

THE MONTHLY NEWS MAGAZINE OF THE NATIONAL BUREAU OF STANDARDS

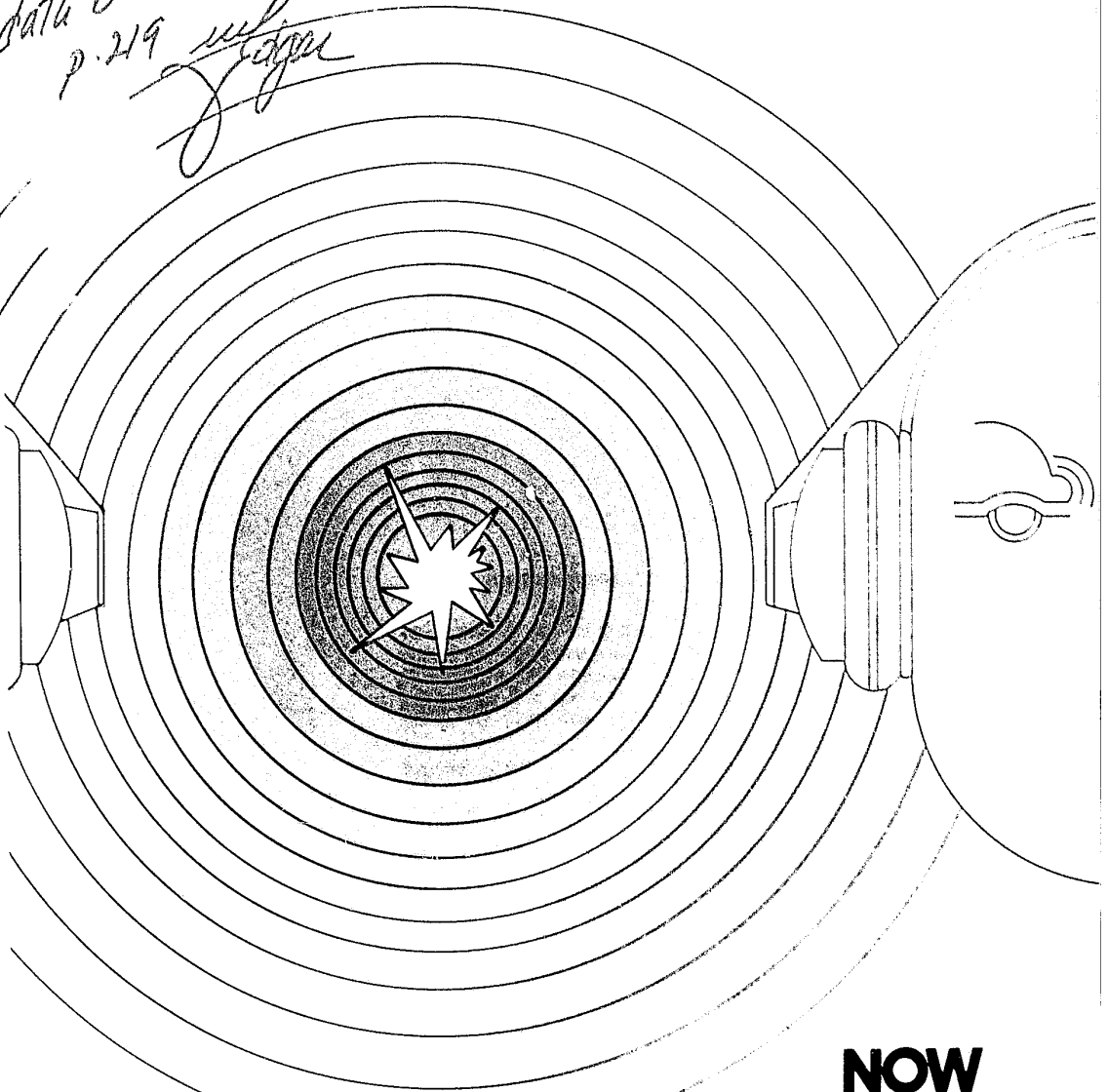
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**NOW
HEAR
THIS!**

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NATIONAL BUREAU OF STANDARDS
Ernest Ambler, Acting Director

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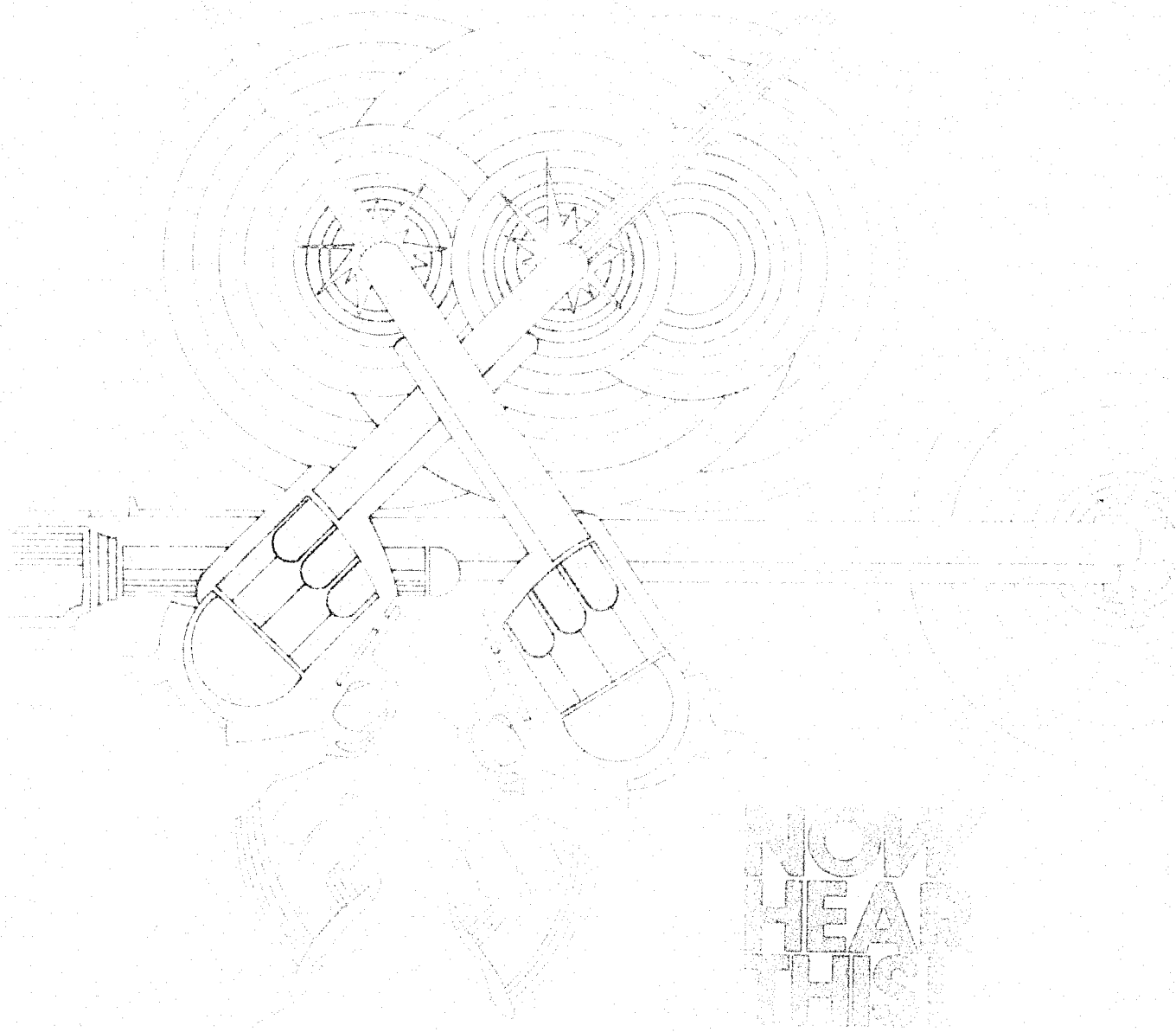


The National Bureau of Standards serves as a focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. For this purpose, the Bureau is organized as follows:

- The Institute for Basic Standards
- The Institute for Materials Research
- The Institute for Applied Technology
- The Institute for Computer Sciences and Technology
- Center for Radiation Research
- Center for Building Technology
- Center for Consumer Product Technology
- Center for Fire Research

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PROTECT
YOUR EARS
OR DON'T
SHOOT

Ears (continued)

monly used firearms menace unprotected ears with severe trauma that can result in temporary or permanent deafness. This conclusion remains firm regardless of individual differences in hearing damage susceptibility and is based on criteria established by responsible government agencies.

Hearing protection is called for under the Occupational Safety and Health Act (OSHA) for any private industry or Federal workers who are even momentarily exposed to noise levels exceeding 140 decibels (dB). (The decibel is most commonly used to express sound pressure levels. In terms of human hearing, 0 decibels represents the threshold of hearing. For various kinds of home appliances, lawn care, and shop tools, the sound pressure level may approach 80 dB. At a rocket launching, the level is about 180 dB. OSHA requirements begin at 90 dB.

Last year, the Environmental Protection Agency (EPA) recommended lowering by 12 dB a 1968 proposed Damage-Risk Criterion (DRC) for daily exposure to gunfire noise. The criterion, drafted by the Committee on Hearing, Bioacoustics and Biomechanics (CHABA) of the National Academy of Sciences-National Research Council, proposes maximum safe peak pressure levels, in dB, for noise impulses of a given duration. Above the DRC maximum level, hearing protectors should be worn.

That gunfire noise is characteristically too loud for hearing safety has been demonstrated in research sponsored by the National Institute of Law Enforcement and Criminal Justice, Department of Justice.

Working with weapons ranging from 9 mm automatics to 12 gauge shotguns, physicists Pearl G. Weissler

The police, including the author, practice gunnery in a sound-proof booth at the FBI's training center. The noise level is controlled by the booth's acoustics.

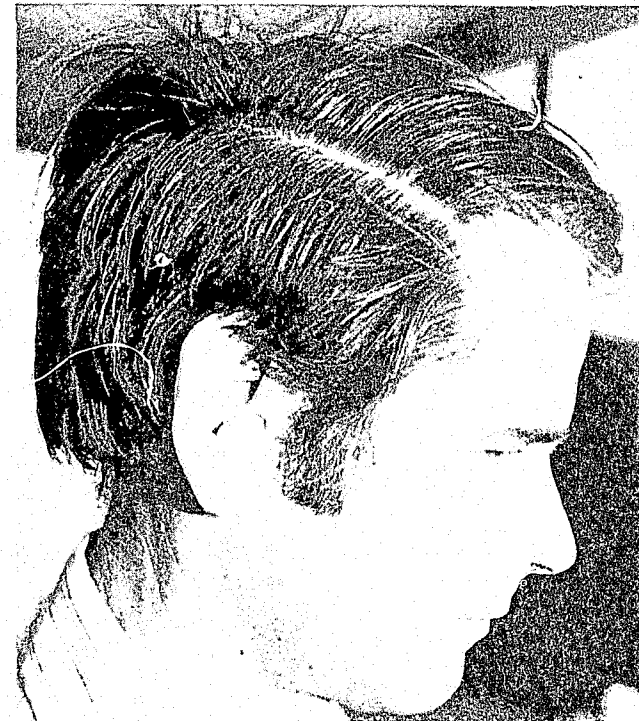


and Michael T. Kobal of the National Bureau of Standards, in a series of laboratory and firing range experiments, measured and compared peak pressure levels and signal durations with OSHA, CHABA, and EPA criteria. The Weissler-Kobal team, from the NBS Sound Section, Institute for Computer Sciences, concluded:

... that on an indoor firing range, with sound-absorbing booths for each snooter, the noise output of all the guns . . . except the caliber .22 rifle . . . exceeds the CHABA Basic DRC, while the noise output of all the firearms tested exceeds the EPA [maximum] levels. In more reverberant firing ranges, the noise output of the caliber .22 rifle also exceeds the CHABA Basic DRC."

On these findings Weissler and Kobal based their strong recommendation for "use of hearing protectors for all indoor and outdoor practice shooting with the possible exception of the caliber .22 rifle when outdoors and far from buildings and reflecting surfaces with no other shooter present."

What kind of hearing protectors? Ronald C. Dobbyn, protective equipment program manager for the NBS Law Enforcement Standards Laboratory (LESL), with LESL Chief Jacob J. Diamond, has directed the preparation of a *Selection Guide to Hearing Protectors for Use in Firing Ranges*. This user guideline is to be published by the Justice Department's Law Enforcement Assistance Administration



(LEAA) through LEAA's National Institute of Law Enforcement and Criminal Justice.

In view of the ever-present danger of temporary or permanent hearing damage that gunfire noise presents, the LESL specialists emphatically declare that there is no substitute for good hearing protectors. The cost is negligible when compared with the cost of potential deafness to the individual.

All high-risk groups—including law enforcers, the military, hunters, and target-shooting sports competitors—should know the basic types of available hearing protectors and choose wisely among them to meet personal requirements. Where gunfire noise is a regular part of one's routine, its

sound pressure cannot ordinarily be reduced to safe levels by sound-proofing of walls or similar expedients. Nor is the use of gun silencers an option, since it is illegal to silence any gun. Hearing protectors represent the only practical approach. More than 30 U.S. manufacturers market earplugs, earmuffs, and helmets as hearing protectors. Plugs and muffs are most popular; helmets may be regarded simply as a special kind of muff.

Industrial noise experts have listed advantages and disadvantages of various hearing protection devices. For example, earplugs are easily carried and stored, but they can just as easily be left in the "other" suit of clothes, lost from a pocket, or dropped while

being placed in the ear. Ear canals vary in diameter (from about 3 to 14 mm) and left and right canals may not be the same size or shape—the same individual may actually require differently designed plugs for each ear. As an alternative, one may use putty-like formable plugs that change their contours to fit any ear canal, but such plugs require frequent replacement. Earplugs can be used with glasses, earrings, any hair style, and any type of hat without affecting their performance. But they should be worn only in "healthy" ears. Properly seated earplugs cannot be seen at a distance. Supervisors must be trained to recognize the appearance of a properly seated earplug at a glance.

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NBS, ERDA Sign Agreement on Energy R&D

THE National Bureau of Standards and the Energy Research and Development Administration (ERDA) have signed a Memorandum of Understanding calling for interagency cooperation to enhance the national energy research and development effort.

The Memorandum of Understanding was signed on September 16, 1975, by Dr. Robert W. Fri, Deputy Administrator of ERDA, and Dr. Ambler, Acting Director of NBS.

Under terms of the agreement, ERDA and NBS management will identify specific problems related to physical measurements and standards in energy research and development which can be undertaken by NBS in support of ERDA programs.

In carrying out its responsibility for planning, developing, and coordinating a vigorous national program in energy research and development, ERDA will use the Nation's most capable scientific, engineering, and management resources in the public, private, and university sectors of the economy.

In signing the Memorandum of Understanding, NBS Acting Director Ambler noted that although ERDA will be using the technical capabilities of a number of Federal agencies, "NBS has a particularly important role to play in helping to solve the energy problems that we as a nation face today. As the Nation's largest physical science and measurement laboratory, NBS scientific and engineering personnel are engaged in the development of national standards of measurement, the determination of physical constants and properties of materials, and the development of methods of testing."

Ambler noted that these capabilities will be used by ERDA in three ways:

1. *Research and Technology.* NBS will conduct energy-related scientific and technical research at its laboratories in specific fields such as radioactivity standards; nuclear fuel measurements; atomic, molecular, and nuclear data for controlled thermonuclear research; materials evaluation for energy conversion systems; and energy conservation.

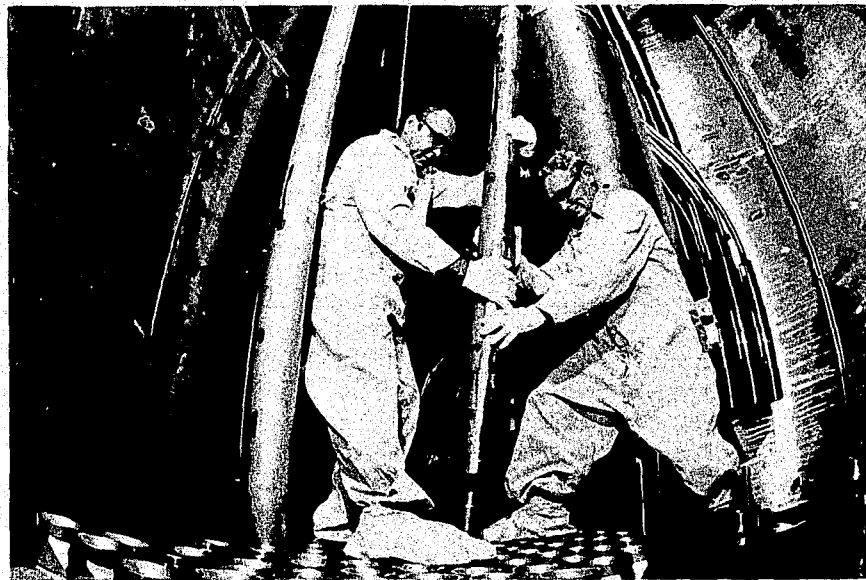
2. *Programs and Projects.* NBS will recommend to ERDA specific technological developments in the fields of standards, measurement methods, and technical data which would contribute to the successful attainment of ERDA program goals.

3. *Technical Advice.* NBS may be called upon by ERDA for technical advice in the evaluation of energy research and development programs,

plans, and proposals.

Program coordinators for each agency will be designated to provide continuing liaison between the two agencies and to implement the Memorandum of Understanding. The coordinators will develop Interagency Agreements providing the operational and management guidelines and covering the specific programs or projects necessary to implement the Memorandum of Understanding.

In addition, each year the coordinators will conduct a joint review of NBS work in support of ERDA programs and develop plans for future efforts. Following such annual review, the Administrator of ERDA and Acting Director of NBS will provide guidance on the scope of NBS work for ERDA in light of ERDA energy R&D strategies and NBS plans. □



The field of nuclear fuel measurements is one of several areas to be addressed by NBS research under a new NBS/ERDA agreement. Shown above, fuel elements are placed in the core of a reactor.

Ears continued

With earmuffs, there are no complex fitting problems since one size fits most adults. On the other hand, earmuffs are bulky and can't fit in a pocket. They may not fit properly when glasses, hearing aids, or other personal items are worn. But they can be worn in spite of minor ear infections. In the winter they are warm and comfortable, but in warm weather heat and perspiration can make them distinctly uncomfortable. Earmuffs are harder to wash than earplugs. When used by groups on the firing range, earmuffs can be seen at a distance and supervisors can readily tell whether all the shooters are wearing protectors.

Cost comparisons indicate that plugs are less expensive than muffs, but if disposable plugs are used frequently they can be more expensive than muffs in the long run.

The overriding consideration in selecting and using hearing protectors is to make sure that the protector provides a good seal when placed in or over the ear. Hearing protectors made from the best noise attenuating materials would not be a good choice if some other factor, such as comfort or the need to wear eyeglasses, prevented one from obtaining an effective seal.

On questions of durability, cleanliness, comfort, and price, the individual obviously has personal choices to make. Through judicious selection, everyone needing hearing protection on the firing range can readily obtain it at reasonable cost. To go without protection, on the other hand, would involve risking a most unreasonable cost—partial or total deafness, developing gradually but probably irreparably over a period of time. □

NOISE OF POPULAR FIREARMS MEASURED

In an effort to provide guidelines for law enforcement personnel to protect their hearing, the peak pressure level and signal duration of various popular firearms were measured by Pearl G. Weissler and Michael T. Kobal of the National Bureau of Standards. Results were compared with requirements of the Occupational Safety and Health Act (OSHA) of 1970, damage-risk criteria (DRC) of the Committee on Hearing, Bioacoustics and Biomechanics (CHABA), and levels established in 1974 by the Environmental Protection Agency (EPA).

Small condenser microphones and a storage oscilloscope were used to record the blast wave signature from a 9 mm automatic, a caliber .357 Magnum revolver, a caliber .41 Magnum revolver, a

caliber .22 revolver, a caliber .45 automatic, a caliber .44 Magnum revolver, a 12 gauge shotgun, and a caliber .22 rifle.

Measurements were made at the ear of the person shooting and at the approximate position of a neighbor at a firing range. Some measurements were also made at a practice firing range. A portable tape recorder was found useful for recording gun signals and measuring durations. It was found that in an anechoic environment the noise from five of the handguns exceeded the CHABA DRC (1968), while the noise from all of the firearms tested, except the caliber .22 rifle, exceeded the EPA levels (1974). At a sound-insulated firing range, the noise from all the firearms tested, except the caliber .22 rifle, exceeded the CHABA DRC (1968), while all the firearms tested exceeded the EPA levels (1974).

STANDARD

An NBS-developed standard for "wearable devices used to protect the auditory system against the excessive sound encountered on firing ranges" was issued in 1973 by the Law Enforcement Assistance Administration's National Institute of Law Enforcement and Criminal Justice.

The standard — NILECJ-STD-0102.00 — establishes performance requirements and test methods for hearing protectors. Included is a method for measuring hearing pro-

tection by means of psychoacoustic tests on human subjects, based on a method long in use to evaluate protectors worn in situations marked by continuous, steady noise. An appendix discusses the state of the art with regard to measurement techniques applicable to the impulsive noise generated by firearms.

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