I love what I hear!

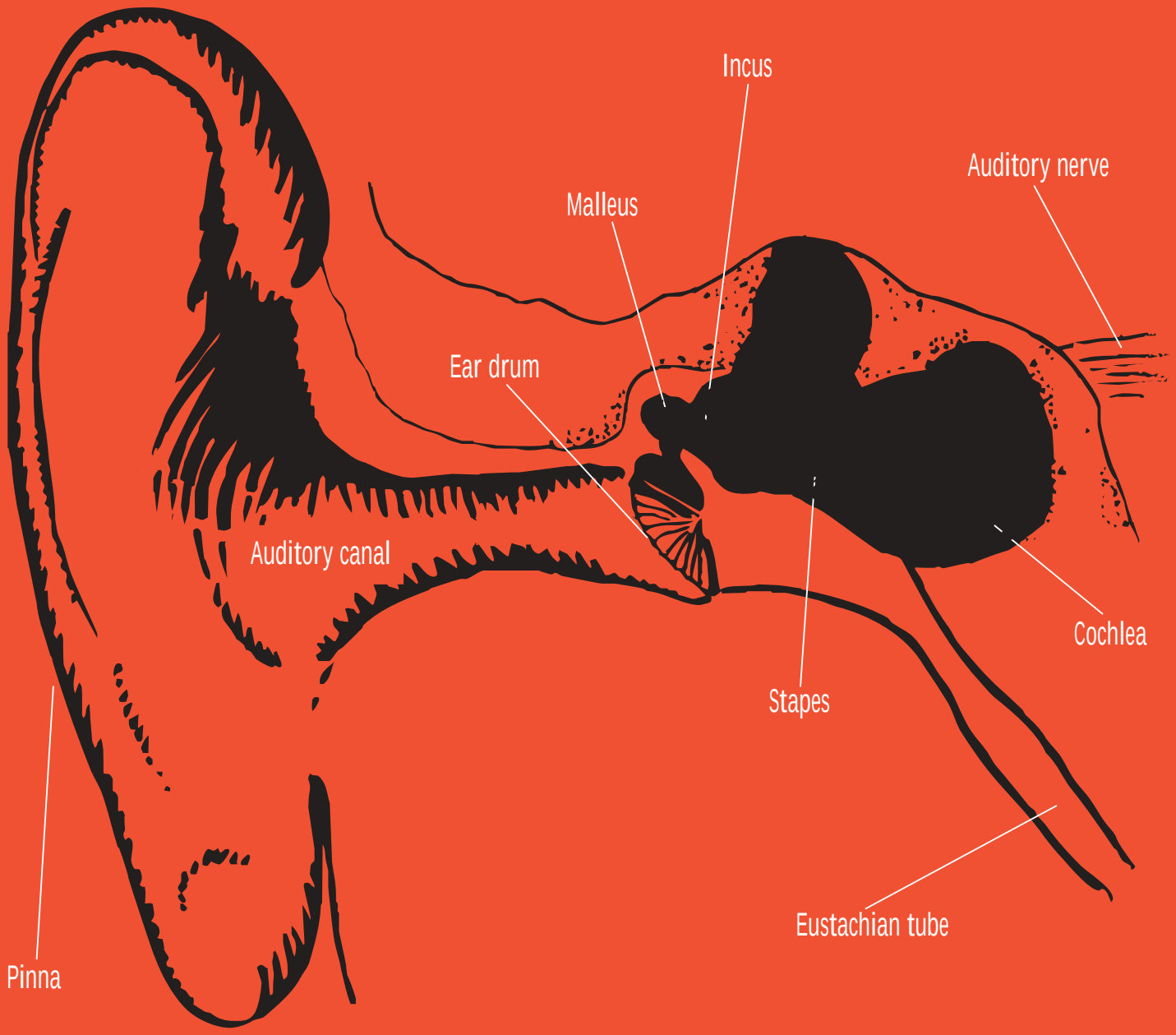
A Web site and teacher's guide
for grades three through six

TEACHERS:

All materials for Web and classroom materials may be duplicated for educational use.

PLEASE COPY

Nearly 10 million Americans have hearing problems resulting from living and/or working in noise-polluted environments. Experts estimate that 30 million Americans are regularly exposed to noise that can result in hearing loss. The activities in this booklet are designed to be used by teachers with children in grades three through six. They may be adapted easily for use with older and younger students. Several are helpful in building awareness in children of the importance of hearing conservation and of the problem of noise-induced hearing loss. Others may be used to introduce and reinforce scientific understanding of hearing and the science of sound. Still others are meant to provide opportunities for children to influence the awareness and understanding of others. All of the activities have been used successfully in classroom settings.


Incus
Auditory nerve
Malleus
Ear drum
Auditory canal
Cochlea
Stapes
Eustachian tube
Pinna

VEL INSIDE THE EAR VIDEO
www.nidcd.nih.gov/health/kids/video/travel_vid.htm

HOW DO WE HEAR?

Hearing depends on a series of mechanical events that transform sound waves in the air into electrical impulses in the nerves which are then carried to the brain.

Sound waves first enter the ear through the fleshy, cup-like portion of the outer ear which collects sound and funnels it towards the brain.

These sound waves then travel a few centimeters down the auditory canal, the pathway to the middle ear, before striking the delicate tympanic membrane, commonly known as the ear drum.

This thin, skin-covered membrane, which separates the external and middle sections of the ear, vibrates with incoming sound waves and transmits these vibrations to three tiny bones in the middle ear, collectively referred to as the ossicles. The ossicles amplify ear drum vibration and carry them to the inner ear.

More amazing than this smooth transition of sound waves is the size of the ear's high-fidelity equipment. For example, the three bones of the ossicles—the malleus, incus and stapes (or the hammer, anvil and stirrup)—are spectacularly small and fit into an area the size of an orange seed.

The third bone of the ossicles, the stirrup-shaped stapes, transmits the amplified vibrations through the oval window and into the fluid that fills the inner ear.

The final destination for sound vibrations is the snail-shaped cochlea. The fluid-filled cochlea coils about itself three times and contains the organ of Corti, named after the Italian scientist who first described it. It is in the hair cells of the organ of Corti that sound energy is transformed to electrical nerve impulses.

Hair cells are special sensory hearing cells fringed with fine hairs that stick up into the fluid of the inner ear. The vibrations in the fluid move these hairs and trigger internal changes in the sensory cells that lead to the production of electrical signals.

Finally, the hearing or auditory nerve carries electrical signals to the brain.

In summary, sound waves are funnelled into the outer ear and amplified in the middle ear. Sound waves are then carried through the oval window and into the fluid of the inner ear. Waves of fluid of the inner ear, in turn, move the ultrasensitive hair cells. Sounds of different frequencies and intensities move the hair cells in slightly different ways, thus allowing the brain to differentiate between sounds.

MORE THAN 28 MILLION AMERICANS ARE DEAF OR HARD-OF-HEARING

T IS SOUND? VIDEO
www.nidcd.nih.gov/health/kids/video/sound_vid.htm

OUD IS TOO LOUD? VIDEO
www.nidcd.nih.gov/health/kids/video/loud_vid.htm

THE EAR

A. Using a diagram or model of the ear, teach the students the names and functions of the parts of the ears. Students may be asked to make a model of the ear using everyday materials.

B. Using a corkboard, cardboard or plywood, construct a jigsaw puzzle of the parts of the ear.

"CELEBRATION OF SOUND" DAY

Sponsor an assembly and invite an audiologist or speech-language pathologist from the local Speech-Language Association to discuss "hearing" and "communication."

- Invite an audiologist to do hearing screenings.
- Display a model of the ear, either commercial or made by students, with a written explanation of how it works.
- Display earplugs and hearing aids with explanations.
- Display a chart of "Hearing Conservation Pointers."

THE LISTENING WALK

Part One—Announce to the class that they will be taking a walk around the school, around the block, or in the school building. With no further instructions, proceed briskly. Return to the classroom and ask students to make a list of all the sounds they heard during the walk.

Part Two—Repeat the walk, but this time with the students instructed to listen for and remember all the sounds they hear on the walk. Return to the classroom and make a second list. Compare (see handout on page 11).

UNDERSTANDING SOUND—THE SCIENCE CONNECTION

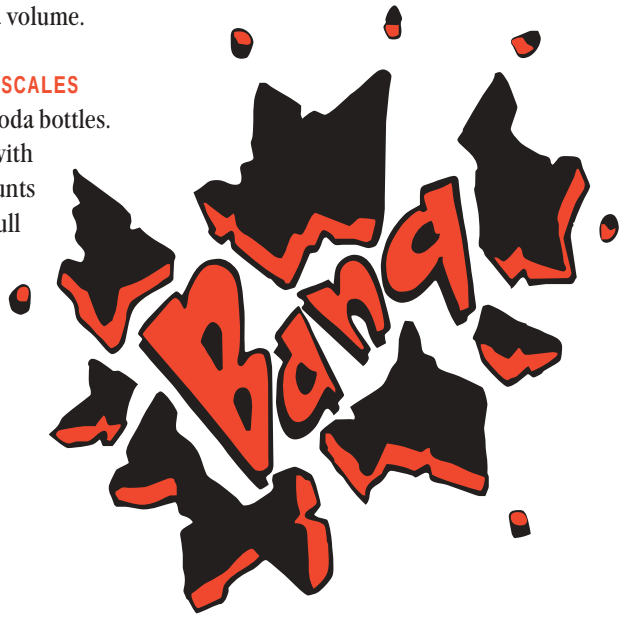
Students may participate in a sequence of lessons which demonstrate what sound is and how it works. Lessons could include activities on what causes sound, how sound carries, and how to create pitch and volume.

SODA BOTTLE SCALES

Collect 8 glass soda bottles. Fill the bottles with graduated amounts of water, from full to empty. Demonstrate pitch by blowing across the top of the bottles or by striking them with a metal rod or a pencil.

SPEED OF SOUND

Take the class to the playground or to a large open area. Using a cymbal, a bass drum, a metal garbage can lid or any large object that will generate sound when struck, position the class a distance from the noise producer (a student



with a stick). As the object is struck, direct the students to move backward and pay attention to the difference between what they see and what they hear.

VIBRATING RULERS

Place a ruler on a desk or table so that part of it hangs over the edge. Push down on the overhanging end of the ruler and release quickly. Listen for the sound. By adjusting the amount of overhang, the pitch is changed. By increasing and decreasing the pressure, volume or loudness is changed.

TUNING FORK TRICKS

Using a tuning fork and a sound box, desk top or table top, demonstrate the relationship between vibrations and sound. Strike the tuning fork on the palm of the hand and place it on the sound box or desk top. Ask children to place their hands on the surface and feel the vibrations. As an alternative, the tuning fork can be struck and placed in a container of water.

HEARING PROTECTION NEWSLETTER

Students may be interested in producing a classroom newsletter or newspaper for parents, teachers, and other students using the theme "protecting your sense of hearing." Jobs to be assigned might include reporting, illustrating, layout, promotion, advertising, and distribution.

TRIVIAL PURSUIT

Have students create a Trivial Pursuit category entitled "Noise-Induced Hearing Loss." Divide the class into two teams. Each team member must submit a card with six questions and the answers to each question. Play as a board game or in "spelling bee" style.

TEACHER-MADE WORD GAMES

Following presentation and discussion of content about "Hearing Loss and the Environment," teachers may create crossword puzzles or word searches for students to complete. Children may be teamed and timed in doing the puzzle or word search as a competitive activity.

HEARING TESTING

Invite an audiologist to demonstrate the functions and uses of an audiometer. Hearing screening may be explained and discussed.

POSTER CONTEST

As a classroom-vs-classroom, individuals within a classroom or as a school-wide event, have students design, draw, color or paint a poster of a scene which depicts an environmental noise pollution "danger." The posters should be captioned with an appropriate title or "slogan" warning against the dangers of noise pollution.

THIRTY MILLION AMERICANS

ARE REGULARLY EXPOSED TO

NOISE THAT CAN RESULT IN

HEARING LOSS.

NOISE POLLUTION DETECTIVE-TELEVISION SHOWS

Ask students to pick a television program and be a "Noise Pollution Detective." Students should list or chart situations or environmental sounds that they feel could cause hearing loss. Lists could be combined and used to design a wall chart.

Videotape a thirty-minute segment from MTV or VH1 during which a heavy metal band is featured. View the tape and have students develop a list of examples of "poor hearing conservation."

Using the list of examples of "poor hearing conservation" developed from viewing heavy metal bands, have students write letters to the musical groups to inform them of the hazards and to provide them with a list of alternatives.

HEARING HAZARDS COLLAGE

Either as an individual or group activity, students may create a collage of pictures from magazines which represent situations with potential for causing noise-induced hearing loss.

ENVIRONMENTAL NOISE POLLUTION BULLETIN BOARD

Have students select stories, headlines and pictures of current events from newspaper which can be used to create a bulletin board featuring everyday examples of environmental noise pollution.

PUBLIC SERVICE ANNOUNCEMENTS

Have students create a series of one-minute Public Service Announcements (PSAs) about causes of hearing loss and alternative practices to prevent this loss. Students can practice reading their PSAs, recording them and presenting them to classmates. These PSAs can be presented as part of the "morning or afternoon announcements" in the school. Arrangements could also be made for their use on local radio stations.

POETRY ANTHOLOGY

Have students write poems about the causes of "noise-induced" hearing loss and/or ways that people can use safer hearing practices. Results can be edited and collected into a class or school anthology. Selected poems could be published in the school newspaper.

NOISE POLLUTION TRIAL

Have students write a script and cast their own video of a student on trial for creating his own hearing loss. His defense is based on the reasoning that "the environment and society made it happen." Cast may include judge, lawyers and witnesses. Witnesses can represent a variety of "environmental sounds." Other students constitute a jury. The verdict may be used as the beginning point for general discussion.

HEARING CONSERVATION RAP

Have students write and produce their own "rap" video about "good hearing conservation." Costuming, choreography, taping and other production activities should be done by students. Other classes may be invited to view the final taped production.

Common sounds

SOUND	NOISE LEVEL(dB)	EFFECT
Boom Cars	145	
Jet Engines (near)	140	
Shotgun Firing	130	
Jet Takeoff (100-200 ft.)	130	
Rock Concerts (varies)	110-140	Threshold of pain begins around 125 dB
Oxygen Torch	121	
Discotheque/Boom Box	120	Threshold of sensation begins around 120 dB
Thunderclap (near)	120	
Stereos (over 100 watts)	110-125	
Symphony Orchestra	110	
Power Saw (chainsaw)	110	Regular exposure to sound over 100 dB of more
Pneumatic Drill/Jackhammer	110	than one minute risks permanent hearing loss.
Snowmobile	105	
Jet Flyover (1000 ft.)	103	
Electric Furnace Area	100	No more than 15 minutes of unprotected exposure
Garbage Truck/Cement Mixer	100	recommended for sounds between 90-100 dB.
Farm Tractor	98	
Newspaper Press	97	
Subway, Motorcycle (25 ft)	88	Very annoying
Lawnmower, Food Blender	85-90	85 dB is the level at which hearing damage
Recreational Vehicles, TV	70-90	(8 hrs.) begins
Diesel Truck (40 mph, 50 ft.)	84	
Average City Traffic	80	Annoying; interferes with conversation;
Garbage Disposal	80	constant exposure may cause damage
Washing Machine	78	
Dishwasher	75	
Vacuum Cleaner, Hair Dryer	70	Intrusive; interferes with telephone conversation
Normal Conversation	50-65	
Quiet Office	50-60	Comfortable hearing levels are under 60 dB.
Refrigerator Humming	40	
Whisper	30	Very Quiet
Broadcasting Studio	30	
Rustling Leaves	20	Just audible
Normal Breathing	10	
		The threshold of normal hearing starts at about 1000 to 4000khz.

Since the sensitivity of the ear to sound is not the same for all frequencies, weighting or attenuating filters are included in the sound level meter's circuits to simulate the ears' response. A noise level meter finds an instantaneous measurement of the noise present, but cannot measure the duration of the exposure. To measure the amount of noise a person is exposed to over a period of time, a "dosimeter" or an integrated sound level meter must be used. Sources for above include the American Medical Association and the Canadian Hearing Society of Ontario. Decibel table developed by the National Institute on Deafness and Other Communication Disorders, National Institutes of Health, Bethesda, Maryland 20892. January 1990.

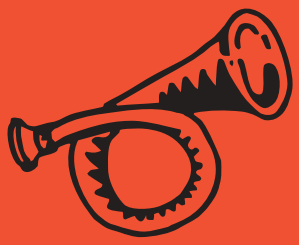
THIS DECIBEL (dB) TABLE COMPARES SOME COMMON SOUNDS AND SHOWS HOW THEY RANK IN POTENTIAL HARM TO HEARING.

IN MANY INDUSTRIES, WORKERS ARE EXPOSED TO DANGEROUS NOISE LEVELS. THIS IS PARTICULARLY TRUE IN THE CONSTRUCTION, LUMBER, MINING, STEEL AND TEXTILE INDUSTRIES.

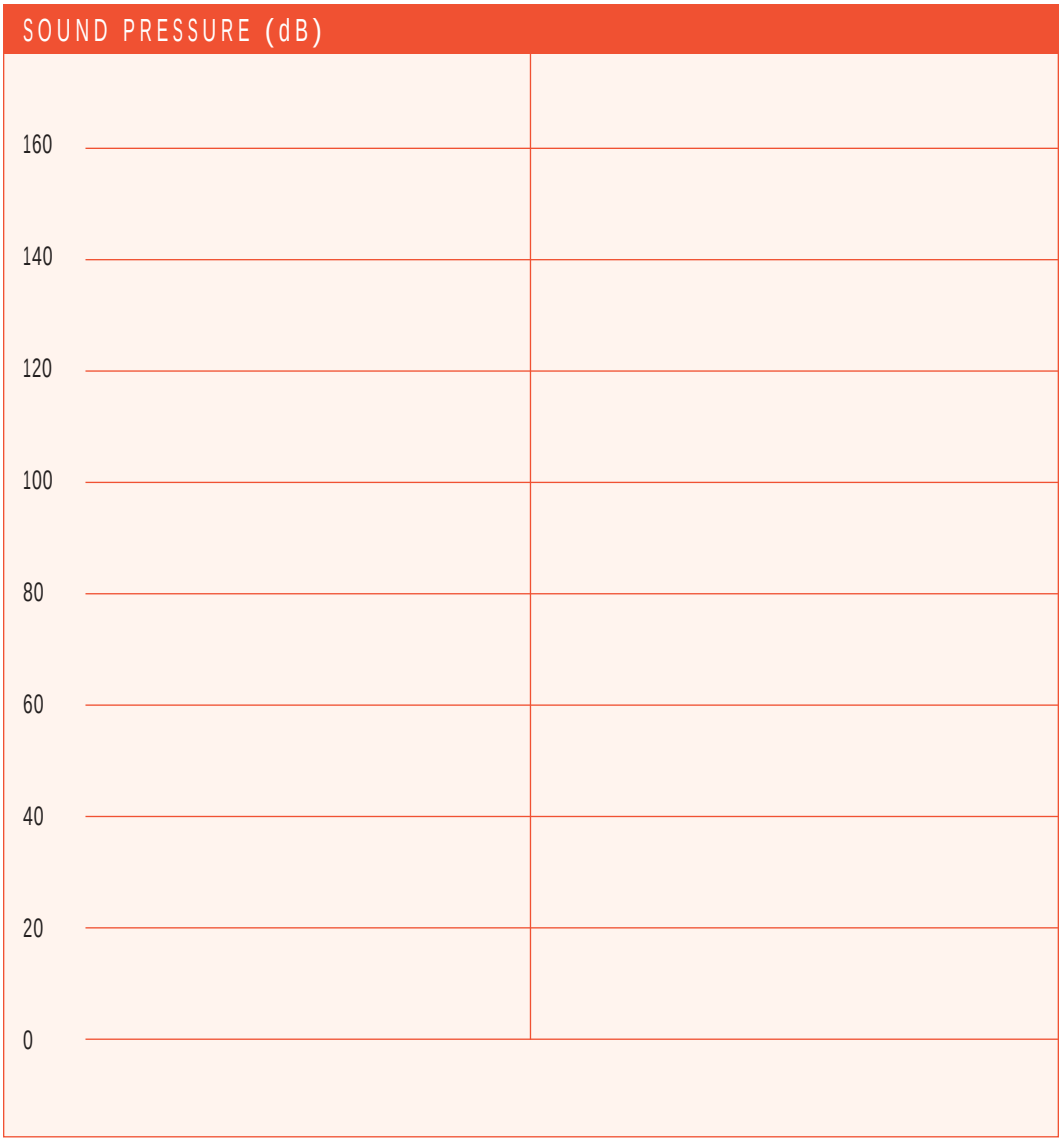
DO YOU STILL HAVE QUESTIONS?

ASK THE SCIENTISTS
www.nidcd.nih.gov/health/kids/ask_dr/ask_dr1.htm

OR LOOK AT ANSWERS TO SOME QUESTIONS
OTHERS HAVE ASKED
www.nidcd.nih.gov/health/kids/owlgame/owl.html



Simple sound chart and separate shapes



Y HAND OUTS

www.nidcd.nih.gov/health/kids/decible/decible.html

COMMON SOUNDS: DRAW AND PLACE THE FOLLOWING

Jet Airplane	Airport	Normal Conservation
Helicopter	Cafeteria	Car Horn
Fire Siren	Heavy Traffic	Quiet Neighborhood
Ambulance	Office Machinery	Humming
School Dance (DJ)	Small Party	Whispered Voice

Simple sound chart with answers

COMMON SOUNDS: ANSWERS

Jet Airplane (160 dB)
Helicopter (150 dB)
Fire Siren (140 dB)
Ambulance (130 dB)
School Dance (DJ) (120 dB)
Airport (110 dB)
Cafeteria (100 dB)
Heavy Traffic (90 dB)
Office Machinery (80 dB)
Small Party (70 dB)
Normal Conservation (60 dB)
Car Horn (50 dB)
Quiet Neighborhood (40 dB)
Humming (30 dB)
Whispered Voice (20 dB)

Listening walk: list the sounds that you remember below

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

NATIONAL INSTITUTE ON DEAFNESS AND OTHER COMMUNICATION DISORDERS (NIDCD)

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Bethesda, MD 20892-2320
301-496-7243 [voice]
301-402-0252 [TTY]
nidcdinfo@nidcd.nih.gov [e-mail]
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AMERICAN ACADEMY OF AUDIOLOGY (AAA)

8300 Greensboro Drive, Suite 750
McLean, VA 22102
703-790-8466 [voice/TTY]
800-222-2336 [Toll free]
info@audiology.org [e-mail]
www.audiology.org

AMERICAN ACADEMY OF OTOLARYNGOLOGY-HEAD AND NECK SURGERY (AAO-HNS)

1 Prince Street
Alexandria, VA 22314
703-836-4444 [voice]
703-519-1585 [TTY]
webmaster@entnet.org [e-mail]
www.entnet.org

AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION (ASHA)

10801 Rockville Pike
Rockville, MD 20852
301-897-5700 [voice/TTY]
800-638-TALK [Toll free]
actioncenter@asha.org [e-mail]
www.asha.org

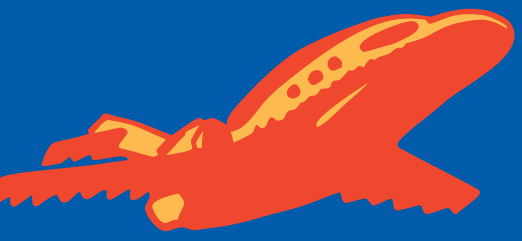
FOR MORE INFORMATION
on noise-induced hearing loss prevention contact the coalition of more than 80 organizations, WISE EARS!sm

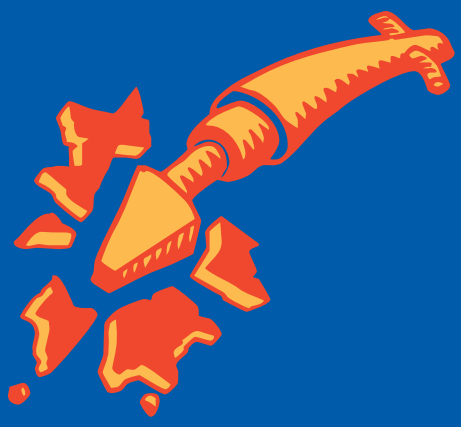
The National Institute on Deafness and Other Communication Disorders (NIDCD), in partnership with the National Institute of Occupational Safety and Health (NIOSH), are joined by a coalition of national, regional, and local organizations, voluntaries, and state and local government agencies in a national campaign to prevent noise-induced hearing loss.

For tons of good material just follow dB the WISE EARS!sm owl . . .

www.nidcd.nih.gov/health/wise

This curriculum material was prepared by the Office of Health Communication and Public Liaison of the National Institute on Deafness and Other Communication Disorders, National Institutes of Health, 31 Center Drive, MSC 2320 Bethesda, MD 20892-2320. 301-496-7243.





FOR MORE INFORMATION

WRITE TO:

NIDCD Information Clearinghouse
1 Communication Avenue
Bethesda, MD 20892-3456

A Public Education Program and Guide from the National Institute on Deafness and Other Communication Disorders.