

# Occupational Noise Exposure in the High School Music Practice Room

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## Introduction

Occupational noise is most often considered potentially hazardous in industrial workplaces or on construction sites. Another workplace where high sound levels commonly exist is the music practice room of an educational facility.

Measurements were performed of the sound levels produced during two instruction periods in a high school music room. Both personal dosimetry and engineering measurements were performed. Through analysis, the typical daily noise exposure of the instructor was determined and was found to exceed the guidelines provided in the Occupational Health and Safety Act.

The implications of this excess in terms of hearing risk criteria and architectural acoustic design are discussed.

## Sound Level Measurements

Sound levels were measured during the 09:45 and 11:40 instruction periods approximately 2 m from the instructor at ear level. The musical instruments included electronically amplified bass and guitar, a full drum set, and various wind and brass instruments including saxophones, trombones and trumpets.

Figures 1 & 2 show the results in terms of the average sound level in each 10 second interval. Warm up and active rehearsal occupied from 40 to 50 minutes of each period during which the sound levels varied from as low as 60 dBA during lulls to as high as 103 dBA during fortissimo brass passages. The one hour average sound level was 93.4 dBA and 91.1 dBA for the two classes respectively. The brass instruments were observed to be the major contributors to the measured levels and were pointed directly at the instructor.

## Calculation of Exposure

The following schedule was provided by the instructor for the measurement day, which is understood to be a typical day of instruction, occurring 5 days a week.

Time	Class	# of Students
08:50 - 09:40	Grade 9	19
09:45 - 10:38	Senior Class	21
10:38 - 11:45	Spare	0

11:40 - 11:50	Recording	3
11:50 - 12:25	Band Practice	20
12:35 - 13:35	Grade 9	16
13:35 - 15:20	Spares	0
15:30 - 17:30	Band Practice	20

This schedule indicates that activities similar to those measured occur for 5.47 hours per day. Calculations indicate that the instructor is exposed to 91 dBA on a daily (8 hour) basis. This estimate is considered to be conservative in that it does not take into account evening activities and was measured 2 m from the instructor. Personal dosimetry verified these results.

## Occupational Health and Safety Considerations

**The sound levels to which the instructor is exposed exceed existing guidelines (90 dBA - 8 hour Leq) found in the Occupational Health and Safety Act<sup>1</sup> for industrial workplaces. They significantly exceed proposed guidelines (85 dBA).**

In an industrial workplace the Act recommends that consideration be given to the reduction of noise levels through any control measures which may be feasible. The use of hearing protective devices is required. Music education facilities are not considered industrial workplaces. **We are concerned that significant (but preventable) hearing damage is occurring in this group of dedicated professionals.**

## Damage Risk Criteria

A spectrum of the sound during one of the loudest passages is shown in Figure 3. It can be seen that significant sound is present in the 250 to 4000 Hz Octave bands, characteristic of trumpets and cymbals.

This is of particular concern to music instructors since it is well documented that "a threshold shift occurs most readily at 4000 Hz, and that it is most readily caused by noise energy in the frequency region about one octave lower (1000 to 2000 Hz or so)"<sup>2</sup>. Considering the high frequency nature of the sound, it may be that music teachers are even more at risk than persons exposed to the same dBA levels of noise in industry where the spectrum may be more low frequency in nature. **This is an area where the authors feel further research is required.**

## Noise Control Measures

Much can be done in the music rehearsal room to moderate sound exposure. The following points are offered as helpful suggestions in that regard, but should not be interpreted as design criteria to eliminate the problem. Each practice room is unique and each situation must be considered individually.

a) Risers (1 - 1.5 feet in height) can be provided. Trumpets should be elevated so that they do not point at the heads of the musicians in front of them and the risers arranged so that they also do not point directly at the instructor. An offset of at least 30 degrees would be beneficial in this regard.

b) Acoustical wall and ceiling panels, a suspended acoustical ceiling and other treatments can be appropriate to control reverberation and overall noise levels. A good implementation should be effective through the entire frequency range (both bass and treble frequencies) and requires careful design. The thickness, amount and precise location of the treatment will depend on the room volume, layout and activities. In a retrofit situation, acoustical measurements are very helpful. The services of a consulting acoustical engineer may be useful in this regard.

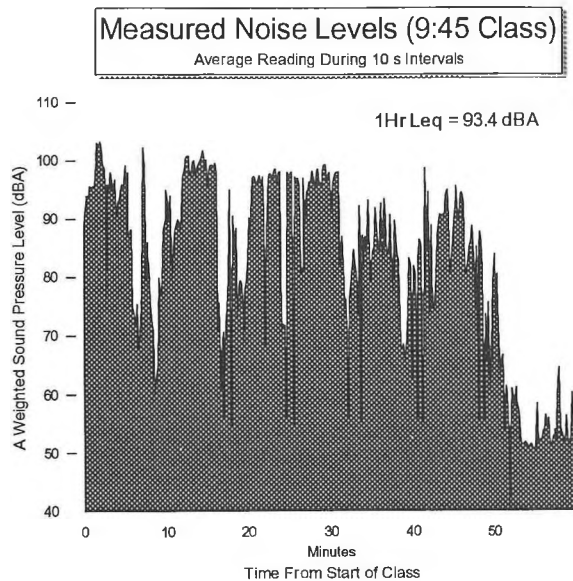
c) It is also appropriate to incorporate some changeable absorption within the space. Pull down baffles or curtains can be temporarily placed over blackboards to attenuate reflections during rehearsals or to assist in recording. Similar treatments can be useful on walls near the drum kit.

d) It may be appropriate to use carpet for additional high frequency absorption near the drum kit and brass instruments. It does not pose a sanitary problem as any debris from wind instruments is primarily the result of condensation. Generally, however, musicians will hear themselves and others more clearly if they are not standing on carpeted areas.

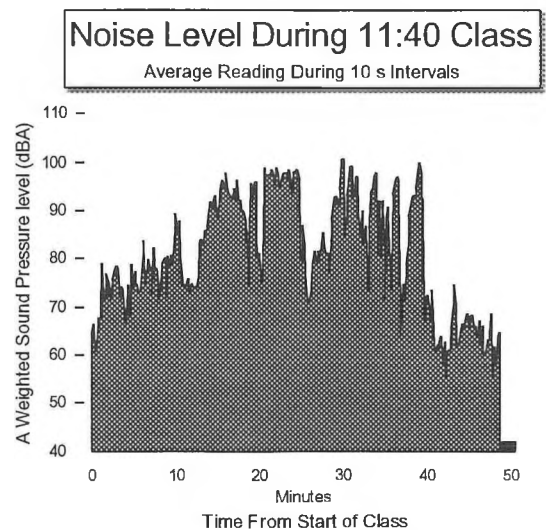
e) Hearing protectors are available with a uniform attenuation at all frequencies for a more natural sound. Instructors should strongly consider the use of such devices since the risk of damage is real.

## References

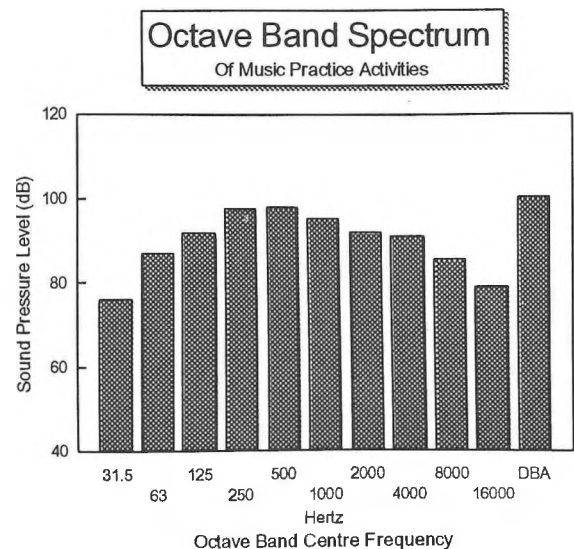
- 1) "The Ontario Health and Safety Act and Regulations for Industrial Establishments", Revised Statutes of Ontario, 1990, November 1993.
- 2) "The Effects of Noise On Man", Kryter, Karl D., Academic Press Inc. 1985.



**Figure 1**



**Figure 2**



**Figure 3**