

**AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS,
INC**

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TC/TG/TRG MINUTES COVER SHEET

TC/TG/TRG NO: TC 2.6 DATE: April 1, 2011
 TC/TG/TRG TITLE: Sound and Vibration Control
 DATE OF MEETING: January 31, 2011 LOCATION: Las Vegas, NV

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
<u>VOTING</u> John Gierzak Robert Hassler Patrick Oliver Chris Papadimos Richard Peppin Karl Peterman Douglas Reynolds Kenneth Roy Robert Simmons Jason Swan Lily Wang Randal Zimmerman <u>CORRESPONDING</u> Michael Froehlich Brian Guenther Michael Keating Reginald Keith James Kline Dan LaForgia Siu-Kit Lau Jerry Lilly Patrick Marks Dustin Meredith Ralph Muehleisen Kim Osborn Raj Prime William Rockwood Lauren Ronsse Michael Schwob Terence Tyson Jack Wang Zhiping Wang Jonathan Weinstein Steven Wise		<u>VOTING</u> Francis Babineau Warren Blazier Curtis Eichelberger Robert Lilkendey Neil Moiseev Matthew Murello Thomas Paige Matthew Stead <u>CORRESPONDING</u> Charles Arnold Mark Bastasch Norman Broner Zvirimumwoyo Chinoda John Dunlap Ronald Eligator Mark Fly Kevin Gaghan Radha Ganesh Lewis Goodfriend Arthur Hallstrom Joseph Horesco Manoj Khati Howard Kingsbury Marvin Klootra Glenn Kowald Heng-Yi Lai Geoff Leventhall Duane McLennan Alexander Michaud Erik Miller-Klein Emanuel Mouratidis Jose Nepomuceno John Pappas James Pooler Michael Resetar Eric Rosenberg Erica Ryherd Mark Schaffer Ken Shook John Sofra William Stewart		Danny Abbate Christopher Ainley David Bloom David Carroll Franco Cincotti Erroll Eaton Carl Hart David Herrin James Holtrop Hyun Hong Larry Hopkins John Murphy Ellen Peng Ronald Ramey Brian Reynolds Marshal Zabel <u>Distribution</u> All Members of the TC/TG/TRG TAC Section Head: Charles Wilkin TAC Chair: Craig Wray All Committee Liasons: Paul Cabot, William Atkinson, Kenneth Fulk, Frederic Genest, Mark Fly, Carl Lawson, Howard McKew, John Wells III Manager of Standards: Claire Ramspeck Manager of Research & Technical Services: Mike Vaughn

**Meeting Minutes for
ASHRAE Technical Committee 2.6 – Sound and Vibration
Monday, January 31, 2011**

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Attendance List

Voting Members:

John Gierzak	Metal Industries	jgierzak@metalaire.com
Robert Hassler	McGill AirFlow LLC	rhassler@mcgillairflow.com
Patrick Oliver	EH Price Ltd.	patricko@price-hvac.com
Chris Papadimos	Papadimos group	cpapadimos@papadimosgroup.com
Richard Peppin	Scantek Inc Sound & Vibration	peppinr@asme.org
Karl Peterman	Vibro-Acoustics	kpeterman@vibro-acoustics.com
Douglas Reynolds	Univ Of Nevada Las Vegas	douglas.reynolds43@gmail.com
Kenneth Roy	Armstrong World Industries	kproy@armstrong.com
Robert Simmons	Petra Seismic Design	rsimmons@petraseismicdesign.com
Jason Swan	Sandy Brown Associates	jasons@sandybrown.com
Lily Wang	University Of Nebraska	lwang4@unl.edu
Randal Zimmerman	Titus	rzimmerman@titus-hvac.com

Corresponding Members:

Michael Froehlich	Carrier Corporation	mike.froehlich@carrier.utc.com
Brian Guenther	Vibro-Acoustics	bguenther@vibro-acoustics.com
Michael Keating	Kinetics Noise Control	michaelsmkeating@gmail.com
Reginald Keith	Hoover & Keith Inc	reggie.keith@hoover-keith.com
James Kline	Intertek	jim.kline@intertek.com
Dan LaForgia	Industrial Acoustics Co	dlaforgia@industriallacoustics.com
Siu-Kit Lau	University of Nebraska-Lincoln	slau3@unl.com
Jerry Lilly	JGL Acoustics Inc	jerry@jglacoustics.com
Patrick Marks	Johnson Controls	patrick.c.marks@jci.com
Dustin Meredith	Trane	dmeredith@trane.com
Ralph Muehleisen	Illinois Institute of Technology	muehleisen@iit.edu
Kim Osborn	CES group	kosborn@governair.com
Raj Prime	Mason Industries	rprime@mason-ind.com
William Rockwood	The Trane Co	brockwood@trane.com
Lauren Ronsse	University of Nebraska-Lincoln	lronsse@unomaha.edu
Michael Schwob	JBA Consulting Engineers	mschwob@jbace.com
Terence Tyson	Kirkegaard Associates	tysont@asme.org
Jack Wang	Trane	jjwang@trane.com
Zhiping Wang	Morrison Products Inc	zpwang@morrisonproducts.com
Jonathan Weinstein	Industrial Acoustics Co	jweinst1@optonline.net
Steven Wise	Wise Associates	stevewise@att.net

Visitors:

Danny Abbate	AHRI	dabbate@AHRInet.org
Christopher Ainley	Univ. of Nebraska - Lincoln	cainley@unomaha-edu
David Bloom	Mason Industries	dbloom@mason-ind.com
David Carroll	Morrison Products, Inc.	dcarroll@morrisonproducts.com
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Erroll Eaton	Lennox	erroll.eaton@lennoxind.com
Carl Hart	Univ. of Nebraska - Lincoln	crhart@unomaha.edu
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James Holtrop	AcoustiControl	jim@acousticcontrol.com
Hyun Hong	Univ. of Nebraska - Lincoln	hyunhong@unomaha.edu
Larry Hopkins	Huntair	lhopkins@huntair.com
John Murphy	Jogram, Inc.	jogram@bright.net
Ellen Peng	Univ. of Nebraska - Lincoln	zpeng@unomaha.edu
Ronald Ramey	Illinois Institute of Technology	ramey@IIT.edu
Brian Reynolds	Trane	breynolds@trane.com
Marshal Zabel	SPX Cooling Technologies	marshal.zabel@spx.com

**ASHRAE TC 2.6 Sound and Vibration Control
Main Committee Meeting Minutes
Monday, January 31, 2011, Las Vegas, NV**

1. Call to order (Wang)

- Call to order by Lily – 2:16 PM
- Additions, modifications to the agenda

2. Introduction of those present (All)**3. Confirmation of current voting members** (Oliver)

- 12 voting members present

4. Review and approval of the minutes (Wang)

- Minutes approved unanimously.

5. Secretary's report (Rockwood)

- All SC chairs to provide reports by the end of the week.

6. TC Chair's meeting report (Wang)

- Tech Council Steering Committees now have web programs
 - under ASHRAE 'Technical Committee' tab:
 - Building Information Modeling (BIM)
 - Advanced Energy Design Guides (AEDG)
 - Building Performance Metrics
 - Building Safety and Security
- Starting at this conference, badge scanning is being implemented to track continuing education credits for each attendee.
- Please check the latest entry/exit requirements for Canada to make sure that your passport and other entry paperwork is up-to-date with new requirements.

7. Chair's announcements and correspondence (Wang)

- Sympathy card/donations with regards to Neil Moiseev's passing. Anyone interested in donating money on Neil's behalf should contact Lily, who will coordinate a donation from the TC.
- Sympathy card/donations with regards to Howard Kingbury's passing. Anyone interested in donating money on Howard's behalf should contact Lily, who will coordinate a donation from the TC.

8. Subcommittee reports**8.1. Research Subcommittee** (Schaffer for Eichelberger)

8.1.1 Research Chair's meeting report

- ASHRAE will have \$1.3M funding from last Fall's executive meeting. One project submitted from TC 2.6, "TRP-1529 Numerical Modeling of Lined Ducts", has all materials complete so this project should be at the top of the priority list for Fall 2011.
- Instituted New Investigator award, for those within 5 years of getting their PhD. Possible source for more funding.
- PMS chairs: keeping up with paperwork is a major challenge. All chairs are asked to keep up.
- The leadership is promoting more cross-TC sponsorship of projects.

8.1.2 Ongoing research projects

- [RP-1322 Performance, Perception and Criteria with PI Wang/UNL](#)
 - Agreement on scope and conclusions from final report is expected in two weeks. We will then have an email vote.

- [RP-1408 Attenuation of Lined Ducts with PI Reynolds/UNLV \(Lilly\)](#)
 - Conducted tour of lab on 1/30/11, followed by PMS meeting.
 - Diagnostic testing in progress.
 - Flanking noise tests showed significant flanking below 100 Hz. Possible issue is break-in from flex duct. Also the annular space around the dual-duct test section is suspect. If flanking still exists, tests will be repeated with the reverb room's steel door to the duct closed.
 - Discussion of placement of speakers in duct. PMS directed the PI to locate speakers in the source chamber to comply with E477 requirements.
 - The PI was asked to provide a test list to PMS, with revised schedule.
 - The PI is two quarters behind in his status report.
 - Geirzak, Babinaeu and Lilly will return to the lab on 2/1/11 to observe testing and finalize plans.

8.1.3 Work Statements/RTAR's/URP's

- [TRP-1529 Numerical Modeling of Lined Ducts \(Marks\)](#)
 - Funding delayed until Fall 2011
- [RTAR-1560 Installed Performance of Vibration Isolators \(Simmons\)](#)
 - This RTAR has dropped off due to two years without activity. The best path to proceed is still not clear. The main difficulty is the technical complexity of the issue.
 - We are not sure if we should wait for SPC-197 to complete their recommendations before resubmitting this RTAR.
 - The Committee voted to resubmit the RTAR.
- [RTAR-*** Effect of HVAC Noise in Hospitals \(Babineau/Roy\)](#)
 - Looking for alternate sponsorship

8.1.4 Topics for future research

- #1: Room effect (R. Keith)
- #2: Fluctuations (L. Wang)
- #3: Noise Generation in Ducts and Duct Accessories (D. Reynolds)
- Effects of High Performance HVAC Systems on Noise and Occupant
- Fan elbow system effects
- Noise in piping systems
- Fan System effects
- Tones
- BIM
- Active Noise Control
- Green / cleanable absorbers
- Tonal Noise

8.2. Programs Subcommittee (Papadimos)

8.2.1. Program Chair's meeting report

- Four sessions were submitted for Vegas, two were accepted.

8.2.2. Programs this meeting

- Conference Paper Session: "Recent Research in Acoustics for Healthcare Facilities" (Papadimos)
- Seminar: "Acoustic Codes, Standards and Design Guidelines: A Primer" (Muehleisen)

8.2.3. Potential programs for upcoming meetings

- Montreal, Quebec, June 2011
 - Seminar: Multiple Plenum Fan Array (co-sponsored by TC's 5.1 and 5.9)
 - Seminar: Acoustic Criteria – Shafer

- Seminar: Vibration-induced Noise and Vibration Isolation and Balance (Marks)
- Forum: BIM and How to Integrate Acoustics (Peterman)
 - to be a hot topic if not accepted
- Chicago, Jan 2012:
 - Aerodynamic Noise
 - Green Building Acoustics – this would be a conference paper session
- Possible programs “in the hopper”:
 - Numerous items voted on in the Programs SC chairs’ meeting
- Request to the TC: if you have an interest in a future topic, please contact Chris Papadimos

8.3. Publications Subcommittee (Wise)

8.3.1. Handbook chapters

- Handbook Applications 2011 (Wise/Peppin)
 - Galley proofs ready in four to six weeks
 - Expect some issues. Five have volunteered to proof read.
 - Comment re revision of NC curves due to ANSI S12.2, and a procedural change. Ralph Mulheisen will modify the chapter to include the latest changes.
 - Karl Peterman recommends not incorporating the modifications. There is a possibility that we will simply present the new NC procedure for information only.
- Handbook Fundamentals 2013 (Weinstein / Wise)
 - We do not expect many changes.
 - Vote planned for Jan 2012
 - Check with Jon Weinstein for any modifications

8.3.2. Other publications

- There is a persistent question as to how our TC influences other publications. We do our best to stay connected, but sometimes we don’t know about all of these and we are not always consulted on them. These include:
 - Other chapters in the Handbook
 - Standards such as 189
 - Pocket Guide
 - Green Guide
 - Performance Measurement Protocol
 - ASHRAE CD++
 - Imbedded spreadsheets, etc.
 - We have the option to “electronically” link to items in our chapters, to provide an interactive capability.
 - We are going to start piecing together a strategy for how to most effectively take advantage of this medium in the future.
- We appear to be migrating more to the Handbook on line. It is not yet clear how this will be handled. Mark Fly advocates not going to “continuous maintenance”, since it is so hard for us to coordinate changes.
- Anyone who has ideas should pass them in to Steve Wise
- Mark Schaffer is nearly complete with SI version of his book “noise and Vibration Control”.

8.3.3. Web page and YahooGroups email

- Mike Schwob is new webmaster
 - Would like to migrate web site into a content-managed system, to improve design, consistency, navigation, and to provide more functionality.
 - Possibly to use a new domain name. how to fund that is a question. Subcommittee formed to address this question.
- Use of yahoo groups will be discontinued.

8.4. Standards Subcommittee (Ronsse)

- Note: Considering process for getting support from tc26 for modifications to existing standards. Will be tried first on 189.1
- 8.4.1. [SPC 189 – Design for High Performance Green Buildings \(Papadimos\)](#)
- Chris has offered to be a liaison to TC 2.6. He will apply for voting membership.
 - Looking for 2 to 3 volunteers. If interested, see Chris.
 - We sent out a request for comments. Received only one comment. We should take advantage of the opportunity to affect this standard.
- 8.4.2. [SPC 197 – Method of Test for Passive Vibration Isolators \(Peterman\)](#)
- Will be meeting later today
 - No significant progress since last meeting
 - Laid foundation to start the process of making a decision as to how to create a MOT.
- 8.4.3. [SPC 200 – Method of Test for Chilled Beams \(Zimmerman\)](#)
- Met this morning.
 - Standard only includes active chilled beams (encompassing air and water)
 - Heat capacity, throw, acoustics. Question as to how to conduct test
 - Use same acoustic standard for diffusers
- 8.4.4. [SGPC ASHRAE Guideline 10 – Interactions Affecting the Achievement of Acceptable Indoor Environments \(Wang, Roy\)](#)
- Guideline out just last year addresses how performance is affected by the environment.
- 8.4.5. [Performance Measurement Protocol \(PMP\) Best Practices document \(Eichelberger\)](#)
- UC Berkeley's Center for the Built Environment research finds that speech privacy concerns are still one of the top concerns in buildings they survey. They are suggesting that we need a way to assess speech privacy at Level II (maybe SNR), not just at Level III.
 - Curt to continue working on a best practices document
 - Speech privacy keeps coming up as top complaint, but the PMP only allows quantification of this at level 3, not level 2. Perhaps a simple measurement like SNR is appropriate.
- 8.4.6. [ANSI Working Group on Sound Measurement in Rooms \(Lilly\)](#)
- The last revision went out. Comments were received from three subcommittee members. We are showing some progress.
- 8.4.7. [Update on Review of AHRI Standard 1120-2007 “Acoustical Test Methods and Sound Power Rating Procedures for Transport Refrigeration Equipment” \(Abate\)](#)
- This document was put through ANSI canvassing process. It did not pass. Expect to resubmit.
- 8.4.8. [Proposed Position Document on “Environmental Health in Green Building Programs” \(Roy, Muehleisen\)](#)
- No update
- 8.4.9. [International Green Construction Code \(Lilly, Wang\)](#)
- ICCG has come out with a code which will be used to direct building construction. The current version comes out of ASHRAE 189, which imposes some unrealistic or unnecessary requirements.
 - A group of ASTM members came up with a response and submitted it. They are trying to get SAS, INCE, ASTM and ASHRAE to agree to this response. There is time still for TC 2.6 to support this. The only opposition heard to date has to do with

background noise limits. That is, the numbers may not match our handbook. One difficulty is that the code sets absolute minimum requirements, and not necessarily the ones we would recommend. INCE has not yet approved this either.

- Peterman and Muehleisen voiced approval of the changes. It's not perfect, but dramatically better than what is in there now.
- ASTM feels that they approve of most of it but not all.
- Motion and second: TC 2.6 supports the updates as presented.
 - Yea: 11
 - Nea: 1

8.5. Standing Subcommittees

8.5.1. Sound Criteria (Wang)

- In Neil Moiseev's absence, we conducted a criteria meeting.
- Mark will draft a seminar for the Montreal meeting.

8.5.2. Vibration Isolation (Simmons)

- The RTAR on acoustic performance of vibration isolators, and research into test methods, will be resubmitted.
- No action on publications chapter needed; input provided to Steve Wise.

8.6. Operations Subcommittee (Oliver)

8.6.1. Bylaws

- No activity

8.6.2. Honors and awards

- No activity

8.6.3. Long range planning

- No activity

8.6.4. Membership (Oliver)

- New voting members have volunteered
 - Off: Peterman, Paige, Wang
 - New: Lau, Lilly, Meredith, Osborne
- 10 new corresponding members. They were asked to apply through the ASHRAE site.
- Current: 50 corresponding, 18 voting, 2 voting non-quorum
- July 2011: 55 corresponding, 18 voting, 2 voting non-quorum
- Election of TC 2.6 Chair 2011-13 (Wang)
 - Nomination of Pat Oliver, seconded
 - Yea: 11
 - Nea: 0
- Filling of open TC 2.6 positions (membership, liaisons, webmaster, criteria subcommittee chair, vice-chair, secretary)

▪ membership:	Pat Oliver (new VC responsibility)
▪ liaisons:	Pat Oliver (new VC responsibility)
▪ webmaster:	Michael Schwob
▪ criteria subcommittee chair:	Lily Wang
▪ vice-chair:	John Gierzak
▪ secretary:	Dustin Meredith

8.6.5. Liaisons (Oliver)

- ASHRAE TC 2.1 Physiology and Human Environment (Wang)
 - Main emphasis is on thermal comfort.
 - Lily is rolling off as voting member of this TC.
- ASHRAE TC 2.7 Seismic and Wind Restraint Design (Peterman)
 - Practical guide to seismic restraint is two-thirds done.

- Seminar today on recent developments in AHRI standard for seismic qualification.
- ASHRAE TC 5.1 Fan Design and Application (Osborne / Brooks)
 - Active finishing up handbook work due in May.
 - RP 1216 final report coming out: airfoil fans.
 - PMS report on 1420 inlet and outlet installations effects. AMCA doing work. Project just started.
 - Forum on Wed: large circulating fans; how to interpret performance based on wind velocity and comfort.
 - Fan efficiency grade (FEG): resulted from SPC 90.1 request. The task force developed a straw man continuous maintenance proposal, and looked at which fans should be excluded from FEG's (largely those which are only part of a larger system).
 - Standards work is moving ahead.
- ASHRAE TC 5.2 Duct Design (*)
 - No report.
- ASHRAE TC 5.3 Room Air Distribution (Oliver / Zimmerman)
 - A research project on the effects of inlet conditions on diffuser performance is nearing completion. The results will provide guidance on how much performance parameters (static, throw, etc.) vary with inlet condition.
- AHRI (Abbate)
 - Standard 275 is now recognized as an ANSI standard.
- AMCA (Brooks)
 - Standards of interest to 2.6:
 - AMCA 310 – sound ratings for fans. In revision process.
 - AMCA 330 – joint with ASHRAE 68. In-duct method. No users in US, some abroad.
 - Trying to adopt ISO 51636
 - AMCA's main effort is the FEG grading standard, AMCA 205. Becoming American national standard, and may be referenced in 90.1. Harmonized with ISO.
 - Silencer CRP program: no report.
- ANSI (Ronsse)
 - Issued list of standards pertaining to TC 2.6:
 - Air measurement
 - Machinery
 - Community noise
 - Classrooms
 - Speech privacy
 - Ambient
- ASA (Wang)
 - Upcoming conference in Seattle in May; San Diego in late Oct.
- ASTM (Peppin)
 - Possibility of starting new working group to measure duct breakout.
- ISO (Reynolds)
 - No report.

- ISO TC205 (Roy)
 - The Acoustics WG has drafted a working document.
 - Interested people who want to participate should contact Ken.
- VISCMA (Peterman)
 - Met Saturday. Some white papers are available on web site.
- Others:
 - CIBSE - Chartered Institute of Building Services Engineers – Britain (Swan)
 - Rewriting their version of a handbook. They appear to be ready to add dBA to NR (similar to our NC, but steeper curves)
 - Jason gave a brief liaison report at the meeting for CIBSE. Their main acoustics publication, called CIBSE Guide B5: Noise and Vibration Control for HVAC, is under review by a committee that includes a former partner at Sandy Brown. Jason was asked to present what has been going on of late with ASHRAE 2.6 in regard to criteria as well as research. As such, it appears they will also be adding dB(A)/dB(C) to their current NR criteria.
 - CIBSE Guide B5 was last published in 2002, and the writing committee's chairman was Geoff Leventhall, who is a corresponding member of TC 2.6.
 - TC 6.10 (Dave Herrin)
 - Sponsoring a combustion oscillation project. May be of interest to TC 2.6.
 - INCE (Muehleisen)
 - Portland meeting in July.
 - Internoise coming up in early 2012.
 - CTI (Simmons)
 - Meets a week from today. If anyone has any comments out this please see Robert.

9. New business/Old business

- No report.

9.1. Hot Topics at this meeting (Wang)

- Effect of Classroom Physical Environmental Conditions on Learning Performance (Reynolds)

9.2. Hot Topics for next meeting (Wang)

- Expect to submit a forum on the subject of Acoustics in BIM – with input from the Technical Council Steering Committee on BIM or TC 7.1 on Integrated Building Design.
 - Expect this will be a Hot Topic if the Forum is not accepted.
- Pocket Guide: Mark Schaffer has volunteered to be the point person for the next revision in four years
- Insertion Loss of Vibration Isolators? (Lilly)

10. Next meeting date and location – Montreal, Quebec; June 25-29, 2011

11. Adjournment: 4:00 pm

Attachment 1: Membership Report – Patrick Oliver

<u>Status</u>	<u>Current</u>	<u>After June 2011</u>
Voting	17	18
NQ Voting	2	2
Corresponding	50	57
Applied	10	

Name	Employer	End Year	Current Status	June 2011
Francis Babineau, Jr	Johns Manville	06/30/2014	V	V
Warren Blazier, Jr	Warren Blazier Assoc Inc	06/30/2014	V	V
Curtis Eichelberger, Jr	Johnson Controls	06/30/2014	V	V
John Gierzak, PE	Metal Industries		V	V
Robert Hassler, PE	McGill AirFlow LLC	06/30/2013	V	V
Robert Likendey	Siebein Associates Inc	06/30/2013	V	V
Matthew Murello, PE	LSG & Associates	06/30/2012	V	V
Patrick Oliver	EH Price Ltd.	06/30/2013	V	V
Thomas Paige, P.Eng.	Kinetics Noise Control Inc	06/30/2013	V	C
Chris Papadimos	Acoustics & Vibration	06/30/2012	V	V
Richard Peppin	Scantek Inc Sound & Vibration	06/30/2014	V	V
Karl Peterman	Vibro-Acoustics	06/30/2011	V	C
Dr Doug Reynolds, PhD	UNLV		V	V
Dr Kenneth Roy, PhD	Armstrong World Industries	06/30/2012	V	V
Robert Simmons, PE	Petra Seismic Design	06/30/2013	V	V
Dr Lily Wang, PhD	University Of Nebraska	06/30/2011	V	C
Randal Zimmerman	Titus		V	V
Matthew Stead	AECOM	06/30/2012	VNQ	VNQ
Jason Swan	Sandy Brown Associates	06/30/2013	VNQ	VNQ

The following people will be added as Voting members after the Montreal meeting:

Dr Siu-Kit Lau	U of N-Lincoln	Mr Dustin Meredith	Trane
Mr Jerry Lilly	JGL Acoustics Inc	Mr Kim G Osborn	

The following people will become Corresponding members after the Montreal Meeting:

Daniel Abbate	AHRI	Joshua Leasure	JEAcoustics
Todd Busch	Todd Busch Consulting	Andrew Mitchell	AIM Acoustics
David Carroll	Morrison Products	Benjamin Sachwald	AKRF, Inc.
Jason George	Ruskin	Tim Simcoe	Price Industries
Dr Brian Landsberger	UNLV	Vijay K Tripathi	
Michael Keating	Kinetics	Daniel Laforgia	IAC

Attachment 2: RP-1408 PMS Meeting Minutes: Jerry Lilly

Working Group Members Present:

Jerry Lilly (chair), Kim Osborne, and Mark Schaffer

Working Group Members Absent:

Rich Peppin, John Gierzak, Francis Babineau, Rob Lilkendey, and Curt Eichelberger (research chair)

Prior to the meeting, a group of approximately 30 guests from TC2.6 were given a tour of the acoustics laboratory at UNLV. After the tour (approximately 11:30 AM) the PMS met with the Principle Investigator (Dr. Doug Reynolds) and 12 guests from TC2.6 at 11:30 AM to discuss the progress of the project since the last meeting. Dr. Reynolds presented the results of the most recent flanking noise tests of the test facility. These test results showed significant flanking at frequencies below 125 Hz. Dr. Reynolds concluded that the flanking noise was entering the reverberation chamber through the exposed flexible duct at the test duct connection to the reverberation chamber. After considerable discussion, another potential flanking path was discovered: the annular space between the double wall test duct.

Although positioning the loudspeakers inside the duct would provide additional signal to noise ratio at low frequencies, the PMS directed the PI to locate the loudspeakers in the source chamber (outside the test duct) for all subsequent testing, so as to conform to ASTM E477 requirements. The PMS also requested that the PI provide a table or matrix of all of the tests (showing duct length, duct liner, and duct size) that will be conducted as part of this project. This list differs slightly from the original proposal because some of the duct liners that will be tested are not suitable for installation in round ducts.

The PI also agreed to send a revised project schedule that is realistic, given the current status of the project. It was also noted that the PI is two quarters behind in submitting progress reports to ASHRAE. The PI agreed to complete these reports and send them in to ASHRAE within the next few weeks.

Jerry Lilly and John Gierzak visited the lab again on Tuesday, February 1, 2011. During this second visit we were able to listen to the noise source in the reverberation chamber and in the work area exposed to the test duct. The following items were noted:

1. Dr. Reynolds has agreed to install another layer of sheet metal (12-gauge) to all four inside surfaces of the empty test duct. It is anticipated that this additional steel will provide additional stiffness to the empty duct and decrease the amount of low frequency sound absorption in the empty test duct, thereby increasing the available signal to noise ratio at low frequencies.
2. There is an audible hum in the reverberation chamber at 120 Hz. This noise is not present in the background noise data previously provided to the PMS, because the background noise data previously provided to the PMS was taken with the heavy door closed at the end of the test duct. When this door is closed the 120 Hz hum is no longer audible. The hum is apparently coming from the work area and entering the reverberation chamber through the flexible connection at the end of the test duct. Dr. Reynolds will be adding a solid steel collar on the inside of the flex connection, and I also recommended that he add a second sound barrier around the outside of the flexible connection fabricated from loaded vinyl with fiberglass or mineral wool batt insulation in the void cavity.

After removing all of the extraneous materials, the reverberation chamber will be re-qualified for broadband testing with the rotating diffuser turned OFF. The rotating diffuser will only be used in this project if it is necessary to qualify the room in accordance with ANSI S12.51 (ISO 3741). The microphone boom will be positioned so as to maximize the distance between the microphone and all surfaces in the room (including the rotating diffuser) and each of the reference sound source (RSS) locations. The minimum distance between the microphone and each RSS location will be used to determine the low frequency cutoff for room qualification. It is understood that the room may be too small to qualify at 50 Hz while maintaining all of the minimum distances required in Section 8.1.2 of ANSI S12.51 (ISO 3741). The PI will provide full documentation of the broadband qualification test including the

low frequency limit, the calculation of d_{\min} and the RSS locations, and the measured sound pressure levels for each RSS location.

The loudspeakers will be moved to the source chamber and located in a position that is in conformance with ASTM E477 requirements. The source chamber microphone will be placed in the fixed location that will be used for all measurements and the microphone cable installed from the microphone to the analyzer. The acoustic signal analyzer for the reverberation chamber and source chamber measurements will be the Pulse analyzer using two microphone inputs. The Pulse system will also be used to collect the acoustic intensity measurements associated with the Addendum to this project. The Crystal analyzer will be used to collect and process the accelerometer data from the 16 accelerometers that will be mounted to the test specimens associated with the Addendum.

After the above work is completed, the flanking test will be repeated as described below:

1. Insert a solid sheet of minimum 10-gauge sheet metal between the flanges of the test duct at the downstream end of the plug. This sheet metal would extend slightly beyond the outer wall of the test duct on all sides so as to completely block the annular space between the inner and outer walls of the test duct.
2. Repeat the flanking test and compare the results with the previous flanking test. The flanking test should include the following data (in spreadsheet format): source room levels (plug in and plug out), reverberation room levels (plug in and plug out), background ambient levels (end door open and end door closed).

It is anticipated that the results of this flanking test will provide acceptable test conditions for this project. To verify this, the PMS requests that an initial test of a ten foot long, 24" round duct with 2" thick duct lining be conducted. The results of this test will be compared against what we have in the current handbook, and the raw data will be evaluated to assess how much signal to noise ratio we have left in the system for testing longer duct lengths.

Jerry G. Lilly
Chair

Attachment 3: Programs Subcommittee Report: Chris Papadimos

THIS MEETING – LAS VEGAS, NV, JAN 29 – FEB 2, 2011

- Theme: Zero Energy Design
<http://www.conferencetoolbox.org/ASHRAE2011/TechnicalTracks.cfm>

The 2011 ASHRAE Winter Conference will feature more market-based papers and programs than in previous technology-driven ASHRAE conferences. In addition, the conference will include traditional full-length Technical Papers (previously known as Transactions Papers) as well as a new Conference Paper format, which requires an abstract and, upon approval, a paper.

- The technical program is organized under the following tracks:
 - Track 1 Codes and Standards in the HVAC&R Industry
 - Track 2 Integrated Design
 - Track 3 Low Energy Design
 - Track 4 Refrigeration Update
 - Track 5 Industrial HVAC&R
 - Track 6 Net Zero Energy
 - Track 7 HVAC Systems and Equipment
 - Track 8 Professional Skills
 - Track 9 HVAC Fundamentals and Applications

- Programs (submitted/accepted/presented):

Type	Track	Date	Time	Subject	Chair
Seminar Session ACCEPTED	1	2/11 Wed	9:45AM	Codes, Standards and Guidelines (Ken Roy); Room Criteria (Jerry)	Ralph Muehleisen
Seminar Session NOT ACCEPTED	7	--	--	Aerodynamic Noise - AHU's, VAV boxes, Diffusers	Mark Schaffer
Forum NOT ACCEPTED	2	--	--	Integrate Acoustics in Building Information Modeling (BIM)	Karl Peterman
Conf Paper Session 10 ACCEPTED	9	1/31 Mon	11:00AM	Recent Research in Acoustics for Healthcare Facilities 1) Wiese and Wang, "Measured Levels and Patient Perception of Hospital Noise Before, During, and After Renovation of a Hospital Wing" 2) Okcu, Hsu, Ryherd, "Evaluating the Hospital Soundscape"	Chris Papadimos

NEXT MEETING – MONTREAL - JUNE 25-29, 2011

- Theme: Sustainability knows no borders
<http://ashraem.confex.com/ashraem/s11/cfp.cgi>
- Submission deadlines:
Forum (1 moderator - 60 min, no presentations) – **Feb 14, 2011**
Seminar (1-2 presentations - 60min; 3-4 presentations - 90 min) – **Feb 14, 2011**
- The link to upload program submissions is on www.ashrae.org/montreal
- The technical program is organized under the following tracks (pending):
Track 1 Refrigeration
Track 2 HVAC Systems
Track 3 HVAC Fundamentals and Applications
Track 4 Net Zero Energy Buildings
Track 5 Professional Skills
Track 6 Engineering Tools
Track 7 Commissioning
Track 8 Alternative Technologies
- Programs to submit:

Type	Subject	Chair
Seminar	Acoustic Criteria for Design, Diagnostics and Commissioning	Mark Schaffer
Seminar	Vibration-Induced Noise and Mechanical Equipment Vibration Isolation and Balance	Pat Marks
Seminar TC 2.6/5.1/5.9	Multiple Plenum Fans in Arrays	Asesh Raychaudhuri
Forum	Building Information Modeling (BIM) – how to integrate acoustics	Karl Peterman

NOTES:

Seminar submissions should include six (6) Learning Objectives and ten (10) Questions/Answers for the session. In addition, a short biography for each speaker will be required so that the program can be submitted to USGBC for LEED-AP credits. The biography should include information about current position, educational background and relevant experience.

The track chairs will be using the following criteria to evaluate the program submissions:

- Relevance to track theme (addresses the abstract appropriately)
- Hot Topic (timely, topic of pressing interest to engineers/industry)
- Strength of session proposal and completeness (well written, comprehensive abstracts for both the overall session and for presentations, including Learning Objectives and Q&A's)
- Market-based session (such as case studies, or application-oriented topic, or "how-to apply" or "how-to use" sessions, etc.)

UPCOMING MEETINGS

- Winter Meeting 2012 Chicago - Jan 21 to 25, 2012
 - Theme: The Impact of HVAC&R on Our Daily Lives
 - Deadline for Conference Paper Submission: **April 18, 2011**
 - The link for conf paper submissions: <http://ashraem.confex.com/ashraem/w12/cfp.cgi>
 - Programs to consider:

Type	Subject	Chair
Seminar	Aerodynamics noise	Mark Schaffer
Conf Papers	Green Building Acoustics	Ralph Muehleisen

- Annual Meeting 2012 San Antonio - June 23 to 28, 2012
 - Theme: Leading the Way to Better Buildings
 - Details to follow in upcoming meetings
 - Programs to consider:

Type	Subject	Chair
Seminar		
Forum		
Conf Papers		
Tech Papers		

PROGRAM TOPICS "IN THE HOPPER"

- Miscellaneous program topics – listed in order of priority by vote in Las Vegas and as tentatively assigned for upcoming conferences.

<u>Votes</u>	<u>Subject</u>	<u>Leader</u>
-	Air handlers with fan arrays (Montreal 2011 Seminar)	Asesh Raychaudhuri
21	Acoustic criteria (Montreal 2011 Seminar)	Mark Schaffer
19	BIM and acoustics (hot topic or forum – Montreal 2011)	Karl Peterman
17	Aerodynamic Noise (Chicago 2012 Seminar)	Mark Schaffer
16	Green Building Acoustics – (Chicago 2012 Conf Session)	Ralph Muehleisen
11	Vibration-Induced Noise - Case Studies (Montreal 2011 Seminar)	Karl Peterman
6	Mechanical Equipment Vibration Isolation and Balance (Montreal 2011 Seminar)	Jerry Lilly
8	Duct Breakout and Flanking Paths Noise	Doug Reynolds
6	Forum on next generation handbook	Bill Rockwood
6	Forum/Seminar on Equipment Sound Standards	Chris Papadimos
4	Outdoor Noise / Liabilities from Outdoor Noise	Matt Murillo
3	Fan Selection for Acoustics	Mark Schaffer
1	Tunnel Ventilation	
0	Variable Capacity Compressors	
0	Exhaust Fan Noise	
0	Standard method of test for vibration isolators	

- Please contact Chris Papadimos with ideas and suggestions for additional topics.
 - Email: chris@papadimosgroup.com
 - Tel 415 456 0170 x202

Attachment 4: Publications Subcommittee Report: Steve Wise

TC Website

Mike Schwob will take over responsibility for the Website Sub-Committee. John Gierzak has also indicated an interest in helping along the way. We discussed host options but primarily left the discussion about that, and any major changes to formatting techniques and overall content, to this summer in Montreal. One recurring topic of interest is a family of audio files of pertinent HVAC noise sources. Jerry Lilly and Ken Roy have volunteered to help put together files that offer consistent volume control and time duration, and perhaps take advantage of compression technologies such as mp3.

Miscellaneous publications available via ASHRAE

Mark Schaffer mentioned that his book, *A practical guide to noise and vibration control for HVAC systems*, 2nd ed, will soon be available in SI units as well as the IP version that has already been on sale through ASHRAE.

Karl Peterman raised the subject of the "Pocket Guide" and the desire to have our TC provide input on future revisions. This publication is available from ASHRAE in the bookstore and on the web, in PDF format, for \$45.

It was agreed that we should endeavor to keep in contact with ASHRAE for an opportunity to make revisions to the acoustical section as desired in the future. Mark Schaffer has possession of the current edition and suggested devoting an hour of meeting time in Montreal to discuss potential revisions to the ~20 page section which contains Handbook snippets.

There are other publications such as the Green Building Guide, Performance Management Protocol, and IgCC building noise control specifications that, in general, we would hope to be consistent with the Handbook. The historic problem is that unless a TC2.6 member volunteers to be champion for providing input, we have no control over what is in the final publication. The first step is for the TC Pub's Sub-chair to make the link. This could be improved, but the second step remains, which is for a volunteer to follow through. It is agreed that we will all try to be diligent in the future.

Note that some of these documents are actually standards. Starting with Montreal, we are going to have a time slot for Standards, as well as Publications, which will facilitate more discussion.

Acoustical CD

Though this is old news now, we recapped the frustrating history of our inability to make this a final released product. There is consensus that this is a desirable item (a canned computer program that makes calculations of receiver noise levels based on the Handbook guidelines), but it remains unclear how to make it happen.

Fundamentals Handbook, 2013 revision

Jon Weinstein remains champion for this following his leadership for the 2009 edition. It is generally perceived that until the laws of physics change it is basically correct as is. At the 2012 ASHRAE Winter Meeting in Chicago, we will have to vote to either leave it unchanged, or agree to specific revisions that surface between now and then. If anyone notices an incorrect item between now and then, please contact Jon.

Applications Handbook, 2011 revision

Galley proofs of the 2011 revision will be available soon. John Gierzak, Reggie Keith, Jerry Lilly, Pat Marks, Andrew Mitchell, and Terry Tyson all volunteered to review the entire chapter proofs when available.

We also discussed how the chapter would benefit from links to spreadsheets which perform the required calculations. This would not only help the users, it would allow for the chapter to be simplified such as in documenting only equations and not tables of data.

There are complications in this approach: who has copyrights; how is the data updated; how are the spreadsheet formats updated to be usable by popular computers such as iPad; who, especially ASHRAE and the spreadsheet developer, gets paid what or benefits how? It was agreed that we need an update from ASHRAE as to the long term vision.

Bill Rockwood has volunteered to take a crack at a few possible items to implement. Once Bill has sent that out to the TC for review, we have an opportunity review that, and also to initiate action on other sections of the chapter.

Attachment 5: Webmaster Report – John Geirzak

- Lilly Wang purchased a web domain through justhost.com.
- The new web domain is ashrae-tc26.org We will have this name and web domain for 4 years at least (through Feb. 8, 2015).
- Michael Schwob has started creating content and has the new website up and running but the content is thin right now. As time permits, Michael will be transferring content so the old site can be shut down.
- Until this complete transformation takes place, members can still access the current site at <http://www.tc26.ashraeregion7.org>

- **Attachment 6: Standards Subcommittee Report: Lauren Ronsse**

Date: January 31, 2011

Submitted by: Lauren Ronsse

- I. STANDARDS section added to TC 2.6 webpage
 - a. List of current **ASHRAE** standards that reference HVAC sound and vibration control
 - i. Standards 62.1, 68, 70, 130, 189.1, Guideline 10
 - c. List of current SPCs and WGs
 - d. List of TC 2.6 liaisons to other standards organizations...these liaisons should maintain a list of standards from their organizations that reference HVAC sound and vibration control issues.

- II. Process for stating support from TC 2.6 for revisions to standards and/or content for new standards
 - a. Ask TC 2.6 members for suggested revisions to standard
 - b. Suggested revisions compiled and sent to all TC 2.6 members for comment period
 - c. Comments compiled and incorporated into suggested revisions
 - d. Final revisions sent for to TC 2.6 voting members to vote YES or NO
 - e. If passes then, will submit suggested revisions with support of this committee

- III. Updates from SPCs and WGs
 - a. SPC 189.1: Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential (Chris Papadimos)
 - i. Standard 189.1 is now under continuous maintenance...review period ending January 5, 2011 (two people provided comments)
 - ii. C. Papadimos is liaison to WG on indoor environmental quality issues for Standard 189.1 (Also, may join SSPC 189.1)
 - iii. Currently developing suggested acoustics content for standard (volunteers requested)
 1. Reverberation Control
 2. Indoor Background Noise Criteria
 3. Interior Sound Isolation (Isolation requirements for walls, floor/ceiling assemblies)
 4. Exterior Sound Requirements
 - iv. Compile content from existing documents
 1. ASHRAE Handbook
 2. PMP
 3. FGI for Healthcare Facilities
 4. IGCC
 5. ANSI S12.60: Schools

- v. Allow time for TC 2.6 members to review of proposed changes and provide comments. This will be followed by YES / NO vote by TC 2.6 members.
- vi. Ken Roy will attend WG 8 (IEQ) on Tuesday to get more details on timeline for submitting proposed changes; possibility of getting membership on SSPC 189.1
- b. SPC 197: Method of Test for Passive Vibration Isolators (Karl Peterman)
 - i. Meeting after this - no work since last meeting
 - ii. Intent: Determine method of test for vibration isolators particularly below 100 Hz
- c. SPC 200: Method of test for chilled beams (Randy Zimmerman)
 - i. Met this morning - only will include active chilled beams
- d. Guideline 10: Interactions Affecting the Achievement of Acceptable Indoor Environments (Ken Roy, Lily Wang)
 - i. L. Wang will attempt to join working group
- e. Performance Measurement Protocol Best Practices document (Curt Eichelberger)
 - i. Review plan for PMP Best Practices Document
- f. ANSI Working Group on Sound Measurement in Rooms (Jerry Lilly)
 - i. Creating new ANSI standard for sound measurement in rooms
- g. Review of AHRI Standard 1120-2007 *Acoustical Test Methods and Sound Power Rating Procedures for Transport Refrigeration Equipment* (Dan Abbate)
 - i. Comments should be accepted this year
- h. Update on Proposed Position Document on “Environmental Health in Green Building Program” (Ken Roy, Ralph Muehleisen)
 - i. No updates
- i. International Green Code Construction Input (Jerry Lilly, Lily Wang)
 - i. Vote on written response: 11 for motion to support changes / 2 abstain

Attachment 7: Liaison Reports

Date: January 31, 2011

Submitted by: Lauren Ronsse

Active Working Groups (Select)

S1/WG01 Standard Microphones and their Calibration

Active

(Parallel to IEC/TC29/WG5 and IEC/TC 28/WG 8) – Revision of S1.10-1966(R 1986) Method for the Calibration of Microphones and S1.12-1967 (W 2001) Specification for Laboratory Standard Microphones

Chair, S1/WG01 V. Nedzelnitsky

S1/WG04 Measurement of Sound Pressure Levels in Air

Active

To revise the current Annex A: Identification and evaluation of prominent discrete tones (Character of the sound) to bring it into consistency with the more up-to-date prominent tone procedures recently published in ECMA-74.

Chair, S1/WG04 VACANT

Vice-Chair, S1/WG04 E. Dunens

S1/WG20 Ground Impedance

Active

i) Measurement of Ground Impedance - To develop a standard describing recommended procedures to characterize and the instrumentation to measure the acoustic properties of a wide variety of natural ground surfaces outdoors.

ii) Attenuation of Sound due to the Ground - To develop a standard describing recommended procedures to account for the attenuation of sound propagating in the presence of the ground.

Chair, S1/WG20 K. Attenborough

S2/WG10 Measurement and Evaluation of Machinery for Acceptance and Condition

Active

The development of standards and standardized terminology for the measurement, analysis, and evaluation of machinery for the purposes of acceptance and condition assessment. This measurement, analysis, and evaluation activity generally applies to the mechanical vibration, balance, structural integrity, and the electrical, thermal and tribology-related properties of machinery. The standardization includes the measurement instrumentation, evaluation procedures, and acceptance criteria related to the balancing, condition monitoring, acceptance testing, diagnostics, life usage, fault analysis, and prognosis of machinery.

Chair, S 2/WG10 R.L. Eshleman

S2/WG14 Prediction of Ground-Borne Noise and Vibration from Rail Transportation Systems

Active

Standardize the prediction methodologies for ground-borne noise and vibration caused by rail transportation systems. Provide guidance with respect to instrumentation selection, field procedures, data analysis, numerical procedures, and reporting. The work may be restricted to the measurement and/or estimation of the Line Source Response as defined in the FTA and FA guidance manuals for environmental assessment of noise and vibration impact of rail systems.

Chair, S2/WG14 J.T. Nelson

S12/WG03 Measurement of Noise from Information Technology and Telecommunications Equipment

Active

(parallel to ISO/TC 43/ SC1/WG23) - Development of procedures for measurement and evaluation of noise emitted from Information Technology and Telecommunications Equipment and their component noise sources.

Chair, S12/WG03 K.X.C. Man

S12/WG15 Measurement and Evaluation of Outdoor Community Noise

Active

To produce a series of Standards for outdoor environmental noise that deal with: (1) definitions and nomenclature, (2) measurements including both short-term measurements and long-term monitoring, etc., (3) modeling of environmental noise, (4) quantitative evaluation of the effects of environmental noise such as annoyance, complaints, sleep disturbance, disturbance by noise-induced vibration and rattles, and (5) compatible land use planning with respect to noise.

Chair, S12/WG15 P.D. Schomer

S12/WG44 Speech Privacy

Active

To develop standards and guidelines for the design and evaluation of speech privacy in health care facilities.

Chair, S12/WG44 G.C. Tocci

Vice-Chair, S12/WG44 D.M. Sykes

S12/WG51 Procedure for Measuring the Ambient Noise Level in a Room

Active

Develop a new standard that will specify how to conduct ambient noise measurements in a room, including: instrumentation requirements, microphone placement, duration of each measurement, identification of specific noise sources (e.g., HVAC, lighting, electrical, exterior traffic and aircraft), and data reduction and analysis.

Chair, S12/WG51 J.G. Lilly

Current ANSI Standards (Select)

- **ANSI S1.13-2005 (R 2010)** American National Standard Measurement of Sound Pressure Levels in Air.
- **ANSI/ASA S1.18-2010** American National Standard Method for Determining the Acoustic Impedance of Ground Surfaces. (*Revision of ANSI S1.18-1999*).
- **ANSI S2.8-2007** American National Standard Technical Information Used for Resilient Mounting Applications.
- **ANSI S2.71-1983 (R 2006)** American National Standard Guide to the Evaluation of Human Exposure to Vibration in Buildings (*Reaffirmation and redesignation of ANSI S3.29-1983*).
- **ANSI S12.1-1983 (R 2006)** American National Standard Guidelines for the Preparation of Standard Procedures to Determine the Noise Emission from Sources.
- **ANSI/ASA S12.2-2008** American National Standard Criteria for Evaluating Room Noise.
- **ANSI S12.3-1985 (R 2006)** American National Standard Statistical Methods for Determining and Verifying Stated Noise Emission Values of Machinery and Equipment.
- **ANSI S12.7-1986 (R 2006)** American National Standard Methods for Measurements of Impulse Noise.
- **ANSI/ASA S12.8-1998 (R 2008)** American National Standard Methods for Determining the Insertion Loss of Outdoor Noise Barriers.
- **ANSI S12.9/Part 1-1988 (R 2003)** American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound, Part 1.
- **ANSI/ASA S12.10-2010/Part 1** American National Standard Acoustics - Measurement of Airborne Noise Emitted by Information Technology and Telecommunications Equipment - Part 1: Determination of Sound Power Level and Emission Sound Pressure Level
- **ANSI/ASA S12.11/Part 1-2003 (R 2008) / ISO 10302:1996 (MOD)** American National Standard Acoustics – Measurement of noise and vibration of small air-moving devices – Part 1: Airborne noise emission. (Modified Nationally Adopted International Standard).
- **ANSI/ASA S12.11/Part 2 – 2003 (R 2008)** American National Standard Acoustics – Measurement of Noise and Vibration of Small Air-Moving Devices – Part 2: Structure-Borne Vibration.
- **ANSI/ASA S12.16-1992 (R 2007)** American National Standard Guidelines for the Specification of Noise of New Machinery.
- **ANSI S12.23-1989 (R 2006)** American National Standard Method for the Designation of Sound Power Emitted by Machinery and Equipment.
- **ANSI/ASA S12.60/1-2010** American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 1: Permanent Schools.
- **ANSI/ASA S12.60/2-2009** American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 2: Relocatable Classroom Factors.
- **ANSI S12.65-2006** American National Standard for Rating Noise with Respect to Speech Interference.