

NOISE **in CLASSROOMS**

**Preventing the Effects on Health
and Interference with Learning**

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Impacts of High Noise Levels on Health

In addition to the risks of hearing loss, noise exposure can contribute to voice damage and tinnitus. Noise exposure can be linked to other health effects including: high blood pressure; increased risk of heart disease; increased stress levels; tiredness; irritability; hormonal changes; and low birth weight. High noise levels may be linked to higher accident rates as noise can interfere with the ability to hear and understand instructions and warnings. Noise levels can hamper communication during both routine and emergency procedures in school communities which is essential to assure the well-being of staff and students.

How High Noise Levels Affect the Teaching and Learning Environment

Noise can interfere with speech-language communication, particularly for students with special education needs, and young children. Research indicates that student learning in early years programs and open concept learning environments can be negatively affected by high noise levels (Bradley and Sato, Crukley, Sparks, Walinder et al).

Factors affecting noise levels in classrooms

- activities within the classroom;
- reverberation from hard surfaces (poor acoustics);
- ambient noise from heating and ventilation systems;
- noise from other classrooms, hallways and stairwells;
- construction and maintenance activities; and
- exterior noises such as playgrounds, traffic and aircraft.

Risks of noise exposure in schools

- crowded work areas;
- open concept classrooms; and
- activities in music, gym and technical programs.

Remedies to Reduce Noise Levels

Reverberation is one factor that contributes to overall noise level. Reverberation is a measurement of acoustical absorption or of the decay of noise as it bounces off the hard surfaces of walls, ceilings, floors and other large surfaces. Reverberation occurs when noise is reflected in such a way that the original sound is distorted and gradually tapers off which affects communication and understanding. The reverberation time (or RT60) describes the time it takes for the sound to decay by 60 decibels (dBA) after the sound source is removed.

To reduce reverberation, absorbent materials can be added to the walls of a room and noise transmission from adjacent rooms or outside of the room can be controlled using tips from the Occupational Health and Safety Council of Ontario (OHSCO)'s Noise Control Tool.

Proactively, noise control should be a consideration during the design and building stage when the choice of building materials in each room is made as outlined in guidance documents from Britain and the United States which focus on the acoustic environment of school buildings for the protection of hearing and voice, and the improvement of the speech-language environment for teaching and learning.

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Legislative Limits and Guidelines

Ontario's regulatory requirement respecting overall noise exposure control is set at 85 dBA - an eight hour, time-weighted average exposure to the loudness of sound, measured in decibels (OHS Regulation 381/15). In Ontario, Section 25 (2)(h) of the Occupational Health and Safety Act (OHS) requires the employer to "take every precaution reasonable in the circumstances for the protection of the worker."

Both Britain and the United States provide guidance documents focusing on the acoustic environment in school buildings. These guides include very useful technical acoustical standards for designing each room in a new building appropriate for its normal use, guidelines for renovations, testing criteria, noise control, sound insulation, and building design. The guidelines from both countries focus on the optimal learning conditions for students and do not deal with the occupational hazards of staff. The British guide states:

"The overall objective of the performance standards is to ensure that the design and construction of school buildings provide acoustic conditions that enable effective teaching and learning."

The purpose of the American ANSI Standard states:

"This standard is intended to provide a minimum set of requirements, based on the best scientific evidence available at the time of publication ... to help school planners and designers provide good acoustical characteristics for classrooms and other learning spaces in which speech communication is an important part of the learning process."

Sample Acoustical Guidelines

- [*ANSI/ASA S12.60-2010 American National Standards*](#) Acoustical Performance Criteria, Design Requirements and Guidelines for Schools (2010). Acoustical Society of America. Part 1: Permanent Schools, Part 2: Relocatable Classroom Factors.
- [*The Acoustic Design of Schools: Performance Standards*](#) Building Bulletin 93 (2015) published by the Department for Education, United Kingdom also references the requirements for noise related to special education needs, building regulations, and accessibility.
- [*Acoustics of Schools: A Design Guide*](#) (2015) is published jointly by the Institute of Acoustics (IOA) and the Association of Noise Consultants (ANC) to accompany the UK standards.

References for Noise Assessment and Controls

- Occupational Health and Safety Council of Ontario (OHSCO). Prevent Noise-Induced Hearing Loss: [*Noise Assessment Tool*](#)
- Prevent Noise-Induced Hearing Loss: [*Noise Control Tool*](#) Concrete Actions and Specific Recommendations
- Occupational Health Clinic for Ontario Workers (OHCOW). [*International Noise Awareness Day, Tools and Resources*](#)

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How to Assess and Address Concerns

Hiring consultants for reverberation and other noise testing is quite costly. The Occupational Health and Safety Council of Ontario (OHSCO) (composed of the Ministry of Labour, the Workplace Safety and Insurance Board and the Health and Safety Associations, including the Occupational Health Clinic for Ontario Workers - OHCOW) recommends using a risk-prevention strategy supported by the research of Kardous and Malchaire, called SOBANE, which is an acronym for Screening, OBservation, ANalysis and Expertise.

The aim is to make risk prevention faster, more cost effective, and more effective in coordinating the contributions of the workers themselves, their management, the internal and external occupational health (OH) practitioners and the experts. These four levels are: screening, where the risk factors are detected by the workers and their management, and obvious solutions are implemented; observation, where the remaining problems are studied in more detail, one by one, and the reasons and the solutions are discussed in detail; analysis, where, when necessary, an OH practitioner is called upon to carry out appropriate measurements to develop specific solutions; expertise, where, in very sophisticated and rare cases, the assistance of an expert is called upon to solve a particular problem.

OHCOW states that “Measurements taken with apps are only a very rough estimate of the acoustical properties of a room - official measurements are much more complicated (and expensive).” To measure the acoustics of a room, OHCOW recommends the following: Measure the noise under normal

conditions and measure it again when people and machines are quiet. Either measure at your workstation, or measure in the center of the room (i.e., office, classroom, non-industrial space). Measure the reverberation in the room (under quiet conditions) - see suggested apps.

The American Speech-Language-Hearing Association's (ASHA's) Working Group on Classroom Acoustics recommended that an appropriate acoustical environment be established in all classrooms and learning spaces. ASHA endorses the American National Standards Institute (ANSI) standard and recommends the following criteria for classroom acoustics:

- Unoccupied classroom levels must not exceed 35 dBA
- The signal-to-noise ratio should be at least +15 dB
- Unoccupied classroom reverberation must not surpass 0.6 seconds in smaller classrooms or 0.7 seconds in larger rooms

ANSI S12.60-2002. Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools:

- Reverberation times above 0.7 seconds indicate too much reverberation in classrooms.
- Open plan offices with noise levels below 42 dBA are too quiet (outside conversations will cause distraction).
- Open plan offices with background noise levels (i.e. without voices) above 48 dBA indicate a ventilation system which is too loud.

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What Can Be Done?

School boards should use existing capital funds for these acoustical improvements and join ETFO's lobby for more funding and guidelines to address noise concerns.

The provincial government needs to develop or adopt acoustical guidelines for schools, similar to those in Britain and the United States.

The provincial government must provide additional funding to address health and safety issues and building improvements, specifically requesting that some funding be dedicated to address noise concerns.

The provincial government must make capital funding contingent on the submission of evidence that the design of new buildings or significant renovations include provisions which address acoustical issues.

Joint Health and Safety Committee(s) must be included in the review of any building design before construction begins to provide them with the opportunity to make recommendations to the employer to address noise hazards and other concerns that may have been overlooked.

Joint Health and Safety Committee(s) must be trained to assist them in using available online tools or cell phone apps to measure reverberation in classrooms and to make recommendations to the employer to add acoustical materials to the room(s) if a problem is detected, or if necessary, to recommend testing and advice from a formal consultant.

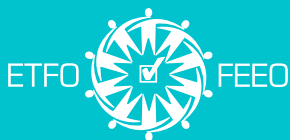
Lobby for Change

- Joint Health and Safety Committees
- School Board Administration (Superintendents, Facility Managers)
- School Board Trustees
- Members of Provincial Parliament, including:
 - Minister of Education
 - Minister of Labour
 - Minister of Finance

Learn More

ETFO has created this resource as a tool to use when advocating for noise controls and proper acoustics in our schools.

Please visit the Elementary Teachers' Federation of Ontario's health and safety website, etfohealthandsafety.ca. This online resource provides useful hyperlinks, as well as other resources on health and safety issues and concerns.



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