

**COMMENTS & RECOMMENDATIONS  
ON NOISE & HEARING CONSERVATION  
REGULATIONS**

presented to

**The Honorable Joseph Dear  
Assistant Secretary of Labor  
for Occupational Safety & Health**

by

**THE NATIONAL HEARING CONSERVATION ASSOCIATION  
THE AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION**

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# CONTENTS

	<u>Section/Page</u>
<b>I. BACKGROUND</b>	<b>Section 1</b>
<b>II. OSHA POLICY</b>	<b>Section 2</b>
A. Re-emphasis on Engineering Noise Control	page 3
B. Form 200	page 4
C. Enforcement	page 7
<b>III. HEARING CONSERVATION AMENDMENT</b>	<b>Section 3</b>
A. Inclusion of Currently Underserved Workers	page 8
B. Exposure Monitoring (d)	page 9
C. Audiometric Testing Program (g)	page 9
D. Baseline Audiograms (g)(5)	page 10
E. Annual Audiograms (g)(6)	page 11
F. Evaluation of Audiogram (g)(7)	page 11
G. Follow-up Procedures (g)(8)	page 11
H. Audiometric Test Rooms (h)(4)	page 13
I. Hearing Protectors (i)(j)	page 13
J. Recordkeeping (m)	page 15
K. Program Evaluation	page 15
<b>IV. NOISE STANDARD</b>	<b>Section 4</b>
A. Permissible Exposure Level (PEL)	page 16
B. Exchange Rate	page 16
C. Threshold for Dosimetry	page 17
D. Inclusion of Underserved Workers	page 17
<b>V. BIOGRAPHICAL INFORMATION/REFERENCES</b>	<b>Section 5</b>

## INTRODUCTION

More than a decade ago, OSHA promulgated an amendment to its noise standard for hearing conservation programs. We believe that the noise standard, as amended, has helped to conserve the hearing of a great many American workers. Time and experience, however, have taught us that the noise standard can and should be improved in numerous ways. Some of these improvements can be accomplished with minimal effort, while others may take longer and require more background work.

Regulatory guidelines must be updated to come in line with current scientific and practical knowledge, and must extend hearing loss prevention programs to workers who are not served or who are underserved by current regulatory guidelines. All workers exposed to all types of ototraumatic agents (not just noise exposed workers in the manufacturing sector) should be governed by regulatory guidelines that adequately address: (1) exposure monitoring, (2) engineering and administrative controls, (3) use of personal protection devices, (4) education and motivation, (5) audiometric evaluation, (6) record keeping, and (7) program evaluation.

It is our opinion that there are three areas in which OSHA must direct its efforts to improve noise and hearing conservation regulations and practices in this country. They are:

1. OSHA Policies
2. The Hearing Conservation Amendment
3. The Noise Standard

Following is a detailed document outlining specific hearing conservation regulatory matters requiring attention from OSHA at this time. Highest priority should be given to policy matters, which can be addressed fairly quickly with a minimum effort on the part of the agency. We offer our continued support and assistance in matters which will require further study and rulemaking activities.

## I. BACKGROUND

Hearing is one of the most important functions of the human sensory system. Without it, the vital interactions between people can become degraded or lost. Hearing loss in general, and noise-induced hearing loss in particular, may cause an individual to suffer a handicap in the communication circumstances of everyday life. This handicap increases with age and can lead to confusion, irritation, and feelings of inadequacy and depression. Helen Keller once said that the loss of the ability to hear was more handicapping than loss of sight. This is because visual impairments separate a person from things, whereas hearing impairments separate a person from other people. Hard-of-hearing individuals tend to become isolated from friends and family and this isolation tends to increase with age.

Even today with increased emphasis on health promotion and disease prevention, people still tend to view noise-induced hearing loss as a necessary element of a noisy occupation, although it is not inevitable. Unfortunately, ears do not bleed and the onset of hearing loss is insidious. Noise-induced hearing loss, like other conditions, such as neurological damage, continues to impair the quality of life for many workers who are inadequately protected.

More than a decade ago OSHA promulgated an amendment to its noise standard for hearing conservation programs. We believe that the noise standard, as amended, has helped to conserve the hearing of a great many American workers. Time and experience, however, have taught us that the noise standard can and should be improved in numerous ways. Some of these improvements can be accomplished with minimal effort, while others may take longer and require more background work.

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For more than a decade, European, Canadian, and other foreign governments have continued to update and improve their noise standards, whereas OSHA has maintained the status quo. The result is that the U.S. is no longer the leader in this area. Consequently, workers in American industry would benefit from an update to OSHA's noise standard.

In addition, NIOSH estimates that many of the 15-20 million workers employed in non-manufacturing industries (in particular, those in construction, agriculture, service and trade industries) are exposed to hazardous noise but are not served, or, at best, may only be partially served by hearing loss prevention regulations. NIOSH also estimates that more than 10 million workers are exposed to industrial chemicals. Because most current hearing conservation protocols do not consider the potential ototoxicity of chemical exposure, there may be a large number of workers with unmet needs regarding hearing conservation practices. We believe that there is a great need

for further study on the synergistic effects of noise and workplace chemicals, and that OSHA must expand noise standards to include currently underserved workers.

## II. OSHA POLICY

The first step toward improving noise and hearing conservation practices could be accomplished quickly, with a minimum of effort on the part of the agency, and with some very tangible benefits. This approach would be to rescind/revise certain directives regarding OSHA policies.

### A. Re-emphasis on Engineering Noise Control

After more than 12 years of neglect, OSHA now has the opportunity to re-emphasize engineering noise control. Engineering control has always been OSHA's preferred method of control for all occupational hazards, and the noise standard should not be an exception. Engineering control, especially at the noise source, can be the most effective method of preventing the adverse effects of noise.

OSHA should begin by withdrawing the compliance policy, CPL 2-2.35, which instructs Federal OSHA compliance officers not to issue citations to companies until workers' time-weighted average exposure levels reach 100 dB (A), as long as the companies have "effective hearing conservation programs." Even in TWA's over 100 dB(A), compliance officers are to use their discretion. Adding to the problem is that OSHA has never formally defined exactly what constitutes an "effective hearing conservation program". Several state-run OSHA programs have never adopted the relaxed policy, and continue to enforce feasible engineering control at the 90 dB(A) level.

The enforcement principle behind CPL 2-2.35 is that employers are allowed to rely on personal protective equipment rather than engineering controls. Most hearing protectors, however, as they are worn in the field, do not provide sufficient attenuation to bring workers' exposures from 100 dB (A) to safe noise levels. This means that many thousands of workers are being exposed to hazardous levels of noise, with a greatly increased likelihood of developing noise-induced hearing loss. This compliance memo has also led to the popular perception that the hearing conservation amendment supplanted the requirement for engineering controls, which, of course, is not true.

At this time, OSHA has the opportunity to return to the original intent of the noise standard and re-emphasize noise control. There exists an abundance of information on noise control and it is simply a matter of pulling it together in a data base. Either OSHA or NIOSH could accomplish this, with the assistance of numerous professional organizations, such as the Institute of Noise Control Engineering, or the Acoustical Society of America. This need for a noise data base has been highlighted in several recent consensus conferences (e.g. NIOSH in 1988, NIH in 1990, and the

American Speech-Language-Hearing Association (ASHA) in 1991 as well as recent workshops sponsored by the Acoustical Society of America.)

B. Form 200

Another improvement that could be accomplished simply by a change in OSHA compliance policy would be to withdraw the current directive on the recordability of occupational hearing loss on the OSHA 200 log (June 1991), and to replace it with one that is more scientifically justifiable and more protective. The current policy is to require employers to record work-related threshold shifts in hearing only after they have reached an average level of 25 dB or more at 2000, 3000, and 4000 Hz. NHCA and ASHA, as part of a coalition of professional organizations, have written to OSHA in the recent past, stating that this policy is dangerously underprotective and not technically well founded. Also, in 1987, the American Industrial Hygiene Association, through the work of its Noise Committee, overwhelmingly passed and issued a position paper that recommended an STS-based recordability criterion. This position paper was subsequently endorsed by a number of other professional organizations, including NHCA and ASHA.

The existing OSHA policy should be revised to require recording of *confirmed* work-related standard threshold shifts (STS). Several state-run OSHA programs currently follow this practice. It should also be noted that OSHA's position prior to June 1, 1991 was that STS should be used as the recording criterion.

It is our recommendation that hearing loss be recordable on Form 200 according to the following definitions:

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**For those employees required to be included in a HCP ... all confirmed work-related cases of Standard Threshold Shift (STS) [not resulting from an instantaneous event] should be recorded as occupational illnesses on the OSHA Form 200.**

- 1) An STS is a change (for the worse) in hearing thresholds relative to the baseline audiogram of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear. Age-adjustments, as indicated in Appendix F of 20 CFR 1910.95 may be applied to this calculation.
- 2) A confirmed STS exists when the annual audiogram shows that the employee has demonstrated an STS, and the employer obtains a retest within 30 days which also shows an STS compared to baseline. If the employer does not obtain a retest within 30 days, then the STS is considered confirmed.

- 3) A work-related STS exists when in the judgement of the audiologist or qualified physician supervising the HCP, the STS is due in full or in part to excessive noise exposure in the workplace (8-hour TWA of 85 dB(A) or greater). Medical or audiological referral for further investigation of cause may be warranted prior to determination. If a reasonable determination of non-work relatedness cannot be made, then the STS is considered to be recordable.

Following are additional issues which OSHA should clarify in its policy guidelines regarding recording occupational hearing loss:

a. time limit for recording

The issue of when an occupational hearing loss should be recorded on Form 200 also must be considered. OSHA currently requires employers to record standard threshold shift (STS) within six days of identification, and "line-out" the entry later if a retest or follow-up professional evaluation reveals that the shift was temporary and/or not work related.

It is widely recognized that many occurrences of STS will be temporary in nature. There is no question that it is in the best interest of the hearing conservation program to identify shifts in hearing while they are still temporary so that follow-up action can be taken immediately to prevent permanent hearing loss. OSHA has previously acknowledged this during rule making activities in 1981 when they stated that "since temporary threshold shift is a harbinger of permanent threshold shift, it is an important symptom or warning sign, and protective measures can then be taken before the change in threshold becomes permanent ..... Employers are encouraged to conduct annual audiometric tests during the workshift since the early identification of TTS can result in the prevention of permanent hearing loss" (Federal Register, Volume 46, Number 11, Pages 4143-4144, January 16, 1981).

It is obvious that it is not OSHA's intention to require employers to record temporary occupational hearing loss. However, requiring companies to record all STS (both temporary and persistent) within six days may have an unintended punitive effect. Companies are usually hesitant to record any incidents on Form 200, even if lining-out the event at a later date is an option. Therefore, disallowing the OSHA 30-day retest for recording purposes may have a negative impact on programs which should be designed to prevent hearing loss. By requiring recording of all STS within six days, companies may actually discontinue

programs of conducting annual testing during the workshift, due to a reluctance to identify (and record) temporary threshold shift.

Conducting annual audiometric tests prior to workplace exposure would significantly diminish the effectiveness of audiometric monitoring, since only permanent occupational threshold shifts could then be detected. Excess noise exposure and/or inadequate hearing protection would not be identified until later, when the worker has already suffered a permanent hearing loss.

We do not believe it is OSHA's intention to diminish the protection provided by the Noise Standard; therefore, we encourage OSHA to adopt a policy of defining the six-day recording time as beginning after the thirty-day retest period as outlined in 1910.95(g)(7)(ii).

b. time-limit for lining-out

Clarification is also needed regarding time limits for lining-out occupational hearing loss entries. Work-related shifts in hearing are considered recordable under current OSHA policy if a retest also shows a shift, or if the retest is not conducted. Some OSHA documents indicate that unconfirmed shifts in hearing can only be lined-out if the retest is performed within 30 days of the annual test. It is therefore possible that temporary shifts in hearing will be recorded simply because 30-day retests were not conducted. It is possible that an audiometric test conducted more than 30 days later, or even the following year, may actually show an improvement in hearing, and hence absence of the original STS. Because of these types of circumstances, we encourage OSHA to allow discretion to the reviewing professional for lining-out STSs which are unconfirmed by subsequent testing, not limited to 30-day retests.

c. baseline revision for recording purposes

Another issue which draws considerable confusion is that of revised baselines. Some OSHA officials have suggested that baselines should be automatically revised following any Form 200 entry. However, once again, circumstances exist when temporary shifts in hearing may at times be considered recordable. Automatic baseline revision following these entries would be inadvisable. If a worker's baseline were automatically revised to a worse test demonstrating a temporary threshold shift, then later occurrences of a shift (persistent change) and

further progression of a shift in hearing may not be identified.

Once again, we do not feel it is OSHA's intention to diminish the protection afforded by 1910.95. Section (g) (9) of 1910.95 states that the audiologist or physician may revise baselines in two cases: (1) where there is a significant improvement over baseline, or (2) when "the STS revealed by the audiogram is persistent". Clearly, automatically revising a baseline following one identification of STS would not meet the spirit of this guideline, and potential abuses could occur. Therefore, we recommend that the decision for baseline revision remain in the judgment of the supervising professional.

C. Enforcement

Despite OSHA's stated commitment to hearing conservation, citations and penalties for all parts of the noise standard have decreased. For example, in 1980, before the hearing conservation amendment, the total fines assessed were \$633,486 for 2292 violations. In 1987, even after all of the hearing conservation amendment's provisions had been added, that figure had dropped to \$200,880 for 2259 violations in total.

OSHA now has the opportunity to increase enforcement of all aspects of the noise standard. More vigorous enforcement of the standard's provisions sends the message that the agency is serious about the prevention of noise-induced hearing loss in the American workforce.

### III. HEARING CONSERVATION AMENDMENT

The second approach to strengthening prevention practices could be accomplished, by improving the hearing conservation amendment through the rule-making process. By confining its proposals to specific provisions of the hearing conservation amendment, OSHA could simplify the rule-making process.

Certain changes were made to the amendment between 1981 and 1983 which have not been beneficial. Other provisions have become outmoded and need to be updated. Still other changes need to be made on the basis of more than a decade of experience in complying with the amendment.

#### A. Inclusion of Currently Underserved Workers

There are at least two main groups of workers who are (in theory) covered by the older "Walsh-Healey" portions of the noise standard, but are not covered by the hearing conservation amendment. They are workers in oil well drilling and servicing and construction workers.

The exact number of noise-exposed workers in oil well drilling and servicing is not well known. In fact, the number of workers in this occupation varies widely, depending upon the current state of the industry. In 1982, there were about 150,000 of these workers at risk for safety hazards, many of whom can be assumed to be exposed to hazardous levels of noise. These workers were excepted from the hearing conservation amendment because of the high mobility of operations, high turnover rates, and limited accessibility of many worksites. OSHA's efforts to develop a "vertical" standard, covering the variety of health and safety hazards found in this industry, appear to have languished.

An estimated one-half million construction workers are exposed to time-weighted average noise levels above 85 dB(A). The construction noise standard is essentially the same as the "Walsh-Healey" noise standard before it was amended for hearing conservation programs. Thus, workers exposed above 90 dB(A) should be receiving some protection, although the standard has never been vigorously enforced, and workers exposed between 85 dB(A) and 90 dB(A) are receiving no coverage. The standard should be enforced more vigorously and should be amended so that construction workers and oil well drilling and servicing workers have the same protection as their counterparts in general industry.

B. Exposure Monitoring (d)

1. Sampling Duration Strategy (d)(i): Because daily equivalent noise exposures frequently vary between days, OSHA should address the issue of how to specify equivalent exposures for such conditions. The approach we recommend is to allow an employer to either use the worst-case daily TWA as descriptive of the job, or to measure a 40-hour equivalent TWA as described by Shaw (1985).

2. Instrument Calibration (d)(2)(ii): OSHA should be more specific regarding instrument calibration requirements. Exhaustive calibration should be required at least every two years, as well as on-site calibration checks prior to and following sampling.

C. Audiometric Testing Program (g)

1. Tester and Supervisor Qualifications (g)(3)

There are three areas which require change in this section of the amendment. These items deal with tester qualifications, supervisor qualifications, and the microprocessor audiometer exception.

a. Tester Qualifications:

Although the amendment mentions CAOHC (Council for Accreditation in Occupational Hearing Conservation) certification, it also allows others with "demonstrated competence" to conduct audiometric tests. Valid, reliable audiometry is the cornerstone of the monitoring requirements and every effort should be made to ensure technician competence. We feel that this allowance is an unnecessary loophole. For example, certain state-run programs, such as Washington and Oregon, have required CAOHC certification for many years. We agree in principle with those programs, and recommend that only technicians who pass a CAOHC-approved course be permitted to conduct tests.

b. Supervisor Qualifications:

Although physicians are highly trained professionals, the assumption that the training a physician receives qualifies him/her to be expert in hearing evaluation and the treatment of hearing disorders is erroneous. The field of hearing evaluation and

rehabilitation is specialized as are other areas of medicine and health care, and thus the physicians mentioned in this paragraph and elsewhere in the standard should be specialists (i.e., otologists or otolaryngologists) or those with "knowledge and experience in hearing test procedure and hearing disorders."

c. Microprocessor Audiometers:

Measuring hearing sensitivity is a skill that requires competence beyond that merely required to push a button and operate a computer. The microprocessor exception, i.e., "a technician who operates microprocessor audiometers does not need to be certified," has been a glaring error in the amendment since it first appeared. The implication of this exception is that the technician who operates a microprocessor does not require training, which is clearly not the case. Technicians who operate microprocessors must be equally skilled with equipment function and calibration, instructions to the worker, earphone placement, and procedures for obtaining results for difficult-to-test listeners. This exception should be removed.

2. Audiometer Specification (g)(4), (h)(2)(5)

Audiometer specifications should allow audiometers which meet current pertinent ANSI audiometer calibrations standards (S3.6). Specific adherence in the regulation to the 1969 S3.6 standard has not provided adequate flexibility for updates in scientific knowledge and ANSI standards. We recommend that the audiometer calibration requirement be updated to ANSI S3.6 (1989). Also, a provision should be added which allows OSHA the flexibility to update calibration policy when new standards are released.

D. Baseline Audiograms (g)(5)

Currently, OSHA allows the use of hearing protection devices (HPDs) to meet occupational exposure portion of the 14-hour "noise-free" requirement for baseline audiograms. In order to reduce potential for contamination of the baseline by workplace exposure, we encourage OSHA to require the following steps when employers exercise the HPD option:

Hearing protectors may be used as a substitute for the requirement that baseline audiograms be preceded by 14 hrs. without exposure to workplace noise, as long as prior to

the test, (1) the employees whose hearing is to be evaluated receive refresher training in the use of their protectors, and (2) the condition of the hearing protector (s) the employee is to wear is checked and found satisfactory. Any employee whose TWA exceeds 100 dB(A) shall be required to wear an earplug together with an earmuff, if hearing protection is to be substituted for the 14 hr. non-exposure period.

E. Annual Audiograms (g)(6)

Unlike the baseline audiogram, the annual audiogram should be conducted *during the workshift*. Comparing the annual audiogram done under these circumstances is the most effective way to detect temporary threshold shift (TTS) and intervene before the shift becomes permanent. It is important to remember that the whole purpose of the hearing conservation program is to prevent hearing loss, not to document it after it becomes permanent. We urge OSHA to encourage employers to conduct annual audiograms during the workshift where possible.

F. Evaluation of Audiogram (g)(7)

Currently, the regulation allows an employer to disregard follow-up actions if an STS is not confirmed by a 30-day retest. Since a temporary threshold shift on the annual audiogram may indicate inadequate hearing protection, however, we believe the employee should still receive adequate protective follow-up unless a medical reason is determined to be the cause. Once again, the intent of audiometric monitoring is to detect temporary threshold shift prior to the occurrence of permanent hearing loss. Simply documenting that the STS is temporary in nature does not in any way indicate that the shift was non-occupationally related. Therefore, OSHA should require employers to complete follow-up actions as outlined under section (g)(8) for any employees demonstrating STS, unless an audiologist, or physician with knowledge and experience in hearing test procedures and hearing disorders, determines that the shift was not work-related.

G. Follow-up procedures (g)(8)

1. Results of retesting (g)(8)(iii)

As noted above, OSHA should also withdraw this section of the regulation which allows employers to discontinue use of required hearing protection for those employees exposed to less than 90 dB(A) TWA with unconfirmed shifts in hearing. Automatically discontinuing hearing protection use for these workers because of unconfirmed STS is contradictory and fails to provide adequate protection. Once again, TTS is the precursor to permanent

damage. We recommend that these employees only be allowed to discontinue HPD use if an audiologist or physician determines that the shift was not work-related.

## 2. Medical referral

**Medical referral:** As the standard reads now, referral for medical or audiological evaluation is contingent upon the identification of an STS. There are, however, a number of circumstances where referral may be necessary, regardless of the existence of an STS and there should be a new section of the standard to address these issues. For example, a noise-exposed employee may have impacted cerumen or an infection of the ear canal that needs to be treated before he or she is able to wear hearing protection safely and comfortably. Yet, the wearing of hearing protection is necessary for protection against the harmful effects of noise. Since it is the employer's responsibility to provide a safe and healthful workplace, the standard should require the employer to refer this worker for medical treatment and to bear the costs.

Another example would be the employee who, for some reason, is unable to give reliable results on the audiometric test. Because the employer is required to administer an effective hearing conservation program and to provide audiometric testing, the employer is obliged to obtain a valid and reliable audiometric test. If such a test cannot be obtained at the company, then it must be conducted by an audiologist, and the employer should bear responsibility for the cost. There will be some circumstances, as in the present standard, where medical referral is required and yet the employer should not be required to bear the cost. The standard should be clear about when the employer must pay and when it is not necessary.

## H. Audiometric Test Rooms (h)(4)

If the majority of workers (in particular, young employees with good hearing) are to receive adequate audiometric evaluations, then hearing threshold levels must be tested to 0 dB hearing level, and the background noise in the test room must be low enough to permit this. The 1981 version of the hearing conservation amendment required employers to meet the background levels specified in the ANSI S3.1 (1977) standard, with a relaxation of 5.5 dB at 500 Hz. The 1983 revision of the amendment backtracked to an antiquated version, dating from 1960, allowing substantially higher noise levels at all frequencies. Since that time the ANSI S3.1 standard has become still more stringent (ANSI, 1991a), highlighting the outmoded nature of this section of the regulation. Although meeting the newest ANSI requirement is likely to be a hardship for some employers and hearing conservation consultants, a recent publication has demonstrated that industrial test facilities can meet these scientifically justified

levels (Frank and Williams, 1994). Therefore, we recommend that OSHA adopt the 1991 ANSI S3.1 standard for permissible ambient noise levels in test rooms for octave band frequencies 500, 1000, 2000, 4,000 and 8000 Hz. We do suggest a 5 dB relaxation at 500 Hz because the detection of noise-induced hearing loss is most dependent upon threshold measurements at 1000 Hz and above.

Maximum Permissible Ambient Noise Levels in dBSPL for  
octave band intervals 500-8000 Hz

	500	1000	2000	4000	8000
OSHA 1983	40.0	40.0	47.0	57.0	62.0
ANSI 1991	19.5	26.5	28.0	34.5	43.5
CURRENT PROPOSAL	24.5	26.5	28.0	34.5	43.5

I. Hearing Protectors (i)(j)

1. When to wear hearing protectors (i)(1)(2):

In the present OSHA noise standard, compliance with the PEL, the action level, and the requirements for hearing protector use and attenuation are determined by measuring or computing employees' time-weighted average exposure levels (TWAs). This makes good sense for the PEL and the action level, but can cause difficulty in the enforcement of hearing protector use. Many companies have dealt with this issue realistically by posting warning signs according to noise *level* rather than *dose*, and by requiring the use of protectors only in these areas. These companies continue to conduct measurement of TWA for compliance with the PEL and action levels, and require all employees who exceed the action level (in terms of TWA) to wear hearing protection in noise *levels* that exceed a criterion level, such as 85 dB(A). This approach also eliminates the confusing HPD "double standard" which currently exists for workers who have shown STS versus those who have not. Such a proposal could also improve likelihood of adequate protection when employee workshifts are extended beyond 8 hours. We recommend further study in this area to determine feasibility for use in general industry.

2. Hearing protection selection (i)(3)

We encourage OSHA to define "variety" of hearing protectors. One style of hearing protector cannot be worn by all people; nor will employee

preferences be the same. We recommend that variety be defined as a minimum of two types (not brands, styles, sizes, etc.) of earplugs (e.g. premolded plug and foam plug) and one type of earmuff which are deemed appropriate for the work environment.

3. Hearing protector fitting (i)(5)

This section of the amendment should be revised in order to clarify that individual HPD fitting is required for each employee.

4. Hearing protector attenuation (j)

The present standard's reliance on the Noise Reduction Rating (NRR) was a reasonable approach in 1981, but by now the NRR's failings for predicting real-world performance are evident. It appears that the actual attenuation received in the field is less than half the attenuation realized in the laboratory, and the standard deviation is about three times larger. If the same method were used to calculate the NRR for field attenuation, some protectors would yield an NRR of 0 dB or even a negative value. Moreover, the NRR does not even provide a means by which hearing protectors may be ranked because the relationship between the laboratory and field attenuation of specific brands is so poor (Berger, 1993, 1994).

Because of these reasons, a revised OSHA noise standard should incorporate a 50 percent derating, meaning that the NRR should be cut in half. This method should be used until the scientific community is able to develop a more satisfactory laboratory method of rating hearing protector attenuation. In the meantime, OSHA should encourage the efforts of consensus groups like ANSI S12/WG11 (Berger, 1992), which is currently studying laboratory methods of evaluating hearing protectors that more closely approximate their field use.

J. Recordkeeping (m)

The current requirements for record retention are inconsistent with more recent similar OSHA regulations regarding medical records. We recommend that the period for retaining audiometric records be extended to thirty years beyond termination of that individual's employment. Retention of noise exposure records and audiometric calibration and sound room documentation should be retained indefinitely.

### K. Program Evaluation

It is common knowledge that employers may comply with the various elements of the hearing conservation program and yet employees may still lose their hearing. For this reason, employers should be required periodically to evaluate the effectiveness of their programs. Neither the 1981 nor the 1983 version of the hearing conservation amendment included requirements for program evaluation, although OSHA considered such requirements in 1983 (OSHA, 1983b). To date there is no consensus standard in this area, but there is a draft ANSI document, ANSI S12.13 (1991b), which is pending consideration for adoption as a standard.

## IV. NOISE STANDARD

Even though it can be expected to take a long while, there is no time like the present to begin the revision of the noise standard. Recently, information obtained about other noise standards from around the world shows that although the U.S. used to be at the forefront, it now looks as though our noise standard is one of the oldest (and, in certain respects, outmoded) of all of the noise standards in the western nations. Many nations, realizing that immediate compliance with noise control regulations can be difficult or even impossible, have used various regulatory alternatives, allowing employers to phase in their noise control solutions over time.

### A. Permissible exposure level (PEL)

As far back as 1970, OSHA acknowledged that a TWA of 90 dB (A) could incur a "disabling loss of hearing in more than 20 percent of the exposed population." (DOL, 1970) The preamble to the hearing conservation amendment listed the risk figures at 90 dB(A), estimated by ISO, NIOSH, and EPA, as ranging from 20 to 29 percent (OSHA, 1981). The risk of incurring a hearing handicap was estimated to be about one-half as great at 85 dB(A). The newer version of ISO 1999 (ISO, 1990) predicts a risk that is somewhat lower than previous estimates, but it still approximately 15 percent at 90 dB(A) and less than half that at 85 dB(A).

The American Conference on Government Industrial Hygienists has long since incorporated a PEL of 85 dB(A) into its threshold limit values for noise (ACGIH, 1977) and it appears that the European Community is moving in that direction (Dove, 1992). The vast majority of other western nations specify an upper exposure limit of 85 dB(A), although some countries still permit 90 dB(A) for purposes of engineering controls.

We encourage OSHA to re-examine the current PEL, including studies of economic impact. Regulatory alternatives, such as, setting lower levels for new plants and processes, requiring written plans for noise control, and use of extended phase-in periods, should be explored. Should the PEL be lowered, we recommend that the action level be the same as the PEL (i.e. PEL and action level = 85 dB(A) TWA).

### B. Exchange Rate

Again, there is agreement in the scientific community that the 3-dB (equal energy) rule is more protective than the 5-dB rule presently used by OSHA. Admittedly, there is also good agreement that noise that is truly intermittent in nature is not as harmful as continuous noise, which would argue for an adjustment to the 3-dB

rule. OSHA's 5-dB rule, however, is not justified on the grounds of intermittency for a number of reasons: (1) it allows uninterrupted periods of noise at high noise levels, (2) it assumes unrealistically spaced periods of quiet between noise bursts, and (3) it is not appropriate for in-door spaces, where reverberant build-up of sound precludes the recovery from temporary threshold shift (TTS).

There is considerable precedent for the 3-dB rule, and we encourage OSHA to follow suit. Both the old and new ISO 1999 standards employ the 3-dB rule (ISO 1971 and 1990) and, consequently, 3 dB is being used by European nations in the process of harmonizing their standards. The 3-dB rule is also used by the Canadian national government, in addition to several of the Canadian provinces, and by the U.S. Environmental Protection Agency. It is under consideration at this time by the U.S. Department of Defense, and it has recently been proposed by the ACGIH (ACGIH, 1993). OSHA should follow their lead and adopt the 3-dB rule allowing industry a reasonable time frame to comply.

#### C. Threshold for Dosimetry

Although not explicitly stated in the noise standard (paragraphs a and b), OSHA interpretation over the years has been that the threshold above which sound levels must fall for inclusion in the measurement/computation of dose for compliance with the noise standard is 90 dB. This is in contrast to the explicit mention of an 80-dB threshold {paragraph (d)(2)(i)} in the hearing conservation amendment. This contradiction between paragraphs within the standard is confusing.

OSHA should make it clear that one sound threshold, namely 80 dB, applies to all measurements regarding noise and hearing conservation.

#### D. Inclusion of Underserved Workers

In addition to oil well drilling/servicing workers and construction workers who are currently partially covered under the noise standard, there is another group, agricultural workers, who receive none of the benefits of the noise standard. Some 300,000 farmers and farm workers are exposed to daily average noise levels of 85 dB(A) and above. These workers could be viewed as the orphans of the occupational noise field since there are no standards or regulations covering their exposure to noise, and the extent of their knowledge about hearing conservation is limited. However, the fact that noise levels of newly manufactured tractors are published regularly could promote awareness of the problems in this area, on the part of both OSHA and the user. The benefits of the noise standard as amended for hearing conservation programs should be extended to agricultural workers as quickly as possible.

We also encourage OSHA to closely monitor research currently being

conducted on potential ototoxicity of chemical exposures. Future noise regulation should incorporate exposure limits related not just to noise, but also to combinations of ototraumatic agents.

## V. BIOGRAPHICAL INFORMATION/REFERENCES

### NATIONAL HEARING CONSERVATION ASSOCIATION

The National Hearing Conservation Association (NHCA) is a professional association composed of over 550 audiologists, physicians, industrial hygienists, engineers, occupational health nurses, equipment manufacturers, and others, all of whom are active in the field of industrial and military hearing conservation throughout the United States. Members serve millions of workers in the noise-exposed industrial and military populations through consultation and direct service provision in the areas of noise exposure measurement, engineering and administrative control of noise exposure, audiometry, personal hearing protection, and education and training. As such, the members of NHCA are vitally concerned with the prevention of noise-induced hearing loss in American workers.

NHCA has served the professional and industrial community, since its founding in 1975, as the only association whose sole purpose is the prevention of noise-induced hearing loss. Annually, NHCA presents a two- to three-day professional conference wherein the latest scientific and clinical information about noise-induced hearing loss and industrial hearing conservation programs is provided. In 1995, NHCA will jointly sponsor with the National Institute for Occupational Safety and Health, the third triennial Hearing Conservation Conference in Cincinnati, Ohio. Through its national office in Des Moines, Iowa, NHCA provides technical assistance to members, non-members, consumers, government agencies, related professional associations, and the media on the topics of noise-induced hearing loss and occupational hearing conservation programs.

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Elliott H. Berger, M.S. - Cabot Safety Corporation, Indianapolis, Indiana

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As Cabot's Manager of Acoustical Engineering, Mr. Berger conducts research and development into hearing protector design, performance, and utilization. He has written over 50 articles on hearing protection/conservation, and was the principal editor for the 4th edition of the AIHA *Noise & Hearing Conservation Manual*. Mr. Berger chairs ANSI working group S12/WG11 on real-world hearing protector performance, and is also involved with numerous other standards committees. In 1993, he was the recipient of the National Hearing Conservation Association's *Outstanding Hearing Conservationist Award*. He is a fellow of the Acoustical Society of America and is Past-President of the NHCA.

Dennis P. Driscoll, P.E. - Associates in Acoustics, Inc., Evergreen, Colorado

Mr. Driscoll is President and Principal Consultant of Associates in Acoustics, Inc. Besides directing the business administration of the company, his primary responsibilities include conducting engineering noise control surveys, data analysis, research, and design and recommendations for noise exposure assessment and control. Mr. Driscoll is a board member of the Council for Accreditation in Occupational Hearing Conservation (CAOHC), an editorial board member of the American Industrial Hygiene Association Journal, and he serves on the NHCA Executive Council as Treasurer. He is a registered Professional Engineer, and a Full Member of the Institute of Noise Control Engineers.

Christine Dixon-Ernst, CIH, MA, CCC-A - ALCOA, Pittsburgh, PA

Ms. Dixon-Ernst has masters degrees in industrial hygiene and audiology. She also holds certification in both areas. She has worked for ALCOA for fifteen years in industrial hygiene and medical surveillance programs, and has also participated in several ALCOA-sponsored epidemiological studies. Ms. Dixon-Ernst is a member of the American Industrial Hygiene Association and serves on the Noise Committee. She is also a member of the National Hearing Conservation Association and several ANSI committees.

Susan Cooper Megerson, MA, CCC-A - IMPACT Health Services, Inc.,  
Kansas City, Missouri

Ms. Megerson has worked in clinical audiological settings, and for the past 11 years has specialized in industrial audiology. She has been employed over 10 years as a member of Impact's management team, and is currently Sr. Vice President of this occupational health consulting firm. Ms. Megerson has served on the NHCA Executive Council for several years and is currently NHCA's President. She is also an active member of the American Speech-Language-Hearing Association (ASHA), representing ASHA as a liaison to CAOHC. Ms. Megerson is currently Secretary-Treasurer of CAOHC and an active Course Director. She is a member of two ANSI working groups developing standards recommendations for evaluating hearing conservation program effectiveness and for computerized audiometry.

Thresesa Schulz, Ph.D., CCC-A - U.S. Air Force, Brooks AFB, Texas

Major Schulz is the chief of the US Air Force Hearing Conservation Data Registry at Brooks AFB, TX. She has served in various hearing conservation positions in the US Army and US Air Force for the past 10 years. Major Schulz recently completed her Ph.D. through The Ohio State University. Her most recent research efforts evaluated various criteria for determining significant threshold shifts in the USAF hearing conservation program. Major Schulz has been a frequent presenter at NHCA conferences and an active member of numerous NHCA committees. Major Schulz is currently NHCA's member delegate to the Executive Council.

Alice Suter, Ph.D. - Industrial Audiology & Community Noise Consultants, Ashland, Oregon

Dr. Suter has been influential in noise criteria development, regulation and public policy, first at the Environmental Protection Agency's Office of Noise Abatement and Control, and later at OSHA, where she was the principal author of the Hearing Conservation Amendment. She has also held positions of Visiting Scientist and Research Audiologist at NIOSH. Dr. Suter is now a consultant in industrial audiology and community noise. Among Dr. Suter's clients are the World Health Organization, the Administrative Conference of the United States, CAOHC, and various private companies and government agencies. She is a Past-President of NHCA and recipient of two awards from the association.

## AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION (ASHA)

The American Speech-Language-Hearing Association (ASHA) is the professional and scientific organization representing over 77,000 audiologists and speech-language pathologists who provide conservation, diagnostic, and rehabilitative services to children and adults who are at risk for or have hearing, speech, and/or language disorders. Over 50% of ASHA audiologists indicate that they provide hearing conservation services to industry.

ASHA has a strong interest and history in the prevention of noise-induced hearing loss. Over the years, ASHA's committee and Special Interest Division on hearing conservation and noise addressed the many issues related to occupational and environmental noise concerns. Currently, two ASHA representatives serve on the Council for Accreditation in Occupational Hearing Conservation. ASHA also funded participants in the International Congresses on Noise as a Public Health Hazard and served as an affiliate organization supporting the National Institute for Occupational Safety and Health (NIOSH) conferences on noise. In addition, over the past ten years, ASHA sponsored approximately twelve workshops or audioteleconferences on occupational hearing conservation and community noise.

The ASHA Professional Practices and Public Information Departments provide technical assistance to members, non-members, consumers, agencies, related professional organizations, and the media on the topic of hearing conservation and noise. ASHA's media relations office reports that noise is the number 1 topic of interest to those in both print and electronic media. The public is concerned about the effects of noise exposure on hearing.

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Rena H. Glaser, MA, CCC-A - 3M Corporation, St. Paul, Minnesota

Ms. Glaser is manager of Hearing Conservation for 3M. A Fellow of the American Speech-Language-Hearing Association (ASHA), she served as chair of ASHA's Committee on Hearing Conservation and Noise and chair of ASHA's Special Division on Hearing Conservation. Ms. Glaser is an ASHA liaison to the Council for Accreditation in Occupational Hearing Conservation of which she is immediate past chair. Ms. Glaser is a Past-President of the National Hearing Conservation Association (NHCA) and was the recipient of the Michael Beall Threadgill Award for Outstanding Leadership and Service to NHCA in 1992.

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