

The NEBB Professional

2019 – Quarter 2

USP 800

Cover Story:
**USP 800: What You Must Know Before
December 2019**

- 2019 Annual Conference: The Bridge to Excellence Was Built!
- Cleanroom Pressure Control Lessons: A Case Study
- Three Errors to Avoid with Sound and Vibration Measurement and Instrumentation
- Building Enclosures: Are Two Lousy Barriers Better Than One?
- Title 24: 101

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NEBB President's Comments

By: Jim Whorton

I would like to express my sincere thanks to all of you who participated in the 2019 NEBB Annual Conference in San Antonio. Meeting with our volunteers, staff, and attendees is always energizing. The dedication this group has to maintaining NEBB's leadership in the industry validates that NEBB has a great future.

The planning and preparation for this event over the past year made our meeting in San Antonio a success. For that effort, we must thank our staff and volunteers.

From the excellent venue, technical, business and networking sessions, to the 22nd Annual Golf Tournament and our great sponsors and exhibitors, there were many experiences to appreciate and take away from our meeting. This year's technical sessions provided great educational events, while the networking sessions provided an opportunity to meet with our peers from around the world—one of my favorite parts of the annual conference.

The networking opportunities with our fellow professionals during the conference allowed us to exchange ideas and learn more about solutions to the many issues we each face day to day. We all face the same hurdles and difficulties, but by taking advantage of this opportunity, we find that our peers can provide us with better solutions to those issues. I believe that is one of the characteristics that makes NEBB great—the ability to share ideas and improve the industry, even among competitors.

Meeting with Chapter Coordinators and Chapter Presidents gave us feedback on how we can better assist the chapters with recertification, marketing and seminar content. The Young Professionals Network Committee was well represented at the seminar, bringing fresh ideas to the technical and marketing committees and ushering in a new generation of great volunteers.

During the Town Hall session, each committee delivered a status update on their projects and goals. It was exciting to hear about the projects recently completed, those underway, and planned for the future. A few of the highlights announced are the NEBB App (to be beta tested soon), the release of the 9th edition of the *TAB Procedural Standards* this summer, and the overhaul of the NEBB website.

A common theme in the Town Hall presentations was every committees' need for additional volunteers. Many times, when this request is made, potential volunteers think of what they currently have on their plate and don't believe it is possible to take on additional responsibilities. Let me assure you that NEBB can find a place that fits with your availability and expertise. From reviewing documents and taking on smaller tasks as a corresponding committee member to full involvement as a voting member of a committee, there are various opportunities to give back and improve the organization.

The number of projects that can be undertaken and speed at which projects can be completed is directly dependent on the number of hours volunteers can provide. "More hands make less work" is not just a trite expression, but allows our committees to complete projects sooner. The rewards from working on these committees is not only that you will be bettering the organization, but interacting with experts in a variety of fields who can help you solve problems throughout your career and give you insight into providing new services.

Our NEBB staff spoke with many of you during the conference, and we thank you for your interest and involvement. To those of you who already have taken on volunteer roles, thank you for your hard work and dedication. For those of you who could not attend the conference but have an interest in becoming more involved at any level, please reach out to a NEBB staff member, me, or other NEBB volunteers to discuss how you can help continue to keep NEBB's future bright.



Jim and Amy Whorton

USP 800: What You Must Know Before January 2020

Kerri Souilliard



In 2012, three lots of contaminated methylprednisolone acetate that had been distributed by a single compounding pharmacy became an industry-wide case of concern. Unopened vials of the injectable drug revealed fungus, causing 749 reported cases of infection across 20 states and a total of 64 deaths by the following year. In addition to a public recall of the contaminated product, patient notification, and clinician outreach, a change was in order to ensure stricter regulations and improved safety for the general public, healthcare personnel, and the environment.

The immediate change came in the form of added legislation through the enactment of the Drug Quality and Security Act (DQSA), passed by Congress in 2013. Prior to DQSA, the FDA's authority to regulate and inspect compounding pharmacies had been limited and successfully challenged in the court systems. In the immediate aftermath of the contaminated drug products and the introduction of the DQSA, most state boards of pharmacy updated and strengthened their regulations and leaned heavily on the existing USP 795 and 797 chapters. USP General Chapter 797: *Pharmaceutical Compounding – Sterile Preparations* was first introduced in 2008 to fulfill the need for an enhanced sterile compounding guidance document and to create separation from the existing USP General Chapter 795 that covers pharmaceutical compounding of non-sterile preparations. USP General Chapter 800: *Hazardous Drugs – Handling in Healthcare Settings*, which was initially introduced in 2016 and enforceable or official as of December 2019, addresses the handling and compounding of both sterile and non-sterile hazardous drugs, as well as some additional facility requirements that are not present within USP 797.

Applying to all facilities that perform sterile or non-sterile compounding with hazardous drugs onsite, USP 800 will affect facilities like hospital pharmacies, independent compounding facilities, oncology medical facilities, patient treatment clinics, physicians' practices, veterinarian offices and hospice facilities. Individuals handling the hazardous drug preparations, such as healthcare personnel, pharmacists, home healthcare workers, and veterinarians, as well as entities responsible for storing, preparing, transporting, or administering them will need to know what is now required of them per USP 800 standards.

Challenges Presented by USP 800

One of the biggest ways USP 800 will affect the aforementioned facility types is by requiring major renovations to ensure they are in compliance with the new standards. Many facilities owners may not know exactly what changes need to be made to comply with USP 800, allowing a margin of error as costly as rebuilding the facility in its entirety in order to be certified. Others are aware of some renovation needs, but



not of the sticker shock that goes along with major changes like completely new mechanical systems and the higher utility costs associated with the operation of new mechanical systems.



Jeff Raposa

For example, compounding facilities will need to ensure biosafety cabinets are vented to the outside and negatively pressurized, the proper number of air changes per hour can be achieved, and that air is pulled out of the building rather than recirculated in certified cleanrooms. Jeff Raposa, Founder and President of Controlled Environment Management (CEM), explains, “For airflow that is removed from a facility, it is appropriate to replenish the facility with outside make-up airflow to maintain the proper balance. Air systems that provide this outside make-up airflow are critical to provide the temperature and humidity specifications of the facility. Because these systems are not recirculating airflow back into the facility, they are often the most expensive component in the design of a cleanroom in compliance with USP 800.”

This is where a certifying authority, such as a NEBB professional, may come in. Owners—and the teams they hire to tackle renovations, including mechanical design engineers that can design systems to comply on paper, but not always for real-world operations—need the expert guidance and viewpoint of a certifier as early on as possible to avoid potentially costly mistakes. Knowing that these changes need to be made for the sake of keeping their facilities operable mean budgeting and planning for efficiency are essential.



Roman Zaretsky

“These facilities know they must spend the money to comply or choose to stop making the drugs and lose all revenue,” explains Roman Zaretsky, CEO of Zaretsky engineering Solutions, Inc. in California. “One of my large healthcare facility clients has 120 pharmacies just in California, alone. If you consider that each renovation may cost around half of a million to a million dollars, that really adds up,” he continued, proving the importance of getting those renovations right from the start in order to achieve compliance.

SCA vs. Cleanroom

To begin, any facility doing any type of hazardous compounding needs to decide whether they intend for their compound-

ing areas to be part of a certified segregated compounding area (SCA) or a cleanroom. One reason an owner may opt for an SCA over a cleanroom would be to save on first costs as well as maintenance.



Michael Funk

“If a facility decides against building a cleanroom for sterile compounding, they are basically choosing not to incorporate HEPA filtration in the ceiling. The room air, however, must be exhausted outside of the building and not returned to the HVAC system,” states Michael Funk, Director of Operations at Pentagon Technologies.



Bill Edwards

“Segregated compounding rooms do not require an ISO-14644 class and, therefore, do not have HEPA cleanrooms, but do need to still control the space by strict requirements and practices such as garbing (gowning), wipe downs, and sanitations,” states Bill Edwards, President and Chief Engineer at MESA3, Inc.

By using externally vented pharmacy barrier isolators or class II biological safety cabinets as a PEC for sterile compounding, facilities can keep hazardous drugs inside a negatively pressurized area and work towards a compliant SCA. Previously, isolators became popular because they only need to be under negative pressure, but do not require a full build out of a cleanroom with HEPA filters and viable particle counts.

Surface Sampling for Residual Hazardous Materials

Another change presented by USP 800 that is sure to be an added cost for owners is the new requirement for hazardous surface sampling to be performed every six months within the compounding facility. A certified company must come in to do a swipe for residuals of particular agents that the facility is working with, and then send those to the lab for testing.

“With lab fees averaging up to \$400 per sample to cover the common hazards used by a hospital for chemo preparations, and each facility requiring multiple samples to be tested, not to mention the potential of repeating the lab tests, shipping samples, and paying the certification company to come in, this can add up,” mentions Raposa.

Dedicated Hazardous Drug Storage Areas

Compliance with USP 800 will also require facilities to have a dedicated place to store their hazardous drugs once compounded. In the case of antineoplastic hazardous drugs requiring manipulation, this storage area will need to be separate from any nonhazardous drugs in a negatively pressured area with external ventilation and a minimum number of air changes per hour.

“All hazardous drugs must be stored in a separate area from nonhazardous compounded sterile preparations to assure no cross-contamination takes place. They do not have to be in a controlled environment necessarily, but they must meet the differential pressure (-0.010 ” to -0.030 ”) and air changes per hour criteria (12 ACPH),” explains Funk. Both cleanroom and SCA storage areas must be built with approved cleanroom materials.

Room Differential Requirements

“The biggest change will be the differential requirements between the hazardous drug buffer room and adjacent spaces. USP 800 requires a pressure range of -0.010 ” to -0.030 ” from adjacent rooms. Prior to USP 800 guidelines, facilities did not have to meet a pressure range between the spaces. Now, it will be difficult for older facilities to comply with the guidelines for secondary engineering controls,” states Funk.

This difference circles back to necessary renovations—many of which include a complete redesign of mechanical systems—for most facilities owners in order to achieve compliance with the new requirements.



Dave Muggah

“We can help find a solution to help meet requirements. Many mechanical engineers, for example, understand airflow, but not the total picture of what the clients need because the requirements aren’t always well defined. We need to follow the SOPs of the clients and understand both airflow and what their compounding process is to achieve compliance,” declares Dave Muggah, President of HEPA Atlantic.

“We have seen a lot of pharmacy clients replacing regular VAV boxes. They’re fully renovating mechanical systems. With dedicated supply and dedicated exhaust, and by choosing pressure independent airflow control devices, they are able to maintain room pressurization,” comments Zaretsky.



Anterooms

Another challenge that applies specifically to cleanrooms is the new requirement for anterooms. Using previous standards, it was not uncommon to see anterooms that had been under-engineered.

“Every time the door from the anteroom was opened, air from the anteroom could enter the hazardous drug room and add more contaminants to the hazardous drug room,” indicates Edwards.

Raposa goes on to explain that, “USP 800 will require anterooms to be built to the same ISO level as the buffer room where hazardous compounding will take place. For example, the anteroom needs to be an ISO Class 7 when the buffer room itself is an ISO Class 7.”

“Since the hazardous drug buffer room is typically adjacent to the anteroom, it is extremely important for anterooms to be designed correctly. The hazardous drug room is pulling air from the anteroom, so assuring no contamination from this room is extremely important. The anteroom is typically used for hygiene and garbing, thus allowing for particles to be introduced into the atmosphere,” says Funk. “If the anteroom is built to the bare minimum of specifications, this will have an effect on the hazardous drug room’s cleanliness.”

How USP 800 Specifically Affects NEBB Firms

“This a major change. I haven’t seen anything so drastic before to change standards. It puts a lot of pressure on clients to make the necessary changes before the deadline,” affirms Zaretsky.

By proving knowledgeable about USP 800 and making suggestions to compounding pharmacy facilities, NEBB firms certified in both Cleanroom Performance Testing (CPT) and Testing, Adjusting and Balancing (TAB) can help clients avoid compliance issues, save on renovation costs, and even take advantage of new opportunities.

“We deal with a few areas in healthcare, so we’re frequently updated on standards; different organizations tell us what we need to know to stay updated on USP to ensure we, as well as our clients, have no issues with it,” clarifies Muggah. “We will be going for additional training to ensure we’re up to speed on all new and current standards,” he continues.

By getting involved early on with clients, NEBB firms can help them ensure they are building facilities that comply with USP 800. If an owner does not have a knowledgeable partner to help advise them on how to meet the new requirements, they will be wasting funds on renovations that are either unnecessary or not enough to meet compliance standards. Worse yet, they risk getting a citation from the Board of Pharmacy in the case of less critical infractions with a chance to be rectified or being shut down by JCAHO altogether when the issue is more vital—and typically more closely related to the compounding area.

Funk explains further, “If the pharmacy is found out of compliance, it is up to the pharmacy director to make arrangements for a corrective action to be performed. They will utilize

the data that was collected during the certification process and assure the compliance issues are resolved in a timely manner. The certification vendor can work closely with the appropriate parties to assure all requirements are being met. This would include working with the engineer, designer, and balancing companies. If the compliance issues affect patient and pharmacy safety, then an assessment of work practices will need to be performed.”

As part of helping clients comply with USP 800, NEBB firms can also look at these changes as opportunities for additional work.

“If a NEBB firm certified in CPT has clients in this industry, they should be proactive in learning the new USP 800 guidelines and advising those clients to be proactive in the measures they take to comply,” suggests Raposa. “There is a lot of pharmacy work that needs to be done before USP 800 takes affect and CPT firms will play an important role in helping those pharmacies execute in a way that ensures compliance.” ■

About the Author

With over a decade of omni-channel marketing experience, Kerri Souilliard leverages her extensive background in digital strategy, copywriting and content development to serve clients' business goals. Her focus on key elements like messaging and branding, help lay the foundation for creative strategies that promote a company's story in the most effective way possible. Visit kreativstrategy.com.

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2019 Annual Conference: The Bridge to Excellence Was Built!



NEBB's 2019 Annual Conference in San Antonio, TX, lived up to its theme "The Bridge to Excellence," held April 4–6, 2019 at the Hyatt Regency. From sessions and vendors, to networking and social events, attendees rated the event as an overwhelming success, giving everyone the tools for professional development and personal connections.



A big Texas welcome from NEBB President Jim Whorton and his wife Amy pictured here at San Antonio's historic Sunset Station.



NEBB president Jim Whorton opened the event on Thursday evening by welcoming all attendees and presenting highlights of NEBB activities in the past year.



NEBB's 2019 Annual Conference played to a full house. Over 325 were in attendance.

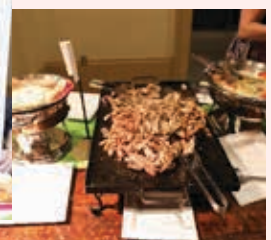


Whorton introduced keynote speaker Mark Jeffries, who kicked off the event with his lively presentation on effectively communicating in the workplace.



Get Acquainted Reception

The fun always starts with the Attendee Get Acquainted Reception, this year held at the beautiful Sunset Station. Good location, great food, fun people and interesting conversation made for a lively evening, connecting with old friends and making new ones.



Technical and Business Sessions

The business of learning began on Friday, running through Saturday and featured three specific tracks: BSC & TAB, CPT and IAQ, and Business. Session topics ranged from among a wide variety of other relevant topics.



NEBB Opportunities in Regulated Industries by Don Hill, NEBB Past President, spoke to an attentive and engaged audience.



When the Golden Rule Doesn't Work by Dave Molenda, Positive Polarity.



Lane Kelman presenting on Best Practices for Reducing Liability to engaged attendees.



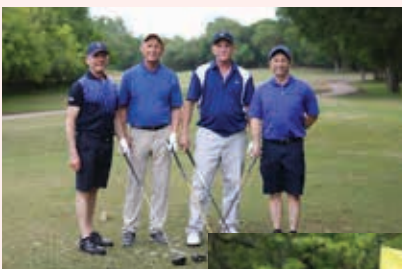
ECM Applications and Balancing Issues for Fan Coils and New Terminal Unit Equipment and Sound and Noise in Occupied Spaces II by Gus Faris, Nailor Industries.



TAB Training Technology Through Virtual Reality, presented by Jonathan Lloyd and Derek Olsen opened new opportunities to view hands-on training in the 21st century in real time.

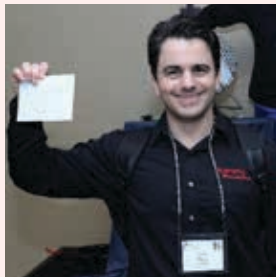
NEBB 22nd Annual Golf Tournament

The NEBB 22nd Annual Golf Tournament sponsored by TSI, Inc. was held at Silverhorn Golf Club. The tournament not only featured a wide variety crazy golf shots but rekindled old friendships and lots of advice on how to avoid chip shots. Golfers enjoyed themselves during the closing golf ceremony.



At the Exhibit Hall

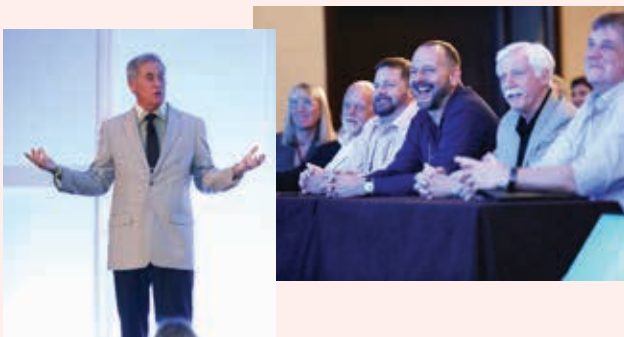
The Exhibit Hall opened Friday and Vendors experienced quality time with attendees throughout the event, particularly during the Vendor-Hosted Reception on Saturday. NEBB President-Elect Jeffrey Schools emceed the raffle and prize giveaway along with NEBB Staffer Sheila Simms, while attendees enjoyed themselves networking. Winners went home with prizes donated by Conference Exhibitors and Sponsors ranging from a gift certificates for product to hoods, meters, tool backpack and more!



Final Wrap-up



The conference concluded with parting words from Jim Whorton, thanking all conference sponsors and an introduction of NEBB President-Elect Jeff Schools, who will take office in October 2019. Schools announced the location of the 2020 NEBB Annual Conference, The Greenbrier: America's Resort, West Virginia.



Closing speaker Mark Mayfield spoke on the importance of laughter and fun in the workplace and life. And the audience seemed to believe him!

During the closing session of the conference, NEBB president Jim Whorton presented a ceremonial check for \$10,000 to ASHRAE Research. Darryl Boyce, ASHRAE President Elect, accepted the check on behalf of the organization. For 19 years, NEBB has been a member of the ASHRAE Golden Circle, a group of contributors who provide significant financial leadership to ASHRAE at the \$10,000 and higher level.

Through its research and other initiatives, ASHRAE is recognized as the leading international authority and source of technical and educational information, standards and guides on the interaction between people and the indoor and outdoor environment as it pertains to the operation of HVAC&R systems in buildings and other applications. ASHRAE Golden Circle investors contribute more than 10 percent of the total amount of funds collected for the society's research initiatives.



Cleanroom Pressure Control Lessons: A Case Study

Matthew C. Lemieux | Air Systems Technologies



As presented in the International Standards Organization, cleanroom differential pressures are an indispensable controlled environment necessity.¹ Room pressure differentials are often the first qualification seized upon by regulators and inspectors, and many regulations mandate installation of visible pressure differential indicators and even continuous monitoring and logging.

Inconsistencies and excursions of room pressure are a continual source of potential headaches for clients. Often, relative room pressurization is neither well understood by client nor inspector. Confusion arises generally in distinguishing pressure terminology such as differential, absolute, ambient, relative to, positive and negative. Further, it is important to realize that specified air differential pressures are surprisingly minute. A variation of as little as 0.0012 percent of an atmosphere can warrant an inspector's or regulatory agency's attention. Unfortunately, regulators can have an alarmingly Calvinistic interpretation of pressure guidelines.

Despite this criticality, cleanroom engineers often incorporate constant-airflow rather than constant-pressure control systems into their designs. Regulators are not concerned with the constancy and tolerance of airflow, nor should they be, provided that the airflow at least meets the minimum air exchange rates. How and why this design strategy persists requires a little background investigation.

Cleanrooms are unlike any other type of building construction. A well-constructed cleanroom is more akin to a submarine or spacecraft than to conventional laboratory space. Tremendous effort is expended in sealing and tightening any and all architectural details to minimize the potential for any air leakage. We can use a term like porosity to describe the conductance of air into and out of a particular room. For example, in a conventional research laboratory, the architectural details are not much more sophisticated than in an office space. Cleanroom construction endeavors are intended to minimize porosity and conductance, or equivalently, maximize resistance to airflow infiltration and exfiltration. Because of the second-order relationship between airflow

and pressure through a gap, a conventional porous space will not register any measurable pressure differential on a gauge, despite the net outflow of air relative to surrounding spaces. By contrast, a cleanroom's resistance causes a measurable pressure differential which can be displayed on an ultra-low-pressure wall-mounted gauge.

Similarly, the same change in airflow produces a much more amplified pressure signal in a cleanroom than in a porous laboratory space. Laboratories may have a requirement to be negatively pressurized to the surrounding occupied spaces due to the nature of materials being handled therein. In HVAC engineering, this is usually accomplished by continuously monitoring and adjusting laboratory supply and exhaust airflow quantities to maintain a net influx of air into the laboratory from the surrounding space. This deficit or surplus between laboratory supply and exhaust devices is often referred to as offset and is usually on the order of 200 cubic feet per minute (CFM) per laboratory. When this same strategy is applied to cleanrooms for the purpose of pressure control, a number of unforeseen consequences can arise. Without examining these consequences in detail, they may involve door openings which have the effect of increasing perceived airflow, rooms being actually pressurized by exfiltration from adjacent rooms rather than their own supply and exhaust terminals, or degradation of non-porous seals, such as door weather-stripping among many others.

By definition, attempting to control room pressures by controlling airflow is what is called an open-loop control system. Controlling room pressure by controlling room pressures is what is called a closed-loop control system. A domestic toaster is an example of an open-loop control system. It purports to control the condition of cooked bread by controlling the time that the bread is exposed to heat. The toaster system (once the timer is set) has no regard for the thickness of the bread, its frozen condition, type of grain, color or physical appearance. Toast burns because there is no system that is monitoring its temperature and crispness during the toasting process.

¹ ISO 14644-4:2001 (E) *Cleanrooms and Associated Controlled Environments – Part 4: Design, Construction and Start-up*, A.5.3

Figure 1 shows a plan view of a cleanroom inside of a building.

The design used in this facility was to control differential pressures between cleanrooms A, B, C and D, along with the warehouse space. Upon initial start-up, it became apparent that the cleanroom pressures were not at all stable, as they were neither constant relative to each other nor relative to the warehouse space. In response, the contractor attributed the instability to frequent unpredictable overhead door openings and to random, cycling economizer modes from the 20-odd general building HVAC systems in this multi-tenant space. In other words, the cleanroom pressures were unstable because the building pressures were not stable. The proposed solution was to provide and install a building pressure control system consisting of a differential static pressure transmitter—a through-the-wall exhaust fan with variable speed control. The system setpoint was $+0.01''$ H₂O relative to the outside (building exterior space).

The intent of the contractor's solution was that as the building pressure increased due to the presumed unpredictable operation of its various HVAC systems, the exhaust fan speed would increase until the setpoint pressure was achieved. By doing so, the building pressure could be reliably controlled and the cleanroom pressure fluctuations would disappear.

Figure 2 shows a detail of the differential pressure transmitter, DPT-1.

The exterior static pressure tap was a 3/16-inch brass tube bent downwards at 90 degrees and exposed to the weather.

When the wind would blow into the page as shown, the velocity pressure of the air outside the building would obviously increase. This increase in velocity pressure at the open end of the brass tube would be interpreted as a decrease in static

pressure at the open end of the brass tube since $TP = VP + SP$. That is also how a curveball works; the rotating stitches on the ball are like fan blades increasing the velocity on the underside of the topspinning baseball. This results in a decrease in the static pressure on the underside of the ball, and since the static pressure on the top side of the baseball is now higher than underneath, the ball drops more than it would otherwise due to gravitational forces. In this case, the drop in the low static pressure input of the transducer is interpreted as an increase in the high-pressure terminal of the transmitter. The transmitter has no way of knowing if the high-pressure side increased or the low-pressure side decreased.

For the moment, the relationship between the cleanroom space and the warehouse space has not changed and the pressures are relatively stable. However, the pressure transmitter is now sending a signal to the exhaust fan variable-frequency drive (VFD) to increase speed to counteract the increase in building pressure that it believes it is experiencing. Speeding up, the exhaust fan now lowers the interior building pressure. This results in the cleanroom pressure gauges reading between the cleanroom and the warehouse to increase until such time that the building pressure control system is satisfied and begins to slow back down. When this happens, the building pressure now increases relative to the exterior, causing the difference between the cleanroom pressure and the building pressure to reduce. After a few seconds or minutes, another gust of wind appears, and the cycle continues. Meanwhile, the cleanroom pressure is being logged as unstable since it is constantly going up and down, relative to the warehouse. The building exhaust fan solution has become an amplifier of the problem, rather than an attenuator.

The eventual solution to the problem was conceptually simple but much more challenging to implement. The existing constant airflow control system which was active on each of the

Figure 1

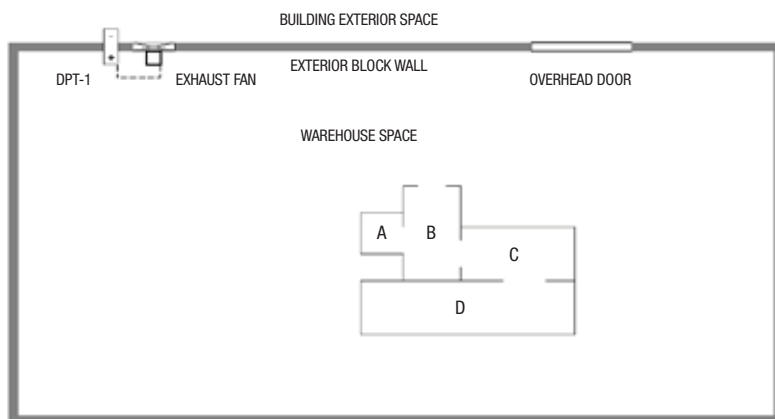
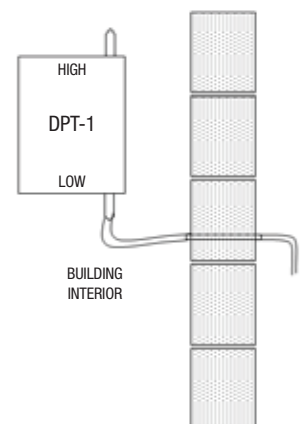


Figure 2



two AHU's supply air outlets, one of the two AHU's return air ducts, one exhaust fan and one AHU face/bypass damper by variable frequency drives were disconnected from automatic control and the speed drives were manually adjusted to achieve the required airflow. Secondly, the building-pressure exhaust fan was decommissioned. The next step was to select a representative critical room supplied by each of the two AHU systems (there were two zones with nine rooms total in reality) for active pressure control. The critical-rooms' pressure sensors were monitored relative to ambient (adjacent warehouse space) and the signal used to control the outside air quantity in a closed-loop arrangement. Via newly installed motorized outside air dampers. Afterward, room-room relative pressures were manually balanced for each of the two zones.

Since final pressure balancing would have required multiple iterations of adjustment with progressively diminishing effect since the automatic outside air damper would be acting to maintain the critical room's pressure during the process, a different approach was taken. Consequently, the OA damper control loop was initially off line, the OA set to a constant CFM value, and each zone's rooms balanced with respect to each other with special attention paid to the critical room's relationship to ambient. At the satisfactory completion of this process, the active pressure-control system was engaged. In actuality, either pressure balancing strategy could have been employed.

In truth, the facility, consisting of nine rooms and two zones, is under a partially closed loop pressure control system since the two critical rooms are under closed-loop active pressure control and their respective adjacent spaces are in an open-loop relationship with the OA damper (like a toaster). A purely closed loop system would have required nine room pressure sensors and nine actuating airflow valves (dampers). This option was not available for this facility. However, as Winston Churchill replied when asked about the rigors of old age - consider the alternative.

While this particular case was very interesting to the author, it was much less amusing to the client. As cleanrooms become less porous and room pressures come under finer scrutiny, design engineers will need to reconsider the wisdom of open-loop pressure control. ■

About the Author

Matthew Lemieux is vice president of training and quality at AIR SYSTEMS TECHNOLOGIES and has over 38 years of field experience as a biological safety cabinet certifier, air and water balancer and cleanroom certifier. He is a NEBB CPT CP, as well as a CETA accredited RCCP-SCF for sterile compounding facilities, and an active member of NEBB's CPT Committee. He holds his B.S. in mechanical engineering from Northeastern University and has been an ANSI/NSF-49 accredited biological safety cabinet certifier since 1997. This article was reviewed by Subject Matter Expert Jim Whorton.



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A black and white photograph of three professionals—two women and one man—standing behind a miniature city skyline. The man is in the center, looking directly at the camera. The woman on the left is looking slightly to the left, and the woman on the right is looking slightly to the right. They are all dressed in business casual attire. The city skyline is a detailed model of various skyscrapers.

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Three Errors to Avoid with Sound and Vibration Measurement and Instrumentation



Stuart McGregor | Engineering Dynamics, Inc.

As a member of the Sound and Vibration (S&V) Committee, receiving questions from NEBB S&V firms and CPs about sound data, vibration data, and instrumentation is common. Below, I will describe three instances which raised concern regarding basic understanding of how S&V measurements are made and instrumentation is set-up.

Because everyone makes mistakes periodically and end up with useless test data, we must repeat work. By using this article as a guide to revisit and refresh our understanding of how we should be doing our jobs, we overcome three issues:

- a. The proper instrumentation setting to take sound data to generate noise criteria (NC) and room criteria (RC) curves.
- b. Instrumentation set-up for vibration measurements so usable data can be taken.
- c. The issue of sound level meter calibration requirements.

Error #1: Sound Level Measurements for NC/RC Curves

Those who have taken the Sound CP or CT technical seminars know the instructors stress the proper setting on a sound level meter when taking sound data to generate NC and RC curves or ratings. Most sound specifications call for one or two measurements; either the overall sound level, which is typically an A-weighted decibel (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 have the frequency weighting of unweighted (dBZ).

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

- Frequency Weighting: Z, linear, flat (this designation is different for different instruments)
- Time Constant: Slow
- Full Octave Data: From 31.5 to 8,000 hertz, or Hz.

Note: The labeling for the unweighted setting may vary from manufacturer to manufacturer and may be dBZ, dB(flat), or dB(linear). Read your instrument's Owner's Manual.

Overall, this isn't difficult, but it brings up a nuance, which depends on the manufacturer of the sound level meter. Consider these two examples:

- a. Manufacturer A: instrument configuration has set-up options which applies the frequency weighting (dBA, dBC or dBZ) to both the overall sound level and the octave band sound levels.
- b. Manufacturer B: instrument configuration has set-up options which allow the user to set the overall sound level frequency weighting (dBA, dBC or dBZ) and then independently set the octave or third octave band frequency weighting (dBA, dBC or dBZ).

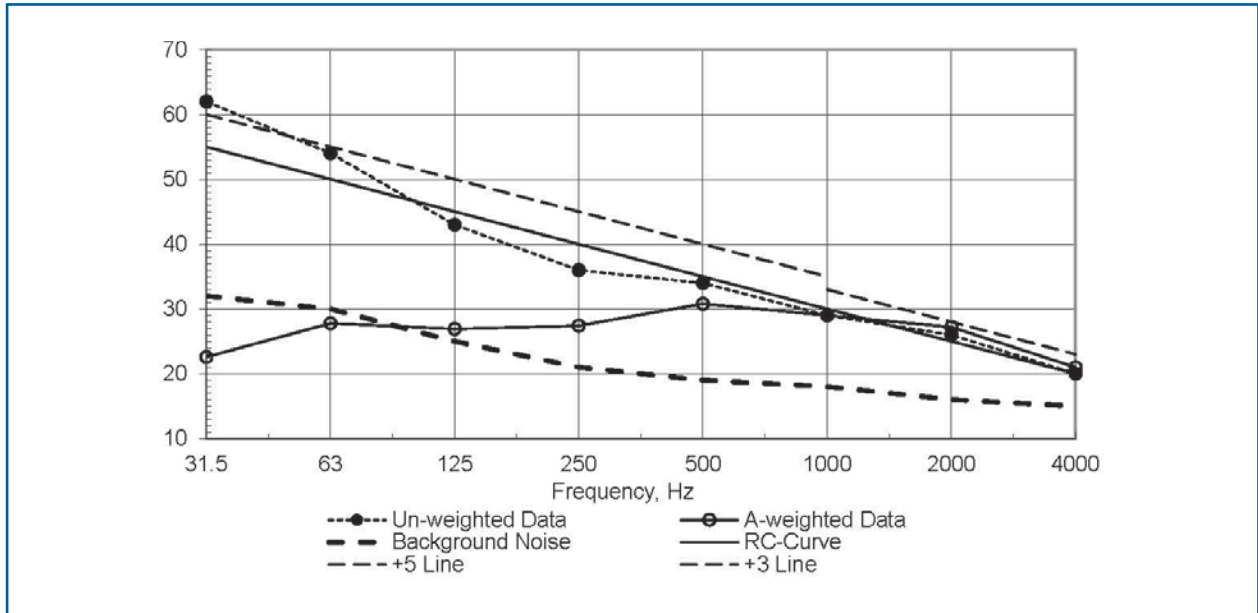
The error arises when both overall sound levels and octave band data are to be measured. If the instrument is not configured correctly, the A-weighting may be applied to the octave band sound level readings. So, what does this error really mean when the octave band data is measured A-weighted instead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

Figure 1 shows three sound level spectra plotted on an 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 A-weighted background sound levels. Inspection of Figure 1 shows the following:

- a. The unweighted sound spectra in an RC-30(R), where 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.

What does this mean? In the NEBB Sound technical seminar, attendees learn that when a measured sound source levels is within 10 dB of the background sound levels, a correction

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



for background sound levels must be done before the NC or RC plots are made. In this case, a correction can be made 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.

What can be done with the 31.5 and 63 Hz octave bands? The answer is nothing, since the A-weighted data are below the background levels and there is no method to make a correction. The data is not usable and the measurements must 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, but if the water is muddy, you don't know where to jump.

Take-home point: Set the sound level meter or analyzer up correctly for the measurement which needs to be made because you may not be able to recover the test data, which leads to having to make measurements again, increases cost, and lowers profit.

Error #2: Obtaining Useful Data from Vibration Measurements

Those who have taken the Vibration CP or CT technical seminar know one of the topics covered is frequency resolution of the vibration measurements. The term frequency resolution, in vibration lingo, is the distance in Hz between two adjacent data points in the digital Fourier transform.

When setting up the vibration instrument for a vibration measurement, the frequency range (bandwidth) is selected and

the number of Fast Fourier Transform (FFT) lines are selected. The frequency range is the highest frequency (Fmax) minus the lowest frequency (Fmin). For example, with a measurement from 0 to 1000 Hz (60 to 60,000 rpm), Fmax is 1000 Hz and the bandwidth is 1000 Hz. The number of FFT lines is just that—a number, that always comes in multiples of two; i.e.: 200, 400, 800, 1600, etc.

The frequency resolution is the maximum frequency times the window factor divided by the number of lines. For this discussion we will ignore the window factor.

$$\text{Frequency Resolution } (\Delta f) = \frac{(\text{Fmax} * \text{Window Factor})}{\text{Number of Lines}}$$

If Fmax is 1000 Hz and the number of lines is 200, the frequency resolution is 5 Hz. We only get to see information every 5 Hz, meaning we have no information about the amplitude of the vibration at, say 17 Hz.

If Fmax is 1000 Hz and the number of lines is 800, the frequency resolution is 1.25 Hz. Typically, for machinery vibrations, a 1 to 1.25 Hz resolution is sufficient to diagnose all vibration related issues.

Let's set-up a scenario of making a measurement on an electric motor/fan assembly with the following parameters:

- Motor speed = 60 Hz, four pole will run at ~1800 rpm (30 Hz). Due to slippage the motor will actually run a bit slower. A 5 hp motor will have ~3 % slip, which

results in an operating speed of 1746 rpm or 29.1 Hz. Also, assume direct line connection, no VFD.

- Motor to fan sheave ratio = motor 8 inches/fan 10 inches.
- Fan speed = motor rpm times 8/10 inches = 1,397 rpm (23 Hz)
- Number of blades on the fan = 11.
- Blade pass frequency = fan speed times number of blades = 15,365 rpm (256 Hz)

In NEBB vibration work, the frequencies of interest are typically one times (1x) rpm and harmonics and the blade pass frequency (BPF) of a fan or the vane pass frequency (VPF) of a pump. Here, we are interested in the following frequencies: 24, 29 and 256, and maybe the 2nd harmonic of each (48, 58 and 512 Hz).

With this information regarding the frequency range of interest, we can set up our vibration instrument several different ways—all of which are acceptable for this application:

- Fmax = 800 Hz, number of lines = 800, resolution = 1 Hz.
- Fmax = 1600 Hz, number of lines = 1600, resolution = 1 Hz.
- Fmax = 1000 Hz, number of lines = 800, resolution = 1.25 Hz.

With each of these setups, the frequency resolution is sufficient to measure vibration information at the frequencies of interest. Which will then allow us to assess the severity of the measured vibration levels.

What if we made a mistake and set our meter off with much lower resolution?

Example 1:

Fmax = 1000 Hz, number of lines = 200, and resolution = 5 Hz.

Here, we only measure data at frequencies which are multiples of 5: 5, 10, 15 and so on. And, we have missed the 1x operating frequency of the motor and fan and the blade pass frequency.

Example 2:

Fmax = 2000 Hz, number of lines = 200, and resolution = 10 Hz.

In this case, we only measure data at frequencies which are multiples of 10: 10, 20, 30, 40, 50, 60,

and so on. And, we have missed the 1x operating frequency of the motor and fan and the blade pass frequency.

Figures 2, 3, and 4 show the vibration spectrum from a two-cylinder reciprocating refrigeration compressor with frequency resolution of 1 Hz, 5 Hz and 10 Hz. Notice that with the 5 Hz and 10 Hz resolutions there is a significant loss of information regarding the health of the compressor; both amplitude and frequency information. In this case, the data loss would be significant since the vibration report would show that the compressors are running smoother than actual.

Take-home Point: Set the vibration analyzer up correctly for the measurement which needs to be made because when you don't, useless data is obtained, leading to making measurements again, increased cost, and lowered profit.

Error #3: Instrumentation Compliance and Calibration

NEBB has instrumentation requirements we use to do our jobs and a list of instruments for each instrument type, which comply with NEBB requirements. Every year, we must send these instruments in for a National Institute of Standards and Technology, or NIST, traceable calibration. Periodically, one of our instruments does not comply with NEBB requirements and we must replace the instrument or the sensor attached to the instrument, or send the instrument back to the factory for internal adjustments.

Side note: The NEBB requirements for sound level meters and analyzers are a subset of the American National Standards Institute, or ANSI, Type 1 (Class 1) and Type 2 (Class 2) specifications. Manufacturers indicate their instrument meets ANSI Type 1 or Type 2, which then implies that the instrument meets NEBB requirements.

This discussion applies to models and manufacturers of sound level meters and analyzers which meet NEBB requirements and are on the NEBB list of pre-approved instruments list, and do not pass an annual calibration. Why would an approved instrument not comply with NEBB requirements? As a sound and vibration instrumentation calibration laboratory, most of the instruments we calibrate yearly comply; however, there are some which are not in compliance. The most common reason an instrument is not in compliance is degradation of the microphone, and many times in the lower-end sound level meters, they most likely did not come out of the factory in compliance.

Figure 2. Reciprocating Compressor 0 to 500 Hz, 1 Hz increments

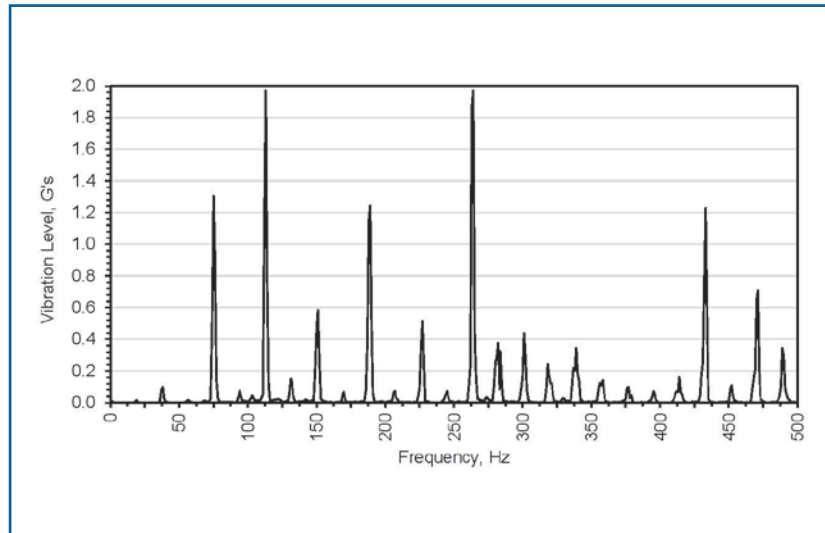


Figure 3. Reciprocating Compressor 0 to 500 Hz, 5 Hz increments

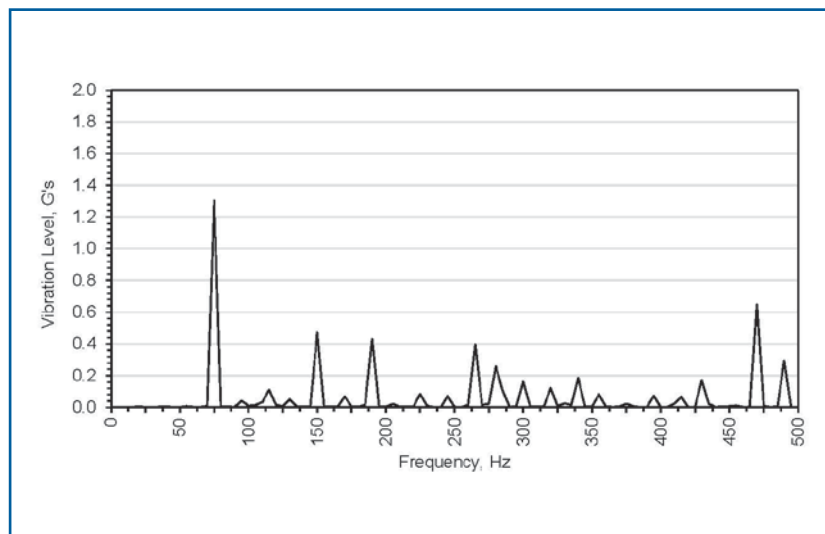
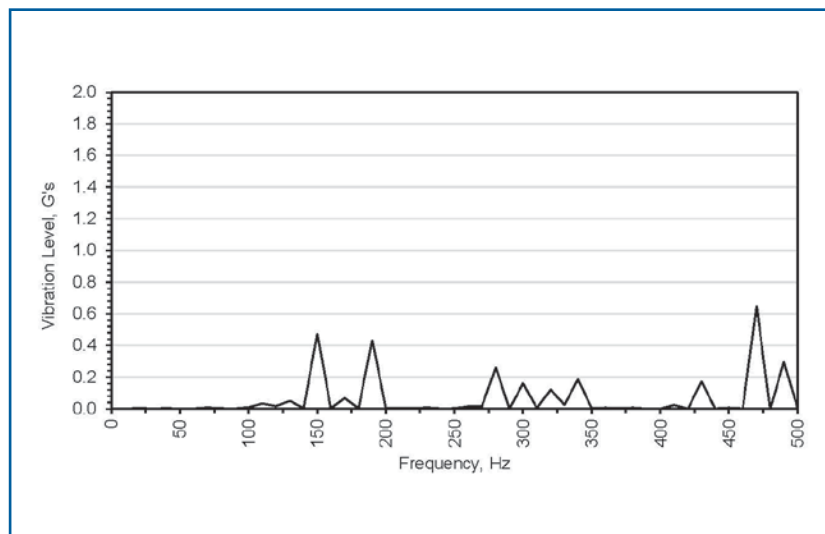


Figure 4. Reciprocating Compressor 0 to 500 Hz, 10 Hz increments



Why would an instrument come from the factory uncalibrated, or not in compliance with the ANSI standards the instrument is advertised to meet? The issue might be cost. Calibrating every instrument takes time, and if a large enough fraction of the customers do not require the instrument to be in compliance, the company can save money. (Note: This is only my opinion.)

As a calibration laboratory, we see this issue only with the lower priced sound level meters that are purchased online or from a wholesale distributor. As a standard practice, these manufacturers do not factory calibrate the meters or analyzers prior to shipment unless a customer specifically requested and paid for this factory calibration. Also, this requested calibration is an additional cost.

As a matter of practice, whenever we purchase any instrument for NEBB related work, we cannot necessarily rely on the vender or distributor to know enough to ensure we get a calibrated instrument. We need to do our own due diligence and explicitly ask if the instrument comes with a NIST traceable calibration, and if not, explicitly ask for one.

I hope this article has helped clarify some nuances of NEBB sound and vibration instrumentation and measurement practices. Remember we humans are about 60% water and the first resonance of a water molecule is about 22.235 GHz. So happy vibrating. ■

About the Author

Stuart McGregor is president of Engineering Dynamics, Inc. He is the co-chair of the NEBB Sound & Vibration Committee and Chapter Coordinator for the Rocky Mountain NEBB Chapter.

Building Enclosures: Are Two Lousy Barriers Better Than One?

Andrew Boyd | NAVFAC



It seemed like a straightforward project, but in the words of Confucius, “Life is really simple, but we insist on making it complicated.” It was a 25-year old, pre-engineered building which had originally been constructed as a temporary warehouse on our military base—simple gable roof, batt insulation installed under the roof supported by the purlins, and gable end vents with louvered openings. Later, it was converted to office use. A dropped ceiling was added, batt insulation was rolled out over it, and ducted supply and returns were added to provide space heating and cooling.

Over the years, condensation and leaks caused some of the under-roof batts to droop down, leaving the underside of the metal roof exposed. We were called in to help, but regarding an air quality issue, not a building envelope issue. The air handler was installed backwards, so the mechanical room with computer server was acting as a return plenum; the louvered opening in the wall was closed because the hot humid air being dumped out was screwing up the servers. The heat source was a strange ductwork experiment which ran a portion of the supply air through the old warehouse’s gas fired unit heater. But I digress.

There are basically two strategies of design for an attic space: vented and unvented. Vented attics are the traditional solution – the horizontal ceiling surface serves as the thermal,

air, and diffusion barrier. The attic space is well ventilated, and the sloped roofing material becomes the bulk moisture barrier. The four enclosure barriers are: liquid moisture, thermal, air, and vapor diffusion retarder (for more information, read the related Architect’s Article in *The NEBB Professional 2018, Quarter 4 Issue*). With an unvented attic, all four barriers happen at the sloped roof plane.

In principle, I prefer unvented attics and modern building science also supports this. Every recessed ceiling light, duct connection, and plumbing penetration is a potential breach in the ceiling thermal and air barrier for a vented attic. Attic vents add hot humid air into the enclosure in the summer and cold dry air in the winter. Providing air distribution in the attic is somewhat nonsensical. In the summer, nice cool air is taken from the air conditioner, dumped into metal boxes (ducts) with lots of joints and minimal insulation, and then sent through the most miserably hot portion of the entire building. In the winter it reverses to heated air being sent into those same metal boxes through the coldest portion of the building.

An unvented attic is a simpler, cleaner system. Put all the lights, ducts, and other stuff nice and cozy within the sealed building enclosure, and life is good. In his air barrier testing, Phil Emory noticed that many of the connections between wall-to-roof perform better than those between wall-to-ceiling.

For this 25-year old, pre-engineered building, I recommend removing the ceiling insulation, closing the gable vents, and adding a spray foam air/thermal barrier to the underside of the sloped roof. Exposed foam can be a fire protection issue, so this required coordination.

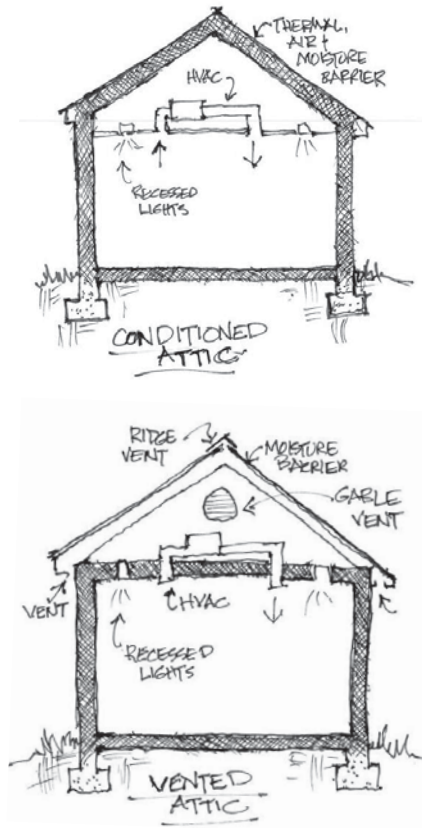
Then, when we got bad news about the budget, the priority was to correct the egregious issues with air quality. Keeping people from getting sick was (rightfully) determined to be a more important priority than our building science experiment.

With no money to do the correct “textbook solution” to the building enclosure, it was time to recommend Band-Aid Plan B. But that came with so many questions: Do we remove the sagging under-roof insulation, and remove the batt insulation

Figure 1



Figure 2



above the dropped ceiling, which by this point had gaps and missing pieces, or leave them both in place? What about the open gable vents?

The under-roof batt insulation had been compromised thermally, no robust air barrier was originally designed, and the nature of this system presented thermal bridging at the structural purlins. The batt insulation above the ceiling was no longer continuous after years of maintenance activities, and pieces were missing. If you believe this system could provide a continuous air barrier, maybe consider purchasing swamp land in Florida. Over years of cold winters, squirrels had nested in the batt insulation using the gable vents. Fortunately, in the mixed climate zone of Washington, DC, we did not have to lose sleep over a vapor diffusion retarder.

Our solution was as follows:

- Leave the under-roof insulation in place. Push the sagging pieces back up into place and affix within the limits of working above an existing suspended ceiling. Considering the metal roof's underside as a prime condensation spot, the insulation helps it stay above the dew point and act as a reservoir for moisture – holding it until it can evaporate on a sunny day and prevent dripping on the suspended ceiling. Even in its compromised state, this helps mitigate the tempera-

ture differential (ΔT) between conditioned interior space and the outside environment.

- Leave most of the batt insulation above the ceiling. Remove those sections fouled by squirrel feces. Add additional insulation in kind and attempt to make it continuous without being obsessive. While an imperfect air barrier, it still performs as a thermal barrier, addressing the ΔT between conditioned interior spaces and semi-conditioned attic space.
- Close the gable vents. In the winter, they introduce cold dry air into the building enclosure; in the summer, they introduce hot humid air into the building enclosure. Make the closure reversible, so if a future moisture issue develops, the building can be brought back to its existing state. Currently, we are making up for the building enclosure sins by wasting energy in order to avoid moisture problems. Making the solution reversible lets us hedge our bets.
- Visually monitor the situation four times per year, once for each season. Because we are making modifications to the building's mechanical system, changes to pressure, temperature, relative humidity, air changes, and other wild-card factors will occur. Changing the mechanical system has the potential to change the rules for the building enclosure system. Increased condensation at the metal roof deck's underside and subsequent water drips could become an issue if moisture-laden attic air falls below the dew point. This may require allowing more heat to escape from the conditioned space below in the winter, or in other words, wasting energy but preventing water damage. Conversely, if there are ice damming issues, the attic space may be too warm and require partially opening the vent seasonally.

Buildings are complex systems. Combine demands for durability, energy efficiency, air quality, and comfort for all occupants with a limited budget to accomplish everything and your blood pressure will soon reach unsustainable levels. As professionals in the building industry, we are called to help building occupants and owners with our knowledge and skills. This requires us to keep the fundamentals in mind, make logical decisions based on sound building science, and swallow our pride if we are wrong. ■

About the Author

Andrew Boyd is a licensed architect (and artist!) who works for NAVFAC and is an Industry Stakeholder on NEBB's Certification Board. This article was peer-reviewed by Subject Matter Experts Phil Emory and Steve Wiggins. The views expressed in the article are those of the author and do not necessarily represent the views of the agency or United States.

Title 24: 101

Amber Ryman | ACCO Engineered Systems



What do you know about Title 24, or “T24” as we sometimes call it in sunny California? Other than being some crazy code California wrote, you may not know much, and understandably so. Title 24 is not an easy concept to grasp unless you live it daily.

Title 24 started with the California Buildings Standards Commission responding to state legislature mandating the reduction of the state’s energy consumption. However, Title 24 is not new to California; some of its language goes all the way back to the 1978 Building Code.

Early on, the California Energy Commission (CEC) made the decision it was going to become a leader in Building Energy Efficiency for new buildings and California still leads the way today. In September 2018, California’s State Governor signed a landmark bill setting a goal of 100 percent clean energy for the state’s electrical needs by the year 2045. However, not all states are on the same path.

According to the U.S. Department of Energy (DOE), as of December 2018 only five states have more stringent Building Energy Code requirements than the ASHRAE 90.1-2013 and only five states are at least meeting the ASHRAE 90.1-2013 standards. That means 40 states are currently working with building codes with energy standards that are less than the current ASHRAE standard.

If you are curious where your state fits in, check out this illustration: <https://www.energycodes.gov/status-state-energy-code-adoption>

How Title 24 Functions and What Triggers It

Title 24 is written for both residential and non-residential buildings, as well as for lighting and mechanical systems. To explain NEBB’s involvement, let’s look at the non-residential mechanical process.

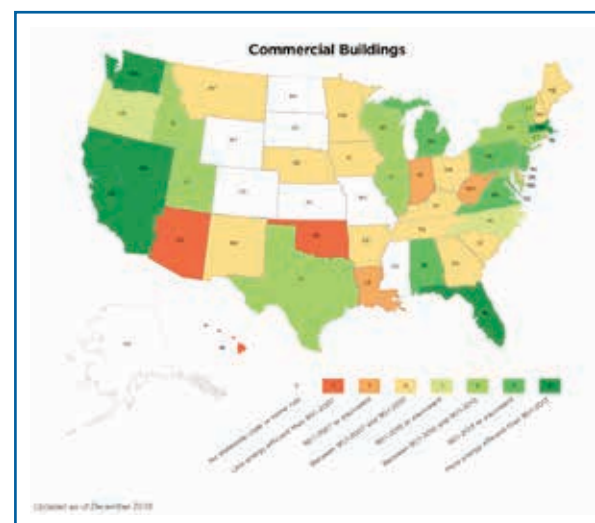
Essentially, Title 24 starts with the design of any mechanical system intended for installation during new construction. In very few cases, existing construction or retrofits may require Title 24, but let’s discuss the overall process first.

The design phase takes into consideration the type of system being installed and verifies it meets all of the CEC Building Energy Code requirements listed in the Building Energy Efficiency Standards (BEES). The current version (2016) can be found here: <https://www.energy.ca.gov/title24/2016standards/>

The Engineer of Record is required to complete what are called the Non-Residential Certificate of Compliance (NRCC) Forms. These forms state the systems being designed are in compliance with BEES and are required as part of the initial permitting process. From there, the mechanical contractor is required to build the system per the compliance forms and BEES.

Once the system has been built, the mechanical contractor is required to complete the next set of forms: the Non-Residential Certificate of Installation, NRCI. Once the system has been built, required testing is done to confirm compliance. *This is where NEBB gets involved and where NRCA forms come into play.*

NRCA, otherwise known as Non-Residential Certificate of Acceptance, forms can only be completed by the “soon-to-be” Certified Technicians. These forms are very specific to each system and have step-by-step instructions of how the mechanical systems should work and be tested.



Once the NRCI and NRCA forms are completed and signed, they are submitted back to the building inspectors for final sign-off for the permit. In the meantime, and until these forms are submitted, the building officials will hold up Temporary Occupancy Certificate (TOC) on the building. The Figure shows the process, as written in Chapter Two of the Building Energy Efficiency Manual, (https://www.energy.ca.gov/title24/2016standards/nonresidential_manual.html):

Where does NEBB Fit In?

In the 2013 BEES, the CEC stated that only Certified Technicians can complete the NRCA forms. Being a certification association, NEBB applied under the 2013 code to become an approved Acceptance Test Technician Certification Provider (ATTCP) and was approved during that code cycle.

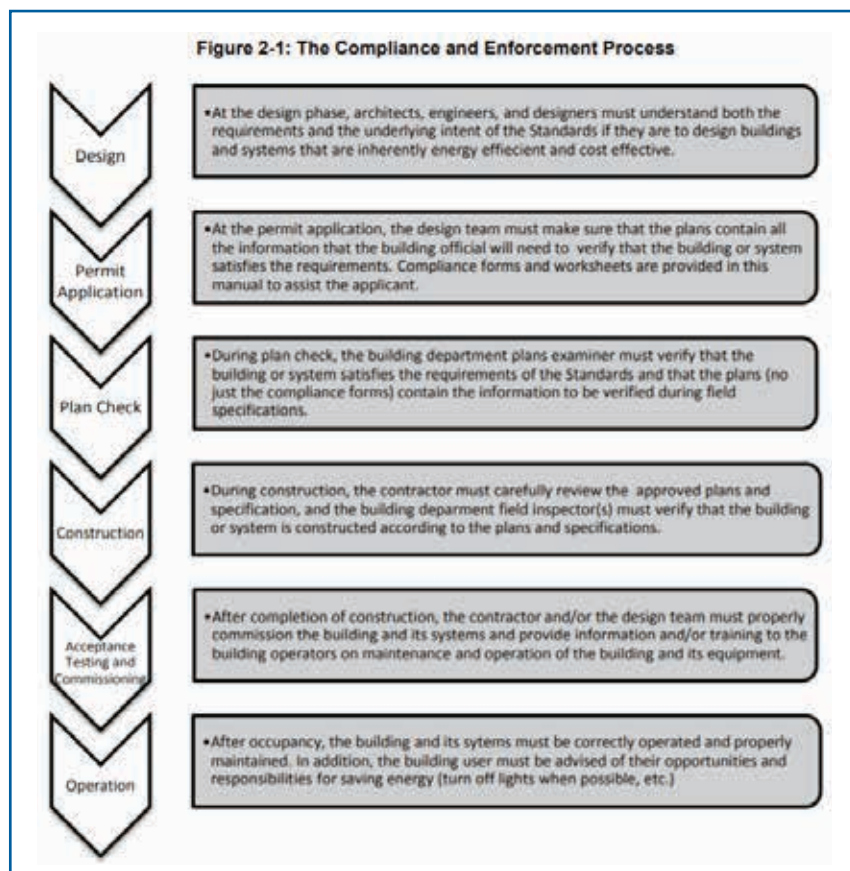
California code is updated every three years. When the code changed in 2016, there was a delay preventing the ATTCPs from receiving an official approval from the CEC to continue training. Language existed requiring random onsite audits with little clarification. That was a stopping point for the ATTCPs in maintaining compliance with the BEES, and most training came to a halt.

NEBB then developed a solution, which the CEC accepted, and NEBB's approval as a 2016 ATTCP was granted.

Only one more thing holds up the requirement for certification: having enough certified individuals to perform the number of tests that occur in the State of California. The requirement is to have at least 300 technicians certified. Once that 300 mark is reached, the CEC will trigger the final mandate to require all testing to be performed by Certified Technicians who work for Certified Firms only. (*Currently, the rumor is that the number has been met.*)

How This Plays Into the 2016 Code Cycle

Unfortunately, it may not. NEBB is waiting to hear that the mandate is going into effect. Once it is on the CEC's agenda, it can be triggered immediately or using a timeline. Maybe six months or maybe a certain date, but regardless, NEBB is fast approaching the next code cycle in 2019. This code goes into effect starting January 1st, 2020, thus it will be mandat-



ed by the next code cycle. The mandate will be here before we know it.

Are you Acceptance Test Technician (ATT) certified yet? If not, here are the quick steps on how to become certified:

Firm Process

- Apply to become an ATT Certified Firm
- Complete the online training
- Complete the online exam
- Obtain final ATT certification

Technician Process

- Decide which forms you or your organization will be performing
 - Package deals exist for multiple forms
- Apply for those specific tests
- Complete the online exam to prove experience is met
- Complete the online course specific to the tests applying for
- Perform the hands-on test
- Obtain ATT certification ■

About the Author

Amber Ryman is the TAB Supervisor at ACCO Engineered Systems in the San Francisco Bay area in California. She is NEBB's Vice President on the Board of Directors and holds certifications as a NEBB Certified Professional in TAB, BSC, RCx-EB, Sound and Vibration disciplines.

Certification Board Continues Expansion of SME Contingent

Cynthia Hereth | NEBB Director of Certification



NEBB's Certification Board is expanding its Subject Matter Expert/Item Writing Team who assist the Certification Board's Exam Development Committee with developing exam items (questions) for various certification exams. Members include the addition of four new SMEs: Erich Schiller, Michael Funk, Jeff Raposa and Steve Clark.



Erich Schiller

Erich Schiller is a NEBB BET CP working for MSTB, Inc. located in Richmond, Virginia. Erich has over 15 years of experience in residential and commercial construction, special testing, building enclosure testing, and indoor air quality testing. He is also a licensed field auditor for the Air Barrier Association of America.

Michael Funk holds his NEBB CPT CP and is employed by Pentagon Technologies which services the critical environment industry. Beginning as a CPT CT, he focused on cleanroom and front-end module "Minienvironment" certifications for Intel and other various sized semiconductor facilities.



Michael Funk

Funk was promoted to project manager, then Certification Program Manager, and for the past 18 months, is Pentagon's Director of Operations, overseeing the site services division.

"I want to thank the Certification Board for its confidence in my ability to add value to the SME team and the NEBB organization. It has been a long-time goal of mine to not only become a NEBB Certified Professional, but to continue my industry growth and involvement by volunteering with the CPT disciplines' top professionals. I look forward to participating with upcoming projects and collaborating with the Exam Development Committee and Certification Board."

Jeff Raposa, CPT CP, is the Founder and President of Controlled Environment Management LLC, based in Phoenix, AZ. His 28+



Jeff Raposa

years of experience and specialty lie within the Life Sciences sector as his early experience came working within the Pharmaceutical and Biotechnology Industry located in the San Francisco Bay Area when the industry was just starting to flourish. Jeff gained valuable knowledge through direct participation in all phases of regulatory compliance requirements with companies that are in the early R&D stage to companies that are established Manufacturers. He currently serves as Vice Chair of NEBB's CPT Cleanroom Standards Committee.

"It is a privilege to work with NEBB as a Subject Matter Expert. I am confident my experience in the Cleanroom Industry will help drive NEBB to a new level of expertise as demanded within the Industry. My goal is to present challenging exam content to the future of NEBB's Cleanroom certification that will remain current with the changing landscape of testing methodologies and regulatory compliance for the Life Sciences sector. I am looking forward to working with other NEBB certification professionals."

Steve Clark, Vice President of Clark Balancing LLC, located in Milton, Ontario Canada, has been a NEBB active volunteer for many years. Tours of "duty" include two years as the TAB Committee Chairperson developing significant TAB documents and instructing and serving two terms on the NEBB Board of Directors. Current involvement is as a member of NEBB's Chapter Affairs Committee and now as an SME/item Writer. Certified in five NEBB disciplines, his knowledge and experience are vast, specifically in TAB, RCx-EB, BET, FHT and BSC.



Steve Clark

"At the industry forefront, NEBB is highly regarded within the indoor environmental industry, the opportunities to be

involved with this organization have been an absolute privilege. There is a great benefit to work alongside the “best of the best. Holding multiple NEBB certifications, I look forward to helping NEBB’s Certification Board and Exam Development Committee to create improved and sustainable exams for the industry,” said Clark.

According to Certification Board Chair, Richard Farrington, having experienced, seasoned industry pros combined with young professionals helps to diversify NEBB’s exam writing and offers a great opportunity for SMEs to learn from each other and advance the mission of NEBB.



Richard Farrington

Said Farrington, “We are growing a base of volunteers that will help us create defensible, high quality exams in disciplines that are expanding exponentially within the industry. It’s exciting to see this type of growth and involvement unfold.” ■

About the Author

Cynthia (Cindi) Hereth is NEBB’s Director of Certification. An association professional for more years that she’ll tell you, Cindi works with NEBB’s Certification Board, Exam Development Committee and Subject Matter Experts to hone, create and expand NEBB’s bodies of knowledge, exams, certification policies and procedures and oversees individual compliance.

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Just when you think things are leveling out, everything speeds up. And so it goes with NEBB's Young Professionals Network (YPN). Three more young professionals have been approved as YPN Chapter Liaisons, bringing the grand total to 13! Let's meet them here!

Adam Jakobsen, YPN Chapter Liaison, Pacific Northwest EBB



Adam Jakobsen

Adam is a NEBB TAB CP and Project Manager for Precision Test & Balance, Inc. located in Canby, OR. Starting out as an entry-level technician, he now manages all the firm's projects, handles all technician training and serves as the Safety Director. Developing and maintaining good working client relationship is one of his most important job responsibilities.

"I would like to help bridge the gap between the younger field technicians with the more experienced professionals. The last five years I have grown into a position of helping manage and grow a TAB Firm that can provide services to most any sized project or client," states Jakobsen. "Most of those of the YPN age have not been exposed to managing a business while maintaining and developing needed career growth. I believe that entrepreneurship will contribute to a strong, viable, highly regarded organization such as NEBB."

Brett Sanicola, YPN Chapter Liaison, Northeast EBB



Brett Sanicola

Brett is a licensed Professional Engineer, NEBB TAB CP, and President of B&L Testing & Balancing LLC, located in Oceanside, NY. In addition to Testing and Balancing, he has acquired extensive professional experience in construction management, mechanical engineering and real estate due diligence.

Mr. Sanicola is an active member of NEBB's Northeast Chapter which serves Connecticut, Maine, Massachusetts, New York City, New Hampshire, Rhode Island, Vermont.

"Brett was in San Antonio with my group and was inspired to volunteer for the committee," said Jay Brainerd, Northeast

NEBB Chapter Coordinator. "He is a newer member of the NEBB family but I have known him for a while and I am happy to have a young CP/Owner wanting to be involved."

"As part of NEBB's YPN community, I believe that I could contribute a fresh and thoughtful perspective on industry and organizational issues," said Sanicola. "Contributing to the organization will not only provide all certified firms and younger professionals with an economic advantage going forward, but it will continue to push the organization to provide solutions to the environmental challenges we will all face in the future."

Jonathan Jarvis, YPN Chapter Liaison, Bonneville (BEBB)



Jonathan Jarvis

Jonathan holds the NEBB TAB CP and BET CP certifications, and is the president of Precision Air & Water Balance, out of Kalispell, MT. A busy man, he is also president of the BEBB Chapter and regularly attends NEBB events both nationally and locally. His certifications with NEBB help with "procuring project because engineers and contractors know they will receive quality product."

"My goal for serving as the YPN Chapter Liaison is to help relay the information the YPN offers, provide insight an experience to those who could benefit from it, and volunteer where I can," said Jarvis. "Being able to converse with like-minded young professionals will be a great benefit and I want to be part of ensuring that NEBB maintains its high standards."

Welcome Gentlemen! ■

NEBB's Young Professional Network's Mission Statement:

Serving as a resource for young professionals to cultivate the growth of NEBB for generations to come.

NEBB NEWS

CHAPTER UPDATES

MAEBA

By: Trish Casey, Chapter Coordinator

MAEBA will hold its Annual Recertification Seminar on September 22-23, 2019 at Harrah's Resort, Atlantic City, New Jersey.

Join the MAEBA Chapter for a full day of great educational topics, vendor displays and arrive on Sunday to join the group for dinner at the Pool Balcony. More information will be available in early Summer! Go to the MAEBA website more information www.maebanet.org.



View from the Harrah's Pool Balcony

North Central NEBB

By: Ashley Lang, Chapter Coordinator

North Central NEBB's Recertification Seminar date is set for Thursday, October 10, 2019, scheduled for the Radisson in Roseville, MN. Details are being finalized regarding fees, special events and details as it relates to vendors & attendees. More information will be sent to chapter members by Q2 2019.

Chapter "special projects" include sponsoring a Golf Hole at the NEBB Annual Golf Outing to support ASHRAE Research and sponsoring a yearly seminar at Pace Analytical. Seminar topics focus on cleanroom testing and purified water systems and is a great avenue for obtaining continuing education credits.

A busy chapter, North Central NEBB meets four times a year: two meetings for General Membership and two for the Board. Topics discussed include finances, board member updates, updating and approving Chapter Bylaws, reviewing recertification seminar speakers and topics, firm issues and various sponsorship opportunities. For more information on the North Central NEBB Chapter, contact Ashley Lang at Ashley@smarca.com.

FEBB Chapter

By: Terry Wichlenski, Chapter Coordinator

The Florida EBB Chapter announced its 2019 NEBB TAB Practical Exam dates.

The TAB Certified Professional's (TAB CP) Practical Exams are scheduled at the FEBB Testing Labs (Jacksonville, Largo & Deerfield) on May 31, 2019, June 1, 2019 and September 13 or 14, 2019. Friday exams are held at the FEBB Jacksonville location; Saturday exams are held at the Largo and/or Deerfield Beach locations.

Registration Process: For TAB CP Practical Exam reservation spots and deadline information on the spring and fall exam dates, contact Chapter Coordinator Terry Wichlenski at 727.240.4254 or email febbcoordinator@gmail.com. Exam fees can be paid by check made payable to "FEBB." Candidates may indicate their preference as to date, and every attempt will be made to accommodate this request. **Space is very limited, so call today to reserve your spot as soon as possible.**

Mid-South EBB Chapter (MEBB)

By: Ginger Slaick, Chapter Coordinator

MEBB's 2019 Recertification Seminar & Annual Meeting is September 21-22, 2019 at the Savannah Marriott in Savannah, GA. Day One of the seminar features technical sessions designed for CPs and CTs to expand their knowledge on relevant industry-specific topics. Presentations include *VFD/Electrical Test & Operation* by David O'Dell of Borie Davis, Inc., *Coordination Control Specifications & TAB Specifications* by Design Engineer from Andrews, *Hammock*

& *Powell and Contractor Expectations* by James McCullough from Brasfiled and Gorrie, LLC. Day Two focuses on HR/Accounting, MEBB's Annual Membership Meeting during which time Ginger Slaick, MEBB's EVP/Chapter Coordinator will review Firm Recertification, dues structure and other valuable chapter related information. Patrick Law, NEBB Board Member, will present a NEBB update.

Certified Technicians are invited to attend the Recertification Seminar on Saturday, September 21st from 8:00 a.m. – 1:00 p.m. at a discounted rate. This provides Certified Technicians

the opportunity to broaden their technical knowledge and provide the required CECs needed to maintain NEBB certification.

MEBB's 4th Annual Vendor Expo is an important aspect of the seminar providing CPs and CTs a firsthand opportunity to view latest industry technology. Thanks to Platinum Sponsors: Instruments Direct & Retrotec; Silver Sponsors: TSI & Evergreen Telemetry; and Bronze Sponsors: Building Start, Ameritech, & Dwyer. For more information please contact Ginger Slaick at 678.407.2754 or email gslaick@midsouthnebb.com.



MEBB's Annual Recertification Seminar location, Savannah Marriott, Savannah, GA.

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Newly Certified NEBB Firms, Professionals and Technicians

NEBB congratulates the following Firms, Professionals and Technicians who achieved NEBB Certification between June 18, 2018 through December 31, 2018. To learn more about NEBB certification, contact certification@nebb.org.

Name	Country	Discipline
FIRMS		
Airadign Solutions	United States of America	TAB-BSC
Air Solutions & Balancing, LLC - Colorado	United States of America	TAB-BSC-SM-VM
Commtech Asia	Australia	TAB
Earthsmart Controls	United States of America	TAB
Energy Transfer Solutions	United States of America	TAB
Enica Engineering, PLLC	United States of America	TAB
Hop Yuen Industrial Ltx	Hong Kong	CPT
Installation Integrity 2006 W.L.L. (i2i)	Qatar	TAB
Integrated Tab Services LLC	United States of America	TAB
MMC Contractors	United States of America	TAB
Research Air Flo, Inc - Charleston	United States of America	TAB
TAB Engineers Inc - Japan	Japan	TAB-BSC-BET
Test and Balance Group	United States of America	TAB
TI SYS-TEK - Houston	United States of America	TAB
TI SYS-TEK	United States of America	TAB-BSC
TnC Consulting and Commissioning	Turkey	TAB

PROFESSIONALS		
Al-Jammal, Murad Moh'd Kamal	Jordan	SM-VM
Ali Saleh, Mahmoud Ahmed	United Arab Emirates	TAB
Armour, Eric R.	United States of America	TAB
Bonny, Eric James	United States of America	TAB
Button, Kevin W.	United States of America	TAB
Cooke, Stanley T.	United States of America	FHT
Desroches, Joel F.	Canada	CxPP
Dierking, Joshua Micaiah	United States of America	BSC
Dunn, Eugene E.	United States of America	TAB
England, Curtis H.	United States of America	SM-VM
Fisher, John William	United States of America	BSC
Harrison, Brian Thomas	United States of America	TAB
Hund, Bryan	United States of America	TAB
Isenhour, Randy Lee	United States of America	TAB

Name	Country	Discipline
Kauffman, Ryan E	United States of America	TAB
Kennedy, Dan Michael	United States of America	TAB-BSC
Kremer, Zachary M	United States of America	RCx-EB
Lane, David S.	United States of America	CPT
Metts, Derek E.	United States of America	BSC
Palmer, Christopher Wayne	United States of America	BSC
Perryman, Jeffrey Owen	United States of America	TAB
Quiros, Diego Jimenez	Costa Rica	CPT
Rogers, James F.	United States of America	TAB
Seo, Hyung Seog	Republic of Korea	TAB
Shouib, Mohammad	Pakistan	FHT
Tinsley, Kevin John	Canada	FHT
Trobaugh, Dawayne C.	United States of America	FHT
Uffelman, Nicholas L.	United States of America	TAB
Vanderheiden, Grant William Franklin	United States of America	TAB
Williford, Weslie Nicole	United States of America	RCx-EB

TECHNICIANS		
Abdel Maksoud, Hassan Kamaleldin Yehia	United Arab Emirates	TAB
Abusali, Ansari	United Arab Emirates	TAB
Amort, Antonio Saraspi	United States of America	TAB
Antal, Peter	Israel	CPT
Apsarsha, Mohamed	United Arab Emirates	TAB
Bartlett, Carey James	United States of America	TAB
Bueno, Kevin Johanny	United States of America	CPT
Caldwell, James Wesley	United States of America	BSC
Chavarria, Josue Conejo	Costa Rica	CPT
Davis, Cody M.	United States of America	TAB
De La Garza, Victor Armando	United States of America	TAB
Drabek, Michael P.	United States of America	TAB
Famiglietti, Charles	United States of America	CPT
Fogarty, Brian Sebastian	United States of America	TAB
Frantz, Frank	United States of America	TAB
Fultz, Andrew Joseph	United States of America	TAB
Gustafson, Jason Scott	United States of America	TAB
Han Meng, Calvin Ku	Malaysia	CPT
Handley, Douglas Cress	United States of America	TAB
Helmy, Mohamed	United Arab Emirates	CPT
Hensel, Michael R.	United States of America	TAB
Huat Sheng, Tan	Singapore	CPT
Huerta, Stephen Edward	United States of America	TAB
James, Matthew Preston	United States of America	TAB
Jani, John	United States of America	TAB

Name	Country	Discipline
Jarvis, Jacob Wayne	United States of America	TAB
Jensen, Jonathan Ray	United States of America	BSC
Kamel Mohamed, Ahmed Mohamed	United Arab Emirates	TAB
Kin, Mak Man	Hong Kong	CPT
Koepke, Carl John	United States of America	CPT
Limoge, Robert Kyle	United States of America	CPT
Littlewood, Ryan N.	United States of America	CPT
Mahmoud Ali, Mohamed Gamaleldeen	New Zealand	TAB
Malek, Faizuddin Riyazuddin	Canada	TAB
Marcum, Richard	United States of America	BSC
Martin, Russell J.	United States of America	TAB
McHenry, Timothy John	Australia	TAB
Mercier, Dylan Joseph	United States of America	TAB
Moore, Edward W.	United States of America	TAB
Morales, Mike M.	United States of America	CPT
Morgan, Dustin Michael	United States of America	TAB
Murphy, Timothy Patrick	United States of America	TAB
Murray, Johnny Elias	United States of America	TAB
Neveu, Joshua Dean	United States of America	BSC
Ninh, Thanh	United States of America	TAB
Orr, Timothy Eugene	United States of America	TAB
Petricig, Michael Enzo	United States of America	TAB
Radomski, Darak	Australia	TAB
Rojas, Aaron Alejandro	United States of America	TAB
Schwalen, Alan Edwin	United States of America	TAB
Spencer, Jaimi Lynn	United States of America	TAB
Steigerwalt, Fred Charles	United States of America	TAB
Stewart, Matthew J.	United States of America	CPT
Tan, Jun Hao Gabriel	Singapore	CPT
Weller, Randy Burton	United States of America	TAB
Wheeler, Taylor M.	United States of America	TAB
Yusuff, Irewole A.	United States of America	TAB
Zeig, Marvin Eugene	United States of America	CPT
Zhu Wei	Singapore	TAB

New Online Courses!

Check out NEBB's new eLearning courses, available online, geared for:

- Certification Candidates looking to expand their self-study options
- Owners looking to train new hires in the basics
- CPs and CTs looking for CECs

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Reminder: CPT Project Personnel Requirements Mandate – As of January 2020

The NEBB Board of Directors (BoD) approved the requirement that all NEBB CPT projects be staffed by a CPT Certified Professional (CPT CP) and/or at least one CPT Certified Technician (CPT CT). The policy was initially publicized in October 2017 to be fully implemented for enforcement on January 1, 2020.

In 2009, a related issue influenced the CPT mandate: NEBB approved a policy requiring a TAB Certified Professional (TAB CP) or TAB Certified Technician (TAB CT) to be on site for all TAB projects where NEBB was specified. This policy took effect on January 1, 2013. The latest NEBB TAB Procedural Standards 8th Edition 2015, section 2.4.3 COORDINATION/SUPERVISION requires the following:

The NEBB Certified Professional is responsible for ensuring either a NEBB CP or NEBB CT is continually present while TAB work is being performed on every NEBB certified project, and directing those technicians in performing the work. The NEBB CP is ultimately responsible for the accuracy of any field measurements and certified reports generated.

With this requirement in place for the NEBB TAB Program, the level of quality on NEBB projects increased dramatically. The NEBB Board of Directors decided this same approach would be ideal for Cleanroom Performance Testing.

Conversations with major cleanroom operation managers indicated they were less than satisfied with firms utilizing untrained personnel to perform the required certification processes. Instances were mentioned where field staff did not know when the Certified Professional was on site. This a common complaint industry wide, across various certification organizations and firms but one that NEBB does not accept as a standard of operation. A major chip manufacturer indicated they will issue a new requirement for all personnel performing cleanroom performance testing to be either a Certified Professional (CP) or Certified Technician (CT).

By taking a proactive approach with the cleanroom performance testing mandate, NEBB provides a professional solution for the cleanroom industry's concerns about on-the-job work quality, while bringing NEBB to the forefront in the cleanroom certification field.

The mandate for Certified Technicians (CT's) on CPT projects provides cleanroom operators and managers with the level of expert CPT testing personnel they expect from NEBB Certified Individuals and NEBB Certified Firms.

NEBB's goal is to provide quality training and certification programs which leads to quality Certified Individuals, be it NEBB CPs or CTs, so clients are provided with competent and high-end work.

January 2020 is only months away and will arrive quickly; thus, for employers looking to get their employees CPT CT-certified, start now while there is ample time to complete the process. For information on becoming CPT CT certified, email certification@nebb.org.

NEBB 2019 Technical Seminar Schedule*

* Subject to change

AUGUST 2019

5-7: Cleanroom Performance Testing (CPT) IND Facilities, Vancouver, WA

Seminar Registration Deadline: July 22, 2019

(Email training@nebb.org for seminar information.)

Optional Exam Day: August 8 & 9, 2019

Application for Candidacy Submission Deadline: July 12, 2019

(Email certification@nebb.org for certification information.)

12-15: Retro-Commissioning for Existing Buildings (RCx) NEBB TEC, Gaithersburg, MD

Seminar Registration Deadline: July 29, 2019

(Email training@nebb.org for seminar information.)

Optional Exam Day: August 16, 2019

Application for Candidacy Submission Deadline: July 12, 2019

(Email certification@nebb.org for certification information.)

SEPTEMBER 2019

9/30-10/4: Sound & Vibration Measurement (S&V) Total Dynamic Balance, Deerfield Beach, FL

Seminar Registration Deadline: August 30, 2019

(Email training@nebb.org for seminar information.)

Optional Exam Day: October 2 & 4, 2019

Application for Candidacy Submission Deadline: August 30, 2019

(Email certification@nebb.org for certification information.)

OCTOBER 2019

7-9: Cleanroom Performance Testing (CPT) NEBB TEC, Gaithersburg, MD

Seminar Registration Deadline: September 23, 2019

(Email training@nebb.org for seminar information.)

Optional Exam Day: October 10, 2019

Application for Candidacy Submission Deadline: September 7, 2019

(Email certification@nebb.org for certification information.)

13-15: Testing, Adjusting and Balancing (TAB) IMI Facilities, Roswell, GA

Seminar Registration Deadline: September 29, 2019

(Email training@nebb.org for seminar information.)

Optional Exam Day: October 16, 2019

Application for Candidacy Submission Deadline: September 13, 2019

(Email certification@nebb.org for certification information.)

NOVEMBER 2019

4-7: Building Systems Commissioning (BSC) NEBB TEC, Gaithersburg, MD

Seminar Registration Deadline: October 21, 2019

(Email training@nebb.org for seminar information.)

Optional Exam Day: November 8, 2019

Application for Candidacy Submission Deadline: October 4, 2019

(Email certification@nebb.org for certification information.)

4-5: Fume Hood Performance Testing (FHT)

Labconco, Kansas City, MO

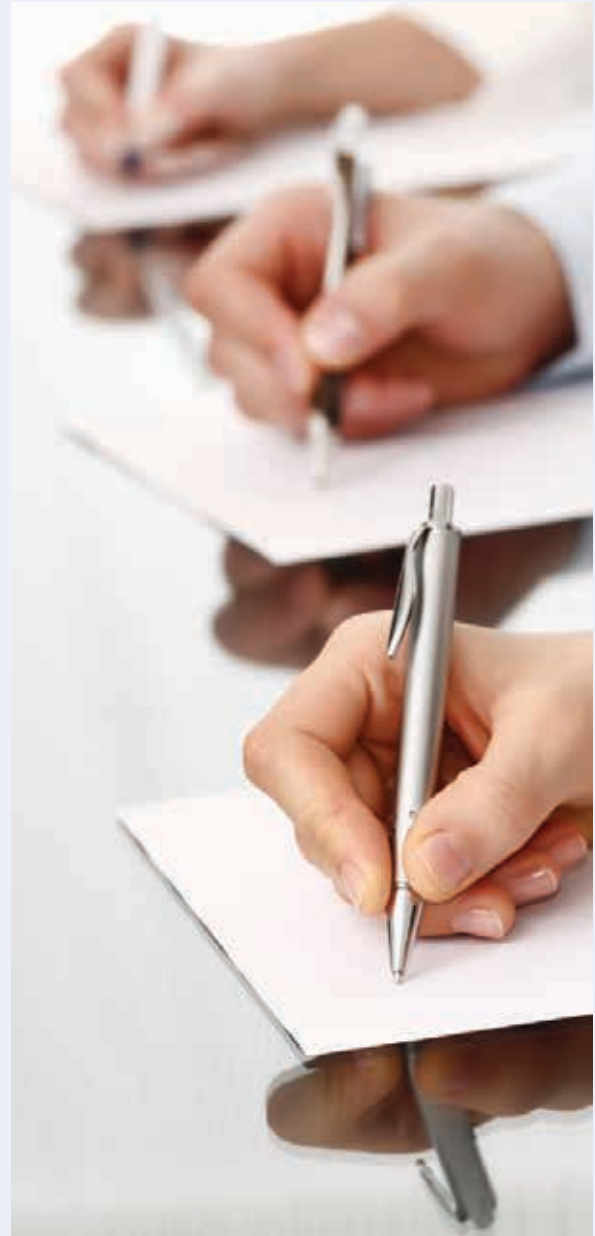
Seminar Registration Deadline: October 21, 2019

(Email training@nebb.org for seminar information.)

Optional Exam Day: November 6-7, 2019

Application for Candidacy Submission Deadline: October 4, 2019

(Email certification@nebb.org for certification information.)



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