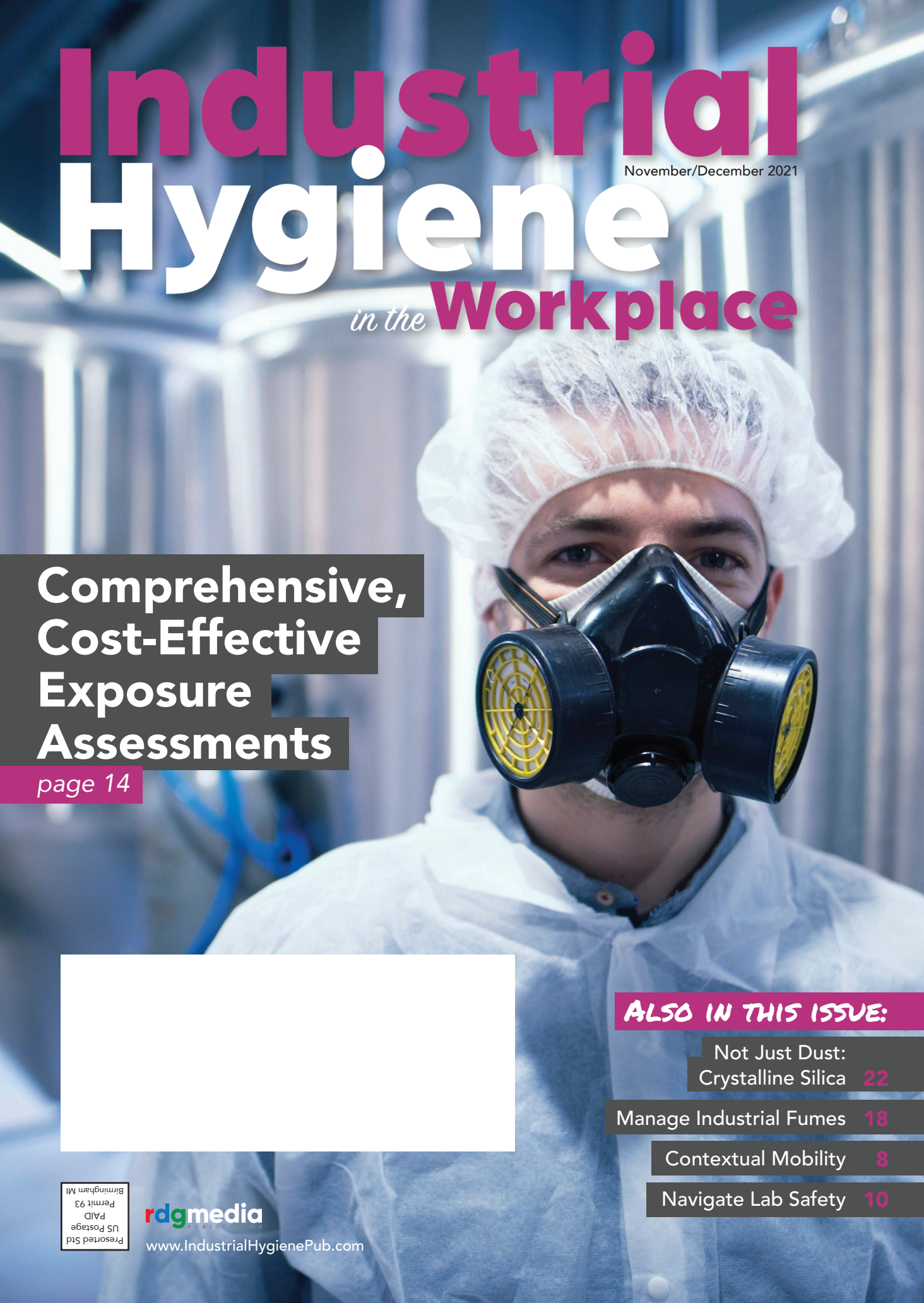
Industrial Hygiene in the Workplace

November/December 2021



Comprehensive, Cost-Effective Exposure Assessments

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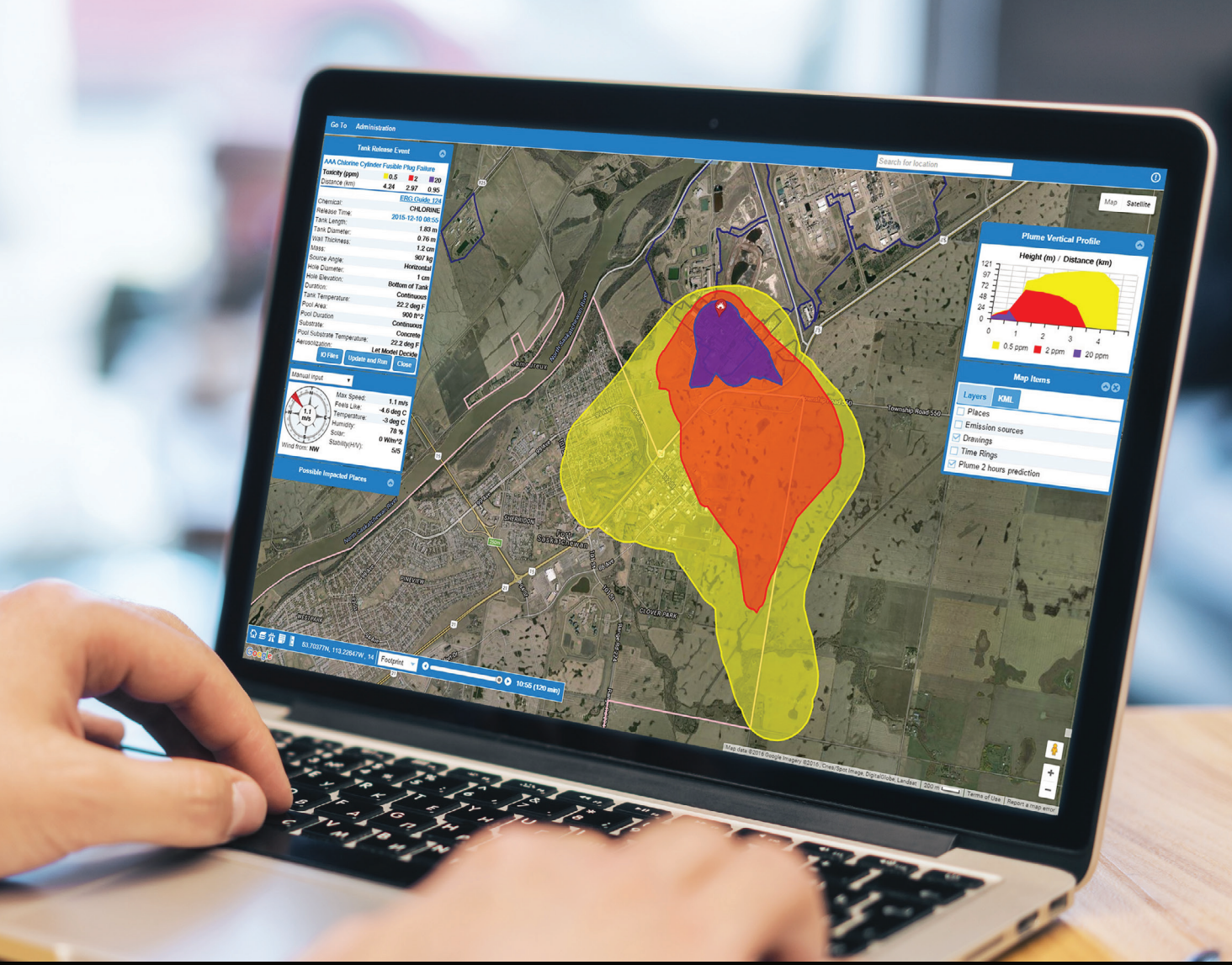

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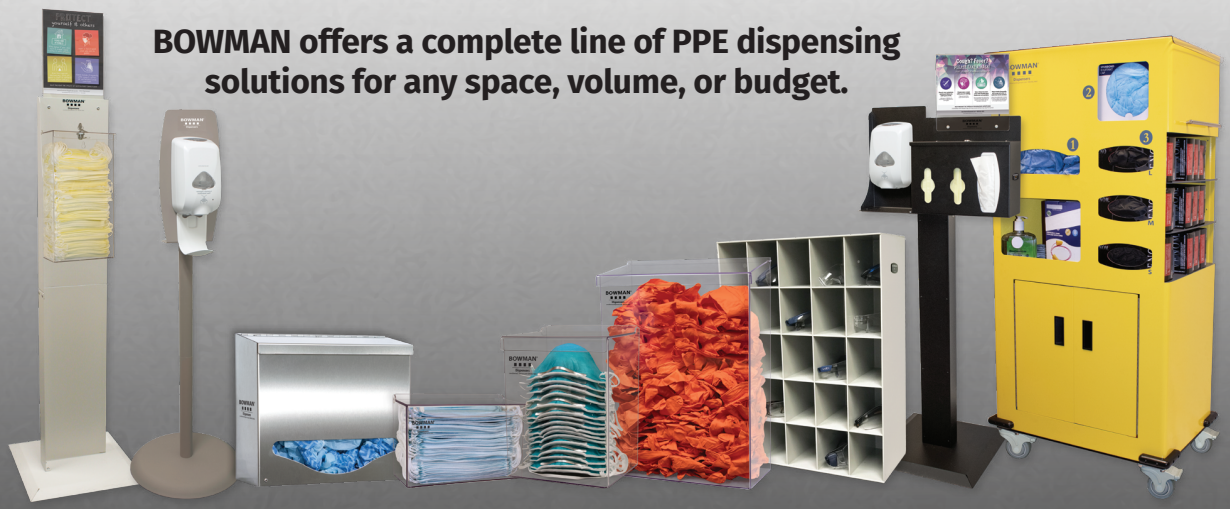

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Note from the Editor

"You can't use up creativity. The more you use, the more you have."

– Maya Angelou

As usual, when we approach the November/December issue, I am astonished that another calendar year is about to turn. Holiday commercials (since before Halloween!) have become ubiquitous already. And, with the turning leaves and cooler temps, I'm hearing how many colleagues and friends are "pairing down" this year or "doing it the easy way." One friend mentioned that it was time to "get creative" with the holidays; this is a response to simplifying our lives in a still-stressful time.

The trend to "think outside the box" or have a "non-traditional Thanksgiving/holiday season" dovetails with some of the trends developed in the business world—including the various industries in which EHS and IH professionals work.

Over the past two years, we've seen communities innovate and create ways to keep people safe. From drive-by graduation or birthday celebrations to "trunk-or-treats" to curbside pickup to outdoor-only festivals—community leaders and private citizens have come up with ways to get things get back to normal—but not in the normal ways. And that's actually great. Change for the greater good shows our collective strength when communities need it most.

We see this willingness to innovate with novel solutions in industry to an exponential degree. From the now-standard Zoom meetings to work-at-home careers to online classes/training to new safety protocols in warehouses, factories and laboratories—the evidence is everywhere. And, I think, when we ever get "back to normal," normal is not going to look the same as it was pre-pandemic.

Safety for employees has always been paramount in the industrial hygiene/EHS world. Many of the protocols implemented due to COVID-19 are now proven to not only prevent the spread of disease; they are part of employees' daily lives. They help instill some peace of mind for everyone involved; that is something worth keeping.

In this final issue of 2021, the lineup of articles will hopefully help readers address various professional safety issues. They include a training program on crystalline silica for general industry; how to manage industrial dust and fumes; and a qualitative, holistic and cost-effective approach to exposure assessments.

In addition, we take a look at laboratory safety, with a specific emphasis on the changes wrought by the pandemic. Finally, we delve into the role context plays in ensuring device use across the workforce—and how it can *increase* employee safety and productivity.

These articles deliver "thinking outside the box," state-of-the-industry information to your doorstep. I hope they assists you in your respective positions within the industry. I also hope you have a restorative, restful holiday season—however you choose to celebrate.

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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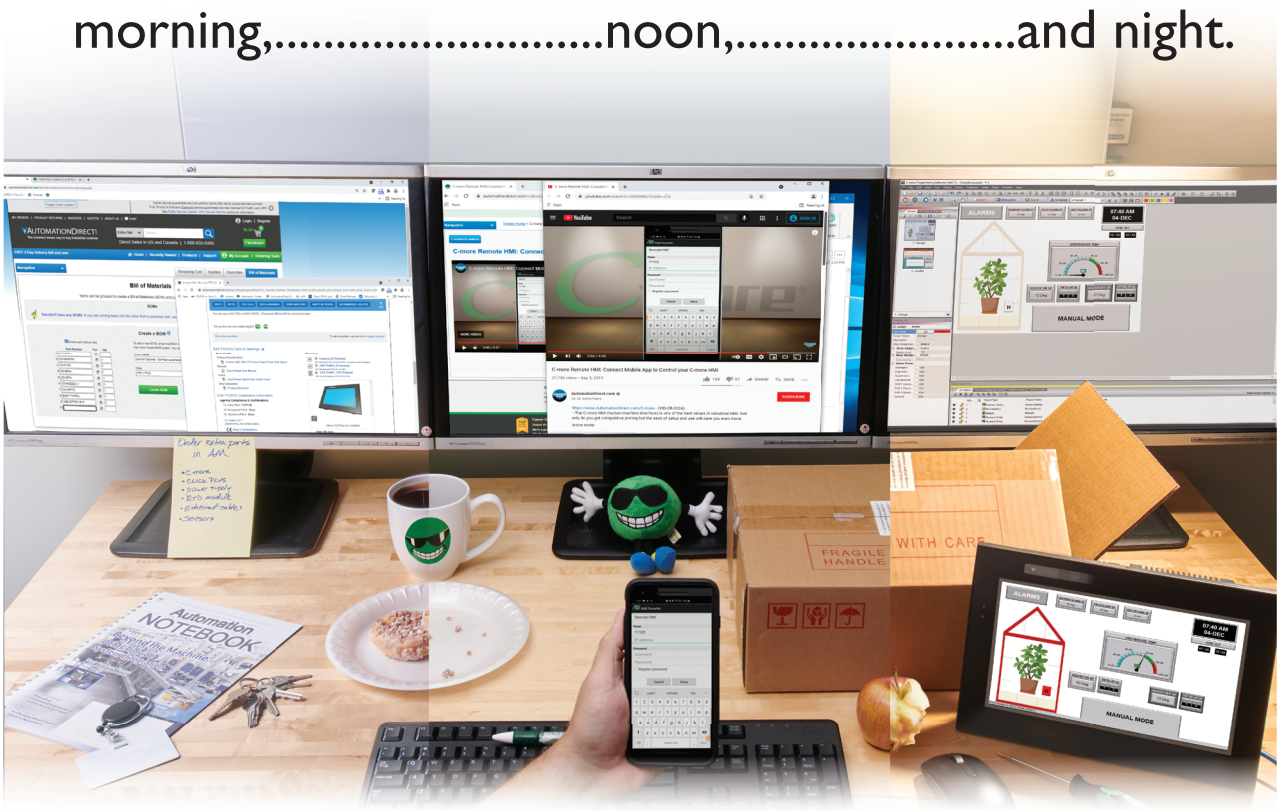

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By: **Joe Boyle**, *Contributor*

Mitigate Workplace Hazards with Contextual Mobility

As business has become increasingly mobile, employers have needed new ways to manage employees' device usage to ensure safe and appropriate use. This is especially true for companies whose workers are field-based, meaning they don't report to an office each day. Rather, they're on the move, such as in transportation and delivery, utilities or pest control. For a delivery driver, going to work could look like picking up packages in a warehouse and then being behind the wheel making drop-offs. For a cable technician, it could be working outdoors installing a service line and then inside a customer's home completing the installation.

Not reporting to an office or sitting at a desk doesn't mean these workers aren't technologically connected throughout each shift. It simply means they're utilizing smartphones and tablets, putting the power of the computer into the palm of their hands in a remote setting.

The rise in advanced mobility has ushered in the need for dynamic mobility management solutions. Such strategies can address the fact that what may be considered safe in one situation may not be in another. Yet, common mobile device management solutions today are optimized to solve for the security of the network and data, but *not* for the productivity, safety and security of the employees using the tools. Because of this, mobile devices are often locked or heavily limited in functionality for workers, as companies believe that's the only way to safeguard what's important to them.

Today's EHS leaders must build mobile device policies with the understanding that workers are not static. *(photo courtesy Adobe Stock)*

Enforcing appropriate use per a company's mobile device policy, while also allowing the features and functionality that enable employees to be productive and flexible, can be a tricky balancing act. So how can environmental health & safety (EHS) professionals allow for the mobile technologies that help their workers do their jobs—while also managing the potential risks they pose if not used appropriately? The answer: Through context.

Accounting for the Human Aspect of Workforce Mobility

One of the ways EHS managers can effectively ensure employees adhere to appropriate use guidelines is by taking context into account. Factors such as time of day, proximity to heavy equipment, workgroup and location should impact what kind of features and functionalities are enabled on a mobile device at a given time. When an employee's context changes, so too should their permissions—automatically and in real-time.

This is referred to as the human aspect of mobility—guided by the fact that employees are not static. They move throughout a shift as the task at hand changes. By taking their context into account and dynamically managing their mobile device permissions (again, automatically and in real-time), employers can ensure workers have access to only what they need for a job and never what they don't need. This seamless ability to adjust permissions without intervention by IT staff has proven to be incredibly powerful for companies who rely on mobile devices.

For example, if an employee is at a high-risk job location, such as an active construction site, a contextual mobility management solution would ensure only the apps needed for the job are available in the right situation. Personal or non-relevant work apps would be kept in the background, while the employee is

operating or near heavy equipment or directing traffic alongside the work site, for example.

The task at hand could be completed more efficiently through the use of mobile technology without introducing incremental risk to the safety of the worker. Once away from the job site, the technology would acknowledge the user's environment has changed and it's safe for additional features to be turned back on. The device permissions would adjust accordingly in real-time.


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Transforming the Way We Work

Mobility will only continue to transform how work gets done—for the better. New apps and processes are being recreated with workforce mobile usage specifically in mind. Because of this, research firm IDC has indicated that U.S. companies have signaled their prioritization of investments in mobile-based management and security solutions. The group also estimates the mobile worker population will grow from 78.5 million in 2020 to 93.5 million in 2024. With this, the focus becomes on how businesses can best enable this group to do their jobs at peak productivity, efficiency and safety.

Today's EHS leaders must build mobile device policies with the understanding that workers are not static. Device permissions must also be fluid and shift as each employee's movements change. It is only then that truly advanced workforce mobility comes to life. IHW

Joe Boyle is CEO of TRUCE Software, the first platform to offer a contextually-aware and responsive mobile management solution for businesses.

By: **Phillip C. Bauknight**, *Contributor*

Navigating Laboratory Safety During a Pandemic

Safety is always critical to the operation of a laboratory. However, the COVID-19 pandemic has dramatically increased the potential risks and safety concerns for many laboratory workers.

As any experienced laboratory personnel can attest, rules can sometimes fall by the wayside even during "normal" times. While such lapses do not always have an immediate impact, the current pandemic has created an environment where it is more important than ever to take the necessary steps to protect laboratory workers. Although guidance continues to evolve, there are various steps you can take to reduce risks for laboratory workers both during the pandemic and going forward.

Centers for Disease Control and Prevention Guidance

In addition to the general precautions issued by the Centers for Disease Control and Prevention (CDC) that we have largely adopted as part of our everyday life (i.e., repeated and diligent hand-washing, covering your mouth, social distancing, masks, using hand sanitizer, staying home if you're sick, etc.), the CDC has also issued detailed recommendations for general laboratory safety practices during the COVID-19 pandemic.

Employers will need to diligently evaluate their laboratory practices to ensure the safety of their employees and to avoid potential legal exposure. *(photo courtesy Adobe Stock)*

General Guidance

The CDC recommends that all laboratories perform site-specific and activity-specific assessments to identify and mitigate risks. The risk assessments should include consideration of the following:

- The number of people that the laboratory can safely accommodate while maintaining social distancing
- The flow of personnel traffic
- Procedures for cleaning and sanitizing commonly shared equipment and areas
- Emergency communication and operational plans

In addition, the CDC recommends that every laboratory should develop a COVID-19 health and safety plan to protect employees. The plan should be shared with all staff and include the following:

- Steps to help prevent the spread of COVID-19 if an employee is sick
- Instructions for sick employees to remain home until the appropriate return to work criteria are satisfied
- Information on whom employees should contact if they become sick
- Flexible sick leave and supportive policies and practices
- Designation of a contact person responsible for responding to employees' COVID-19 concerns
- Accurate information about COVID-19, how it spreads, and the risk of exposure
- Re-inforced training on proper hand-washing practices and other routine infection control precautions

In addition, the CDC recommends that laboratories should ensure that employees have access to personal protective equipment (PPE), appropriate disinfectant products, soap, clean running water, drying materials for handwashing, as well as alcohol-based hand sanitizers that contain at least 60% ethanol or 70% isopropanol.

Social Distancing

The CDC also recommends that laboratories follow social distancing recommendations by:

- Adjusting staff schedules
- Adding more shifts

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- Implementing non-overlapping teams to minimize personnel contact
- Identifying laboratory tasks that can be performed with reduced face-to-face interactions

Employers should also consider reconfiguring workspaces and locations where there is shared equipment to reduce crowding; creating one-directional paths, decluttering workspaces; and disposing of unnecessary items to help with reconfiguration. If reconfiguration is not feasible, employers are recommended to consider placing barriers (plexiglass, partitions, plastic, etc.) between workstations, desks or equipment that help staff remain six feet apart. Laboratories should also limit visits from vendors and other external partners, instead utilizing virtual communication whenever possible.

Face Coverings

All laboratory personnel should wear cloth face coverings in laboratory spaces that do not have respiratory PPE requirements. In addition, laboratory workers should wear a cloth face covering in settings where social distancing measures are difficult, such as offices, computers and break rooms. In addition, any facial protection worn inside a laboratory area where personnel work with potentially infectious material should not be subsequently worn outside of that laboratory area.

The CDC also recommends that laboratory workers wash their hands before putting on face coverings and also minimize the removal of the coverings. If a laboratory worker contaminates or soils a face covering, the following procedure should be taken to remove and replace the face covering:

- Remove the face covering carefully
- Untie the strings behind the head or stretch the ear loops
- Handle the face covering only by the ear loops or ties
- Fold outside corners together
- Be careful not to touch eyes, nose, or mouth when removing a face covering
- Place it in a sealed bag until it can be washed
- Wash hands immediately after removing

The CDC also recommends that face coverings should be washed frequently. In addition, depending on the activity, each laboratory worker may need to have multiple clean face coverings available for use. Critically, cloth face coverings are not respirators and are not appropriate substitutes for respiratory PPE.

Personal Hygiene and Disinfection

The CDC also recommends that extra measures be taken to ensure a clean and appropriate work environment as more workers return to the laboratory. Employers should re-evaluate their protocols for use of PPE and cleaning. In addition, employers should increase the number of available cleaning supplies and distribute them throughout the laboratory, making sure to frequently disinfect high-touch locations.

Finally, the CDC recommends that employers should use visual reminders throughout the laboratory environment, such as posters, to emphasize the importance of proper hand hygiene and coughing etiquette.

OSHA-Specific Guidance for Laboratory Workers and Employers

OSHA has also issued COVID-19 control and prevention guidance for clinical and research laboratory workers and their employers. While OSHA's guidance references the recommendations provided by the CDC, there are several distinct recommendations that should be highlighted.

First, OSHA's guidance provides risk levels for various laboratory work tasks. For example, employees performing administrative duties in non-public areas of work sites, and away from other staff members, have a "lower" risk of exposure to COVID-19. Alternatively, laboratory workers collecting or handling specimens from known or suspected COVID-19 patients, and those performing aerosol-generating procedures on samples that may (or do) contain SARS-CoV-2, have the a "very high" risk of exposure.

OSHA's guidance also advises that until more information is known about how COVID-19 spreads, both the CDC and OSHA recommend using a combination of more general precautions (e.g., appropriate respiratory hygiene, cough etiquette, PPE, routine cleaning, disinfection procedures) and eye protection, such as face shields, to protect laboratory workers. OSHA also recommends that laboratory workers should follow recognized biosafety practices to help minimize the transmission of infectious agents.


Photo courtesy Adobe Stock

The CDC recommends that all laboratories perform site-specific and activity-specific assessments to identify and mitigate risks.

Although guidance continues to evolve, there are various steps that can reduce risks for laboratory workers, both during the pandemic and going forward. *(photo courtesy Adobe Stock)*

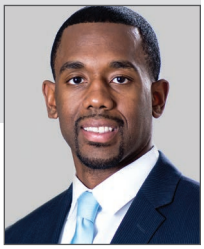
Employers of laboratory workers are also responsible for following applicable OSHA requirements, including OSHA's Bloodborne Pathogens, Personal Protective Equipment, Respiratory Protection and Occupational Exposure to Hazardous Chemicals in Laboratories standards. Employers should routinely review their standard laboratory safety and health procedures with their laboratory employees; train and test the competency of their employees regarding the appropriate implementation of these practices; and ensure consistent compliance with these procedures.

Employers of laboratory workers are also recommended to implement protocols for the handling, storing and shipping of specimens. Employers should ensure that their facilities and precautions meet the necessary biosafety level for the work being conducted. Finally, OSHA recommends that employers implement administrative controls, safe work practices and PPE appropriate for the level of risk in the laboratory.

Conclusion

Employers will need to diligently evaluate their laboratory practices to ensure the safety of their employees and to avoid potential legal exposure. As more employees return to work, employers should familiarize themselves with the substantive and detailed recommendations issued by the CDC and OSHA. However, as the guidance continues to evolve, consultation with a workplace safety and catastrophe management attorney is a best practice that can serve both you and your business. IHW

*[**Editor's Note:** Although vaccines have been available since early 2021, the CDC continues to recommend practices that ensure safety for all laboratory personnel. For updated CDC guidance, visit the Lab Safety Portal: https://www.cdc.gov/labsafety/index.html.]*



About the Author

Phillip C. Bauknight, Of Counsel in Fisher & Phillips LLP's New Jersey office.

By: Tom Burgess, *Contributor*

Exposure Assessments Can Be Comprehensive and Cost-Effective

photo courtesy Getty Images

As an industrial hygienist, I work with companies to ensure employees are not exposed to dangerous conditions at work. These conditions can include anything from chemical vapors to noise or heat. An exposure assessment process is used to understand worker exposures and potential health risks.

For some companies, the phrase "exposure assessment" might conjure a very technical and expensive procedure that involves taking air samples or performing other measurements and analysis. There can be very technical aspects to this process. But there are techniques in exposure assessment that take a simpler approach; they can be very practical and cost-effective.

From the Beginning: Survey

The process for exposure assessment recommended by the American Industrial Hygiene Association begins with a general, or qualitative, survey of the workplace, the workforce and the general environment of the site and tasks. This involves observation of the workplace; sources of exposure and controls; as well as interviewing workers, supervisors and managers about conditions, workflow and any safety procedures currently in place.

Some questions that are asked in an initial survey include:

- What are the types and sources of exposure?
- What are the potential health risks?
- Are there exposure limits to help understand acceptable levels of exposure?
- When are workers exposed—to how much—and for how long?
- Can you use odor or other observations to help you understand the exposures?
- What controls are in place, and how well are they working?
- What exposures occur during maintenance, cleaning or non-routine tasks?

Quite often, you can gain a good understanding of the nature of worker exposures and begin to sort out those that are a concern; the ones that are not a concern; and which need more assessment. Frequently, I get requests to do air monitoring before the initial assessment has been done. Without this initial qualitative part of the assessment, we may end up wasting time and money doing air monitoring in areas, or for tasks where an initial observation would have already told us exposures are acceptable.

A more technical and expensive analysis could, in fact, be necessary, but that time and effort can be targeted to areas where it can be the most beneficial.

Practical Improvements

The survey detailed above can often directly lead to practical and cost-effective improvements. In some cases, we may observe that a hazard can simply be eliminated or physically removed from a work area. In other cases, we might be able to keep workers out of a hazardous location, or limit the time they are exposed. We may also find that controls or PPE are not being used or are not effective. Making these improvements might not involve significant cost or require additional analyses.

Other effective solutions might involve building in physical safeguards; establishing new procedures to work more safely around hazards; or even providing personal protective equipment to workers. If workers are unnecessarily exposed to vapors when taking samples, for example, a company might consider investing in a sampling port for this procedure.

The exposure assessment procedure also helps to identify hazards that may be overlooked. One client was concerned about workers being overexposed to chemicals when loading chemicals into tanks during a chemical batching process. Observation

of the process found that good controls were in place, including local exhaust ventilation and use of PPE. However, after watching the entire process from start to finish, it was clear that during cleanup following the loading of the tanks, workers were more exposed than during the original work.

With these observations, we were able to focus our improvements on the tasks which were resulting in the higher exposures. Full shift air samples alone would not have identified the specific tasks within the overall batch-making process that were causing the highest exposures.

Technical Expertise for Exposure Assessments

In some cases, exposure assessment does reveal the need for a more detailed, technical analysis to understand exposures and health risks before new controls or improvements can be implemented. In such cases, it's vital that companies involve the right expertise in toxicology, engineering, ergonomics or chemistry for the job. It is also important to have employee involvement, as this will typically help with the implementation of controls.

While odors, visible dust or other indicators can help us observe the nature of some exposures, there are times that this will not be effective, and air monitoring or sampling may be needed. One equipment manufacturer was concerned with the many solvents with which they worked and, in particular, one substance that had a strong odor. When we reviewed the types of solvents they were using, it was actually a type with a low odor, (i.e., poor warning properties) that presented the greatest health risk. For the process that used that solvent, the initial survey

The exposure assessment process recommended by the American Industrial Hygiene Association begins with a qualitative survey of the workplace, the workforce and the general environment of the site and tasks. *(photo courtesy Getty Images)*

found enough exposure potential that air samples were needed.

Moving Forward: Periodic Re-evaluation

It is critical that exposure assessments, and any controls implemented in response to these assessments, be periodically re-evaluated. Workflows and work conditions could change, for a variety for reasons, and these in turn could impact the types of dangers to which employees are exposed. A management of change process can be used to assess the potential health and safety impact of changes to equipment or processes before they occur. It is usually much more cost effective to integrate health and safety controls into a change than to try and add them on after the change has occurred.

Effective exposure assessments are comprehensive, holistic and consider a wide range of factors, but they need not be the most expensive ones. *(photo courtesy Getty Images)*

Another manufacturer with whom I've worked wanted to bring in a new process that included a type of chemical they had not used previously. During the process design, they reviewed the process and hazards and found that there was the potential to generate potential hazardous vapors. Since this was identified early in the process, a lot of decisions could be made about the design—in order to minimize potential risk before design and installation was complete.

In this case, the client decided that industrial hygiene technical support was needed, and I was brought in to assist their team. We developed effective controls with a minimal cost impact. If the problem was found after the process was started, the same changes would have been costly and disruptive and, even worse, workers could have been overexposed.

While effective controls were implemented for this new process, this will still need to be re-assessed. The same type of qualitative assessments we discussed earlier should be done periodically. We may see that a control is not working or that some change has occurred.

Employee safety should be the top priority of any company, and many companies are willing to invest considerable resources to ensure their workers are not exposed to workplace hazards. But effective exposure assessments are not necessarily the most expensive ones. Effective exposure assessments are comprehensive, holistic and consider a wide range of factors. IHW

[Tom Burgess is a Client Manager at T&M Associates, a leading national consulting, engineering, environmental, technical services and construction management company.]

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By: **Jon Ladwig**, *Contributor*

For Safety's Sake: *Managing Industrial Dust and Fumes*

Many industrial manufacturing and processing applications produce dangerous airborne dust or fumes. Facility operators must be diligent in controlling these particles to ensure the health and safety of workers and to maintain regulatory compliance.

Dust consists of fine particles of dry, solid matter that are carried in the air and eventually settle on exposed surfaces. The airborne particles or dust clouds can irritate eyes and skin and damage the lungs. As dust settles on flat surfaces, it becomes a hazard that is often combustible, and it increases the risk of slips and falls. In addition, dust can be a highly combustible fuel source that can burn easily or, in the right conditions, explode upon contacting an ignition source.

Industrial dust is generated during a facility's manufacturing or processing operations, such as cutting, drilling, grinding or sawing. Process dust can also come from materials, chemicals or ingredients used in the production process such as flour, sugar and pharmaceuticals.

Industrial processes create airborne dust particles that pose a health risk to employees and a safety risk to facilities. *(photo courtesy Camfil APC)*

Applications like welding, plasma cutting and laser cutting also produce tiny particles, generally referred to as fumes. Like dust, these fumes reduce indoor air quality and endanger workers. Fumes consist of tiny airborne dust particles that contain ingredients that can aggravate eyes and skin, and they can be toxic when swallowed or inhaled.

To maintain a clean and safe work environment, airborne dust and fumes must be captured before they harm workers or cause combustible dust explosions. It is best to convey the captured dust and fumes into a dust-collection system that gathers the dust and contains it in a safe way. After the dust is removed from the air, the clean air can often be safely returned indoors or exhausted outdoors.

Important Considerations for a Dust Management Plan

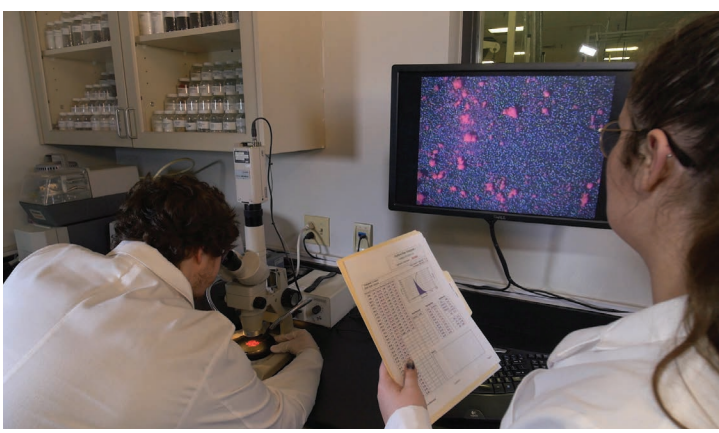
1. Conduct a Dust Hazard Analysis

Performing a dust hazard analysis (DHA) is the best way to evaluate your facility's risk for employee exposure and is a required task, per National Fire Protection Association (NFPA) Standard 652, to determine if any of the dust you are generating is combustible.

Understand the dust you produce by:

- Conducting a dust analysis to identify characteristics of the particles to determine the best collection and filtration system
- Completing dust explosivity testing
- Having an industrial hygiene or environmental engineering assessment performed

OSHA's General Duty Clause, Section 5(a)(1), stipulates that it's an employer's responsibility to identify and abate hazards in the workplace. OSHA also requires employers to keep records of these dusts, and it provides guidelines on hazard identification and assessment.



Dust analysis laboratory where particle characteristics are identified. *(photo courtesy Camfil APC)*

2. Test for Explosiveness & Flammability

NFPA standards 652 and 654 require a combustible DHA to assess risk and determine the necessary fire and explosion

Combustible Dust Properties

- **Kst** - Deflagration index (bar m/s)
- **Pred** - Reduced pressure after venting (bar)
- **Pstat** - Vent static burst pressure (psi)
- **Pmax** - Max pressure for an unvented dust explosion (bar)
- **(dp/dt)** Rate of pressure rise (bar/s or psi/s)
- **Pes** - Enclosure strength = 2/3 of yield strength of weakest part or 2/3 of ultimate strength if deformation is allowed

Combustible Dust Classifications

Dust Explosion Class	Kst	Characteristic
St 0	0	Not explosible
St 1	<200	Weak to Moderately Explosible
St 2	201-300	Strongly Explosible
St 3	>300	Very Strongly Explosible

protection. Facilities producing combustible dust during their processes must demonstrate reasonable progress toward completion of the DHA each year before the deadline.

The first step is to determine whether your dust is explosive by sending a sample to a lab for an explosive dust test. If your test results are explosive, then your testing report should include the Kst and Pmax, which indicate the amount of pressure an explosion can generate and how fast it can travel. NFPA classifies dusts according to explosibility in terms of their Kst values and by type—organic or metal.

Kst is the normalized maximum rate of explosion pressure rise, measured in bar m/s. A bar is a metric unit of pressure, which is slightly less than the average atmospheric pressure on earth at sea level. Your dust-collection equipment supplier will need the Kst and Pmax values to correctly size explosion venting and suppression systems.

3. Assess Employee Exposure & Dust Hazards

An industrial hygiene assessment helps to identify and control harmful exposures to dusts. This assessment includes evaluating your facility to ensure you are meeting OSHA permissible exposure limits (PELs) for the dusts your processes produce.

Ask your dust-collection equipment supplier to recommend an industrial hygienist or environmental engineering company that is experienced in identifying dusts specific to your operation.

Dust Hazards Testing

It's also important to analyze dust characteristics to determine the best dust-collection system design for your operation. The following dust characteristics are determined by bench-testing a sample of your dust:

- Particle size distribution
- Dust shape
- Bulk density
- Moisture level
- Abrasiveness

Be sure to look at whether your dust is a type that tends to generate static electricity. Those types of dusts can be ignition sources for dust explosions. Dust-collection equipment suppliers often can conduct dust testing and work with you to specify the best system and required filter media. Dust testing is an excellent tool to better understand the physical properties of your dust, which forms the basis for equipment selection. To create a complete picture of your operation, the testing laboratory should ask for detailed application data.

4. Create Air Quality Goals

Your dust management program should include air quality goals based on both of the following sources:

- Guidelines found in *Industrial Ventilation: A Manual of Recommended Practice for Design* from the American Conference of Governmental Industrial Hygienists (ACGIH)
- OSHA regulations regarding the PELs for applicable dusts, particularly where workers are at risk for long-term health effects

Review the results from your industrial hygiene assessment, OSHA guidelines, explosive dust testing and dust analysis to determine solutions to capture and contain dusts. Another important part of your assessment is listening to, observing and questioning your workers. They can let you know if current engineering controls are effectively managing dusts at the facility and suggest areas for improving processes and equipment.

If you are recirculating the cleaned air back into the facility, it must stay below OSHA PELs for contaminants. When exhausting the air outdoors, you are subject to EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) Rule 6X and must perform an EPA Method 22 Fugitive Emissions test. The test is conducted using a visual determination of fugitive emissions from exhaust sources and is performed by a trained observer.

Dust collector hood to capture dust at the generation source. *(photo courtesy Camfil APC)*

5. Method of Capturing Dust

An industrial dust-collector system designed specifically for your operation is a proven engineering control for hazardous airborne contaminants. There are three general methods for capturing dust using dust-collection systems:

• Source Capture

These systems typically use flexible source capture arms, slotted dust hoods or smaller slotted hoods with side shields on a workbench operation.

• Enclosures and Canopies

Hoods are often used if the footprint area is less than 12 X 20ft. Curtains or walls may be added to the sides of a hood to create an enclosure, as long as they don't interfere with workspace. Some applications use a full enclosure over and around the process area.

• Ambient Systems

You can filter all the air in a facility using one central system or multiple smaller collectors. Ambient systems are often favored for larger work areas involved in multiple operations, but they might require a bank of HEPA safety monitoring filters (also called secondary or after-filters). Secondary filters provide backup protection, particularly where air is returned indoors downstream of the collector. Since ambient systems don't remove dust particles directly from the breathing zone, PPE might also be required.

Indoor dust-collection system that recirculates filtered air. *(photo courtesy Camfil APC)*

6. Design a System that Minimizes Operating Costs

A safe dust-collection system can also be very cost-effective. A properly designed system will minimize energy usage and operating costs. For example, system zoning allows you to operate the collection system where it is needed, while other areas can be turned down or shut off.

Incorporating variable speed drives for fans on dust collectors saves energy. The variable speed drive produces a steady airflow because the system only runs the motor as needed to maintain the static pressure setpoint. Also, it automatically reacts to filter loading or movable applications. Having this feature increases reliability, extends filter life, reduces maintenance and saves energy.

Recirculating the filtered air is an ideal way to save energy and maximize return on investment. Flowing cleaned air from the collector back through the facility instead of venting it outdoors eliminates the cost of replacing that air. In addition, you can eliminate the complex EPA paperwork and monitoring procedures involved when dusts are exhausted outdoors.

It is recommended to use a secondary safety filter when recirculating into your facility to obtain the required OSHA PEL levels.

7. Consult with Peers and Your Local AHJ

Networking with peers is another way to discover processes, equipment and vendors to help manage airborne dust. Also, consult with professional associations and certification groups. Ask your authority having jurisdiction (AHJ), such as Factory Mutual or local fire marshals, for their safety guidelines.

When selecting a dust-collection system supplier, look for one that is experienced with your specific processes, as well as being knowledgeable about OSHA, NFPA and EPA requirements. The supplier also needs to have the technical resources to develop an engineered solution. It should offer a full range of equipment in order to give unbiased advice on the right type of system for your facility. Experienced suppliers also provide testing services and training.

Summing It Up

Managing dusts in manufacturing and processing facilities is necessary for the safety and well-being of employees and to achieve regulatory compliance. Conducting proper dust hazard analysis with industrial hygiene assessment, explosive dust testing and dust analysis will help you to develop a dust management plan. Incorporate components that provide flexibility, increase reliability, reduce maintenance and maximize energy savings.

A dust-collector system designed specifically for your operation and containing high-efficiency cartridge and secondary filters is an accepted and proven engineering control that filters hazardous, respirable particulates and makes indoor environments safer and healthier. IHW

About the Author

Jon Ladwig is the Metal Processing Specialist for Camfil Air Pollution Control (APC). Camfil APC, a unit of the Sweden-based air filtration company Camfil, is an industry-leading global manufacturer of dust-, fume- and mist-collection equipment for challenging industrial applications, with production facilities around the world including the Americas, Europe and Southeast Asia. For information, contact 800-479-6801 or 870-933-8048; email filterman@camfil.com; or visit www.camfilapc.com.

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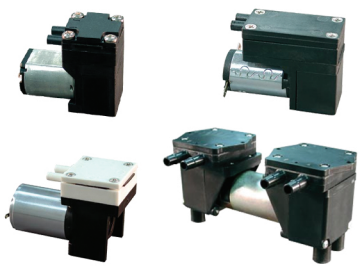

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By: **Rachel Krubsack**, *Contributor*

It's Not Just Dust: *Implementing a Respirable Crystalline Silica Training Program*

More than 2 million workers in the U.S. are exposed to crystalline silica on the job. Crystalline silica is a natural component of sand, rock and mineral ores. It's also found in materials such as concrete, mortar, granite and artificial stone. The most common form of crystalline silica is quartz.

Simply being near silica-containing materials is not hazardous. The hazard exists when specific activities create respirable dust that's released into the air.

Employees must be trained at the time they're assigned to a position involving exposure to respirable crystalline silica. *(photo courtesy J.J. Keller & Associates, Inc.)*

Respirable crystalline silica—very small particles at least 100 times smaller than ordinary sand found on beaches—is created when cutting, sawing, grinding, drilling and crushing stone, rock, concrete, brick, block and mortar.

Overview

OSHA has two standards for crystalline silica–one at 1910.1053 for general industry, and one at 1926.1153 for construction. This article will focus on a training program for general industry.

Employees must be trained at the time they're assigned to a position involving exposure to respirable crystalline silica. While there's no annual training requirement in the standard, additional training must be provided as often as necessary to ensure that employees know and understand respirable crystalline silica hazards and the protections available in their workplace. Additional training may be necessary when:

- Employees are asked to perform a task that is new to them
- The employer introduces new protections
- Employees are working in a manner that suggests they have forgotten what was learned in training

Getting Started

Establishing an effective training program may seem overwhelming as you read through the standard's many requirements. Here are six steps to get you started.

1) Identify the tasks that may expose workers to respirable crystalline silica.

In general industry, the most severe exposures to respirable crystalline silica result from abrasive blasting. Other exposures occur in cement and brick manufacturing, asphalt pavement manufacturing, and the tool and die, steel and foundry industries. Crystalline silica is used in manufacturing, household abrasives, paints, soaps and glass.

Respirable crystalline silica exposure during the fabrication of artificial stone countertops is an emerging hazard that has been associated with several recent outbreaks of severe accelerated silicosis in young workers in the U.S.

2) Explain the health hazards associated with exposure to respirable crystalline silica.

Employees exposed to respirable crystalline silica are at increased risk of developing serious adverse health effects, including silicosis, lung cancer, chronic obstructive pulmonary disease (COPD) and kidney disease.

Silicosis is a life-threatening disease. It typically occurs after 15–20 years of occupational exposure to respirable crystalline silica. Crystalline silica dust particles that are small enough to be inhaled enter the lungs and cause scar tissue to form. The scarring reduces the lungs' ability to take in oxygen. The worker may experience shortness of breath, fatigue, weakness, chest pain and weight loss.

3) Describe how OSHA regulates exposure to respirable crystalline silica.

OSHA's standard on respirable crystalline silica sets the permissible exposure limit (PEL) as 50µg/m^3 (micrograms of silica per cubic meter of air), calculated as an 8-hour, time-weighted average (TWA).

The rule includes provisions for:

- Exposure assessment
- Regulated areas
- Engineering and work practice controls
- Written exposure control plan
- Abrasive blasting
- Respiratory protection
- Housekeeping
- Medical surveillance
- Hazard communication
- Signs
- Employee information and training
- Recordkeeping

A copy of 1910.1053 must be readily available without cost to each covered employee. Employers may provide access by means of a printed or electronic copy in a central location or company website. When access is provided electronically, however, employees must receive training on accessing designated computers that must be available at all times, without any barriers to access.

4) Outline the specific measures implemented to reduce exposure in the workplace.

Employers monitor the air and use the results to make decisions on engineering controls, work practices, PPE and the need for a medical surveillance program.

Within 15 working days after completing an exposure assessment, the employer must individually notify each affected employee, in writing, of the results of that assessment or post the results in an appropriate location accessible to all affected employees.

Examples of controls include exhaust-ventilation and dust-collection systems, water sprays, wet drilling, substitution of less hazardous materials for abrasive blasting, using vacuums with

HEPA filters and wet sweeping of work areas. Use warning signs to identify hazardous work areas.

5) Explain the medical surveillance program.

A medical surveillance program is available at no cost, and at a reasonable time and place, to each employee who will be occupationally exposed to respirable crystalline silica at or above the action level for 30 or more days per year. The action level for airborne respirable crystalline silica is set at 25µg/m^3 (micrograms of silica per cubic meter of air), calculated as an 8-hour TWA.

The initial, baseline medical examination will be given to each affected worker within 30 days of his or her initial assignment. The exam consists of taking the employee's medical and work history, with an emphasis on exposure to respirable crystalline silica, dust and other agents affecting the respiratory system; along with any history of respiratory system dysfunction, including signs and symptoms of respiratory disease; any history of tuberculosis; and smoking status and history.

The physical exam will include a chest x-ray, a pulmonary function test, testing for latent tuberculosis infection and any other tests deemed appropriate by the physician. Periodic examinations will be available at least every three years or more frequently, if recommended by the physician.

The physician will give each affected employee a written medical report within 30 days of the exam. The report includes information on any medical conditions that need further evaluation or treatment; recommendations on the worker's fitness to use a respirator; any recommended limitations on the employee's exposure to respiratory crystalline silica; and any referrals to a specialist.

If there is a referral to a specialist, the employer must make a medical examination by a specialist available to the worker within 30 days of receiving the written medical opinion.

6) Explain what employees can do to protect themselves.

Workers exposed to respirable crystalline silica should:

- Learn about the health effects of respirable crystalline silica and know that smoking adds to the damage.
- Participate in air monitoring and training programs.
- Know the work operations where exposure to respirable crystalline silica may occur.
- Follow all safe work procedures for the job.
- Use all available engineering controls, such as blasting cabinets, water sprays and local exhaust ventilation. If a less hazardous material can be substituted for crystalline silica, use the less hazardous material.
- Use an N95 NIOSH-certified respirator if a respirator is required. Wear a type-CE, abrasive-blast, supplied-air respirator for abrasive blasting.
- Change into disposable or washable work clothes at the worksite, if possible; shower and change into clean clothing before leaving the worksite.
- Never eat, drink, use tobacco products or apply cosmetics in areas where there is dust containing crystalline silica.
- Wash their hands and face before they eat, drink, smoke or apply cosmetics *outside* of the exposure area.

While the silica standard has numerous requirements related to training, these six steps can provide a starting point for an effective program. Employers can assess employees' understanding through discussion of the required training subjects, written tests or oral quizzes. IHW

About the Author:

Rachel Krubsack is an Associate Editor on the Environmental, Health and Safety (EHS) Publishing Team at J. J. Keller & Associates, Inc. She researches and creates content on a variety of workplace safety topics, including hearing conservation, training requirements, bloodborne pathogens, emergency action plans, hazard communication and lockout/tagout. She is Editor of the Employee Safety Training Advisor *newsletter and the following manuals:* OSHA Rules for General Industry, Hazard Communication Compliance *and* Hazard Communication Pro.

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Selecting the right chemical resistant glove for the job is obviously complicated. In this *IHW* exclusive interview with Gilbert LeVerne, Jr., Director, Marketing at SHOWA International, we discussed a wide range of issues that can help protect workers from chemical burns, including the company's *Chemical Resistant Glove Directory*.

Q Employees where chemicals are manufactured are obviously at risk for hand injuries due to chemical exposure. Other industries are also high-risk for such hazards (i.e., mining, painting, construction, welding, etc.). How can workers unintentionally expose themselves to harmful solutions?
Mishaps, misunderstandings and lack of training: Proper training and certifications are paramount to a safe work environment, especially where harmful chemicals are in use.

Q What is "chemical permeation," and how can it be combatted in industries where chemical exposure is a risk?
Permeation is a process by which a chemical can pass through a protective film without going through pinholes, pores or other visible openings. Individual molecules of the chemical enter the film and "squirm" through by passing between the molecules of the glove compound or film. This is combatted by wearing the proper hand protection within the regulated time of exposure to chemicals.

Q How does permeation differ from the term "penetration," when used to describe a chemical process?
Permeation is described as something moving through a substance by diffusion or going through the pores of it by being spread onto it. Penetration of something is when a certain chemical can find its way into the pores and imperfections of a certain material.

Q There seem to be many complications that workers might suffer from chemical burns. What are some of these complications?
Serious chemical burns can cause long-term complications:

- Many people have pain and scarring.
- Burns in the eye can lead to blindness.
- Swallowing harmful chemicals can lead to problems in your gastrointestinal tract, potentially leading to permanent disability.
- Some acid burns can cause the loss of fingers or toes.
- Burns can cause emotional issues including anxiety, depression and insomnia.

Long-term effects for employees and employers differ and are reviewed by incident. Employers lose tens of thousands of dollars in work compensation for injuries at work, loss of valuable employees due to permanent injuries, OSHA violations, etc.

Q What are the three "service pillars" of SHOWA's ChemRest Platform?
Educate, Evaluate, Equip

Q What type of education does SHOWA provide for employees on chemical resistance and permeation?
SHOWA has 70 years of experience with chemical hand protection. Our sales professionals, our technical team and our online services all are available to our customers at any time. We make complex chemical applications much easier for our customers to understand and prevent against.

Q How is this education or training delivered?
We do in-person training, video conferencing and videos.

Q Has the company conducted any after-education assessments to see if their training/education programs help to mitigate a company's injury statistics?
Yes, we utilize our Sentinel evaluation program to measure all of our recommendations, training, injury prevention, cost savings, etc.

Q What is SHOWA's process for determining a company's best choice(s) for chem-resistant gloves?
Application Type/Chemical Name/CAS #/Time of Exposure are the main areas that we cover before recommending the proper glove.

Q Can you briefly explain SHOWA's global labeling system and its various benefits?
We utilize the EN-374 TYPE A, B, C labeling system*. This labeling system is throughout our online assets, catalogs, inner packaging, dispensers, marketing materials, training materials, etc.

Q Selecting the right chemical resistant glove for the job is obviously complicated. What is the Chemical Resistant Glove Directory (ChemRest.com) and how does it help users navigate the myriad issues they might face in choosing the right hand protection?
Our mission is to educate, evaluate and equip. We do this most effectively in-person, but that is not always an option. We developed chemrest.com to bridge the gap in an easy to use interface with our chemical glove portfolio of products. Go to chemrest.com; register as a user; and walk through the clear steps to finding the chemical, the exposure time and the product to protect.

SHOWA professionals are experts at using chemrest.com and can also be of great benefit to aiding the user in navigating the site.

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SKC provides the air, noise, and surface/dermal solutions and expertise that support OEHS professionals in protecting worker health and safety. Founded in Pennsylvania in 1962, the SKC network stretches across the U.S. and to over 65 countries. At our heart is the power of science in the service of people. Innovation, quality, and reliability are the basis for our best-in-class air sample pumps, calibrators, sampling media, particulate samplers, noise instruments, and surface/dermal testing kits. We are committed to serving your needs with our products, Knowledge Center, rentals, calibration services, and outstanding technical and customer support.

The SKC story is a unique one that began in the 1960's with founder Lloyd V. Guild in Pittsburgh, PA asking: "Why are so many workers being exposed to toxic air? Why isn't more being done to protect workers?" In the 1970s, as the industrial hygiene industry started to take shape, SKC became a passionate supporter and technological contributor to the growth of industrial hygiene and the protection of workers. Today, SKC leads forward with innovative technologies, expertise, and advanced science that is highly valued by OEHS professionals.

Nearly 60 years ago, SKC's contributions included producing and marketing some of the very first air sample pumps. Over 45 years ago, we partnered with agencies to bring the NIOSH sorbent tube design to the commercial market. Each decade brought advancements in pump and sorbent technologies and product expansion to place even better tools into the hands of practitioners. Today, SKC offers air sample pumps, sampling media, passive and particulate samplers, noise instruments (including the award-winning NoiseCHEK), surface/dermal testing kits, and an array of other helpful innovations that continue to set the standard for measuring occupational hazards. The SKC brand and our products are widely recognized and trusted in industries around the world.

The SKC team comprises scientists, engineers, marketers, and business leaders with a genuine passion for and commitment to industrial hygienists and the workers they protect. With over 200 combined years of experience in the industrial hygiene field, our deep expertise is always available. From manufacturing and expertise to service provider and industry supporter, SKC gives its all to its products, customers, and partners. It is SKC's science, used in the service of people, that sets us apart as a leader in industrial hygiene.

Many people ask what we mean by "Science. Serving people." SKC's core is science connected to human values. We practice our science for the benefit of OEHS professionals and those they protect. The integrity of our science and that of our products are one in the same. Knowledge and value in the service of people are the practical applications of our work.

SKC is not just a manufacturer—we go beyond to serve with expertise, support, and passion. There is no greater proof of our leadership in industrial hygiene than our many loyal and satisfied customers who remain with us for decades and look forward to the technology and science that is to come.

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At TSI, our global team strives to provide not only instruments, but also innovative solutions. We operate at both a global scale and a human scale—instruments that measure everything from atmospheric aerosols to the fit of a personal respirator. Turning data into actionable information enables our customers to do their jobs more efficiently and safely. TSI understands the science, the data, and the processes that support your work. Every day, our dedicated employees turn research into reality.

Measure What's Important

TSI develops and manufactures accurate and reliable occupational health and safety instruments to measure what's important in your safety program.

- Monitor risks such as heat stress, confined space gases, noise, and particulate mass
- Evaluate workplace exposure, including short-term and long-term exposure to dust, particles, or gases
- Build strong respiratory protection programs with quantitative fit testing
- Optimize comfort and productivity with HVAC and industrial ventilation tools and indoor air quality assessments

Customer & Instrument Solutions

A strong safety program depends on good data. Only with correct measurements, can you identify risks, report on them with confidence, and make informed decisions. TSI is a leading supplier of instruments designed to assist safety professionals with intelligent solutions for evaluating exposure and safety. Professionals call on TSI's breath of products for monitoring worker, area and environmental exposure to hazards, like:

- **PortaCount® Respirator Fit Tester** - instruments & software to support respiratory protection programs from training through compliance.
- **SidePak™ Personal Aerosol Monitor** – measuring risk to workers by monitoring the worker breathing zone
- **Quest™ Edge 5 Personal Noise Dosimeters** - monitor personal noise exposure levels in real-time
- **Sound Examiner Sound Level Meters** - comprehensive information on noise sources and employee noise exposure to make informed safety decisions
- **Q-Trak™ XP Indoor Air Quality Monitor** - used to measure temperature, humidity, outdoor air calculations, CO, CO2, and particles.

Your Trusted Partner

We understand how important your job is—and what you need to do it well. Trust TSI to help you handle your Occupational Health & Safety challenges every day. For more details, please visit TSI.com or contact us directly at 651-490-2860.

UNDERSTANDING, ACCELERATED

TSI Incorporated
500 Cardigan Road
Shoreview, MN 55126
651-490-2860
www.TSI.com

TOGETHER, we are STRONGER

Strengthen your **Respiratory Protection** Program

Respirators protect workers from breathable hazards in the workplace. Fit testing evaluates the seal between a respirator and the face, identifying gaps or leaks that put workers at risk. The **PortaCount® Respirator Fit Tester** from TSI® provides a precise fit and training. Have confidence with the most trusted fit test instrument to increase your staff's safety, and improve your program's efficiency and productivity.

Learn more
TSI.COM/STRONGER

HafcoVac Air-Powered Industrial Vacuums

About Us
HafcoVac is a product line of Hafco Foundry. Hafco Foundry is located in Midland Park, New Jersey. Founded in 1969, Hafco Foundry manufactures and distributes a variety of vacuum cleaner units and accessories that are perfectly adapted to the heavy duty requirements of industrial and machining cleanup.

HafcoVac Air-Powered Industrial Vacuums are designed to be high-performance solution for use within environments where electricity is not available, too dangerous or prohibited for use. Our vacuums are multi-functional, maneuverable, easy-to-use and can be accessorized to meet the needs of any type of industrial cleaning necessary. HafcoVacs safely collect both wet and dry materials and are constructed with no moving parts that can create friction, arcs or sparks. They are also ATEX and NRTL certified for use in the cleanup of hazardous combustible dusts. Many industries have to comply with safety regulations involving combustible materials and the versatile HafcoVac is both a price and service leader for intrinsically safe, certified, air-powered industrial vacuum cleaners.

HafcoVacs are perfect for use in heavy-duty industrial cleaning for the purpose of recovery of wet and/or dry materials. Using the existing compressed air in your facility, our simple Venturi system can provide up to 5x the power generated by motor driven systems. Since the Venturi has no moving parts it also maximizes operation and minimizes maintenance and all of our Vacuums carry our industry-leading Lifetime Warranty.

Highly portable, Air-Powered HafcoVacs can be used in a multitude of industrial work area spaces. For confined areas that require the removal of combustible and possibly hazardous dusts, our 30-gallon drum may be more effective and for larger spaces and amounts of material to be collected or recovered we offer a 55-gallon capacity drum. HafcoVac Air-Powered industrial vacuums always work wherever electricity is unavailable and within ATEX and NRTL guidelines.

HafcoVacs are engineered and manufactured for maximum efficiency. Using a minimum of air consumption they generate powerful suction 5x more powerful than a equivalent electric motor driven vacuum. HafcoVacs are an industry leading solution for reaching and keeping housekeeping standards within industrial locations. They are also very effective for atmospheres producing dangerous fumes in their processes and facilities that have machines prone to issues related to the production of dust as a by product.

When coupled with our popular Overhead Cleaning Kit accessory, Air-Powered Hafcovacs prevent blowdown and distribution of harmful fumes and materials. Available in 4 different lengths the kit makes cleaning pipes, beams and overhead areas quickly, efficiently, and safely.

Certified, safe, strong, portable, easy-to-use, built to last, and backed by our Lifetime Warranty it is particularly suitable to use within a range of industries while also complying with the directives of ATEX and NRTL.

HAFCO Vacuums are ATEX certified and designed for use in Class I: Division 1, Groups A, B, C and D T6, Zone 1, and Class II: Division 1, Groups E, F, G, T6, and Class III: Division 1 Hazardous Locations as defined in the National Electric Code (NFPA 70). They can be used in a Division 2 hazardous location, providing it is in the same Class and Group.

HAFCOVAC

HafcoVac
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Midland Park, NJ 07432
877.820.0050
info@hafcovac.com
www.hafcovac.com

HAFCOVAC

SAFE ▸ SIMPLE ▸ STAINLESS

HAFCOVAC STAINLESS STEEL EXPLOSION-PROOF VACUUMS

Housekeeping Compliance Made Simple.

MEETS NFPA 652 REQUIREMENTS

SAME DAY SHIPPING

BENEFITS OF STAINLESS STEEL

- **CORROSION RESISTANCE**
  Resists corrosion to water, acids, alkaline solutions, and chlorine environments.
- **FIRE AND HEAT RESISTANCE**
  Retains strength at high temperatures.
- **EASY TO CLEAN**
  Easy to clean, perfect for strict hygiene areas including food.
- **IMPACT RESISTANT**
  A natural property of Stainless Steel is it's inherent toughness.
- **LONG TERM VALUE**
  Summed up by it's natural characteristics HafcoVac Stainless Explosion-Proof Vacuums are often a less expensive option when total cost is considered.
- **SUSTAINABLE**
  Stainless, being corrosion resistant, durable, and containing high-recycled content and recapture rates is one of the most sustainable material choices available.

THE ESSENTIAL OVERHEAD TOOL KIT

HAFCOVACHEPA

HEPA FILTRATION
included with all units

HAFCO VACUUMS HAVE THE **MOST POWERFUL VENTURI SYSTEMS** WITH **LIFETIME WARRANTIES**

ComDust CERTIFIED Meets NFPA Standards

FOR WET OR DRY USE

ANTI-STATIC EXPLOSION PROOF

ATEX II 2 D c T6 X

Equivalent to National Fire Protection Association 70: NEC Rating:

Class I Division 1*	Groups A, B, C, D T6	Zone 1
Class II Division 1*	Groups E, F, G T6	
Class III Division 1*		

Zone 1 Only
Certified for use in a Division 1 hazardous location, can be used in a Division 2 hazardous location, providing it is in the same Class and Group.

PHONE: 201.447.0433 **TOLL-FREE:** 855-HAFCOVAC **EMAIL:** safety@hafcovac.com www.hafcovac.com

Miller Electric Manufacturing Co.

About Us
Miller leads the welding industry by building advanced, solution-focused products and meeting crucial needs for welding safety.

Miller Electric Manufacturing Co.
1635 W. Spencer St.
P.O. Box 1079
Appleton, WI 54912-1079
(920) 734-9821
MillerWelds.com/safety

All of our products are designed and built to protect the welder behind the hood and the environment in which they perform their job – because that's what we know. By listening to welders, safety managers, and industrial hygienists and working with them side-by-side, we understand their needs and have developed respiratory and welding solutions with enhanced technologies that provide around the clock protection.

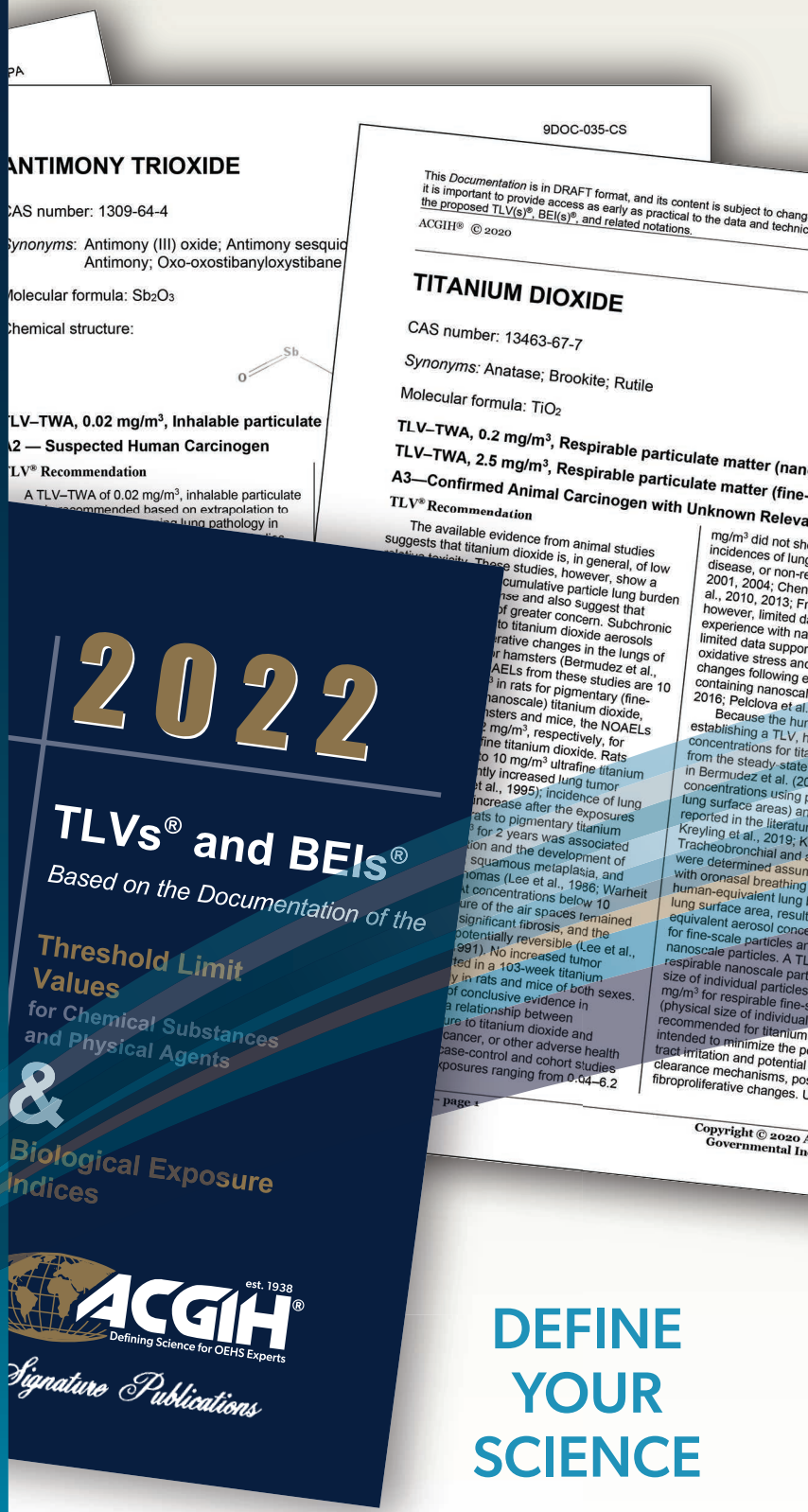
Miller is committed to bringing forward-thinking technologies and solutions to the welding industry. We listen to your challenges and constantly seek to improve our products to better address them. Our complete line of fume extraction, head and face, heat stress and hand and body protection is designed to protect and perform in demanding welding environments. We strive to enhance operator skills and weld quality, improving safety and productivity in the workplace.

IMPORTANCE of TLVs and BEIs DOCUMENTATION when using TLVs and BEIs Book

TLVs and BEIs are more than just numbers. Each TLV and BEI value is supported with unique Documentation which provides its underlying scientific information and data while also referencing the specific literature used to publish the corresponding levels in ACGIH's annual TLVs and BEIs book.

As an occupational, environmental, health, and safety professional it is essential to review the Documentation to ensure their proper use in evaluating workplace exposure interactions, to understand their limitations, and to properly utilize them in the workplace. By effectively utilizing Documentation, professionals assessing worker exposures are incorporating critical context about the potential health effects of a substance – information a limit alone cannot provide.

Sale of the Documentation supports the TLV/BEI Development Process and ensure the continuation of this valuable resource in ACGIH's mission to advance occupational and environmental health.



DEFINE YOUR SCIENCE

ACGIH.ORG

Vortec The Leader In Innovative Compressed Air Products

In 1961, Vortec became the first company to develop technology for converting the vortex tube phenomenon into practical, effective industrial cooling solutions. Since then, Vortec has continued to refine and expand vortex tube applications, as well as develop air amplification products for more efficient use of compressed air in cleaning and conveying applications. In 1990, Vortec was purchased by Illinois Tool Works, a Fortune 200 company; and is now

part of the ITW Air Management business unit, which, in addition to Vortec products, offers the Paxton Product line of products for drying and blow off. Vortec's line of innovative compressed air products include;

- Vortex Tubes, Cold Air Guns, and Vortex Enclosure Coolers for spot and enclosure cooling;
- Personal Air Conditioner vests for worker comfort and safety in extreme temperatures;
- Energy Saver Nozzle and Jet to blow off and clean while conserving compressed air and reducing factory air-related noise and operating costs;
- Air Amplifiers and Air Knives for air conveying, surface cooling, static elimination and blowing off of wide areas; and
- Dual Force Drum Pump & Vacuum to spill and sump clean up and liquid material handling.

These products and the full line of Vortec products are all designed to improve your facility maintenance and productivity, increase equipment efficiency, and improve manufacturing methods and costs for cooling, cleaning and conveying.

The ITW Air Management team of design and technical application engineers have decades of experience and can help you to find a solution for your industrial and commercial applications. Vortec products are often incorporated into other machinery and equipment to maximize productivity and reliability.

Highly reliable Vortec products are backed by a best-in-class 10 year Warranty for all core, compressed air products we manufacture. Our entire staff is committed to the quality and dependability and continuous improvement of our products. Please don't hesitate to contact us if you have questions or suggestions.

VORTEC

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WITH VORTEC PRODUCTS

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AIR FLOW AMPLIFIERS

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