HEARING CONSERVATION PROGRAM

The purpose of this document is to provide information on noise, hearing, noise control methods, and employer and employee responsibilities for the Hearing Conservation Program.

For a successful program, all Monroe 1 BOCES employees concerned must share in the responsibility of ensuring that these program requirements are fulfilled.

1. Introduction

The Monroe 1 BOCES Hearing Conservation Program is designed to prevent hearing impairment as a result of work-related noise exposure and to satisfy State hearing conservation requirements. Employees who are exposed to noise levels at or above allowable limits will be included in the program. This document is written for personnel primarily responsible for the implementation of the program and meets the guidelines established by the Occupational Safety and Health Administration (OSHA).

2. Noise and Hearing

Noise is defined as unwanted sound. Sound is characterized by its frequency and intensity. Frequency is measured as sound vibrations per second (hertz), while intensity is measured in decibels. Frequency is related to pitch, and intensity is related to the loudness of the sound. Sound is produced by a vibrating source which causes air pressure waves. While the term sound is usually applied to the form of energy that produces a sensation of hearing, vibration usually refers to the non-audible acoustic phenomenon that is recognized by touch. Both sound and vibration are the results of a vibrating source. This document refers only to sound.

a. The Human Ear The human ear is divided into three sections: the outer ear, middle ear, and inner ear. (See Figure 1.)

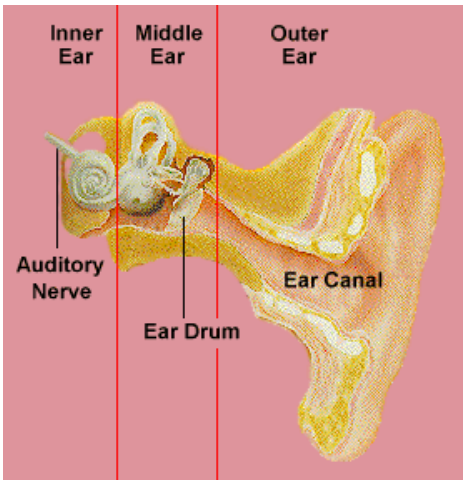

Figure 1

The outer ear, which includes the auditory canal, collects airborne sound waves and funnels them to the eardrum (the barrier between the outer and middle ear). In response to the sound waves, the eardrum and three small bones, called ossicles, vibrate. The ossicles transmit these vibrations to an inner ear structure called the cochlea. The cochlea is a fluid-filled structure with tiny hair cells. These hair cells become stimulated in response to the vibration, thereby transforming the vibration into nerve impulses. The brain then translates these impulses into the sensation of sound.

b. Effects of Noise on Hearing

Prolonged exposure to loud noise can damage or destroy the sensory hair cells of the cochlea causing hearing impairment resulting in a loss of information transmitted to the brain. At first, damage to a few hair cells can go unnoticed. But as more cells deteriorate, the brain will not compensate for the lack of information. Individuals may be able to hear a conversation, but will not be able to understand it. If overexposure continues, the damage will gradually be aggravated until the entire hearing range is affected.

The degree of hearing loss is dependent upon many factors:

- the susceptibility of the individual (genetic),
- the duration of exposure,
- the intensity of the noise, and
- the nature of the hearing protection worn.

Only genetic deviations cannot be controlled through engineering or administrative controls and/or personal protective equipment.

Below is a list of common indicators of overexposure to noise:

- temporary hearing loss and/or speaking loudly upon leaving the work area,
- ringing in the ears after leaving the work area (tinnitus),
- difficulty hearing normal speech in the work area.

If workers experience any of these common indicators, they should notify their supervisor. The supervisor should then notify the Environmental Health and Safety Office to evaluate the noise exposure and recommend adequate control measures, if warranted.

3. Occupational Noise

Protection against the effects of noise will be provided whenever an employee's noise exposure equals or exceeds an eight-hour time-weighted average (TWA) sound level of 85 decibels (85 dBA).

a. Noise Exposure Limits

There are three exposure limits to consider in relation to noise levels:

- Permissible Noise Exposure (continuous noise)
- Action Level (continuous noise)
- Peak Sound Pressure Level (impulsive and impact noise)

(1) Permissible Noise Exposure (continuous noise)

The permissible noise exposure is the noise limit adopted by Cal/OSHA from Federal OSHA for an eight-hour working day at a sustained level of 90 dBA. The standard states that when workers are exposed to noise levels above 90 dBA, suitable engineering controls should be introduced to reduce noise levels. If control measures either fail to lower noise levels to or below the permissible noise exposure limits, or they are technologically or economically unfeasible, the wearing of personal protection, such as ear plugs and ear muffs, will be mandatory.

Table 1 is a sliding scale which describes allowable noise levels in relation to the amount of time a worker may be exposed.

Table 1 -- Permissible Noise Exposure

Sound Level dBA	Permitted Duration per Work Day (Hours)
90	8
92	6
95	4
97	3
100	2
102	1-1/2
105	1
110	1/2
115	1/4 or less

Table 2 shows examples of noise sources and the noise levels typically associated with them.

Table 2 -- Typical Sound Levels and Noise Sources

dB	Noise Source
120	Pain threshold
110	Rock 'n' roll band
100	Textile loom
90	Power lawn mower (at operator's ear)
80	Garbage disposal truck
70	Vacuum cleaner
60	Air conditioning window unit, conversation
50	
40	Quiet room
30	
20	
10	
0	Threshold of hearing

(2) Action Level

The Action Level is an eight-hour time-weighted average noise exposure of 85 dBA. Employees exposed to the action level will be included in the Hearing Conservation Program. Representative noise monitoring will be performed by the Genesee Valley Educational Partnership Environmental Health and Safety Office to determine and document worker exposure. Should noise levels exceed the action level, employees will be notified of the results.

These employees must participate in an annual training program, and will be provided with annual audiometric tests at no cost to the employee.

Hearing protection will be available to those exposed to noise levels at or above 85 dBA, and will be mandatory for those employees who, on a time-weighted average basis:

- are exposed to noise levels above 90 dBA,
- have experienced a standard threshold shift, or
- have not received a baseline audiogram.

(3) Peak Sound Pressure Level (impulsive or impact noise)

Impact or impulsive noise is a “sharp burst of sound,” such as hammer blows, punch presses, or explosions. Generally, this type of sound is less than one-half second in duration and repeats no more than once per second. Employees should not be exposed to impulsive or impact noise above 140 dBA peak sound pressure level.

b. Noise Control Methods

There are three types of control measures that may be used to limit noise exposures. In preferential order, they are engineering, administrative, and personal protective controls. Engineering controls are generally permanent solutions, whereas administrative controls and personal protective controls require constant monitoring to ensure adequate implementation.

(1) Engineering Controls

Noise control through engineering practice is the preferred control method because it is an attempt to remove the hazard. This allows the sound intensity to be reduced either at the source or in the hearing zone of the worker.

Examples would include:

- replacing worn, loose, or unbalanced parts (e.g., replace mufflers when needed on gasoline engines),
- lubricating machines,
- substituting the machinery or process, or
- using noise dampening material, vibration isolators, compressed air silencers, and acoustical enclosures around noise sources.

(2) Administrative Controls

Administrative noise controls generally reduce employee noise exposures by decreasing the worker's exposure time to high noise levels by work assignment rotation. This approach often exposes more employees to the noise, thereby creating a potentially larger problem.

(3) Personal Protective Controls

Personal Protective Equipment (PPE) should be worn during operations where noise sources cannot be controlled through engineering methods. PPE can act as a barrier between the noise source and the ears, thereby reducing the amount of sound transmitted through the ear canal to the receptors in the inner ear. PPE must be sufficient to reduce employee exposure to an eight-hour time-weighted average of 90 dBA; or 85 dBA, if the employee has experienced a standard threshold shift.

Employees will be given the opportunity to select their PPE from a variety of suitable hearing protectors approved by the Director of Educational Facilities. PPE will be approved based upon the characteristics of the noise source, service life, cost, maintenance requirements of the device, and the noise reduction rating (NRR) established by the Environmental Protection Agency (EPA). Employees should be encouraged to select suitable PPE based upon comfort and ease of care and maintenance. This will help ensure that the hearing protection will be used.

- Types of Personal Protective Equipment (PPE)

  The two most common types of PPE available are earplugs (or inserts) and earmuffs.

- Earplugs

Earplugs are generally inexpensive. Most varieties are designed for one time use and are then discarded.

They are usually made of pliable material which is rolled into a conical shape before being inserted into the ear. It is imperative that adequate fitting instructions be provided to emphasize the importance of a snug fit. Small air leaks in the seal can significantly reduce the amount of attenuation provided by the earplug.

Some of the disadvantages associated with the use of earplugs are:

- ➔ inadequate fit because of the physical shape of the ear canal which precludes the use of insert-type protectors,
- ➔ sensitivity to a particular earplug material, and
- ➔ hygienic purposes, for example, when employees with consistently dirty hands have to insert and remove plugs constantly during the work shift.

- ➢ Earmuffs

  Earmuffs consist of two cup-shaped devices that fit entirely over the ears and seal against the sides of the head with a cushion or pad.

  Sizes and shapes of the ear cups vary by manufacturer. The cups of a properly fitting earmuff should be of the smallest possible circumference that will completely fit around the ear lobes. Otherwise, the slightest pressure on the ear lobe may become painful with time.

  The efficiency of earmuffs is reduced when they are worn over the frames of glasses. When eye protection is required, it is recommended that earplugs be worn.

- ◆ Fitting of Personal Protective Equipment

  Of all the fit tests that have been developed, listening or the occlusion effect is the most applicable and suitable for use with most types of hearing protectors. The occlusion effect causes wearers of PPE to experience a change in their perceived voice quality and other body generated sounds/ vibrations (breathing, chewing, walking, etc.).

  The occlusion effect can be used as a fit test for other plugs or muffs by asking the wearer to count loudly from 1 to 5 while listening for the change in voice quality. This change indicates an acoustical seal and the presence of the occlusion effect. If a poor seal is indicated it can be improved by inserting the plug more deeply into the ear canal or reforming the plug. Muffs are less likely to present a problem with fit; however, selecting a pair of muffs with different sized ear cups should solve the problem.

- Foam Earplugs

  Foam earplugs are prepared for insertion by rolling them into very thin, crease-free cylinders. The cylinders should be as small in diameter as possible, and compressed tightly as possible. Crease-free rolling is accomplished by squeezing lightly when rolling, and then applying progressively greater pressure as the plug becomes more tightly compressed. Be sure to roll the plug into the shape of a cylinder.

  Unlike other types of earplugs, foam earplugs should not be readjusted while in the ear. If the initial fit is unacceptable, they should be removed, rerolled, and reinserted. The deeper the insertion (which for foam earplugs is usually associated with improved comfort), the better the fit and attenuation.

  A test that either the wearer or the fitter can perform to ensure a proper fit, is to remove an earplug after it has expanded in the ear for about a minute. If it was well fitted, the earplug should appear free of creases and wrinkles. The still partially compressed portion of the plug should indicate that at least one-half of its length has extended beyond the entrance of the ear canal and forms a seal within the canal itself.

- Premolded Earplugs

  When initially inserting premolded earplugs, the fitter should be able to easily detect gross errors in sizing. A plug that feels well seated and appears to fit without appreciably stretching the tissues is generally a good fit. When an ear canal falls between two sizes, the larger size plug is not necessarily the better one to choose. Even though the bigger earplugs may provide more attenuation, they may not provide effective protection if they are worn incorrectly or are uncomfortable.

  A properly inserted premolded earplug will generally create a plugged or blocked-up feeling due to the airtight seal. When a seal is present, resistance should be felt if an attempt is made to withdraw the plug from the canal. The seal can be further tested by gently pumping the plug in and out of the ear canal. When a proper seal is present, the pumping motion will cause pressure changes in the ear which the wearer should be able to detect.

  Because of the seal created by properly inserted premolded earplugs, suction is created if they are rapidly removed. This can be uncomfortable, painful, and/or potentially harmful to the ear. Wearers should be instructed to remove plugs slowly. Use a slight twisting or rocking motion to gradually break the seals as the plugs are withdrawn.

- Earmuff Fitting Tips

  Contrary to popular belief, earmuffs are not one-size-fits-all devices. The headband may not extend or collapse enough to fit all head sizes, and cup openings may not properly accommodate all ears. Contours in areas on the wearer's head may be so irregular that the cushions cannot properly seal against the head. Like earplugs, earmuffs must be individually dispensed and checked for fit to acquaint wearers with its features and make sure it is compatible with their anatomy.

  Place the muffs on the wearer's head and make sure that the cups fully enclose the outer ear, without resting on them. Adjust the headband so that it sits comfortably on the head and the cushions feel as though they exert evenly distributed pressure around the ears. Instruct users about the importance of achieving the best possible seal between the earmuff cushions and the side of the head. Caps, other head-worn gear, and excess hair must not interfere with this seal.

c. Audiometric Tests

Audiometric testing is the method used for determining an individual's hearing threshold level and measuring an individual's hearing loss. Audiometric tests are performed by audiologists or technicians who are certified by the Council of Accreditation in Occupational Hearing Conservation (audiologists must be responsible for technicians). The test involves wearing headphones while sitting in a soundproof booth. Each ear is tested individually by playing a series of beeps at different frequencies from about 50 dB to 60 dB. The noise levels are then gradually reduced until the subject can no longer hear the signal. The results of these tests are called "audiograms."

4. Outline of Responsibilities

Described below is a delineation of responsibility for the Monroe 1 BOCES Hearing Conservation Program.

a. General District Responsibilities

Monroe 1 BOCES shall administer a continuing, effective hearing conservation program whenever employee noise exposures are equal to or exceed an eight-hour time-weighted average (TWA) sound level of 85 decibels (85 dBA), otherwise known as the action level. Monroe 1 BOCES shall make audiometric tests available to all employees whose exposures are equal to or exceed the action level. Baseline audiometric tests will be provided within six months of an employee's first exposure to noise at or above the action level. Subsequent tests shall be performed annually.

b. Genesee Valley educational Partnership Environmental Health and Safety Office

The Environmental Health and Safety Office will:

(1) Obtain noise level measurements for employees at the request of supervisors and during general surveys to identify those employees who may be exposed at or above the action level. These measurements can be performed either by area monitoring or by personal monitoring, whichever is more representative of the employee's exposure. Circumstances such as high worker mobility and significant variations in sound level generally make area monitoring inappropriate. In such cases, representative personal monitoring will be used unless it can be shown that area monitoring produces equivalent results.

Monitoring will be repeated whenever an alteration in process, production equipment, or controls may change noise exposure to the extent that:

- additional employees may be exposed at or above the action level,
- hearing protection may be rendered inadequate, or
- a decrease in noise exposure occurs.

(2) Upon request from supervisors, approve a selection of hearing protection equipment which will attenuate employee exposure to at least an eight-hour TWA of 90 dBA, and to 85 dBA for employees who have experienced a standard threshold shift.

(3) Contract with an outside contractors to provide audiometric testing for employees who have average noise level exposures equal to or above an eight-hour TWA of 85 dBA. Baseline audiometric examinations will be

provided to employees assigned to areas or crafts which are at or above 85 dBA within six months of exposure at no cost to the employee.

(4) Obtain annual records regarding audiometric test rooms, instrument calibration, and background sound pressure levels from the District's contracted audiometric testing services.

(5) Periodically review/analyze the audiometric data bases in consultation with the contracted medical services to determine the effectiveness of the program.

(6) Distribute, upon request, noise monitoring and audiometric test records to employees, former employees, employee representatives, and any authorized representative of OSHA.

(7) Upon request from supervisors, provide annual training for employees who are exposed to noise levels greater than or equal to eight-hour TWA of 85 dBA. The training program shall include:

- the effects of noise on hearing,
- the purpose of hearing protection, including advantages, disadvantages, and capabilities of various types of PPE,
- instruction on the selection, fitting, use, and care of hearing protectors,
- the purpose of audiometric testing, including an explanation of the test procedures, and
- access to information and training materials.

c. Supervisors

Maintain noise monitoring records for at least two years, and audiometric testing and training records for the duration of employment.

Schedule tests for employees who have average noise level exposures equal to or above an eight-hour TWA of 85 dBA. Baseline audiometric examinations will be provided to employees assigned to areas or crafts which are at or above 85 dBA within six months of exposure at no cost to the employee.

Fourteen hours prior to the examination, employees may not be exposed to noise levels above 80 dBA. Hearing protection may be worn to ensure low noise levels. In those cases where a standard threshold shift is detected, the tests will be reviewed by the contracted medical services to determine if further evaluation is necessary. Also, the employees will be informed in writing within 21 days of the test results.

If subsequent audiometric testing of an employee (whose eight-hour TWA is less than 90 dBA) reveals that a standard threshold shift is not present, the employee will be so informed, and may discontinue the required use of hearing protectors.

Upon receipt of noise monitoring results from the Environmental Health and Safety Office, the supervisor shall inform those employees exposed at or above the action level (eight-hour TWA of 85 dBA) of the results.

Supervisors shall perform periodic visual inspections to ensure that approved personal protective equipment (PPE) are worn whenever any of the following scenarios occur:

- noise exposures at or above an eight-hour TWA of 90 dBA,
- noise exposures at or above an eight-hour TWA of 85 dBA,
- employee(s) has not had a baseline audiogram, or
- employee(s) has experienced a standard threshold shift.

Supervisors shall notify the Environmental Health and Safety Office of changes in processes, production, equipment, controls, or job assignment which may increase or decrease existing high noise levels.

Supervisors shall notify the Environmental Health and Safety Office of new employees assigned to areas or crafts which have been identified to be at or above 85 dBA, and should be included in the Hearing Conservation Program.

d. Employees

Employees shall participate in a training program if their noise exposure exceeds an eight-hour TWA of 85 dBA.

Employees shall wear approved hearing protection whenever noise levels:

- equal or exceed an eight-hour TWA of 90 dBA, or
- equal or exceed an eight-hour TWA of 85 dBA, and a baseline audiogram has not been performed, or a standard threshold shift has been determined.

Employees shall periodically inspect the condition of their personal protective equipment for wear, e.g., hard, cracked, or creased parts.

GLOSSARY

Action Level:	An eight-hour time-weighted average of 85 decibels measured on the A-weighted scale, slow response, or equivalently, a dose of fifty percent.
Attenuation:	The process of lessening or weakening a perceived noise level through a variety of control measures.
Audiogram:	A chart, graph, or table showing an individual's hearing threshold level as a function of frequency.
Audiometric Test:	A method of producing an audiogram to determine hearing threshold level or measure hearing loss.
Baseline Audiogram:	The audiogram against which future audiograms are compared.
Continuous Noise:	Noise of approximately constant level and spectrum. If noise exhibits peaks of one second or less, the noise may be considered continuous.
Decibel (dB):	Unit measurement of sound level.
dBA (Decibel A-Weighted):	A unit measurement of sound level which is filtered or weighted in a similar manner as the response of the human ear.
Hertz:	A measurement of frequency, the number of pressure vibrations per second, or numerically equal to cycles per second.
Impact Noise:	Peak variations of noise levels at intervals of one second or more. Exposure to impact noise should not exceed 140 dB peak sound pressure level.
Impulsive Noise:	Noise comprised of transient pulses that can occur repetitively such as a jackhammer. Exposure to impulsive noise should not exceed 140 dB peak sound pressure level.
Noise:	Unwanted sound.
Noise Reduction Rating (NRR):	A numerical value which indicates the noise reduction (in dBA) that a particular hearing protection device affords.

OSHA:	Occupational Safety and Health Administration, the governmental agency responsible for enforcing health and safety regulations in the public and private sector.
Personal Protective Equipment (PPE):	Devices such as earplugs and earmuffs which reduce user sound exposures when properly worn.
Representative Exposure:	Measurements of an employee's eight-hour time-weighted average sound level which the employer deems to be a representative exposure of other employees in the workplace.
Sound Pressure:	The minute fluctuations in atmospheric pressure that accompany the passage of a sound wave; the pressure fluctuations on the tympanic membrane are transmitted to the inner ear and give rise to the sensation of audible sound.
Standard Threshold Shift:	A change in the hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2,000, 3,000, and 4,000 hertz in either ear.
Time-Weighted Average (TWA):	An employee's noise level exposure as measured or calculated during the workday.