The NEBB Professional

2024 – Quarter 2

Practices to Be Aware of in Sound Measurement and Instrument Set-Up

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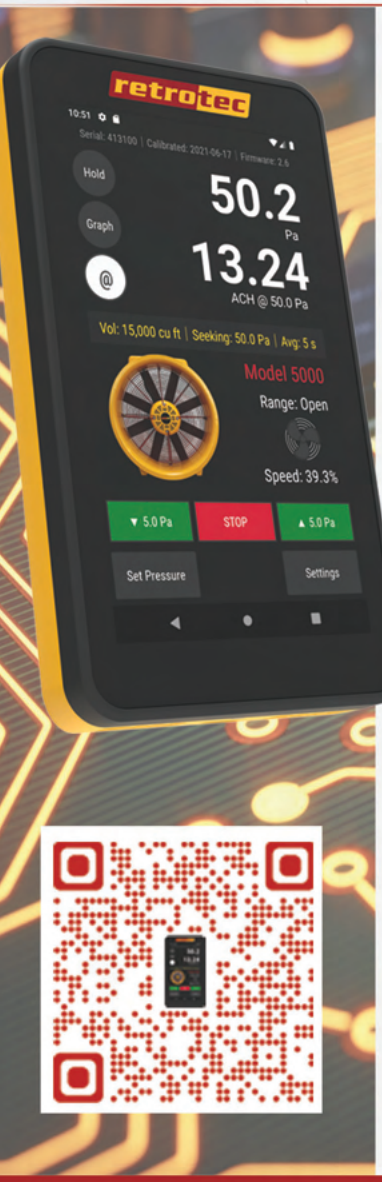

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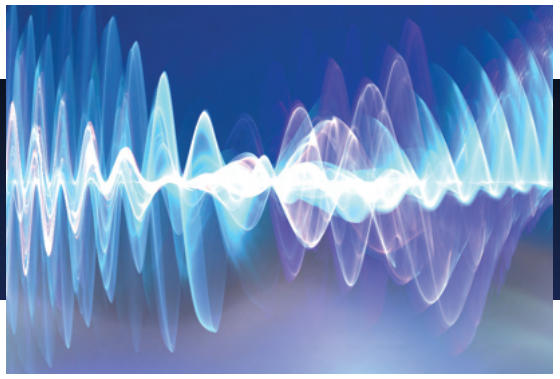

Contents

Quarter 2 – 2024

Features

The NEBB Professional is a quarterly magazine published by NEBB. 8575 Grovemont Circle, Gaithersburg, MD 20877 Tel: 301.977.3698 Email: communications@nebb.org

President's Message

The first thing that came to mind when I was preparing this message was a phrase I have heard from many others before me: Time goes so fast that before you realize it, it will be over.

Time has indeed gone so fast that it just highlights the emphasis and efforts around maintaining the direction of the organization across time. The current EFC and Board have done an outstanding job on keeping the direction consistent and I would like to recognize them for that. In addition, supporting that direction and the events planned requires a great NEBB staff and NEBB Committees and I would like to also recognize the hard work executed by both on keeping this alignment.

One important realization during the second quarter of 2024 is that the engine that moves this organization runs with a combination of two key elements: the work of world class volunteers and the work of our incredible staff members.

In April, we held our Midyear event, which was a perfect example of this symbiosis. All participants of our NEBB community in attendance had the opportunity to interact at different levels with all members of the organization, as well as towards the goals set forth by Mike Kelly as the Committees' Committee Chair.

The committees prepared and reviewed their yearly plans, and worked on the goals set for the Midyear session. The review and alignment of such plans was conducted by EFC members in parallel. Proper coordination was also fostered between different committees and NEBB staff members to ensure their plans' success.

Such an outstanding level of interaction is a perfect example of teamwork and what it truly means to transpire the core values of NEBB: Quality Performance, Professionalism, Integrity, Industry Leadership and Technical Expertise.

To wrap up, I would like to share an anecdote from the Midyear. I was asked by one of the hotel staff members what this team was all about and the first analogy that came to my mind was, "This is an All-Star event." The people that reunite for the Midyear are the best of their class volunteers and the best staff, wearing a single jersey—the NEBB one when working for the organization.

These types of events energize everyone participating! I would like to extend the invitation to all in the NEBB Community to join the committee that best fits your career, so you too can enjoy the personal satisfaction that only volunteer work can bring.

The plans for the remainder of 2024 continue at full steam, with key items such as:

- Exam Development in our Cx and CPT disciplines, while metrification of TAB is near completion
- Continued development of the NEBB Learning Center including a variety of new material available for the NEBB community
- Tuning up the NEBB Technical Training Center to convert it into an engineering powerhouse within the building sciences community
- The communication of the Future Technologies Ad-Hoc Committee (FTACA), which will engage different members to help all of us present what future technologies out there will mean to NEBB as an organization.

The second half of the year has also been identified as the period of the year where our current NEBB Strategic Plan will be updated considering all the elements that have changed in the industry and across our organization to ensure we are keeping our initiatives current and relevant for NEBB, the NEBB firms, NEBB CPs and NEBB CTs.

As you can see, lots of things under continuous work to be at your service, so let's keep it up!

Pura Vida!!!

Luis Chinchilla
NEBB President

Mensaje del presidente

Lo primero que se me vino a la mente cuando estaba preparando este mensaje fue la frase que he escuchado de muchos otros que han estado antes de mí: ¨El tiempo se va tan rápido que antes de que te des cuenta, ya todo paso¨.

El tiempo ha pasado muy rápido en verdad y eso solo confirma el esfuerzo realizado alrededor de mantener la dirección de la organización a lo largo del tiempo. La Junta Directiva y el EFC actuales han hecho un trabajo sobresaliente en mantener la dirección y quiero reconocerlos por ello. Adicionalmente, apoyar esa dirección y todos los eventos planeados requiere de un gran personal administrativo así como de los Comités de NEBB y por eso mismo quiero también reconocerles el gran trabajo realizado al mantener dicho alineamiento.

Una realización importante durante el segundo cuatrimestre es que el motor que mueve a esta organización funciona con una combinación de dos elementos claves: un trabajo voluntario de clase mundial, así como el trabajo del personal administrativo de la organización.

El evento de medio año recién celebrado la primera semana de abril representó un ejemplo perfecto de esa simbiosis, donde todos tuvimos la oportunidad de interactuar en diferentes niveles, con todos los miembros de la organización hacia las metas establecidas por Mike Kelly como el líder del Comité de Comités.

Los Comités prepararon sus planes anuales, los revisaron, y trabajaron en las metas establecidas para la sesión de medio año, mientras que, en paralelo, la revisión y alineamiento de esos planes fue llevada a cabo por varios miembros del EFC y su coordinación adecuada fue promovida entre los diferentes Comités y miembros del personal administrativo de NEBB.

Un nivel tan sobresaliente de interacción es un ejemplo perfecto de trabajo en equipo y lo que realmente significa transpirar los valores de NEBB: Desempeño de Calidad, Profesionalismo, Integridad, Liderazgo en la Industria y Habilidad Técnica. Como corolario me gustaría compartir una anécdota de la sesión de medio año: un miembro del personal del hotel me preguntó de qué era este equipo y la primera analogía que se me vino a la mente fue "Este es un Equipo de Estrellas". La gente que se reúne para el medio año son los mejores voluntarios de su clase y el mejor staff, vistiendo todos una sola camiseta, la de NEBB cuando trabajan para la organización.

Este tipo de evento energiza a todos los que participan en él y me gustaría extender una invitación a toda la comunidad de NEBB para que se unan a los comités que mejor se ajusten a sus carreras y que disfruten de esa satisfacción personal que solo el trabajo voluntario trae a cada uno de nosotros.

Los planes para el resto del 2024 se mantienen a todo vapor, trabajando en temas clave como:

- Los planes de desarrollo de los exámenes en las disciplinas de Cx y CPT, así como la metrificación del examen de TAB están casi terminados.
- El NEBB Learning Center continúa desarrollando nuevo material disponible para toda la comunidad de NEBB.
- El Centro de Entrenamiento de NEBB se está desarrollando para convertirse en una fuente de fuerza ingenieril dentro de la comunidad de ciencias de los edificios.
- Se anunció el Comité Ad-Hoc de Futuras Tecnologías (FTACA), con la incorporación de diferentes miembros que nos ayudarán a entender lo que significa el futuro de las tecnologías existentes y qué significan estas para NEBB como organización.

La segunda mitad del año ha sido identificada como el periodo en el que nuestro plan estratégico será actualizado considerando todos los elementos que han cambiado en la industria, así como en nuestra organización, para asegurar que mantenemos nuestras iniciativas vigentes y actualizadas para NEBB, las firmas NEBB, los profesionales NEBB y los técnicos NEBB.

Como pueden ver, hay muchas cosas en las que se trabaja continuamente para su servicio, ¡así que sigamos así!

¡Pura vida!

Luis Chinchilla
Presidente de NEBB

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Letter from the Editor

Welcome to the second issue of the NEBB Professional Magazine for the year 2024! Can you believe we are already approaching the midpoint of 2024?

This quarter, we're turning our focus to Sound and Vibration, spotlighting the pivotal role they play in the building industry and the indoor environment. Presented by NEBB's Sound and Vibration Committee, our feature article on page 9 covers the nuances of this critical discipline.

Further examining the impact of sound on our surroundings, Evan Benway's article on page 14 discusses workplace productivity and efficiency. Regardless of your current specialization, these insights offer valuable guidance for optimizing workplace environments, fostering harmony and productivity.

As we anticipate the 2024 NEBB Annual Conference in the latter half of the year, those preparing to make the trip to Phoenix can read up on the Valley of the Sun on page 34.

Once again, I extend my sincere gratitude to our contributors whose invaluable involvement shapes the direction of our magazine and enriches our collective knowledge. The NEBB Professional thrives on contributions from industry leaders and experts, allowing decades of meaningful experience to be shared with all.

As you engage with this issue, consider how these insights can drive improvements in your engineering and construction projects, and perhaps whether you have tips or lessons learned that could benefit the NEBB community. Whether you're embarking on your career journey or nearing retirement, your professional perspective holds the potential to inspire and support others.

Please reach out to me at editor@nebb.org to share your experiences, ideas, articles, or feedback. Let's harness the power of collective knowledge to propel our professional growth, together.

Kerri Souilliard,
Editor

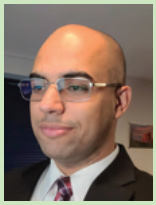
CONTRIBUTORS

Stuart McGregor, PE, is a senior acoustical engineer at Engineering Dynamics, Inc. of Englewood, CO. He has 30 years of experience as an acoustical engineer and vibration analyst, for environmental and building projects. He is a member of NEBB's Sound and Vibration (S&V) Committee, NEBB Certified Professional (S&V) and ANSI CAT II Vibration Analyst certified (via the Vibration Institute).

Evan Benway is an advisor to the International Well Building Institute, where he contributes to the development of the WELL Building Standard's Sound concept. A passionate advocate for advancing the field of soundscape design, Benway is also founder and managing director of Moodsonic, a science and technology company specializing in generative soundscaping.

Matthew Lemieux has over 43 continuous years of field experience as a biological safety cabinet certifier, air and water balancer and cleanroom certifier. He has been an ANSI/NSF-49 accredited biological safety cabinet certifier since 1997, is a NEBB CPT-CP certified professional, and a CETA accredited RCCP-SCF for sterile compounding facilities, ASHRAE-110 fume hoods, and cleanrooms. He serves as Director of Training at Vanir Technical Group (VTG, LLC) of Vancouver, WA; Salem, NH; Raleigh, NC; Tel Aviv, Israel; and Penang, Malaysia.

Michael Kelly has been a NEBB Certified Professional for CPT since 1991 and FHT since 2011. He serves on the NEBB Fume Hood Committee, Board of Directors and is the current President-Elect. He is a Project Manager at Air Filtration Management with nearly 40 years of experience in the cleanroom industry.



George E. Martin is a commissioning agent at Loring Consulting Engineers. He is currently a NEBB TAB CP and serves as a corresponding member of the NEBB TAB, YPN, and Marketing Committees.

Samantha Hawa is the Online Learning Coordinator for NEBB and one of her primary roles is to manage NLC, the online learning platform. She has over 20 years of experience in managing various online training and education programs. Samantha resides in Northern Virginia.

Jeff Schools is the Past President of NEBB and currently works with the NEBB Headquarters team, NEBB committee chairs, and Compliance members as NEBB Technical Director.

Executive Vice President's Update

The relationship between NEBB and its chapters is one of mutual support, collaboration, and shared goals. NEBB serves as the overarching organization responsible for setting industry standards, providing certification programs, and promoting excellence in environmental balancing and building performance. Meanwhile, NEBB chapters operate at the regional or local level, serving as the primary interface between NEBB and professionals within their respective regions.

In Florida, the NEBB Chapter stands as a beacon of excellence, offering a suite of extended services tailored to meet the diverse needs of firms across the state, as well as investing in the future of the industry. With a commitment to professionalism, education, and support, the Florida NEBB Chapter has become a leader among the NEBB chapters, providing resources that elevate the services a chapter offers to NEBB Certified Firms.

We can all agree that accessibility is key to fostering growth and success within the industry. Recognizing this, the Florida Chapter, under the amazing support of chapter coordinator Terry Wichlenski, operates five days a week, ensuring that firms have ample opportunities to engage, seek guidance, and access the array of services offered. This commitment to availability underscores the chapter's dedication to supporting the needs of firms across Florida, regardless of size or specialization. Terry has served as the coordinator for over 10 years and is a source of knowledge and professionalism. I recently had the honor to meet with Terry to hear more about the Florida chapter and its commitment and initiatives within the NEBB community. Let's delve into the myriad ways in which the NEBB Florida Chapter, otherwise known as FEBB, is revolutionizing the ways a chapter can support their NEBB firms.

Florida board 2023-2025. Left to Right: Joe Molloy, Harlan Rosenberg, Robert Shorr, Heath Allbaugh, Josh Whitley, Dean Davis, Lyndon McGill.

Terry Wichlenski, Florida Chapter Coordinator

Certification is the hallmark of excellence in environmental balancing, and the FEBB Chapter is dedicated to simplifying and expediting this process for candidates. With multiple TAB practical testing sites strategically located across the state, firms have convenient access to the resources necessary for certification. These sites not only streamline the certification and testing process but also ensure that firms have the practical skills and knowledge needed to excel in their endeavors.

In addition, and in recognizing the challenges that newly certified firms may face as they navigate the complexities of the industry, the FEBB Chapter stands ready to offer a guiding hand through its comprehensive mentoring program. With a commitment to fostering growth, professionalism, and excellence, the chapter is revolutionizing the way newly certified firms establish themselves and thrive in the field. Through one-on-one mentoring relationships, experienced professionals offer invaluable guidance and advice, helping mentees navigate challenges, capitalize on opportunities, and build successful businesses. From technical expertise to business development strategies and everything in between, mentors share their wealth of knowledge and experience to empower mentees to achieve their goals.

In the fast-paced world of environmental balancing, staying ahead of the curve is essential for professionals to maintain their edge and uphold industry standards. Recognizing this need, the FEBB Chapter proudly holds an annual two-day recertification seminar tailored exclusively for NEBB Certified Professionals and Technicians. The first day is packed with a corn-hole tournament that funds the chapter scholarship program, followed by a networking dinner for all attendees. The second day is filled with the chapter business meeting and several educational sessions. The chapter's annual recertification seminar is highly attended and serves as a cornerstone of the chapter's commitment to excellence in providing NEBB CPs and CTs with the knowledge, skills, and networking opportunities they need to excel in their field.

In addition to providing NEBB certified individuals opportunities to obtain CECs, the FEBB chapter distinguishes itself through its unwavering commitment to nurturing talent and fostering innovation through investing in the future. At the heart of this commitment lies the annual scholarship program, a cornerstone initiative that not only empowers young individuals, but also enriches the fabric of the industry itself. The FEBB chapter's scholarship program stands as a testament to its dedication to empowering the next generation of leaders in environmental balancing and related fields. More than just a monetary award, the scholarship program provides recipients with invaluable opportunities for mentorship, networking, and professional development, setting them on a path toward success and impact.

The NEBB Florida Chapter is more than just a collection of professionals—it is a beacon of dedication, innovation, and collaboration. The chapter's unwavering commitment to promoting and supporting NEBB's mission and core values is evident in everything they do–from the services they offer to the initiatives they champion to the relationships they cultivate.

I challenge each one of the NEBB chapters to strive for greatness, just as the FEBB chapter has done and continues to do. Together, we have the power to shape the future of our industry, to drive innovation, and to make a lasting impact on the world around us. ●

Practices to be Aware of in Sound Measurement and Instrument Set-Up

By Stuart McGregor

It's not uncommon for members of the Sound and Vibration (S&V) Committee to field questions from NEBB S&V Firms and Certified Professionals (CPs) regarding sound data, vibration data, and instrumentation. Such questions have involved three recurring themes, which we aim to shed light on as a means of helping others avoid the same potential mistakes, useless data, and repeat work:

a. The proper instrumentation setting to take sound data to generate Noise Criteria/Room Criteria curves.
b. Instrumentation set-up for vibration measurements, so usable data can be taken.
c. The issue of Sound level meter calibration requirements.

Those who have taken the Sound CP or Sound CT courses know that the instructors stress the proper setting on a sound level meter when taking sound data to generate Noise Criteria (NC) and Room Criteria (RC) curves/ratings. Remember, most sound specifications call for one or two measurements: the overall sound levels which is typically a dBA measurement, and/or the NC/RC rating which is an octave band measurement. The octave band measurement for NC/RC must **always** have the instrument set to the frequency weighting of unweighted or dBZ.

In accordance with the 2015 NEBB Sound and Vibration Procedural Standard, a sound level meter/analyzer should be set up as follows:

- *Frequency Weighting* – Z, Linear, Flat (this designation is different for different instruments)
- *Time Constant* – Slow
- *Averaging* – time average over 60-seconds
- *Full Octave data* – from 31.5 to 8,000 Hz

The labeling for the unweighted setting may vary from manufacturer to manufacturer, and may be dBZ, dB(-Flat), or dB(Linear). Read the owner's manual of your instrument. This doesn't seem too hard, however, it brings up a nuance depending on the manufacturer of the sound level meter, or SLM. Let's look at two examples:

- **Manufacturer A** has set-up options which apply the frequency weighting (dBA, dBC or dBZ) to both the overall sound level and the octave band sound levels.
- **Manufacturer B** has set-up options which allow the user to set the overall sound level frequen-

cy weighting (dBA, dBC, or dBZ) and then independently set the octave or third octave band frequency weighting (dBA, dBC, or dBZ).

The error arises when both overall sound levels and octave band data are to be measured. If the instrument is not configured correctly, then the A-weighting may be applied to the octave band sound level readings. So, what does this error really mean when the octave band data is measured A-weighted instead of un-weighted? The examples in the following figures will illustrate.

Figure 1: Equipment On Levels are Less than Background Levels

Figure 1 shows three sound level spectra plotted on a Room Criteria (RC) chart; the first is an un-weighted sound spectrum, the second is the A-weighting applied to this sound spectrum, and the third is the un-weighted background sound levels. Inspection of Figure 1 shows the following:

a. The unweighted sound spectra in an RC-30(R). R is the quality factor for rumble.

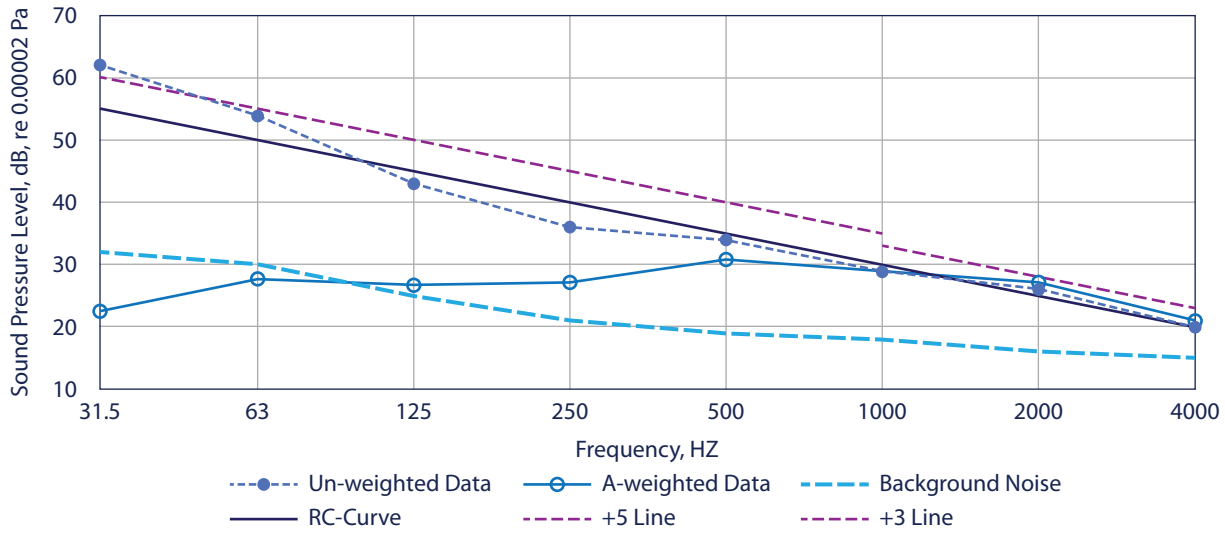
b. The A-weighted sound spectra is below the background sound levels in the 31.5 and 63 Hz octave bands and 2 dB above the background in the 125 Hz octave band.

So, what does this mean? In the NEBB Sound CP course, candidates learn that when a measured sound source level is within 10 dB of the background sound levels, that a correction for background sound levels must be done before the Noise Criteria (NC) or Room Criteria (RC) plots are made. In this case, one can make a correction for the 125, 250, 2000, and 4000 Hz octave bands; although, the correction in the 125 Hz octave band is sketchy since it is so close to the background.

The question is, *what can be done with the 31.5 and 63 Hz octave bands?* Well, nothing. Since the A-weighted data is below the background levels, there is no method to make a correction. The data is just not usable, and the measurements will need to be repeated. This is analogous to jumping into a swimming pool. If the water is clear, you can see where to jump to miss the obstacle under the water's surface; however, if the water is muddy, you do not know where to jump.

The point to take home is that one must set the sound level meter/analyzer up correctly for the measurement that needs to be made. This is especially important because you may not be able to recover the test data, which would lead to retaking measurements, increased cost, and lower profit.

Figure 1: Sound levels from the same sound source measured in dBZ and dBA, and plotted on an RC-curve



Figures 2 - 3: Range Setting on Real Time Analyzer SLM Display Not Set Correctly

The intent of Figures 2 and 3 is to resemble the sound level meter display.

Figure 2 shows measured sound levels with the Real Time Analyzer (RTA) display range set so that none of the octave band sound levels exceed the upper display range limit of 80 dBZ.

Figure 3 shows the same data, with the exception of the RTA display range set to 70 dBZ. Note, if all we see is Figure 3, we do not know what the sound levels are in the 31.5 and 63 Hz octave bands.

Figure 2: SLM Screen showing Actual Sound Levels with Range set from 10 to 80 dBZ

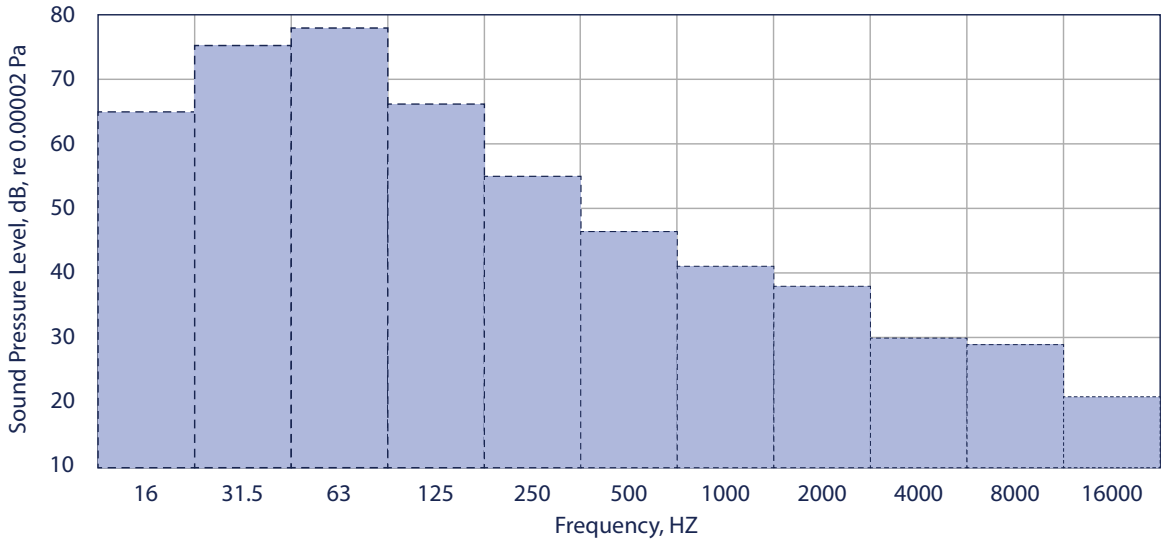
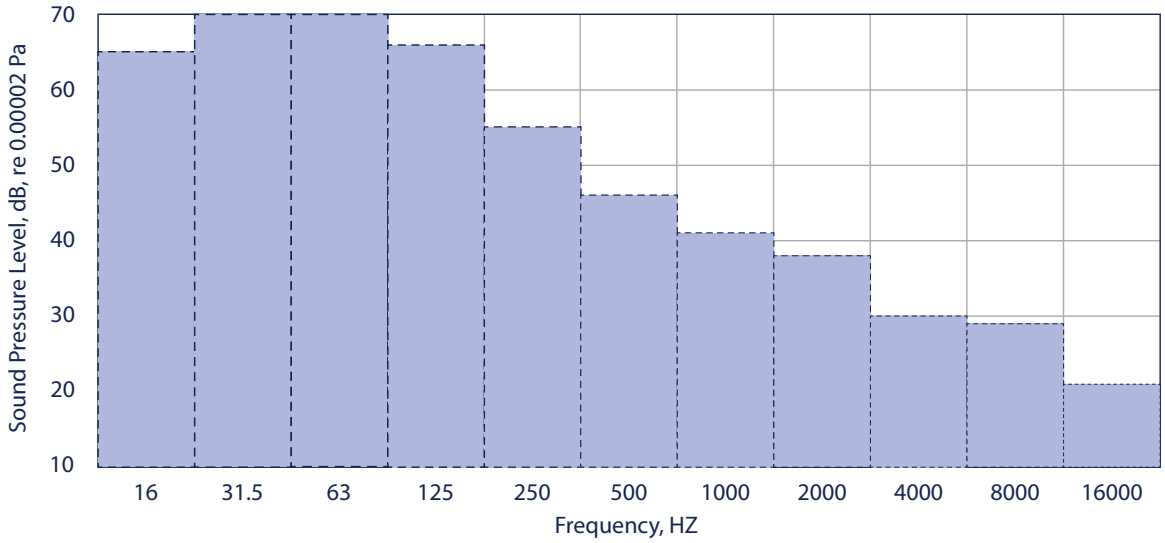
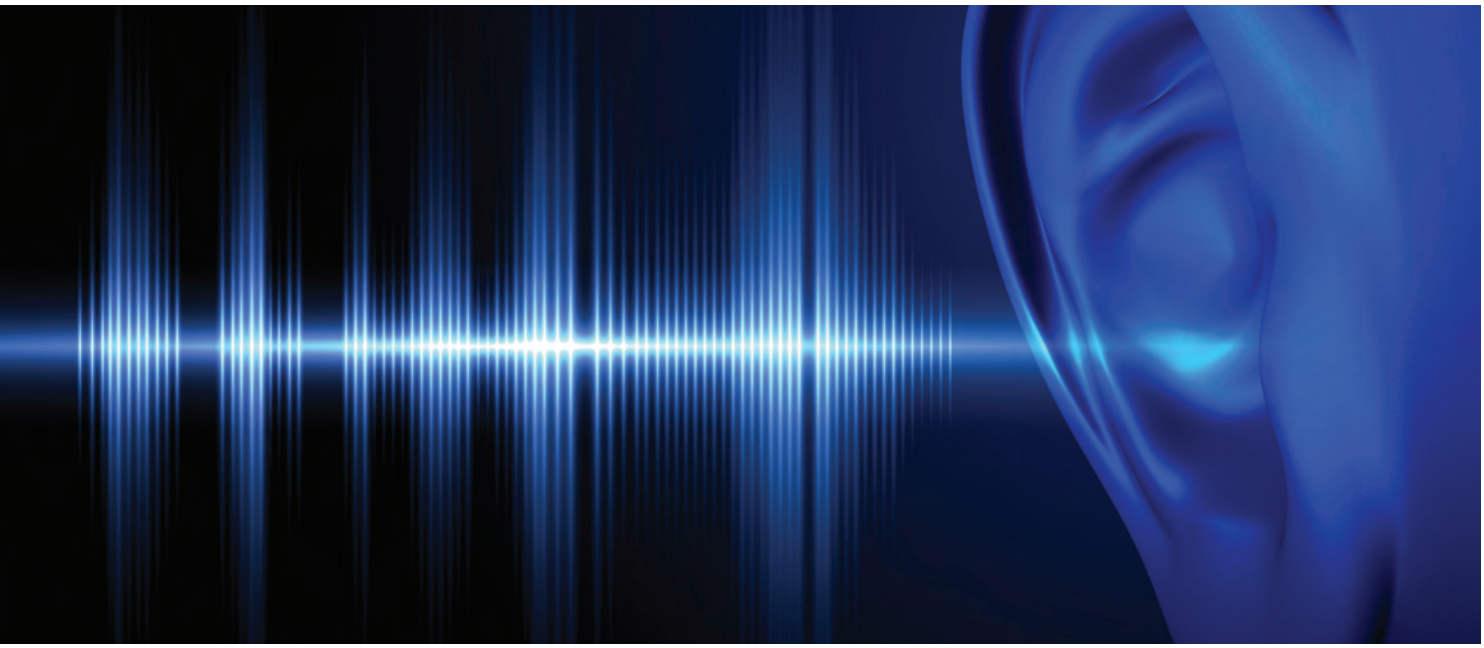


Figure 3: SLM Screen with Range set from 10 to 70 dBZ





With RTA SLMs, the measured sound data is stored in a data file on the RTA and can then be downloaded for plotting and report preparation. Let's consider the implications of this for the examples in Figures 2 and 3.

Depending on the RTA you own, if you had the display range set as shown in Figure 3 with an upper display limit of 70 dBZ, the RTA may truncate the data at 70 dBZ. Then, you would not know that the actual sound levels in the 31.5 and 63 Hz octave bands are 75 and 78 dBZ, respectively. That means when plotting an NC or RC chart, your measurement results will show lower ratings than actual.

Some RTAs will log and store the correct sound levels regardless of the meter display limits, and some will truncate data at the display limits.

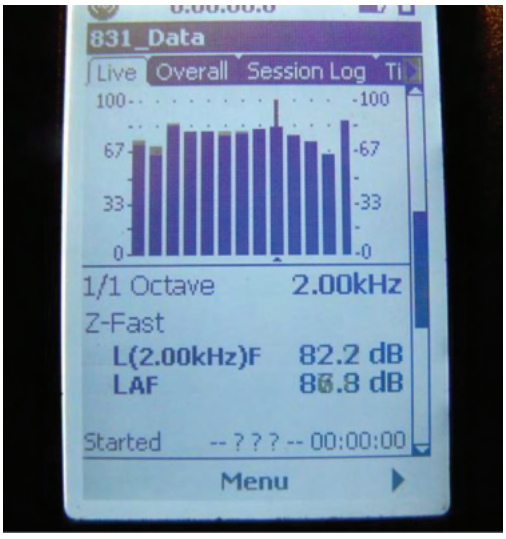
The takeaway here is twofold.

First, understand exactly how your meter logs and stores measured data. Is the display only a human interface and does the meter log and store actual data, or does your meter truncate data based on the upper and lower display limits that you see on the meter?

Second, it is simply good measurement practice to sample the sound levels in the area you are measuring data and adjust the meter display range so that upper sound levels for ALL the octave band display bars are visible and displayed sound levels are below the upper display range limit.

Finally, Figure 4 shows a photograph of a real time analyzer display ranged correctly and showing all octave band bars **below** upper display range. However, Figure

Figure 4: Photograph of Real Time Analyzer Display Ranged Correctly, Showing All Octave Band Bars below Upper Display Range

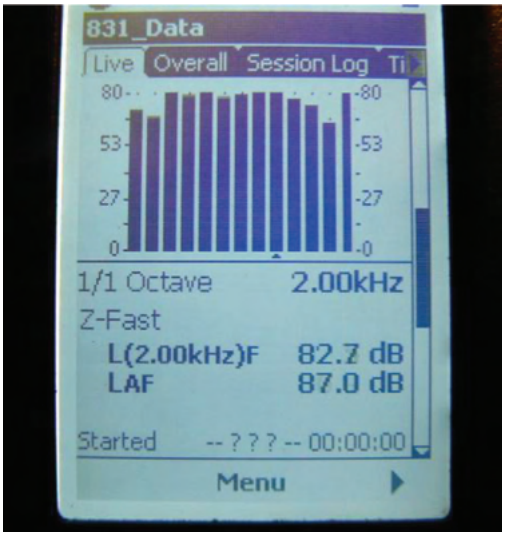


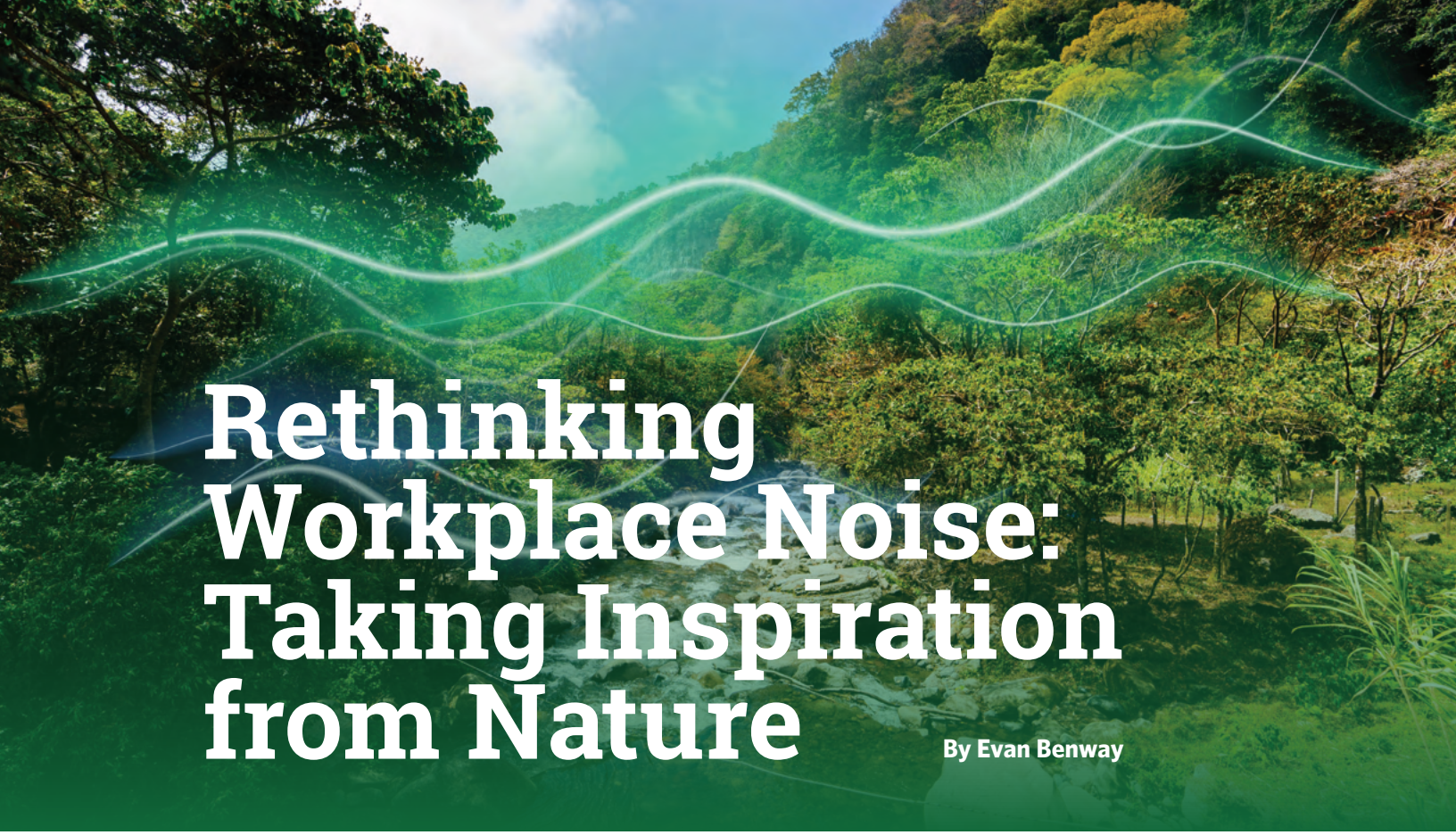
5 shows a photograph of a real time analyzer display **NOT** ranged correctly, showing some octave band bars **at or above** the upper display range.

For those interested in deepening their understanding of Sound Measurement, NEBB offers the Sound Home Study Course, which provides a comprehensive exploration of this field. Additionally, our NEBB Online Learning Center features a concise course on the Review of Logarithms, ideal for those seeking to strengthen their foundational knowledge. The Sound and Vibration Committee organizes annual seminars on Sound and Vibration Measurement with written and practical certification testing offered at the seminar. Discover these educational opportunities and more at nebb.org. ●

***Written by NEBB S&V Committee member Stuart McGregor, this article has been peer reviewed by NEBB S&V Committee members Chad Matthews (acting committee chair), Elizabeth Blankenship, and Joseph Reynolds.*

Figure 5: Photograph of Real Time Analyzer Display NOT Ranged Correctly, Showing Some Octave Band Bars at or above the Upper Display Range





Rethinking Workplace Noise: Taking Inspiration from Nature

By Evan Benway

At the beginning of human history, the built environment looked quite different from how it does now. It consisted of caves, huts and temporary dwellings before more permanent structures began to be formed from materials like clay, mudbricks and stone.

As Stephen Kellert, a renowned professor of social ecology, points out, humans evolved in "a sensory world dominated by critical environmental features such as light, sound, wind, weather, water, vegetation, animals and landscapes." The move to predominantly urban environments is a historically recent phenomenon.

In the midst of all the change sweeping workplace and commercial real estate, it is particularly useful to think back to the natural environments humans occupied for most of history. Doing so is a reminder of some basic needs — the foundations of healthy and comfortable buildings — which have been neglected.

The sense of hearing is exceptional, both in its power and the degree to which buildings have frustrated it. Hearing is the body's early warning system. Ears are always on, even during sleep. They give living beings extraordinarily detailed information about their surroundings, in all directions. And of all the senses, hearing is the one that affects people the fastest.

It is no surprise, then, that complaints about noise are top of the list in modern workplaces. Some spaces are stressful and distracting; others lack privacy. Some are too quiet, while others are too loud. After years of solitude working from home, these problems have only intensified as people return to the office. Leesman's research this year found that dealing with issues relating to noise is the environmental change that could make the greatest positive difference to employees' experiences in the physical workplace.

Workplace soundscaping

Soundscaping is the act of bringing designed sound into an indoor environment to support people. While often designed to be subtle and ambient, it is nonetheless a profound change from how sound in workplaces has previously been considered.

Historically, the focus in workplaces has been on one sonic metric: loudness. There has been a concert-

ed effort to reduce noise levels, but this can cause more problems than it solves. Not all sound is bad. Soundscaping can create a powerful link between people and the natural world, fulfilling many basic human requirements for health, comfort and connection.

The human need for safety

People need to feel safe to be comfortable and engaged in the office. But many workplaces fall at this first hurdle.

Sound can be an indicator of whether a space is clean, nourishing and free from predators. For this reason, a babbling brook, leaves rustling in the breeze and gentle birdsong are tell-tale sounds of safety and refreshment. People instinctively relax when they hear these sounds.

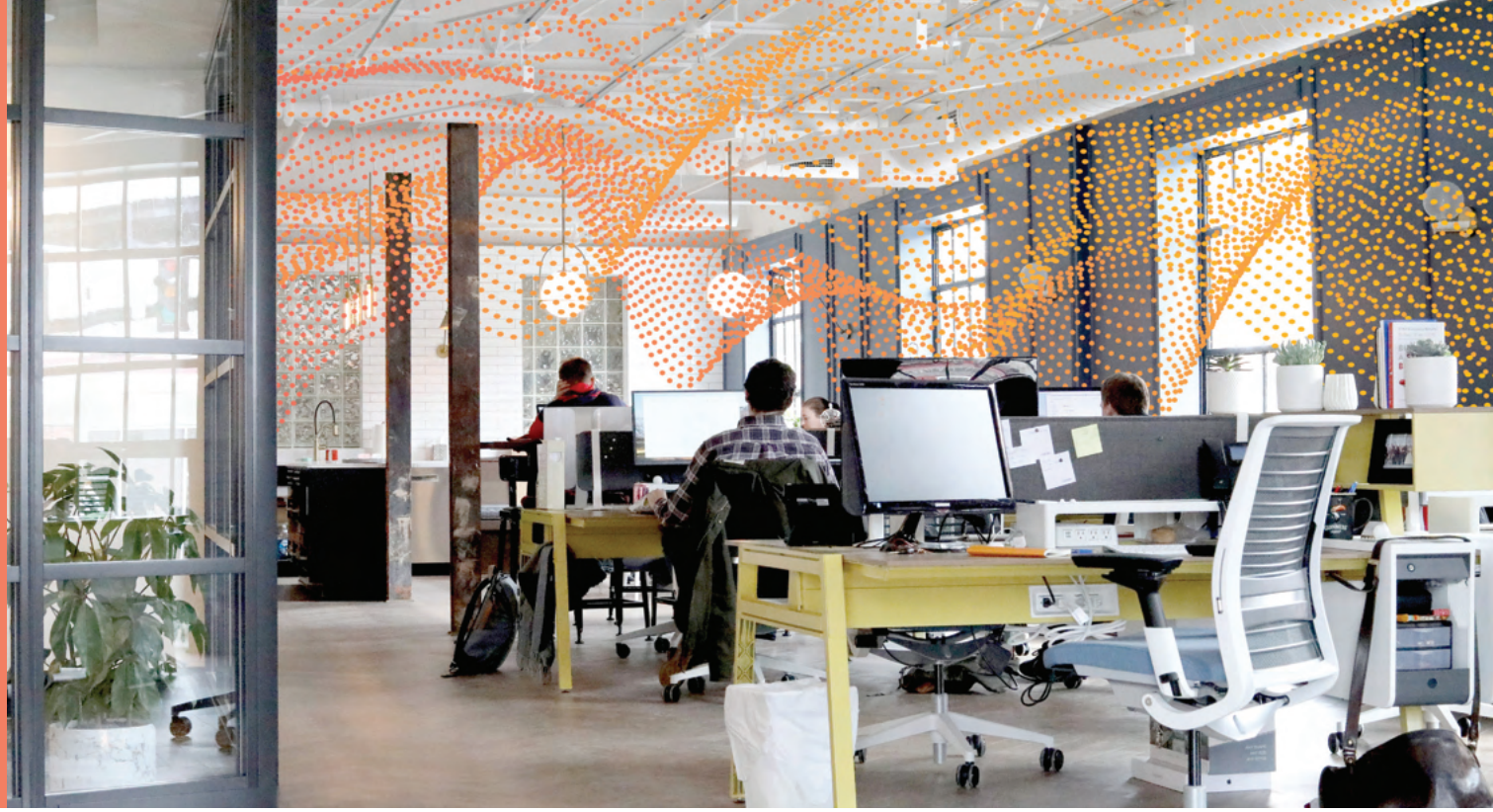
Now think about the noises people typically encounter indoors: machinery, notifications, construction. Humans are hard-wired to react negatively to these sudden, jarring sounds. Even if they consciously know they are not in immediate danger, these "mini-threats" subconsciously cause stress, distraction and trigger the body's fight-or-flight response.

It may be surprising to learn of another stressful sound: silence. Think back to human evolutionary experiences in nature when the cessation of birdsong signaled an impending threat. In today's workplaces that are so quiet staff can often hear a pin drop, the absence of sound becomes its own kind of disturbance. Silence is unnerving. With lower occupancy levels, it is a growing issue in workplaces.

Silence is very different from quiet. Quiet — taken here to mean the absence of human-generated noise — can restore; enable deep focus; give space to think, wonder and create. The forest might be quiet, but not silent. The bluffs near the ocean with the inhalations and exhalations of distant waves are quiet, but not silent.
People still positively respond to the sounds of nature, even when they are introduced into the built environment. Introducing these "safe" natural sounds indoors through soundscaping can reduce physical symptoms of stress, reduce psychological anxiety and encourage positive emotions of safety and comfort.

The human need for social connection

Social connection is a double-edged sword when it comes to sound in workplaces.



Humans are inherently social beings and find speech almost impossible to ignore. Despite humans' need for social connection, overheard conversations are the most complained about sound in offices. When people are distracted by someone else's chatter, they do not have enough mental bandwidth left to focus on their own thoughts and work. This innate response to sound causes frustration and degrades productivity.

Workplace sound also affects the quantity and quality of social connections. Not only does silence unnerve people; it also hinders collaboration. People hold back on talking to one another to avoid disturbing their neighbors or being overheard.

Workplace designers are then faced with the unenviable task of creating environments with enough background sound that people feel comfortable collaborating, while also minimizing speech distractions for people who are trying focus.

Natural soundscaping can be an antidote to both problems. The sounds of water -- like a flowing river -- can be engineered to mask speech very effectively. The addition of this soundscaping into a workplace reduces the intelligibility of overheard conversations, making them far less distracting. And in turn, these natural soundscapes ensure that spaces are never eerily silent and allow people to feel comfortable talking to one another. Natural sounds can even bring a sense of life to empty offices. Researchers found that hearing birdsong in empty spaces creates a sense of social presence. They believe it is because birdsong has many complex characteristics, just like human speech, and therefore signifies intelligent life and helps people feel less alone.

The human need for sense of place

People have an innate need to establish ownership over spaces. Evolutionary, this gave a sense of security. Thus, feeling "at home" and being connected to surroundings is important for human health.

Someone's relationship with a place can take many forms. The connection might be an emotional one -- people are familiar with their sensory surroundings and are emotionally invested in them. Or they could think about the relationship from a physiological perspective -- people's bodily rhythms are in sync with the cadences of the natural world.

Circadian rhythms (internal biological clocks) help humans function normally and healthily, alerting, among other things, when it is time to wake up and move or slow down and relax. Most people know that light can

regulate these rhythms, but sound plays an important role, too. Natural sounds that are characteristic of different times of day, like an early morning dawn chorus, can trigger circadian rhythms. Natural soundscaping that changes over the course of a day can therefore create a physiological connection to place in the built environment, and pairs well with circadian lighting systems.

Consider too, how distinctive regional natural sounds can link a building to its geographic surroundings or amplify interior design concepts. Nature is more restorative when our senses are aligned.

The human need for choice and control

People need a sense of control over their environment. Researchers argue it is essential for well-being, from both a psychological and a biological perspective. Historically, being able to make choices about the places we inhabited contributed to a healthy sense of personal autonomy and allowed us to adapt and solve problems.

Giving people control over their environment in workplaces increases satisfaction. Sound is no different — there is no one size fits all. Natural sounds are far less subjective than music and are beneficial for most people. But there is no one sound or soundscape that will benefit everyone equally all the time. In the workplace, people perform different tasks, and they have different personalities, preferences and ways and working. And consider the diversity of sensory sensitivity: neurodivergent employees respond differently to noise compared to neurotypical people -- typically they are hypersensitive to disturbances.

Sometimes it is possible to offer people direct control of the soundscape, for instance in smaller spaces, like meeting rooms or wellness rooms. In these spaces, people can use soundscaping technology to directly select the content that is right for them.

In larger shared spaces, implement a process of sensory zoning. A workplace should not sound the same across the building. There can be sonic options based on different work functions or to provide distinct levels of auditory stimulation. In one area the soundscape might be lively and dynamic, while in another it is calming and quiet. It is important to communicate with employees about the sensory options available to them. This approach of sensory zoning will help people understand their environment and choose areas that will best support them.

It's time to rethink workplace noise

The sound of offices should be characterized by far more than a decibel level. By learning from nature and harmonizing the soundscape to human biology, workplace designers can create environments that cater to people's fundamental needs from a sensory perspective. Nature-inspired, science-backed sound can create offices that are healthier, more engaging and better places to work. ●

This article by Evan Benway originally appeared in **IFMA Facility Management Journal.*

EXHAUST SYSTEM INTEGRATION OF CLASS II TYPE A2 VENTED BIOLOGICAL SAFETY CABINETS

By Matt Lemieux

Biological safety cabinets (BSCs) are ubiquitous in laboratories, cleanrooms, and many other research and production venues. BSCs are utilized as primary engineering controls (PEC). They are distinct from fume hoods and likewise from unidirectional (laminar) flow benches, and are tragically, all too often, mistaken as such by facilities planners, engineers, and end-users. Biological safety cabinets, designated as Class II by the regulatory standard, NSF/ANSI 49, differ from other primary engineering controls in that they provide three kinds of protection: (1) The personnel protection offered by a chemical fume hood, (2) the sterile work area provided by the unidirectional HEPA flow bench, providing product protection, and (3) the environmental protection offered by the HEPA filtered BSC airflow exhaust pathway.

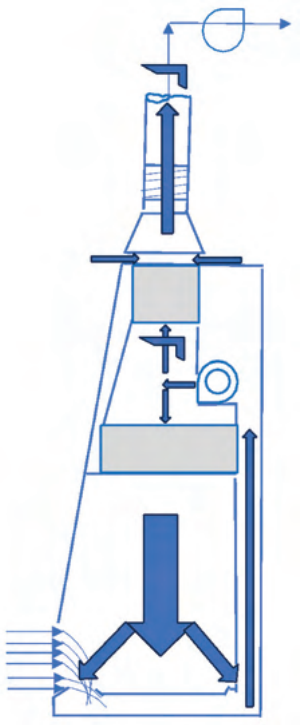
This complex, integrated engineered control is accomplished by clever design of the cabinet's internal plenums, work surfaces, discharge plenums, and ducted connections to building exhaust systems. Work surfaces are exposed strictly to HEPA-filtered sterile air and personnel work access openings are subject only to protective ambient room inflow velocities. These two airstreams only mix beyond the critical work areas in the cabinet's rear negative pressure plenum and a portion of the internal cabinet blower air–equivalent to the work access opening inflow for Type A cabinets–is exhaust through the cabinet's exhaust HEPA filter. BSCs are fixed sash height devices (unlike fume hoods), although they are equipped with slidable or hinged windows for product insertion, removal, and cleaning. When in operation and product manipulations are taking place, the hood sash is at a predetermined fixed elevation.

As a rule, Class II BSCs can be either self-contained and free-standing in the laboratory (Type A) or connected to building exhaust systems (Type B). A variation of type A can also connect to the building exhaust system – these are nominated as Class II, Type A2-vented. These BSCs were formerly designated as Class II Type A/B3. In this arrangement, the cabinet's internal HEPA-filtered exhaust discharges to a remote exhaust fan to provide additional environmental protection. The reason for opting for this installation configuration is because HEPA filters are limited in their filtering efficiency to discrete particulate matter, this building-connected installation is appropriate when volatile hazards or radioisotopes are used in small quantities as part of the product manipulations. Common applications for the Class II A2 Vented cabinets include isoflurane used for anesthetizing animals, volatile chemotherapeutic agents, combustion products, and small amounts of radioisotope vapors.

Figure 1 illustrates the airflow patterns inside a Class II Type A2-Vented BSC in an elevation cross-section.

With this design, the work access opening air quantity is discharged out through the exhaust HEPA where it joins with bypass room air to comprise the remote exhaust fan air quantity. A recirculation loop of HEPA-filtered air contained in the cabinet provides the sterile work surface conditions. The bypass air is normally induced into the canopy exhaust duct downstream of the cabinet exhaust and below the finished ceiling of the room. Class II Type A cabinets are colloquially known

Figure 1: Class II, Type A2 Vented Biological Safety Cabinet



as 70/30 cabinets, meaning 30% of the cabinet internal blower is induced and exhausted. However, newer cabinets are designed with less HEPA-filtered recirculation air and are closer to 50/50.

Equation 1 describes the airflow quantities for a canopy-connected Class II A2 – vented cabinet installation.

Equation 1:

$$Q_T = Q_I + Q_B$$

Where:
Q_T is the total cfm in the duct riser from the BSC.
Q_I is the work access opening cfm.
Q_B is the bypass cfm.

Current Problems

Accredited certifiers perform mandatory, routine certification on these cabinets. Among other tests, both HEPA filters must be integrity-tested with a handheld scanning probe and the work access opening inflow velocity must be verified within a stringent ±5 % of design. Additionally, with each certification cycle, the field certifier must verify the canopy airflow alarm system operation by manually blocking the canopy exhaust airflow. NSF/ANSI 49 Normative annex N.5 specifies the requirements for routine field certification, stating: *Containment loss of canopy connection on Type A1 or A2 cabinets – shall be tested at the time of alarm verification – introduce a visible medium source into the canopy air intake(s) while slowly reducing the exhaust volume until there is a loss of capture of the visible medium into the canopy air intake(s). The audible and visual canopy alarms shall respond within 15 seconds…*

Unfortunately for the field technician, there is frequently no installed provision for reducing the exhaust volume, as airflow dampers are a suggested installation feature. However, they are not mandated. The standard obliges the certifier to perform this test but often there is no adjustment provided to accomplish this. There *may* be a manual balancing damper above the secure finished ceiling or there may be a branch automatic valve under the authority of the facilities staff or third-party controls contractor. Decreasing the common fan speed is not a viable option, as it will cause all the other BSCs on this system to simultaneously alarm.

In the early days of laboratory design, these building-connected BSCs were directly coupled to 8", 10", or 12" galvanized ductwork – balanced to exhaust an air quantity equal to the work access opening inflow. This raised an issue with certification setpoints whereby if the exhaust system fluctuated or more likely, if there were multiple cabinets connected to a single remote blower, a change in one affected the others. So, if an operator shut off the cabinet blower or closed the window sash on one cabinet, as shown in Figure 2, the other connected hoods would inadvertently go out of certification tolerance. This recognized shortcoming led to a more enlightened design (as shown in Figure 1), whereby bypass air canopies are utilized so that ideally, the work access opening inflow velocity of associated cabinets would not modulate as one or more cabinets were modified. System variations would be absorbed by the canopy bypass air instead and the work access opening airflows would remain constant. On April 15th, 2016, the regulatory body, NSF/ANSI 49,

issued a memorandum reading, *"NSF Accredited field certifiers shall no longer certify either direct-connected Type A cabinets or canopy-connected Type A cabinets without alarms, even if specifically asked to do so by the customer."*

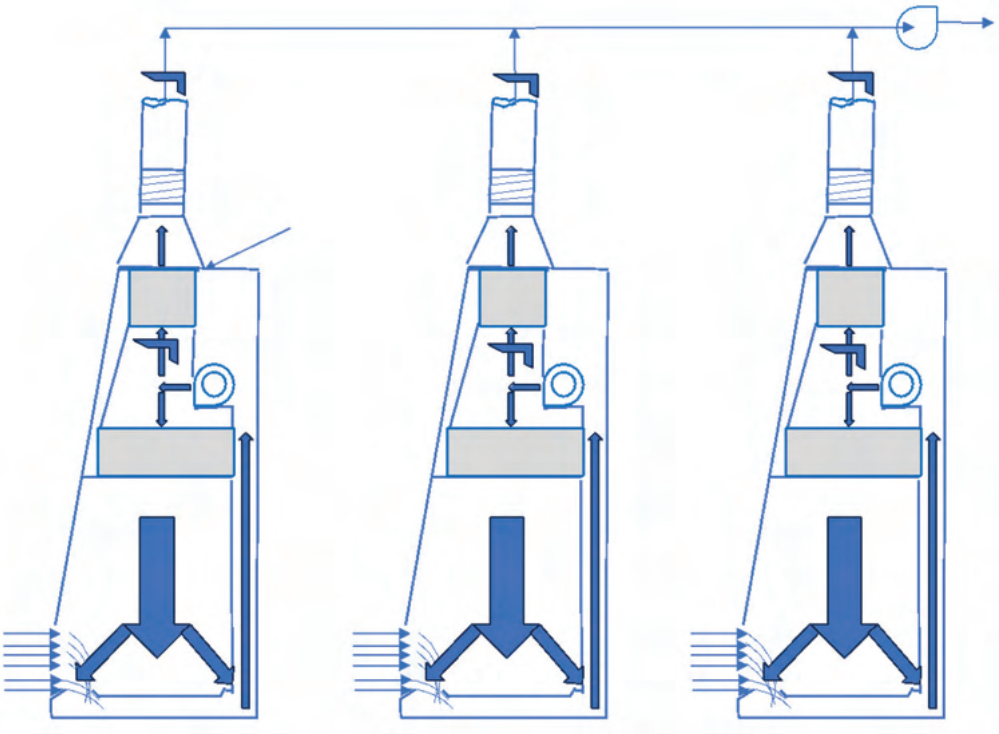
Figure 2 Shows the original configuration of multiple directly connected A2 vented cabinets.

Canopy duct connections were thus required on Class II, A2 Vented biological safety cabinets going forward. Prescribing this engineering solution to the problem, however, raises other collateral issues. The first issue is how much bypass air to exhaust. Further, how can the cabinet exhaust filter air, Q_I, be integrity tested for downstream challenge concentration when it is being diluted by the inrush of dilution room bypass air? How can the exhaust HEPA filter be integrity tested using a hand-held scanning probe without adequate access for the hand and arm of the technician? How can the work access opening airflow be measured in the duct if it is conjoined with the room bypass air? How is the duct pressure in the canopy transition regulated with widely varying exhaust and bypass air? Finally, how can the exhaust filter downstream surface be sealed with tape and plastic during planned biological decontamination efforts without adequate technician access openings and with the disruptive suction pressure and sideways turbulence caused by the canopy bypass?

Previously, when the cabinets were directly connected as in Figure 2, these incipient issues were preempted by optionally performing overall penetration testing (rather than scanning) of the exhaust filter, pitot-traversing the exhaust duct, and closing an airtight duct damper. NSF/ANSI 49 makes various suggestions for canopy installation including typical canopy connection duct pressures, flexible duct sections and accessible manual balancing dampers but does not, nor cannot, mandate these suggestions. The particular site configuration is subject to the whims of the design engineer and site installation contractor.

In a recent case study, we encountered a Q.A. laboratory having four of these Class II, Type A2 Vented cabinets sharing a common exhaust blower and hav-

Figure 2: Direct connected A2 cabinets with common exhaust system



ing four dedicated, adjustable CAV automatic air valves. When the branches were each balanced for the appropriate bypass CFM, the excess duct static pressure inside the BSC manufacturer-supplied canopy transitions was so high (negative) that it caused the cabinet ECM blower wheels to rotate backwards, and the motors did not have sufficient torque to overcome this imposition. Consequently, each time the cabinet blower switches were energized, after a few seconds, a blower failure alarm was indicated – preventing use of the cabinets.

Quite frequently it is impractical to perform a confident exhaust HEPA filter integrity scan on the downstream side of the exhaust filter due to the turbulent dilution of the inrushing bypass air. It is also incredibly challenging to seal the exhaust HEPA filter with tape and plastic when performing a decontamination without adequate work opening space and the ever-present danger of unintentionally sucking the 4 ft^2 sheet of plastic up through the exhaust duct.

In summary, NSF/ANSI 49 does require canopy connections on the Class II Type A2 vented cabinet installations. It also requires audible and visual alarms to indicate loss of capture of the exhaust HEPA filtered air, Q_I. Furthermore, the regulation requires that the field certifier routinely validates the operation of the loss of capture alarm by restricting the total exhaust duct air, Q_T. The regulation also prescribes that the exhaust HEPA filter be integrity tested at each certification. The standard also mandates that the exhaust HEPA filter be sealed airtight when the BSC is undergoing decontamination procedures. However, NSF/ANSI 49 limits its authority to the design, construction, performance, and certification of Class II cabinets. It can only inform and suggest critical aspects of the client site applications.

Therefore, what exactly is an HVAC duct canopy?

NSF/ANSI–49 is parsimonious in its requirements for a canopy. A canopy is *"A BSC exhaust connection where there are one or more openings or gaps in the connection between the BSC and the external exhaust system."* NSF/ANSI 49 also distinguishes between a canopy and a modified canopy installation as, *"Installation of any canopy other than a designated acceptable option for an NSF-listed biosafety cabinet."* NSF/ANSI 49 provides an informative annex discussing the canopy transition in which it indicates, *"This pressure should typically be 0.001 to 0.01 in w.g. at the canopy's connection to the exhaust system, depending on the canopy design, BSC exhaust volume, and possible obstructions around the canopy's openings."* Furthermore, NSF/ANSI 49 describes the canopy accordingly, *"In normal operation, the volume of room air drawn into the canopy connection's openings, gaps, or both, shall be sufficient to ensure the capture of all of the BSC's HEPA filtered exhaust, as verified by a visible medium."* Another prescription reads, "*The flow of room air into the canopy connection through openings, gaps, or both provides assurance of consistent BSC performance during fluctuations in exhaust system flow rate, room pressure, or both.*" Finally, the canopy must be designed such that, *"The measured (work access opening inflow velocity, V_I) shall be no more than 8 ft per minute below the lowest value of inflow velocity range stated on the cabinet data plate…"* when the facility exhaust system is blocked. Elsewhere, *"Inflow velocity shall not be reduced by more than 10 feet per minute after turning off the facility exhaust."* NSF/ANSI 49 provides a guideline for Q_T in its Informative appendix table I.1.1 as, *"If canopy connected, typically 100 CFM/ft of BSC width or less."* This guidance value is evaluated for adequacy herein. We will examine the above guideline to see if it satisfies all the engineering design constraints of canopy connections.

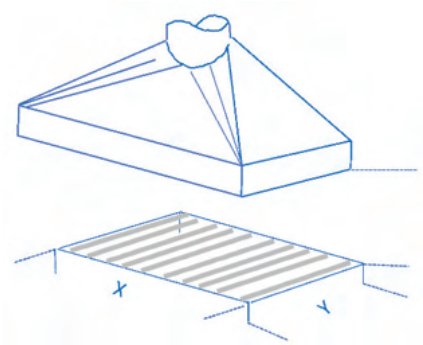
NSF/ANSI 49 utilizes the phrase *"properly designed canopy connection"* and it is this very concept that we will explore.

The canopy concept for Class II A2 hoods intended to be building-connected was originally referred to as a thimble connection or a loose-duct connection. With the development of more enlightened laboratory engineering, the term canopy came to be used to represent this type of installation. The word canopy has an interesting etymology. It comes from the ancient Greek root word, κανοπσ – /'kanəps'/, meaning mosquito. The Greek noun κανοπε, pronounced canopy, came to mean mosquito bed netting. The American Institute of Architects defines a canopy as "an overhead roof or structure over which fabric or metal cover is attached

able to provide shelter." A canopy is distinct from an awning, which is a cantilevered cover attached to the building, because the canopy can be suspended or free standing.

Figure 3 illustrates a canopy connection as envisioned by the Industrial Ventilation Handbook.[1]

Figure 3: Canopy Connection



With this nomenclature, Equation 2 gives the total perimeter, P, and Equation 3 yields the cross-sectional bypass area, A_B. X and Y are the nominal dimensions of the exhaust HEPA filter.

Equation 2:

$$P = 2 * x + 2 * y$$

Equation 3:

$$A_B = P * D$$

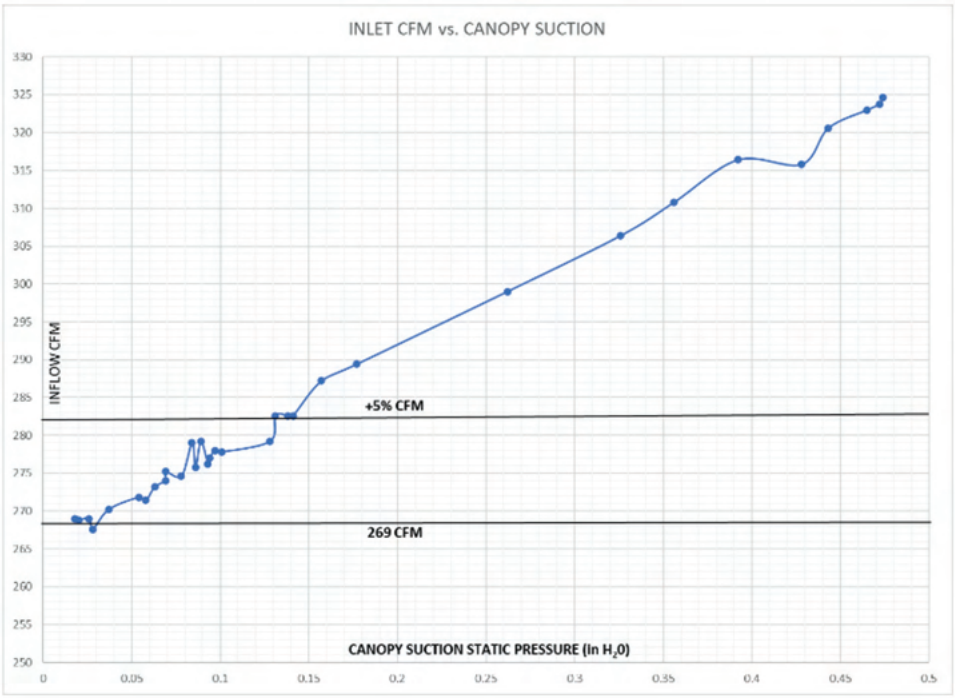
Equation 4 gives the bypass CFM (Q_B) as a function of area and velocity, V_B, where K_V is an empirical, dimensionless correction factor.

Equation 4:

$$Q_B = A_B * V_B * K_V$$

Our internal laboratory research at VTG, LLC. characterizes the variation (loss of constancy) of work access opening inflow, Q_I, at various canopy suction pres-

Figure 4



1 Adapted from Fig. 4-4 of *Industrial Ventilation Handbook – A Manual of Recommended Practice*, American Conference of Governmental Industrial Hygienists (ACGIH)- 19th edition 1986.

sures. Figure 4 shows the loss of constancy occurring at approximately 0.012" H_2O. This value is substantially in agreement with the suggestions found in NSF/ANSI 49: *This pressure should typically be 0.001 to 0.01 in w.g. at the canopy's connection to the exhaust system.*

This increased exhaust airflow phenomenon occurs because by reducing the downstream static pressure on the exhaust HEPA filter, the pressure drop (Δp) increases on the exhaust HEPA filter and augments the resultant airflow.

Based on the assumption that 100 CFM/ft. of cabinet width is an adequate exhaust quantity, Figure 5 tabulates the calculated canopy slot height (nominal), D, based on common exhaust filter perimeters at the minimum and maximum allowable canopy suction pressure (0.001 in H_2O – 0.012 in H_20) for 8-inch and 10-inch work access opening sash heights for nominal 4-, 5- and 6-foot wide BSCs. With a nominal inflow velocity work access opening of 105 fpm, this table recommends between approximately 15 - 45% bypass flow beyond the work access opening inlet flow. Each installation is going to have a maximum available branch/valve CFM to service that IIA2 Vented BSC. The net canopy bypass CFM is described by Equation 1. The work access opening CFM, Q_I, must be maintained ±5% during operation for the BSC to remain certified.

The table values are consistent with the NSF/ANSI 49 table I-1.1 guideline of: ≤ 100 CFM/ft. A coefficient of entry loss factor, C_e = 0.7 is assumed for conversion of suction pressure to canopy cross-section inlet velocity, V_B.

The range of canopy slot access openings is between 0.4 inch and 3.7 inches. This coincides with a range of between 18 - 49% above Q_I. These heights are based on the nominal perimeter, P_N, of the exhaust HEPA filter and, in practice, would need to be increased to accommodate the physical open perimeter of the canopy transition including the support frame, spacing or any sliding panel openings to realize the actual perimeter opening, P_A.

Equation 5 describes the relationship between velocity and velocity pressure.

Equation 5: Velocity/Pressure Conversion

$$V = 4005 * C_e * \sqrt{VP}$$

Where:
V is velocity (fpm).
VP is velocity pressure (in H_2O).
C_e is a dimensionless, empirical energy conversion loss coefficient. ($0 < C_e < 1.0$)

Equation 6 expands upon Equation 5 to incorporate volumetric flow, Q, and area A, under a static pressure potential.

Equation 6: Effective Leak Area

$$ELA = \frac{Q'_B}{\frac{2610}{144} * \sqrt{SP} * C_e}$$

Figure 5: Canopy slot elevations (D)

	Work access opening area (ft^2)	Work access opening inflow @ 105 fpm (CFM)	Maximum total tempered air loss per NSF/ANSI Table I-1.1 (CFM)	Net bypass canopy tempered air loss from Eq. 1 (CFM)	Percent of work access opening airflow in canopy bypass (%)	Typical maximum exhaust HEPA perimeter standard models (ft)	**Canopy D @ 0.001" duct static (Ce=0.7) (inches)**	**Canopy D @ 0.012" duct static (Ce=0.7) (inches)**
Nominal 4' Hood 8" Sash	2.56	269	400	131	49	6.0	**3.0**	**0.9**
Nominal 4' Hood 10" Sash	3.12	328	400	72	22	6.0	**1.6**	**0.5**
Nominal 5' Hood 8" Sash	3.22	338	500	162	48	7.0	**3.1**	**0.9**
Nominal 5' Hood 10" Sash	4.03	423	500	77	18	7.0	**1.5**	**0.4**
Nominal 6' Hood 8" Sash	3.89	335	600	265	44	9.7	**3.7**	**1.1**
Nominal 6' Hood 10" Sash	4.86	510	600	90	18	9.7	**1.3**	**0.4**

Where:
ELA is effective leak area (in^2)
SP is static pressure potential (in H_2O)
Q'_B is the airflow quantity flowing out of the canopy transition into the room (CFM)

Suggested Solutions

The engineering design constraints for a properly designed canopy connection is summarized below:

1. Maintain cabinet bypass velocity, V_B, (fpm) under normal operating conditions accordingly: $88 \leq V_B \leq 307$. This is the resultant velocity with canopy duct static pressure P_C (in H_2O), $0.001 \leq P_C \leq 0012$, with a $C_e = 0.7$, to maintain capture phenomenon.[2]
2. Provide, under normal operating conditions, a sufficiently large enough cross-sectional area (ELA), A_B, such that in the event of exhaust failure, Q_I, is maintained adequately large enough to ensure that V_I is not below (92 fpm). Where V_I is the velocity at the work access opening.
3. Maintain consistent work access opening velocities, V_I, ± 5 fpm under varying exhaust system static pressure conditions.
4. Provide an audible and visual alarm strategy which indicates both when the canopy pressure is too high (more positive) to indicate loss of capture as well as too low (more negative) to indicate loss of certification tolerance at V_I.
5. Enable adequate clearance space for exhaust HEPA filter integrity testing during routine certifications.
6. Enable the certification technician to reduce the exhaust air volume, Q_T, both when performing the site installation alarm verification and when performing the exhaust HEPA filter integrity testing without affecting the adjacent facility space.
7. Enable the certification technician adequate space and ability to block the exhaust suction to reliably seal the exhaust HEPA filter with tape and plastic during the decontamination process.

Our internal VTG research mentioned above, also discovered that the maximum achievable positive static pressure, downstream of the exhaust filter, in a sealed duct (simulating exhaust fan failure) was approximately 0.05" H_2O produced by the internal cabinet blower. If we revisit Figure 5 with the additional condition detailed in design constraint #2 and the application of Equation 6, we produce a modified list of canopy slot heights, D as shown in Figure 6.

Figure 6: Canopy slot elevations (D)

	Work access opening area (ft^2)	Work access opening inflow @ 105 fpm (CFM)	Work access opening inflow @ 92 fpm (CFM)	Typical maximum exhaust HEPA perimeter standard models (ft)	Canopy D @ 0.001" duct static from Figure 5 (Ce=0.7) (inches)	Canopy D @ 0.012" duct static from Figure 5 (Ce=0.7) (inches)	**Canopy D from effective leak area (ELA) (Ce = 0.7) SP = +0.05" H_2O (inches)**
Nominal 4' Hood 8" Sash	2.56	269	235	6.0	3.0	0.9	**1.2**
Nominal 4' Hood 10" Sash	3.12	328	287	6.0	1.6	0.5	**1.4**
Nominal 5' Hood 8" Sash	3.22	338	296	7.0	3.1	0.9	**1.2**
Nominal 5' Hood 10" Sash	4.03	423	371	7.0	1.5	0.4	**1.6**
Nominal 6' Hood 8" Sash	3.89	335	358	9.7	3.7	1.1	**1.1**
Nominal 6' Hood 10" Sash	4.86	510	447	9.7	1.3	0.4	**1.4**

2 A canopy pressure range of 0.001" – 0.010" H_2O is assumed for this article in view of consistency with the NSF/ANSI 49 recommendations. Some BSC manufacturers recommend other canopy pressures (-0.05" H_2O). The internal cabinet exhaust airflow damper can be adjusted to accommodate any negative canopy pressure to maintain Q_I & V_I. There may be a problem with cabinet blower start up in the presence of high negative canopy pressures, however.

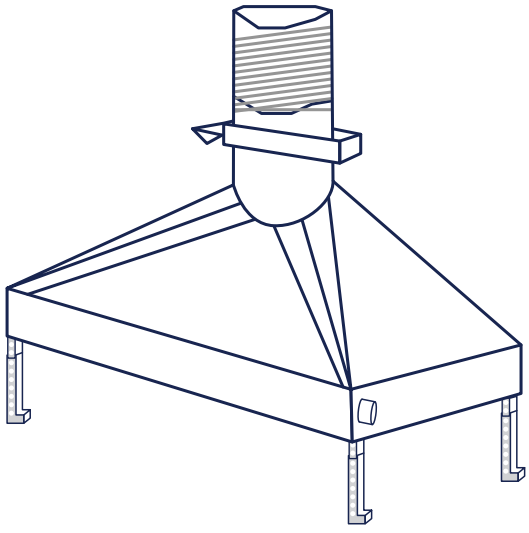
The actual canopy opening elevation, D_{MAX}, should be taken from Figure 6. The associated Q_B should be sufficient to achieve at least 88 fpm inflow at D_{MAX}.

To provide a properly designed canopy connection four modifications should be specified. (1) Provide a suspension system and/or adjustable slot to maintain the appropriate slot opening elevation, D. (2) Provide a bi-modal positioning mechanism for uplifting the canopy assembly to allow for HEPA filter integrity scanning and decontamination access. (3) Include a blast gate or other adjustable airflow damper device to allow for site installation assessment during certifications. (4) Provide an alarm system to monitor both hi-negative and low-negative (positive) pressure.

Figure 7 illustrates a suggested conceptual properly designed canopy connection.

By including a mandatory blast gate damper in the throat of the canopy round duct, two incipient issues are rectified. This allows the technician agency to verify the alarm operation without affecting other BSCs in the facility. Without the tools to do so, it is unreasonable for NSF/ANSI 49 to mandate the alarm operation as a portion of the routine field BSC certification, burdening the certifiers with an impossible task. Incorporation of an integral blast gate, coupled with adjustable height mounts facilitates exhaust HEPA filter integrity scanning and enables decontamination sealing and taping. The installed alarm is adjusted to alarm at low pressure (highly negative, i.e., ≤ -0.012" H2O) and may incorporate a sail switch to indicate positive canopy duct pressure. At a minimum, the canopy positioning must be bimodal for normal operation and for service, certification, and maintenance. While NSF/ANSI – 49 does not have the authority to mandate such a device, it is incumbent upon the manufacturers who are already providing their own canopy designs to incorporate these suggestions. ●

Figure 7: Properly Designed Canopy Connection



The NEBB Learning Center: Your Online Training Destination

By Samantha Hawa

If you haven't created an account with the NEBB Learning Center (NLC), or accessed one of the many online courses, today is the day to go to the NLC! Simply visit www.nebb.org/nlc to get started now. It is free to create an account and you will be able to choose from over 35 courses that cover all of NEBB's disciplines, like BET, Cx, CPT, FHT, S&V, and TAB, along with information on the Young Professionals Network (YPN).

The NLC offers a wide variety in terms of free courses versus courses with a minimal fee. Even better, 27 of those courses provide continuing education credits (CECs) right from the comfort of your own office or home! Since the NLC was launched in 2021, there has been a combined access of over 5,276 users with some taking multiple courses.

One new feature on the NLC Dashboard is the video from the Robert B. Gawne Training and Education Center Grand Opening in late 2023 in Gaithersburg, MD. Take a look and see 2023 NEBB President Phil Emory give his dedication speech along with members of the Gawne family.

Overall, the NLC has generated a lot of praise since its launch. Nick Uffelman, President of Holistic Test and Balance shared his positive feedback on the NLC with, "Hi all, just wanted to drop a line saying how great the Learning Center is. I had an employee who has been trying to pass the CT exam. We used the old study course for the longest time until we found out about the learning center. We purchased the TAB technician seminar and he really focused on studying from that

information for a good while. He finally passed the exam this past Saturday. Just wanted to share that news. Hope the learning center keeps expanding–especially for technicians. It's been a great resource!!"

Everyone in the NEBB community is encouraged to explore the NLC. Anyone with questions concerning the NEBB Learning Center can direct them to Samantha Hawa, NEBB Online Training Coordinator at samantha@nebb.org.

We are constantly adding new courses and features, and invite you to start learning with the many courses available, such as those listed below:

Free Courses on the NLC:

- **NEBB Fume Hood Procedural Standard for Fume Hood Performance Testing: VAV Response Time** (.5 CEC): This presentation details the test procedures for performing the VAV Speed of Response and Time to Steady State Testing in accordance with NEBB Procedural Standard for Fume Hood Performance Testing.
- **YPN Happy Hour** (1 CEC): The NEBB YPN Happy Hour introduced the YPN Committee, gave attendees some lessons from the committee along with the sharing of some war stories.
- **CPT Test Your Knowledge:** As additional Study Material for your CPT Discipline, we have created fun and free flashcards for you to Test Your Knowledge.
- **S&V Test Your Knowledge:** As additional Study Material for your S&V Discipline, we have created fun and free flashcards for you to Test Your Knowledge.
- **TAB Test Your Knowledge:** As additional Study Material for your TAB Discipline, we have created fun and free flashcards for you to Test Your Knowledge.
- **YPN Test Your Knowledge:** To learn more about the YPN, we have created fun and free flashcards for you to Test Your Knowledge.
- **TAB Pump Curves:** Learn the basics of reading pump curves including how to plot the testing points of no-flow "deadhead" readings, full flow, and determining impeller sizes.

- **Cx Electrical Systems Technology** (.5 CEC): In this presentation, learners will be introduced to the basics of electricity and its application in the construction industry. Electrical definitions and formulas are presented and applied to real-world examples that learners may encounter when working in the field. The presentation concludes by summarizing how electricity is distributed throughout the power grid and supplied to commercial buildings and residences.

- **NEBB Standards for Reports and Forms** (1 CEC/ 1 AIA LU): This presentation is intended for NEBB Certified Professionals and NEBB Certified Technicians and represents the format as well as required information necessary to produce a NEBB compliant report.

- **Designated Certified Professional Individual and Firm Recertification Attestation Tutorial:** This tutorial is for the Designated Certified Professionals (DCP) completing their Individual Recertifications and must complete the Firm Recertifications.

- **Certified Professional Recertification Tutorial:** This tutorial is for Certified Professionals (CP) who need to complete their Individual Recertifications.

- **Certified Technician Recertification Tutorial:** This tutorial is for Certified Technicians (CT) who need to complete their Individual Recertifications.

- **TAB Equations for Calculations and Study:** From basic mathematics to TAB Formula Equations, this training covers it all. Every NEBB TAB Formula is covered including rearranging equations with step-by-step instructions. This TAB Mathematics is the first step in your NEBB training.

Courses with a fee on the NLC:

- **Conditions That Could Affect Fume Hood Performance** (0.5 CEC) $50: This presentation discusses the effects that improper planning and other room conditions could affect the performance of a chemical fume hood. We discuss what a fume hood is, the different types, a brief rundown of ASHRAE 110 testing and the processes of testing the performance of a fume hood, and how outside factors can have an adverse effect on the lab space and fume hood performance.

- **Velocity Variations** (0.5 CEC) $50: As a TAB Professional, have you ever done a project involving Fume Hoods and had discrepancies with the Fume Hood Testing Contractor? As a Fume Hood Testing Professional, have you ever tested a Fume Hood and the face velocity doesn't match the TAB report? Dive into the different approaches that Test/Adjust/Balance (TAB) and Fume Hood Performance Testing (FHT) Professionals might use on the same project, and why these differences don't necessarily signal a deficiency.

- **Room Pressurization** (1.5 CEC) $150: Learn proper room pressure recording format. Avoid unintentional documentation pressure reversals. Understand the distinction between door differential pressures and room vs. ambient pressures and their interrelationship. Perform pressure cascade calculations. Calculate pressure differentials between unconnected rooms. Determine negative and positive pressure room relationships. Identify executable room pressure relationships. Units' system independent learning approach, no conversions required.

- **Relative Standard Deviations** (0.5 CEC) $50: Learn standard deviation calculations, gaussian (normal) distributions and normal probability distributions. Distinguish between relative and absolute standard deviations. Interpret data sets and find arithmetic mean, mode, & median of a data set. Learn the difference between sample standard deviation and population standard deviation. Make inferences from a data set. Learn to manipulate student-t size samples.

- **TAB Fan Laws, Pump Laws and Tip Speed** (1 CEC) $100: TAB Fan Laws: The Fan Laws Module will cover the Fan Affinity Laws #1 through #5 and discuss their application to HVAC System Testing, Adjusting and Balancing. The module will also provide practical working

examples of each Fan Law. TAB Pump Laws: The Pump Laws Module will cover the Pump Affinity Laws #1 through #3 and discuss their application to HVAC System Testing, Adjusting and Balancing. The module will also provide practical working examples of each Pump Law. TAB Fan Tip Speed: The Fan Tip Speed Module will discuss what Fan Tip Speed is and its relationship with Fan Classification which dictates how fan are made. The module will discuss their applications to HVAC System Testing, Adjusting and Balancing. The module will also provide practical working examples of Fan Tip Speed.

- **Design Phase Concepts of Building Enclosure Testing** (.5 CEC) $50: Air Barriers: This module will discuss various types of air barrier systems, the installation requirements for these systems, the details on the architectural drawings highlighting air barrier systems and some of the issues you will see as the result of poor installation. Design Review: This module will discuss design review of an air barrier system. The design review focuses on cross section drawings, floor to wall details, wall to roof details and penetration details. Test Zones: This module demonstrates how to determine the test area boundaries and how to calculate the related parameters required to perform a Building Enclosure Test.

- **Testing, Adjusting and Balancing (TAB) Technician Seminar** (12 CECs) $600: Building owners and tenants are concerned that environmental performance of buildings must be optimal while operating costs should be minimal. These goals can only be accomplished when a building's HVAC and hydronic systems are properly balanced. Three major steps used to achieve the proper operation of the HVAC and hydronic systems and a desirable climate are testing, adjusting, and balancing (TAB). This Seminar is Designed for: Entry-level professionals who are interested in advancing their knowledge in HVAC and TAB work considering an extensive review to enhance their technical education; Other Professionals interested in learning about TAB; Qualified Candidates for the NEBB TAB Certified Technician.

- **A Walk-Through BET Procedural Standards** (1 CEC/1 AIA LU/HSW) $25: This includes 4 modules: (1) Introduction to BET: This module provides a high-level review of building enclosure testing and its importance to the construction industry; (2) BET Equipment & Instrumentation: This module outlines typical instrumentation requirements for performing building enclosure testing.; (3) BET Project Team: This module highlights the key individuals and responsibilities that make up a successful project team for building envelope testing; (4) BET Testing Standards: This module outlies the following building enclosure testing standards: NEBB Procedural Standards for BET, USACE Protocol, ASTM E779, ASTM E1827, ASTM E1186 and ASTM C1060.

- **S&V Review of Logarithms: Use of Logs in Sound and Vibration** (1 CEC) $50: This course provides participants with the basic understanding of how logarithms are used in sound level measurements. Specifically, this course provides the participant with the necessary basic mathematical understanding to remove background sound levels from equipment sound levels so that Noise Criteria and Room Criteria ratings can be calculated.

- **NEBB TAB Pre-Field Report Preparation Exercise Module** (1 CEC) $325: This course provides comprehensive instruction concerning the requirements and formats needed to write a NEBB Certified Testing, Adjusting and Balancing (TAB) Report. NEBB Procedural Standards and the usage of NEBB Certified TAB Report forms and formats are discussed in detail. Successful completion of this course helps to prepare the student for NEBB Certification.

- **NEBB TAB Report Error Finding Exercise Module** (1 CEC) $325: It is the job of the TAB Certified Professional to control the quality of the TAB work and TAB reports. This course provides comprehensive instruction in the methods and procedures recommended by NEBB to insure an accurate and error free Testing, Adjusting and Balancing (TAB) Report. NEBB Procedural Standards and the usage of NEBB Certified TAB Report forms and formats are discussed in detail. Successful completion of this course helps to prepare the student for NEBB Certification.

- **2022 NEBB Annual Conference - Flow Hydraulics and Their Effect on Ultrasonic Flow Meters** (1 CEC/1 AIA LU) $100

- **2022 NEBB Annual Conference - TABopts Reporting with NEBB Compliant Forms** (1 CEC/1 AIA LU) $100

- **2022 NEBB Annual Conference - Life Science Enclosures: A Review of Types, Operation, Requirements** (1 CEC) $100

- **2022 NEBB Annual Conference - Capture Hood Errors Associated with Commercial Diffusers** (1 CEC/1 AIA LU) $100

- **2022 NEBB Annual Conference - Sound & Vibration in the Building Commissioning Process** (1 CEC/1 AIA LU) $100

- **2023 NEBB Annual Conference – It's All About Containment and Seeing is Believing** (1 CEC/1 AIA LU) $100

- **2023 NEBB Annual Conference – How Employee Engagement Drives Growth** (1 CEC) $100

- **2023 NEBB Annual Conference – Achieving Optimal Performance: Understanding Hydronic Balancing, Pump Optimization, and Balancing Strategies for Efficient Hydronic Systems** (1 CEC) $100

- **2023 NEBB Annual Conference – Improving Work Relationships** (1 CEC) $100

- **2023 NEBB Annual Conference – Proper Usage and Limitations of Air Flow Capture Hoods** (1 CEC/1 AIA LU) $100

- **2023 NEBB Annual Conference – The Challenge with The Challenge** (1 CEC) $100

- **2023 NEBB Annual Conference – Cleanroom Air Change Rate Optimization with VisionAir Clean** (1 CEC/1 AIA LU) $100

The NEBB TOOLBOX

By Jeff Schools

Instrument Verification and Recertification for the 2024 Cycle

This is the second year of using Instrument Verification during the recertification cycle, and it has run smoothly again. The key to this success is that most of the firms populate their instrument submission ShareFile early in the process. Not all, but most. We will always have the ones who put things off until the last minute.

Starting early allows ample time for the Chapter Technical Director and their committee to review each submission, finalize the review, and send it back to me as "meets the requirements," or work with the firm until it does. I am very thankful for the Chapter Technical Committee Chairman and Chapter Coordinators who assist in making this process as seamless as possible.

In this most recent cycle,127 NEBB Certified Firms were randomly selected and informed that during recertification their firm had been selected for instrument verification. Once a firm is selected, it has 30 days to submit documents to ShareFile for review. The local NEBB chapter then has 45 days to review the submission. (For more information on this, see the Toolbox article in the 2023 Q4 Edition of *The NEBB Professional*.)

When a firm is not selected, the Designated Certified Professional (DCP) for each discipline the firm holds will attest to meeting the instrument requirements and sign the firm Code of Ethics and Arbitration Agreement when paying their annual fees, in addition to submitting their recertification, annually, via Certelligence.

Recertification opens every year on August 1st and runs through December 31st. This gives all NEBB Firms, NEBB Certified Professionals (CPs) and NEBB Certified Technicians (CTs) five months to complete the process.

After January 1st, a late fee will be assessed. It will be $150 for a firm, $50 for a CP and $25 for a CT. After February 1st,, a second late fee is assessed and compounded. It will be $250 for a firm, $100 for a CP, and $50 for a CT. After March 1st, a third late fee will be assessed and compounded: $350 for a firm, $150 for a CP, and $75 for a CT.

If recertification is not completed by April 1st, the firm, CP, or CT will be suspended until their late fees and reinstatement fees have been paid. The reinstatement fees are as follows: $1,000 for a Firm, $100 for a CP, and $50 for a CT. If a firm, CP, or CT does not complete recertification by July 1st, they will be automatically decertified.

This is why it's a great idea to start your recertification early. As I stated before, it starts on August 1st and runs through December 31st. That's FIVE months before the late fees kick in. And nobody likes late fees, especially when they can be avoided. ●

Q&A

NEBB Across the Generations

Since 1971, NEBB has been serving firms and individuals that deliver high performance buildings and systems. As the premier international certifying association in the building industry today, NEBB thrives as a result of collaboration across various generations that all bring different experiences and perspectives to the table. We sat down with NEBB President-Elect Michael Kelly to discuss his personal journey with NEBB below:

The NEBB Professional (NP): What generation do you identify with?
Michael Kelly (MK): I am the youngest Baby Boomer

NP: How did you initially get involved with NEBB?
MK: In 1990 I attended the 2nd Cleanroom Seminar NEBB ever offered and I obtained my certification that year. It was 35 years ago, but I remember that week like it was yesterday. Getting a certification was new to the cleanroom industry and it was an opportunity to gain knowledge and to market to our customers the value of the NEBB certification.

NP: What made you want to get more involved?
MK: In 2006, NEBB was starting a new discipline for Fume Hood Testing and I was asked to serve on the committee. I found it an honor and that is when my volunteering started. It was an opportunity to work with the leaders in my industry (Cleanroom and Fume Hood) and others in industries I work closely with (TAB and Commissioning).

NP: What NEBB committees or positions have you been involved with?
MK: I have served as the FHT Committee Chair, EDC Chair, Board of Directors, EFC, and I am currently the President-Elect.

NP: Was it difficult to find the time to volunteer with NEBB?
MK: There never seems to be enough hours in the day for work, family, and a little relaxation, so to add

volunteering into the equation can be overwhelming. Time management is obviously the key to not losing my sanity, but I truly enjoy my time with NEBB so that makes it easy.

NP: How do you feel your involvement with NEBB has been an investment in yourself and your career?

MK: I have learned so much from the people that I have had the opportunity to work with within this organization which is invaluable, not only professionally, but also personally. There is a lot of in-depth discussion in the conference room, but some of the most valuable conversations are in the hallway or over dinner in a relaxed atmosphere. Working with NEBB has given me the opportunity to learn from past Technical Directors David Bevirt and Andy Nolfo, which is something I will never forget.

NP: What would you like to see for the future of NEBB?

MK: I would like to see NEBB continuing to be at the forefront of the industry. The opening of the Robert B. Gawne Training Center allows for more hands-on training at our seminars and we need to stay on top of all technology advancements. I would also like to see the continued success of our young professionals, and see them grow within the organization to become our next group of leaders.

NP: How do you see NEBB transforming in years to come?

MK: Again, staying on top of all technology advancements, as well as all disciplines by producing the best Procedural Standards and Seminars to continue the be the leaders in the industry. We all want NEBB to continue to be the premier certification association.

NEBB's Certified Professionals are the industry leaders and we need to continue to get them active in the organization. NEBB was built on its volunteers, and we currently have a talented group, but we need to recruit the next generation to keep NEBB as the premier certification association. ●

Phoenix Rising: Embrace the Spirit of the Southwest

By Kerri Souilliard

Nestled in the heart of the Sonoran Desert, Phoenix, Arizona, is a testament to resilience, innovation, and the allure of the American Southwest. With a rich history dating back centuries, this vibrant metropolis has evolved from a humble agricultural community to a bustling urban center, earning its reputation as the Valley of the Sun. From its soaring skyscrapers to sprawling desert landscapes, Phoenix captivates visitors and residents alike with its unique blend of natural beauty, cultural diversity, and cosmopolitan charm. Read on to get a glimpse of what you can expect when attending the 2024 NEBB Annual Conference in Phoenix this fall:

Resourceful Beginnings

Long before the first settlers arrived, the land that would become Phoenix was inhabited by indigenous groups, such as the Hohokam, who built an extensive irrigation system that sustained their civilization for centuries. In 1868, Jack Swilling, a former Confederate soldier, recognized the area's agricultural potential and founded a small farming community in the Salt River Valley. This settlement, known as Swilling's Mill, laid the groundwork for the future city of Phoenix.

Fueled by the discovery of gold and silver in the nearby mountains, Phoenix's population continued to grow and the city emerged as a hub of commerce and industry. The arrival of the railroad in the 1880s further accelerated its growth, transforming it into the capital of the Arizona Territory in 1889. Over the decades that followed, Phoenix weathered economic booms and busts, but its spirit of resilience never wavered. As the fifth-largest city in the United States today, it serves as a testament to the tenacity and vision of its inhabitants.

The Modern Oasis

Phoenix's allure lies not only in its storied past, but also in its vibrant present. The city boasts a thriving economy, fueled by industries ranging from technology and healthcare to tourism and aerospace. Skyscrapers dot the downtown skyline and their sleek facades reflect the brilliance of the desert sun. Pockets of natural beauty like the iconic Camelback Mountain and the tranquil Desert Botanical Garden contrast the city center.

What sets Phoenix apart is its unique blend of cultural influences, shaped by centuries of migration and settlement. The city's vibrant arts scene showcases the creativity of its residents, with galleries, theaters, and museums celebrating everything from Native American heritage to contemporary innovation. Immerse yourself in Phoenix's vibrant cultural scene by visiting the iconic Heard Museum, renowned for its extensive collection of Native American art and artifacts. Marvel at the architectural wonders of Frank Lloyd Wright's Taliesin West, or step back in time at the historic Arizona Biltmore estates dating back to the 1920s. Or take in the visual delights of the iconic Phoenix Art Museum, or the eclectic street art scene in the Roosevelt Row Arts District.

Beginning with its larger-than-life murals and art installations, Roosevelt Row leads to photo ops aplenty, not to mention an array of cultural offerings. Wander through galleries, such as Grand ArtHaus, Bentley Gallery, or Chartreuse. Discover the creative appeal of the area with shops like MADE Art Boutique and Changing Hands Bookstore. Wander through unique boutiques like Phoenix General, Bunky Boutique, and Practical Art, featuring handcrafted goods and locally made treasures.

With its blend of artistic expression and community spirit, downtown Phoenix is a haven for those seeking distinctive shopping experiences that capture the heart of the city. Throughout the year, Phoenix plays host to various festivals and events celebrating the cultural heritage and natural beauty of the region. From vibrant parades to electrifying performances like those featured at the Phoenix International Jazz Festival, there's always something happening in the Valley of the Sun.

A Gastronomic Treat

No visit to Phoenix would be complete without indulging in its culinary delights. The city's dining scene is as diverse as its population, offering everything from Southwestern fusion cuisine to international flavors from around the globe. Local favorites include the legendary Pizzeria Bianco, renowned for its wood-fired pizzas crafted from locally sourced ingredients, and Barrio Café, where traditional Mexican recipes are elevated to new heights.

Those seeking a taste of the Southwest are encouraged to sample authentic Sonoran cuisine. From savory tamales to fiery green chili stew, the flavors of the desert come alive in dishes that have been passed down through generations. Visitors can explore the bustling stalls of the Mercado de los Cielos, where vendors offer everything from freshly made tortillas to handcrafted ceramics, or savor the smoky flavors of mesquite-grilled meats at a traditional barbecue joint.

Breakfast Bites

Start your day at Matt's Big Breakfast, an iconic spot renowned for its hearty breakfast fare. Or check out Snooze, an A.M. Eatery: with a hip, retro-chic vibe and a exciting menu, ranging from creative pancake stacks to decadent breakfast sandwiches. For a cozy neighborhood spot, look no further than Ollie Vaughn's Kitchen & Bakery, serving up freshly baked pastries, hearty breakfast bowls, and artisanal coffee that's sure to satisfy even the most discerning palate.

Out to Lunch

Postino Wine Cafe is a stylish wine bar that offers a delectable lunch menu featuring gourmet bruschetta, artisanal sandwiches, and fresh salads, not to mention an extensive selection of wine pairings. Phoenix Public Market Cafe downtown is the place to go for inventive, fresh salads and grain bowls showcasing locally sourced ingredients. Meanwhile, the Welcome Diner housed in a charming vintage trailer serves up classic comfort food with a creative twist. Sink your teeth into their famous fried chicken sandwich or indulge in a plate of mouthwatering poutine for a lunchtime treat.

ACCOLADES APLENTY

From Michelin stars to James Beard Awards and AAA Diamond ratings, several Phoenix restaurants have garnered acclaim for their unique culinary offerings. Treat yourself by visiting any of these 15 award-winning eateries:

- **Kai at the Sheraton Grand at Wild Horse Pass -** AAA Five Diamond restaurant known for its Native American-inspired cuisine.
- **Binkley's Restaurant -** Acclaimed for its innovative tasting menus and commitment to local ingredients.
- **Nobuo at Teeter House -** Renowned for its Japanese-inspired cuisine served in a historic setting.
- **FnB Restaurant -** Celebrated for its farm-to-table fare and extensive wine selection.
- **Durant's -** Iconic steakhouse with a storied history and impeccable service.
- **Kai Market at Sheraton Grand at Wild Horse Pass -** Offers gourmet fare sourced from local purveyors.
- **The Arrogant Butcher -** Known for its contemporary American cuisine and stylish ambiance.
- **Citizen Public House -** Recognized for its modern gastropub fare and craft cocktails.
- **Quiessence at The Farm at South Mountain -** Farm-to-table restaurant serving seasonal cuisine in a rustic setting.
- **T. Cook's at the Royal Palms Resort and Spa -** Offers Mediterranean-inspired cuisine in an elegant atmosphere.
- **Marcellino Ristorante -** Acclaimed for its authentic Italian dishes and house-made pastas.
- **The Mission -** Famed for its modern Latin cuisine and vibrant atmosphere.
- **Beckett's Table -** Known for its inventive American cuisine and welcoming vibe.
- **Tarbell's Restaurant -** Esteemed for its classic American fare and extensive wine list.
- **Postino WineCafe -** Celebrated for its relaxed atmosphere, gourmet bruschetta, and extensive wine selection.

Delightful Dinners

Set in a historic building in downtown Phoenix, The Arrogant Butcher offers a sophisticated dining experience with a menu that highlights contemporary American cuisine from hand-cut steaks to fresh seafood. Step back in time at Durant's, an iconic steakhouse where the ambiance is as memorable as the impeccable service and perfectly aged steaks. For a truly unforgettable dining experience, head to Kai at the Sheraton Grand at Wild Horse Pass, boasting a stunning desert setting and Native American-inspired cuisine. Crafted with ingredients sourced from the Gila River Indian Community, this AAA Five Diamond restaurant is a dining destination like no other.

Specialty Treats

Indulge your sweet tooth at Churn, a charming ice cream parlor serving up homemade treats in a variety of delicious flavors, from classic favorites to unique creations like lavender honey and salted caramel. La Grande Orange Grocery & Pizzeria is a one-stop shop for eclectic treats, including freshly baked pastries, homemade English muffins, artisanal chocolates, and gourmet pantry items. Or treat yourself to creative flavor combinations with a scoop of signature Salted Butter Caramel or seasonal ice cream flavor at the well-renowned Sweet Republic.

Exploring the Desert Playground

Beyond its culinary delights, Phoenix offers a wealth of recreational opportunities for outdoor enthusiasts. Begin your journey by immersing yourself in the stunning natural beauty of the Sonoran Desert. Embark on an exhilarating hike up the iconic Camelback Mountain, where you'll be rewarded with panoramic views of the sprawling city below. For an impressive collection of desert flora and fauna, stroll through the Desert Botanical Garden.

Take to the skies with a heart-pounding hot air balloon ride over the desert landscape, or soar through the treetops on a zip line adventure at one of the city's many outdoor parks. The city's vast network of parks and preserves beckons visitors to explore its rugged terrain, from the scenic trails of South Mountain Park to the tranquil waters of Papago Park. Hiking, biking, and horseback riding are popular pastimes, offering a chance to connect with nature amidst the hustle and bustle of urban life.

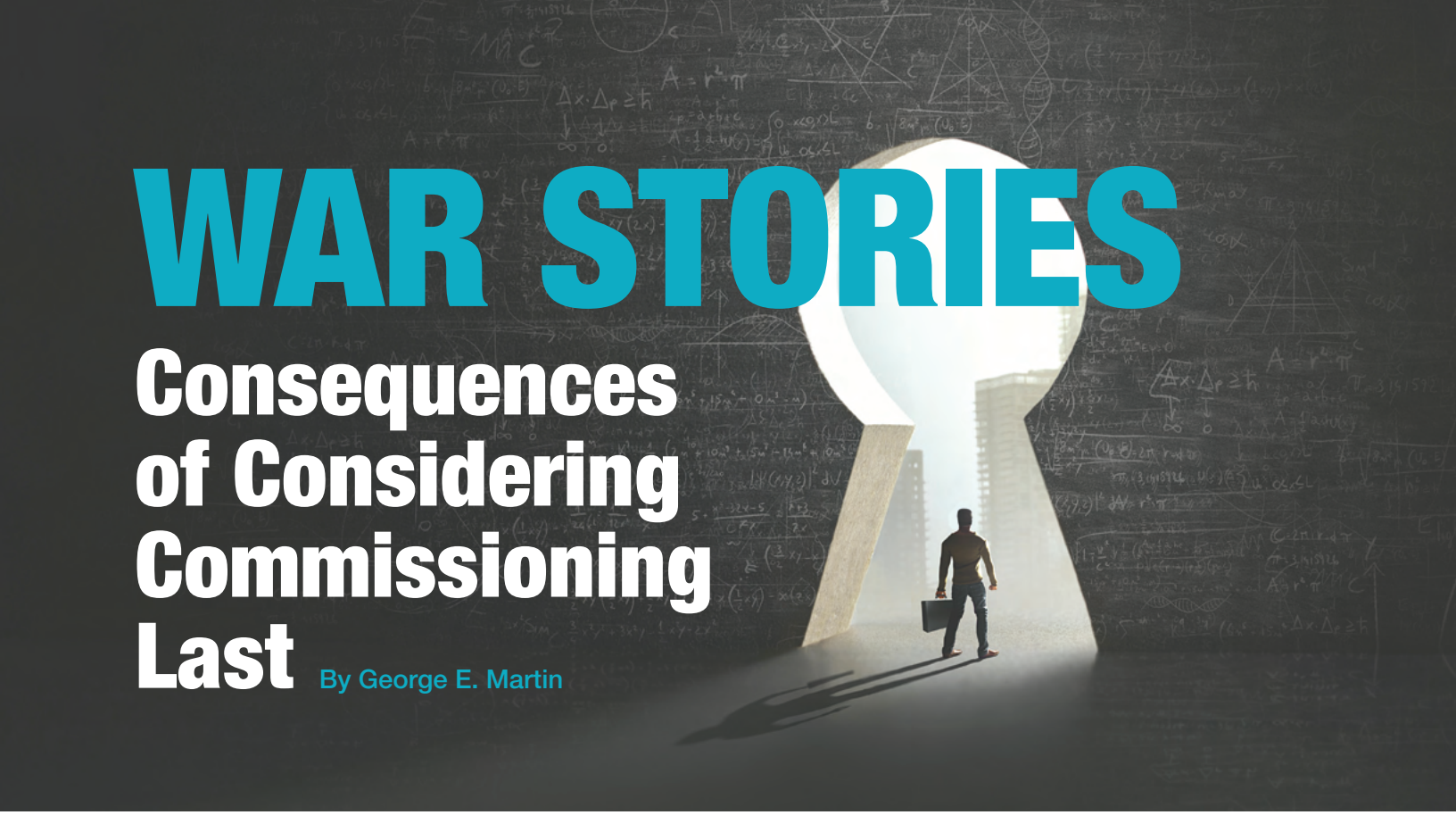
For those seeking a more leisurely pace, Phoenix boasts an array of world-class golf courses, where lush fairways and manicured greens beckon players of all skill levels. From championship courses designed by golfing legends to scenic resort destinations nestled against the backdrop of the desert mountains, the city offers an unparalleled golfing experience for enthusiasts and novices alike. Attendees of the 2024 NEBB Annual Conference's that take to the green during the annual golf outing will get the chance to play and make memories at the Wigwam Golf's Red Course, designed by Arizona Golf Hall of Fame member and golf course architect Robert "Red" Lawrence.

As the sun sets over the desert horizon, casting a golden glow across the cityscape, it's easy to see why Phoenix has become a repeat destination for those who have had a chance to embrace the Spirit of the Southwest. A literal hot spot of rich history, vibrant culture, and opportunities for adventure, Phoenix rises to greet its visitors with favorited experiences and new treasures each time. ●

WAR STORIES

Consequences of Considering Commissioning Last

By George E. Martin



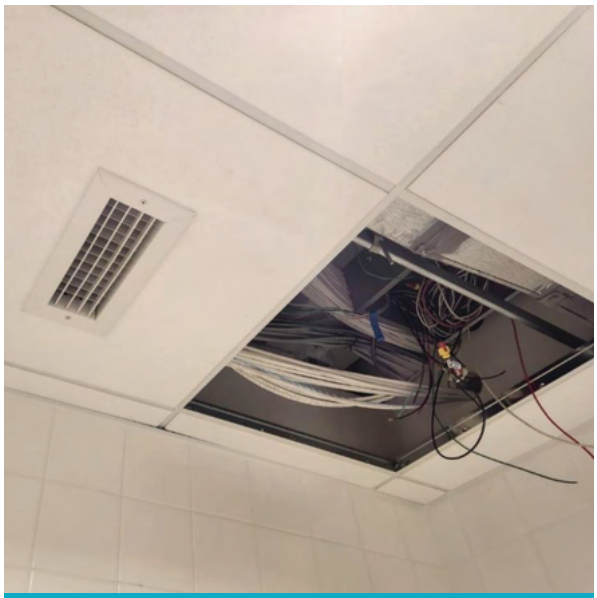
"It's ready"

The commissioning of this project began in an odd way. I received a call from the soon-to-be tenant of the site saying that the landlord had reported that construction of the space had been substantially completed and that they could begin to occupy the space. More interestingly still, the landlord would begin charging rent in two weeks per the agreement. I was told "They say 'It's ready', but we're not so sure. We were hoping you could come by and verify things for us." Having been in the TAB industry, my first question was whether they had a balancing report. The response? "We don't have a copy of the balancing report, but they tell us our floors have been balanced and the landlord is the one who will be receiving the report. They keep telling us 'It's ready.'"

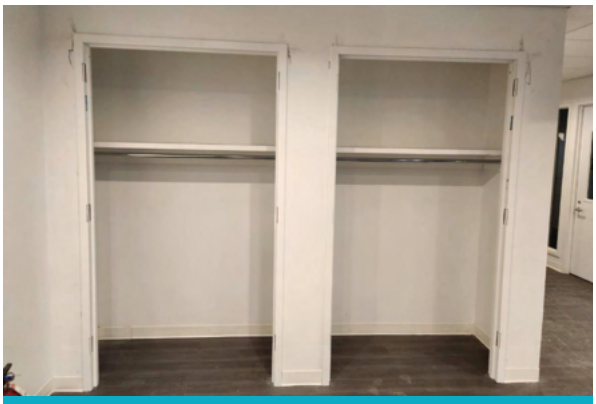
Having heard that phrase many times before, and not knowing what kind of situation I would be walking into, I scheduled a date for the site visit and mentally prepared for a new adventure.

The First Site Visit

On arrival, my team and I immediately realized the reason for the future tenant's concern. There was no way this space was ready to be occupied. Exposed wiring was hanging down in multiple places from the openings left behind by missing ceiling tiles. The space was still littered with construction debris. There were even missing doors to some of the closets! In short, the space was visibly still in the thick of its construction phase.



Exposed wiring visible where ceiling tiles were not installed



Closets did not have doors installed

Still, I am a TAB guy, so the focus of my attention turned farther upward – to the ductwork. According to our client, the space had been balanced and the landlord was expecting a TAB report within a few days. So I go to the nearest thermostat to see if I could lower the set points and hear an increase in airflow.

Thermostats were not powered

I walk to the nearest wall and confirm what you likely already suspect - the thermostats had no power. Got it. Maybe the TAB contractor had connected directly to the VAV boxes to calibrate them. I find a nearby ladder and start poking my head above the ceiling to see what I can find. Now, of course the VAVs had covers on them, and so-called T's were installed on the pressure lines so it was completely possible that the VAVs had been calibrated by pressure drop and the outlets had been balanced downstream, but given everything else I had seen onsite, I felt compelled to make sure. I tugged a bit on the lines and heard a rattling sound come from inside the box. Uh-oh. I pulled out my screwdriver and removed the panel.

VAVs had no controllers (aka "guts")

The VAV I was checking had no "guts", no internal controls. After tugging on the hoses a bit more, they pulled clear out of the box, not being connected to anything. At that point, I knew we could not assume anything had been done. After checking multiple VAV boxes, I verified that all the boxes on the floor were in the same condition. There was no way this space had even started to get balanced. The tenant's concerns were more than justified.

As my team and I progressed through the remaining 5 floors in the contract space, we noticed many more issues. Exhaust fans were sitting on the ceiling grid, lights were hung so low from the ceilings that they would be hit by nearby doors being opened, and flexible duct connections to the ceiling diffusers were angled and bent in such a way that would inhibit almost any airflow from

Connections with flex duct were completely kinked

We noticed a number of additional issues and presented all of these in a comprehensive report to the client. I

am grateful for having had two teammates with me on this project and for their contributions on that report. We were able to show the client that the site was most certainly not ready to be occupied and that they had good reasons to wait before moving into the space. The legal issues that ensued, however, did not fall under the purview of my team, or any Commissioning service provider.

The Second Site Visit

A few short months later, the same client called again. This time, the landlord was insisting the site was ready to be occupied and demanded that the client move in within the coming weeks. They were looking for help again.

I will not be as detailed in my discussion of what I found on this site visit. In short, the thermostats were powered now and the VAVs all had controllers installed. There were still openings at the seams in the ductwork that would definitely not pass a medium pressure leakage test, but everything had been cleaned and made to look presentable. Was the system balanced, though?

Again, according to the landlord, every system had been balanced and the balancing report was in the landlord's hand. Was this the case? My scope did not include any TAB verification, but I had good reason to doubt that this was the case. Not only was the landlord's reputation suspect, but all the dampers were set to the fully open position. There did not appear to have been any adjustments made to the systems. Now, it's possible that every kink in the flexible duct just so happened to provide exactly the amount of resistance needed to supply each diffuser with precisely the amount of airflow required on the contract drawings – but I (most assuredly along with you) seriously doubted that. There were a few other issues noted and detailed in my next report to the client based on this visit's findings, but I had no way of knowing how this story would play out. As it turns out, I would never really find out either.

You Need Commissioning

The client had not anticipated a need for Commissioning. They had been told that Commissioning was not needed since everything would be done as outlined in the contract documents anyways. Why pay someone to verify that things had been done right, if everything would be done right regardless, right?

Now, I understand that this is a uniquely nightmarish scenario but, if this could happen in New York City - a city notorious for having litigious occupants - I guarantee you it could happen wherever you are located.

This story highlights why professionals are needed to review newly constructed or renovated spaces and ensure that the end-users are receiving the products they paid for. In this instance, since Commissioning was not budgeted as part of the contract from the beginning, the tenant could not afford to continue bringing my team and I to the site to perform all the other needed aspects of the Commissioning process. They would inevitably be forced to accept the product that their soon-to-be landlord would give them and they would likely end up in some drawn-out legal battle in search of compensation for the issues my team and I had presented in our reports. Would their systems ever be balanced? If so, could the balancing report they might someday get their hands on be reliable? Would their occupants receive sufficient fresh air, an especially important concern in a post-COVID world?

Truly, I do not know. My intention in sharing this story is to highlight the need for Commissioning to be planned for from the beginning of a construction project. Additionally, many of the HVAC issues identified by my team on this project would certainly have been noted on a balancing report issued from a certified firm. Commissioning agents and TAB contractors work shoulder-to-shoulder in ensuring that design requirements are met and that the end-user inhabits a safe and functional space. If you or someone you know is planning a construction project, please do not let that project look anything like the one I have shared here.

Having a commissioning agent from the start of the project is absolutely worth the cost. Yes, you need commissioning! ●

Chapter News

Capital-MarVa Chapter

Barbara Huber

Capital-MarVa International NEBB held its 2024 annual recertification seminar and business meeting in Annapolis, MD on April 19, 2024. Guests enjoyed educational presentations and networking with NEBB peers. Topics included Artificial Intelligence in the world of TAB (Luis Chinchilla), Air Filtration in the Covid Era (Dave Blackwell & Mark Davidson), Advanced Troubleshooting of Hydronic Systems (Brad Watkins) and Proper Usage and Limitations of Air Flow

Capital-MarVa recertification seminar in Annapolis, MD

Capture Hoods (Scott Fielder). A special thanks goes to Rodney Hinton for presenting the NEBB Update, and to our vendors who always show up for our members: Ameritech Data Solutions, Building Start, Comfort Air/ Camfil, Evergreen Telemetry, Retrotec and TSI.

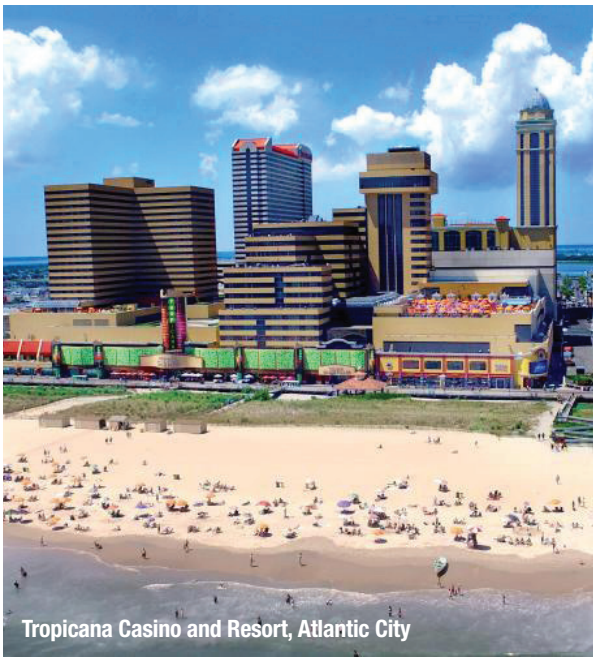
We post our scheduled practical exams on the NEBB website under the Events section, under the Seminars and Practical Exams Calendar at www.nebb.org. You can also contact Barbara Huber to be added to our exam waiting list at capmarvainternationalchapter@nebb.org.

The Chapter is hosting a 2-Day Technician TAB-Refresher Seminar May 16-17 at the Capital-MarVa office in Upper Marlboro, MD. Earn CEUs and get a great overview of topics including introduction to math, fans, TAB, electrical, motor drives, hydronic system, report forms and so much more. Registration is open. Contact Chapter Coordinator Barbara Huber at capmarvainternationalchapter@nebb.org to register.

MAEBA Chapter

Trish Casey

The MAEBA chapter will be holding its Annual Recertification Seminar this September 22-23, 2024 at the Tropicana Casino and Resort in Atlantic City, NJ.



Tropicana Casino and Resort, Atlantic City

Tropicana Casino and Resort, Atlantic City

During an extended lunch, MAEBA will hold its Dessert and Coffee with the Vendors. This gives the CPs and CTs an opportunity to visit the vendors and learn about their products and services.

Mid-South EBB (MEBB) Chapter

Ginger Slaick

We are happy to announce MEBB will host its first practical exams June 14-15 at the new testing site in Columbus, GA. Registration is now open. Candidates interested in taking the practical exam can request additional information by emailing midsouthchapter@nebb.org. This endeavor has been a long time coming and wouldn't have been possible without the time and dedication of our volunteers! We would like to thank Don Pittser, Jeff Schools, and the NEBB TAB Committee for their help through the process; and special thanks to Scott Kleback, Travis Stuck, Thad Routh, Mark Andrews, Joel Shannon, Scott Goller, Chris Goff, Ken Doyle, John Dachenhaus, Billy Bivins, III, Brandon Caves, Ron Greene, and several others for making the new Mid-South Practical Exam site a reality!

MEBB's Recertification Seminar and Vendor Expo will be held at the Atlanta Marriott Marquis in Atlanta, GA, September 14-15, 2024. Be on the lookout for more details about registration, hotel accommodation, and CECs for CPs and CTs. For now, mark your calendar and plan to attend! ●

Introducing the NEBB YPN Honors Program

Do you know a young professional between the age of 20-39 whose achievements deserve recognition?

The NEBB YPN Honors Program is more than an accolade; it celebrates those who have left an indelible mark on the NEBB industry. This program is crafted to acknowledge and honor young professionals who embody exceptional leadership, paving the way for a brighter future.

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https://www.nebb.org/nebb-ypn-honros-program/

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