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## Creating Audible Sound from Sloppy Pump Motor Replacement – Case Study

**By: Stuart McGregor, President, EDI**

How many times have each of us been involved in a project where everything seemed to go wrong? Then at the end of the project we can look back and find exactly how and why everything did go wrong. This is one of those tales.

Background: 16-story condominium building about 30-years old, constructed of cast-in-place concrete. Noise from a water pump in the top floor mechanical room is generating an audible tone in a unit 5-stories below. Buildings

constructed of cast-in-place concrete or post-tension concrete are great at transmitting vibration and hence, noise throughout the structure; that is; a person on the 12th floor can hear someone on the 1st floor drilling a hole in the concrete.

In this case, the water pump drive motor that circulates water up to the open cycle roof top cooling is inputting a vibration into the building structure that is clearly audible on the 12th floor; motor drive RPM is 1750 (~29 Hz) The pump is

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## NEBB Certification and Compliance News

**By: Ted Salkin, P.E., NEBB CP; Certification Board  
Member and MAEBA Technical Committee**

The NEBB National Certification Board has been very busy in the past year. There is new staff, and all new or revamped procedural manuals and documents. This might sound boring, but it's critical for the future of NEBB programs. Lot of "inside baseball" stuff here, but know that NEBB is hard at work to improve and modernize the certification process to make the NEBB certificates more valuable and the most trusted in the industry.

Ultimately, these upgrades bring more value to the contractors, owners and managers of buildings through higher standards, accountability, enforcement of policy, and level of expertise.

NEBB is getting "antsy"! NEBB is moving towards ANSI accreditation for all disciplines and certs.

Several other Commissioning and TAB certifying organizations are going this way. ANSI-accredited certifications will be specified for DOE, federal and government projects; but not necessarily commercial projects for now. There really are no technical changes or differences to our TAB and Cx programs. It mostly involves the certification processes and using the "best practices" for application and exam procedures.

As of now, only the new Cx Process Professional certification is close to obtaining the ANSI-accreditation.

Other news: NEBB's Certification Board has added Industry stakeholders: from NAVFAC and a university. This will provide NEBB with fresh perspective on users' and owners' needs.

The Certification Board recently issued the

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## Certification Board Update

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Policy and Procedure Manual and the Candidate Handbook.

These docs and more are available at the NEBB website; under “Resources/Governing Documents”.

Continuing Education Credits: The recertification “hours” requirements for Professionals and Technicians have changed significantly. There are now many options to get “hours” credits, including non-NEBB activities and learning events. This includes: industry volunteering; safety courses; webinars; in-house training; lunch & learn’s; technical classes. Refer to the full details and submission forms at: [nebb.org/“Become NEBB Certified”](http://nebb.org/“Become NEBB Certified”). CP’s and CT’s are encouraged to submit their continuing education credits as soon as they earn them and not wait until the end of their two-year cycle to submit. This can be done easily with NEBB’s new Certelligence portal.

In 2016, NEBB introduced the Commissioning Process Professional (CxPP) Certification. Many of you may not know about this new program. This is an individual personnel certification; with no corresponding firm certification. This credential is separate from the existing BSC certification. CxPP is a process based certification, not “hands-on” or technical like the BSC CP cert.

The ANSI accreditation for the CxPP is almost approved (the first for NEBB). The CxPP will then be recognized by the Dept. of Energy and U.S. GSA commissioning specifications. The Exam and study guide are currently available.

All NEBB-discipline exams have been, or will be, revamped. An Exam Development Committee of 27 NEBB-certified volunteers have been working to develop new exams that will meet the ANSI standards.

Most exams are now available at convenient testing centers. Also, expect changes in the TAB Practical exam within the next year or two. Please refer to [nebb.org](http://nebb.org) for more resources and updates, and link to the Certelligence secure portal for your re-certification needs.

## Andy Stadheim, CEO and Founder of Building Start

On October 5, 2016, nine days after the MAEBA Recertification Seminar, Andy Stadheim, CEO and Founder of Building Start passed away suddenly. Andy and Building Start have been long time friends and supporters of the MAEBA chapter and will be greatly missed. It has been said, Andy lived life full-speed-ahead and always had a positive outlook. He was a brilliant visionary and there was literally nothing that was too big for him to try.

Andy’s dreams and vision are responsible for the creation of AiRNAB, now Building Start. The Building Start team is committed to his vision of providing better ways to document a variety of field activities in the construction workplace. Andy was 43 and is survived by his wife Brenda and 2 children, Bella (13) and Derek (9). A memorial fund has been set up for his children. Stadheim Memorial Fund, 2628 Town Lake Drive, Woodbury, MN 55125.



**BUILDING START**

# Audible Sound

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on a spring isolated concrete inertia base and the inlet and discharge have metal braided flex connectors.

Four additional and anecdotal pieces of information are: one, the mechanical system in the building has significant deferred maintenance and the mechanical room is not or has never been kept clean. Figure 1 shows the motor / pump assembly on its isolated inertia base and Figure 2 shows the state of how dirty and corroded the pump spring isolators are. Two, the population of the building, especially the upper floors of the building, is advanced in age and most likely has some level of hearing loss. Three, the building maintenance person (building engineer) lives in the building and part of his compensation is a free apartment. Four, the building HOA is frugal to a fault in not spending money, unless absolutely necessary.

**Figure 1: Re-Circulation Pump & Drive Motor Assembly**



Issue: A younger tenant, maybe in her mid 60's (most of the other tenants in the building are in there

late 70's or 80's, so young is relative), moved into a unit five floors below the mechanical room and had no noise complaints for several years.

Then early 2011 the noise started. The noise is a discrete tone and while, not a high level, it is clearly audible above the background within the unit of 26 to 27 dB(A); very quiet. Figure 3 shows a 1/3-octaveband plot of the background noise and the tonal noise in the unit.

What is important to notice in Figure 3 is how quiet the background noise is in the condominium unit. Look at Figure 3 and compare the Original Tonal Noise plot versus the Background plot. The A-weighted sound level in the condominium, with the Original Tonal components is 26.6 dB(A) and the Background without the tonal components is 26.4 dB

(A); both very quiet. Hence, why the tonal components were so clearly audible.

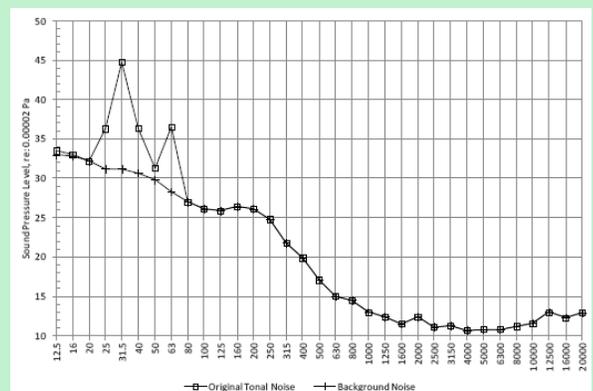
Calls from the tenant to the building engineer, received a response of nothing has changed in the building. Similar calls from the tenant to the HOA president received similar response; nothing has been done in the building. At this time EDI was called to see what might be creating this noise. EDI made a site visit and found several issues. First, there was an old motor on the roof next to the cooling tower and a brand new cooling tower motor. EDI then inspected the mechanical room and immediately noticed a motor making a significant noise. This motor drives the cooling tower recirculation pump. This was also, a brand new motor (there was no dust on the motor). EDI then made vibration measurements on the cooling tower recirculation pump motor, see Figure 4.

Figure 4 clearly shows a significant vibration peak at the motor rotation frequency of 29 Hz and at two and three times the motor rotation frequency. This harmonic behavior

**Figure 2: State of Deferred Maintenance in Mechanical Room**



**Figure 3: Motor Pump Tonal Noise with No Remediation and Background Noise, in Condominium Unit**



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# Safety Column

By: John Connolly

## Active Shooter

We see it on TV all too often. Not on an action drama show, but on the news. A person is moving stealthily and bursts into a home, school or workplace. There's a pop, pop, pop of gunshots. We don't want to think about it, but what if it happens at your shop or jobsite? What do you do? How do you react?

In 2012 violence accounted for about 17% of all fatal work injuries, that is 463 homicides and 225 suicides. The first step to address workplace violence: think about "What am I going to do if..." The next step is having a plan. Adopt a 'Workplace Violence Policy' including zero tolerance for violence or the threat of violence, not only by workers, but by anyone who may come in contact with company personnel. Make employees aware of your policy and enforce it. A hazard analysis can be a good tool for lessening the chances of violence. For example, do you need a buzzer on the door for admittance; security cameras on the perimeter; a 'panic button' at reception?



What to do if the worst happens and there is an 'active shooter'. According to Police Sgt. Travis Rakestraw, you have three options when confronted with a shooter: **RUN. HIDE. FIGHT.**

Your first reaction to a shooter is to run. Look for a safe escape route and flee. Once in a safe place call 911. Don't put yourself in danger. Police don't want someone to immediately hide if there is a chance to get out. Know your surroundings, especially at a jobsite, and the alternate escape routes. If escape is out, then hide. Find a place that the attacker doesn't/ can't know. If there is a door, barricade it. Be quiet; don't call 911 or anyone if there is a chance to be heard. As a last resort, facing harm, use what you can to fight back. Do whatever it takes to stall or disable the shooter.

As a Balancer, you often work alone and in a variety of buildings and facilities that are occupied and operating. To protect yourself, take some time before starting the job/ task to familiarize yourself with the safety measures in the building (fire routes, communications, etc.) and plan on what you would do in an emergency. Not only an emergency like a shooting, but an injury, illness, fire and so on. Have an idea in advance what you need to do. The Federal Bureau of Investigation (FBI) has a quick reference guide on their website that may be useful, it is called **Active Shooter Event: Quick Reference Guide**, [https://www.fbi.gov/file-repository/active-shooter-event-quick-reference-guide\\_2015.pdf/view](https://www.fbi.gov/file-repository/active-shooter-event-quick-reference-guide_2015.pdf/view).



# MAEBA and NEBB Education

## MAEBA Semi-Annual Meeting

**April 26, 2017**

**Radisson Hotel**

**Trevose, PA**

**11:30 am - New! Lunch with the Vendors**

**12:30 pm - Air Leakage Testing**

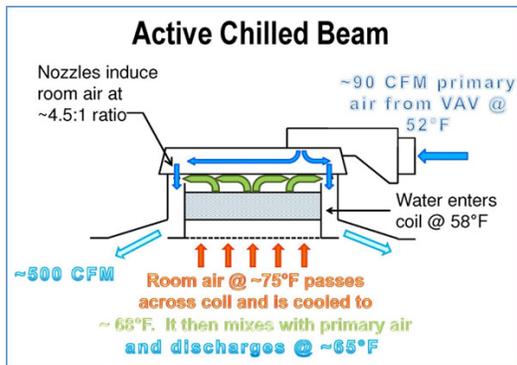
**Mark Terzigni**

**SMACNA Director, Engineering and Technical Resources**



**1:45 pm - Chilled Beams**

**Scott Smith, P.E., Accuspec, Inc.**



Example

**NEBB Technicians!**

**Attend this meeting and fulfill your NEBB Annual Continuing Education Credits for the Year!**

**All are welcome!**

**Notices will go out in early March.**

## Hold the Date! Recertification Seminar

**September 24-25, 2017**  
**Resorts Casino Hotel**  
**Atlantic City, New Jersey**



### MAEBA In The Balance Newsletter

MAEBA will be adding an additional publication of this newsletter each year. This new addition will be sent out electronically. If you wish to receive the electronic edition please send your email address to [tcasey@maebanet.org](mailto:tcasey@maebanet.org).

### NEBB Annual Conference

The NEBB Annual Conference will begin on the evening of Thursday, March 30th at the Hilton Orlando Lake Buena Vista. This year's theme is "The Science of Buildings: Operations, Performance and Testing." Consider attending this enjoyable and education conference.



#### Schedule at a Glance

<b>Monday, March 27</b>	
8:00 am – 5:00 pm	NEBB Building Enclosure Testing Seminar (BET) for Certified Professionals
<b>Tuesday, March 28</b>	
8:00 am – 5:00 pm	NEBB Building Enclosure Testing Seminar (BET) for Certified Professionals
8:00 am – 5:00 pm	Sound Measurement Technician Seminar
12:00 pm – 5:00 pm	Annual Conference Pre-Registration Open
<b>Wednesday, March 29</b>	
7:00 am – 5:00 pm	Annual Conference Registration Open
8:00 am – 5:00 pm	NEBB Exam Day
8:00 am – 5:00 pm	Closed Committee Meetings
1:00 pm – 5:00 pm	Teach the Proctor Meeting
6:00 pm – 10:00 pm	NEBB Volunteer Appreciation Dinner (15-minute walk from Buena Vista)
<b>Thursday, March 30</b>	
7:00 am – 5:00 pm	Annual Conference Registration Open
8:00 am – 3:00 pm	NEBB 20th Annual Golf Tournament
1:00 pm – 5:00 pm	Exhibit Hall Open
4:00 pm – 5:00 pm	NEBB Past Presidents Meeting
5:30 pm – 6:45 pm	Opening Session: Welcome and Keynote Presentation
7:00 pm – 10:00 pm	Get Acquainted Reception (for registered attendees and registered guests)
<b>Friday, March 31</b>	
6:30 am – 8:00 am	Continental Breakfast (for registered attendees only)
7:00 am – 5:00 pm	Annual Conference Registration Open
7:00 am – 5:30 pm	Exhibit Hall Open
8:00 am – 4:30 pm	Chapter Coordinators Meeting
8:00 am – 3:45 pm	Technical Sessions
11:15 am – 12:30 pm	Networking Luncheon (for registered attendees only)
3:45 pm – 5:30 pm	Vendor Hosted Reception (for registered attendees only)
<b>Saturday, April 1</b>	
6:30 am – 8:00 am	Continental Breakfast (for registered attendees only)
7:00 am – 2:00 pm	Annual Conference Registration Open
7:00 am – 1:00 pm	Exhibit Hall Open
8:00 am – 9:30 am	NEBB Business and Town Hall Meeting
9:30 am – 10:30 am	Chapter Presidents and Coordinators Meeting
10:30 am – 4:00 pm	Chapter Coordinators Meeting
9:45 am – 3:45 pm	Technical Sessions
11:15 am – 12:30 pm	Networking Luncheon (for registered attendees only)
4:00 pm – 5:00 pm	Closing Session (for registered attendees and registered guest
5:00 pm – 5:30 pm	Vendor Recognition and Adjournment (for registered attendees

is indicative of component misalignment (drive motor and pump misalignment). Diagnosis of these harmonic peaks, the second harmonic being greater than the fundamental indicates that the misalignment is predominately Parallel Misalignment. Also, shown in Figure 4 are the 'ASHRAE Equipment Vibration Severity Ratings for Vibration Measured on Equipment Structure or Bearing Cap', Rough and Very Rough Curves. The drive motor vibration levels exceeded the ASHRAE Rough Ratings.

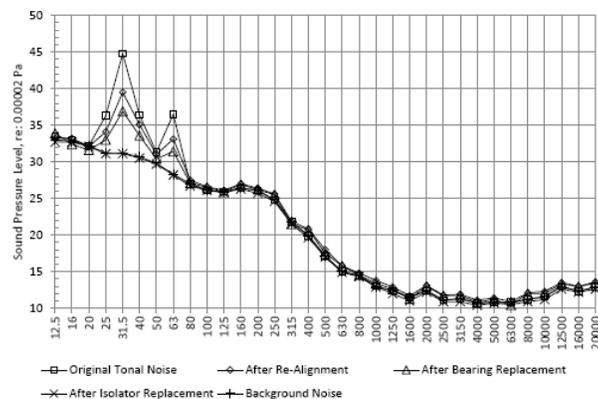
The tenant then took EDI's report to the HOA president, who indicated that the building engineer forgot to mention that these two motors had been replaced. At this point it is important to interject information regarding the individual who replaced the motors. This person had been in the mechanical business for years, however, he was not highly skilled or in good health, and also a close friend of the building engineer; not that this should have made a difference. Soon after EDI's report was given to the building engineer the tonal noise significantly decreased. Again inquiries from the tenant to the building engineer and the HOA president received a response of nothing has changed or was done.

EDI was then called back to measure the tonal noise in the tenants unit and it had significantly decreased; see Figure 3. At this time a meeting was set-up with the building engineer, HOA president, EDI and an independent mechanical contractor, to assess possible solutions. Immediately upon entering the mechanical room it was obvious something had been done, because noise from the pump motor was significantly less. EDI made a comment about the motor being much quieter, at this point the building engineer let it slip out that an independent mechanical contractor had been called in and the alignment of the motor to pump coupling was found to be out of tolerance (not data was given how out of tolerance), the motor and pump had been aligned. A telephone call was made to the mechanical balancing / alignment contractor.

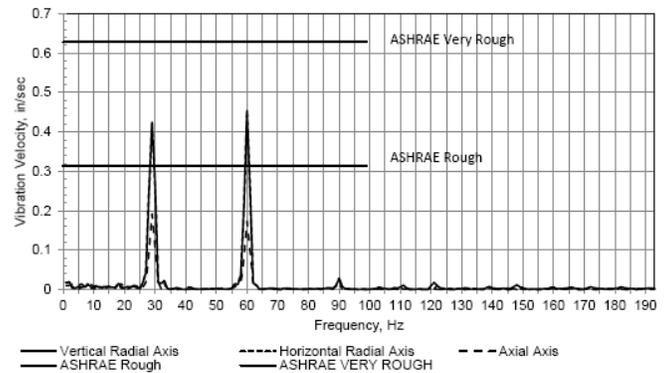
During the meeting two additional vibration mitigation options were discussed. First, was to replace the motor bearings, which had been damaged from running misaligned, and second to replace the existing vibration isolators; see Figure 2. Figure 3 shows the tonal noise decrease in the condominium unit for each step of the process and the original tonal noise as well.

During installation of the new spring isolators it was determined that during installation of the new motor the mechanical technician installing the motor had bumped the inertia base and shifted the isolators so that they were not properly aligned and shorting out against the isolator side wall.

**Figure 5: Motor Pump Tonal Noise at Various Stages of Remediation and Background Noise, in Condominium Unit**



**Figure 4: Vibration Measurement Plot on Pump Drive Motor**



While, this tale had a happy ending, in that the tonal noise was no longer audible in the condominium unit, it is a lesson in the importance of competent well trained people to do mechanical equipment maintenance. Improper installation cost the HOA 3 to 4 times the initial replacement cost of the motor; costs for alignment and bearing replacement, engineering time and installation of new vibration isolators. The hidden costs here are the building engineers', the HOA presidents and the condominium owners' time.

Yes. I know. CECs are the bane of most Certificants' existence. But let's imagine a world where no one took continuing education seriously. Let's focus on your dentist – who you recently learned, hasn't cracked a book since passing their credentialing exam 25 years ago or attended a training seminar since. They're using outdated dental techniques, tools and practices. Nothing new. Yet, your dentist believes they know everything about modern-day dentistry. Your dentist purposely left themselves behind while dental trends continued to change. Why? Because they felt no need to enhance their knowledge. They know it all.

The reality is the continuing education obtained by your dentist gives you a sense of security. While they're drilling in your Novocain-frozen mouth, you're staring at those Certificates of Course Completion hung in frames on the wall and you know they're up to par with their knowledge, skills and abilities and can fill that cavity with ease. Without continuing education, the credibility of the dental profession – actually, any profession -- erodes away. Continuing education serves a greater purpose and is a necessary part of any proper certification program.

Nearly all professions have some form of continuing education which is a mechanism for a credentialing agency to ensure it is producing the best possible Certificants. It's quality control, and allows a platform to teach innovation, techniques, and improvements.

There are many sources of continuing education available to NEBB Certificants – be it the CP, CT or CxPP. NEBB's Certification Board fine-tuned the CEC Policy & Submission Form to allow a Certificant to select from of a variety of categories. Choose from live or online events (NEBB or non-NEBB), technical, community or college courses, leadership involvement, speaking or article submissions, safety training, Lunch & Learns or Vendor Events. Download the CP, CT or CxPP CEC Policy & Submission Guide at [http://www.nebb.org/certified/continuing\\_education\\_credits\\_cecs/](http://www.nebb.org/certified/continuing_education_credits_cecs/). Continuing education is meant to maintain high-quality professionals that are always learning and differentiating themselves from others in the field. Take advantage of this opportunity to grow your own knowledge base and broaden your horizons which keeps you and your certification updated – and not left behind.

NEBB Certified Professionals (CP's) must obtain 12 continuing education credits (CEC's) within their current two-year cycle.

- A minimum of 6 of the 12 CEC's must be submitted from NEBB events per two-year cycle.
- Payment of the non-refundable Certified Professional Renewal Fee is required for recertification.
- CP's with CEC's exceeding the 12 CEC requirement within a two-year cycle cannot carry over CEC's into their next certification cycle.
- CP's holding multiple certifications may combine CEC activity from any Category on the chart below to achieve 12 CEC's and can apply CEC's simultaneously to all active NEBB certifications if cycles overlap.
- The CEC Recertification Submission Form must be completed and uploaded to the Certificant's online personal profile in Certelligence along with verification documentation for each category. See "Documentation."

NEBB Certified Technicians (CT's) must obtain 6 continuing education credits (CEC's) within their current two-year cycle.

- A minimum of 3 of the 6 CEC's must be submitted from NEBB events per two-year cycle.
- Payment of the non-refundable Certified Technician Renewal Fee is required for recertification.
- CT's with CEC's exceeding the 6 CEC requirement within a two-year cycle cannot carry over CEC's into their next certification cycle.
- CT's holding multiple certifications may combine CEC activity from any Category on the chart below to achieve 6 CEC's and can apply CEC's simultaneously to all active NEBB certifications if cycles overlap.
- The CEC Recertification Submission Form must be completed and uploaded to the Certificant's online personal profile in Certelligence along with verification documentation for each category. See "Documentation."



Mid-Atlantic Environmental Balancing Association

**1100 E. Hector Street Suite 185  
Conshohocken, PA 19428**

## **Calendar of Events**

**April 26, 2017**

**MAEBA Semi-Annual Meeting**

Radisson Hotel, Trevose, PA

11:30 am Lunch with the Vendors, 12:30 pm Seminar

**May 1-3, 2017 (Exam Day May 4th)**

**NEBB TAB Certified Professional Seminar**

Gaithersburg, Maryland

**September 24-25, 2017**

**MAEBA Recertification Seminar**

Resorts Hotel and Casino, Atlantic City, New Jersey

Registration will be available during the summer.

**October 9-11, 2017 (Exam Day, October 12th)**

**NEBB TAB Certified Professional Seminar**

Rosewell, Georgia

For more important dates go to the MAEBA website  
[www.maebanet.org](http://www.maebanet.org), News and Events and also check  
the NEBB website [www.nebb.org](http://www.nebb.org).

## **MID-ATLANTIC ENVIRONMENTAL BALANCING ASSOCIATION**

A Chapter of the  
National Environmental Balancing Bureau

**DAVID WOOD - PRESIDENT  
CLINT FRANKS - VICE PRESIDENT  
THOMAS DEMUSIS - TREASURER  
TRISH CASEY - CHAPTER COORDINATOR**

**1100 E. Hector Street, Suite 185  
Conshohocken, PA 19428  
(610) 828-5738 Fax (610) 828-4625**

