficult, they are not impossible to overcome. There are already connected solutions being produced that meet or fix the criteria listed above. The initiative now is on organizations to choose the solutions that fit their needs and perform in the environments their workers are exposed to daily.

Digital Operations: IIoT and IIoP

Many companies are well into their digital transformation journeys. But too many organizations build out IIoT without consideration for the people that are the crucial part in these processes. This is starting to change, as more organizations are realizing that IIoT is a game changer for safety and view adopting advanced safety solutions as the right thing to do, both morally and from a business perspective.

However, it is much more than simply hooking up machines, switches and sensors to your network. This is where the concept of Industrial Internet of People, or IIoP, comes into being. The benefits of IIoT and IIoP are incredibly aligned and should be used together to improve and transform how we work. Both make production safer; work best if they include an understanding of where equipment and people are; require a connection between operations and IT; and deliver information to make better decisions.

The key difference is the inclusion and focus on the people aspect, in addition to the machine. No matter the level of automation; people are always going to be the most important part of an organization's efforts to succeed.

Doug Matthews, Chief Growth Officer, Guardhat

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Thought Leadership

By: Edward Stern, Contributor

What to Put into an Anti-Bullying Policy

If your organization does not have a good anti-bullying policy and does not implement it fairly, over time, your organization will lose conscientious, talented workers. Of course, there are other adverse consequences to the organization and to the employees apart from the loss of talent. An abusive environment discourages people from asking questions and offering ideas. (You need those ideas for workplace safety and productivity.)

A good anti-bullying policy does not have to be long and elaborate, but it should cover the elements set forth below. Most of the ideas presented here are drawn from federal, state and municipal government policies, and from university policies. A few ideas come from personal observations.

Items to Cover for a Respectable Bullying Policy

1. <u>Open verbal abuse</u>: This is usually obvious. It is obnoxious, demeaning, degrading and humiliating. It makes the target and witnesses cringe. This includes threats of harm; even vague words, like "I will get you for this."



- 2. <u>Hidden verbal abuse</u>: This is unheard/unseen by the target. It includes backstabbing with gossip and innuendo, e.g., "don't ask me about her" or "I won't speak about her." Some policies prohibit gossip and innuendo "that is false," but gossip that is true about personal/private matters can be very hurtful. If your policy includes "that is false" regarding gossip, delete that phrase.
- 3. Non-verbal abuse: Cold, hard stares and sneers and eyerolls are non-verbal expressions of hostility and contempt. Experts have found that sneers are understood in all cultures.
- 4. Physical harassment and intimidation: This is more than a threat. It is in-your-face menacing gestures, or touching or hitting. It includes blocking the victim from leaving an office. Blocking could support a civil or criminal charge of holding someone against their will. (I know of a couple of cases of blocking.)
- 5. Omissions or deliberate inaction: Refusal to meet with or respond to an employee who can reasonably expect a response is bullying. Pressing circumstances that delay a response for a day or two may be reasonable. A long delay shows disrespect, contempt and evasion of duty. It is not good management; it is bullying.
- 6. Withholding needed information from or providing false/misleading information to a co-worker:

 This is sabotage of the target. This includes false criticism of someone's work. Other acts or omissions could sabotage targets or their work.

7. What is Not Bullying?

- a. *Management rights:* Factual, civil criticism is not bullying. Assignment of work or training for legitimate business reasons is not bullying. These are management rights.
- b. *Frank*, *civil disagreement*: People do not always agree or even understand one another. Honest disagreement is not bullying, provided that the discussion is civil. Cursing, screaming and insulting someone are out.

8. What is Not a Management Right?

- a. False, abusive or humiliating criticism: Even the best people can make mistakes, and they should apologize for them. If it happens more than once a year, it is a problem.
- b. Assigning work or training with intention to humiliate a person is bullying: When a supervising professional

assigns an experienced professional to a remedial English class, and the target's credentials greatly outshine her supervisor's, the assignment is to humiliate her. Humiliating staff is not a management right.

9. When to call the police instead of HR: Companies and universities have gotten into trouble for handling sexual and other assault cases when they should have called the police. Allegations of assault should be handled by police departments; tell HR later. Any improper touching should also go to the police. Employees should contact their supervisors or HR for



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non-physical violence, including sexual harassment.

10. Require periodic training of managers and supervisors on workplace bullying: Some states call bullying "abusive conduct" or "unprofessional conduct." The State of California requires all businesses with more

than 50 employees to train supervisors on abusive

conduct every two years and new supervisors within six months. This is a sensible model.

11. Procedures for reporting complaints:
Include clear guidance
on how and to whom to report workplace bullying.
(The State of Utah has a thoughtful complaint intake form at https://dhrm.utah. gov/wp-content/uploads/
Abusive-Conduct-Intake.pdf.)

12. Make clear you are serious: For example, say: "Supervisory personnel who allow abusive conduct to continue or fail to take appropriate action upon learning of such conduct will also be subject to corrective and/or disciplinary action." (Nashville Executive Order 39.) Note: this useful reminder should have included all HR staff.

One Reason People Bully Others

I am a policy analyst, not a psychoanalyst. I cannot explain all bullying behavior. I can share insights from friends in the mental health professions. A small percentage of people are very narcissistic. They think they are "special" and more important than everyone else. They may be manipulative, dishonest and self-serving. Such people may resent co-workers or subordinates who are better educated, more knowledgeable, more intelligent, more socially skilled or even better looking. The narcissists feel that the others are taking the spotlight or sunshine away from them. Narcissists bully others (often only one or two at a time) to drive them away. The victims suffer—and so do their employers.

Conclusion

Good anti-bullying policies protect legitimate business conduct, not abusive conduct. Get an anti-bullying policy and implement it. Do not lose good people and their knowledge. Do not lose your organization's good name. **IHW**

About the Author

Edward Stern began studying workplace bullying in 2002 when bullying drove away a talented co-worker he needed. A few years later, he began writing on bullying for a union magazine. Since he retired, he writes, speaks and advises on workplace issues for organizations and the public.



Understanding the principles of ventilation when controlling atmospheric hazards in a confined space is critical for any crew working inside that space. The use of proper, mechanical ventilation is a key control measure that helps ensure the air being breathed by the entrants is clean and safe. This article discusses the types of mechanical ventilation available and the practical aspects of using it in the field.

The lack of proper ventilation can create an asphyxiation hazard. According to the U.S. Department of Labor, asphyxiation is the leading cause of death in confined spaces. In general, this occurs when there is a lack of oxygen in the space or a build-up of airborne toxic substances. Toxic substances can include benzene, carbon monoxide, volatile organic compounds, welding fumes, dust and hydrogen sulfide. Ventilation helps ensure oxygen remains at the appropriate levels and the toxic substance are eliminated or kept below acceptable limits.

Selection & Use of Mechanical Ventilation

When I was a young industrial hygienist working on the ship channel in Houston, I once had a project that involved monitoring the outside of a crude oil tanker ship for hydrogen sulfide (H2S). The concentration inside the vessel's hold was well above the Immediately Dangerous to Life and Health (IDLH) concentration for H2S of 100ppm. No one was allowed to enter that space, and my only purpose was to make sure the atmosphere outside the space was not dangerous for those working on the ship.

If the decision had been made to enter the space an expert, such as a Certified Marine Chemist (CMC) or Certified Industrial Hygienist (CIH), would have to be consulted and the space properly prepared before allowing anyone to enter. The

selection and use of mechanical ventilation and the appropriate PPE for the entrants would have been critical. Although you may not work in the shipyard industry, the selection and use of the type of mechanical ventilation should be taken just as seriously.

Various types of mechanical ventilation exist. They fall into two different categories: dilution ventilation and local exhaust ventilation (LEV). Each type serves a different purpose with the goal of ensuring a safe breathing atmosphere for the workers inside the confined space. An example of dilution ventilation would be the natural flow of air in and out of the confined space (i.e., air changes) created by wind and air movements outside and inside the space. Although this "natural ventilation" can be appropriate in some instances, mechanical ventilation is the preferred method inside a confined space to ensure there are an adequate number of air changes occurring inside the space to reduce the concentration of toxic substances below recognized exposure limits.

Mechanical dilution ventilation, also known as "forced air ventilation," is provided by either blowers or fans. Both devices are referred to as air movers, but they differ in the discharge and suction pressures they create and depend on different power sources to make them work. Both can be configured to either blow air into the space (positive pressure ventilation) or out of the space (negative pressure ventilation), depending on the configuration of the space; characteristics of the toxic gases and vapors potentially present in the space; and the location of the workers. An expert in choosing the appropriate device should be consulted when trying to achieve the needed amount of air changes per hour.

Local exhaust ventilation (LEV) is not used as frequently as forced air ventilation inside a confined space. It is typically used when the type of task being performed produces high

concentrations of toxic gases, vapors or fumes inside the workers' breathing zone before the dilution air is able to remove it. It depends on the placement of a ventilation hood at a location close enough to the source of emission that it captures and removes it away from the worker. (A good example of where LEV might be used is for welding inside a confined space.)

Ventilating a space should start before anyone is allowed to enter the space. This means you will have to start the forced air ventilation early enough to allow time for the toxic gases and vapors to be removed. In some instances, this may take a day or more, depending on the size of the space and the capacity of the air mover.

Monitoring the Air

Air monitoring is an important part of making sure the ventilation being provided is adequate. This should be done both before an entry occurs and as long as entrants are inside the confined space. The attendant, or "hole-watch," should have an instrument that continuously monitors for 02 and LEL. Periodic monitoring for toxics should also be conducted. If the concentration

of O2 decreases below 19.5%, or the concentration of toxics increases, the space should be evacuated immediately and the source of the problem identified and eliminated.



Local exhaust ventilation (LEV) is typically used when the task being performed produces high concentrations of toxic gases, vapors or fumes inside the workers' breathing area, such as confined space welding. (photo courtesy Adobe Stock)

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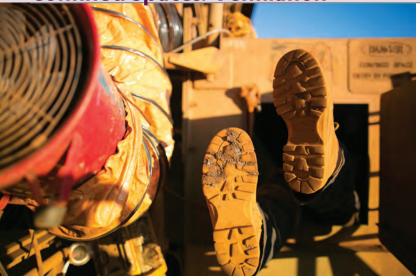
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Confined Spaces/Ventilation



Understand the basics of ventilation and involve an expert when attempting to set up ventilation for the first time inside a confined space. (photo courtesy Adobe Stock)

If the source of the exposure can't be removed, the ventilation plan may have to be changed or the use of supplied air respirators, such as an SCBA, should be used. For more information about monitoring confined spaces, OSHA has a Fact Sheet entitled "Procedures for Atmospheric Testing in Confined Spaces" that provides a good overview.

The potential presence of flammable gases must also be considered when deciding what type of ventilation device to use. If a

KNOW THE STANDARDS!

OSHA's confined spaces standard: https://www.osha.gov/ confined-spaces

OSHA's permit-required confined spaces standard (1910.146): https://www.osha.gov/laws-regs/regulations/ standardnumber/1910/1910.146

Fact Sheet "Procedures for Atmospheric Testing in Confined Spaces:" https://www.osha.gov/sites/default/ files/publications/atmospheric_test_confined.pdf

confined space contained a material such as crude oil, natural gas, methane or any other flammable material, intrinsically safe air movers should be used. These type of devices are designed in such a way that they do not become an ignition source capable of igniting the gas.

In summary, properly ventilating a confined space can be the difference between life and death for the

workers inside the space. Understand the basics of ventilation and involve an expert when attempting to set up ventilation for the first time inside a space. It takes the right equipment and know-how to ensure atmospheric conditions are safe to breathe. **IHW**

[Doug Niemtschk, CIH, CSP, is Health and Safety Manager, EHS, for Holly Energy Partners. He can be reached at Douglas.niemtschk@hollyenergy.com.]





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Breathing Safely:

FDA's Reissue of Emergency Use Authorization of NIOSH-Approved Respirators for Healthcare



Throughout the course of the COVID-19 pandemic, the FDA has issued Emergency Use Authorization (EUA) of various types of personal respiratory protection for healthcare workers, primarily due to the shortages of disposable face mask options. The exact details of this EUA has changed a number of times, with the most recent updates going into effect in July 2021.

Here's a breakdown of what you need to know about these latest updates.

What Was Included in the FDA's First EUA During the COVID-19 Pandemic?

In early March 2020, the FDA issued a letter authorizing emergency use of:

- 1. All disposable filtering facepiece respirators (FFRs or respirators) approved by NIOSH, in accordance with 42 CFR Part 84, as non-powered air-purifying particulate FFRs
- 2. FFRs that were NIOSH-approved but had since passed the manufacturers' recommended shelflife

Later that same month, the FDA reissued its EUA, amending the scope to include additional respiratory protection options for healthcare workers. The updates included:

- 1. Non-powered air-purifying particulate FFRs and reusable respirators, such as elastomeric half- and full-facepiece respirators, approved by NIOSH in accordance with 42 CFR Part 84 and listed on the NIOSH Certified Equipment list (CEL) for non-powered air purifying respirators with particulate protection
- Other powered air purifying respirators (PAPRs) approved by NIOSH, in accordance with 42 CFR Part 84, and that are listed on the NIOSH CEL for PAPRs with particulate protection
- 3. FFRs that were NIOSH-approved but have since passed the manufacturers' recommended shelflife; are not damaged; and have been held in accordance with manufacturers' storage conditions in strategic stockpiles

4. Any authorized respirator under (1) or (3) above that has been decontaminated pursuant to the terms and conditions of an authorized decontamination system

What Are Latest Changes to the EUA?

In June 2021, the FDA concluded that, based on the increased domestic supply of respirators approved by the CDC and NIOSH, and the latest CDC and OSHA guidelines for protecting healthcare workers, healthcare facilities should no longer use crisis capacity strategies.

The FDA announced that the original EUA *no longer authorizes* use of decontaminated or non-NIOSH approved disposable FFRs, or respirators that are beyond the manufacturer-designated shelflife. The FDA also revoked the remaining decontamination system and bioburden reduction EUAs.

The updated and reissued EUA went into effect on July 6, 2021, and now includes *only* NIOSH-approved respirators which can be cleaned, disinfected and reused in healthcare settings in response to the ongoing COVID-19 pandemic. This reissue limits the scope of the EUA to include:

- 1. Non-powered air-purifying particulate FFRs and reusable respirators, such as elastomeric half- and full-facepiece respirators, approved by NIOSH in accordance with 42 CFR Part 84 and listed on the NIOSH Certified Equipment list (CEL) for non-powered air purifying respirators with particulate protection
- Other powered air purifying respirators (PAPRs) approved by NIOSH, in accordance with 42 CFR Part 84

This latest update remains in effect until the FDA declares that circumstances exist justifying the authorization of the emergency use of personal respiratory protective devices during the COVID-19 outbreak is terminated or the EUA is revoked.

[Editor's Note: This article first appeared on MSA Safety's blog. For the original article, go to https://blog.msasafety.com/what-the-fdas-reissue-of-emergency-use-authorization-of-niosh-approved-respirators-means-for-healthcare/.]

For further reference, more details about the EUA updates can be found here:

- https://www.fda.gov/medical-devices/letters-health-care-providers/update-fda-recommends-transition-use-non-niosh-approved-and-decontaminated-disposable-respirators
- https://www.fda.gov/medical-devices/emergency-use-authorizations-medical-devices/historical-information-about-device-emergency-use-authorizations#ppe



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Contractors can dramatically speed pipe cleaning and prevent process disruptions and downtime using a variety of high-

performance hose nozzles.

Although industrial processes vary broadly, in any plant, dusts, grease, slag, metals, residues and cementitious particulates generated during manufacturing can make their way into the wastewater stream, accumulate and even harden in underground pipelines. As a result, plants conduct periodic maintenance to flush debris and sediment from pipes, including breaking up hardened obstructions, to prevent blockage and protect downstream wastewater treatment equipment from excessive loading.

"Many plants were built 40-80 years ago, with most of the pipes underground, so they are old, hard to access and can accumulate excessive, hardened debris that must be removed," said Bill Benner, Senior Project Manager for Ventilation Power Cleaning (VPC), a Seattle-based firm that provides vacuum truck services to remove various industrial debris in the form of solids, liquids, sludges and slurries.

"If this kind of debris is transported by pipe to onsite clarifiers, digesters, sewer vaults or treatment plants, it can disrupt and overburden the process as it collects and hardens," Benner added. "A similar problem occurs when rain washes debris in outdoor processing or storage areas into basins, ponds or reservoirs prior to transport through pipes for further treatment."

The task of industrial pipe cleaning typically falls to third-party cleaning companies like VPC, which come to facilities with a vacuum truck and perform the work periodically, unless emergency debris removal is required.

According to Benner, most wastewater pipes are typically 300-500ft long and 12-46in in diameter. Special nozzles are used to propel a hose connected to a vacuum truck down the pipeline

and back, using water jets. The nozzle must supply enough force to dislodge any debris and carry it back using water pressure to be suctioned out by the vacuum truck.

"Industrial plants cannot afford production downtime, so we rely on high-performance nozzles to get the job done quickly and reliably. Using the right nozzle and technique can be the difference between cleaning out a pipe within 20 minutes or having it take hours, days or fail completely," commented Benner.



For wastewater applications, floor cleaner and spinning style nozzles travel along the floor of large diameter pipe—instead of just the center—and focus high-pressure water from hoses through an assortment of jets. (photo courtesy KEG Technologies)

Fortunately, an assortment of high-performance hose nozzles is available to expedite the removal of any debris buildup in the pipes of facilities, such as refineries, cement plants, chemical plants, steel mills, or pulp and paper mills. This can help to prevent a range of problems, including regulatory fines, process disruption and unscheduled downtime.

Optimizing Performance

As known in the industry, there are tiers of nozzles rated for performance and water efficiency: Tier 1 (about 30% efficient), Tier 2 (50-60% efficient) and Tier 3 (75-98% efficient). Lowperformance Tier 1 nozzles tend to use only 30% of the available

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energy, wasting 70% due to excessive turbulence. Tier 2 nozzles are more efficient but still inadequate for tougher jobs. In contrast, the most effective Tier 3 nozzles have tight water patterns that efficiently clean the pipe floor/wall. In addition, the units create a powerful water stream that not only moves debris long distances but also propels the nozzle.

Benner noted that he relies on high-efficiency Tier 3 nozzles, "[b]ecause they provide the two most important things we need: the ability to move the hose and nozzle down the entire length

of pipe to the debris location, along with the ability to push the debris out of the line (with water pressure), so we can remove it with the vacuum truck."

What sets the most efficient Tier 3 nozzles apart from others in the category is fluid mechanics engineering on a par with the aerodynamics of race cars or jet fighters. Many Tier 3 nozzles' performance fluid mechanics design leave little room for power losses and excessive turbulence.

Wastewater Cleanup

For wastewater applications, VPC prefers floor cleaner and spinning style nozzles. As the name suggests, these nozzles travel along the floor of large diameter pipe—instead of just the center—and focus high-pressure water from hoses through an assortment of jets. The directed, high-pressure water is ideal for removing sludge, mud, compacted materials and heavy debris (rocks, bricks, broken concrete, etc.) from industrial pipes, storm lines and sanitary lines.

"Floor cleaner nozzles are designed to ride on the bottom third of pipe, so they have the most dynamic effect for removing heavy debris, sand and rock that has accumulated there," noted Benner. According to Benner, VPC also uses a unique rotating nozzle to remove stubborn debris from pipes. This nozzle utilizes water-driven rota-

tion and vibration to create a unique "jackhammer" action to remove grout and mortar residue, scaling, tuberculation or other deposits that have hardened to the pipe floor or wall. This approach is more efficient than cutting and milling out the material but is not recommended for clay pipes.

When a severe blockage is identified, chain-cutter nozzles are designed to cut through difficult obstructions and thick root masses. When high-pressure water enters the chain cutter nozzle chamber, it is directed to spin the cutting chains at high velocity with enough torque to avoid seizing.

Although the high-performance Tier 3 nozzles cost more than lower performing nozzles, Benner has found this acceptable,

because his work crew completes jobs much faster using them. He noted that there is no substitute for having the right tools and experience to clear industrial pipes quickly, whether for routine maintenance or an emergency.

"We will not use inferior nozzles, because they just don't work when industrial pipes and lines must be efficiently cleaned and cleared of any debris. This commitment to quickly getting the job done right has earned us repeat business and helped to keep plants running without incident or downtime," Benner averred.



When a severe blockage is identified, chain-cutter nozzles cut through difficult obstructions and thick root masses. When high-pressure water enters the nozzle chamber, it is directed to spin the cutting chains at high velocity, with enough torque to avoid seizing. (photo courtesy KEG Technologies)

High-performance nozzles are designed to last. Some can still perform reliably after as much as 15 years or more.

KEG Technologies, a manufacturer of industrial, sewer and storm lines products, including Tier 1 to Tier 3 nozzles, floor cleaners and chain cutters, is a member of NASSCO, the National Association of Sewer Service Companies. For more information: 866-595-0515 or www.kegtechnologies.net.

[Del Williams is a Technical Writer based in Torrance, Calif.]

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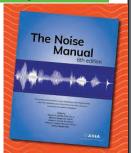
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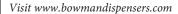
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Updated Confined Spaces Standard Published

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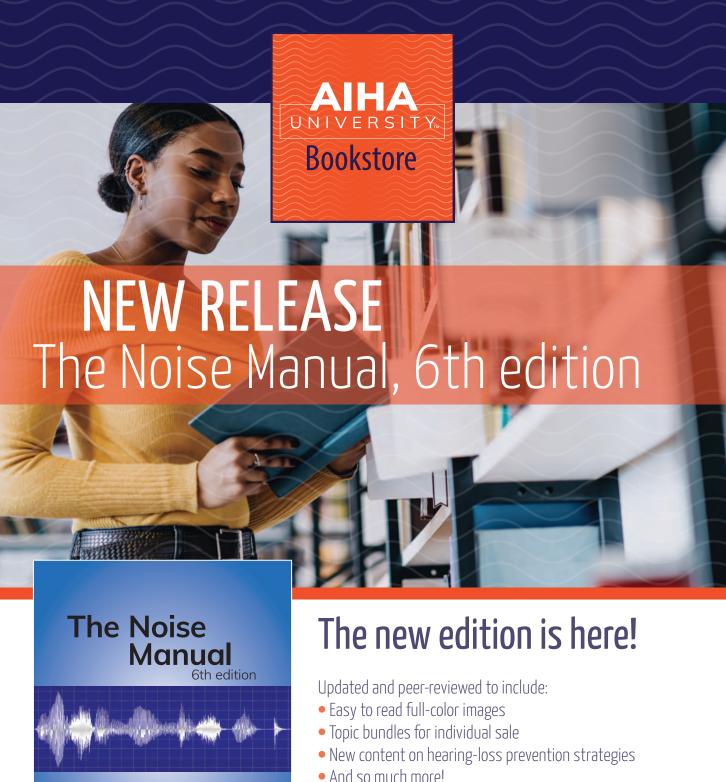


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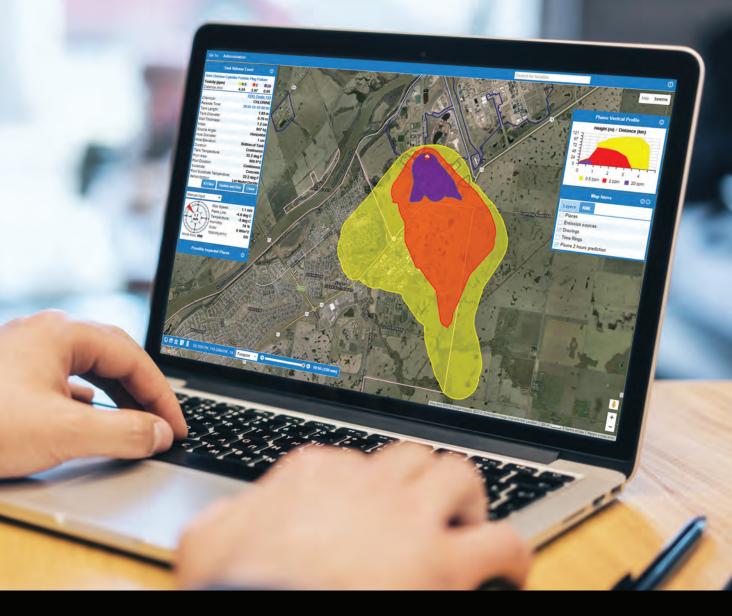


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