Industrial January/February 2021 Hyglene in the Workplace



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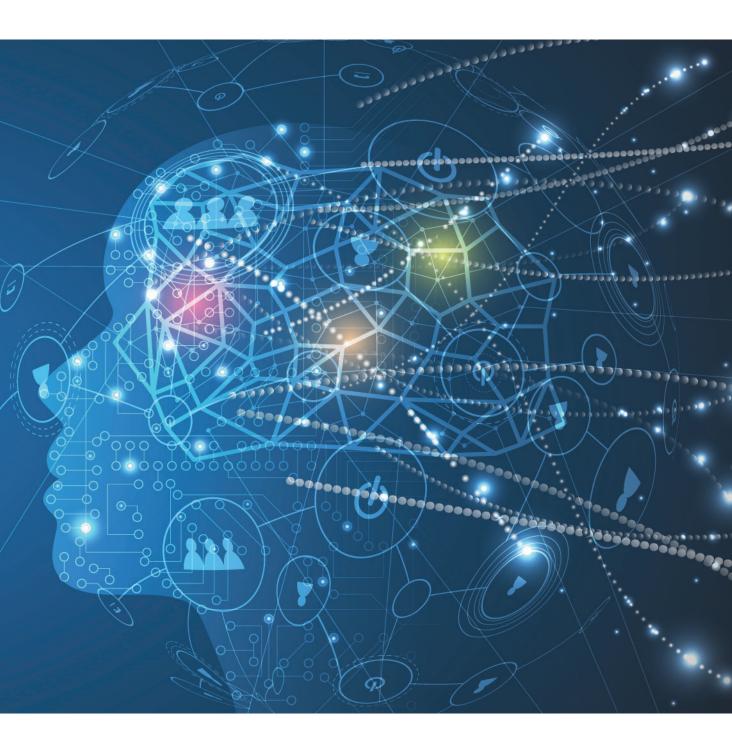
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<u>Since 1938</u>, ACGIH has been respected for its dedication to the occupational and environmental health, industrial hygiene and safety communities. We have grown and expanded without losing sight of our original goal – to encourage the interchange of experience among industrial hygiene workers and to collect and make accessible such information and data as might be of aid to them in the proper fulfillment of their duties.

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Table of Contents - JANUARY/FEBRUARY 2021







COVER STORY

10 Forward Focus: Future of Industrial Hygiene, Part 1
IHW reached out to numerous companies for expert opinions on a range of subjects that affect how the industrial hygiene/safety field will change going forward, as well as issues and challenges ahead. This is the first in a series on the topic.

HEARING PROTECTION

14 Listen Up!

This new column joins our IHW lineup with a note from the National Hearing Conservation Association (NHCA).

16 Protect from Noise-Induced Hearing Loss

A modern, successful noise monitoring program can be carried out on-site, by trained health and safety managers, using either a sound level meter or a dosimeter. Learn about state-of-the art noise level monitoring, including the latest in hand-held monitors and wearables.



COVID-19 SAFETY

18 Safety in the COVID Era

It is the safety industry's responsibility to help essential businesses protect their people and keep them safe—both from the daily challenges of the industrial worksite and from the global pandemic.

ENVIRONMENTAL COMPLIANCE

20 Aerosol Science's Significance for COVID

This article takes a scholarly look at air particle size and the spread of COVID-19, including recent studies of aerosol transmission.

FACILITY MAINTENANCE + CLEANING

22 Clean, Sanitize and Disinfect the Workplace

Best practices for infection control are broken down by surface material; types of cleaners/disinfectants are also examined.

ergonomics, Health + Safety

26 Workplace Safety: Best Foot Forward in 2021

Ways to make employees' day-to-day work lives easier, such as ergonomic, antifatigue solutions, can boost employee health and morale.

RESPIRATORY PROTECTION

28 Checklist for Selecting a Safe & Reliable Respirator

A reliable, four-step litmus test should apply to every respirator any institution proffers to its employees. If it passes the checklist, it can be worn with confidence.

AIR SAMPLING + CALLIBRATION

32 Air Quality

Instrumentation: A HistoryThis article provides a brief

history of the developments of air quality instrumentation in the cleanroom space.

THOUGHT LEADERSHIP

38 Should Employers Require COVID-19 Vaccines?

Do employers have a moral responsibility to insist employees be vaccinated? A look at the legal issues behind the question offers clarity.

BEFORE YOU GO...

8 Note from the Editor

A note from Barbara Nessinger, Editor-in-Chief

40 Products that Protect

44 Ad Index

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Note from the Editor



Welcome to *IHW*'s first issue of 2021! I can't remember ever hearing so many people happy to say good-bye and good riddance to the "old year" as I have for 2020. That signals a dual message: On the one hand, of course, 2020 was an historically bad year due to COVID-19 and the hundreds of thousands of people lost throughout the world, as well as the accompanying economic fallout. On the other hand, the joy with which folks greet 2021 signals a resurgence of hope.

Hope and a renewed sense of possibility abounded in my research for the cover story titled "Forward Focus: The Future of Industrial Hygiene." Originally thought to be a single article, the enthusiastic response to queries from people across the industry convinced us to run this topic as a series. Part one deals mainly with changes anticipated with the new Biden administration—specifically how they will relate to worker safety—as well as the challenges deemed most important in the industry going forward.

In talking to folks in the industrial hygiene and safety industry, I was once again struck by how committed and dedicated this group of professionals is. The people involved in everything from hearing protection to gas detection to facility maintenance to environmental safety all have one thing in common: They strive every day to do their best; to keep workers safe; and to stay informed and on top of the newest technology, research and innovations.

2021 also starts *IHW*'s first of six issues, rather than the four issues we've done in the past. The editorial calendar has expanded to include more topics than ever before.

In addition to our focus on the future, this issue has a full lineup of feature articles, including a checklist for selecting a safe, reliable respirator; monitoring solutions for hearing/noise protection; the latest in aerosol science and how it relates to COVID-19—and much more. We also have a Thought Leadership piece on the legalities of requiring your workforce to be vaccinated.

In addition, we are introducing a new regular column called "Listen Up!" This section highlights news and pertinent information from the National Hearing Conservation Association (NHCA).

IHW's goal, as always, is to provide facts-based articles from around the industry that help serve readers in their everyday jobs and lives. To that end, I hope this issue brings you educational, thought-provoking information.

Stay safe.

Regards,

Barbara Nessinger, Editor-in-Chief

P.S. If you are interested in contributing an article or "Perspectives" piece, contact me at bnessinger@workplacemhs.com.



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P.O. Box 893 Fort Dodge, IA 50501 586-227-9344

www.IndustrialHygienePub.com

PRESIDENT/GROUP PUBLISHER

Randy Green

EDITOR-IN-CHIEF Barbara Nessinger

SENIOR ACCOUNT EXECUTIVE

Jacob Swindell

ACCOUNT EXECUTIVE

Lydia Stewart

ACCOUNTING MANAGER

Tara Scanlan

SYSTEMS ADMINISTRATOR

Angi Hiesterman

OPERATIONS/CUSTOMER SERVICE

Jody Kirchoff

PUBLICATION COORDINATOR

Lacey Scanlan

WEB DESIGN

Josh Scanlan

LIST RENTAL

Angi Hiesterman

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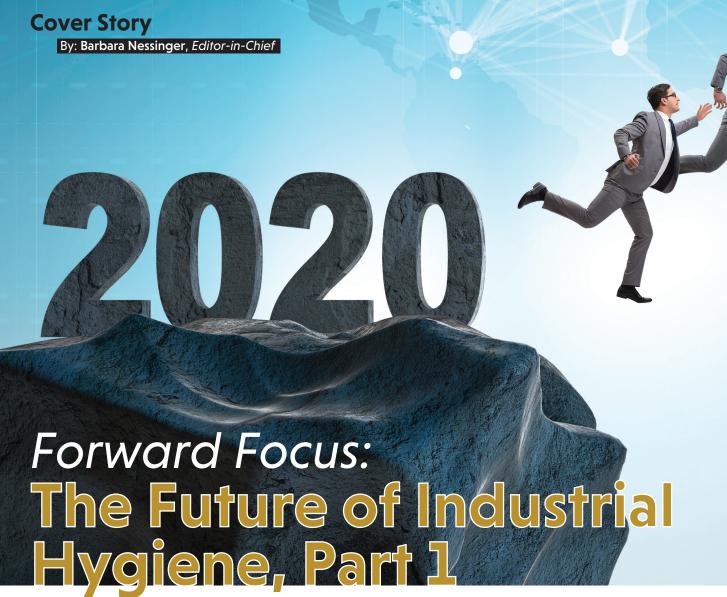
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The evolution of industrial hygiene includes improving the ability to anticipate, recognize, evaluate, control and confirm worker protection—across all of the industries that serve this growing field. *Industrial Hygiene in the Workplace* reached out to numerous companies for expert opinions on a range of subjects that affect how the field will change going forward and, most importantly, the issues and challenges ahead.

The good news is that, despite setbacks this year by the global pandemic and budget cuts over the past four years—there is great enthusiasm in the industry, as a whole. In fact, the responses we received were so passionate and so thorough, it would take a 10,000-word article to sufficiently address all of the ideas and opinions expressed. Not only would I not want to write that article—I highly doubt anyone would want to read such a tome.

Therefore, this is first in a three-part series. This article begins with a look at how the new Biden administration's positions on worker safety will likely change the scenario for most industries. The focus is on looking toward the future, rather than in the rearyiew mirror.

The second topic addressed here will be what challenges are most important to the various industries and companies we've interviewed. Although excluding the changes brought about by the global pandemic is nearly impossible, we examine additional issues that arose in our respondents' engagement with clients, prospective clients, and other health and safety thought leaders and practitioners.

Shift in Power, Shift in Focus

Over the past four years, budget cuts in the U.S. under the Trump administration have affected key departments overseeing Environmental Health and Safety (EHS) standards. Some 20-30% cuts have been seen, as well as cuts to the Department of Labor and the EPA. These cuts influence the EHS industry, including job security and how industry values EHS/IH professionals.

The changes of the Trump administration have had a marked affect, not only on U.S. companies, but also on their global partners, all of whom have been impacted by the reduction in government resources and support. Said one member of the ACGIH staff, "[t]he result of the reduced resource allocation to OHS/EHS is a diminished perception, on the global



stage, of the U.S. as an impactful, committed leader in OHS/EHS. Specifically, professional peers (i.e., scientists, engineers, researchers, etc.) likely question the commitment of the U.S. government to the promotion of health, safety, sustainability and the environment." That said, the ACGIH Board was swift to point out that the organization tries to remain indifferent to changes in administrations. "Though the industry may ebb and flow with implementation of best practice vs. compliance," they stated, "ACGIH works to stay at the front of the field, year in and year out."

Some see the cuts of the past four years as a continuation of how some companies have been consolidating their expertise

Finding new industrial hygienists and H&S professionals will be important for the future. Most see the task of recruiting the next generation of safety professionals as a major challenge. (photo courtesy Adobe Stock)

over the past decade. The Product Marketing Manager at Cority noted that there was already a noticeable shift in how businesses manage EHS staffing. "It appears that organizations are continuing to pivot toward a more generalist approach to health & safety, favoring practitioners who can 'wear many hats,' as opposed to in-house specialists engaged in a particular discipline like industrial hygiene."

By staffing an organization with professionals able to manage multiple aspects of an integrated health & safety program and procuring specialists *if* and only *when* those services are specifically required can make sense. But, continued the Cority representative, "it also means organizations are losing con-

> siderable in-house expertise in several domains and, consequently, need tools to help generalists determine when those specialists need to be brought in to help address specific risks and opportunities."

> The need to create a lean, highly efficient work-force presents a challenge for safety executives. It has led to many organizations turning to a "connected" approach to safety. Opined the folks at Blackline Safety: "Whether it's two-way communications, location monitoring or gas detection, technology that can help worksites 'do more with less' have helped managers empower their workforces to be as productive as possible, all while ensuring the safety of their people and staying within budget."

One important question moving forward is how the new Biden administration in 2021 (and beyond) will affect EHS standards, OSHA, the EPA, etc.—and how it will affect businesses. According to AIHA's representative, one of the first and largest public fights will be over an emergency and then permanent standard from OSHA to protect workers from occupational exposure to COVID-19. President Biden has publicly supported issuing such a standard, and his administration will likely do so shortly after the inauguration.



Most H&S professionals already recognized that safety culture is critical for operational excellence; it is clear that those companies that practiced the most effective H&S efforts did better at weathering the pandemic. (photo courtesy Adobe Stock)

"While this move would be strongly supported by worker advocate organizations who believe that additional protections are needed, business groups have signaled steep opposition, arguing that existing regulations already cover COVID-19, pointing to citations issued by OSHA to employers for coronavirus-related violations as evidence of this," AIHA continued.

Business groups routinely point to the fact that regulations historically take time to be developed, issued, implemented and enforced. Further, said AIHA, "Government guidance is much more useful, because it can be quickly issued and updated as new information about the virus becomes available. Despite the anticipated opposition, the Biden-Harris administration is expected to issue an emergency temporary standard early next year. There will be little, if anything, members of Congress who oppose this action could do to stop it."

The Biden administration's priorities include accelerating the production of PPE (with priority going to frontline workers); expanded COVID-19 testing; and rapidly distributing vaccines. The new administration also supports doubling the number of OSHA investigators to increase workplace inspections and is expected to support additional funding for OSHA, NIOSH, and related occupational and environmental health and safety agencies and programs.

Safety Culture at the Forefront

COVID-19 placed enormous attention on how organizations are managing health risks. Some of the most pressing concerns mentioned across the board include the concept of "total worker health"—i.e., issues concerning aging populations, mental health, organizational risk factors and other socio-

economic impacts to workers' overall health & wellness.

The pandemic has also reinforced the overwhelming importance of safety culture. Most health & safety professionals already recognized that safety culture is critical for operational excellence, year in and year out. And it is clear that those companies that practiced the most effective H&S efforts did better at weathering the pandemic. This can't be overemphasized. In fact, Cority stated, "COVID-19 has been a great litmus test that's proven the importance of engagement and culture on H&S results; we anticipate the focus on building a stronger safety culture will only continue to grow in the years ahead."

Beyond the Pandemic

Although excluding the affects of COVID-19 on the industry at large is difficult, we asked about other chal-

lenges they see as being most important.

The ACGIH staff mentioned a few challenges, with the most important being a transient workforce; the increase in telework; fewer organized labor unions; language barriers; and "the ongoing introduction of new chemicals, products, processes and equipment that tend to put production and environmental performance ahead of impact on worker health."

New technology and the ability of the workforce to interact with it was another much-stated issue that companies will face. Stated Blackline Safety, "Moving forward, one of the largest challenges our industry faces is overcoming that technology trust gap by helping organizations see the holistic value in embracing a digital transformation, especially as it relates to workplace safety."

This often occurs, they averred, when "safety and operations professionals are often hesitant to embrace new technology, especially when it comes to the productivity of their worksites and the well-being of their people, since many of these digital tools have not been implemented in the field for a significant period yet."

Current challenges across workplace sectors include fatigue management and fitness for duty. These two areas impact all areas of occupational health and safety and certainly total worker health. The ACGIH members noted that this includes "the impact of aging, recreational cannabis use, mental health and personal well-being. Equally challenging is the rapidly evolving impact of climate change and economic hardship. All of these areas have been exacerbated by the current global pandemic in almost every jurisdiction in the world."

Changing Workforce

Another issue mentioned by many of those we interviewed was finding new industrial hygienists and H&S professionals. Most see the task of recruiting the next generation of safety professionals as a major challenge. "Reaching and educating new IHs will be a key challenge, as many 18-30-year-olds do not follow traditional media—no newspapers, magazines or

traditional TV channels. Pay walls for websites and subscription services for visual media have created a fractured market where people are only exposed to what they want to see (and pay for)," averred the President of Air Systems International, Inc.

Members of ACGIH concurred with this sentiment, seeing the aging workforce as an important hurdle, as well as the retirement of many IH professionals. "The impact of the outsourcing of the work, as well as the use of external consultants, will dramatically impact the potential for illnesses and injuries for workers," they stated.

[Editor's note: Don't miss the March-April issue of IHW, where part two of this article series delves into the diversity of the modern workforce—and more.] **IHW**

ABOUT THE CONTRIBUTORS

We'd like to thank the following people for their assistance and participation in this article's content. The time these individuals took to give complete, thoughtful answers is greatly appreciated.

- ACGIH: members of both the ACGIH staff and the ACGIH Board participated
- Mark Ames, Director of Government Relations, AIHA
- Dave Angelico, President, Air Systems International, Inc.
- Sean Baldry, CRSP, Product Marketing Manager at Cority
- Sean Stinson, Chief Revenue Officer, Blackline Safety



Listen Up! A note from NHCA Tenting of the control of the control

The National Hearing Conservation Association (NHCA) was formed in 1976. The founders of NHCA were mainly audiologists and otolaryngologists who were concerned with the serious problem of noise-induced hearing impairment resulting from occupational exposure to noise. The Association was created to provide a forum where professionals with similar interests could share information and gain increased insights regarding occupational hearing conservation.

Our membership includes, but is not limited to, audiologists, engineers, industrial hygienists, safety professionals, physicians, nurses, educators, etc. In short, NHCA is a group of passionate hearing conservationists willing to share their expertise in the quest for the prevention of hearing loss.

SAVE THE DATE: NHCA CONFERENCE

More information about our organization can be found on our website at www.hearingconservation.org. Please consider joining us for our annual conference (http://www.nhca.civicaconferences.com) to learn more about us and the inspiring work in the area of hearing loss prevention. While the virtual conference will look and feel different than traditional in-person conferences, the NHCA is committed to bringing you the best virtual conference experience possible. You can expect high-quality scientific content; novel ways to interact with vendors; maximized CEU opportunities; plus



presenters and fellow NHCAers. Register today and save the date (Feb 26-27, 2021).

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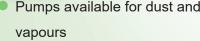
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Hearing Protection/Noise Conservation

By: Steve Ochs, Contributor

Protect Your Workforce Against Noise-Induced Hearing Loss

An estimated 22 million workers are exposed to potentially damaging noise at work each year. For employers, worker exposure to noise could result in catastrophic penalties and compensation for hearing loss disability.

The Occupational Safety and Health Administration (OSHA) claims that "an estimated \$242 million is spent annually on workers' compensation for hearing loss disability," with noise-induced hearing loss (NIHL) affecting nearly one in four adults in the U.S.²

Monitoring solutions, like hand-held sound level meters and noise dosimeters, are an ideal way to comply with government standards and protect to your workforce. (photo courtesy Casella)

Employer Responsibility

NIHL is preventable, but the effect is permanent, resulting in life-changing injuries that can seriously impair a worker's quality of life. Thousands of construction workers suffer hearing loss from excessive noise exposure on the job every year. According to a study spanning a decade of research, construction accounted for the second-highest prevalence of workers

with a hearing impairment, with at least one in five self-reporting hearing trouble.³

Despite having a duty of care to protect employees from work-place hazards that can cause injury or illness, employers have no obligation to test workers' hearing (audiometric testing) in construction, even if noise exposure levels exceed OSHA's Permissible Exposure Limit (PEL).⁴ For this reason, hearing loss is rarely recognized as an "occupational disease" in construction. The Bureau of Labor Statistics (BLS) reports that

hearing loss is underreported due to this fact and, for this reason, hearing loss data for the construction sector is not comparable with data for general industry.⁵

However, the repercussions to the employer, if they do not seriously consider the auditory welfare of their workforce, can be significant, leading to huge pay outs in compensation benefits to employees.

Why Monitor for Noise Exposure

OSHA sets the legal limits on noise exposure in the workplace based on a worker's time-weighted average over an 8-hour day. OSHA's maximum permissible exposure limit to noise is 90dBA (decibels) for all workers for an 8-hour day, minimizing the risk of occupational noise-induced hearing loss. Conversely, the National Institute for Occupational Safety and Health (NIOSH) recommends that all worker exposure to noise should be controlled below or equivalent to the level 85dBA Recommended Exposure Limit (REL) for 8 hours. Although NIOSH recommendations are designed to represent best scientific prac-

tice concerning noise exposure, the OSHA exposure limit is regulatory and the law with which companies must comply.

In 1981, OSHA introduced a new regulation requiring employers to implement a hearing conservation program for workers that are exposed to an average noise level of 85dBA or higher for an 8-hour shift. Hearing Conservation Programs

- 1 https://www.osha.gov/SLTC/noisehearingconservation/
- 2 https://www.aiha.org/publications-and-resources/TheSynergist/Industry%20News/Pages/Report-Suggests-Nearly-One-in-Four-Americans-Has-Noise-Induced-Hearing-Loss.aspx
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Noise dosimeters are small, body-mounted devices that collect individual exposure data, typically worn during an employee's entire shift. (photo courtesy Casella)

require employers to measure noise levels; provide free annual hearing exams and hearing protection; provide training; and conduct evaluations of the adequacy of the hearing protectors in use-unless the employer makes sufficient changes to tools, equipment and schedules so that conditions are less noisy and worker exposure is less than the 85dBA.

To ensure you adhere to OSHA regulations, monitoring provides accurate insights

into the noise levels of a working environment, identifying where the problem areas are. There are many monitoring devices on the market, but it can be difficult to identify what type of product is most suitable for your working environment and where training is required. A successful noise-monitoring program can be carried out on-site, by trained health and safety managers, using either a sound level meter or a dosimeter.

How to: Sound Level Meters

A sound level meter is a hand-held device, enabling measurements to be taken at the ear with the instrument pointing at the noise source. This process must be repeated for both ears, for all duties employees perform, making it possible to calculate an accurate record of daily exposure. Settings on these meters can be adjusted according to the type of noise being assessed.

When using a sound level meter, measurements must be started at the beginning of a task, representing workers' actual exposure. If workers are likely to be exposed to high levels of impulsive noise, emitted from heavy pressing operations or sheet metal working, peak noises must be measured for accurate results and compared to peak action levels.

If individual working patterns are irregular; if the worker is highly mobile; or if the work carried out means it is not practical or safe to conduct noise monitoring with a sound level meter, noise dosimeters can be used. These are small, body-mounted devices that collect individual exposure data.

Dosimeters are worn by employees for their entire working shift. Data is logged instantly and, when downloaded onto another device, details the time history of the noise exposure, highlighting where high exposures occur throughout the day. Workers can also make a diary of times and jobs performed, allowing the employer to see the operations that require more effective noise controls.

Protecting the Future Workforce Through Noise Monitoring

The statistic regarding workers in the U.S. exposed to potentially damaging noise at work each year is concerning. What is equally concerning is some employers' disregard of NIHL as an occupational disease—particularly in construction—where it poses a major risk. Employers have a crucial responsibility to protect workers' health from being damaged and to upskill their workforce, so they realize the implications of damaging noise exposure. Monitoring solutions, like hand-held sound level meters and noise dosimeters, are an ideal solution for you and your organization to achieve compliance with government standards and protect to your workforce effectively and demonstrably.

About the Author:

Steve Ochs is Casella's (U.S.) Area Business Manager supporting Casella's Health Safety and Environmental boundary monitoring solutions. He assists in the reduction of workplace and environmental health exposures through the supply of effective monitoring solutions for noise and dust. Casella is dedicated to reducing occupational health and environmental risks, and supporting businesses in solving their monitoring and analysis needs. For more information about Casella's noise monitoring solutions visit, www.casellasolutions.com. To find out more about Casella, please visit www.casellasolutions.com/us/en, featuring live chat, or follow @Casella_USA on Twitter, Linkedin Casella USA or Facebook Casella USA.



To ensure adherence to OSHA regulations, monitoring provides accurate insights into the noise levels of a working environment, identifying where the problem areas are. (photo courtesy Casella)



Responding to COVID-19

The COVID-19 pandemic brought about several, onceunthinkable challenges to the safety industry. Along with protecting workers from the daily risks of an industrial worksite, organizations were suddenly faced with continuing operations—while also keeping their people healthy and safe from a rapidly spreading disease.

At the onset of the pandemic, most of these challenges were limited to businesses deemed "essential," which included Blackline Safety, as well as other organizations in sectors such as healthcare, financial, manufacturing, energy, utilities, telecom, retail and logistics. The world looked to these essential industries to ensure the continued flow of vital goods and services, also helping to keep the economy afloat as it battled the pandemic.

These industries were operating with a reduced workforce where teams often split shifts and shared daily workflows, resulting in more people working alone than ever before. These people are defined as lone workers, or personnel working in isolation, beyond the sight and sound of others, where no one is available to lend a hand.

Whether it is for short periods of time, continuously or intermittently, any second a lone worker is not monitored presents

from the global pandemic. **Lone Worker Monitoring Tools** While COVID-19 forced businesses to respond and adapt quickly, some were fortunate to not have to start from square

distancing.

one. The connected safety landscape has transformed in recent years, and solutions to monitor lone workers have become widely available for many businesses.

a major safety risk. That's why lone worker safety has been an

increasingly critical topic in recent years; the COVID-19 pan-

As time went on and more businesses began to resume opera-

tions in a limited capacity with reduced staff, the stress on the safety industry only increased. Some organizations that had

been operating for months began welcoming more employees back to work. Others were just restarting operations. No

matter which category businesses fell into, they faced serious

obstacles—such as continuing to protect lone workers or en-

suring a higher number of on-site staff maintained physical

It has been the safety industry's responsibility to help these essential businesses protect their people and keep them safe—

both from the daily challenges of the industrial worksite and

demic has only pushed it to further into the forefront.

For example, connected safety wearables and cloudhosted software with 24/7 staffed Safety Operations Centers are tools created by the safety industry that helped protect the increased number of lone workers. This technology offers a broad range of capabilities, including monitoring, location technology, gas detection and two-way communications, which helped organizations seamlessly combat the early challenges of the pandemic.

In addition to the capabilities of lone worker technology, several companies that employed isolated personnel created or expanded a live monitoring team to help further optimize the impact of these tools. These teams tracked employees' location and activity, as well as established and closely followed documented response protocols, empowering them with full situational awareness and a plan for every scenario that might occur.



The connected safety landscape has transformed in recent years; solutions to monitor lone workers have become widely available for many businesses. (photo courtesy Adobe Stock images)

For lone workers and monitoring teams, the most effective organizations also implemented a strong system of communication that operated without interruption. The same connected safety products that businesses leverage to monitor lone workers also often come equipped with functionality similar to a walkie-talkie, allowing field and office staff to communicate directly in real-time. These tools helped expand and enhance communication systems that were challenged with an increased number of lone workers.

No matter the severity of a potential incident, the response must be quick and seamless. The combination of technology and an equipped monitoring team ensured every lone worker could go to work during an uncertain time, knowing they had somebody looking over them and keeping them safe.



As many regions began re-opening, the importance of physical distancing increased, and organizations needed strategies for monitoring workers who are not alone. Location-enabled, wearable safety technology, such as this Blackline G7 device with a "close contact" notification, enables businesses to manage exposure risks as part of their COVID-19 return-to-work programs. (photo courtesy Blackline Safety)

The Challenges of Returning to Work

As many regions began re-opening to some degree and the importance of physical distancing increased, organizations also needed a strategy for monitoring workers who are not alone. This was because individuals who returned to the field or office and did not properly distance present a severe risk to any given workforce and their loved ones.

While masks and other PPE played an important role in avoiding an outbreak, the safety industry was quick to create tools that helped encourage and remind workers to social distance while performing work. Through the location-monitoring feature of safety wearables, many organizations benefitted from technology that offered a close contact-detection feature, which provides users with a real-time notification when they enter into proximity of others wearing the same technology.

Additionally, through communications, location technology, cloud-hosted software and data science, businesses were also

able to leverage the same digital tools to support contact tracing investigations on an industrial worksite. While Google and Apple collaborated on contact tracing apps for smartphones, most industrial entities required employees to leave their phones in their locker due to safety concerns. This left a gap that lone worker monitoring solutions were able to readily fill, helping support business continuity while maximizing employee safety.

Specifically, location-enabled wearable safety technology helped industrial businesses to better manage exposure risks as part of their COVID-19 return-to-work programs. Organizations that already deployed connected safety solutions were able to quickly achieve an integrated digital contact tracing system without needing to install additional infrastructure.

Through data science and visualizations from their current connected solutions, businesses had immediate and improved visibility into the frequency of close contact events between workers and where on the worksite these interactions were occurring. Safety professionals could identify potential superspreaders or high-contact areas in which close contact was most frequently occurring. They could also quickly retrace a worker's steps, in the event of a positive test, and identify exactly which workers with whom they had close contact during the past weeks.

All of this data has helped enable companies to rapidly mitigate the spread of COVID-19 throughout their workforces, while simultaneously maintaining or improving the productivity of their worksites. For example, on a construction job site, organizations have been able to glean insights, such as how long it takes for workers to wait at a tool crib, while ensuring those people properly distance and the area is not at risk of high contact occurrences.

Innovation in the Safety Industry

While COVID-19 continues to impact our communities and industrial worksites, the various capabilities that technology has delivered have enabled organizations to effectively navigate the safety and economical challenges of the pandemic. This digital and "connected" approach has also helped prepare the safety industry for future challenges, enabling businesses to quickly adapt to new or unknown concerns that may emerge down the road.

The past year has demonstrated the innovation, passion and responsiveness of our industry—a tremendous accomplishment that makes the team at Blackline Safety proud to have played a small role in making it a reality. Together, we have the tools and expertise to protect industrial workers around the world, giving them the confidence they need to get the job done and return home safe.

[Sean Stinson is Chief Revenue Officer at Blackline Safety.]

Environmental Compliance

By: Thomas Grillo, Contributor

Aerosol Science Significance for COVID

This past October, The American Association for Aerosol Research conducted a virtual press conference to share insights on the airborne spread of the novel coronavirus. The conference was presented by a professional panel of aerosol researchers who shared convincing evidence that supports the fact that aerosols, not droplets, may be the leading cause of the pandemic.

Both the Center for Disease Control (CDC) and the World Health Organization (WHO) have held that large ballistic droplets and surface contact with the virus are the key modes of transmission.

he leading cause of ent were singing, with no masks being worn.

It is important to understand that the size of the virus organism is typically between 0.06-0.13µm (microns) in diameter. Particles smaller than 5.0µm are easily suspended and remain airborne for many hours—even days—depending on their size and the conditions of the enclosed environment. These con-

The super-spreading event evidenced low exposure to droplets

(close proximity conversations) or fomites (touching common

surfaces). The extremely high infection rate can be explained

by the aerosol suspension of the virus, due to a low ventilation

rate in the room that was well mixed in a space where all pres-

ditions can include convection, movement and activity from occupants, air handling systems, fans, etc.



There is convincing evidence that supports the fact that aerosols, not droplets, may be the leading cause of the pandemic. (photo courtesy Adobe Stock)

Both organizations have been hesitant to accept aerosol transmission, partly due to their historical bias, even contrary to the evidence being presented. It is important to note that the CDC now has toned down their previous stance against aerosol transmission.

Jose Jimenez, Ph.D., of University of Colorado at Boulder, provided multiple examples to support the premise that COVID-19 is primarily spread through aerosols expelled from infected persons.

The example of the super-spreading event at the Skagit Choir in Washington, U.S., demonstrated that during the 2.5-hour rehearsal, a single infected person caused 52 new infections, some of them more than 13 meters behind the spreader.

Documented Study Confirms

During a study conducted in 2017 at the Healthy Building Summit, in Seven Springs, Pa., Particles Plus instruments were able to document the particle suspension times for 1.0µm particles which were ~ 8 to 10 hours, based on a sealed and activity-free control room. The room, when disturbed, created measurable and repeatable values that were monitored over multiple days and continued to demonstrate this approximate suspension time.

Smaller particles less than 1.0μm, down to 0.1μm, can stay airborne for days due to multiple condi-

tions in the enclosed indoor environment, including Brownian Motion, with smaller air molecules impacting and creating chain-reaction movement of the larger airborne aerosols.

Practice the Three Cs

Linsey Marr, Ph.D., of Virginia Tech University-Blacksburg, stressed the importance of Japan's "Three Cs" for infection control: avoid *closed* spaces; avoid *crowded* places; and avoid *close-contact* settings. Ventilation, social distancing and PPE are all key in helping to reduce the risk of transmission, but not completely eliminating it.

Professor Kelly Miller discussed the ventilation rates and air changes per hour, sharing results of a study that demonstrated that, in indoor spaces with very few air changes per hour,



Smaller particles less than 1.0µm, down to 0.1µm, can stay airborne for days due to multiple conditions in the enclosed indoor environment, with smaller air molecules impacting and creating chain-reaction movement of the larger airborne aerosols. (photo courtesy Particles Plus, Inc.)

high transmission rates have been documented. However, spaces that have high air-change rates had much lower transmission cases.

Professor Miller also discussed a case of an outbreak of tuberculosis at a university, where transmission flourished with air changes of 1.7 liters per second per person. Following a retrofit of the building's ventilation system, it then increased the air changes to 24L/sec/person. In doing so, the university effectively stopped the outbreak in its tracks.

Air Purifying Systems

Air purification/air cleaners are other effective methods to clean the smaller particles from the air in an indoor environment. This is highly recommended, with many commercial facilities upgrading their filtration systems and improving the performance of cleaning out sub-micron particulates. Properly sizing an air purifier is important. You must know the cleanair delivery rate of the device, so you can determine how large of a room can be effectively used to properly clean that room.

Particle counters are being used by more contractors, facility engineers and property managers to understand their buildings' indoor particle count levels, especially the respirable particles below 2.5 μ m, and then testing again following retrofits and improvements to their filtration and air purification systems or air handlers with filtration. Many filtration system resellers and installing companies have also been utilizing particle counters to demonstrate the effectiveness of their products, creating even more awareness of the amount of aerosols that remain airborne in indoor spaces that are not well-ventilated or -filtered.

It is important that our scientific and medical communities work together to better understand COVID-19, and to help

develop and educate the public on sound, common-sense practices to help reduce the spread of this horrible virus.

Particles Plus is proud to support the many institutions, think-tanks, laboratories and government agencies who are involved in aerosol-dispersion testing and research. It is our goal to provide the tools needed to accurately and repeatedly quantify the submicron aerosol exposure in public and indoor settings. What is key is that, as a society, we all employ common sense; accept that this is real and not something political; and be concerned for our well-being and the well-being of others through our actions and the use of faces masks—and honoring the Three Cs.

Thomas Grillo is Sales Manager at Particles Plus, Inc.

[Editor's note: This article first appeared on Particles Plus's "News & Education" blog: https://particlesplus.com/aerosol-science-significance-for-covid/]

For more information about the American Association of Aerosol Research, visit them at aaar.org.

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By: Bernard L. Fontaine, Jr., CIH, CSP, FAIHA, Contributor

Best Practices to Clean, Sanitize & Disinfect the Workplace

With the current COVID-19 pandemic, there has been an even greater urgency to keep industrial workspaces, schools, public spaces and commercial facilities clean. While a clean workspace can help reduce the risk of contracting the SARS CoV-2 virus, people need to understand that wiping a surface clean and/or spraying a chemical after wiping the surface is not always going to do the trick. It is a bit more scientific than traditional custodial or janitorial services—but far less complicated than infection control in a hospital.

Best practices for infection control can be used in medical clinics, office buildings, banks, restaurants, government facilities, schools, libraries, museums, bowling alleys, theaters, cruise ships, prisons, municipalities, essential/nonessential businesses, and other facilities or locations where workers or public come into contact with contaminated, touched surfaces. The same techniques should be used to clean, sanitize and disinfect high-density work occupancies, such as fisheries, canneries, meat packers, agricultural fields and migrant living quarters; assisted living facilities; emergency medical services; conference rooms; and public transportation (buses, trains, ferry boats, etc.).

Cleaning Dos & Don'ts

Cleaning is a process to remove germs, dirt and impurities from building surfaces or touched objects. Cleaning works by scrubbing, washing and rinsing using soap (or detergent) and warm water to physically remove debris, along with any residual fats and oils (grease). This process does not necessarily kill germs; rather, it removes most of the gross surface contamination that prevents sanitizers and disinfectants from doing their jobs.

Most people use products like paper towels, commercial towelettes or reusable cloths to wipe the surface. Studies show that using a microfiber cloth, rather than other cleaning products, provides better cleaning efficiency. This is because dirt, grease and grime are able to cling better to the microfiber cloth.

Using a black light and uncooked chicken, demonstrations show that residual bacteria was left behind on the countertop after using a commercial towelette and paper towel, but the surface was clean with the microfiber cloth.

These products failed to pick up the surface residue left behind during the cleaning process. The black light clearly showed how the smeared surface was left unknowingly contaminated, whereas the surface with the microfiber cloth was visibly clean.

Microfiber cloths, like any other cleaning product, must be laundered periodically for cleaning efficiency. The cloth must be folded into quarters; one should wipe in a structured pattern (up and down, then horizontal); and the cloth surface should be rotated periodically to remove any surface grease, grime or grit .Wiping in a circular pattern is not effective.

Proper procedure for wiping high contact surface with microfiber cloth. (photo source AIHA)



Comparison between microfiber cloths and commercially available towelettes (photo source AIHA)

Sanitize and Disinfect

Sanitizing helps lowers the number of germs (bacteria) on surfaces or objects to a safer level, as determined by public health standards and requirements. Sanitizers should be used only after effectively cleaning a high-touched surface. These chemicals and commercial products do not kill all organisms. Disinfectants are the only commercial and industrial products

that are registered to kill or inactivate viruses by the U.S. Environmental Protection Agency (USEPA).¹

Countertops and other high-touch points also should be sanitized twice a day. A multi-purpose cleaner can help kill germs in work areas. Sanitizer can be used in common areas where it's difficult to always keep surfaces and technology clean. The CDC recommends using an alcoholbased sanitizer with at least 60% percent alcohol. Make sure facilities are stocked with plenty of hand soap in the breakroom and bathrooms. Different areas, including office furniture and various surfaces, require different types of cleaning products.



A worker sprays disinfectant inside a Delta airplane at the Ronald Reagan Washington National Airport in Arlington, Va., between flights to kill any coronavirus left on surfaces. (photo courtesy Nathan Ellgren/Associated Press)

Disinfecting kills or inactivates germs (both bacteria and viruses) on touched surfaces or objects. Disinfecting works by using chemicals to kill germs on surfaces or objects. This process does not necessarily clean dirty surfaces or remove germs, but by killing germs on a surface after cleaning, it can further lower the risk of spreading infection. If disinfectants on this list are in short supply, alternative disinfectants can be used (for example, 1/3 cup of 5.25-8.25% bleach added to 1 gallon of water; or 70% alcohol solutions). Bleach solutions will be effective for disinfection up to 24 hours.²

Besides ethyl and methyl alcohol, other disinfectants include chlorine and chlorine-based compounds, formaldehyde and glutaraldehyde, hydrogen peroxide, iodophors, ortho-phthalaldehyde, peracetic acid (with and without hydrogen peroxide), phenolics and quaternary ammonia.³

Fogging, Vaporizing and Other Risky Methods

Beside wiping surfaces, contractors are using other application methods, like fogging, airless and electrostatic spraying, vaporizing and ionization, to cover large areas in commercial buildings, public transportation, bars and restaurants, and other public spaces. While the USEPA and chemical manufacturers restrict the use and application of certain pesticides, there are contractors that do it anyway. Most of these contractors fail to realize the potential occupational hazard to the applicators and the workforce and/or public that may reoccupy the space.

A small percentage of workers and people who are asthmatics, migraine sufferers, have allergies, or those with immune disorders or suppressed immune systems may experience symptoms such as memory loss, trouble concentrating, mood swings, irritability, headaches, seizures, nausea and vomiting without proper building ventilation, airflow and distribution of air throughout the build environment. Many of the chemicals used evaporate quickly. The evaporation also may impede the necessary dwell time the chemical needs to contact the surface to sanitize or disinfect. Chemicals used to sanitize and disinfect need the appropriate dwell time to work. Otherwise, the surface may remain contaminated with the SARS CoV-2 virus.

Here are few more tips regarding use of cleaning products.

- Store and use disinfectants in a responsible and appropriate manner according to the label.
- Do not mix bleach or other cleaning and disinfection products together—this can cause fumes that may be very dangerous to breathe in.
- Keep all disinfectants out of the reach of children.
- Do not overuse or stockpile disinfectants or other supplies.
 This can result in shortages of appropriate products for others to use in critical situations.
- Always wear gloves appropriate for the chemicals being used when you are cleaning and disinfecting.
- Additional PPE may be needed, based on setting and product. For more information, see CDC's website on "Cleaning and Disinfection for Community Facilities." ⁴

¹ Pesticide Registration List N - Disinfectants for Coronavirus (COVID-19): https://www.epa.gov/pesticide-registration/list-n-disinfectants-coronavirus-covid-19

² Important Reminders about Coronaviruses and Reducing the Risk of Exposure: https://www.cdc.gov/coronavirus/2019-ncov/community/reopen-guidance.html

³ Chemical Disinfectants: Guideline for Disinfection and Sterilization in Healthcare Facilities: https://www.cdc.gov/infectioncontrol/guidelines/disinfection/disinfection-methods/chemical.html

⁴ Cleaning and Disinfecting Your Facility - Everyday Steps, Steps When Someone is Sick, and Considerations for Employers: https://www.cdc.gov/coronavirus/2019-ncov/community/disinfecting-building-facility.html

Facility Maintenance & Cleaning

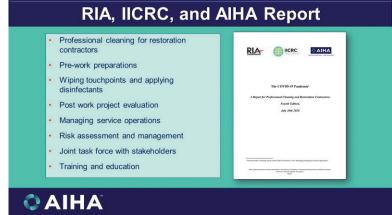
Surface Matters

For soft surfaces, such as carpeted floor, rugs and drapes, clean the surface using soap and water or with cleaners appropriate for use on these surfaces. Launder items (if possible) according to the manufacturer's instructions. Use the warmest appropriate water setting and dry items completely. Vacuum as usual.

For electronics, such as tablets, touch screens, keyboards, remote controls and ATM machines, consider putting a wipeable cover on electronics. Follow manufacturer's instruction for cleaning and disinfecting. If there is no guidance, use alcohol-based wipes or sprays containing at least 70% alcohol. Dry surface thoroughly. Alternatively disinfect with a household disinfectant on "List N: Disinfectants for use against SARs-CoV-2".

For clothing, towels, linens and other items, launder items according to the manufacturers' instructions. Use the warmest appropriate water setting and dry items completely. Wear disposable gloves when handling dirty laundry from a person who is sick. Dirty laundry from a person who is sick can be washed with other people's items. Do not shake dirty laundry. Clean and disinfect clothes hampers according to guidance above for surfaces. Finally, remove gloves and wash hands right away with soap and water.

The American Industrial Hygiene Association (AIHA) has published a number of free Back to Work Safely (BTWS) guidance documents to help employers, workers and the public better understand some of the issues related to returning back to work. In addition, AIHA has published other free guidance



Joint collaboration of AIHA, RIA and IICRC to clean, sanitize and disinfect by contractors (photo courtesy AIHA)

and provided resources on "Effective and Safe Practices, Guidance for Custodians, Cleaning and Maintenance Staff," "Employers Guide to COVID Cleaning and Disinfection in Non-Healthcare Workplaces" and "Workplace Cleaning for COVID-19." The Restoration Industry Association (RIA), in collaboration with both the Institute of Inspection, Cleaning and Restoration Certification (IICRC) and AIHA, published another guidance document titled "A Report for Professional Cleaning and Restoration Contractors".

In conclusion, cleaning, sanitizing and disinfection is a defined process that must be clearly understood by employee education and training, and practiced by janitorial and custodial staffs. The selection and use of chemicals and their application must be done in accordance with guidelines to prevent occupational exposure to hazardous vapors in air or direct contact causing skin or eye irritation. The selection and use of respirators and/or PPE and clothing should be appropriate for the work task and the anticipated hazard or risk.

Finally, workers should be properly trained to read and understand any written information presented on product labels and Safety Data Sheets (SDSs). SDSs should be readily available for workers to read and copy. Each of these suggestions are clear mandates by federal and state OSHA regulatory compliance requirements. Any questions regarding the proper procedures for cleaning, sanitizing and disinfection should be addressed by the employer. Workers who are affected or become ill by using chemicals for cleaning, sanitizing or disinfection should report the incident to their supervisor.

Bernard L. Fontaine, Jr., CIH, CSP, FAIHA, is with The Windsor Consulting Group, Inc.

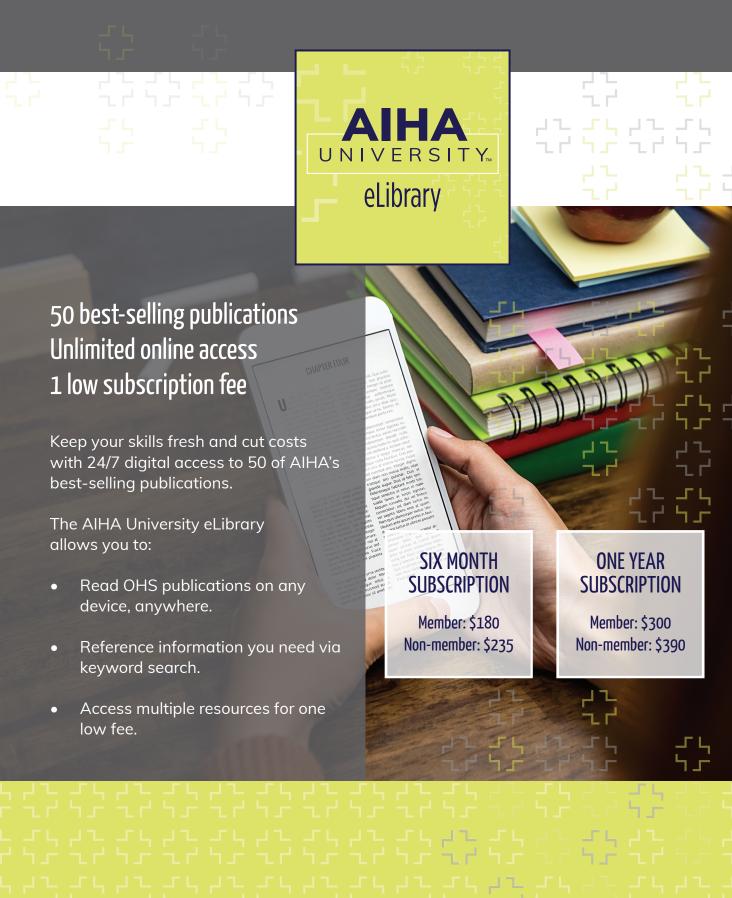


Reference material available from the American Industrial Hygiene Association (photo courtesy AIHA)

⁵ COVID-19 guidance documents from the American Industrial Hygiene Association (AIHA): Ref: https://www.aiha.org/public-resources/consumer-resources/coronavirus_outbreak_resources/aiha-covid-19-pandemic-efforts/free-covid-19-public-resources

⁶ AIHA Back to Work Safely (BTWS) guidance: https://www.backtoworksafely.org/

⁷ A Report for Professional Cleaning and Restoration Contractors, 5th edition, Oct 26, 2020, Ref: https://www.restorationindustry.org/sites/default/files/docs/covid-19-professional-cleaning-and-restoration-industry-fifth-edition-1026-2020.pdf



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By: Dr. Kevan Orvitz, Contributor

Workplace Safety:

Best Foot Forward in 2021

Our workforce is living in strange but critical times. For many in North America, coming out of the 2020-2021 holiday season was quite different than other years. The urgency of holiday hours, coupled with time spent away from family and friends, has been an adjustment—especially as we head into all the uncertainty brought on by the year ahead.

The food processing industry, for example, has been a critical player throughout the pandemic, supplying products and services to essential businesses and a key partner in keeping many businesses afloat—local and global alike. Despite its essential nature, the industry has unfortunately appeared in many headlines over the course of 2020, due to COVID-19 outbreaks at warehouses and food processing plants. Workers spending long hours in enclosed indoor spaces in close proximity to others has heightened the risk of exposure and infection.

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Repetitive work exposes employees to a high risk of musculoskeletal diseases. Anti-fatigue insoles are one way of combating foot and bodily discomfort.

With the rollout of the COVID-19 vaccine, many healthcare professionals are cautiously optimistic that this year looks like the beginning of the end of the pandemic. But, now more than ever, it is imperative that we do not drop the ball on the well-being of our essential workers.

For employees that work long hours in high-risk environments, COVID-19 precautions and ergonomic safety actions are intrinsically connected. As the expression goes, one has nothing if they don't have their health; this is especially true this year, where essential workers are trying hard to do their jobs effectively—without bringing the virus home. As frontline workers continue to await the vaccine rollout, here are some vital health and safety recommendations for helping essential industry workers get through this critical year ahead.

Lead by Example: Clear & Concise

Such times can be draining, and a combined emphasis on mental and physical health is crucial for keeping workers safe and healthy on the floor, as well as keeping spirits up. When colleagues are not fatigued at work and feel good about themselves, their work performance undoubtably improves. Studies

> have shown an undeniable link between workers' day-to-day health and overall company success.

> Here is what employees in leadership can do: Set an industry example. Work hard to be the employer that encourages a proper break when employees are not on the floor. With a repetitive industry, such as food processing, employees can be at high risk of musculoskeletal diseases, which can irreversibly destroy the body over long periods of time. To mitigate burnout, remind employees to take their allotted break time; go for a walk; as well as hydrate, stretch and allow their bodies to move differently than they have over their shifts. Activities such as yoga can easily be done outside during downtime. This offers a chance to correct muscles that have been overworking in the same position on the floor for too long.

Provide & Promote Proper PPE

Using adequate PPE is also more crucial than ever, with an emphasis on how to wear and continue to use them properly

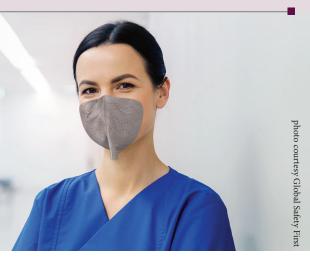
while working. Whether using gloves, face shields for extra protection or mask string adjusters to keep masks properly on the face, reminding colleagues and staff to wear PPE on the floor not only mitigates risk of the virus, but acts as a visual to help employees feel safer around one another. *Continued on page 46*



Respiratory Protection

By: John Schwind, Contributor

A Checklist for Selecting a Safe & Reliable Respirator



Throughout most of the pandemic, our most prestigious medical and governmental institutions have advocated social distancing—six feet, at least—and wearing a respirator as the two most reliable practices to protect from the coronavirus. The former is an issue of behavior. Being alert about our physical surroundings allows some degree of control, and six feet is a measuring standard that doesn't change.

The latter practice is product-centric. Wear a respirator, especially in the workplace. It might seem axiomatic nearly a year into the pandemic, but a recurring question persists: How can I have confidence that my respirator provides the highest degree of safety?



A professionally designed, comfortably fitting respirator that seals tightly and meets government N95 specifications is considered a first line of defense against the coronavirus or any respiratory infection. (photo courtesy Global Safety First)

When followed, this checklist ensures the respirator you choose meets the accepted scientific guidelines for protection from particulate hazards, including dust, bacteria, viruses, mold, industrial particles and smoke particles. It is imperative to follow safety protocols from reliable sources, such as the Centers for Disease Control and Prevention (CDC) or the National Institute for Occupational Health and Safety (NIOSH).

A reliable, four-step litmus test should apply to every respirator any institution proffers to its employees. If it passes the checklist, you can wear the respirator with confidence.

The steps are as follows:

STEP 1: What's your number?

N95 respirators and surgical masks are examples of PPE used to protect the wearer from airborne particles and liquid

contaminating the face. The CDC, NIOSH and OSHA regulate N95 respirators. By now, most of us want our respirator to have an N95 rating. This is particularly true for medical and factory workers. It can filter out both large and small particles at 0.03 microns, the desired efficiency that NIOSH demands for its coveted rating. The appeal is that it offers two-way protection. The "N" stands for "not resistant to oil," and the 95 represents its ability to filter at least 95% of particles. Most experts consider the N95 rating the gold standard for respirators.

The CDC has also designated most N95s as "single-use" but has provided interim "reuse" and "extended use" guidelines that include:

- → Are usable for up to eight hours
- → Are usable for up to five donning and doffing times
- → Recognizes that face shields will extend the use of up to five days or more

STEP 2: Who's the imprimatur?

Carefully examine the packaging and ensure that NIOSH or the FDA have certified your N95. Both have stringent guidelines that demand rigorous testing that manufacturers must meet before receiving government approval. We are essentially in the Wild West of respirator manufacturing. This warrants ongoing government scrutiny, because anyone can manufacture respirators, and hundreds—possibly thousands—have tried. News stories abound, reporting that some Chinese manufacturers falsely claimed their N95 respirator had met U.S regulations. You can check your respirator against the CDC's counterfeit and misrepresentation list at https://bit.ly/370SsWu. Searching for a "Made in the USA" brand is a permissible bias, I believe.

STEP 3: Does it fit?

There are two questions regarding the respirator's "fit." The first is whether you appropriately don and doff the respirator. Legitimate manufacturers will provide a comprehensive manual, and some, like Global Safety First, provide video instruction (https://www.youtube.com/watch?v=DcjCCXBna 18&t=1s). The larger question is whether your respirator can pass a fit test.

There are essentially two types of fit testing. A quantitative fit test uses an instrument to measure the respirator's effectiveness numerically. A qualitative fit test is a pass/fail test that relies on the individual's sensory (taste or smell) detection of a test agent, such as saccharin (sweetener) or Bitrex® (bitter) solutions.

Fit testing confirms the fit of any respirator that forms a tight seal on the user's face before using it in the workplace. This ensures users are receiving the expected level of protection by minimizing contaminant leakage into the facepiece. The CDC is blunt about the need for a tight-fitting seal. "This all boils down to a simple reality: If the respirator does not form a seal with the face, it cannot provide the expected level of protection."

STEP 4: Are you in compliance?

Be sure your employer or administrator follows established guidelines. A serious consequence of failing to follow protocols for respirators and other PPE can be legal sanctions. Recently, OSHA levied fines against medical institutions in Connecticut, Illinois, Massachusetts and New Jersey, ranging from \$12,000 to more than \$25,000. In October 2020, an OSHA press release revealed it had levied 204 citations for coronavirus-related violations. The proposed penalties totaled more than \$2.8mil.

Among the legal community, expect more activity in the post-coronavirus era. In one case, a person sued after the employer told them to wear a coffee filter for protection after they ran out of PPE. It is not unreasonable to expect an uptick in litigation for institutions and companies that fail to provide adequate safety products and protocols.



Fit testing confirms the fit of any respirator that forms a tight seal on the user's face before using it in the workplace. This ensures the expected level of protection by minimizing contaminant leakage into the facepiece. (photo courtesy Global Safety First)

A professionally designed, comfortably fitting respirator that seals tightly and meets government N95 specifications is your first line of defense (along with social distancing) against the coronavirus or any respiratory infection. Just make sure that your respirator is up to the task. **IHW**

[John Schwind is President of Global Safety First and the co-inventor of the ReadiMask. For a video of how to wear an N95 respirator, such as the ReadiMask, visit https:// www.youtube.com/watch?v=DcjCCXBna18&t=1s. To obtain free samples, visit www.ReadiMask.com.]

Want to contribute to Industrial Hygiene in the Workplace? Let us know if you have an interest in writing an article for an upcoming issue.

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A REVOLUTION IN RESPIRATORY PROTECTION

RESPIRATORY PROTECTION: NEGATIVE VS POSITIVE PRESSURE

Powered Air Purifying Respirators (PAPRs) and N95 Disposable Respirators are two of the respiratory protection options available to protect workers from dangerous or hazardous airborne contaminants such as crystalline silica, but the design and means by which these two types of respirators function are very different.

DISPOSABLE N95 RESPIRATORS: NEGATIVE PRESSURE

N95 Disposable respirators are specifically manufactured to be able to filter particles that are above 0.3 microns in size with 95% filtration efficiency. N95s are negative pressure masks which means air is drawn in through the mask.

However, in order to be effective, N95 respirators are designed to be worn with a tight seal against the wearer's face. This ensures that when the wearer inhales, the air being drawn in, is coming through the mask's filtration layers, and not from leakage around the edges of the mask where it meets the face. Part of the procedures for proper use of an N95 mask requires that the mask be correctly fitted to assure that it is properly donned.

POWERED AIR PURIFYING SYSTEMS: POSITIVE PRESSURE

Powered Air Purifying Systems (PAPRs) consist of a battery powered air handler or blower that draws ambient air through a filter cartridge, directing the purified air to headgear such as a mask, hood or helmet. The power unit generates positive pressure inside the mask, which serves to keep unfiltered ambient air from entering the headgear and being potentially inhaled by the user.

This positive pressure feature means that the fit of the headgear used with PAPRs need not form a tight seal, unlike the N95 mask where the tight fit to the face is a key requirement. This capability means that users with facial hair are able to wear the respirators because if there is a break in the seal, the air is pushing outwards, preventing any air from entering.

PAPRs are capable of filtering anywhere from 96% of contaminants at the low end to upwards of 99.9% at the higher end of the filtration metric.

CLEANSPACE RESPIRATORS

CleanSpace Respirators are PAPRs, but are seen as a revolution in the area of respiratory protection because while they provide all the protection of a PAPR, they a free from belts, battery packs and hoses making them more comfortable and easier to deploy.

Disposable masks are well known for causing fogging of eyewear and discomfort, leading to low compliance. When used in hot or humid conditions, CleanSpace Respirators provide cool, clean air to the user and eliminate fogging and moisture. CleanSpace Respirators are light, easy to put on, reliably safe and comfortable. These smart powered devices are easily operated using a one button smart system. These unique features mean more workers wear these respirators for a full shift every time.

High protection: CleanSpace Respirators are NIOSH and CE approved. CleanSpace Respirators offer 99.97% HEPA filter efficiency for particles from 0.3microns.

Comfort equals compliance: CleanSpace offers both half face and full face masks with assigned protection factors of 50 and 1000 respectively. The full face mask also has a high impact rating. CleanSpace Respirators are compact systems that have up to eight hours run time and fast top up charging.

"The feedback we get from teams wearing CleanSpace Respirators with the full face mask for mining, is that the mask is comfortable to wear all day, and the cool fresh air on the face is a dramatic improvement on disposable or reusable half masks," said CleanSpace CEO Alex Birrell. "They have also told us there is no fogging or hot moisture on their face."

Product Range: CleanSpace Respirators have four models depending on the requirements of the industry.

- CleanSpace EX is intrinsically safe, so that it can be worn in potentially explosive environments such as mining.
- CleanSpace Ultra is IP rated 66, making it water tolerant, perfect for stonemasons carrying our wet-cutting.
- CleanSpace 2 can be used in a variety of industrial applications where water tolerance or intrinsic safety is not required.

Contact CleanSpace Technology for more information.



Air quality monitoring is relatively new in the commercial space, and we've seen a number of issues and concerns that are remarkably similar to those we faced in the early days of air quality monitoring in the industrial space.

This article provides a brief history of the developments of air quality instrumentation in the cleanroom space. It appears that we're at the beginning of similar developments for air quality instrumentation within the commercial space. In fact, we're already seeing many of the key players in indoor/out-door air quality raising many of these same issues today.

For the purposes of this article, I'll only discuss particulate monitoring, since it's what I'm most familiar with, but similar issues exist with gas sensors and other environmental sensors, to some degree.

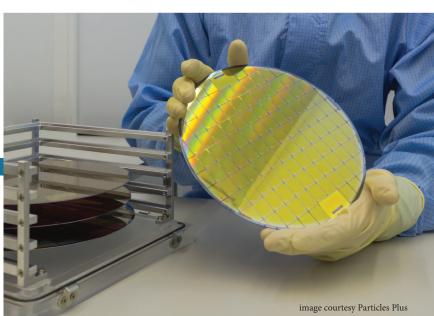
Particle counting as an industry was born largely to address yield problems in semiconductor manufacturing. The explosion of semiconductors in the 1960-1970s revolutionized the world; circuitry that, prior to this time, was large, bulky and drew loads of power was being quickly replaced by miniature, solid-state circuits produced at fractions of the cost.

Miniaturization Issues

The miniaturization meant the very small geometries in these circuits could be compromised by airborne (or liquid-borne) particulates inadvertently deposited on the surface of the circuitry during the manufacturing process. Particulates above a specific size (dictated by the process geometries of the devices being produced) could cause shorts or opens within these circuits—causing them to malfunction or fail.

Since many of these circuits were manufactured simultaneously (on the same silicon wafer), even short-lived air quality issues could destroy large numbers of these devices. In order to ensure that particles above a specific threshold size were kept to an absolute minimum, semiconductor manufacturers built large, expensive cleanrooms with extensive filtration to attempt to ensure that the air in their manufacturing environments was kept as free of particulates above that threshold size as possible.

Of course, installing filtration was no guarantee that this would indeed be the case. There are lots of ways filters can fail and clean environments can be compromised, so it was an ongoing battle to ensure that the environment was kept within the required tolerances for the process in question. The major tool that was used to ensure this was the optical particle counter.



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GAS DETECTION



GAS DETECTION



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Air Sampling & Calibration

Simplistically, these instruments sample the air in an environment by passing it carefully through a chamber where a light (typically a laser) shines a ribbon of light through which the air passes. If the air is perfectly clean, it passes through the ribbon without scattering any of that light.

However, when particles are present, they scatter light as they pass through the beam; the amount of light scattered being proportional to the size of individual particles. A detector would measure the scattered light and update one or more internal counters based on the amount of light for that particle. In this way, an instrument could count all the particles passing through an instrument and report on how many particles were seen during a sample period, sorting them in various size bins (or channels).

The manufacturer could then look at these readings and determine whether the quantity of particulates above their specified threshold was acceptable. Having this information in real-time (as opposed to capturing a sample of air and sending it off for analysis) allowed them to more tightly control their process and respond more quickly to events, saving huge sums, in many cases.

Early Instrumentation

The early instruments were very crude, incorporating only discrete logic chips (no controllers or onboard processors). They would simply have manually calibrated thresholds that a technician would adjust; these would drive binary counters and then periodically shift these counts to small numeric displays before resetting themselves and restarting. There was no logging, no control and only a few features.

These products were a commercial reaction to a pressing need, and a number of vendors sprang up to meet the growing demand. There were no standards as to how this should be done, with each company developing their own solutions based on this basic principle.

Over time, features like logging, printing, external communication interfaces, more channels, smaller channels, etc., were added in response to client demands and in attempt to differentiate products.

This took a few decades and, over that time, these instruments had huge impacts on production yields and quickly became absolute requirements in every semiconductor cleanroom. An enormous appetite for semiconductors had created a huge need for these instruments.

Eventually, these products would find their way into all industrial cleanrooms (i.e., disk industry, life sciences, etc.). Of course, it only makes sense to measure what you're trying to control, and the more important that control is, the more critical the measurement becomes.

A Maturing Industry

At first, semiconductor companies were created by mavericks developing products and bringing them to market, often as fast as they could. They strove to provide process control but these companies were startups with limited resources, very short design cycles and large process geometries (by today's standards). So, they could get away with instruments that were "reasonably accurate," and processes could be tuned to the instrument you had in hand.

However, as the semiconductor industry matured, geometries dropped; production volumes soared; and it became increasingly important to fine-tune the manufacturing processes and, in most cases, transfer these processes offshore.

In order to do that, they could no longer rely on the instrument they'd used to fine-tune the process on their pilot line; they had to be able to specify a process using parameters that could be measured using any "standard" instrument. Unfortunately, no such standard existed.



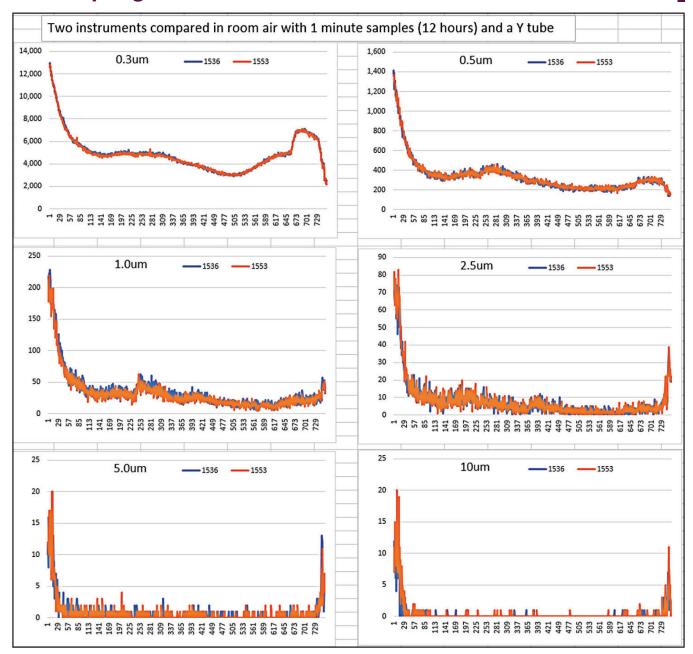
Particle counting as an industry was born largely to address yield problems in semiconductor manufacturing. (image courtesy Particles Plus)

A client could buy instruments from two separate vendors and find that particle counts between these instruments varied dramatically (dramatically enough to make it impossible to reliably transfer a manufacturing process).

Even more worrisome, two instruments from the same vendor could also vary dramatically. So, significant pressure was



Air Sampling & Calibration



These graphs show two instruments from a production line, connected together by a tube with a Y in it, to ensure they are sampling from the same air and run with 1-minute samples over a 12-hour period. You can see by the plots (each one showing a different size channel 0.3um through 10um) that the instruments have a very high degree of correlation to each other in all channels. (image courtesy Particles Plus)

applied to the vendors to come up with a solution to standardizing the manufacture of these instruments, so a client could buy instruments from a variety of vendors and have them agree on particle density and distribution (by size) within an environment.

This process took some time and, initially, a Japanese standard (JIS) emerged. This was then supplanted by an international standard (ISO 21501-4), which became a requirement for anyone supplying the cleanroom industry.

The standard was created by the manufacturers in response to the above pressure and codified various tests required to create an instrument that would provide accurate air quality measurements.

It's interesting to note that this standard initially made it impossible for any of the current manufacturers to ship a product that met the standard. Every one of them had to go through a significant redesign process in order to meet this new standard. It's certain that some of the smaller manufacturers could not meet this standard and many potential manufacturers have been unable to clear this hurdle and bring credible products into the space. But, made it possible for instruments that met the standard to agree with a much higher degree of correlation on the particle counts by size within an environment.

This made it possible for the cleanroom industry to rely on these instruments to control their processes. As an example, the figure on pg. 36 shows two instruments from our production line connected together by a tube with a Y in it to ensure they are sampling from the same air and run with 1 minute samples over a 12-hour period. We can see by the plots (each one showing a different size channel 0.3um through 10um). As we can see, the instruments have a very high degree of correlation to each other in all channels.

Because of ISO 21501-4, all of our instruments track similarly. And, with a high-quality calibration system, we've found that instruments calibrated many months apart also track with similar correlation.

Where to Go From Here

So, what does this mean for the commercial air-quality space? It's important to note that what drove this growth and the development of these instruments in the cleanroom space was the enormous demand for these products.

Because of that demand, the industry grew quickly with whatever instruments were at hand, initially being consumed by clients without much oversight or discrimination. We believe that we're seeing similar conditions today in the commercial air-quality space.

There is an enormous appetite for instrumentation and sensors to monitor air quality in many environments and applications. Unfortunately, many of the vendors in the space are making unsupported or misinformed claims and selling entirely unsuitable products to unsuspecting clients who have no simple means to determine suitability.



the day where a client can choose between various instruments, based on features, price, service, etc. The hope is that they will be able to rely on a manufacturing standard that ensures accurate information and instrumentation.

[Editor's note: This article is part of a three-part series, used with permission from Particles Plus. It first appeared in Healthy Indoors magazine and is used with permission. For the entire series, go to https://particlesplus.com/air-quality-instrumentation-a-history/]

About the Author



David Pariseau is an embedded systems design engineer with 36 years of development experience in consumer electronics, financial payment, medical devices, lab instrumentation, industrial controls and machine design. The original founder of Lighthouse Associates (now Lighthouse Worldwide Solutions) in 1985, Technology Plus in 1995 and SinoEV Technologies in 2009,

David co-founded Particles Plus in 2010. The company's focus is to bring quality products into the mainstream, commercial air-quality monitoring space. He can be reached at dpariseau@particlesplus.com.

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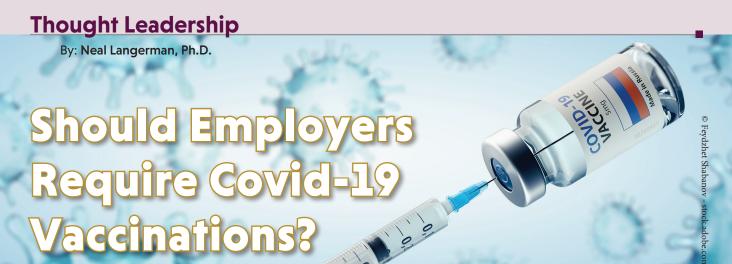


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Vaccines approved under Experimental Use Authorizations (EUAs) will be available soon. In theory, this should make re-opening businesses easier.

As immunity develops within the population, the case-count will drop, and the many restrictions will be eased. Realistically, individual immunity will require about 2-3 months following the initial vaccine dose to develop fully. At best, in the U.S., everyone who wants a vaccination should be able to get two doses by late second quarter 2021.

This will vary significantly in other parts of the world. But, one in three people polled in August said they would refuse to be vaccinated (Paulsen, 2020). The "anti-vax" presence on social media has grown significantly (Burki, 2020). In this environment, do you, as an employer, have a duty or moral responsibility to insist your employees be vaccinated—and can you do that?

The law makes it clear that a state government can mandate

employee vaccinations. In the 1905 case of Jacobson v. Commonwealth of Massachusetts, the U.S. Supreme Court held that States have the authority to require vaccinations. The Americans with Disabilities Act (ADA) defines vaccinations and health screenings as "medical examinations" and, therefore, an employermandated vaccination must be job-related and consistent with business necessity. In the opinion of Dorit Reiss (Weise, 2020) of the Hastings College of Law, "Legally, every employer can require it—you don't have to be a high-risk employer to require it. On one hand, employers will be concerned about pushback from employees. On the other hand, they'll also be concerned about COVID outbreaks that can be prevented." Other laws are addressed further by Widener (Widener, 2020).

While OSHA has been reticent dealing with the pandemic and has issued citations mainly addressing respirator use (Agency, 2020), the General Duty Clause of the Occupational Safety and Health Act makes it clear that the employer has a duty to take action to prevent illness from spreading in the workplace. There is clear precedent for vaccinations within the healthcare industry. Given the infectivity of SARS-CoV2, it is realistic for employers to protect their employees and their business by requiring all employees to be vaccinated. (Widener, 2020)

Carve-outs to the mandate for religious reasons, for medical reasons and, possibly, for personal/philosophical reasons should be provided. Large employers should consider offering onsite clinics, open to employees and their families for vaccination. Small employers can provide release time and compensation for employees to go to public-access vaccination locations.

Employees should be reassured that if side effects occur, they will be taken care of medically and financially. Recent reports from the phase III trials suggest that vaccine recipients may exhibit moderate flu-like symptoms during the 24-36 hours following the second dose. Employees knowing they will not



Given the infectivity of SARS-CoV2, it is realistic for employers to protect their employees and their business by requiring all employees to be vaccinated. (Widener, 2020) [photo courtesy Adobe Stock]

be penalized for staying home under those circumstances will be reassured and more willing to be vaccinated.

There are down-sides to such a mandatory requirement. Pushback by employees is certainly possible. If a union is involved, pushback could be complicated, depending on the contract. Since a vaccine approved under an EUA is considered "investigational," the application of existing laws, regulations and precedents is a bit uncertain. On this last point, Stephen Hahn (Weise, 2020) FDA Commissioner, said, "It's possible that some employers or schools will have questions or concerns about an investigational product issued an Emergency Use Authorization, which is why we will be as transparent as possible about the data and information we use to make our decision. This should help those organizations determine what is most appropriate for them." The message is clear: follow the FDA and CDC guidelines and recommendations.

What, then, should a business owner do? Legally, you can require employees to be vaccinated as long as you can make a credible argument of a business necessity. Protecting your production staff should be adequate. You must make the moral decision based on your beliefs and self-interests.

For me, I would urge all employees and their families to be vaccinated and provide incentives for them to do so. Certainly, a bonus of \$100 per family member vaccinated is a small investment to assure a healthy employee base.

Stay safe and stay healthy. **IHW**

About the Author:

Dr. Neal Langerman provides litigation support and expert testimony for both defendants and plaintiffs in litigation involving a wide variety of chemical-related issues. [Advanced Chemical Safety, www.chemical-safety.com]

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Coming in our March/April Issue:

- Confined Spaces/Ventilation
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Products That Protect



Self-Disinfecting Biotechnology

NanoVapor Biotech, a technology solutions company focused on eliminating bacteria, microbes, fungi and mold in workplaces and businesses, announced the launch of OMNISOL*, a unique new line of spray-on anti-microbials that provide businesses with long-term solutions to sanitizing surfaces to protect employees, customers and the public from threats posed by harmful pathogens. OMNISOL products provide an unparalleled level of microbial protection by forming a nanolayer of sub-microscopic spikes—each about 1/1000th of the diameter of a human hair—that can pierce the cell walls of microbes that land on treated surfaces, killing them. Surfaces treated with OMNISOL actually become self-disinfecting, adding an advanced new dimension to the fight against harmful pathogens.

Nano Vapor Biotech, www.nanovaporbiotech.com

Partners to Combat Heat Stress

Examinetics, a leading provider of workplace safety compliance services, announced a strategic investment in Kenzen, innovator of a wearable device to reduce workplace injuries by providing continuous temperature monitoring of workers. As climates get more extreme, heat stresses to workers—which can lead to serious injury—are on the rise. Heat affects the worker's health and productivity and a company's safety and financial results. Safety professionals increasingly want real data to predict and prevent heat issues, while protecting workers' personal health privacy; the Kenzen solution is designed to provide both.



Examinetics (Freedom 3 Capital), www.freedom3.com; Kenzen, www.kenzen.com



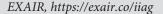
New 2021 Master Catalog

The 2021 Air Systems International, Inc. new Master Catalog features Air Systems' most popular items, including the Breather Box® Grade-D Air Filtration System, Saddle Vent® Confined Space Ventilation Kits, Air-Light® Portable Area Lighting Systems and Breathing Air Transporter™ (BAT) bottled air cart system. The catalog is available in both print and digital formats; to request one, go to https://www.airsystems.com/index.php/mainmenu/catalog-request. Download a PDF version at www.airsystems.com.

Air Systems International, Inc., www.airsystems.com

New Ion Air Gun for Static Elimination

EXAIR's patented Intellistat* Ion Air Gun is a handheld, lightweight solution to static elimination in clean processes or sensitive assembly work, such as scientific and electronic test facilities, laboratories and clean rooms. It was designed to consume minimal compressed air while simultaneously delivering precise blow-off and exceptional static decay rates capable of reducing 1,000 volts to less than 100 in less than a second, at up to 24in away. The Intellistat is a low maintenance solution that is UL-listed and CE-compliant.





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VAC-U-MAX, www.vac-u-max.com

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Autac Inc., www.autacusa.com



Reduce Industrial Dust Dangers

Handling and milling grain, seed and feed are occupational hazards that expose workers to dust-related dangers, like respiratory injury and inhalation of allergens. In addition, most food dust is combustible, so particles in the air and on surfaces can cause fire and explosion. To help agricultural and food processing facilities reduce the risks of dust-related hazards, Camfil APC offers the Gold Series X-Flo (GSX) industrial dust collection system. The system safely collects airborne food particles to provide cleaner air to breathe, a cleaner work environment and a significantly reduced risk of combustible dust incidents. It is ideal for facilities that handle milling grain, seed and feed.

Camfil APC, www.camfilapc.com

QuantiFit2 battery packs allow for cordless operation, animations guide the user through each

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Casella, www.casellasolutions.com



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ENMET, www.enmet.com

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Providing users with lightweight, breathable face coverings, Milwaukee Tool is introducing the first ever face masks built for the jobsite: the 3-Layer Performance Face Mask and 2-Layer Face Mask. The masks are constructed with

soft, breathable layers, designed for all-day wear on the jobsite. To prevent odor-causing bacteria, the masks feature an anti-microbial treatment and moisture-wicking layers help the masks dry quickly and keep cool. For all-day comfort, they have adjustable ear loops and a flexible nose bridge to easily fit to the user's face. All Milwaukee® Face Masks meet the CDC recommendations for face coverings and are reusable and machine washable.

Milwaukee Tool, www.milwaukeetool.com

Improved Brushless Wet/Dry Dust Extractor-Vacuums

Makita U.S.A., Inc., manufacturer of high-quality professional tools and accessories, has released two improved 18V X2 (36V) LXT $^{\circ}$ Brushless Cordless Wet/Dry Dust Extractor/Vacuums, models XCV20Z and XCV23Z. The new dust extractor/vacuums offer longer run time and lower noise. Users now get 100 minutes of run time on the normal setting with two LXT 5.0Ah batteries and a quieter operating sound level of 64 dB(A) on the highest speed.

Makita U.S.A, Inc., www.makitatools.com



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ZOLL's Full-Rescue AEDs feature CPR-D-padz*, a one-piece, pre-connected electrode with Real CPR Help* feedback. Ordinary AEDs require that the rescuer use two separate electrodes. By using CPR hand placement as the landmark, it is easy to place the CPR-D-padz on the victim quickly. The CPR-D-padz also lasts five years—the longest shelflife of any defibrillator electrode sold today. The universal design of the CPR Uni-padz electrodes gives rescuers a single solution for both adult and pediatric



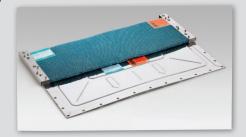
victims of SCA. To treat a child, rescuers use the same set of pads and simply activate child mode. WiFi connectivity enables automatic reporting of device status, giving the user confidence the AED is ready in an emergency. WiFi also provides the ability to quickly access and transmit cardiac arrest event data to medical professionals.

ZOLL Medical Corporation, an Asahi Kasei company, www.zoll.com

Comprehensive Combustible Dust Explosion Protection

Combustible dust explosions occur within a few milliseconds—different approaches to protecting against the ravages of the explosion are regularly used to limit damage. Explosion panels, which relieve the explosions by "bursting" at a predetermined pressure point, are economical and relatively easy to manage. However, this type of traditional explosion pressure relief presents

a problem for many facility operators—extensive safety zones have to be set up around the relief area to protect people, equipment and the surrounding areas. These zones become unusable space. REMBE* TARGO-VENT is an opening angle limiter, developed for use with REMBE* Explosion Panels, which guides the pressure relief specifically into areas in which there is no danger to the adjoining infrastructure. TARGO-VENT absorbs the enormous repulsive forces of explosion energy and guides the flames and shock wave in the desired direction. IHW



REMBE Inc., www.Rembe.us





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Workplace Safety: Best Foot Forward in 2021 Continued from page 26



Long hours in enclosed indoor spaces, in close proximity to others, heightens the risk of exposure and infection. This is especially true among essential food service workers, who have worked throughout the pandemic.

When updates are made to CDC and OSHA safety guidelines, company leaders should maintain a clear and concise message to all employees and supply reminder emails, as well as visual signage of health and safety standards.

Best Foot Forward

Going back to employees' risk of contracting musculoskeletal diseases, the industry does not place enough emphasis on foot safety, which is multifold in nature. Not only are industrial, assembly line-type workers more susceptible to these problems, but their likelihood of obtaining short- and long-term foot issues significantly increases when proper footwear PPE is not incorporated into floor working environments.

Particularly in the COVID-19 climate, previously standard industry safety practices, such as standing on rubber floor mats, can be costly in the long term. Mats are less effective than properly fitted foot insoles, and they can restrict ergonomically safe movement and are not conducive for longer working hours brought on by the pandemic. Also, floor mats do not encourage adequate social distancing of 6ft apart. Thus, the increase of danger to employees is coupled with higher chances of infection and further COVID-19 outbreaks at factories and plants when relying solely on mats for ergonomic protection.

To mitigate these risks, employers can invest in anti-fatigue insoles for their teams. Remind employees to wear the adequate insoles that are fitted properly to their shoes and make such wear part of their daily lives. Foot comfort is a vital part of the job, because it translates to employees' health outside working hours.

When we commit to the health and safety of our employees, we can see not only a larger company return on investment and overall time-savings—we also see happier, fulfilled employees and higher retainment levels. It's a win-win situation when employers invest in employees' overall comfort and movement. Company leaders and floor managers should emphasize the ongoing importance of this throughout the pandemic.

As we hope to near the end of the pandemic's finish line soon, industry needs to adapt quickly to the increasing demands. Essential work can only continue to be its most productive and effective if we maintain a united front and not just talk about health and safety in the workplace—but show employees that we care. **IHW**

About the Author

Dr. Kevan Orvitz, Doctor of Podiatric Medicine, is Founder & President of MEGAComfort Inc. Dr. Orvitz's revolutionary ergonomic designs have paved the way for employees to experience en-

hanced comfort, decreased pain and fatigue—helping to create a safer, more productive workplace.



REAL-TIME DUST MONITORING INSTRUMENTS.

ANY ENVIRONMENT. ANY APPLICATION.



TSI offers a complete portfolio of dust monitoring instruments to measure aerosol contaminants in most any application.

- + For long term surveys and unattended remote indoor or outdoor monitoring
- + For walk-through surveys, single-point location and single-point data collection
- + For personal worker breathing zone monitoring



*Image used for illustrative purposes only; AccuTec-IHS does not imply nor endorse any specific type of Respirator for any given application



QUANTITATIVE TESTING FOR ALL RESPIRATOR TYPES:

- ✓ N95
- P100 & N99
- FFP1, FFP2, & FFP3
- Full- & Half-Face Elastomerics

Make a difference. Make it count.

Introducing the New AccuFit 9000° PRO

Getting workers fitted fast and back on the job is missioncritical. There's no time for chance and uncertainty.

Today's tough environment means Quantitative Fit Testing Systems can make the difference between safe and at-risk exposures.

The new AccuFIT 9000 PRO has all the capabilities you need to accurately fit ALL mask types. It's a simple, easy-to-use device that includes OSHA's streamlined 2019 CNC protocol.

Rugged, quick to deploy, and fully featured, AccuFIT and AccuFIT PRO both provide answers you need in a format you can use and come with a 3-year warranty.



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RESPIRATOR FIT TESTING for the REAL WORLD

Let's make it count. Together.

Our primary mission is helping professionals like you make a difference every day by protecting those who need it most-but we're not content to stop there. We created the #accutecgivesback initiative to bring much-needed Fit Test equipment to deserving community-based non-profit organizations by donating AccuFIT products and supplies to those in need. See accutec.com for more information.









About AccuTec-IHS

AccuTec-IHS was founded by a passionate, experienced team of Respirator Fit Test experts to introduce a new and better choice in particlecounting Respirator Fit Test devices. We're truly honored to help professionals making a difference in the post-SARS-2 CoV world.