

The NEBB Professional

2019 – Quarter 4

How to Ensure Safe Laboratory Environments that Meet Requirements:

The Advantages of Partnering
with a NEBB Professional

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NEBB President's Letter

It seems like just yesterday that Jim Whorton was elected 2019 President of NEBB—wow, that year flew by fast! I would like to thank Jim for a productive year at the helm and welcome his guidance as Immediate Past President going forward. I would also like to thank the Board of Directors for their confidence in electing me 2020 NEBB President. I am honored to serve this Board—a Board of volunteers working tirelessly to make NEBB a great organization—for the next year. As my predecessors have done, I will continue to focus on making NEBB the industry leader in training, education, and certification.

As our current Board turns over, we will be saying goodbye to Immediate Past President Don Hill. Don has been a member NEBB's Board since 2012, and his knowledge and guidance will surely be missed. His number one priority has always been doing whatever possible to make NEBB better. I am honored to call him my colleague, my mentor, and especially my friend. Thank you, Don!

One of the greatest things that makes this organization continue to operate as an industry leader is the tireless efforts of our volunteers. As the writer Elizabeth Andrew once said, "Volunteers do not necessarily have the time; they just have the heart." I would like to thank all of our volunteers who make this engine run and let you know that your efforts do not go unnoticed. We are made up of the Executive Finance Committee (EFC), Board of Directors, National Committees, Chapter Boards and Chapter Technical Committees—all volunteer positions filled by people with big hearts, giving up their personal time for the betterment of NEBB.

We have a hardworking staff that supports all of our volunteers, firms, Certified Professionals and Certified Technicians. Tiffany Suite is NEBB's Executive Vice President, working closely with NEBB's EFC and Board of Directors on policy and administrative issues. She also oversees firm certification, Certelligence and all aspects of the association from the NEBB TEC expansion to the annual conference. Sheila Simms is our Manager of Certification, managing individual certification processes from start to finish, recertification, and many other certification-related issues. Emily Demmons is our Finance Manager and she manages the accounting aspects of NEBB, oversees NEBB's Bookstore and makes sure the money is in the bank. Christy Flippo is our Site Manager for NEBB TEC, coordinating technical seminars and providing general support for all of NEBB's staff. If you have any questions or problems, these ladies are great to work with and always available to help.

As the President-Elect, I have had the privilege of meeting with all of the committees on a quarterly basis. These committees consist of dedicated professionals who work hard on the marketing, procedures, standards and policy that make up NEBB.

As you already know, the TAB Committee just put out the 9th Edition of the Procedural Standard. They are also working to get out a mobile app by the beginning of the year. Other technical committees are working diligently



**“ I am honored to serve this Board
—a Board of volunteers working
tirelessly to make NEBB a great
organization—for the next year. ”**

on standards and procedures while the Chapter Affairs Committee works to make sure that the By-Laws and Operational Procedures are being applied equally throughout the organization.

Jim Whorton, Immediate Past President, oversees the NEBB Young Professionals Network (YPN) Committee. This is currently an Ad-Hoc Committee that was founded by Past President Jean Paul Leblanc. His vision of needing a committee of young professionals to introduce to the workings of NEBB before eventually moving on to technical committees is in full bloom and working as he planned. These young professionals have gone above and beyond and helped in many ways.

We are also working on the next phase of the NEBB TEC project. The classroom has been completed and has held many seminars since opening. We are now working to complete the hands-on training lab.

Please, don't forget to mark your calendar for April 2-4, 2020. We are currently in the process of preparing for the 2020 NEBB Annual Conference. This conference is a great opportunity to meet up with old friends, visit the vendor booths to keep on top of new products being introduced to the market, and gain knowledge from the many speaker sessions. An added bonus is that this year, the location is drivable for many of the chapters since it is being held at The Greenbrier, America's Resort. It will not disappoint! Located amid the breathtaking mountains of West Virginia, The Greenbrier is a National Historic Landmark and world-class resort that has been welcoming guests from around the world since 1778. The natural mineral springs that drew its first guests over 235 years ago continue to lure visitors to their 11,000 acre luxury retreat today. With a guest list that includes 27 of our country's 45 Presidents, America's Resort has long been a favorite destination of royalty, celebrities and business leaders. I hope to see you there!



Jeff Schools

Jeff Schools

President



NEBB Past President's Comments

Congratulations to Jeff Schools, our recently installed 2020 NEBB President! I want to thank the NEBB Board of Directors for allowing me to serve as NEBB President throughout 2019 and state what an honor it has been working with both the Board and staff this past year.

Jeff is committed to maintaining the direction of the association moving ahead, and will be a very effective leader. I look forward to working with Jeff in any manner I can to contribute to the success of both current and future NEBB projects.

I also look forward to working with the NEBB Young Professionals Network (YPN) during the coming year to carry out the projects they have underway, update their goals, and continue to bring future generations into the organization. We all want to thank Past President Don Hill for his incredible mentorship to this group over the past year, and his service to NEBB in general.

Speaking of Don, I want to acknowledge his service to NEBB, his leadership and work on the Board of Directors for the past eight years, along with chairing committees for many years prior to that. His ability to provide the history of the organization and contribute to the future direction is something that we have been fortunate to have and do not want to lose. We look forward to Don continuing his dedication and service to NEBB in the coming years. Thank you, Don!

My time as a volunteer for NEBB has been very rewarding from both a personal and professional point of view. Meeting so many volunteers from across the world, committed to increasing NEBB's influence, and working with the dedicated staff that carries out countless behind-the-scenes activities necessary for our organization to thrive, truly emphasizes the power of this organization. Thank you for the opportunity to be included in this group.

Jim Whorton

Jim Whorton
Past President



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NEBB's New Exam Development Coordinator

NEBB would like to welcome Cristi Arbuckle, who joined us in November

as our new exam development coordinator. She is charged with creating and updating NEBB exams to keep them current with the industry since legally defensible exams are essential to proving competency in the field.

Cristi has a number of years' experience in exam administration and development in the area of clinical psychology and substance use counseling. Although she's new to the discipline of high-performance building systems, she is looking forward to learning more about the industry.

Cristi has a variety of interesting work experiences. She's worked for a U.S. Senate Subcommittee, had her own business in Omaha, Nebraska, worked for a Georgetown University public policy center, and as a training coordinator for clinical psychology students at Argosy University, Washington, DC. She has a B.A. in Psychology from Argosy University, and lives near York, Pennsylvania.



How to Ensure Safe Laboratory Environments that Meet Requirements: The Advantages of Partnering with a NEBB Professional

By Kerri Soulliard

When it comes to critical environments like laboratories, a NEBB Certified Professional (CP) does more than testing, adjusting and balancing (TAB), building systems commissioning (BCS), fume hood performance testing (FHT), or cleanroom performance testing (CPT) work. Long after conducting the steps outlined in NEBB's procedural standards including the submission of test reports to the client with results and recommendations, the unique perspective and experience of a NEBB CP continues to help owners ensure their facilities meet codes and standards, while keeping workers safe.

However, safety in critical environments like laboratories is truly a combined effort. Whether the laboratory exists to support life sciences work, higher education research, or pharmaceutical manufacturing, all parties involved are responsible for establishing a safe environment. Owners, designers, NEBB professionals, and lab personnel each play an important and distinct part in creating and maintaining the safest possible working conditions for their specific laboratory environment.

Designing for Safety

Beginning with end users in mind, lab owners take precautions to ensure the safety of their environment for workers both before and during construction of the lab itself, as well as once the lab is up and running. Some of these precautions include calculating the maximum volume of materials to be stored or handled in the lab, so that in the event of an accidental release, adequate airflow is ensured to protect the worker even in a worst-case scenario. Setting up the lab protocols and procedures to handle smaller quantities of hazardous chemicals can also help scale down the potential of a hazardous event.

For example, Vice President and COO of Institute for In Vitro Sciences, Hans Raabe, who is focused on product research and safety testing, explains, "We're working with cell cultures to replace traditional safety tests conducted in animals, so the amount of test materials needed for

our test methods is around one-hundredth to one-thousandth of what's needed for typical animal testing. By using 96-well microtiter plates the size of a three by five-inch card, each of the replicate wells can be analogous to replicate animals used in a test, but in downsizing to the cellular or tissue level, each well only uses nanogram to milligram quantities of hazardous material versus the much larger quantities required for actual animal testing."

"We planned for worker safety in the facility design. Prior to opening the new lab, we worked with a contractor to check the performance of the biosafety hoods and verify airflow design," Raabe continues. "And we have the performance of the hoods certified by the contractor at least annually."

Mechanical engineers like Associate/Mechanical Technical Leader of Henderson Engineers Kelley Cramm, PE play an important role in designing lab environments like the one described above. Cramm attests to the importance of engaging a NEBB CP by asserting, "It's important for designers to cultivate and maintain relationships with local NEBB professionals because they can be a great resource. As the designer, I often enlist the balancer and commissioning agent as a partner because they understand a lot about a project, whether systems are operating correctly, or if there's a risk for exposure. They're the ones doing the hands-on work and have a different experience than I do, which is valuable to me as an engineer."

"When a NEBB CP is hired by the owner directly and early on, they are really able to become part of the team. They then have the necessary background info and understand the intent of the project. In my experience, at least in this part of the country around Kansas City, I wouldn't work with anyone but a NEBB Certified Professional," she continues.

Proper Training and Protective Gear

Another essential precaution taken by owners to ensure safe procedures are followed in the lab is personnel



training. This can include teaching employees to adhere to strict gowning requirements, as well as following the proper order of procedures in the lab and ensuring everyone knows the step by step requirements for working safely in that particular environment.

“We have training and standard operating procedures in place for how a worker needs to work in the laboratory as well as in the biosafety cabinets. They learn to gown up and wear personal protective equipment like gloves, eye protection, and in some instances half-face respirators; they learn to wipe down the interiors of the biosafety cabinets both to protect themselves as well as the cell cultures, and then they clean down the hood again after the work is done,” explains Raabe.

Training also takes place before a NEBB CP enters the lab. Oftentimes, the NEBB CP watches a video provided by the owner to learn the proper sequence of protocols and procedures taking place in the lab day in and day out. That training ensures the NEBB professional can follow the exact sequence when performing the necessary testing to determine whether or not the work taking place in the lab, as well as the systems and equipment making up the lab, are up to codes and standards. In some situations, the observations of a NEBB CP may even lead to an altered order of the steps being taken to execute the work if they can identify that a different sequence offer lab personnel a safer manner in which to do their work. Likewise, if the NEBB professional is taught that steps should be executed in one order through the training, but then encounters personnel in the lab performing the tasks in a different order, it is their job to note it in the report.

“The training and personal protective gear we provide is intended to ensure anyone that will enter the lab has the proper knowledge and tools to protect themselves and their coworkers while they’re engaged in activities, as well as to ensure the integrity and sterility of the cell cultures and associated materials” states Raabe.

“Gowning up properly keeps us from the environment and the environment from us,” adds CEO of IND Analytical Tiffany Russell, a NEBB CPT Certified Professional who frequently works in pharmaceutical and life sciences lab environments. “Clear communication with the customer is also really important. We rely on the customer to outline their processes and to display the appropriate signage showing hazards. That helps NEBB CPs become hyper aware of the dangers specific to that environment.”

Staying Alert and Aware in the Lab Environment

Following training, even employees with vast experience in that lab must stay on high alert in order to maintain safety in a hazardous environment. Regardless of the type of lab, it is vital for lab personnel to mentally walk through the steps they are about to take to ensure the processes can be done well and done safely.

“Pre-study planning the steps or creating a mental prototype of what you’re going to do can go a long way in terms of safety,” offers Raabe. “Things like proactively checking the meters and gauges on the laminar flow hoods to ensure air is flowing properly, rather than only relying on the airflow alarm systems installed during construction

of the lab, add another layer of protection for workers. Laboratory safety should be foremost in the worker's agenda; people can't become complacent."

The same goes for a NEBB CP entering a lab environment to perform testing. Before testing can commence onsite, a NEBB CP is required to perform a job hazard analysis per NEBB procedural standards. Evaluation of the site and what is being asked of the NEBB CP prior to the onset of work inside the lab helps to ensure client requests are possible and can be executed safely.

Once onsite, Russell recommends, "If something looks questionable, stop what you're doing immediately. Go with your gut and go ask for help." Knowing it is imperative to one's personal safety to keep an eye out for anything that looks off, she continues, "If you see a puddle of liquid on the floor, don't assume it's water. Question everything! Be aware, be alert, and treat everything as a potential hazard. It's the safety of your team and end users on the line."

Owner Education and Ongoing Testing

Certain precautions undoubtedly help owners maintain a safe environment that meets requirements—but that is only possible when the owner knows the applicable codes and standards for their facility.

"Someone that can help educate the owner is always helpful. Some owners may not know that they need to get someone to test the fume hood and calibrate the alarm annually," explains Cramm. "An owner needs an ongoing relationship with a NEBB Professional."

"We need to be sure that airflow, pressurization, and supply air and exhaust are all functioning as they were designed to in that lab. If a designer didn't set up the lab to be negative or if the lab is recirculating air, those things need to be noted in the NEBB CP's report," says Cramm. "Depending on who has hired the NEBB CP for that facility, they can be put in a somewhat delicate position, but by simply listing items that do not meet requirements as observations and giving the owner a chance to correct things that need to be corrected, safety can be maintained."

"NEBB CPs can make recommendations back to the customer on products we use—especially if there's something more appropriate for the task. It's part of why we're hired," mentions Russell.

Knowledge of Applicable Codes and Standards

Although regulations vary with each industry a given lab is intended to serve, it is always advisable for NEBB CPs to familiarize themselves with codes and standards that may be relevant to their clients' lab environments. NEBB's procedural standards already require NEBB CPs to perform a series of stringent tests that have been extrapolated from various sources, but NEBB professionals must also get to know the specific codes and standards outlined for each unique client's lab to test properly and ensure it meets the specified requirements.

Some common codes and standards* relevant to different types of lab environments include:

American National Standards Institute (ANSI) Z9.5 Laboratory Ventilation Standard: Outlining laboratory ventilation requirements and practices, this standard covers performance tests, air cleaning, preventive maintenance, and work practices. It is intended to help inform designers of ventilation guidelines that can be used to achieve acceptable concentrations of air contaminants and can also prove useful for lab management personnel.

ASHRAE 110 Methods of Testing Performance of Laboratory Fume Hoods: Intended primarily for laboratory and factory testing, this method of testing applies to conventional, bypass, auxiliary air, and variable-air-volume (VAV) laboratory fume hoods. Designers and NEBB CPs likely know this standard from its frequent appearance in project specifications and use as an aid in evaluating installed performance.

ISO 14644-1:2015 Cleanrooms and associated controlled environments, Part 1: Classification of air cleanliness by particle concentration: Focusing on professionals who deal with controlled environments, this standard specifies the classification of air cleanliness in terms of concentration of airborne particles in cleanrooms and clean zones, as well as separative devices.

National Fire Protection Association (NFPA) 45: Standard on Fire Protection for Labs Using Chemicals: This standard provides basic requirements to protect life and property through the prevention and control of fires and explosions involving the use of chemicals in laboratory-scale operations. By building control hazards into lab operations, the potential effects of chemical exposure during a hazardous event are designed to prevent injury or death to occupants and emergency response personnel.

NSF International Standards: As an organization dedicated to developing standards and criteria for health-related equipment, products, and services, NSF serves as a resource for manufacturers, regulators and consumers looking to protect food, water, consumer products, and environments.

Occupational Safety and Health Administration (OSHA) Laboratory Safety Guidance: Most relevant to the employer or lab owner in terms of maintaining a safe environment for workers, OSHA guidelines cover lab design, equipment, and ventilation systems. More specifically, these standards require the availability and maintenance of safety equipment, measures to control the risk of exposure to chemical hazards or biological specimens by employees of the lab testing facility, sanitary condition of testing lab, annual inspections, a waste management program, procedures for infectious material response, ventilation failure, first aid, fires, and emergencies, as well as documentation of all spills and exposure incidents.

Scientific Equipment and Furniture Association (SEFA) Recommendations: Created to meet the needs of lab designers and manufacturers of laboratory furniture, these recommended practices help manufacturers avoid liability while also ensuring safety for clients by minimizing risk due to poor ventilation or operation of fume hoods and lab equipment.

United States Pharmacopeia (USP) General Chapter <797> Pharmaceutical Compounding – Sterile Preparations: By developing standards for preparing compounded sterile medications, USP standards help reduce risks to the patient such as contamination, infection or incorrect dosing. This standard helps outline the risks inherent in sterile compounding and ensure compounded medications are not sub-potent, super potent or compromised.

Whether a NEBB CP has two years or twenty-two years of experience working in a lab environment, it is important to brush up on regulations and fully understand the intent of the lab's operations. Russell suggests, "Read the project specifications and applicable codes and standards and talk to other NEBB professionals in our network if you have any questions. Reach out. It's a network we have available to us, so we should use it."

"At the end of the day, we all want to make the lab safe for those working in it," sums up Cramm. Together, the designer and project team can use best practices to create a safe lab environment and lab personnel can maintain safety through proper training, but it is the ongoing dedication of the owner to engage NEBB professionals that ultimately results in meeting standards and achieving safety success. ●

*This list is not exhaustive.

About the Author



With over a decade of omni-channel marketing experience, Kerri Souilliar 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. For more info, visit: www.kreativstrategy.com

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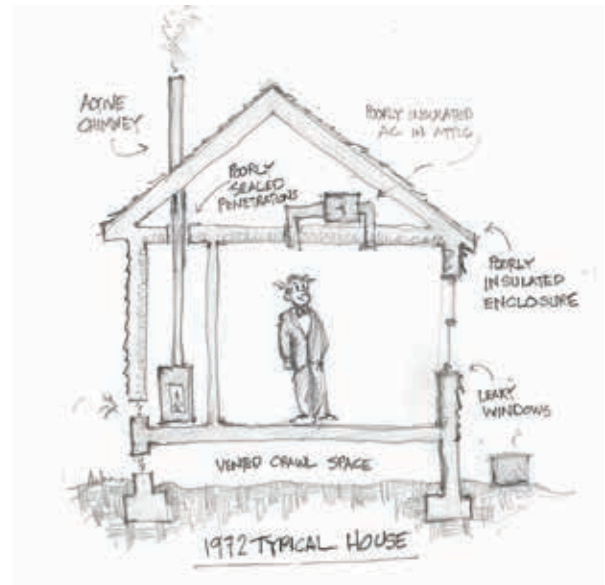
They Don't Build Them Like They Used To!

By Andrew Boyd

Client: "I am interested in having you design for me a new building on a vacant lot I own. The adjacent buildings are over 100 years old – my main priority is to build a building like they used to so I can pass the building down to my children. You know, design it "Old School!"

Architect: "Alright, let's discuss how we will go about designing your new building – old school. First, we will make the walls 3 to 4 bricks thick, and the interior finish will be a real 3-coat plaster troweled to the interior of the brick. Such construction is highly forgiving of moisture that will enter the building, with the ability to store it and then release it and dry out later, without unduly damaging the material. Some mold may grow during a wet humid summer, but it will be gone by fall.

For the wooden dormers above the roof, I think we can get some protected old growth timber cut through the black market. Old growth timber with the tight growth rings is dimensionally stable and more rot resistant. Too bad they cut most of it down 200 years ago. To protect the wood, I have a contact who still has some cans of old-fashioned high lead paint that he kept hidden for all these years. Lead, as a paint additive is both toxic to microorganisms that attack wood and helps paint flow easily. The paint industry had to work very hard to replace it when banned. For insulation, we can probably procure some high asbes-



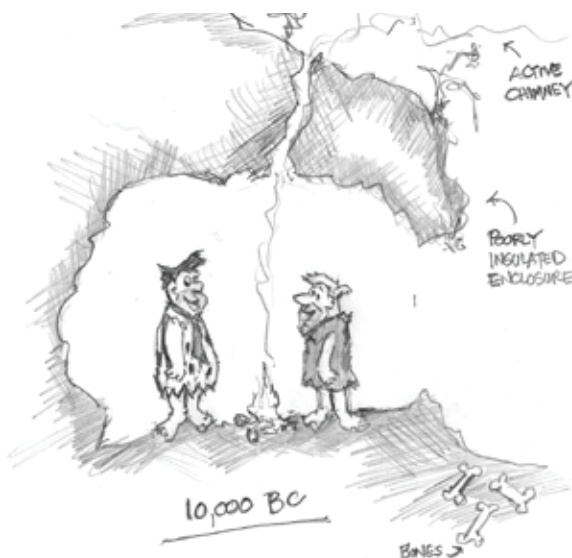
tos content material from overseas. Asbestos is an amazing natural product – fireproof, great insulator, and high tensile strength.

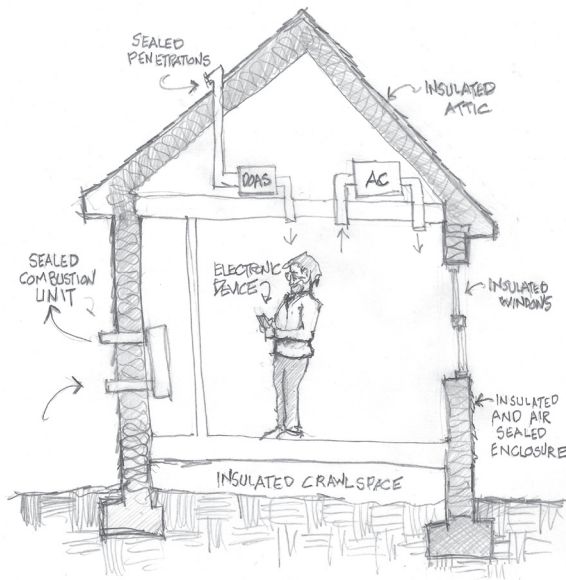
We will make sure the building is poorly insulated, with lots of gaps in the siding and trim to promote air movement. Leaky buildings tend not to trap moisture. Watch out when the wind blows though – you will be able to feel the air movement on a cold winter day! Of course, we will need a big masonry chimney with a large flue for the mechanical systems.

To heat our proposed building, we will install a 75% efficient conventional fossil fuel furnace. All winter long it will depressurize the building, pulling cold, dry air through the gaps in the building enclosure, and sending the hot flue gas after combustion up and out the large chimney. In the summer, we will install an oversized air conditioner. We will pressurize the building, sending the nice cool dry air from the AC through the building enclosure. Thus both summer and winter we will be using energy to dry the building enclosure.

Build it and operate it "old-school" like I suggest, and I can assure you, it will last a long time."

Client: "But those thick brick walls and plaster will be very expensive to build. It certainly is not very environmentally friendly to harvest old growth timber. Lead based paint and asbestos are dangerous to human health!





With all the cold drafts, the building will be very uncomfortable in the winter. Moreover, think of the energy bills, not to mention that my building will be promoting global warming! I am not sure I like your ideas, Mr. Architect."

Architect: "So let me get this straight. You want a modern, energy efficient, comfortable, and sustainable building AND one lasts a long time? Why didn't you tell me that from the start? I am convinced we can design and construct buildings that meet all your criteria, but we have to be smart. We can learn many valuable lessons from

the last 20,000 years of human construction, but we also need to be innovative and clever if we are to make them sustainable. Physics has not changed in this time, but many construction materials have changed. Some were banned because of the unpleasant tendency to kill people. Modern science has also developed some wonderful new products. We have also developed the knowledge on how to integrate construction materials, techniques, and mechanical systems to achieve your goals. Some rules of the game are the same, and some rules have changed – for the better.

Now for a more important question. What color tile do you want for the sink backsplash?" ●

About the Author

Andrew Boyd is a licensed architect who works for NAVFAC. This article was peer-reviewed by Subject Matter Expert Phil Emory. The view expressed in the article are those of the author and do not necessarily represent the views of the agency or the United States.



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How Disruptive is Artificial Intelligence for my NEBB Business?

By Luis Chinchilla

The pace at which changes from new technologies are occurring within the business world continues to increase at an astonishing rate. But narrowing it down to what some authors have identified as “disruptive technologies,” the one that keeps me awake at night is artificial intelligence (AI).

Harvard Business School professor Clayton M. Christensen presented the concept of disruptive technologies in his 1997 book *The Innovator's Dilemma* when he separated technology into two categories: sustaining and disruptive. In my interpretation, sustaining technology can be defined in simple terms as what the majority of us normally do and experience in our day to day: improve an already established technology. Disruptive technology, however, is defined as the type of technology that is not completely refined, sometimes might have performance issues because it is new, and could be appealing only to a limited audience as it is not “proven” yet.

With this definition in mind, we can look back through the history of mankind and find such types of disruptive technologies exemplified in the early days of our species. Examples include control of fire, writing, and the wheel. More examples closer to our current time are the PC, software operating systems, cloud computing and social networking.

Even though the phrase, “past performance does not guarantee future results,” is often found in financial documents (especially the fine print), it does not seem to apply to disruptive technology in the same way. If there is one common factor that can be taken from all the examples of disruptive technology it is that its performance often earns it a place in the future as a current standard. In other words, many types of disruptive technology that have emerged are here to stay. One prime example is artificial intelligence. Artificial intelligence has now arrived in all the fields in which NEBB companies and NEBB professionals deliver services, and the best way we can predict the future is to create it.

We have invited guest speakers to our yearly strategic session to talk to us about cloud computing, data mining and artificial intelligence, amongst other topics, so

that we can be a little bit more savvy about these topics. Based on what we have learned, we wanted to share our simple definition of artificial intelligence for our company:

Artificial Intelligence = Data x Knowledge

Armed with this simple definition, we have set our firm up to experience what we think AI is in our business segment, and wanted to share two examples of (internally focused) strategic initiatives that involve AI:

1. The business opportunity does not stop when becoming NEBB certified. AI is quite disruptive, therefore NEBB members and firms have to keep learning and probably the first experience we have had with AI in our business segments has been with the output of building monitoring systems (BMS) or building automation systems (BAS) and how it relates to the TAB, CPT and CX disciplines, as well as facilities equipment in general. More often than before, we are receiving inquiries from our customers regarding issues about the conditions of their facilities and/or drifting in critical operation parameters. Upon review of these inquiries, we supported these customers by routinely requesting data trends from their BMS/BAS sys-





tem to analyze the different scenarios and provide back a list of suggested corrective actions. This type of exercise certainly has a “cost” to us, as we need to invest engineering time on the analysis, but at the end of the day the payback for that time invested is keeping the business of these customers. Sharing knowledge insights with customers helps to continue building and strengthening our relationship with them.

2. Next, comes the second area in which we have purposely entered AI in our TAB, CPT and Cx segments: incorporating data analysis into the general services provided, so that added value can be extracted from the data obtained by our firm. Two examples are:

- a. A customer had asked us to do TAB work in a warehouse space. Upon completing it and finding that the customer was entering the validation process of this storage facility right afterward, we offered our support. Given that we were already on-site, we could process the data obtained from the validation dataloggers they have installed (which is something Cx firms do anyway) and extend our value offer. We had to research a bit in order to understand what “mean kinetic temperature” was besides the regular calculations of maximum, minimum, and average, as well as dust off the statistical concepts of Cp (Process Capabilities)/Cpk (Process Capability Index) that we were taught in the University, but the most insightful learning was to correlate how the uniformity of supply airflow obtained during TAB reflected in the data graphs from the validation process, enabling the system perspective for our team.
- b. Another one of our customers was experiencing issues with viable particles spikes inside their cleanroom and upon being contacted, we offered to perform a cross analysis in two dimensions: time and spatial distribution of our testing data

for the past three years (flows, non-viable particles and differential pressures), and overlaying the HEPA filters layout on top of their manufacturing equipment layout. Upon completing this analysis, it was possible to offer the customer ideas regarding simple equipment re-layouts, increasing the air changes per hour without affecting the differential pressure level, and clearing “paths” to the return air intakes that have helped improve performance and enable a data-based proposal that was highly appreciated.

By no means do we pretend to be experts on the interaction of AI with NEBB disciplines, but if there is one thing we have clear in our strategic radar it is that we need to get onto the AI bus and pay our ticket to get on board—otherwise, someone else will. For us, paying the ticket has meant to:

1. Take the risks to do things we not have done in the past.
2. Become better at data management and data processing.
3. Become a “translator” of the “story” data is telling to actual actions to be performed by our customers.
4. Exercise more and more deductive thinking: start with the big picture and end with the tiny details.

As with any other businesses, some of the experiences have worked and some have not, but from both cases we are able to develop better ways of doing TAB, CPT and Cx. And to us, that is in essence how disruptive AI has been to the NEBB disciplines we focus on. ●

About the Author

Eng. Luis Chinchilla is the Director for OPIA Operaciones e Ingeniería de Avanzada de Centroamérica S.A. out of Costa Rica. Luis is a licensed Chemical Engineer and possess a MBA with a major in Finance and a MBA with a major in General Management. At the NEBB level, is a NEBB CP for TAB, CPT and CxPP and a NEBB CT for CxA. He is a member of the BOD and Technical Committee for Capital-Mar Va International NEBB Chapter and a member of the NEBB BOD.



Perchloric Acid Testing and Decontamination Techniques

By Kevin Tinsley

Historical use of perchloric acid in selected laboratory fume hoods has posed a difficult challenge to planned laboratory renovations when the fume hoods were not equipped with safety controls to prevent the build-up of perchloric acid crystals within the ductwork. In this situation, duct removal by demolition trades workers without performing decontamination can cause the ductwork to explode, as the dry perchloric acid crystals are potentially flammable and shock explosive. Modern fume hoods which are designed for perchloric acid use employ wash down systems to remove the majority of these crystals from building up inside the hood work area, and similarly use effluent scrubbers to prevent perchloric acid migration into the ductwork.

Hazards of Perchloric Acid Deposition

Perchloric acid (ClHO_4) is a colorless liquid at room temperature. It is popular in chemical processing because it offers all the desirable properties of mineral acids without introducing ions such as chloride, nitrate, and sulfate, which often interfere with other chemical reactions. When hot and concentrated, perchloric acid can also be a powerful oxidizing and dehydrating agent.

The unique and unusual properties of perchloric acid make it desirable for use in many chemical processes, including use as a dehydrating agent, an oxidizing agent, a solvent for metals and alloys and in the destruction of organic matter. Perchloric acid is also used in a number of commercial processes due to its strong acidic nature and ease by which its oxidation power can be controlled by concentration and temperature.

If hot perchloric acid is used in a fume hood that does not have internal wash-down capabilities, the acid vapors may accumulate on internal portions of the duct. As the perchloric acid dries it leaves behind a perchlorate salt that resembles white crystal deposits. These perchlorate salts will show up over time in the hood, baffles, filters, fans, ducts, and exhaust stacks and can be flammable

and highly explosive when subjected to heat or impact or reaction with other specific chemicals.

Evaluation

Fume hoods which are suspected to contain perchloric acid can be evaluated and tested for the presence of these crystals by use of inspection and laboratory analyses by an experienced consultant or decontamination specialist. Much of what is known about these hazards has been learned by a world laboratory community from tragic explosions during renovation or demolition activities over the last century. Current standards pertaining to the sampling and decontamination techniques are published online by the Brookhaven National Laboratory (BNL), a United States of America National Laboratory.

Testing and evaluation is limited to access provided by the current ductwork configuration. The situation does have a "Catch 22" scenario, as most fume hoods have sealed ductwork that cannot be readily accessed without cutting into the duct runs. The cutting cannot be employed due to the threat of perchloric deposits possibly being present. Visual inspection by experienced personnel of the hood interior, and the exhaust stack openings for whitish deposits can be performed to the extent allowed. Swab surface sampling following the BNL procedure can be performed inside the fume hood and exhaust stack at the heaviest deposition points. Field blanks and background samples are essential to establish baseline for the analysis results within the building. Analysis is performed using High Performance Liquid Chromatography/Mass Spectroscopy, employing Environmental Protection Agency (EPA) analysis method 6850. This sampling and inspection protocol can give a very accurate picture as to the likelihood of significant perchloric deposits being present.

Prior to the development of this testing method, a previous method used in industry was methylene blue test solution. This method, which provides an immediate visual outcome, is not useful as it has been proven to yield both false negative and false positive results due to in-



Worker with PPE and ballistic gear working on a decontaminated duct (flushed 24 hours).



Lined tank filled with mechanical ductwork, soaking in water for perchloric deposits.



Stack that needed to be flushed accessed thru a mechanical lift.

teractions with other chemical residues which often are present. Currently, this type of testing has been determined to not be useful when assessing fume hoods for perchloric acid presence.

The swab sampling is performed in a known sized area (using a template), collecting all deposits within the area. Once analysed, the amount of perchlorate and/or perchlorate salts detected in that sample can be expressed in a concentration when taking into account the size of the sample area. From this information, comparable concentrations can be determined, and NPFA 45 and BNL Procedure have listed concentration levels that can be considered “negative”, “suspect”, or “positive” for the presence of perchlorate deposits.

Remediation Plan after Evaluation

Should it be concluded from testing and inspection that decontamination of the fume hoods and duct work be necessary, the method to employ is flushing the ductwork with large volumes of water for a minimum of 24 hours. This poses significant logistical problems in many cases due to the type and location of ductwork, and access points. Designing a decontamination protocol must be performed on a case by case basis, to prevent water leakage or infiltration to adjacent areas.

From a general safety standpoint, projects of this nature should be planned during periods of low building occupancy. From an industrial hygiene standpoint, the workers who are performing these procedures must be protected using Personnel Protective Equipment (PPE) for a physical perspective and a chemical perspective. Chemically, they will be protected through the use of Tyvek or chemical suits, gloves, face shields, respirators, etc. From a physical perspective, the workers will require the use of ballistic gear (body protection helmets, face shields, etc.) that are composed of Kevlar, or equivalent protective materials, similar to what bomb disposal unit personnel wear.

After decontamination, the ductwork should be dismantled by personnel equipped with ballistic gear. The dismantling should still be performed as a “wet” demolition method where possible and as warranted from testing results. Further rinsing and/or soaking in water of the removed duct metal can be performed prior to the material being disposed of as uncontaminated waste. In some cases, this may be performed by submerging the duct sections into a tank, bin or vessel on site for soaking (again for 24 hours).

For heavy or stubborn deposits, (and again depending on the results of testing) some scraping and/or physical cleaning can be employed to remove deposits, provided the work is entirely performed as a wet method.

Disposal

Projects of this nature are evaluated in terms of the effectiveness of the procedures, taking into account the levels of deposits and results of initial testing. Thoroughly soaked and cleaned metal components can be often safely disposed of as uncontaminated waste after visual inspection and review of all aspects of the project. Depending on the location of the project, the water used to rinse, clean and/or soak the ductwork and metal may be disposed of in sanitary drains, or in some municipalities, may require collection (of all cleaning/soaking water throughout the project) and specialized disposal, or pre-treatment prior to disposal. ●

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Sources for the information used in this article were obtained from the following:

- 1) Brookhaven National Laboratory Procedure IH75200 – Perchlorate and Perchloric Acid Sampling and Analysis
- 2) Public Works and Government Services Canada (PWGSC) Standard MD15129 – 2006 – Perchloric Acid Fume Hoods and Their Exhaust Systems
- 3) Perchloric Acid Contaminated Hood Decontamination Procedure Manual – Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, Oak Ridge Tennessee, Copyright 1993.
- 4) U.S. National Fire Protection Association (NFPA) – NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals (2019 Edition).
- 5) EPA Method 6850, “Determination of Perchlorate using High Performance Liquid Chromatography/Mass Spectrometry (LC/MS)”.

About the Author

Kevin Tinsley, C.E.T., M.C.I.C. is a Principal and the Operations Manager at Advanced HEPA Technologies Inc. in Mississauga, Ontario, Canada. He is a NEBB Fume Hood Performance Testing Certified Professional and is an NSF International Accredited Biological Containment Cabinet Field Certifier.

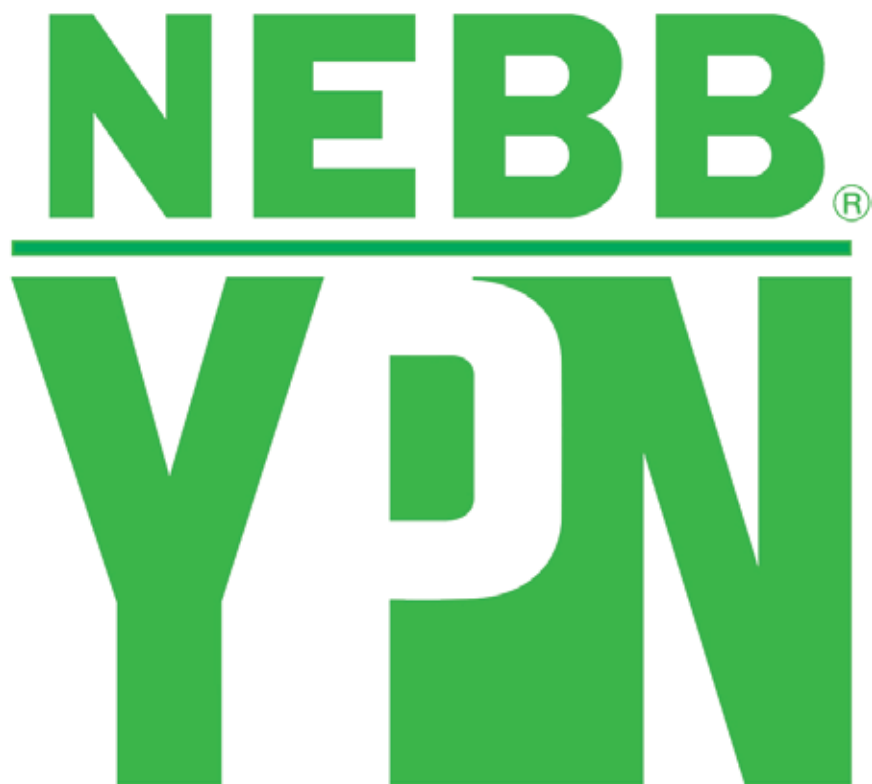
Advanced H.E.P.A. Technologies Inc. specializes in biological and chemical decontamination techniques, including specialty decontamination of explosive substances such as perchloric acid and sodium azide.



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Pressure and Altitude

By Matt Lemieux

Cleanroom static air pressure differentials are very small. The conventional units of measurement (imperial units) are inches of water. This has many abbreviations, including: in. w.c., in. H₂O, "w.c., "w.g. "H₂O, in w.g., w.c., and w.g., amongst others. All these abbreviations stand for the same thing. In the real world, they refer to an air pressure equivalent to the pressure exerted at the bottom of a column of water, that many inches high. If **G** is the magnitude of the gauge reading in inches of water, then **G** is often in the range of 0.01 or 0.001.

Gauge readings are the total atmospheric pressure plus gauge pressure at point P_2 minus the total atmospheric pressure plus gauge pressure at point P_1 . Standard atmospheric pressure at sea level (29.9212 inches of mercury column) measured in this unit is 406.792 in. H₂O. So, that implies that a measured difference in air pressure between two cleanrooms of 0.001 in. H₂O, representing a sensitivity of $\left(\frac{0.001}{406.792}\right) = 0.00000246$. Or, 0.000246% or less than 3 parts per million.

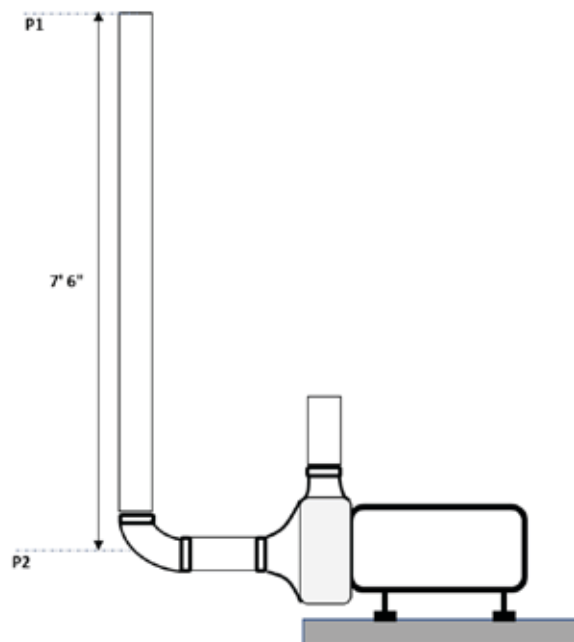
The atmospheric pressure of the air varies with elevation. At a higher elevation, there are fewer molecules of air above you pressing down.

Alternatively, rather than considering air pressure, if we take a look at the effect of actual columns of water, the gravitational phenomenon becomes more pronounced. Unlike air, water, of course, is a liquid and is much denser. When we are measuring water system pressure in a pipe, we have to account for the difference in elevation between point P_2 and P_1 . Water balancers are very familiar with this phenomenon as shown in Figure 1.

A water pressure gauge inserted at point P_2 will read 7 feet, 6 inches (90 inches) higher than that same gauge inserted at point P_1 . That is the literal meaning of inches of water column. When the water balancer has to calculate the effect of the pump on the system pressure and energy, she must account for the elevation at which the pressure measurement was taken. It is a common practice to equilibrate all system pressure readings to the elevation of the pump impeller as indicated by P_2 in Figure 1. However, any arbitrary, consistent elevation will suffice. The relationship between the units of inches of water and pounds per square inch (psi) is such that a column of water 2.768 inches (2.31 feet) high exerts a pressure of 1.0 psi at its bottom surface. As shown by the example in Figure 1, 90 inches of water column means that the pressure measured at P_1 will be 3.25 psi lower than that measured at P_2 .

This realization naturally raises the question: Is there an elevation-dependent difference in room static air pressure measurements? We know that the air pressure at cruising altitude outside of the airplane is measurably different than at sea level, but what about the air static pressure at the cleanroom ceiling elevation relative to the floor?

Figure 1: Gravitational Variation in Water Pressure



The formula for air pressure as a function of altitude is known as the barometric formula. One version of this formula can be expressed as in Equation 1. For simplicity of understanding¹, I have chosen SI units which will be converted back from Pascals to inches of water column after the calculation.

Equation 1: Barometric Formula for Isothermal Environment (SI)

$$P_h = P_b * e^{\left[\frac{-g * M * (h - h_b)}{R * T_b}\right]}$$

Where the negative exponent indicates a decreasing pressure with increasing elevation, and where:

P_h = the resultant pressure at the elevation of concern (Pa)

P_b = the barometric pressure at sea level 101,325 (Pa)

e = the base of the natural logarithm (2.71828)

g = the acceleration due to gravity 9.80665 (m/s²)

h = height of elevation of concern (m)

h_b = height of sea level 0 (m)

R = universal gas constant 8.3144598 [(J)/(mol*K)]

T_b = standard temperature 288.15 (°K)

M = molar mass of Earth's air 0.0289644 (kg/mol)

When we calculate P_h for a height of 7' 6" (2.286 m) which is the elevation of the suspended ceiling above my desk, we end up with something like this:

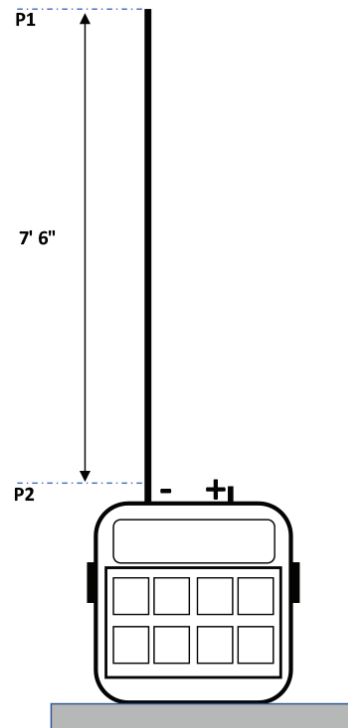
$$P_h = 101,325 * 2.71828^{\left[\frac{-9.80665 * 0.0289644 * (2.286)}{8.3144598 * 288.15}\right]}$$

Or $P_{h=90"} = 101,297.542$ Pa, which is 27.458 Pa less than 101,325 or equivalent to **0.110 in H₂O**. This result seems to indicate that we have a serious problem in how we specify and measure room pressure differentials! It doesn't appear that the barometric formula is useful for very small elevations.

To check this result empirically, I used a Shortridge ADM-880C data logging multimeter configured as in Figure 2.

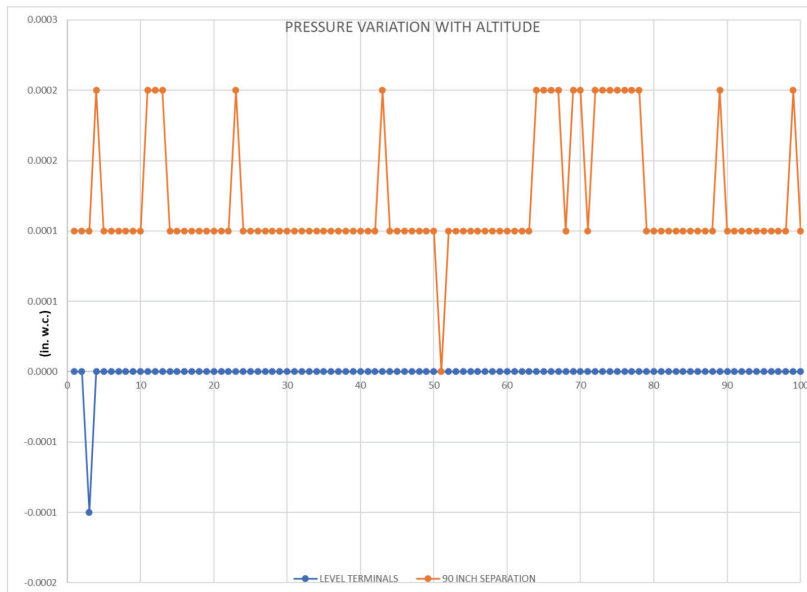
Two hundred individual samples were taken with one hundred of those configured as shown above and the other hundred taken at floor level without the 7' 6" extension tube. Figure 3 illustrates those results.

Figure 2: Measuring Air Pressure as a Function of Elevation



¹ In the IP system, we would have to contend with units such as lb.*mass, lb.*mol and (lb.*ft²)/(lb.*mol*K*s²) which gets very confusing. The SI units are easier to manage for these types of calculations.

Figure 3: Graph of Air Pressures at Two Elevations



These Shortridge readings clearly indicate a measurable difference in pressure when measured at the 7' 6" elevation ($p = 0.005$). The average ($n=100$) pressure difference was 0.00012 in. w.c. So, the answer to the question of whether there is a significant, measurable difference is yes. A ceiling mounted room pressure tap will definitely read at least 0.00012 in. H_2O less than the tube inserted under the door. However, the answer to whether it matters for our purposes is probably no. ●

About the Author

Matt Lemieux is a senior staff engineer at Daldrop SBB, LLC. in Ipswich Massachusetts. A mechanical engineer and NEBB CPT-CP with 38 years of cleanroom industry experience.

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What's So Wonderful About *West Virginia*?

Find Out Why You'll Want to Follow
NEBB Into the Wild Mountain State

By Kerri Soulliard

As you likely know by now, NEBB has chosen The Greenbrier in West Virginia as its conference location next year. The refined landmark resort spanning 11,000 acres has hosted many key international meetings and golf championships over the years, as well as 27 U.S. Presidents, a long list of Hollywood A-listers, and several best-selling artists. Beyond the likelihood of spotting a celebrity, the grandeur of the resort itself enchants guests from the moment they set foot on the property.

“As soon as I drove up to The Greenbrier, I knew it was the place for NEBB’s next annual meeting. I decided to go inside and see if my instinct was right, and sure enough, the incredible folklore and history it exudes around every corner proved it was,” explains incoming NEBB President Jeffrey Schools. “And the fact that it’s accessible to many local chapters is a bonus.”

Whether for its rich history, colorful interiors designed by Dorothy Draper, or vast and beautiful landscape, The Greenbrier has earned a place on the travel bucket list of many. The resort, however, is just the beginning. With nearly three quarters of the state covered in forests and all of it located within the Appalachian range, West Virginia is called the Mountain State for good reason. For those that know little about this wild and wonderful state, this may be the time to dive in and get to know the state on a deeper level to prevent missing out on a wide array of natural wonders, historic treasures, and adventurous recreation. Between the opulence of The Greenbrier and the

breathtaking natural landscapes found at every direction across West Virginia, 2020 NEBB Annual Conference attendees may not want to return home.

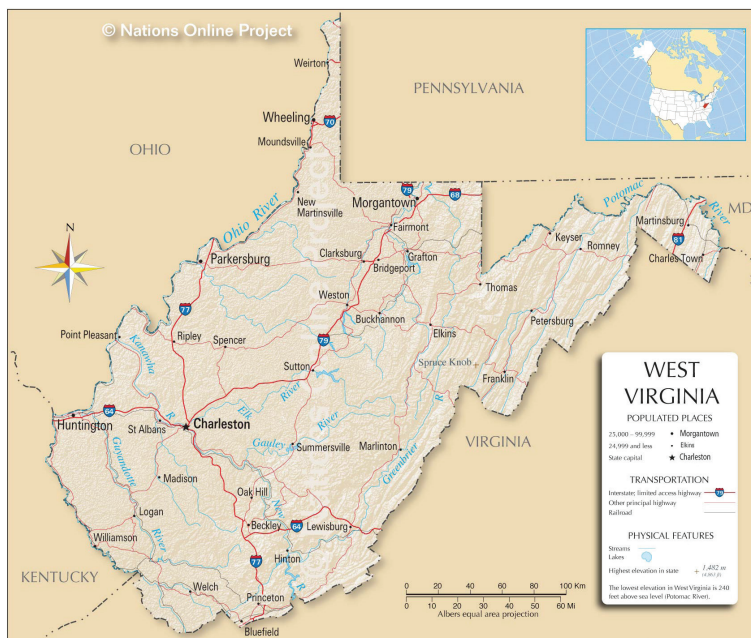
Creating Kanawha

When Virginia voted to secede from the Union five days after the start of the Civil War in April 1861, the western population of the state decided it was time to split off. Unlike the eastern Virginians, the western Virginia residents supported the abolition of slavery and desired to remain part of the Union. As Virginia joined the Confederacy, the Unionists in western Virginia held conventions and drafted a new constitution with an emancipation clause. In June 1863, West Virginia was admitted as a state.

The naming of the state, however, was not nearly as simple as it may sound. Originally called Kanawha after a Native American tribe in the region, the name was confusing since it was already used to refer to a local river and a county, not to mention residents’ atrocious attempts at spelling it. Next was Vandalia, intended to honor Queen Charlotte, former ruler of England, but that was scrapped, too. Then came Augusta for the original district that included Wheeling, the city that served as the state’s first capital. Allegheny, as in the mountains that largely divided the eastern and western populations of the original state of Virginia, was also considered though it was already in use. After a lot of trial and error, lawmakers vot-

Opposite Page:
Dolly Sods Wilderness.
This Page: The
Greenbrier Resort.





ed that the 35th state be named West Virginia, a tribute to the state's historic roots.

Between 1870 and 1950 the state's population more than quadrupled in size. Since 1950, however, that residential boom came to a halt. Between dips in population and small bouts of growth throughout the next several decades, the state's population has teetered around two million ever since. Taking its surface area of 24,230 miles into consideration and calculating population density, that's about 77 people per square mile. In fact, not one of West Virginia's cities can claim more than 50,000 inhabitants in total. For comparison, that's less people than the total amount residing in the city of Chicago.

State of Wanderlust

Recent census results have shown that the majority of the state's counties are rural, the median age (about 42 years old) is slightly older than the US average, and its racial and religious composition is majorly Caucasian Christians. Meanwhile, the West Virginia Department of Commerce reports that in addition to the state's traditional coal industry, the majority of statewide employment occurs in the chemical manufacturing, biotech, aerospace and automotive sectors. Although this may not result in vast opportunities for younger residents to dive into metropolitan life, experience great diversity, or build any career they choose, it does equate to a whole lot of uninhabited land ripe for outdoor adventures. For visitors, that often means a welcome break from crowded city—and even suburban—life.

Anyone that's had the pleasure of viewing the West Virginia Tourism Office's recent "Almost Heaven, West Virginia" advertising campaign can tell you how appealing many of those adventures appear. From family camping, hiking, and fishing to white water rafting and rock climbing, the state is presented as a wonderland for outdoor exploration—the perfect setting for lifelong memories made in nature. The award-winning campaign has been said to have changed the way 52 percent of viewers feel about West Virginia and enticed 64 percent to want to visit the state.

With 55 counties that form an odd shape some say resembles a leapfrog, West Virginia offers miles of exciting wonderland for those that have an opportunity to hop around. Its Latin state motto—*Montani Semper Liberi*, which translates to "Mountaineers are Always Free," suggests West Virginians know the freedom to scale mountains, roam lush landscapes, and blaze their own trails is a priceless gift. As a guest in the state, you too have many options for discovering pristine surroundings in nature, from self-guided quests to exciting attractions curated specifically for tourists.

Into the Wild

Known as the Switzerland of America, the lofty peaks of this scenic state stand higher than any other state east of the Mississippi River. The Potomac Highlands, which encompasses eight different counties, is the mountainous eastern part of the state that stretches across the Alleghenies. With seven wilderness areas and a dozen state parks and forests, it's a worthwhile stop for active travelers looking for memorable thrills in nature.

Within the 100,000 acres of the Monongahela National Forest, one of the most diverse ecosystems in the US, you can find the highest peak in the state: Spruce Knob. Also home to Seneca Rocks and Snowshoe Mountain, this



area is a rock climbing enthusiast's dream. These prime Allegheny Mountain peaks include routes ranging from traditional and sport to top rope and boulder climbs.

Nature lovers looking to travel farther horizontally than vertically can find plenty of hiking and backpacking opportunities in the same region. Burnt out city dwellers in need of some fresh forest air would do well to seek out the rugged trails, breathtaking vistas, and serene waterfalls of Dolly Sods Wilderness Area—but only if fully prepared spend some time off the grid, away from the amenities of society.

About four hours southwest of the Potomac Highlands, casual campers can find fun at West Virginia Adventures Rafting and Campground in Beckley, which offers tent, cabin, and RV options. With nearby river rafting on the Lower New River rapids ranging from classes II through V, as well as rafting on the Gauley River's Class IV+ rapids, travelers of all skill levels are accommodated. If the weather's bad, you can always head to Tamarack, where the work of many Appalachian artisans is on display, demonstrated live, and available for purchase.

Supreme Sightseeing

For casual day trips in nature, Blackwater Falls State Park in Davis is another must-see in the northern part of the state. Go for the hikes leading to breathtaking views of cascading falls, but stay for the watersport adventures on Cheat River and the local trout fishing in Tucker County. For more outdoor exploration, visit the neighboring 16,550-acre Canaan Valley National Wildlife Refuge. Home to 580 species of plants and 288 different animals, you'll get a glimpse of some of the state's most stunning native flora and fauna.

Southwest of Blackwater, in Fayetteville, is the third-highest bridge in the US. Opened in 1977, the New River Gorge Bridge has become a popular West Virginia landmark for its scenic overlook deck from which visitors can gaze down into the waters flowing through the Appalachian Mountains. You may recognize the bridge from its depiction on the West Virginia state quarter that's been in circulation in the US since 2005.

Down south, Pipestem Resort State Park has something for everyone. In addition to the usual hiking, biking, and fishing, Pipestem boasts horseback riding, golf, and hunting along with exhilarating zipline tours, stand-up paddle boarding, and tubing on the Bluestone River. A unique ae-



Greenbrier River Trail



New River Gorge Bridge

rial tramway offers visitors picture-perfect sights as they sail over the Bluestone River Gorge.

Hit the Historic Trail

History buffs, rejoice! Anyone looking for more of a culturally rich trip through the state has a variety of landmarks, museums, and parks to choose from. You could spend a week-long vacation venturing the Civil War trail alone, but here are some highlights:

With scenic views overlooking the merging of the Shenandoah and Potomac Rivers, you might never guess Harpers Ferry was the setting for battle scenes before the Civil War had even officially begun. From John Brown's attempt to arm enslaved African Americans for a rebellion in 1859 to Confederate General Robert E. Lee's Battle of Harpers Ferry during the war, Harper's Ferry is a picturesque site that holds a part of our country's history.

Heading west from Harper's Ferry, you'll find Rich Mountain Battlefield on the mountainside above Beverly. This battle-



Black Water Falls

field got its name in 1861 when Major General George B. McClellan took command of the Unionists that would go on to make up West Virginia, forcing the Confederates to surrender atop Rich Mountain. The nearby Beverly Heritage Center details the battle's history, along with what American life was like during the Civil War and frontier days.

Below Beverly, near Hillsboro, lies Droop Mountain Battlefield State Park. On the same site as the pivotal Battle of Droop Mountain in 1863, the park and its history museum exist to commemorate the last major battle in West Virginia.

Further South, the North House Museum and Greenbrier Historical Society in Lewisburg helps tell the town's history, including the Battle of Lewisburg in 1862. As an added bonus, many Civil War sites are located around the town.

If you're looking for something a little livelier, a trip to Carnifex Ferry Battlefield State Park, may be worth your while. The park reenacts the 1861 Civil War battle that took place there, while the adjacent Patterson House Museum offers more about how the Union troops secured an important victory that led to Confederate withdrawal from western Virginia.

Project Greek Island

Then, there's The Greenbrier, also known as America's Resort. Unlike your typical luxury resort, this high-end haven in the Allegheny Mountains was approached by the US government in the 1950s to house to a secret bunker to serve as a relocation center for Congress in the event of a nuclear emergency. Now that it's been declassified and anyone with internet access can find out what Project Greek Island once stood for, daily tours of the Cold War era bunker are open to the public. If that's not enough to entice guests to Greenbrier, there's also 20 restaurants and lounges, 38 shops, an onsite glassblowing studio, golf courses with professional instruction available, a 110,000 square foot private casino, a state-of-the-art ice rink, arcade, bowling alley, and options for off-road driving adventures.

In 2020, when NEBB holds its annual conference at the esteemed Greenbrier Resort in West Virginia, conference attendees are in for a treat. If you're lucky enough to attend, you'll not only gain technical knowledge from industry experts and network with experienced peers, but also have the chance to explore the wild and wonderful Mountain State for yourself. ●

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- A two-hour Vendor Reception in the Exhibit Hall maximizes your time with attendees.
- You can attend our Technical Track sessions and learn alongside your industry peers.



2020 NEBB Conference Exhibit Schedule

Thursday, April 2, 2020

8:00 am – 1:00 pm Exhibitor Setup
1:00 pm – 5:00 pm Exhibit Hall Open

Friday, April 3, 2020

7:00 am – 5:30 pm Exhibit Hall Open
7:00 am – 8:00 am Breakfast in Exhibit Hall
11:15 am – 12:30 pm Networking Lunch in Exhibit Hall

Saturday, April 4, 2020

7:00 am – 5:30 pm Exhibit Hall Open
7:00 am – 8:00 am Breakfast in Exhibit Hall
11:15 am – 12:15 pm Networking Lunch in Exhibit Hall
3:30 pm – 5:00 pm Vendor Reception and Prize Giveaway
5:00 pm – 7:00 pm Exhibitor Strike

**Exact times subject to change*

Exhibitors Receive

- 6 Foot Exhibit Table Top with 2 Chairs and wastebasket
- Two (2) Exhibitor Conference Registrations with access to Technical Track sessions and group events
- Conference attendee list for marketing purposes (Name, Title and Company)
- Listing in NEBB's on-site conference program
- Listing on NEBB's online annual conference website
- Food and beverage at all exhibiting food functions
- Participation in the vendor prize giveaway at Vendor Reception



Become a Sponsor!

NEBB Annual Conference Sponsors are valuable partners who help keep registration fees affordable while helping NEBB to enhance its excellent program and ancillary activities.

NEBB's 2020 Sponsorship Program is organized into two categories:

- 1. Top Tier Sponsorships**
- 2. General Sponsorships**

Each sponsorship has unique opportunities within each level. Choose the package that is best suited for your company and budget.

TOP TIER SPONSORSHIP LEVELS



PLATINUM LEVEL: \$10,000

- One complimentary Exhibit table top space and standard exhibit package extras
- Opening Speaker Session Sponsor, plus signage at the Opening Event
- Full-page ad in the conference program guide
- Acknowledgment in conference program guide as a Platinum Sponsor
- On-screen acknowledgment during the Opening Session
- Acknowledgment on conference sponsor signage as a Platinum Sponsor
- Sponsor logo listed on conference website
- (2) Platinum Sponsor Ribbons for badges



GOLD LEVEL: \$8,000

- 70% off one Exhibit table top space and standard exhibit package extras
- Closing Speaker Session Sponsor, plus signage at the Closing Event
- Half page ad in the conference program guide
- Acknowledgment in conference program guide as a Gold Sponsor
- On-screen acknowledgment during the Closing Session
- Acknowledgment on conference sponsor signage as a Gold Sponsor
- Sponsor logo on conference website
- (2) Gold Sponsor Ribbons for badges



SILVER LEVEL: \$5,500

- 50% off one Exhibit table top space and standard exhibit package extras
- Vendor Reception Sponsor, plus signage at the event
- ¼ page ad in the conference program guide
- Acknowledgment in conference program guide as a Silver Sponsor
- Acknowledgment on conference sponsor signage as a Silver Sponsor
- Sponsor logo listed on conference website
- (2) Silver Sponsor Ribbons for badges



BRONZE LEVEL: \$3,500

- 30% off one Exhibit table top space and standard exhibit package extras
- Friday and Saturday Networking Luncheon Sponsor, plus signage at the event
- ¼ page ad in the Conference Program guide
- Acknowledgment on Conference Sponsor signage as a Bronze Sponsor
- Sponsor logo listed on conference website
- (2) Bronze Sponsor Ribbons for badges

2020 Annual Conference Sponsorship Opportunities

SPONSORSHIP	PRICE	SPONSORSHIP DESCRIPTION
Company Promo Products Giveaway	\$2,500	EVERYONE LOVES GIVEAWAYS! Your company will be able to place a flyer or a unique promotional item in each conference attendee's bag. Flyer or promotional item to be provided by Sponsor and imprinted with company logo.
Opening Session	\$2,500 2 Available	BE NOTICED! Sponsor logo recognition during NEBB's Opening Session as this premier Sponsor. This event is attended by all conference attendees. Your company logo will be featured prominently at this event.
Get Acquainted Reception	\$2,500 2 Available	Company logo front and center, leading off NEBB's Annual Conference by welcoming attendees to the opening reception. Sponsor(s) will be able to supply gifts/giveaway items to attendees in the kick-off social event for the NEBB annual conference.
Vendor Reception	\$2,000	This reception will be held on Saturday afternoon in the Exhibit Hall. You can offer attendees a choice of beverages. Your company logo will be featured prominently at this event.
Closing Session	\$1,500 2 Available	Sponsor logo recognition during NEBB's Closing Session as this premier Sponsor. This event is attended by all conference attendees. Your logo will be featured prominently at this event.
Conference Program	\$1,000 2 Available	Your company advertisement or logo will appear on the inside front cover of the on-site printed program guide, distributed to all conference attendees and posted on the NEBB Annual conference website.
Friday Networking Luncheon	\$850	Attended by all conference attendees, your sponsorship will be acknowledged during lunch and your company name will be featured on the on-site event signage.
Saturday Networking Luncheon	\$850	Attended by all conference attendees, your sponsorship will be acknowledged during lunch and your company name will be featured on the on-site event signage.

NEBB Board of Directors Announces 2020 Members

At its annual organizational meeting held October 18-19, 2019 in New Orleans, the NEBB Board of Directors voted in the next slate of members and attended to other organizational business.

The newest NEBB Board Member is Brian Hill, AccuTec, Lee's Summit, MO. Hill will serve a two-year term.

"It was a breath of fresh air to see that the Board selected a hard-working volunteer from the Young Professionals Network to serve as our newest Board Member. Brian is a great choice and we can expect that he will continue to help keep NEBB the top certification organization in the world," said NEBB President Jeff Schools. "We're proud to have such a dedicated professional like Brian join the NEBB Board".

The immediate past President, Jim Whorton also shared, "The 2020 NEBB Board of Directors come from a wide range NEBB certified firms and disciplines serving multiple market types. This representative makeup is necessary to continue to understand the needs of the NEBB Certified Firms and maintain our leadership in testing the built environment. I am excited to work with these dedicated Directors sustaining and growing this organization."



Changing of the Guard: Jeffrey Schools (right) accepting the position of 2020 NEBB President from 2019 NEBB President Jim Whorton.

The newest member appointed to NEBB's Executive Finance Committee as Treasurer is Phil Emory, Neudorfer Engineers, Inc. Seattle, WA.

Every October the NEBB Board of Directors convenes to discuss and implement strategic plans, review upcoming priority projects and assess the status of NEBB, looking for ways to increase growth, gain efficiencies, assessing volunteer and committee involvement, reviewing potential new programs, and enhance the overall operational procedures of the organization. This year we had the honor of meeting with Darryl Boyce, ASHRAE's President to formalize the effort to Improve Building Design, Construction, Performance Verification, and Operation by signing a memorandum of understanding (MoU).



Pictured above is the 2019 NEBB Board of Directors, along with Tiffany Suite, NEBB Executive Vice President and Darryl Boyce, ASHRAE President.

2019 NEBB Board of Directors (Term October 2018 – October 2019): (Top – left to right): Rodney Hinton, Jon Sheppard, Mike Kelly, Phil Emory, Luis Chinchilla, Glenn See. (Middle – left to right): Amber Ryman, Patrick Law, Jeffrey Schools, Don Hill, Allen King, Curtis Anthony, Tiffany Suite. (Front – left to right): Darryl Boyce, Jim Whorton.

NEBB Board Members

- Phil Emory, NEBB CP in BET
- Curtis Anthony, NEBB CP in TAB, BSC, RCx-EB, FHT, Sound, Vibration
- Patrick Law, NEBB CP in CPT
- Allen King, NEBB CP in TAB, BSC
- Glenn See, NEBB CP in TAB
- Luis Chinchilla, NEBB CP in TAB, BSC, CxPP, CPT
- Mike Kelly, NEBB CP in CPT, FHT
- Rodney Hinton, NEBB CP in TAB, BSC, BET

2019 – 2020 NEBB Executive Finance Committee (Term October 2019 – October 2020)

- Jeffrey Schools, NEBB President, NEBB CP in TAB, BSC
- Amber Ryman, NEBB President-Elect, NEBB CP in TAB, BSC, RCx-EB, Sound, Vibration
- Jon Sheppard, NEBB Vice President, NEBB CP in TAB, BSC, RCx-EB, Sound, Vibration, CxPP
- Phil Emory, NEBB Treasurer, NEBB CP BET, BSC
- Jim Whorton, NEBB Past President, NEBB CP in TAB, BSC, Sound, Vibration, CxPP



The 2019 – 2020 NEBB Executive Finance Committee.

Chapter Updates

25 Chapters Worldwide



Bonneville EBB

Shelley Lester, Chapter Coordinator

On Friday, September 27, 2019, Bonneville EBB hosted a successful Annual Meeting and Recertification Seminar in Bozeman, MT. Business meetings were conducted in the early morning at the C'mon and featured NEBB updates delivered by Phil Emory, NEBB Board of Directors.

Participants then moved venues to Montana State University where they were joined by members of Big Sky ASHRAE and Big Sky ASHRAE Student Chapter for a day filled with several well received, highly informative programs.

Acoustical Consultant and Professional Acoustical Engineer Sean Connolly of Big Sky Acoustics, presented on Sound and Vibration, covering the challenges and pitfalls of noise measurement and the direct influence of noise in relation to building functionality and individual spaces.

Phil Emory returned to his alma mater to present on Building Enclosure Testing. The program covered the purpose and ideal outcomes of this discipline, as well as several valuable case studies. Phil elaborated on the forward thinking technologies being implemented to better train individuals in this discipline, including the use of virtual reality.

Ross Montgomery, ASHRAE Distinguished Lecturer and past ASHRAE Society Vice President, delivered two informative presentations. The first was "Building Commissioning in the Built Environment," which covered the importance of com-



Top: Phil Emory at Bonneville meeting.
Bottom: Bonneville NEBB meeting.

missioning, why we use it, and its many features and benefits. The second program, "Energy Audit Basics," provided examples of energy and economic evaluation calculations that could result in energy saving opportunities in a typical building, including renewables.

The program was sponsored by Evergreen Telemetry.

Capital-MarVa International NEBB

Barbara Huber, Chapter Coordinator



Quinton Smith

Capital-MarVa is pleased to announce that Quinton Smith was recently approved by NEBB as their Young Professional Network (YPN) liaison. Based out of Powhatan, Virginia, Quinton will represent the Capital-MarVa International Chapter in all things YPN. Welcome aboard, Quinton!

In addition, Capital-MarVa held their 2019 Recertification Seminar on September 11, 2019 at the Waterford at Springfield. We received high marks for our presenters and topics which included Building Envelope Testing presented by Phil Emory with Neudorfer Engineers, Cyber Crime presented by Derek Hedrick with Ameritech Data Solutions, and VFD Drives presented by Scott Mathews with Yaskawa America, Inc.

A big thank you goes out to our vendors for both their participation in exhibiting and donation of a door prize: Building Start, Ameritech, Yaskawa, and TSI.

We were pleased to see over 117 attendees from our membership representing Maryland, Virginia, Puerto Rico, Qatar, Turkey, Costa Rica, Dubai, India, Saudi Arabia, and Egypt.

MAEBA

Trish Casey

MAEBA held their Annual Recertification Seminar in September at Harrah's Resort in Atlantic City, NJ. Thank you to all the following speakers for a great seminar: Mike Kelly and Jeff Schools from the NEBB Board of Directors, Greg Wharton, SMCA Safety Professional, James Barrette from Phoenix Controls, Chris Miller from the Kirkman Oliver Co., Tom Lorenz from Dwyer, Jared Eberly and Josh Horn from Azzur Labs and Sam Myers from Retrotec.

In addition to a full day of speakers, MAEBA also held a Vendor Display. Thank you to all the vendors that took part: Kanomax USA, Azzur Labs, Ameritech Data Solutions, TSI, Dwyer, Retrotec, DelRen HVAC, Evergreen Telemetry, Building Start and Victaulic.

During the Annual Meeting at the Recertification Seminar, MAEBA presented the Andrew Stadheim, P.E. Award to Retrotec in recognition of their contributions to MAEBA and their support of MAEBA Firms. MAEBA started the award back in 2017 in memory of our friend, Andy Stadheim of Building Start, who sadly passed away in October 2016. Andy was a constant supporter, speaker and vendor at MAEBA seminars for years.



Pictured: Scott Stadheim from Building Start, MAEBA President Clint Franks and Sam Myers of Retrotec.

FEBB Chapter

Terry Wichlenski, Chapter Coordinator

The Florida EBB Chapter announced its 2020 NEBB TAB Practical Exam dates.

The TAB Certified Professionals (TAB CP) Practical Exams will be available at the FEBB Testing Labs (Jacksonville, Largo and Deerfield) on January 10 - 11; June 6, 2020; and September 11 - 12, 2020. 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, 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 date and location preference and every attempt will be made to accommodate each request. **Space is very limited, so call today to reserve your spot as soon as possible.**

The Florida EBB Chapter is already underway with plans for its 39th Annual Recertification Conference & Business Meeting scheduled April 30 - May 1, 2020. Starting Thursday at 3:00 p.m., the event will be held at the Omni Orlando Resort in Championsgate, Florida. A great agenda is in development with excellent speakers, and reservations will be opening soon.

Attendees arriving early Thursday morning will have the chance to network with FEBB's vendors, sponsors, and speakers as well as have fun participating in the FEBB Corn Hole Tournament Fundraiser. This fundraiser is for FEBB's Florida College Scholarship, which is awarded to a junior or senior college student pursuing a mechanical or electrical degree at a designated Florida college.

MEBB

Ginger D. Slaick, Chapter Coordinator/Executive Vice President

MEBB held its Recertification Seminar, Annual Meeting, and Vendor Expo from September 21-22, 2019 at the Savannah Marriott Riverfront in Savannah, GA. It was another successful event with over 100 CPs and CTs in attendance and nine vendors, including Platinum sponsors: Retrotec and Instruments Direct, Silver sponsors: TSI, Evergreen Telemetry, and Performance Instruments, and Bronze sponsors Building Start, Dwyer, Testo, and Ameritech. Technical sessions included VFD/Electrical Test & Operations, Advanced TAB Parts 1 & 2, Importance of Coordination Control Specs & TAB/CxA Specs, and Expectations of a Test & Balance Contractor. The successful day of continuing education came to a close with our generous vendors giving away terrific door prizes!

To conclude the seminar, President Joel Shannon presented the MEBB Founders Distinguished Service Award. The prestigious award was established by the MEBB Board this year at the recommendation of longtime chapter member Rodney Hinton. The award is given in honor of the eight founders of MEBB (formerly GEBB) as special recognition to members of the chapter who have truly made a distinguished contribution to the chapter and the profession during their career.

MEBB proudly awarded the first recipient of the MEBB Founders Distinguished Service Award to Donald E. Almand. As one of the eight founders and the chapter's first president, there was no one else more deserving of the award than Don! As a result of Don's leadership and vision, the chapter was formed, and NEBB granted its charter in 1972—the same year that Don became a NEBB Certified Professional. Built on a foundation of principles, ethics and integrity, the longevity and success of the chapter is credited to Don along with the other founders. Congratulations Don on the much-deserved recognition!



MEBB Founders Distinguished Service Award recipient Don E. Almand with the MEBB Board of Directors. Left to Right: Scott Kleback, Vice President; Henry Long, Don Almand, Ginger Slaick, MEBB EVP/Chapter Coordinator; and Chris Goff. Back Row, left to right: Scott Goller, MEBB Sec./Treas.; Joel Shannon, MEBB President; and Ken Doyle. (Not pictured: Mark Andrews)



Representatives from Retrotec, Instruments Direct, TSI, Evergreen Telemetry, Performance Instruments, Dwyer, Ameritech, Building Start, and Testo pictured with the lucky door prize winners!



Barry Clark, of Clark Balancing receiving his 30-years plaque.

NEBB Canada

Barbara Flagel, Chapter Coordinator

NEBB Canada held its annual Conference October 4, 2019 and it was a great success with many attendees benefiting from our informative speakers and vendors. Starting this year, NEBB Canada presented its members and companies that have achieved the 30-year mark with a 30-year pin and company plaque.

Please congratulate the following 30-year recipients: Peter McCurdy of Air Velocities Control Ltd. Mississauga, Ont. , Barry Clark of Clark Balancing Ltd., Milton, Ont., Kevin McCann, Con-Test, Ajax, Ont. (accepted by Rob Chopowick) and Jean-Paul LeBlanc, Hydrauliques R & O Services, Mount Royal, Quebec (Accepted by Jean-Marc Robitaille).

Northern California/Hawaii NEBB

Audrey Kearns, Chapter Coordinator

The Northern California/Hawaii NEBB Chapter held its Chapter Annual Meeting and Recertification on Friday, October 4, 2019 at the River Terrace Inn in Napa, CA. With a larger than usual attendance at the meeting due to the participation of Pacific Test & Balance, Inc. attending with their entire crew from both California and Hawaii, the meeting was a success.

Featured speakers for the day were Gus Farris with Nailor presenting "Efficiency and Applications for Airside Equipment," Melissa Olsen with Belimo, presenting "Evolution of the Control Valve" and "Optimizing Performance to Save Energy and Improve Control," and lastly, Brent Baird from Instrument Direct who enlivened and entertained everyone with this presentation, "Tools to Control Your Environment in the Bubble We All Live In." TSI, Instrument Direct, Evergreen Telemetry, Building Start, Ameritech and Retrotec also attended our meeting, displaying their products and services.



Top: Participants at the Chapter Annual Meeting and Recertification Seminar. Bottom: Lunch by the Napa River.



North Central NEBB

Ashley Lang, Chapter Coordinator

North Central NEBB Chapter held their Recertification Seminar on Thursday, October 10, 2019. In attendance were 84 registered guests, 10 speakers, 7 different vendors and 2 break sponsors.

Listening to a speaker at the North Central NEBB Chapter Recertification Seminar.

SW EBB

Shandre Guy, Chapter Coordinator

On Friday, October 4, the Southwest NEBB Chapter held its Annual Chapter Recertification Seminar. The day started off with Chapter President Troy Newman welcoming all guests and speakers. The seminar featured Derek Hendrick, President of Ameritech, presenting "Streamlining Project Management" and "Cyber Crime and Security," Colby Cronn, Charmayne Ivy and John Luckey from Evergreen Telemetry speaking on "3 LBS and 15 Capture Hoods" as well as Michael Funk, Director of Ops at Pentagon Tech giving a presentation on the Young Professionals Network (YPN). Representing NEBB was Don Hill, 2018 NEBB President, who presented NEBB Board of Directors 2019 Updates.



Attendees at the Annual Chapter Recertification Seminar.

WEBB

Jonathan Kowalski, Chapter Coordinator

On Monday, November 4, 2019 WEBB hosted their Annual NEBB Seminar in Milwaukee at their office location at 11001 W. Plank Court, Wauwatosa, WI 53226.

They featured vendor, technology, and continuing education presentations from:

- Ameritech Computer Consultants
- TSI Alnor/Quest
- Glenn See, NEBB Board of Directors
- Vyron/Greenheck



NEBB Marketing Chapter Liaison

"Connecting NEBB Chapters and NEBB National to expand branding efforts and promote professionals that comprise NEBB."

Has Your Chapter Signed Up Yet?

If not, contact marketing@nebb.org to get started.

NEBB 2020 Technical Seminars Schedule

February 2020

Testing, Adjusting, and Balancing (TAB)

February 15-18, 2020

Hilton Phoenix Airport Hotel, Phoenix, AZ

Registration Deadline: February 1, 2020

Optional Exam Days: February 19, 2020

March 2020

Cleanroom Performance Testing (CPT)

March 9-11, 2020

NEBB TEC, Gaithersburg, MD

Registration Deadline: February 24, 2020

Optional Exam Days: March 12, 2020

Building Enclosure Testing (BET)

March 30-31, 2020

Greenbrier Resort, Sulphur Springs, WV

Registration Deadline: March 16, 2020

Optional Exam Days: April 1, 2020

May 2020

Building Systems Commissioning Technician (BSC CxCT)

May 31 - June 2, 2020

NEBB TEC, Gaithersburg, MD

Registration Deadline: May 15, 2020

Optional Exam Days: June 3, 2020

June 2020

Fume Hood Performance Testing (FHT)

June 1-2, 2020

Labconco, Kansas City, MO

Registration Deadline: May 18, 2020

Optional Exam Days: June 3-4, 2020

Testing, Adjusting, and Balancing (TAB)

June 4-7, 2020

NEBB TEC, Gaithersburg, MD

Registration Deadline: May 21, 2020

Optional Exam Days: June 8, 2020

July 2020

Building Systems Commissioning (BSC)

July 21-23, 2020

NEBB TEC, Gaithersburg, MD

Registration Deadline: July 7, 2020

Optional Exam Days: July 24, 2020

September 2020

Sound & Vibration Measurement

September 28- October 2, 2020

Total Dynamic, Deerfield Beach, FL

Registration Deadline: September 14, 2020

Optional Exam Days:

Sept. 30, 2020 and Oct. 2, 2020

October 2020

Testing, Adjusting, and Balancing (TAB)

October 18-21, 2020

IMI Facilities, Roswell, GA

Registration Deadline: October 4, 2020

Optional Exam Days: October 22, 2020

Retro-Commissioning of Existing Buildings (RCx)

October 12-15, 2020

NEBB TEC, Gaithersburg, MD

Registration Deadline: September 28, 2020

Optional Exam Day: October 16, 2020

November 2020

Fume Hood Performance Testing (FHT)

November 2-3, 2020

Labconco, Kansas City, MO

Registration Deadline: October 19, 2020

Optional Exam Days: November 4-5, 2020



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**2020 NEBB
Annual Conference
Registration
Is Open!**

**April 2-4,
2020**

**You
Can't
Miss It!**



The Greenbrier Resort, WV