AMERICAN
SPEECH-LANGUAGE-
HEARING
ASSOCIATION

November 4, 2002

Occupational Safety and Health Administration
Docket Office
Docket No. H-011G, Room N-2625
U.S. Department of Labor
200 Constitution Avenue, NW
Washington, D.C. 20210

Re: Occupational Safety and Health Administration (OSHA); Advanced Notice of Proposed Rulemaking (ANPR); Request for Information and Comment (67 FR 50610, August 5, 2002); Hearing Conservation Program for Construction Workers (29 CFR Part 1926)

Dear Sir or Madam:

The Coalition to Protect Workers' Hearing (the Coalition) appreciates the opportunity to provide the Occupational Safety and Health Administration (OSHA) with comment regarding revision of the construction noise standards to include a hearing conservation component for the construction industry. OSHA is to be commended for this proposed rulemaking as noise induced hearing loss among construction workers is a significant national problem. It is well known that the general industry noise standard provides more protection for general industry workers–due to provisions of the OSHA 1983 Hearing Conservation Amendment (29 CFR 1910.95)–than the construction standards provide for construction workers.

As OSHA itself states, excessive noise at construction sites not only causes hearing loss, but can create a safety hazard. It is unacceptable that one in four workers will develop permanent hearing loss when exposed to 90 dBA (the permissible exposure limit [PEL] of the current construction standard) over a 40-year working lifetime.

The National Occupational Research Agenda of the National Institute for Occupational Safety and Health (NIOSH), unveiled in 1996, identified hearing loss as a priority for the Agency. NORA has been very successful in stimulating new research to address the problem of workplace injuries and illnesses. Despite NORA, ongoing efforts to prevent occupational hearing loss continued to be hindered because the problem is insidious and occurs without pain or obvious physical abnormalities in affected workers.

The Healthy People 2010 Health Objectives for the Nation target noise as a health hazard as well. The chapter on Occupational Safety and Health has two relevant objectives:

- **20-2**: Reduce work-related injuries resulting in medical treatment, lost time from work, or restricted work activity; and
- **20-11**: Reduce new cases of work-related, noise-induced hearing loss.

The Coalition represents over 130,000 consumers with hearing loss, audiologists, speech-language pathologists, industrial hygienists, safety and health professionals, acoustical engineers, occupational health nurses and physicians, and industry representatives from professional organizations committed to the prevention of hearing loss and occupational and environmental hearing conservation and noise abatement.

Organizational members of the Coalition are the American Academy of Audiology (AAA), American Association of Occupational Health Nurses, the American Speech-Language-Hearing Association (ASHA), the Council for Accreditation in Occupational Hearing Conservation (CAOHC), the National Hearing Conservation Association (NHCA), and Self Help for Hard of Hearing People, Inc. (SHHH).

We would be pleased to discuss the Coalition's recommendations with OSHA staff. Please contact Maureen Thompson at ASHA if you have any questions or require additional information. Ms. Thompson can be reached by phone at 301-897-5700, ext. 4431; by fax at 301-897-7356; or by e-mail at *mthompson@asha.org*. Please see Appendix C for a description of other organizational members of the Coalition and contact information for each.

Sincerely,

American Academy of Audiology

American Association of Occupational Health Nurses

American Speech-Language-Hearing Association

Council for Accreditation in Occupational Hearing Conservation

National Hearing Conservation Association

Self Help for Hard of Hearing People, Inc.

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29 CFR Part 1926

Occupational Safety and Health Administration

Advanced Notice of Proposed Rulemaking
Hearing Conservation Program for Construction Workers

Written Testimony

Submitted by the Coalition to Protect Workers' Hearing

American Academy of Audiology

American Association of Occupational Health Nurses

American Speech-Language-Hearing Association

Council for Accreditation in Occupational Hearing Conservation

National Hearing Conservation Association

Self Help for Hard of Hearing People, Inc.

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Exposure Monitoring: General Comments

Procedure and protocol for noise exposure monitoring in construction is a function of the application of data. The information collected and methods of obtaining the information are determined by the ways the data will be used. In the general industry model under 29 CFR 1910.95 § (d)(1)(i), the purposes of monitoring are to—

- Estimate exposure sufficiently to determine the need for program inclusion
- Estimate exposure sufficiently to determine appropriate selection of hearing protection devices (HPDs)

In addition, the general industry monitoring process should identify sources of exposure sufficiently to assist in selecting noise sources for control.

Are the goals the same for hearing conservation in construction? Studies cited in the Advanced Notice of Proposed Rulemaking (ANPR) indicate that noise is pervasive on construction sites. Hattis and Makri (1999) indicated that each of 14 "industry descriptions" bears Leq exposure meriting inclusion in the hearing conservation program (HCP). The Worker's Compensation Board of British Columbia (Eaton, 2000) found that 14 of 18 "plant/equipment" items and 18 of 18 "trades/tools" items produce in Leq exposures exceeding 85dB(A). Kerr, et al. (2002) report 17 of 28 trades, tools or tasks have mean dB (A) exceeding 85 dBA, with an additional 7 exceeding 85 with one standard deviation. Legris and Poulin (1998) found that 14 of 20 8-hour equivalent exposure levels of operators or tasks exceeded 85dB(A). Neitzel, et al., (1999) found 4 of 4 trades to have substantial overexposures. Seixas, et al. (2001) demonstrated that even "quiet" trades like electricians have high exposure levels. Such findings, common throughout the literature, indicate that noise in construction is widespread and ubiquitous.

With noise so pervasive in construction trades, presumption of exposure is merited, with exposure monitoring potentially being used to determine individuals for HCP *exclusion* rather than *inclusion*. The primary purpose of monitoring then becomes the appropriate identification of areas, tasks, and trades requiring HPD use, and the identification of equipment and processes for control activity.

In direct response to OSHA's questions:

II.A.1. Methods of compliance

How should noise exposure be evaluated: tool, task, job title, type of construction?

As noise exposure is a feature of each of the items above, all should be considered in determining risk; However, presumption of exposure meriting HCP inclusion is warranted.

Are the trades identified presumptively covered/are there other trades that should be listed?

The trades detailed in the British Columbia report (Eaton, 2000) share enough characteristics with their U.S. counterparts that presumptive inclusion is merited. In addition, proximity of non-noise generating operations to "heavy equipment" or noisy operations (Kerr, et al., 2002) supports presumptive inclusion for all construction site workers.

Are their any other investigations on the effects of HCPs?

Lusk, et al. (1998) and others have assessed the use of HPD among construction trades, but the Coalition is unaware of any investigations on the effects of HCPs in construction.

II.A.2. Monitoring

How much noise monitoring is currently being done at construction sites?

29 CFR 1926 currently has no specific requirement for systematic noise exposure monitoring. Most noise measurement at construction sites is done as research, or similar purposes (e.g., environmental compliance, community complaints). Outside the research arena, the Coalition is unaware of noise monitoring.

Should OSHA provide specific sampling strategies for the construction industry?

The noise in the construction industry is quite similar to other industrial noises; thus specifying different/modified strategies will only confuse the process in the hearing conservation program.

Should these strategies be mandatory or recommended?

If HCP inclusion is presumptive, the purpose of monitoring becomes selection of areas, tasks, and/or trades requiring HPD use. OSHA may want to recommend noise measurement strategies to effectively determine HPD boundaries, which may or may not have direct relation to 8-hour Time Weighted Average (TWA) or Leq. One example is "Noise Perimeter Zones" (as described in http://www.cdc.gov/niosh/elcosh/docs/d0400/d000470/d000470.html). Performance-based standards are desirable so long as the worker is sufficiently protected; permitting the employer to determine mechanisms for compliance encourages innovation and creativity.

When is exposure monitoring appropriate in the construction industry?

It is appropriate whenever a standard threshold shift (STS) is identified or when any changes in equipment or process has been implemented.

What criteria should trigger noise exposure monitoring?

Noise monitoring is most appropriately used in the construction environment as an HCP exclusion tool. Presume exposure meriting HCP inclusion; use monitoring to determine workers, tasks, trades, or equipment that could be excluded from the program. A statistical approach to sampling should be required for exclusion from a program. Otherwise one poor sample might incorrectly justify removal from the HCP.

II.A.2.a. Area Monitoring

Are there any circumstances in the construction industry where area monitoring would be appropriate?

Area sound level meter-measurements could be used to determine HPD boundaries on the jobsite. With equipment in typical operation, area measurements could be used to determine how far hazardous noise levels travel; use yellow tape or similar boundary marking processes to indicate mandatory HPD zones (See http://www.cdc.gov/niosh/elcosh/docs/d0400/d000470/d000470.html).

II.A.2.b. Continuous, Intermittent and Impulsive Sound

Is the integration of all noise levels between 80 dBA and 140 dB the appropriate criteria for calculating construction workers' noise dose? Please support your answer.

Yes. The Coalition supports the integration of all continuous, intermittent, and impulsive noise levels between 80dBA and 140dB in the calculation of employee exposure or dose. Today's dosimeters and integrating sound level meters are capable of dynamic ranges from 80dB to 140dB, which was not the case when the general industry noise standard (29 CFR 1910.95) was promulgated. This is consistent with the recommendation made in *Criteria for a Recommended Noise Standard* (NIOSH, 1998).
Suter (1992) also states that certain trends are evident with the noise variables of spectrum, duration, and level. Specifically,

- High-level sound stimuli (i.e., greater than 120dB) produces greater task-performance decrements than sounds of lower intensity.
- High-frequency noise is more disruptive than low-frequency noise of comparable levels.
- Continuous noise appears to have little effect on simple tasks, even in relatively high sound levels.
- Intermittent noise appears to be more disruptive than continuous noise, especially when the intermittencies are unpredictable. Impulse noise can disrupt task performance, at least for a limited period of time.

What are the additional costs associated with this requirement and how can they be minimized?

No additional costs are projected because currently available instrumentation already provides the dynamic range in question. Inclusion of all construction workers in the HCP will ensure that noise induced hearing loss (NIHL) is minimized and ultimately that claims are reduced. As workers are excluded from the HCP, the cost will decrease.

Is 140 dB the appropriate ceiling level for impulse noise?

Yes. The Coalition supports 140dB as an appropriate ceiling level for impulse noise.

II.A.2.c. Repeat Noise Monitoring

Would employers know when to repeat noise exposure monitoring?

According to Royster et al. (2000), the needed periodicity of noise exposure monitoring depends on several variables:

- noise exposure level,
- potential changes in exposure due to changes in equipment or production,
- the rate of STS noted among workers,

- measurements of HCP effectiveness,
- governmental regulations,
- workers' compensation requirements,
- union contracts, and
- company policies.

As stated in the "Exposure Monitoring: General Comments" noise is so pervasive in construction trades that the presumption of exposure is merited. As with initial noise exposure monitoring, repeat monitoring can be used to determine individuals for *exclusion* in a HCP rather than *inclusion*. Repeat monitoring can also be used to identify areas, tasks, and trades requiring HPD use, and the identification of equipment and processes for control activity.

Should there be a more specific requirement, such as the NIOSH recommendation for remonitoring every 2 years or if workers are developing significant threshold shifts?

Given the presumption of exposure, the Coalition recommends that noise exposure monitoring be repeated as necessary when change takes place in the worker's area, task, or trade and could result in an increase in noise exposure level or render the worker's current HPDs inadequate. The Coalition also recommends remonitoring when a worker's annual audiogram demonstrates that a STS has occurred. Regular (daily) noise measurement with sound level meters or integrating sound level meters will assist in the development of "noise zones" or areas where hearing protection should be required. This monitoring could also be utilized to detect a noise notch and identify NIHL at an early stage.

Would such a requirement be useful, feasible, or effective in the construction industry?

Requiring that repeat noise exposure monitoring in the construction industry be repeated only once every 2 years may prove ineffective given the high rate of turnover and short-term work assignments in the construction industry.

Are there any alternative monitoring schemes that would be easier for construction employers to follow that would obtain the same objective?

Running a software program to detect a noise notch could be a simple way of identifying the initial signs of a NIHL.

II.A.2.d. Secondary Sources of Noise Exposure

Are there other methods, besides direct employee noise monitoring on a site-by-site basis that would characterize elevated noise exposure to other or co-workers who are not using tools or equipment generating loud noise? Please provide data showing the prevalence of noise exposures near or exceeding 85 dBA (1) to coworkers or helpers doing a supporting task, or (2) to other trades receiving secondary exposures they did not create.

Seixas, et al. (2001) provide data on a trade not typically considered "noisy" (e.g., electricians). They found more than 24% of noise exposure samples exceeded the OSHA Action Level, demonstrating that "presumably quiet trades such as electricians are at risk of exposure to potentially harmful noise exposures, and that *other workers' activities and the general environment contribute substantially to that risk."* (Emphasis added).

Has any exposure or prediction modeling been done in this area?

How can information concerning expected or measured secondary exposure be incorporated into training requirements, hazard warnings and the general phasing of work in different types of construction?

This could be arranged very much like the mining safety training, which provides a basic safety card for every individual going on a mine site. The card could be reciprocal between construction sites.

II.A.3. Employee Notification

No time limit is given for this notification. Is a similar notification requirement appropriate for the construction industry? Should employers be required to notify construction workers within a certain period, such as 1, 5, 10 or 15 days, of the results of noise exposure monitoring?

As stated in the "Exposure Monitoring: General Comments" presumption of exposure is merited in the construction industry. Employers should notify construction workers immediately of hearing protection requirements. When follow-up measurements identify additional noise hazards, employers should notify workers within 10 days.

II.A.4. Audiometric testing

Paragraph (g) of the general industry noise standard requires employers to make audiometric testing available, at no cost, to all employees who are exposed at or above the action level of 85 dBA. Is a similar requirement appropriate and feasible for the construction industry?

A similar requirement for audiometric testing in the construction industry is very appropriate. The noise levels in the construction industry routinely exceed the OSHA general industry Noise Standard Action Level of 85 dBA. Therefore they pose the potential for a significant hazard to the hearing health of the workers in that industry. To date, the most appropriate way to monitor change in hearing levels of any worker is through regular audiometric monitoring.

How can this service be delivered in a cost-effective way to a mobile workforce of predominantly small employers?

Delivering cost-effective audiometric services is a challenge to small employers in any setting. However, this should not absolve the employer of his responsibility for protecting the hearing health of the employee. In a large metropolitan area, audiometric services are readily available and should not pose a hardship for employers. Smaller companies, operating in remote locations, may want to consider forming a consortium with other employers in an attempt to obtain group rates for audiometric services from a provider that utilizes a mobile van. Additionally, several smaller employers might consider testing at a single location during a specified time in order to obtain better pricing for the audiometric tests. In some cases, local organized labor entities (union locals) may be in a position to provide audiometric testing as a service to employers.

While the workforce in the mining industry is less mobile than that found in the construction industry, obtaining cost-effective audiometric testing services for small and employers is a challenge for both industries. Discussions with noise consultants to the mining industry suggest that mine operators are not

feeling overwhelmed by the requirements imposed on them with the recent Mine Safety and Health Administration (MSHA) noise standard. Construction management might find it useful to consult with mine operators to see how they have handled the challenge of implementing their audiometric testing programs in a cost-effective manner. Many mobile vans are willing to do small numbers of workers while they are in a particular geographical area. Audiometric testing is also available in "home" area of most employees, even if they work at a remote site.

In general industry the trigger for audiometric testing is an employee exposure at or above 85 dBA. Are there alternative triggers that might be more appropriate or less burdensome to initiate audiometric testing in the construction industry? For example, should OSHA require audiometric testing for those in specified construction trades?

With the pervasive nature of noise in the construction workplace (see "Exposure Monitoring: General Comments" above), hearing tests should be mandatory for all construction workers unless evidence indicates no risk of exposure. The presumption of exposure and HCP inclusion obviates the need for a trigger exposure level.

Does OSHA need more precise provisions in terms of audiometric procedures, equipment, and sound booth requirements so as to reduce the variability between audiograms or has this variability been anticipated in the general industry hearing conservation standard?

One area of concern regarding audiometric testing procedures that needs to be addressed is a statement found in (g) (3) of the general industry hearing conservation standard, which reads:

> "Audiometric tests shall be performed by a licensed or certified audiologist, otolaryngologist, or other physician, or by a technician who is certified by the Council for Accreditation in Occupational Hearing Conservation, or who has satisfactorily demonstrated competence... A technician who operates microprocessor audiometers does not need to be certified."

Allowing physicians without specific qualifications to administer or supervise audiometric testing is unwise. There is a wide range of medical specialties and many physicians know little about the details of hearing, its measurement, and its destruction due to noise exposure. Additionally, in order to supervise the audiometric testing program or administer audiograms, the physician should have "... experience and expertise in hearing and hearing loss."

The latter part of this statement implies that technicians who operate microprocessor audiometers do not need any type of training. This is blatantly false as the technician may encounter problems in the testing which require judgement calls that can only be made when the technician has been instructed in the proper procedures for obtaining pure tone audiograms.

NIHL is often accompanied by tinnitus, which may make it more difficult for technicians lacking the proper training to test with manual audiometric testing procedures may be required. The technician is also a critical resource for employees who pose questions regarding their hearing test results, changes in hearing, medical complaints, and hearing protection issues. The success of any HCP is dependent on the quality of the audiometric testing and the provision of appropriate responses to employee questions. Additionally, the technician is most often the person responsible for assuring audiometer calibration and assessment of ambient noise levels. Training and recordkeeping in these topics is necessary. Lastly, the technician is the ideal person to do the initial HPD training and fitting. Again experience and training in these techniques should be required for the technician performing such activities.

The Coalition recommends the following wording for this statement:

"Audiometric tests shall be conducted by an audiologist, physician with experience and expertise in hearing and hearing loss, or a qualified technician under the direction or supervision of an audiologist or a physician with experience and expertise in hearing and hearing loss. Qualified technicians are those who have been certified by the Council for Accreditation in Occupational Hearing Conservation (CAOHC), or by another recognized organization offering equivalent certification."

The latter part of the suggested wording regarding certification of technicians is taken directly from the current MSHA (1999).

Additionally, adopting more recent American National Standards Institute (ANSI) standards for audiometers (ANSI S3.6-1996) as well as requiring a consistent, accepted audiometric test protocol (ANSI S3.21-1978 [R 1997] will help to assure consistency in test results (See comment on ANSI S3.1-1999 in Section 2.B.3). The Coalition recommends that audiometric testing be conducted in accordance with the most current version of pertinent ANSI standards at the time of promulgation of the regulation.

Allowing the use of insert-type earphones may provide more control over ambient noise levels in the test environment, which is another factor that may contribute to inconsistency in test results.

II.A.4. a. Baseline Audiograms

Should the maximum waiting period for baseline audiograms be shorter or longer than 6 months? For example, NIOSH recommends an audiogram within 30 days after hire.
What length of time with a given employer should trigger the requirement to provide an audiometric test?

For new employees, an audiometric test should be completed prior to an employee starting a job where sound levels will be ≥85 dBA or preplacement. It is in the employer's best interest to obtain an accurate measurement of an employee's hearing levels as early as possible. While logistical problems might preclude obtaining an audiogram within 30 days, it seems reasonable that employers should be able to complete them within 90 days, even if a mobile test van is utilized. The timeframe should not exceed 6 months, and if an audiogram is not obtained before placement on the job, hearing protection should be required until the audiogram is obtained for all employees whose noise exposures meet or exceed the action level.

Should the trigger for audiometric testing be by exposure level, type of construction, job process, job title or equipment type or should there be multiple triggers?

From an employer's standpoint, multiple triggers for audiometric testing would be extremely confusing and make compliance more difficult. Since both the OSHA general industry noise standard and the MSHA noise standard use exposure levels as the trigger for audiometric testing, it seems logical for the OSHA construction noise standard to use the same trigger. It also seems reasonable that the trigger should be 85 dBA, resulting in presumptive inclusion in the hearing testing program for construction workers per studies cited previously and obviating the need for an exposure "trigger."

Alternatively, should baseline audiograms be considered for all workers entering construction employment?

Since many construction workers operate multiple types of equipment and are exposed to sound levels that meet or exceed 85 dBA, it is reasonable for OSHA to require baseline audiograms for all workers entering construction employment. At a minimum, however, all employees with the potential for

exposure to sound levels ≥85 dBA should have baseline audiograms. A licensed audiologist, physician, CAOHC-certified occupational or environmental health nurse, or CAOHC-certified audiometric technician must perform the baseline audiograms. In addition, baseline audiograms must be retained by the employee and provided to all subsequent employers.

Paragraph (g)(5)(ii) of the general industry noise standard requires workers whose exposures equal or exceed the action level to use hearing protectors until a baseline audiogram is completed, if the employer is using the one-year period allowed when mobile test vans are used. Should a construction worker be allowed to have exposures above the action level but less than the PEL without hearing protectors for any amount of time before the baseline audiogram is obtained?

No. For the protection of both the employee and the employer, it is most prudent for OSHA to require the worker to use appropriate hearing protection before obtaining a baseline audiogram. This practice will help to ensure that the baseline thresholds have not been affected by noise on the construction site.

Should the use of hearing protectors in this circumstance be advisory rather than mandatory if exposures are between the action level and the PEL?

No. Since it is likely that a considerable percentage of the construction workforce (10 – 15%) exposed to TWAs between 85 and 90 dBA will develop a material hearing loss (OSHA, 1983), good hearing loss prevention practice dictates that hearing protection should be worn whenever the employee is exposed to sound levels that meet or exceed 85 dBA.

Paragraph (g)(5)(iii) of the general industry noise standard requires that a baseline test be preceded by at least 14 hours without exposure to workplace noise. Should this requirement be extended to the construction industry?

OSHA should extend this requirement to the construction industry since it is well documented that the ear recovers from most temporary threshold shifts (TTS) within the first 14 hours following exposure. The worker should be instructed that off-the-job noise exposures can contribute to TTS and should be encouraged to refrain from noisy activities away from the job during the 14 hours preceding the baseline audiogram. Additionally, since it is not always feasible to obtain an audiogram at the start of the shift (before exposure to workplace noise) and exposure to noise is presumed, the employee should be required to wear appropriate hearing protection.

II.A.4. b. Annual Testing

Should the frequency of audiometric testing vary by the type of work and the degree of anticipated exposures? For example, should audiograms be required every six months for workers with exposures that are consistently above 100 dBA?

It is well documented from both human and animal studies that NIHL develops exponentially (Burns and Robinson, 1970; Glorig et al, 1961). Good hearing loss prevention practice suggests that audiograms be required more frequently (e.g., every 6 months for workers with exposures consistently above 100 dBA for the first couple of years of employment). If no change is noted in hearing threshold levels during that time period, audiograms can then be scheduled on an annual basis.

Should audiograms be less frequent for workers whose measured or expected exposures are between 85 and 90 dBA?

In order to maintain consistency between the various federal noise exposure standards, it seems logical for the OSHA construction noise standard to be the same as the OSHA general industry noise standard and the MSHA noise standard. The percentage of the population at risk for developing material hearing impairment at with exposure to sound levels at or above 85 dBA ranges from 10 to 15 percent according to information supplied in the preamble to the OSHA Hearing Conservation Amendment (OSHA, 1983). In order to ensure the best possible protection against NIHL for construction workers, hearing protection devices should be worn when sound levels meet or exceed 85 dBA.

Is there a way to make sure that construction workers who move from one site to another during the year are identified and given annual audiometric tests?

Ensuring that construction workers who move from one site to another during the year are identified and given annual audiometric tests would not prove to be a challenge if they moved from site to site with the same employer. It should be the employer's responsibility to ensure that the testing is completed. This requirement becomes more of a logistical challenge if the worker changes employers, as is often the case in the construction industry.

If the construction sites are union sites, it might be possible to have the worker register with his/her local representative and have the union assist in keeping track of the test intervals. Another suggestion is to have the worker supplied with a record of his/her audiometric test results. The new employer would be required to determine when the last test was done and schedule additional audiograms as required. The employee would have to give the service provider copies of previous audiometric test results in order for the service provider to determine if hearing threshold changes have occurred. A licensed audiologist, physician, CAOHC-certified occupational or environmental health nurse, or certified audiometric technician must perform all baseline audiograms.

It is possible that there might be some type of state health department data registries or other large data registries that would allow for tracking of construction worker audiometric testing. This would have to be investigated on a state-by-state basis. For example, Colorado is in the process of implementing a Web-based database, CHIRP, with a grant from the Centers for Disease Control (CDC) to integrate universal newborn hearing screening with birth certificates and immunization records that will be accessible to health care providers. Conceptually, it seems logical that this same type of system could be developed for construction industry hearing records.

Refer to *Recordkeeping* which discusses the use of optical card technologies for the management of audiometric test data.

II.A.4.c. Retest Audiograms

Paragraph (g)(7)(ii) of the general industry noise standard gives employers the option to retest an employee within 30 days if an STS has occurred and to consider the retest as the annual audiogram. Considering the high mobility of the construction workforce and NIOSH's recommendation for immediate retesting (Ex-2-1, pp. 49-50), should there be a requirement for an immediate retest if an STS has occurred? Is a confirmatory retest within 30 days desirable or feasible for construction workers?

For the construction industry, the Coalition supports NIOSH's recommendation (NIOSH, 1998) for an immediate retest if STS has occurred. If the retest audiogram does not show the same shift, the retest audiogram becomes the test of record and there is no need for a confirmatory retest within 30 days.

The Coalition also agrees with NIOSH's recommendation that confirmation audiograms be conducted again within 30 days of any monitoring or retest audiogram that continues to show an STS.

Should there be a requirement or recommendation that the retest be preceded by 14 hours without exposure to workplace noise and should hearing protectors be allowed to substitute for this pre-test "quiet"?

Yes. The Coalition recommends that the employee's retest audiogram be preceded by 14 hours without exposure to workplace noise. However, OSHA must also consider that off-the-job exposures can result in TTS.

It may not be practical or possible to conduct retest audiograms for every employee immediately on their arrival at work, and thus reliance on HPDs for the 14-hour quiet period is necessary. One can also argue that additional training and motivation can be given to employees to properly wear their hearing protection on the day of a retest audiogram because it is in their best interest to have a noise-free (i.e., non-shifted) retest.

OSHA may want to consider the following for both baseline and confirming retest audiograms:

> Hearing protectors may be used as a substitute for the requirement that retest audiograms be preceded by 14 hours without exposure to workplace noise, as long as no more than 5 days prior to the test:
>
> (a) the employee whose hearing is to be evaluated receives individual training or retraining in the use of HPDs,
> (b) the condition of the employee's HPD is checked and found satisfactory, and
> (c) the hearing protector selected is either an earmuff or a foam earplug, or a protector with proven, documented attenuation.

Note: Reliance on HPDs for the noise free requirement assumes the HPDs are effective.

In addition, any employee whose TWA exceeds 100dBA shall be required to wear an earplug together with an earmuff if hearing protection is to be substituted for the 14-hour non-exposure period. The rationale for limiting HPD selection to earmuffs or foam plugs for the baseline audiogram is that those devices are the ones that in general have been shown to provide the highest levels of real-world performance (Berger, et al., 1996).

II.A.4.d. Follow-up Procedures for Audiograms Showing Hearing Loss

*Paragraph (g)(8)(ii) of the general industry noise standard details follow-up procedures triggered by an STS unless a **physician** determines that the STS is neither work related or aggravated by occupational noise exposure. These procedures include: (A) fitting with hearing protectors and training in their use and care; (B) refitting and retraining for those already wearing hearing protectors; (C) referral for a clinical audiological or otological examination if additional testing is necessary or if an ear pathology (medical problem) is determined to be related to the wearing of hearing protectors; and (D) informing the worker of a need for an otological exam if an ear pathology is deemed unrelated to the use of hearing protectors.*

OSHA is seeking comments and information on whether there are follow-up actions that should be taken even when an STS has not occurred, and specifically on the provisions of paragraph (g)(8)(ii)(C) of

1910.95, which require referral in cases where additional testing is necessary to obtain a valid audiogram or a medical problem is related to the wearing of hearing protectors, and paragraph (g)(8)(ii)(D) of 1910.95, informing the worker of a need for an otological exam regardless of whether the problem is related to the use of hearing protectors. Are there other circumstances where follow-up actions should be either required or recommended for construction workers, such as counseling in the event of an STS or pathology of the ear?

General Comments

Allowing physicians without specific qualifications, as specified in paragraph (g)(8)(ii) of the general industry noise standard, to determine work relatedness is unwise. There is a wide range of medical specialties and many physicians know little about the details of hearing, its measurement, and its destruction due to noise exposure. The Coalition recommends that an audiologist or a physician with experience and expertise in hearing and hearing loss should be responsible for the determination of work relatedness of an STS.

In direct response to OSHA's questions:

In order to ensure that the construction industry noise standard is as protective as the general industry noise standard, the Coalition finds it reasonable for the employer to be required to—

- refer an employee for a clinical audiological evaluation or an otological examination as appropriate, if additional testing is necessary or if the employer suspects a medical pathology of the ear is caused or aggravated by the wearing of hearing protectors as required in paragraph (g)(8)(ii)(C) of 1910.95;
- inform the worker of a need for an otological exam regardless of whether the problem is related to the use of hearing protectors as required in paragraph (g)(8)(ii)(D) of 1910.95;
- Obtain a "valid" hearing test in cases where the employee cannot be tested accurately by a technician (i.e., needs masking for asymmetrical hearing loss, surgically modified ear, etc.); and
- Notify an employee of the need for a personal medical referral for any referral indication suggestive of a medical condition that should be evaluated by a physician; such as dizziness, hearing loss, pain (these have been published by AAO, CAOHC etc.)

It has proved difficult to convince construction workers to protect their hearing. These workers will continue to be deafened by toxic noise until the issue of HPD compliance is resolved. In order to address compliance in this industry, the Coalition recommends that employers be required to develop flexible education programs that encourage worker involvement and ownership and conduct these programs annually as required in the general industry noise standard.

These worker and management training activities are one of the most effective components of a hearing conservation program. Providing a forum for discussion not only involves workers, it also serves to reveal problems they face in adhering to the components of an HCP. A diverse workforce with high turnover as in the construction industry offers many challenges to the trainer and forces them to reassess the audience and tailor messages every time training is provided.

Merry (1999) made the point that people behave differently in the various "stages" of the change process thus, the necessary training interventions differ at each stage. For example, if a trainer is attempting to increase compliance with HPD use, the following are the stages the workers can be expected to progress through as they adopt the new behavior.

- **Precontemplative.** The workers do not recognize the issue or feel any need to change their behavior. To move workers out of this stage, the trainer must create a sense of urgency and concern about occupational hearing loss.
- **Contemplative.** The workers are aware of the problem, so simply providing them more facts is unlikely to spur them into action. They are thinking about changing their behavior, but are unsure how to do so. To assist them, the trainer can help the worker consider the costs, benefits, and probabilities of future handicaps associated with preventing–or not preventing–hearing loss.
- **Preparation.** The workers recognize and appreciate the "pro" arguments. They begin to take steps that will facilitate their ability to adopt new behavior. For example, they may purchase hearing protectors, participate in a sound survey of their workplace, or schedule an appointment for a hearing test.
- **Action.** The workers set reasonable goals for themselves. Workers in the action stage intend to maintain their healthy behaviors and benefit from encouragement each step of the way.
- **Maintenance.** The workers are strong champions of healthy behavior and publicly identify themselves as proponents of the "new" safe work practices.

II.A.5. Hearing Protectors

Are other data available on current hearing protector use in the U.S. construction industry?

There is a need for research in this area. In the meantime, all construction workers who are exposed to sound levels at or above 85 dBA should be required to use HPDs.

OSHA solicits information from employers, employees, and safety and health professionals on their experience with regard to the ability to communicate or other risks that may be incurred while wearing hearing protectors. This includes information on the effectiveness of traditional hearing protectors and particularly on the effectiveness of newer devices (both plugs and muffs) with uniform attenuation, active attenuators, and communication systems developed, at least in part, to address these problems.

II.A.5.a. When Should Hearing Protectors Be Required?

Should the requirement be contingent upon incurring an STS or waiting for a baseline audiogram, as in the general industry noise standard?

HPD use should be required for *everyone* exposed to sound levels at or above 85 dBA. The simpler the requirement, the more likely it is that more workers will use HPDs. In the very unlikely event that the sound levels for a construction worker's *entire shift* do not exceed 75 to 80dB, OSHA could consider an exception to the use of HPDs.

Is there an increased hazard for these workers that is caused by the inability to hear warning signals at moderate noise levels, such as 80-85 dBA, when wearing hearing protectors?

Studies have shown that the use of hearing protectors either by individuals with normal hearing or individuals with hearing impairment does not affect their ability to hear intentional warning signals. Noise, attendant to dangerous situations (e.g., a truck in need of new brakes) was audible by both those with normal hearing and hearing impairment even when wearing hearing protectors— provided the individual was not distracted. However, workers who were distracted and not wearing hearing protectors were found to have elevation of effective thresholds (6-9dB) for particular test stimuli. (Berger, 2000).

Whether workers must wear their hearing protectors for the entire workshift or only when noise levels exceed 90 dBA is not addressed. The Agency is requesting information on the use of hearing protectors in varying noise environments, especially in the intermittent noise environments that characterize many construction exposures. Should construction workers be required to wear hearing protectors only in noise levels that exceed the PEL of 90 dBA, an action level of 85 dBA, or should they be required to wear hearing protectors in all noise environments where exposures are expected to exceed a certain TWA?

As stated in the "Exposure Monitoring: General Comments" with noise so pervasive in construction trades, presumption of exposure is merited. Monitoring will determine those workers who are to be excluded from the hearing conservation program. Given that assumption, workers should wear hearing protection for the entire work shift until monitoring excludes them from the program.

If the requirement is only for levels above the action level, how would workers know when to put on their hearing protectors?

Sound level meter readings and establishing "noise perimeter zones" as described above could be used to define noise-hazardous areas.

II.A.5.b. Selection of Hearing Protectors

Paragraph (i)(3) of the general industry noise standard states that employees must be given the opportunity to select their hearing protectors from a variety of suitable hearing protectors provided by the employer. This requirement has been interpreted to mean that at least one variety of plug and one variety of muff must be available (Ex. 2-14). Is a choice between two protectors sufficiently protective where noise exposure is often intermittent and communication may be of particular importance?

The effectiveness of any hearing conservation program relies heavily on the workers' willingness to wear HPDs. The following factors have been identified as extremely important determinants in workers' acceptance of hearing protectors.

- Convenience and availability
- Belief that the device can be worn correctly
- Belief that the device will prevent hearing loss
- Belief that the device will not impair the worker's ability to hear important sounds
- Comfort
- Adequate noise reduction
- East of fit
- Compatibility with other personal protective equipment

While a single earmuff and a single earplug meet current OSHA requirements, most hearing conservationists recommend that a larger selection be offered to employees.

A preferable requirement would be:

> "to choose from at least four different models of hearing protectors, including at least two types of earplugs and one type of earmuff." (Berger, 2000).

A larger selection of HPDs addresses the issue that construction workers face many different working environments with many different exposures to noise and requirements for communication.

II.A.5.c. Hearing Protector Attenuation

Should OSHA continue to recommend the use of the NRR for estimating the attenuation provided by hearing protectors for construction workers?

Should a standard for construction recommend or require a 50% de-rating to account for the difference between laboratory and field performance?

Should OSHA continue to require the 7-dB subtraction for spectral uncertainty?

Should OSHA adopt the NIOSH device-dependent de-rating formula discussed above?

Should OSHA allow or recommend the NRR(SF) or a similar rating based on subject fit data as an alternative to the NRR?

Hearing protector ratings including the noise reduction rating (NRR) are based on data obtained under laboratory conditions in which the experimenters are fitting trained listeners. These ratings differ markedly from the noise reduction that workers actually experience on the job. In the late 1970's and early 1980's, two NOISH field studies demonstrated that insert-type hearing protectors provided less than half the noise attenuation measured in the laboratory (Edwards, et al., 1979; Lempert and Edward, 1983).

Royster, et al. (1996) addressed problems associated with the use of the NRR. They demonstrated that relying on the manufacturer's instructions or the experimenter to fit hearing protectors may be of little value in estimating the protection that workers would actually experience. The Royster et al. study also demonstrated that having untrained subjects fit their own hearing protectors provided much better estimates of the hearing protector's noise attenuation in the workplace than having the experimenter fit them. This method has been adopted for use in ANSI S12.6-1997 (R2002), *Methods for Measuring the Real-Ear Attenuation of Hearing Protectors* (ANSI, 2002).

NIOSH also recommends the use of subject-fit data based on ANSI S12.6-1997 (R2002) (ANSI, 2002) to estimate hearing protector noise attenuation. However, if subject fit data is not available, NIOSH recommends de-rating hearing protectors to correspond with available real-world data. Specifically,

Earmuffs	Subtract 25% from the manufacturer's labeled NRR
Foam earplugs	Subtract 50% from the manufacturer's labeled NRR
All other earplugs	Subtract 70% from the manufacturer's labeled NRR

The Coalition recommends that OSHA continue to apply the 7-dB subtraction. Consideration should be provided for on-site or personal tests of hearing protector effectiveness.

II.A.6. Training Programs

Paragraph (k) of the general industry noise standard contains requirements for training programs, which must be repeated annually for each employee in the hearing conservation program. These programs must include: information on the effects of noise on hearing; the type of task or equipment that can cause loud noise and maximum usage time without hearing protection, the purpose of hearing protectors; the

advantages, disadvantages, and attenuation of various types of hearing protectors; instructions on selection, fitting, use, and care of hearing protectors; and the purpose of audiometric test procedures. Are these training requirements appropriate for the construction industry?

These requirements are appropriate as a foundation for construction industry training requirements. However, the following topics should be addressed as well:

1. Since there is considerable equipment unique to the construction industry, noise levels and hazards associated with the equipment should be incorporated into the training program.
2. The fact that noise levels may vary considerably from day-to-day and from one job to another needs to be stressed.
3. Workers should be made aware of the dangers of overprotection given that some types of hearing protectors may provide more attenuation than is appropriate for the particular situation. Workers do not want to put themselves at a disadvantage in terms of communications/warnings by using a hearing protector with a very high attenuation rating when a lesser level of attenuation is adequate.
4. Hearing can be damaged by both occupational and non-occupational noise exposures. The addition of information on non-occupational noise exposures should be included as part of the worker training. Hearing loss prevention program professionals in general industry have found that providing information to workers on the hazards of non-occupational noise (e.g., recreational shooting, rock concerts, power tool) is very effective in raising awareness of the need for using hearing protectors off-the-job.

In general industry the trigger for training is an employee exposure at or above 85 dBA. Are there alternative triggers that might be more appropriate and less burdensome in the construction industry?

As we stated in the "Exposure Monitoring: General Comments" noise so pervasive in construction trades that exposure should be presumed and exposure monitoring potentially should be used to determine individuals for HCP *exclusion* rather than *inclusion*. The presumptive approach to HCP inclusion described would entail hearing conservation training for all construction workers, thus making the need for a "trigger" unnecessary.

Is there a need for face- to- face training in the construction industry? Why?

Face-to-face training can prove burdensome and costly for all employers—and perhaps more so for the construction industry. However, it is imperative that initial training be completed on a face-to-face basis to ensure that the worker understands the principles involved in the hearing conservation training program and how to correctly fit hearing protectors appropriate for the worker's occupational noise exposures. This training could be accomplished at the time of the annual hearing test.

Greater cost effectiveness and efficiency could be realized if annual training sessions were not conducted in a face-to-face setting. But there should always be a resource available (either on site or by phone) to answer workers' questions. Interactive training programs can be very effective if there are knowledgeable resources available to the worker to clarify issues that may arise. Additional re-training could be accomplished at the time of the annual hearing test.

Also, are there exemplary training programs that are construction or trade specific that should be brought to OSHA's attention?

Both Dr. Sally Lusk at the University of Michigan School of Nursing in Ann Arbor, MI, and Dr. Carol Merry Stephenson at NIOSH have done extensive research on worker hearing conservation education in

the construction field. Dr. Lusk has developed a set of training materials (*Take Control: Protecting Yourself from Noise-Induced Hearing Loss*). The materials include a videotape training program, a trainer's manual, a flyer on where to obtain HPDs, sample HPDs, and a brochure to remind the employees of the materials that were included in the training program. These materials can be obtained from the American Industrial Hygiene Association (AIHA).

Dr. Stephenson has indicated that NIOSH is currently field testing a program that can be used by construction workers moving from site to site. Preliminary findings show positive response and results. Early data on this program have been presented at the National Hearing Conservation Association (NHCA) conference.

OSHA is referred to *Follow-Up Procedures for Audiograms Showing Hearing Loss* for additional information on training programs.

Contact with Drs. Lusk and Stephenson can provide more detailed information. Dr. Lusk may be reached at 734-647-0347. Dr. Stephenson can be reached at 513-533-8581.

II.A.7. Recordkeeping

OSHA is aware of two possible approaches to this logistical problem in construction: (1) Centralized (possibly web based) recordkeeping systems and (2) portable smart cards carried by workers (currently being used in British Columbia). Workers could also take their records manually from one employer to the next. This might work for employment of one or two years, but would be cumbersome and inefficient over a working lifetime. OSHA seeks information on successful approaches for maintaining and transferring medical records used in the construction industry, whether maintained by the company, state, union, trade association, or other groups.

Current recordkeeping systems work well in some, but not all, situations. Many construction workers routinely move from job to job, work only part time, or are self-employed. As such, traditional recordkeeping systems are often impractical. NIOSH has investigated the use of emerging information management hardware and software, that can facilitate the management of records of a mobile or itinerant workforce. In particular, optical card technology may be useful in developing hearing loss prevention programs that serve these workers.

According to NIOSH (1996), an optical card has a storage capacity of up to 6 megabytes (the equivalent of more than 2,400 pages of typewritten text). Each optical card can therefore accommodate all data fields and records pertinent to a worker's participation in an HCP. By comparison, the typical 3.5" floppy disk can store only 1.4 megabytes of data and a "smart card" can hold only 256 kilobytes of data. Each optical card can contain all records of occupational and non-occupational noise/solvent exposure histories, relevant medical histories, training records, protective equipment use histories, and related medical records from previous evaluations.

Although optical card technology offers significant advances in storage capacity and data security, its most significant benefit may be its potential to facilitate the provision of audiometric monitoring services for a mobile or itinerant workforce such as construction workers. Current HCPs are site-based. If a worker leaves, his/her audiometric and noise exposure records remain at the site. By contrast, an optical card will be in the possession of the worker. When the worker changes jobs, the worker will carry his/her "records" to the next job. The continuity of care for a worker would be assured regardless of how many occupational health care workers he or she received hearing health services from. Such continuity of care

would make it feasible to establish an audiometric baseline and monitor the hearing of a mobile or itinerant worker.

Please refer to *Annual Testing* for a discussion on the use of a web-based database for the maintenance of employee records. It is critical that not solely the employer or employee maintain the data.

What problems have surfaced in these efforts?

OSHA is referred to NIOSH because it has investigated the use of this technology.

What costs are incurred and how are the delivery of services structured between the involved parties?

OSHA is referred to NIOSH for this information.

In any shared record system, how is the privacy of the employee's medical data protected?

With respect to the Health Insurance Portability and Accountability Act (HIPAA), if an individual provides a new employer with his personal identifiable health information via an optical card, the individual is in a sense authorizing the employer to use that information. There may have to be limits placed on the employer's use of that health information. In addition, the individual should be provided with information as to his/her rights on how the information is to be used.

For what duration should employers be required to retain records?

The audiometric test record for each worker tested should be consistent with the recordkeeping requirements outlined by OSHA, which include the following information:

1. Name and job classification of the employee
2. Date of the audiogram(s)
3. The examiner's name
4. Date of the last acoustic or exhaustive calibration of the audiometer
5. Employee's most recent noise exposure assessment

In addition to the requirements outlined by OSHA, the Coalition recommends that—

- the audiometric test record include the model and serial number of the audiometer used for testing,
- the employer maintain accurate records of the measurements of the background sound pressure levels in audiometric test rooms, and
- the name of the individual supervising the hearing conservation program in question be recorded on the audiogram form.

The employer should retain audiometric test records and noise exposure measurement records for the duration of the affected employee's employment plus 30 years.

In addition, noise exposure database records should be established and maintained for 40 years in order for OSHA to evaluate the effectiveness of its HCPs.

2.B. Other Hearing Conservation Issues Raised by NIOSH in its Criteria Document

2.B.1. Hazard Communication

2.B.1.a. Warning Signs

The general industry noise standard does not contain a provision for warning signs and regulated areas, although the NIOSH criteria document recommends a requirement stating that warning signs shall be clearly visible at the entrance to or at the periphery of areas where noise exposures routinely equal or exceed a TWA of 85 dBA (Ex. 2-1). Should a hearing conservation rule for construction have such a requirement?

Yes. The Coalition supports NIOSH's (1998) recommendation that warning signs be placed wherever exposures equal or exceed 85 dBA as an 8-hour TWA. NIOSH also recommends the use of warning signs, which are clearly visible at the entrance to or the periphery of areas where noise exposures routinely equal or exceed 85 dBA as an 8-hour TWA. The warning signs should be printed in English or in the language of most workers. Workers who do not read should be informed verbally about the instructions. Moir (2001) recommended the establishment of a "Noise Perimeter Zone" in which all workers must wear hearing protection. All other workers are prohibited from entering the area.

If so, should the requirement be for areas where noise levels or noise exposures (TWAs) equal or exceed a certain level?

Warning signs should be required wherever an employee could be exposed to sound levels at or above 85 dBA.

How should these areas be selected?

Area sound level meter-measurements could be used to determine HPD boundaries on the jobsite. With equipment in typical operation, area measurements could be used to determine how far hazardous noise levels travel. Yellow tape or a similar boundary-marking process could be used to indicate mandatory HPD zones.

Should OSHA give specific guidance on how to post these areas?

Yes. The Coalition refers OSHA to NIOSH (1998) for guidance on the posting of warning signs.

Could the posting of warning signs serve as an alternative to noise monitoring under the assumption that the assigned site or project is above the hearing conservation action level?

No. Ongoing noise exposure monitoring is critical if an accurate characterization of the noise hazard present is to be maintained. In addition, noise exposure assessments may need to be updated if there are potential changes in exposure resulting from changes in equipment or production, and the rate of STS, among other things. Noise monitoring is also necessary when determining the work-relatedness of a hearing loss for CFR 1904.10.

2.B.1.b. Noise Labeling of Equipment and Tools

OSHA requests data and information, including the outcomes, of any noise labeling programs in the U.S. or abroad, as well as information about the progress of the ANSI working group, S12 WG38.

Have employers used noise labels on equipment or tools to communicate risk of hearing loss?

The German "Blue Angel" construction equipment-labeling program is the leading example of how this process could work (Suter 1999; http://www.blauer-engel.de). Equipment or product labeling could be a valuable adjunct to the jobsite area monitoring process described in *Monitoring*. U.S. contractors have

used equipment and/or tool labeling as one part of an overall approach to exposure control (Scott Knowlan, Cianbro Corp., personal communication, 10-02).

2.B.2. Program Evaluation Criteria

The general industry noise standard does not include criteria for evaluating the effectiveness of hearing conservation programs. However, the NIOSH criteria document does contain a section on this topic and there is a draft ANSI standard, S12.13-1991 (currently in the process of revision), that addresses the evaluation of audiometric testing programs. NIOSH recommends a two-step process: 1) The evaluation of an individual worker's hearing loss prevention program at the time of the annual audiometric test, and 2) Annual evaluation on a programmatic level.
OSHA seeks information on methods to evaluate the success of hearing conservation programs in construction.

Please note that ANSI S12.13-1991 (DRAFT) has been voted down as a standard, but has been published as a Technical Report (ANSI S12.13-2002TR).

The sentinel analyses to determine program effectiveness are—

- a reliable audiometric testing protocol,
- a combination of STS criteria, using the definitions outlined by OSHA and NIOSH (i.e., 15 dB change in hearing from baseline at any test frequency confirmed with 2nd test),
- impairment analysis, and
- professional program supervision and follow-up action items.

If the occurrence of an STS is used as the measure of hearing loss, what rates of STSs are seen in effective programs, i.e., when does an employer know that the program is working?

General industry employers, fully employing the presbycusis and work-relatedness exclusions allowed in 29 CFR 1910.95, can consistently achieve annual STS rates of less than 1% (James, Anderson & Associates personal communication 2002; Rink 2002).

What other benchmarks can be used to evaluate a successful program in construction?

An audit process can provide assurance that program components are in place and functioning. Audit items should include the following:

- Appropriate identification of noise hazard areas
- Use of hearing protection in required areas and operations (Washington State is considering use of hearing protection audits in cases where full HCP and hearing testing are not appropriate because of short tenure of workers [Krause personal communication 10-02].)
- Systematic selection of quiet new equipment
- Integrity and completeness of hearing testing process
- Appropriate analysis of hearing test data and follow-up indicators

- Qualified audiometric technicians who report to a licensed professional supervisor. The credentials of the licensed professional should be "at risk" if the critical audiometric testing component is not conducted in such a way as to produce accurate and reliable results.
- Availability of hearing protection devices
- Evaluation of training program
- Employee feedback

NIOSH and others have developed audit processes and forms that are applicable to the construction environment. An example is available at http://www.cdc.gov/niosh/hpprgmch.html.

OSHA also seeks information on the advisability of using the provisions of the draft ANSI standard, S12.13, for evaluating the effectiveness of hearing conservation programs through the examination of audiometric data. Is this method practical and does it produce useful results?

No. ANSI S12.13-2002TR requires too large a restricted set of subject employees for too long a time to be applicable in the small employer, transient workforce situations found in construction.

Is there a simple self-evaluation tool that can be used by small employers?

See NIOSH audit processes and checklists, above.

2.B.3. ANSI Standards

Should OSHA adopt the most recent ANSI standards? Please provide data and documentation supporting your position. Are any of these ANSI standards not applicable to the construction industry?

The Coalition recommends that a hearing conservation program for the construction industry incorporate current ANSI standards intended to improve performance and calibration criteria for audiometric testing, audiometric booths and vans, dosimeters, and sound level instruments.

The Coalition is concerned with the "real world" ability to comply with ANSI S3.1-1999, *Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms*—Specifically, the maximum permissible noise level of 21dB at 500Hz. Studies have shown that a large percentage of actual audiometric booth and test vans would fail those requirements at 500Hz (Lankford, et al., 1999). A compromise exists in the position of the National Hearing Conservation Association (NHCA, 1996) which relaxes the ANSI requirement by 5dB to a value of 24.5dB at 500Hz, relative to the 1991 ANSI standard and 3.5dB relative to the current 1999 standard. Lankford, et al., found that 100% of the mobile facilities they tested met the compromise requirements.

With respect to audiometric testing, the general industry noise standard paragraph (h) (2) "Audiometric tests shall be conducted with audiometers (including microprocessor audiometers) that meet the specifications of, and are maintained and used in accordance with, American National Standard Specification for Audiometers, S3.6-1969," is inappropriate for the construction industry. Requiring compliance with S3.6-1969 excludes the use of new technology for audiometric testing. If the restrictions in effect in the general industry noise standard are applied to a construction industry regulation, existing technology that has the capability of reducing the variability between audiograms would be prohibited.

In 29 CFR 1910, VI (p. 9749, col. 2, bottom), "Summary and Explanation of Actions Taken, Methods of Measurement and Instrument Calibration," the following comment appears:

> "Measuring instruments should conform to the specifications of nationally recognized consensus standards, but the specifications should not be mandated, because it might restrict the development and use of new instruments and methods."

The same rationale should apply to the measurement of hearing. It is recommended that OSHA reference the ANSI specification for audiometers revision in effect at the time of testing. This would allow the program to benefit from new, scientifically validated technology that has emerged since the ANSI S3.6-1969 document was published and accommodate improvements yet to appear.

2.C. Noise and Safety on the Construction Site

Suter's work discusses the possible link between noise, hearing loss, and the occurrence of accidents in the construction industry, as well as studies of this problem in other industries (ship building, general industry) (Exs. 2-2; 2-6). OSHA seeks information and data on construction worker accidents associated with or caused by excessive construction project noise or noise-induced hearing loss, including individual accident investigation reports, and research results.

The Agency also seeks information on the availability of warning signals, such as reverse alarms on heavy vehicles that are specially designed to be audible in the noise environments typical of construction sites or by workers with noise-induced hearing loss.

Are there alternatives to reverse alarms (visual as well as acoustical) that have proven to be effective?

Refer to the Coalition's comments in *When Should Hearing Protectors be Required?* These comments discuss that the use of hearing protectors does not pose as much of a concern as initially assumed.

Warning sounds can be adjusted for both pitch and loudness to achieve optimum perceptibility; therefore workers should be able to wear hearing protectors and still be able to hear intentional warning sounds. Keeping the primary acoustic output of the warning signal below 2kHz will enhance the audibility of the signal because most workers with hearing loss exhibit the largest loss above that frequency and many HPDs will deliver less attenuation below that frequency (Berger, 2000).

2.D. Noise Exposure Controls
2.D.1. Engineering and Administrative Controls

What are the noise exposures of operators of heavy equipment and those who work nearby?

Exposures related to heavy equipment and construction activity typically exceed 85dB(A) TWA. See Eaton, 2000; Hattis and Makri, 1999; Kerr et al., 2002; Legris & Poulin, 1998; Neitzel et al., 1999; Seixas et al., 2001; Waitzman & Smith (N.D.); and many others.

What progress has been made over the last two decades to control the noise of heavy construction equipment?

Progress in the U.S. has been limited because of the lack of enforcement support from the U.S. Environmental Protection Agency (EPA) (Suter 1999); those equipment manufacturers dealing internationally have been compelled to meet more stringent EU requirements. Heavy equipment commonly used in construction is very similar to that used in mining, and the U.S. Bureau of Mines has published extensively on noise control for mining equipment (http://www.msha.gov/1999noise/surface/noisesurface.html); many of these techniques for control are applicable to construction equipment.

Are quieter tools powered by means other than pneumatic power available for the kinds of construction jobs traditionally done by pneumatic tools?

In general industry, substituting electric tools for pneumatic and torque tools for impact tools have proven successful. Transfer of this technology to construction may prove beneficial.

Are these tools as efficient and cost-effective as the pneumatic versions?

Some processes and tools are suitable for substitution; others are not.

Please provide data on the availability of quieter equipment and tools, price quotes, productivity information, and any other data that would be helpful in determining the relative cost-effectiveness of purchasing quieter equipment.

Worksafe Western Australia (http://www.safetyline.wa.gov.au/sub30.htm) and others have conducted Work in this area. MSHA also has this information.

What types of engineering and administrative controls have proved most effective?

Administrative controls have proven problematic in general industry. Scheduling noisy operations to minimize number of workers exposed and limiting time of operation of noisy equipment have taken a secondary role to productivity. In other words, day-to-day management decisions often trump such strategies. Purchasing quiet equipment and controlling noise at the source have proven most effective; some limited success has been found in erecting barriers to shield workers from high noise levels, but the effectiveness of this approach has been limited in general industry due to maintenance and enclosure removal issues.

How have these controls affected operations on construction sites?

Temporary barriers have proven effective in some construction situations (Moir, 2002); the best way to manage exposure is to eliminate the source of noise by substituting quieter tools and operations where feasible.

2.D.2. Machine Design, Retrofit, and Substitutions

OSHA seeks information on quieter tools, equipment, or processes for the construction industry that have been developed either in the U.S. or abroad that could be substituted for existing noisy tools, equipment, and processes. The Agency also requests information from equipment manufacturers, noise control engineers, and others involved in the purchase, use, or modification of equipment or parts of equipment

used in construction on those features of machine design and retrofit (including installation of mufflers, power rating of the engine, presence of enclosed, sound-insulated cabs) affecting the noise exposure of workers operating the equipment or working in the vicinity of such equipment. Please provide specific information on the types and noise emission levels (both sound power and sound pressure levels, if available), as well as information on the cost-effectiveness of various types of "quiet" construction equipment now being marketed and used in the construction industry.

Much of this information is available from international sources cited above. The Laborer's Health and Safety Fund of North America has compiled a list (http://www.lhsfna.org/html/links1/html).

In commercial, road and bridge and residential construction, control of which types of equipment would have the greatest impact in reducing the number of people exposed and the intensity of exposure?

Has any study or modeling been done in this area?

Studies cited previously indicate that pneumatic breakers/jackhammers, bulldozers, mobile cranes, pavers, diesel and pneumatic pile drivers, and many other pieces of equipment contribute to overall job site noise levels in the environments in question. In many cases, equipment control research has focused on the operator of the equipment. Applications, such as insulated cabs on bulldozers and mobile cranes, have yielded significant reductions in exposure for the operator, but more research is required to determine the most effective controls to mitigate exposure for workers adjacent to the noise-producing equipment.

2.D.3. Administrative Controls

To what degree are administrative controls feasible or desirable in the construction industry?
What administrative controls are used for noise control in the construction industry?
How are such controls implemented?
What are the costs?
Are there any data on the effectiveness of administrative controls in the construction industry?
Do certain construction operations preclude the use of administrative controls?
If so, which are they, and why do they make the use of such controls difficult or impossible?

Generally, administrative controls are more easily overlooked than engineering controls. Oftentimes, attempts to manage worker exposure via scheduling or duration of operation of noisy equipment are secondary to the project completion schedules. Administrative controls should be considered secondary to engineering controls and HPD as a means of exposure control. However, on larger sites where multiple workers from a given trade are present, job rotation may be possible. Also, increasing the distance between the noise source and nearby workers can reduce noise exposure levels, and training workers to avoid unnecessary exposures (e.g., work breaks taken in the immediate vicinity of heavy equipment) can lower exposure levels.

Resources

American National Standards Institute. (1978). *Method for manual pure-tone threshold audiometry* (ANSI S3.21-1978) [R1997]. New York: Acoustical Society of America.

American National Standards Institute. (1996). *Specifications for audiometers* (ANSI S3.6-1996). New York: Acoustical Society of America.

American National Standards Institute. (1999). *Maximum permissible ambient noise levels for audiometric test rooms* (ANSI 3.1-1999). New York: Acoustical Society of America.

American National Standards Institute. (2002). *Methods for measuring the real-ear attenuation of hearing protectors* (ANSI 12.6.1997) [R2002]. New York: Acoustical Society of America.

American National Standards Institute. (2002). *Technical report: Evaluating the effectiveness of hearing conservation programs* (ANSI S12.13-2002). New York: Acoustical Society of America.

Berger, E.H., Franks, J.R., & Lindgren, F. (1996). International review of field studies of hearing protector attenuation. In A. Axlesson et al. (Eds.), *Scientific basis of noise-induced hearing loss*. New York: Thieme Medical Publishers.

Berger, E.H. (2000). Hearing protection devices. In E.H. Berger et al. (Eds.), *The noise manual.* Fairfax, VA: American Industrial Hygiene Association.

Burns, W., & Robinson, D.W. (1970). *Hearing and noise in industry.* London: Her Majesty's Stationery Office.

Eaton, S. (2000). *Construction noise engineering section report* (Project Number 7.11-00284). British Columbia: Workers' Compensation Board.

Edwards, R.G., Hauser, W.P., Moiseev, N.A., Broderson, A.B., & Green, W.W. (1979). A field investigation of noise reduction afforded by insert-type hearing protectors. Cincinnati: U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, DHEW (NIOSH) Publication No. 79-115.

Glorig, A., Ward, W. D., and Nixon, J. (1961). Damage risk criteria and noise induced hearing loss. *Archives of Otolaryngology, 74,* 413-423.

Hattis, G., & Makri, A. (1999). *Expected hearing loss and disability from noise exposures in construction* (Report to the Occupational Safety and Health Administration).

Kerr, M., Brosseau, L., & Johnson, C.S. (2002). Noise levels of selected construction tasks. *Journal of the American Industrial Hygiene Association, 63*(3), 334-339.

Lankford, J.E., Perrone, D.C., Thunder, T. D. (1999). Ambient noise levels in mobile audiometric testing facilities. *Journal of the American Occupational Health Nurses, 47*(4), 163-167.

Legris, M., & Poulin, P. (1998). Noise exposure profiles among heavy equipment operators, associated laborers, and crane operators. *Journal of the American Industrial Hygiene Association, 59,* 774-778.

Lempert, B.L., & Edward, R.G. (1983). Field investigations of noise reduction afforded by insert-type hearing protectors. *Journal of the American Industrial Hygiene Association, 44*(2), 894-902.

Merry, C. J. (1999). Why training needs change (Summary). In *Best practices in hearing loss prevention.* Loveland, OH: NIOSH.

Moir, S., (2001, April). Construction worker safety facts. *Nuts and Bolts.*

National Hearing Conservation Association. (1996). *A practical guide to Mobile hearing testing and selecting a provider, Guide #3.* Denver, CO: National Hearing Conservation Association.

National Institute for Occupational Safety and Health. (1998, June). *Criteria for a recommended standard: Occupational noise exposure.* Cincinnati, OH: NIOSH.

National Institute for Occupational Safety and Health. (1996). *Practical guide for preventing hearing loss.* Cincinnati, OH: NIOSH.

Neitzel, R., Seixas, N., Camp. J., & Yost, M. (1999). An assessment of occupational noise exposure in four construction trades. *Journal of the American Industrial Hygiene Association, 60,* 807-817.

Occupational Safety and Health Administration. (1983). Occupational noise exposure: Hearing conservation amendment; Final rule (29 CFR 1910.95). *Federal Register, 48*(46), 9738-9785.

Rink, T. (2002). *The hearing conservation amendment on trial.* Paper presented at the meeting of the National Hearing Conservation Association Conference, Dallas, TX.

Royster, L.H., Berger, E.H., & Royster, J.D. (1986). Noise surveys and data analysis. In E.H. Berger et al. (Eds.), *Noise and hearing conservation manual.* Akron, OH: American Industrial Hygiene Association.

Royster, J.D., et al. (1996). Development of a new standard laboratory protocol for estimating the field attenuation of hearing protection devices (Part I: Research of Working Group 11, Accredited Standards Committee S12, noise). *Journal of the Acoustical Society of America, 99,* 1506-1526.

Seixas, N., Ren, K., Neitzel, R., Camp, J., & Yost, M. (2001). Noise exposure among construction electricians. *Journal of the American Industrial Hygiene Association, 62,* 615-621.

Suter, A.H. (1992, November). *Communication and job performance in noise: A review.* Rockville, MD: American Speech-Language-Hearing Association.

Suter, A.H. (1999). *Construction noise: Exposure effects and the potential for remediation.* Washington, DC: Occupational Safety and Health Administration.

Waitzman, N., & Smith, K. (N.D.). *Unsound conditions: Work related hearing loss in construction*, 1960-1975. www.eLCOSH.org (Center to Protect Workers Rights).

Coalition Organizations

American Academy of Audiology
The American Academy of Audiology (AAA), a professional organization of nearly 7,000 audiologists, is dedicated to providing quality hearing care services through professional development, education, research and increased public awareness of hearing disorders. The Academy focuses on the prevention of hearing loss as well as helping the 28 million Americans who suffer from hearing loss. A task force of hearing conservation within the Academy coordinates efforts relating to prevention of hearing loss.

Contact: James Lankford, American Academy of Audiology, 11730 Plaza America Drive Suite 3000 Reston, VA 22102. Phone: 703-790-8466; fax: 703-790-8631.

American Association of Occupational Health Nurses, Inc.
The American Association of Occupational Health Nurses, Inc. (AAOHN), a 12,000-member professional association, is dedicated to advancing and maximizing the health, safety, and productivity of domestic and global workforces by providing education, research, public policy, and practice resources for occupational and environmental health nurses. These nurses are the largest group of health care providers serving the worksite.

Contact: Michelle Castleberry, American Association of Occupational Health Nurses, 2920 Brandywine Rd., Ste. 100, Atlanta, GA 30341. Phone: 770-455-7757, ext. 112; e-mail: michelle@aaohn.org.

American Speech-Language-Hearing Association
The American Speech-Language-Hearing Association (ASHA) is the professional and scientific organization representing over 108,000 audiologists, speech-language pathologists, and hearing/ speech/language scientists. Over 60% of ASHA-member audiologists provide hearing conservation services for industry. In recent years, ASHA has coordinated the Coalition to Protect Workers' Hearing to address federal regulatory initiatives from OSHA, NIOSH, and MSHA and agency reform efforts by the U.S. Congress. ASHA has a Special Interest Division on Hearing Conservation.

Contact: Maureen Thompson, 10801 Rockville Pike, Rockville, MD 20852. Phone: 301-897-5700; fax: 301-897-7356; e-mail: *mthompson@asha.org*

Council for Accreditation in Occupational Hearing Conservation
The Council for Accreditation in Occupational Hearing Conservation (CAOHC) is dedicated to the establishment and maintenance of training standards for those who safeguard hearing in the workplace. CAOHC has been a leader in providing standards for occupational hearing conservation programs since its inception in 1973. Currently, there are over 21,000 certified occupational hearing conservationists and 360 certified course directors who conduct over 500 training courses annually. Council members are objective third-party professionals in hearing conservation, dedicated to improving testing and other hearing conservation measures and to reducing the number of noise-related occupational injuries. Council members include representatives from American Academy of Otolaryngology-Head & Neck Surgery, American Association of Occupational Health Nurses, American College of Occupational and Environmental Medicine, American Industrial Hygiene Association, American Society of Safety Engineers, American Speech-Language-Hearing Association, Institute of Noise Control Engineering, and the Military Audiology Association.

Contact: Paul J. Brownson, MD FACOEM, FAAFP, CAOHC, 611 E. Wells Street, Milwaukee, WI 53202. Phone: 414-276-5338; fax: 414-276-2146; e-mail: *info@caohc.org*

National Hearing Conservation Association
The National Hearing Conservation Association (NHCA) is an organization of professionals who share a common goal: the prevention of hearing loss due to noise and environmental factors. It is the only national organization whose sole concern is the conservation of the hearing of people who live, work, and play in noise. NHCA was formed in 1976 and today is composed of audiologists, physicians, industrial hygienists, safety specialists, engineers, scientists, occupational health nurses and hearing conservationists, equipment manufacturers, and others, all of whom are active in hearing conservation. The Association's vital concern and focus includes the prevention of hearing loss due to noise and other environmental factors in the American workforce and in the general population. As such, its interests extend to all situations in which hearing hazards exist, whether occupational settings in industry and the armed forces, or nonoccupational applications in the consumer and recreational sectors.

Contact: Dennis Driscoll, National Hearing Conservation Association, 9101 East Kenyon Avenue, Suite 3000, Denver, Colorado 80237. Phone: 303-224-9022; fax: 303-770-1812; e-mail: *nhca@gwami.com*

Self Help for Hard of Hearing People, Inc. (SHHH)
Self Help for Hard of Hearing People, Inc. (SHHH) is an international volunteer organization of hard of hearing people, their relatives and friends. It is a nonprofit, nonsectarian educational organization devoted to the welfare and interests of those who cannot hear well. It was established in 1979.

Contact: Brenda Battat, Self Help for Hard of Hearing People, Inc, 7910 Woodmont Avenue, Suite 1200, Bethesda, MD 20814. Phone: 301-657-2248; fax: 301-913-9413.