The NEBB Professional

2018 – Quarter 4

Cover Story:
The Importance of Integrated Project Delivery:
A Better Project Experience for Commissioning and TAB Professionals

The official magazine of

NEBB®

ACCURATE. DEPENDABLE. VERSATILE.

TSI provides the most accurate, dependable and versatile ventilation and indoor air quality measurement instruments on the market today.

TSI offers a full line of:
+ Hydronic Manometers
+ Capture Hoods
+ Thermal Anemometers
+ Indoor Air Quality Monitors
+ Micromanometers

To learn more, visit
www.tsi.com/comfort

UNDERSTANDING, ACCELERATED

The NEBB Professional

2018 – Quarter 4

Index of Articles

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

NEBB President's Comments

By: Jim Whorton

Three years ago, I was humbled when elected by my peers to the NEBB Executive/Finance Committee as Treasurer. It is hard to believe how quickly those years have passed and I am now honored to serve as the 2019 NEBB President. I can only imagine how fast this year will pass. The focus of my tenure is not to leave my personal mark on the organization but to continue the path set forth by my predecessors and work with my successors to leave NEBB a better organization, with a clear, continued path forward.

I thank Don Hill for his selfless leadership and mentorship. A little background: Don and I are competitors, as we all are. But Don and I are in the same city, providing the same services, often competing for, and working on, the same projects. Many would think this would be a difficult working arrangement and there would be some level of conflict, but that could not be further from the truth. Our mutual respect and understanding of how this organization has improved our companies, staff and services, enables us to work together for NEBB and exemplifies what makes this an incredible organization. I look forward to Don's continuing leadership during his term as immediate past president.

Don and his predecessors have laid out a great roadmap for the future of NEBB. To plagiarize from Don's first article as President (which he may have plagiarized from his predecessor), my focus is to continue "to make NEBB's training, education and certifications the best in the industry."

This focus led to the theme of the 2019 Annual Conference: "Training and Education: The Bridge to Excellence." For NEBB to continue leading the industry and providing the most valuable certifications, NEBB must not only produce the best educated personnel in the industry (booksmart), but also the best trained personnel (fieldsmart).

NEBB's headquarters has undergone an incredible transformation over the last three years, tripling the original office footprint. NEBB completed Phase 1 of the NEBB Technical Education Center (NEBB TEC) where technical seminars and committee meetings are held. Throughout this past year, the NEBB Board and Committees held multiple meetings and seminars at this facility, making this an investment in NEBB's future that has immediate payback.

We are in the process of acquiring equipment and constructing the NEBB Training Center. This facility will allow our committees to deliver hands-on training and troubleshooting seminars for basic training of newly hired personnel as well as advanced troubleshooting for professionals. Training on actual systems will educate NEBB's future technicians and professionals beyond other certifications in the industry.

The Young Professionals Network (YPN), the brainchild of Past-President Jean-Paul LeBlanc, has turned into a wonderful asset. The volunteers involved in that group make me believe the future of NEBB is great. For any of you who have met these young volunteers know the energy and ideas which they have brought to

NEBB. For those attending the 2019 Annual Conference or the ASHRAE AHR show, you will be amazed by the educational transformations the YPN are developing.

The NEBB Staff must be recognized for carrying out this organization's goals. Tiffany Suite, NEBB's Executive Vice President has assembled an incredible staff which make this organization run incredibly well. Volunteers, firms and certificants can count on the NEBB staff to carry out the duties necessary to maintain this great organization.

Finally, I would like to thank Jim Kelleher for his numerous years of service, both at the national level and the local levels. Jim's ability to provide historical insight of NEBB and his knowledge of the NEBB Bylaws and Operational Procedures are unmatched. His input will be missed at the board level. Jim continues to remain involved at the technical committee and chapter level, which confirms his dedication to NEBB.

Over the next year, I look forward to sharing the accomplishments and the challenges that NEBB faces in these articles.

NEBB Past President's Comments

By: Don Hill

It has been an honor to serve as NEBB President for 2018 and I am now looking forward to working with Jim Whorton in any way I can for a successful term as the NEBB President for 2019. NEBB is very fortunate to have a Board of Directors and E/FC that are all working toward the same end, making NEBB the best of the best!

We have a great staff that is working very hard to help the Board and Committees meet the goals we set. We have seen an increase in firm applications and seminar attendance that is far greater than it has been in many years. I believe this is because we are all working toward the goal of providing the best training available.

The NEBB Board, Committees and Staff are all a very hard-working group committed to continuous improvement of our great organization and it has been my privilege to work with all of them.

One last group that often goes unrecognized but deserves a lot of credit for what we as NEBB are today are the Past Presidents. This group forged the path for all of us and for NEBB to be what it is today. I want to thank Jim Kelleher for always picking up the phone and being willing to provide advice when necessary. These people are always willing to answer the phone and always willing to talk out different approaches to the various challenges.

Volunteering for NEBB has been a very rewarding experience and I thank you for the opportunity.

35 lb. Commercial Duct Tester

... a game changer!

- Test up to 300 CFM and 20 inches
- Typical accuracy 0.25% of reading down to 0.001 inches
- Live digital display of compliance in CFM and CFM/100 sq ft
- Automated software & reports for SMACNA requirements

We Do More Than Ducts!

... test opportunities for:

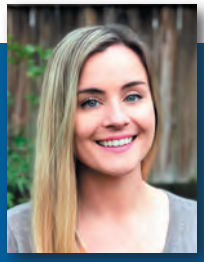
- Large Building Airtightess
- UFAD Under Floor Air Distribution
- Isolation, Clean Rooms, Labs, & Hospitals
- Clean Agent Enclosures

Training for all skill levels

www.retrotec.com | sales@retrotec.com | 1-855-738-7683 retrotec

The Importance of Integrated Project Delivery:

A Better Project Experience for Commissioning and Testing, Adjusting, and Balancing Professionals



Kerri Souilliard

First introduced in the 1990s, and later trademarked in the year 2000, the integrated project delivery (IPD) process was originally devised to empower owners, incentivize lower project costs, increase transparency across the project team, and enhance overall project value. Like any new and unfamiliar method in the traditional world of construction, IPD adoption rates by both owners and contractors were initially slow, as it took time to gain widespread recognition and much of the industry had yet to be educated on what it was.

However, taking certain construction industry statistics into account, there is no question that a better way to execute projects was desperately needed. In 1998, the U.S. Bureau of Labor Statistics published a now popular statistic stating construction was the only major non-farming industry to show a decrease in productivity over a thirty-year period. According to an article in *The Economist* in 2000, those inefficiencies, mistakes, and delays account for almost one-third of the total dollar amount spent on construction in America each year.

Through the help of multiple task forces, including parties from all phases of a project lifecycle, options for tackling this extreme level of waste through transforming project delivery were investigated across the industry. From design to construction to maintenance and operations, each of those groups discovered, in some form or another, that an integrated, team-based approach aligning interests and objectives for the greater good of a project outcome as a whole, was a viable solution.

The Intentions of IPD

According to the American Institute of Architects (AIA), IPD is a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction.

Bill Edwards

Typically, IPD works best with projects that are large, complex, or repetitive—or any combination of the three. Respectively, this is due to the long-standing relationships needed for larger projects with a longer duration, the unified team effort and problem-solving capabilities required for complex projects, and the ability to produce consistent—or improved—results with a repeat team and existing knowledge of one another's strengths. Bill Edwards, President and Chief Engineer of MESA3, adds, "We see it a lot in labs and data centers. The pharmaceutical and mission critical industries have been utilizing IPD for some time."

A true IPD job is one that works to establish time savings, enhance quality, and lower risk—benefits that not are only advantageous to the owner, but to the entire project team. In the best cases, IPD projects lead to the implementation of lean methods, innovative outcomes, and a better project experience for all. In more cases than not, IPD projects are a breeding ground for new ideas and a place to find some of the most progressive players in the industry.

Jim Whorton

"Owners that choose IPD are generally more open-minded, which leads to a more progressive project team," states Jim Whorton, NEBB President-Elect and Vice-President of ViroCon, Inc.

For nearly two decades, forward-thinking owners, architects, engineers, and contractors have been working in the IPD realm, but what about those that provide services like commissioning and testing, adjusting, and balancing (TAB)? As a NEBB Commissioning or TAB Certified Professional, what opportunities for involvement in IPD should you expect?

For starters, the capacity in which commissioning and TAB professionals are invited to participate in IPD may vary slightly from the typical IPD experience of other trades. Commissioning and TAB contractors might not be selected by the owners, like some other partners are, but will instead work directly for the general contractor or mechanical contractor.

Likewise, most project team members sign a multi-party contract, such as an integrated form of agreement (IFOA) or profit-sharing contract, to ensure potential risks—as well as incentives in the case of effective teamwork to cut project costs and schedule—are distributed across the team. Unlike most project team members, it is somewhat rare for a commissioning or TAB contractor to sign a multi-party agreement.

Early Involvement to Deliver Valued Input

Two of the many pillars of success for an IPD project are early involvement for key partners and early goal definition. As a commissioning or TAB provider, you will be brought in much earlier than in a traditional project setting and heavily relied upon to deliver input during the design phase.

Jerry Bauers

"The IPD process does require a greater engagement by the NEBB professional early in the project. This should be part of the contract negotiation, so that you have the time and fee available to 'consult' with the design and construction teams during those parts of the project in which the NEBB professional – especially in the TAB and commissioning disciplines – may not normally be engaged," mentions Jerry Bauers, P.E., NEBB Marketing Chair and Vice President of NV5.

"It may seem like IPD causes higher TAB fees, and therefore project costs, because of the time and fees required for initial, frequent meetings—But, these discussions occur when

issues are easy to fix. If TAB finds one issue to correct early on, compared to 50 instances of that one issue after once it is installed, overall project costs and schedule time are both reduced," Whorton adds.

In its published guide to IPD, the AIA suggests, "Where quantitative criteria are used, the closeout procedures should be determined during the process design. Specific commissioning protocols and calculations should be developed during project design."

"Both TAB and commissioning providers—whether working in traditional TAB, fume hood, clean room, or other discipline-specific processes—are particularly well suited to advise the team on sequences of construction that facilitate early and effective system testing and adjustments to perform in accordance with the IPD team's expectations. We can influence both construction schedule and sequence by collaboratively identifying the benefits that other parties to the process will accrue if the work is completed in a way that promotes a patient and disciplined start up process," Bauers continues.

By collaborating with the other parties that make up the project team, the TAB and commissioning providers' assistance in defining the conditions of satisfaction for the owner is essential.

Sargon Ishaya

"According to CA building codes, codified in 2013, a commissioning agent is required to be hired by the owner and publish the owner project requirements document, as well as review basis of design from the architect before the design is released," comments Operations Manager and Principal Engineer of Pragmatic Professionals Engineers Sargon Ishaya, P.E. "On a biotech job I experienced, the commissioning agent was actually part of contract agreement due to their role in ensuring the design met owner requirements."

Building Trusted Relationships

Regardless of your role, before an IPD team is able to act as a cohesive unit focused on identifying and achieving the owner's goals, trust comes into play. Without trust, a true IPD environment where all are free to share ideas and thoughts—without fear of criticism or backlash from a partner concerned only about their own bottom line—is not possible.


Tyler Hall

"There are a few simple, but important components to trust—honesty, reliability, and respect. We build trust in the IPD environment by being a proactive team member with a positive attitude. Both positivity and negativity can spread like wildfire in a collaboration effort—we prefer the positive approach," says Tyler Hall, Director of Commissioning at Atlantic Testing and founding member of NEBB's Young Professionals Network Ad Hoc Committee.

Combine those traits with a little humility and a consistent effort to get to know your peers, and trust is easy to establish across the IPD project team. Oftentimes, it is the result of building key partnerships off-site that leads to improved trust on-site during project meetings.

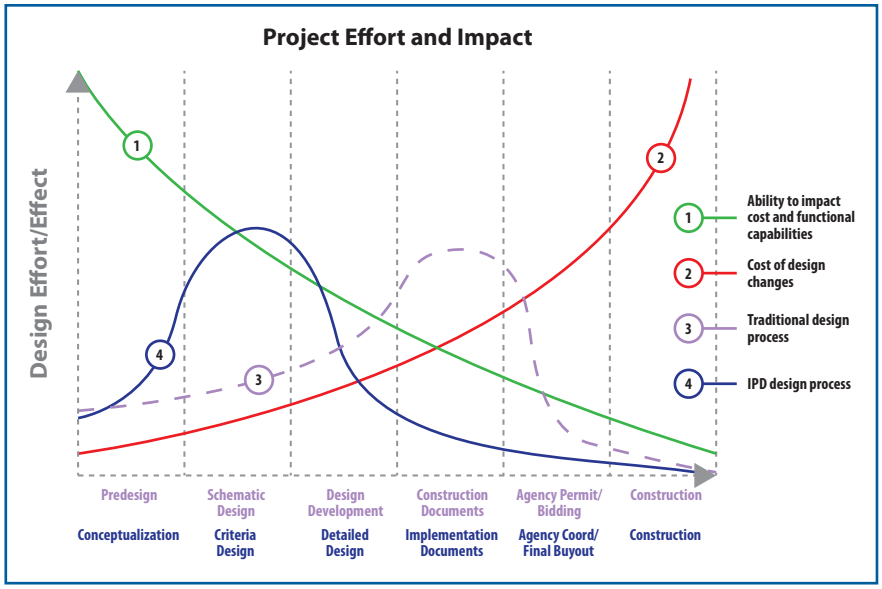
"It's important to eat together once per week and go out maybe one night each month (to a ball game, hockey, whatever) to build friendships and comradery. Team members should not be self-seeking and should have an air of unpretentious confidence. Be humble enough to not get offended if someone points out an issue with your work," states Ishaya.

Open Communication to Enhance Problem Solving

With increased trust, comes better communication. Barriers, like fear of offending another party by pointing out key issues in their work, or a partner's over-the-top assertiveness simply to prove his own worth, quickly become non-issues. With trusted relationships, the IPD Big Room—a collocation environment that supports brainstorming and innovation—becomes a much more informal setting, facilitating solution-oriented exchanges that allow all parties to actively solve problems for the sake of the project as a whole.

"Feeling more comfortable asserting operational and commissioning expertise goes back to the comfort of the IPD environment—a place with no judgement, where it feels like a peer is talking versus someone pointing out issues or critiquing. It's more conversational and solution-oriented. In IPD, the team has more respect for your area of knowledge. Even supers for the GC felt easy to talk to and receptive to suggestions," Edwards points out.

In comparing the IPD environment to that of a more traditional delivery method, Hall mentions, "The primary difference we have seen is improved workflows through enhanced communication. There is an emphasis on working as a team in lieu of one party solely taking the lead role. From the owner to the subcontractor of a subcontractor, team members collaborate and improve productivity by systematically planning and executing tasks throughout the construction process. With the focus IPD has on team collaboration, addressing issues early is simplified with the established communication protocols."



Advanced Technology and Streamlined Planning

Once early involvement leads to delivering valued design input and trusted relationships pave the way to better communication, it's time to focus on the cutting-edge components of the IPD environment: the utilization of appropriate tools and technology, and intensified planning.

Each IPD project team selects different technological tools based on availability and project requirements, but building information

modeling (BIM) is almost always preferred. BIM not only has the capability to show a project before it is built on-site, it also allows for the proper planning of different trades' work with clash detection visualizing issues prior to installation.

"BIM has proven to be fantastic for improving workflows and reducing issues prior to construction. We review and identify installation conflicts and maintainability issues before systems even arrive on-site. Additionally, web-based file sharing technology has monumentally improved the collaborative process," defines Hall.


Jeffrey Schools

NEBB Vice President-Elect and Vice President of Fisher Balancing Jeffrey Schools agrees, "BIM allows trades to pull in information and changes as they occur. It also helps with having a final 'as built' drawing."

As IPD projects tend to dedicate more time to the design and planning stages, the goal is to shorten and increase productivity during the costlier construction stage. Pull-planning, or reverse scheduling, is another popular IPD tactic for increased efficiency. Edwards explains, "We had post-it notes all over the walls, moving their order, as we jointly planned out when we needed to start worrying about this or that. The way we laid out the tasks in the IPD environment working together with everyone's ideas and opinions helped ensure a better workflow and productivity for the project."

Mutual Benefits and Rewards

At its core, the success of IPD relies on several different partners of varied skillsets and experiences, working as a single, collaborative unit to share information, ideas, and expertise in a way that yields innovation and betters the project outcome as a whole. This integrated effort clearly produces benefits for the project and its owners, but it is most valuable because it offers mutual benefits and rewards to all involved.

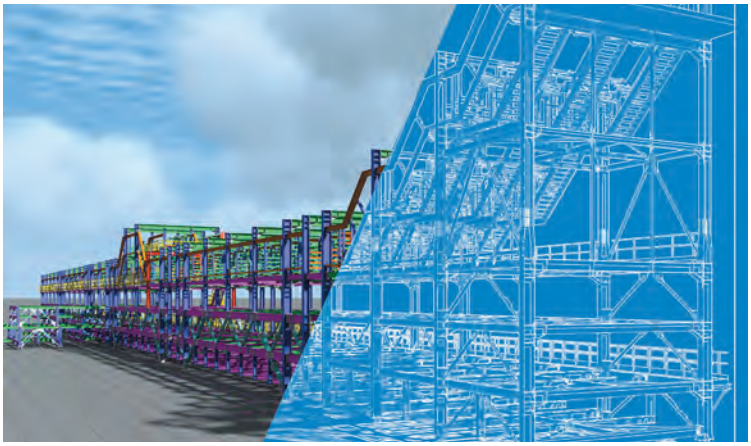
Ishaya notes, "From an engineering perspective, the IPD process is helpful because you can talk to commissioning and find out what they're going to be checking. You know what's on the test or what the hot buttons are, so you prepare and know you're meeting owner's needs ahead of time."

As a commissioning or TAB provider, the IPD setting is like a breath of fresh air just by knowing that the entire project team values—and encourages—your input. That early involvement leads to the enormous benefit of proactive problem solving and project planning, meaning you do not have to scramble to fix others' mistakes at the end of the project.

"During a commissioning level design review, we discovered an issue where a boiler's heating capacity was designed for 25 percent of the total system load. Had we not been involved early and found this simple typo prior to the contract documents being finalized for construction, there would have been significant thermal comfort issues, delays in project schedule, and an expensive change order," describes Hall.

"We were able to identify by the drawings, submittals, and sequence of operation that a negative space would have never been able to control to its design pressure. Changes were made early, so the room was able to perform as intended," Schools recalls. "When we came to the end of the project, there were very few open items that had to be closed out. As the end date approached, we met in person or by tele-conference to make sure everyone closed out their outstanding issues—with a week to spare," Schools continues.

The bottom line is that the IPD process produces better project outcomes that meet owner expectations, lead to superior project turnover, and improved savings and schedule, while offering a better project experience to all members of the project team. As Whorton notes, "It's a big deal to get all these people together—97 percent of the time, you don't get this chance on projects." ■



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 kreativestrategy.com.

Mission Impossible: USP Room Pressurization Guideline

Matthew C. Lemieux | Air Systems Technologies

In the healthcare industry, many patients are served by pharmacies that prepare drug compounds and dosages in local facilities. Unlike most of the drugs taken daily, drugs that must be administered intravenously for certain patients (cancer treatment patients, autoimmune disease patients) within hospital and infusion settings are often prepared in specialty pharmacies.

The United States Pharmacopeia (USP) in its USP <797> *Pharmaceutical Compounding Sterile Preparations* and USP <800> *Hazardous Drugs-Handling in Health Care Settings* documents provides quality standards and practices to promote patient and worker safety, as well as environmental protection. Some of these practices address topics such as dispensing dosages, safe work practices, personnel training, exposure and other critical concerns. One of those concerns is facility and engineering controls.

Engineering controls can be imagined as concentric circles of protection surrounding the direct compounding area (DCA). The concentric levels of protection are commonly designated primary, secondary and tertiary. Primary controls are the most critical in that the DCA is entirely enveloped in filtered air, which is nominally ISO 14644-1:2015 Class 5, but much cleaner. Secondary controls consist of the HEPA filtered cleanroom space wherein the primary engineering controls reside.

One of the most important secondary-control barriers to contamination in HEPA filtered cleanrooms is room pressurization. Room pressurization levels between adjacent cleanrooms and surrounding uncontrolled spaces determine the direction of surplus air flow between those spaces. Rooms are commonly referred to as positive or negative pressure. Any room is positive relative to some other space and likewise negative to some other space. Any space pressure must be compared to some other space pressure to determine whether it is referred to as positive or negative.

In cleanrooms, we are often concerned with pressure differentials as low as 0.01 inches of water (inH_2O), or 2.5 pascals (Pa). In the IP system of measurement, a common unit of thickness is a mil. One mil is equal to 1/1,000 of an inch, or 0.001 inches. Therefore, the pressure magnitudes that concern us in cleanrooms are ten mils, or even as low as one mil. A pressure difference of 0.01 inH_2O is the equivalent of the pressure which would be impressed upon the bottom of a container having a column of water 10 mils—about as high as the thickness of your shower curtain. They are extremely small pressures indeed.

When cleanroom practitioners talk about ambient space and ambient pressure, the term ambient is arbitrary. The ambient space is typically chosen as the uncontrolled building space just outside of the controlled cleanroom space, and is considered the arbitrary zero pressure from which to characterize the rooms' pressures. This is a sensible choice since this space is presumably contaminant-laden and consequently serves a practical purpose for contamination-controlled spaces. The units of inches of water are used for this example (0.01 inH_2O = 2.5 Pa):

The first fundamental law of understanding room pressures is that each room has its own unique pressure relative to ambient. This is the value which should be reported for the cleanroom pressure. Many rooms have more than one door, and consequently, more than one available pressure measurement pathway out to the ambient space. In Figure 1, the pressure in room D can be measured along two different pathways—Pathway 1: Ambient less ΔP room "A" less ΔP room "B" less ΔP room "C" less ΔP room "D," or Pathway 2: Ambient less ΔP room "D." The final pressure in room D relative to ambient must be the same ceteris paribus, regardless of the pathway taken.

Reading in the fashion of Pathway 1 is called a cascade. The second fundamental law of understanding room pressures is that room pressures add algebraically. The correct way to report cleanroom pressure differentials is room A – room B = (value), meaning that the value is the algebraic difference of the pressure in room A minus the pressure in room B. This is known by having the positive gauge terminal connection exposed to room A and the negative gauge terminal connection

exposed to room B. If this notation is used, then the following relationship applies: room B – room A = (- value)

In Figure 1, the blue arrows represent the differences in room pressures, and consequently, are typically located across the room's doors, indicating the physical location of the measurement. The pressure differences should always be stated as *positive* numbers. This might be somewhat confusing at first, but consider that there are only two possibilities, i.e.: there is no difference, or there is some difference. The concept of a negative difference is nonsensical in this context. The arrows represent the direction of air flow with the understanding that air, like any fluid, always flows from a region of higher pressure to a region of lower pressure. The bordered values in the center of each room represent the unique room pressure algebraic sums relative to the arbitrarily chosen ambient.

Cleanroom pressure specifications can be presented in one of two fashions: door-to-door or cleanroom with respect to ambient. The number of doors in a cleanroom complex must equal or exceed the number of rooms. More likely than not, there are more doors than rooms. This situation can lead to irreconcilabilities in the room pressure schedule. Figure 2 illustrates this inconsistency.

Counting the ambient space as one of the rooms, the six rooms are connected with nine doors. The arrows represent the client-specified differential pressure relationships across the various doors, with each arrow representing a specified value of 0.02 inH_2O. The rectangles inside of the rooms represent each room's unique pressure relative to ambient, just as in Figure 1. The problem is identifying the solution set of the six room pressures that satisfies all nine door arrows.

Figure 1

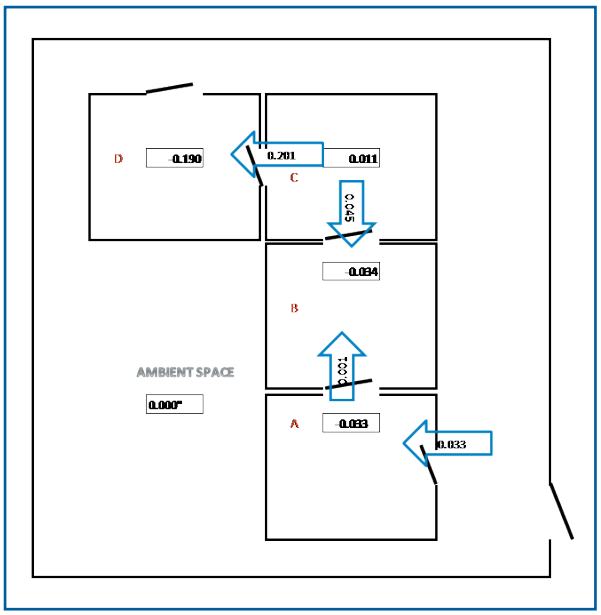
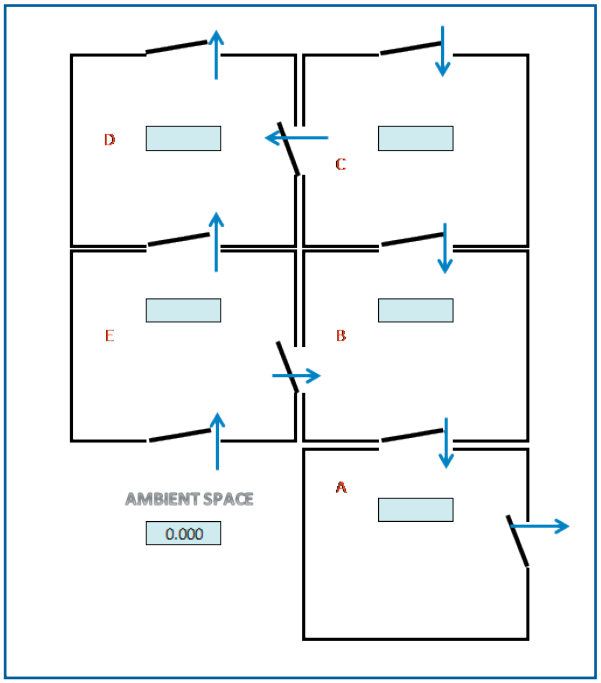


Figure 2. Room Pressure Plan



If we look at the door between room E and room B, room E is specified to be 0.02 inches positive with respect to room B. However, room B is specified to be 0.04 inches with respect to ambient for the two arrows in room A to be satisfied. Room E must be -0.02 inches with respect to ambient for the arrow between ambient and room E to be satisfied. But this situation immediately leads to an inconsistency. Namely, if room E is -0.02 inches with respect to ambient and room B is +0.04 inches with respect to ambient, then the arrow between room E and room B *must* point from room B into room E, not vice versa. Furthermore, the magnitude of the differential pressure between room E and room B must be 0.06 inches, not the client-specified +0.02 inches. The lesson is that unique room pressures determine door differentials; door differentials do not determine room pressures.

A current misapplication of this critical principle is found in the United States Pharmacopeia (USP) <797> and USP <800> regulations. Taken collectively, the requirements are: (1) the positive pressure rooms such as non-HD compounding relative to ante room and/or the ante room relative to ambient must be +0.020 inches ≤ P ≤ +0.050 inches, and (2) the HD compounding pressure must be -0.010 inches ≤ P ≤ -0.030 inches to all adjacent spaces. Both regulations are door-door pressure specifications.

Now, let's look at two common compounding architectural floor plans. The first is the nested HD compounding layout where the HD compound is inside of the non-HD IV com-

Figure 3. Nested HD Compounding

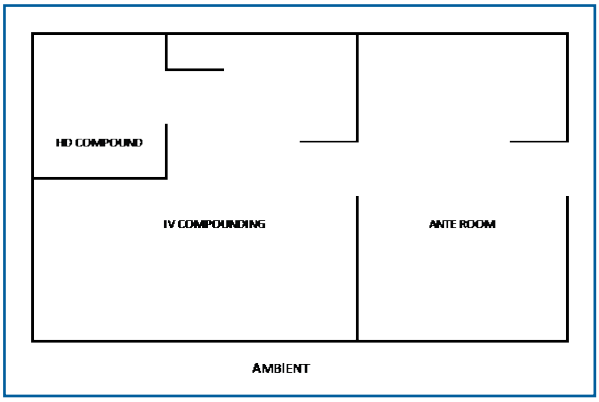
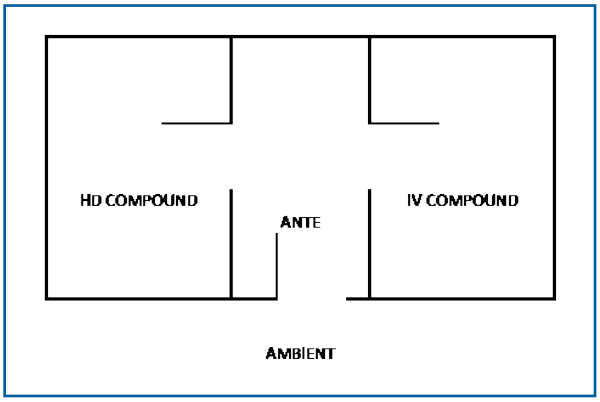


Figure 4. Common Ante Room



pounding room, as shown in Figure 3. This is an obsolete architectural plan layout for new facilities, but one which is found in legacy compounding pharmacies.

In the second type of facility layout, the common ante room layout, the HD and IV compounding rooms are accessible through the same ante room, as shown in Figure 4.

There are many other variations in compounding room layout but for now we will address just these two. In both layouts, there are three controlled spaces: ante room, non-HD (IV) compounding and HD compounding.

Figure 5 tabulates a range of possibilities for the three rooms' pressures relative to ambient. In this table, the assumption is

Figure 5

Room Pressure relative to ambient (in H_2O)					NESTED CHEMO	NESTED CHEMO	NESTED CHEMO	NESTED CHEMO	NESTED CHEMO	COMMON ANTE	COMMON ANTE	COMMON ANTE	COMMON ANTE	COMMON ANTE
TRIAL I.D.	AMBIENT	ANTE	IV COMPOUND	CHEMO	*Chemo-Ante*	*Chemo-Ambient*	*Ante-Ambient*	*Chemo-IV*	*IV-Ante*	*Chemo-Ante*	*Chemo-Ambient*	*Ante-Ambient*	*Chemo-IV*	*IV-Ante*
1	0.000	0.020	0.040	-0.030	N/A	-0.030	0.020	-0.070	0.020	-0.050	-0.030	0.020	N/A	0.020
2	0.000	0.020	0.040	-0.020	N/A	-0.020	0.020	-0.060	0.020	-0.040	-0.020	0.020	N/A	0.020
3	0.000	0.020	0.040	-0.010	N/A	-0.010	0.020	-0.050	0.020	-0.030	-0.010	0.020	N/A	0.020
4	0.000	0.020	0.040	0.000	N/A	0.000	0.020	-0.040	0.020	-0.020	0.000	0.020	N/A	0.020
5	0.000	0.020	0.040	0.010	N/A	0.010	0.020	-0.030	0.020	-0.010	0.010	0.020	N/A	0.020
6	0.000	0.020	0.040	0.020	N/A	0.020	0.020	-0.020	0.020	0.000	0.020	0.020	N/A	0.020
7	0.000	0.020	0.040	0.030	N/A	0.030	0.020	-0.010	0.020	0.010	0.030	0.020	N/A	0.020
8	0.000	0.030	0.050	-0.030	N/A	-0.030	0.030	-0.080	0.020	-0.060	-0.030	0.030	N/A	0.020
9	0.000	0.030	0.050	-0.020	N/A	-0.020	0.030	-0.070	0.020	-0.050	-0.020	0.030	N/A	0.020
10	0.000	0.030	0.050	-0.010	N/A	-0.010	0.030	-0.060	0.020	-0.040	-0.010	0.030	N/A	0.020
11	0.000	0.030	0.050	0.000	N/A	0.000	0.030	-0.050	0.020	-0.030	0.000	0.030	N/A	0.020
12	0.000	0.030	0.050	0.010	N/A	0.010	0.030	-0.040	0.020	-0.020	0.010	0.030	N/A	0.020
13	0.000	0.030	0.050	0.020	N/A	0.020	0.030	-0.030	0.020	-0.010	0.020	0.030	N/A	0.020
14	0.000	0.030	0.050	0.030	N/A	0.030	0.030	-0.020	0.020	0.000	0.030	0.030	N/A	0.020
15	0.000	0.040	0.060	-0.030	N/A	-0.030	0.040	-0.090	0.020	-0.070	-0.030	0.040	N/A	0.020
16	0.000	0.040	0.060	-0.020	N/A	-0.020	0.040	-0.080	0.020	-0.060	-0.020	0.040	N/A	0.020
17	0.000	0.040	0.060	-0.010	N/A	-0.010	0.040	-0.070	0.020	-0.050	-0.010	0.040	N/A	0.020
18	0.000	0.040	0.060	0.000	N/A	0.000	0.040	-0.060	0.020	-0.040	0.000	0.040	N/A	0.020
19	0.000	0.040	0.060	0.010	N/A	0.010	0.040	-0.050	0.020	-0.030	0.010	0.040	N/A	0.020
20	0.000	0.040	0.060	0.020	N/A	0.020	0.040	-0.040	0.020	-0.020	0.020	0.040	N/A	0.020
21	0.000	0.040	0.060	0.030	N/A	0.030	0.040	-0.030	0.020	-0.010	0.030	0.040	N/A	0.020
22	0.000	0.050	0.070	-0.030	N/A	-0.030	0.050	-0.100	0.020	-0.080	-0.030	0.050	N/A	0.020
23	0.000	0.050	0.070	-0.020	N/A	-0.020	0.050	-0.090	0.020	-0.070	-0.020	0.050	N/A	0.020
24	0.000	0.050	0.070	-0.010	N/A	-0.010	0.050	-0.080	0.020	-0.060	-0.010	0.050	N/A	0.020
25	0.000	0.050	0.070	0.000	N/A	0.000	0.050	-0.070	0.020	-0.050	0.000	0.050	N/A	0.020
26	0.000	0.050	0.070	0.010	N/A	0.010	0.050	-0.060	0.020	-0.040	0.010	0.050	N/A	0.020
27	0.000	0.050	0.070	0.020	N/A	0.020	0.050	-0.050	0.020	-0.030	0.020	0.050	N/A	0.020
28	0.000	0.050	0.070	0.030	N/A	0.030	0.050	-0.040	0.020	-0.020	0.030	0.050	N/A	0.020

that the IV compound is +0.02 inches relative to the ante room, in accordance with USP regulations, which in turn, is varying from 0.020 to 0.050 inches relative to ambient per USP regulations. In the figure, the HD (CHEMO) compounding room varies from -0.030 to +0.030 inches relative to ambient under each of the four pressure permutations for the ante room. Pressures relative to ambient for the four spaces (including ambient) are shown in the left-hand columns in black. The center and right-hand thirds of the table detail the resultant door-door differential pressures. Green indicates that the room-room differential pressure is within specification, while red indicates that the room-room differential pressure is outside of specifications.

The results are apparent. There is only one possible permutation (for each allowable IV compounding – ante room acceptance value 0.02,0.03,0.04 and 0.05 inches) of room pressures relative to ambient that will satisfy the USP door-door regulations, which can be seen in trial 3. The USP regulations can never be satisfied in the nested HD design and there is only one possibility, as stated, for the regulations to be satisfied in the common ante room design. We encounter another insurmountable problem, however, with the apparent equilibrium in trial 3. For the door-door USP regulations to be satisfied as in trial 3, the HD compound must be simultaneously maintained such that the *combined* errors of both HD and ante do not exceed the 0.004 inH_2O requirement. The most sophisticated commercially available room pressure control systems can only maintain tolerances of hundredths of an inch water column, not thousandths.

By ignoring the fundamental principle that unique room pressures determine door differentials and door differentials do not determine unique room pressures, the USP is mandating an impossibility. ■

About the Author

Matthew Lemieux, is vice president of training & quality at AIR SYSTEMS TECHNOLOGIES and has over 37 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.

Life Safety Dampers: Code-Required Testing

Larry Felker | Belimo Americas

Building codes require installation of life safety dampers for several purposes. Most are used as part of compartmentalization to prevent the spread of fire and smoke in a life-threatening event. Smoke control systems employ dampers to prevent the spread of smoke or to remove it, while some dampers can be used for other types of fire and smoke control. Periodic testing of all life safety dampers is required.

Codes and Referenced Standards

While the International Building Code[1] (IBC) defines the requirements for *installation* of life safety dampers, it is the International Fire Code[2] (IFC) that defines the requirements for their *periodic testing*. Section 706.1 Maintaining Protection of the IFC references NFPA 80[3] (fire) and NFPA 105 (smoke)[4] for those requirements.

Some clarification or additional requirements and exceptions are contained in the IBC and IFC. Dampers installed per Chapter 7 of the IBC are part of fire-resistance-rated construction and the dampers are referred to as "containment dampers." In contrast, dampers installed per Chapter 9 are referred to as "smoke control system dampers."

Owner's Responsibility

The building owner is responsible for maintaining fire-resistance-rated construction. This is clearly stated in IFC Section 701.6 Owner's Responsibility and includes "construction installed to resist the passage of smoke." The owner shall maintain records of inspections and repairs.

Section 907 of the IFC deals with fire alarm and detection systems and includes "life safety systems" which are more inclusive. Section 907.8.5 Inspection, Testing and Maintenance also states that the building owner is responsible. A record of inspection, testing, and maintenance must be kept. This is also stated in NFPA 80 and NFPA 105 which are more specific to dampers. An up to date log book is normally enough for examination by the building official or fire marshal during inspections. This, however, is the provenance of the authority having jurisdiction.

In both the IFC and IBC Section 909.3 Special Inspection and Test Requirements, commissioning of a smoke control system is required to be subject to special inspections and tests, in addition to ordinary inspections and tests. IBC Section 1704 references the professional qualifications and record keeping requirements.

Section 909.18.8.2 Qualifications of the IFC and the IBC Section 1705.18.2 establish that qualifications require that smoke control testing (commissioning) agents "shall have expertise in fire protection, engineering, mechanical engineering and certification as air balancers." However, no qualifications are explicitly stated for periodic testing.

Some of the larger owners and hospitals have qualified people on staff to perform the testing. Others ignore the requirements or are not aware they exist. Service contracts should include periodic testing either by the ventilation or mechanical contractor themselves, or by a sub with whom they contract.

Local code officials may have expectations and owner prudence would indicate that a test, adjust, and balance (TAB) contractor or otherwise qualified agent perform or oversee the work. In any event, TAB contractors should make their building owners aware of the code requirement and, when attending local ICC or ASHRAE meetings, inform mechanical contractors and engineers of their capabilities.

Testing Requirements

The IBC does not mention any periodic damper testing requirements within Chapter 7. IFC Section 706 covers duct and air-transfer openings. Section 706.1 Maintaining Protection, states that dampers protecting openings shall be maintained in accordance with NFPA 80 and NFPA 105.

IFC Section 717.4 Access and Identification requires proper access to dampers. It also requires a minimum of half-inch high labels with capital letters identifying the damper type –

fire/smoke, smoke, or fire damper. While this is not a testing requirement, it makes locating the dampers, and thus facilitates testing, possible. There is no further mention of testing requirements in Chapter 7 of either code.

Chapter 9 of both the IBC and IFC have the most detail regarding testing requirements. Both have the same Section 909.12 Detection and Control Systems requiring fire alarm and controls, as well as associated equipment be listed to UL 864[5] and UUKL listing if used for smoke control. UL 864 requires all equipment listed to it to be capable of a weekly self-test.

Actuated dampers are not investigated to UL 864 standards and are excluded from the weekly self-test as long as the fire code official approves. Infrequently, there is confusion about the above requirement between UL 864 and the UL 555 family of standards.[6] UL will not investigate dampers to UL 864 and listing to one of the UL 555 family of standards is correct.

The exception to 909.12.1 allows components that could interfere with building operation to be bypassed and that Section 909.20.6 of the IFC should be followed. The most common situation where dampers should not be tested is at the intakes or outlets of fans. If the fan is running and a damper closes, negative duct pressure (suction) or positive pressure (discharge) can collapse ducts or split the seams and the fans may shut-down on static pressure limits, which are usually manually reset. As the smoke control fans and dampers are typically part of the fire alarm equipment and non-dedicated equipment part of the building management system, care must be taken to avoid not just interference, but actual damage.

IFC Section 909.20 is maintenance. Sections 909.20.1. through 909.20.6 detail requirements. Operational testing of each control sequence and device must be tested semi-annually for dedicated systems, while non-dedicated systems must be tested annually. Dampers are specifically included in Section 909.20.3. Section 909.20.6 Components Bypassing Weekly Test requires semiannual testing. Dedicated system dampers must be tested semi-annually per NFPA 105, and non-dedicated dampers must be tested annually. Since they are not UL 864 listed, the NFPA standard regulates their testing frequency.

Other dampers that need testing may be installed per IBC 909.20 Smokeproof Enclosures. They should be tested per smoke control system damper requirements.

Fire extinguishing equipment other than sprinklers is covered in IFC Section 904 Alternative Automatic Fire-Extinguishing Systems. In Section 904.8.5 Auxiliary Equipment, the requirement exists for components, including dampers, to be operated at "12-month intervals." Section 904.12.3 covers carbon dioxide systems. It recognizes that dampers may be installed in a duct as part of the system. Section 904.8.1 System Test requires yearly inspection and testing. NFPA 12[7] is referenced in Table 901.6.1 Fire Protection System Maintenance Standards, and as with all systems, records must be maintained.

The IFC Section 910 Smoke and Heat Removal states that smoke and heat vents are required to be inspected annually and operationally tested not less than every five years. Section 910.5.2 states that mechanical smoke removal equipment should be tested and maintained according to NFPA 204[8] and manufacturer's instructions. These systems should be inspected and tested annually, and all ancillary equipment should be included. This would include any associated fan discharge dampers. Again, a record must be kept. These dampers are not typically considered to be smoke control related per se, but in specific cases may be interpreted to be so. Table 1 summarizes these explanations.

Table 1

Chapter 7 Containment Dampers	
Commissioning End of first year Every 4 years except in hospitals every 6 years	
Chapter 9 Smoke Control System Dampers	
Dedicated	**Non-dedicated**
Commissioning Semi-annually	Commissioning Annually
Chapter 9 Mechanical smoke removal dampers	
Commissioning Annually	
Auxiliary fire extinguishing equipment (CO_2)	
Commissioning Annually	

Fire detection & smoke control systems	
Dedicated	**Non-dedicated**
Weekly self-test	Not required[i]

i. Subject to the Exception in 909.12.1

Dampers

There are four essential types of life safety dampers:

1) Ceiling radiation
2) Fire

3) Smoke
4) Combination fire and smoke

Depending on the application, they have varying requirements for periodic testing. Further details will be covered in Part II of this series in early 2019.*

In summary, building owners are responsible for maintaining and periodic testing of life safety dampers. The IFC references NFPA 80 and NFPA 105 for some details but states the requirements in Chapter 7 and Chapter 9. Table 1 has a summary of the requirements as detailed above. Part 2 of this article will explain the primary types of life safety dampers and their periodic testing requirements. ■

**This is the first article in a series. Part II will appear in the next issue of* The NEBB Professional *and will explain the primary types of life safety dampers and their periodic testing requirements.*

About the Author

A specialist in fire and smoke dampers and actuators, Larry Felker is fire- and smoke-product manager for Belimo Americas. He is vice chair of Air Movement and Control Association (AMCA) International's Fire and Smoke Damper Task Force, a member of the International Code Council, the National Fire Protection Association and the Society of Fire Protection Engineers, as well as a life member of ASHRAE. He is co-author of the book "Dampers and Airflow Control" published by ASHRAE Special Publications in 2010.

---

1 International Building Code 2018, International Code Council, Inc. (ICC), Country Club Hills, IL 60478-5795

2 International Fire Code 2018, ibid.

3 NFPA 80 Standard for Fire Doors and Other Opening Protectives, 2016 Edition, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471

4 NFPA 105 Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives, 2016 Edition, ibid.

5 UL 864 Standard for Safety Control Units and Accessories for Fire Alarm Systems, 10th Edition, 2018, Underwriters Laboratories Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062-2096. UUKL is a list of smoke control approved components and systems within UL 864.

6 https://ulstandards.ul.com/access-standards/, ibid. Also see IBC 717.3 Damper testing, ratings and actuation.

7 NFPA 12 Standard on Carbon Dioxide Extinguishing Systems, op. cit.

8 NFPA 204: Standard for Smoke and Heat Venting, 2018, op. cit.

In Memory

Robert (Bob) Gawne, NEBB CP, one of NEBB's Founding Fathers passed away on September 14, 2018.

Bob received his Mechanical Engineering Degree in 1950 from the University of Notre Dame and served as a Captain in the U.S. Marine Corps. He began his career at Chatelaine, Gauger & Nolan FAIA, 1953-1958, then joined Stromberg Metal Works, Inc. as an estimator. He purchased Stromberg in 1987 and was CEO until his death. He was a Founding Board Member of NEBB in 1971 and became president in 1988. A member of ASHRAE, Bob also served on the State of Maryland HVAC Review Board from 1999 - 2003.

According to Jim Kelleher, NEBB Past President, 2017, Bob Gawne was an inspiring individual with a lasting impact on NEBB, Capital Mar-VA International, and personally. His efforts at both the national and local levels served to encourage the participation of scores of individuals who followed in his footsteps.

"I am fortunate to have known Bob professionally and routinely sought information and guidance from him in mechanical and NEBB related matters. He had an unending desire to assist in the professional development of those he met regardless of who you worked for," said Kelleher. "Competitor or not, Bob's belief, as I understood it, was that if everyone was better qualified and prepared for the needs of the industry, it improved the environment for all. His ability to relate on a personal level showed the depth of his compassion for others. A welcoming person, he always checked on the status of family and friends whenever we were together. Capital Mar-VA International and NEBB are truly at a loss with the passing of Bob, NEBB lost one of its founding members. I have lost someone I considered a friend."

Bob is survived by his beloved wife of 65 years Patricia Ann Schilke, daughters, sons, 20 grandchildren and 20 great-grandchildren and many other family members.

60 Years Testo

Be sure. testo

The NEW testo 440 Air velocity & IAQ Meter

The testo 440 combines the benefits of a compact and handheld device with intuitive menus and a comprehensive selection of both Bluetooth and wired measurement probes.

For more info visit www.testo.com

testo 420 Flow Hood

Available Now!

Building Enclosure: A Primer on the Basics of the Building Enclosure

Andrew Boyd | Industry Stakeholder, Certification Board

One of my pet peeves is to hear a fellow architect, engineer, or builder tell me that we should not build the building enclosure too tight, because the building needs to "breathe." I have never heard of a brick taking in carbon dioxide and exhaling oxygen, nor have I seen a two-by-four needing oxygen to survive while it produces carbon dioxide.

It's a great excuse to allow us to be sloppy designers and builders—to construct our buildings with lots of gaps and defects in the building enclosure combined with a poorly designed mechanical system. Building science and common sense does not support this myth. We can—and must—do better.

Building exterior assemblies will—I repeat, *will*—get wet. They *need* to be able to dry. If an enclosure wall assembly consists of vapor impervious outer and inner layers, the inside of the wall will likely resemble a petri dish of biological activity.

One reason I am an architect instead of an engineer is because I fear big numbers. There are only three ways a building enclosure assembly can dry: towards the interior, towards the exterior, or both. We can build tight building enclosures if we carefully consider the four (another small number) primary barriers, design them correctly, and install them properly.

Before we discuss the four barriers, try to envision an old wooden sheathed barn standing in a field. None of the barriers are well done, yet the building is performing well, as evidenced by its old age. But, would you like to live year-round in this unheated, drafty barn? Obviously, this model will not work if we want to live in a modern, high performance, energy efficient building.

The first primary barrier is the liquid moisture barrier, preventing water in its liquid phase from passing through the enclosure assembly. I like to think of this as preventing the "big holes" in the enclosure. A tree branch through the roof, window left open during a thunderstorm, or poorly installed flashing can all allow relatively large quantities of liquid water into the structure. Historically, we have developed ingenious ways to mitigate this unwanted intrusion. Overlapping shingles and siding, roof overhangs, molding with drip edges, and (properly installed) flashing are all tried and true methods of dealing with liquid moisture.

Next, comes the thermal barrier. Pink and fluffy or blue and rigid, this barrier is commonly known as insulation. It is installed to prevent the transfer of heat, helping keep our buildings warm in the winter and cool in the summer. Architects and builders would have a much easier time preventing moisture damage if we could just eliminate the stuff; clients, building occupants, and our finite fossil fuel resource managers would object. Heating objects dries them out –a primary reason why old, poorly insulated and leaky buildings with oversized heating systems performed so well from a longevity perspective. Creating comfortable, energy efficient buildings without adding gratuitous heat puts demands on the building enclosure.

Barrier number three is the air barrier. Defects in this barrier are the "small holes"—often small enough that liquid water is not an issue—in the enclosure. However, any water in the vapor state passes freely through these holes. Pressure differences between the interior and exterior of the building can move large quantities of water vapor through the building enclosure. If you live in a climate where the exterior temperature and relative humidity always match ideal interior conditions, this is not a problem—*and let me know where this magical land is because I would like to join you there*. Additionally, if there is no condensing surface within the enclosure assembly, there may not be a problem. Real problems occur when water vapor reaches a condensing surface (plywood sheathing, painted gypsum wallboard) which falls below the dew point, causing a buildup of liquid or frozen water.

Among the four barriers, the air barrier is unique because it must be continuous throughout the six sides of the enclosure – floor to walls and walls to roof or ceiling. The other three barriers can typically have a few gaps that will not unduly affect building performance. As an analogy, you can go out on a cold, rainy day with a floppy hat and loosely tucked scarf around your neck and remain warm and dry but try riding a bike fifty miles with a pinhole in the tire tube.

The fourth barrier is often confused with the third. A vapor barrier, or more correctly a vapor diffusion retarder, is installed to prevent individual water molecules in the vapor state from migrating through the assembly due to differences in vapor pressure. Think of this as closing the "really tiny holes" in the enclosure. To understand this mechanism, imagine that we place a million water molecules in a glass jar, seal the lid up tight, and leave it out in the sun for 100 years. When we return, thousands of the molecules will have found their way through the glass and metal lid and escaped. Try the same experiment using blotter paper and a rubber band for a lid and you will get the same effect in a day. Blotter paper is much more vapor pervious than metal and glass. This movement of vapor is not due to pressure differences but is due to nature's desire to have the same concentration of water molecules on both sides of a membrane.

In very cold regions, such as Fairbanks Alaska, the vapor is almost constantly driven from the warm humid air inside to the cold dry outside. In hot and humid areas, such as Miami, the vapor is almost always driven from the hot and humid outside to the cool and dry inside. In such areas, a vapor retarder could be indicated on the inside up North and the outside down South. Fortunately, in most mixed climates the vapor drive is not constant and if the other three barriers are detailed well, we can often omit a separate dedicated vapor barrier.

Hopefully, I have helped illustrate why a well-insulated enclosure with a great air barrier is so important. One pesky problem now occurs. The occupants of this building will need to breathe, and perform other annoying activities, such as using the bathrooms and taking showers. Even if we can eliminate the humans, some moisture will enter the enclosure and some air exchange with the exterior is required to mitigate its effects. This is why a well-designed mechanical system that introduces the proper amount of outside air, controls the humidity, and captures some of the energy loss is so critical.

The building science adage, "build tight, vent right" is spot on. Architects, mechanical engineers, and builders need to work together intelligently to produce comfortable, energy efficient buildings that last more than a couple of years.

NEBB shows leadership in this effort. The new Building Enclosure Testing effort is at the forefront of air barrier testing, and continued developments in testing, adjusting, and balancing and mechanical system testing lead the industry. NEBB members have the tools, the motivation, and knowledge to drive improvements in building enclosure performance. ■

About the Author:

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

2019 Annual Conference: San Antonio – Here Comes NEBB!

Mark these dates in PEN, as this is one adventure you won't want to miss!

San Antonio will host NEBB's 2019 NEBB Annual Conference starting on **Thursday April 4, 2019 through Saturday, April 6, 2019.** The full complement of networking, education events, keynote speakers, social gatherings – everything you've come to expect from a NEBB annual convention awaits, and more! **Watch NEBB's website for complete details.**

2018 Annual Conference Schedule-at-a-Glance

Monday, April 1, 2019

8:00 am – 5:00 pm	NEBB Building Enclosure Testing (BET) Seminar, Day 1
8:00 am – 5:00 pm	NEBB Testing, Balancing & Adjusting (TAB) Seminar, Day 1

Tuesday, April 2, 2019

8:00 am – 5:00 pm	NEBB Building Enclosure Testing (BET) Seminar, Day 2
8:00 am – 5:00 pm	NEBB Testing, Balancing & Adjusting (TAB) Seminar, Day 2
12:00 pm – 5:00 pm	Annual Conference Pre-Registration Open

Wednesday, April 3, 2019

6:00 am –11:00 pm	Annual Conference Registration Open
8:00 am – 5:00 pm	NEBB Exam Day
8:00 am – 5:00 pm	Closed Committee Meetings
6:00 pm – 10:00 pm	NEBB Volunteer Appreciation Dinner

Thursday, April 4, 2019

6:00 am – 11:00 pm	Annual Conference Registration Open
7:00 am – 3:00 pm	NEBB 22nd Annual Golf Tournament
1:00 pm – 5:00 pm	Exhibit Hall Open
4:00 pm – 5:00 pm	NEBB Past Presidents Meeting
5:30pm – 6:45 pm	Opening Session: Welcome and Keynote Speaker Presentation
7:00 pm – 10:00 pm	Get Acquainted Reception

Friday, April 5, 2019

6:45 am – 8:00 am	Breakfast for Conference Attendees
7:00 am – 5:00 pm	Annual Conference Registration Open
7:00 am – 5:30 pm	Exhibit Hall Open
8:00 am – 3:45 pm	Technical Track Sessions
To be announced	Chapter Presidents Meeting
11:15 am – 12:30 pm	Networking Luncheon

Saturday, April 6, 2019

7:00 am – 8:00 am	Breakfast for Conference Attendees
7:00 am – 1:00 pm	Exhibit Hall Open

Schedule continued from pg.19

8:00 am – 4:00 pm	Chapter Coordinators Meeting
8:00 am – 9:30 am	NEBB Business and Town Hall Meeting
9:45 am – 3:45 pm	Technical Track Sessions
11:15 am – 12:30 pm	Networking Luncheon
3:00 pm – 4:30 pm	Vendor Reception and Prize Giveaway
5:00 pm – 7:00 pm	Closing Session

Sunday, April 7, 2019

8:00 am – 12:00 pm	Board of Directors Meeting – OPEN
1:00 pm – 5:00 pm	Board of Directors Meeting – CLOSED

Conference Hotel Information

Hyatt Regency San Antonio
123 Losoya Street
San Antonio, TX 78205

A 10-minute stroll from the iconic San Antonio Riverwalk, this upscale, modern hotel is a 6-minute walk from the Alamo Mission, and 8 minutes' walk from the galleries of the historic La Villita district.

The high-end, modern rooms feature free Wi-Fi, flat-screen TVs and coffeemakers. Upgraded quarters offer views of the River Walk or the Alamo. Suites feature iPod docks, wet bars and separate living/sleeping areas.

Hyatt Regency, San Antonio, TX

There's a regional restaurant with an open kitchen, a market with grab-and-go fare, and a lively lounge with big-screen sports and a 55-foot bar. Additional amenities include a rooftop pool, a fitness center and a spa.


Interior lobby of the Hyatt Regency


Upper deck view from the Hyatt Regency

About San Antonio!

Work or playtime in San Antonio means one thing: everything is going to be Texas-sized! Regardless of who you are, how old, or where you're from, big thrills await. A south-central major city in Texas, San Antonio boasts a rich colonial heritage. From historic missions to the winding miles-long River Walk landmark pedestrian promenade filled with shops, cafes, breweries and stores galore, you'll want for nothing in this city of landmarks.

Step to the beat of wafting flamenco music as you wander the downtown before sampling as much chili (San Antonio's signature dish) as your taste buds will allow. A visit to the Alamo is an absolute must, as is taking in a show at the ornate Majestic Theatre. San Antonio Missions National Historical Park is dotted with 18th-century buildings and features, making for an enriching excursion.

For a different type of excitement, the Riverwalk at night promises to be a great evening adventure.

The Alamo, one of San Antonio's "must-see" museums and attractions.

From River boat tours, to culinary dining and more, you'll be going non-stop in San Antonio!

Be prepared for anything to happen, like dancing in the streets!

NEBB Annual Golf Tournament

A NEBB Annual Conference isn't an annual conference without its annual golf outing. This year, golfers will be able to tee up at Silverhorn Golf Club, with the earned reputation of being among "The Top 25 Courses in Texas."

The distinct Hill Country character of SilverHorn Golf Club can be credited to designer Randy Heckenkemper along with PGA Tour Professionals Willie Wood and Scott Verplank. SilverHorn Golf Club's tree-line fairways, strategic use of sand and water, and beautifully framed contoured greens make this par 72 course a treasured Hill Country experience long remembered. Silverhorn Golf Club is a fantastic upscale Golf Club that is a must play while in San Antonio.

Scheduled for: Thursday, April 4, 2019, 7:00 am – 3:00 pm.

Become a 2019 NEBB Conference 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 2019 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: $10,000

- One complimentary Exhibit table top space & standard exhibit package extras
- **Opening Speaker Session Sponsor, plus signage at the Opening Event**
- Full-page ad in the conference program guidebook
- Acknowledgment in conference program 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: $8,000

- 70% off one Exhibit table top space & standard exhibit package extras
- **Closing Speaker Session Sponsor, plus signage at the Closing Event**
- ½ page ad in the conference program
- Acknowledgment in conference program 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: $5,500

- 50% off one Exhibit table top space & standard exhibit package extras
- **Vendor Reception Sponsor, plus signage at the event**
- ¼ page ad in the conference program
- Acknowledgment in conference program 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: $3,500

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

For more information and to obtain a 2019 Conference Sponsorship Agreement, contact Emily Demmons, emily@nebb.org.

Certification Board Announces New Subject Matter Experts

Cynthia Hereth | NEBB Director of Certification

Nick McDonald, Mark Privitt, Scott Davies were recently approved by NEBB's Certification Board (CB) as its newest Subject Matter Experts / Item Writers who will work with the CB's Exam Development Committee on the writing of questions for various new exams in development.

A Brief Introduction

Nick McDonald

With a father who owned a heating and air conditioning company, **Nick McDonald** had the opportunity to learn HVAC installations early on. A graduate of Ohio State University with his undergraduate degree in Agricultural Engineering, Nick pursued his master's degree in mechanical engineering at Wright State University. He currently holds his NEBB CP certifications in Testing, Adjusting, & Balancing and Sound & Vibration. As a TAB and Commissioning Manager for Four Seasons Environmental, he helps building owners attain optimum efficiency through their buildings' mechanical, electrical and plumbing systems.

Mark Privitt

Currently a Commissioning Project Manager with Coffman Engineering in Spokane, WA, **Mark Privitt** is a graduate of Tarleton State University where he earned his Bachelor of Business Administration and Management. With Coffman Engineering, he is responsible for the daily business operations which includes scheduling, safety, training, contract negotiation, supervising field personnel, Cx and RCx operations, project management, and quality control. Mark also oversees onsite Cx and RCx projects including commercial, government, industrial, medical and hospitality. He also develops commissioning plans, Cx procedures, functional performance tests and strategic plans for individual project application.

Scott Davies

Scott Davies is a NEBB TAB CP, having been in the HVAC business since 1999. At present, he is the Seattle Fire & Life Examiner and Forman for Airtest, Inc. in Issaquah, WA. Having completed a wide variety of high-profile projects, he's mastered the art of multi-tasking and being a positive role model for apprentices at work. Scott has a deep interest in all types of energy transfer and how mechanisms physically work.

"NEBB's Certification Board is so fortunate to have NEBB CPs step up and take an interest in certification exam development," said CB Chair, Rick Farrington. "Our SMEs/Item Writers go through specific training to understand the nuances of what it takes to write a defensible exam question. These professionals are the ones who make the exam development process go much more smoothly and having the diversity of experience is tremendous." ■

If you would like to learn more about becoming a Subject Matter Expert/Item Writer, email cindi@nebb.org.

NEBB Launches New YPN LinkedIn Page

With 562 million users, LinkedIn is all about building networks and connections. It's not just about who you know, but about who your *connections* know.

NEBB leadership recognized the power of LinkedIn to engage and connect with many young professionals in the various disciplines represented by the organization, and to that end, NEBB launched its new LinkedIn page for the Young Professionals Network (YPN).

For a business, non-profit association, or any organization, the real power of LinkedIn is the ability to tap into existing connections and grow the organization's brand through word-of-mouth.


Tyler Hall

According to Tyler Hall, NEBB CP, Director of Commissioning for Atlantic Testing and YPN's Social Media Expert, "the YPN's goal for social media is to provide another resource for industry-relevant young professionals to learn, grow, mentor and get plugged into NEBB. The infusion of the younger generation will be crucial to the continued success of NEBB. Social media is a simple, yet powerful platform to further enhance NEBB's community presence."

LinkedIn offers the potential to connect with professionals within NEBB, as well as to reach other industry professionals who may not know of NEBB. Hall shared his personal profile experience, "With only 162 followers (not a lot for social media), a simple post with engaging pictures led to 745 views of my post. That's 4.6 times my "professional connections" and great exposure!"

The bigger the network, the higher the potential for more professionals to be reached. The news "sticks" with the reader on a personal level because a colleague liked or shared the post. People actively choose to view, share and like social media content.—no one forces them to view this content.


Caleb Antone

"In today's business and electronic world, connecting with your peers quickly is the most efficient way to bring about action," stated Caleb Antone, NEBB CP, TAB Dept. Manager for Gootee Construction, Inc. and NEBB's Arkansas Chapter Liaison. "LinkedIn will be a great benefit to the young professionals in NEBB. It's something we've been hoping for."

Beyond the personal allure, social media uses multimillion-dollar algorithms designed to keep its users interested. To succeed, LinkedIn invests in a platform people enjoy and connects them to the content they want to see.

This benefits NEBB because it allows the NEBB YPN to tap into technological resources that would otherwise be unobtainable. These multimillion-dollar algorithms can help connect NEBB with relevant, industry professionals for *free*. The YPN LinkedIn Group has the potential to connect young professionals (YPNers) with NEBB unlike ever before. The YPN LinkedIn Group can serve as a resource into the NEBB world by connecting the YPners to the appropriate committee or personnel for the following:

a. Technical questions
b. Getting Certified
c. YPN Chapter Liaison or Coordinator Contact
d. Mentorship

Use the following link to check out the new YPN LinkedIn page and share your insights, questions and stories: https://www.linkedin.com/company/nebb-young-professionals-network-ypn/

YPN Welcomes Two New Chapter Liaisons

NEBB's Young Professionals Network (YPN) is expanding its grassroots reach with the approval of two more young professionals adding to its cadre of Chapter Liaisons.

Caleb Antone

Welcome to **Caleb Antone**, a NEBB TAB CP with over eight years tab experience and over four years of sheet metal experience with two of those years being a mechanic. The Chapter Liaison with NEBB's Arkansas Chapter, Caleb is currently employed at Gootee Construction, Inc., responsible for overseeing the TAB department, concentrating on air, hydronics, duct leakage, commissioning, controls, troubleshooting, and has experience with clean rooms, kitchen hoods and fume hoods. His personal mantra is to approach everything with a positive attitude and look for a solution instead of just seeing a problem.

Dane Gresko

A warm welcome to **Dane Gresko**, NEBB TAB CT, and the new MAEBA YPN Chapter Liaison, he has been employed at Fisher Balancing for the past eight years. A member of Sheet Metal Workers Local Union 19, Dane is also a TABB Fire Life Safety Technician and Supervisor Level 1. With an enthusiastic approach to life, Dane is looking to make an impact with the YPNers at his chapter and becoming more involved with NEBB. He credits Fisher Balancing for the opportunity to participate in highly integrated building systems for pharmaceuticals, hospitals, and universities and was honored to work and learn under three past MAEBA chapter presidents, all of whom are still involved with NEBB.

NEBB NEWS

CHAPTER UPDATES

Southwest NEBB

Shandre Guy, *Chapter Coordinator*

Shandre Guy

Southwest NEBB is pleased to introduce Chapter Coordinator, Shandre Guy who started in April 2018. Originally from Colorado, Shandre brings a wealth of knowledge to her position. A graduate from Redstone College with an Associate's Degree in Airframe and Powerplant Mechanics, Shandre worked with aviation companies for several years.

Introduced to NEBB through her experience as an office assistant for a NEBB firm, coupled with her experience working with credit unions and Smart Home companies, Shandre has a variety of unique knowledge and skills to help her Chapter. Shandre is excited to learn more about NEBB, meeting new people and working with her chapter (when she's not running after her son, Jeremiah.)

- Southwest NEBB's Annual Recert Seminar was held on October 12, 2018 at ABM Training Center in Tempe, AZ.

MAEBA

Trish Casey, *Chapter Coordinator*

MAEBA's Annual Recertification Seminar was held September 23-24, 2018 at the Kalahari Resorts and Conventions in Pocono Manor, PA. hosted 125 attendees which was the largest attendance to date. The Chapter's Annual Vendor Dessert & Coffee Event had a record of 13 Vendors participating. In addition to all the seminar vendors, MAEBA thanks those vendors who joined the MAEBA Associate Program this year! A list of participating vendors can be found here: http://www.maebanet.org/associate-firms.html.

In 2017, MAEBA launched a new award in memory of a great MAEBA supporter, Andy Stadheim of Building Start who passed away in October 2016. Andy was involved in many capacities at MAEBA seminars for years. This year, the MAEBA Board of Directors awarded the 2018 Andrew Stadheim, P.E. Award to Kanomax USA for its continued support of MAEBA.

Save the Dates: 2019 MAEBA Seminar Schedule

- April 25, 2019 MAEBA Semi-Annual Meeting, Radisson Hotel, Trevose, Pennsylvania
- September 22-23, 2019 MAEBA Recertification Seminar, Harrah's Resort, Atlantic City, New Jersey

Mid-South EBB Chapter (MEBB)

Ginger Slaick, *Chapter Coordinator*

The show had to go on! Despite Hurricane Florence, MEBB hosted its Recertification Seminar on September 22nd-23rd. Originally scheduled for Wilmington, NC, the seminar was quickly relocated a mere 205 miles northwest to the Sheraton Greensboro at Four Seasons in Greensboro, NC. With 115 CPs/CTs/Vendors/Speakers and 65 spouses/guests in attendance, it was touted by attendees as one of the best seminars to date. Nearly all scheduled speakers could rearrange their travel and present as planned. Top-notch educational sessions on industry related topics in the areas of Hydronic Pumping Systems, Balanced Kitchen Systems, Laboratory Air Flow Control Devices and How to Test and Balance Lab Spaces, and Contracts, Liens, Pitfalls to Avoid, and & How to Get Paid.

A sincere "Thank You" to speakers Chris Edmondson, James M. Pleasants Co.; Skip Almond, Accurex Systems – A Greenheck Company; Dean Dray, Hahn-Mason; and Richard Conner, Conner Gwyn Schenck, LLC. for presenting at the

CPs/CTs attending the MEBB Recertification Seminar

Vendors with the lucky door prize winners.

seminar. Special thanks to the staff at James M. Pleasants Co. for granting the last-minute request for an educational tour of their facility. Last and certainly not least, thanks to Don Hill, NEBB President for his willingness to present the *NEBB Board of Director's Update* via go-to-meetings so that the CPs/CTs of MEBB did not miss out on the latest in NEBB.

Vendor exhibits are a valuable part of the recertification seminar and MEBB's Leadership cannot thank the vendors enough for their commitment and support of the chapter and event. Despite the inconvenience and increased expense associated with last minute travel changes, Vendors were eager to share information on their product line and latest technology – and they came bearing terrific door prizes to give away! 2018 Gold Level Sponsors: Instruments Direct & Retrotec; Silver Level Sponsors: Testo & TSI; Bronze Level Sponsors: Building Start, TAB Opts, Evergreen, Dwyer, and Technical Maintenance Inc.

Plans are underway for the 2019 MEBB Recertification Seminar & Vendor Exhibit scheduled for September 21st – 22nd at the Marriott Riverfront in historic Savannah, GA. For additional information on attending or vendor exhibiting, contact MEBB's EVP/Chapter Coordinator, Ginger Slaick, at 678-407-2754 or gslaick@midsouthebb.com.

FEBB Chapter

Terry Wichlenski, *Chapter Coordinator*

The FEBB Chapter is already underway with plans for its 38th Annual Recertification Conference & Business Meeting set for May 2 - 3, 2019, starting Thursday afternoon at 3:00 pm. The event will be held at the new Margaritaville Resort Orlando, 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, speakers and have fun by participating in the FEBB Corn Hole Tournament Fundraiser. This fundraiser is for FEBB's Florida College Scholarship, awarded to a junior or senior college student studying for a mechanical or electrical degree.

NEBB's 2019 NEBB TAB Practical Exam Schedule is set for January 18th or 19th, May 31st or June 1st and Sep 13th or 14th. Candidates planning to take the TAB Practical Exam are encouraged to plan early and contact the FEBB Chapter Coordinator to make their reservation.

For any additional information or questions, contact FEBB Chapter Coordinator, Terry Wichlenski at 727-240-4254 or Febbcoordinator@gmail.com.

Northern California/Hawaii NEBB Chapter

Audrey Kearns, *Chapter Coordinator*

The Northern California/Hawaii NEBB Chapter's Annual 2018 Recertification Meeting was held on September 21, 2018 in beautiful Monterey, California. Chapter Education Chair, Sargon Ishaya and his Education Committee developed another successful meeting with speakers, Dave Dougan, Ebtron, speaking on Maintaining Minimum Outdoor Airflow Rates and Building Pressurization and Bart Decker, IMI Hydrondics, speaking on Differential Pressure/Pump Optimization.

Seven vendors participated in the seminar, giving a brief talk and displaying their products. Thank you to TSI, Retrotec, Evergreen Telemetry, Byrza Wind Labs, Ameritech, Building Start and EMSL. ■

Speaker Dave Dougan addressing the group.

Vendor participation is always an added benefit for seminar attendees.

Selling Your Business? It's a Process, Not a Choice

JT Kraai | Exit Strategies 360

Many business owners have most of their wealth invested in one thing—their business. With a significant piece of your wealth at stake, understanding how to protect and preserve it is time well spent. Converting that life's work into a successful retirement is no trivial matter.

Making an Expensive Choice

If done poorly, selling your business is a decision that may look like this: After a frustrating event at the office, you abruptly decide to sell what took decades to create. You think, "Sell quickly, close this chapter and move on." Not looking at the larger planning and financial picture, you unknowingly leave hundreds of thousands of dollars on the table for the buyer, or worse, the IRS.

Creating a Deliberate Exit Strategy

When done properly, a deliberate course of action is implemented. This is called an "exit strategy." The purpose of an exit strategy is to receive solid answers, ensuring solid decisions will follow. These decisions fall into 3 areas: succession planning, retirement and wealth preservation.

Succession Planning

Succession planning initiates the hard questions:

- Is it best to sell my business? Or, transition to family members or key employees?
- How would I sell my business?
- To whom would I sell my business?
- What is my business worth?
- Can I prepare my business for sale?
- When is the best time to sell?

Answers to these questions and more provide the foundation for a successful exit strategy.

Retirement Planning: The Future and Cash Flow

Retirement planning looks at the next chapter for you and your family, focusing on cash flow requirements, risk factors and more. When considering a possible sale, the key variable is wealth preservation—the process of converting your life's work into a solid, future cash flow. With a significant piece of your wealth hanging in the balance, solid answers are a must.

Estate Planning: Preserve Wealth

With answers, it boils down to timing. Once the decision to sell has been made, the focus shifts from "acquiring wealth" to "preserving wealth."

Estate planning ties everything together with wealth preservation. It spotlights the transference of wealth to family members and other charitable considerations in the most appropriate and tax efficient manner. Depending on your financial situation and entity structure, there can be a variety of wealth preservation vehicles available. Guidance and advice from key professionals allows you to focus on extracting and preserving your hard-earned dollars.

Transition Team: Maximize Yield, Minimize Risk

For best results a "transition team"—often including a CPA, estate and financial planner, business transaction attorney and a business advisor—is required. Working in harmony, team members focus on your two key priorities: maximizing financial yield and minimizing risk, both at the point of sale and into retirement. Additionally, they will provide options and solve problems not yet considered.

Planning Ensures the Best Possible Outcome

Establishing an exit strategy is one of the most significant issues facing owner. It protects the quality of your future. As you consider retirement, give yourself the gift of confidence and peace of mind by asking a few questions. Your retirement will thank you! ■

About the Author

JT Kraai is president of Exit Strategies 360, specializing nationwide in business sales, valuations, and exit planning for specialty contractors. He can be reached 100% confidentially at 503.577.5649 or info@exitstrategies360.com.

2019 Technical Seminar Schedule*

* Subject to change

MARCH 2019

March 18-22, 2019
Sound & Vibration Measurement (S&V)
NEBB TEC, Gaithersburg, MD
Seminar Registration Deadline: February 18, 2019
Optional Exam Day: March 20 & 22, 2019
Application for Candidacy Deadline: February 18, 2019

APRIL 2019

April 1-2, 2019
Building Enclosure Testing (BET)
Hyatt Regency San Antonio, San Antonio, TX
Seminar Registration Deadline: March 11, 2019
Optional Exam Day: April 3, 2019
Application for Candidacy Deadline: March 1, 2019

April 1-2, 2019
Testing, Adjusting and Balancing (TAB)
Hyatt Regency San Antonio, San Antonio, TX
Seminar Registration Deadline: March 11, 2019
Optional Exam Day: April 3, 2019
Application for Candidacy Deadline: March 1, 2019

JUNE 2019

June 7-9, 2019
Testing, Adjusting and Balancing (TAB)
NEBB TEC, Gaithersburg, MD
Seminar Registration Deadline: May 24, 2019
Optional Exam Day: June 10, 2019
Application for Candidacy Deadline: May 7, 2019

June 10-11, 2019
Fume Hood Performance Testing (FHT)
Labconco, Kansas City, MO
Seminar Registration Deadline: May 27, 2019
Optional Exam Day: June 12-13, 2019
Application for Candidacy Deadline: May 10, 2019

AUGUST 2019

August 12-15, 2019
Retro-Commissioning for Existing Buildings (RCx)
NEBB TEC, Gaithersburg, MD
Seminar Registration Deadline: July 29, 2019
Optional Exam Day: August 16, 2019
Application for Candidacy Deadline: July 12, 2019

SEPTEMBER 2019

September 30-October 4, 2019
Sound & Vibration Measurement (S&V)
Total Dynamic Balance, Deerfield Beach, FL
Seminar Registration Deadline: August 30, 2019
Optional Exam Day: October 2 & 4, 2019
Application for Candidacy Deadline: August 30, 2019

OCTOBER 2019

October 7-9, 2019
Cleanroom Performance Testing (CPT)
NEBB TEC, Gaithersburg, MD
Seminar Registration Deadline: September 23, 2019
Optional Exam Day: October 10, 2019
Application for Candidacy Deadline: September 7, 2019

October 13-15, 2019
Testing, Adjusting and Balancing (TAB)
IMI Facilities, Roswell, GA
Seminar Registration Deadline: September 29, 2019
Optional Exam Day: October 16, 2019
Application for Candidacy Deadline: September 13, 2019

NOVEMBER 2019

November 4-7, 2019
Building Systems Commissioning (BSC)
NEBB TEC, Gaithersburg, MD
Seminar Registration Deadline: October 21, 2019
Optional Exam Day: November 8, 2019
Application for Candidacy Deadline: October 4, 2019

November 4-5, 2019
Fume Hood Performance Testing (FHT)
Labconco, Kansas City, MO
Seminar Registration Deadline: October 21, 2019
Optional Exam Day: November 6-7, 2019
Application for Candidacy Deadline: October 4, 2019

NEBB
8575 Grovemont Circle
Gaithersburg, MD 20877
USA

Are you looking for ways to keep up with NEBB and the latest updates, posts and seminars?

Follow us! Like us! Share us!

- NEBB Twitter
- NEBB LinkedIn
- NEBB Facebook
- NEBB YPN Facebook
- NEBB YPN LinkedIn

For any questions, please contact
communications@nebb.org

To update mailing address and to continue to receive *The NEBB Professional*, please send an email to communications@nebb.org.