



Virginia Occupational Safety and Health



VOSH PROGRAM DIRECTIVE: 02-436

ISSUED: February 1, 2002

SUBJECT: Enforcement of the Occupational Noise Exposure Standards, §§ 1910.95, 1926.52, and 1926.101

A. Purpose.

This directive transmits to field personnel inspection procedures and interpretive guidance policies which provide clarification to ensure uniform enforcement of the occupational noise exposure standards in general industry, maritime, and construction worksites.

This Program Directive is an internal guideline, not a statutory or regulatory rule, and is intended to provide instructions to VOSH personnel regarding internal operation of the Virginia Occupational Safety and Health Program and is solely for the benefit of the program. This document is not subject to the Virginia Register Act or the Administrative Process Act; it does not have general application and is not being enforced as having the force of law.

B. Scope.

This directive applies to all VOSH personnel.

C. Reference.

OSHA Regional Instruction STD 1-4.1A (July 19, 2001).

D. Cancellation.

Not Applicable.

E. Action.

Directors and Managers shall ensure that field personnel understand the guidelines and interpretive guidance in this directive are followed.

F. Effective Date.

February 1, 2002.

G. Expiration Date.

Not Applicable.

Jeffrey D. Brown
Commissioner

Attachment: OSHA Regional Instruction STD 1-4.1A (July 19, 2001):

Distribution: Commissioner of Labor and Industry
Directors and Managers
VOSH Compliance Staff
Cooperative Programs Staff
Legal Support Staff
OSHA Regional Administrator, Region III
OSHA Area Office, Norfolk

When the guidelines, as set forth in this Program Directive, are applied to the Commissioner of the Department of Labor and Industry and/or to Virginia employers, the following federal terms if, and where they are used, shall be considered to read as below:

Federal Terms

VOSH Equivalent

29 CFR

VOSH Standard

Regional Administrator

Commissioner of Labor and Industry

Area Director

Regional Director

Regional Solicitor

Attorney General or VOSH Office of Legal Support (OLS)

Agency

Department

Office of Statistics

VOSH Research and Analysis

Compliance Safety and Health Officer (CSHO) and/or Industrial Hygienist

CSHO

Field Inspection Reference Manual (FIRM)

VOSH Field Operations Manual (FOM)

REGIONAL OSHA INSTRUCTION

DIRECTIVE NUMBER: STD 1-4.1A **EFFECTIVE DATE:** July 19, 2001

SUBJECT: Enforcement of the Occupational Noise Exposure Standards, 29 CFR 1910.95, 1926.52, and 1926.101, Inspection Procedures and Interpretive Guidance

REGIONAL IDENTIFIER: III

ABSTRACT

Purpose: This Instruction establishes policies and provides clarification to ensure uniform enforcement of the occupational noise exposure standards in general industry, maritime, and construction worksites.

References: OSHA Instruction CPL 2.103, September 26, 1994, Field Inspection Reference Manual.

Cancellations: Philadelphia Regional Instruction STD 1-4.1, dated May 31, 1992, is canceled.

State Impact: None.

Action Offices: Region III Area Offices.

Originating Office: Technical Support.

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By and Under the Authority of

RICHARD D. SOLTAN
REGIONAL ADMINISTRATOR
PHILADELPHIA REGIONAL OFFICE

Executive Summary:

This directive cancels Philadelphia Regional Instruction STD 1-4.1, issued May 31, 1992. It revises the directive to be in agreement with the Field Inspection Reference Manual and updates policy statements made in the 1992 directive.

Significant Changes:

This Instruction clarifies:

1. Issuance of citations is to be in accordance with the Field Inspection Reference Manual, OSHA Instruction CPL 2.103, September 26, 1994.
2. Updates policy guidance.

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- I. Purpose: This Instruction establishes policies and provides clarification to ensure uniform enforcement of the occupational noise exposure standards in general industry, maritime, and construction worksites.
- II. Scope: Region III Area Offices.
- III. Cancellations: Philadelphia Regional Instruction STD 1-4.1, dated May 31, 1992, is canceled.
- IV. References: OSHA Instruction CPL 2.103, Field Inspection Reference Manual.
- V. Action: Area Directors and District Supervisors shall ensure that the guidelines and interpretive guidance in this instruction are followed.
- VI. Federal Program Change: No impact on States.
- VII. Coverage:
 - A. Agriculture: 29 CFR 1928.21(b) exempts all farming and agricultural operations from compliance with 29 CFR 1910.95; however recording of hearing loss on the OSHA log is required if the conditions for recording are met.
 - B. Maritime: The General Industry noise standard, 29 CFR 1910.95, applies in full for all shipyards, longshoring, marine terminal, vessels not licensed or regulated by the United States Coast Guard, and all marine structures from the shoreline to the continental shelf that are fixed to the sea bed (e.g., oil drilling platforms)
 - C. Construction: Standards 29 CFR 1926.52 and 29 CFR 1926.101 are enforceable at all construction sites. The standards apply to all employees who are exposed to noise in excess of the permissible exposure limit.
 1. No noise exposure below 90 dBA may be reflected in the daily noise dose unless the construction employer is covered by 29 CFR 1926.65. Thus, only use noise dosimeters with 90 dB thresholds or use the 90 dB threshold on a dual threshold instrument for construction employers not covered by 29 CFR 1926.65.
 2. There are important aspects of the construction standards which are different from the general industry noise standard:
 - a. The Hearing Conservation Program (HCP) outlined in 29 CFR 1910.95(c), fully applies in construction only when the operation is covered by 29 CFR 1926.65, Hazardous Waste Operations and Emergency Response. Section 29 CFR 1926.65(a)(2)(i) states if there is a conflict or overlap, then the provision which is more

protective of employee safety and health standard shall apply, such as an overlap with the 1926 and 1910 noise standards.

- b. For compliance purposes, the following guidance is provided concerning the elements of a continuing effective hearing conservation program as required by 29 CFR 1926.52(d) whenever the daily dose exceeds the permissible exposure limit. The hearing conservation program in the construction industry is to include as many of the following elements as are feasible for that employer at the particular worksite:
- (1) Assessment of employee noise exposures either through actual industrial hygiene monitoring or other data that would indicate possible excessive exposures.
 - (2) The institution of engineering, work practice, and administrative controls for excessive noise.
 - (3) Providing a properly fitted hearing protector with an adequate noise reduction rating to each overexposed employee. Note 29 CFR 1926.101(b) requires hearing protection to be fitted or determined individually by competent persons. “Competent persons” for the purposes of this section would be persons who have knowledge of proper techniques related to the fitting and wearing of the hearing protection as well as knowledge related to types of hearing protection and the benefits and disadvantages of various types of hearing protection. Section 29 CFR 1926.101(c) further explicitly states “plain cotton is not an acceptable protective device.”
 - (4) Employee training and education regarding noise hazards and protection measures.
 - (5) Baseline and annual audiometry, if feasible. Audiometric testing will not be cited in construction unless it is feasible for the employer to obtain annual audiograms. If the workforce changes frequently (workers do not work for an employer for greater than one year), then it would usually be impractical to require the construction employer to obtain annual and follow-up audiograms on employees.
 - (6) Procedures for preventing further occupational hearing loss by an employee whenever such an event has been identified. Such procedures could include assuring usage of

hearing protection, assuring maintenance of equipment to reduce noise levels, etc.

- D. General Industry: The General Industry Noise Standard, 29 CFR 1910.95, is enforceable at all general industry, maritime (not pre-empted by the Coast Guard) and construction work sites included through 29 CFR 1926.65(a)(2)(i). Oil and gas well drilling and servicing operations are exempt from compliance with paragraphs (c) through (n) as stated in the Federal Register of March 8, 1983, page 9775. The general industry standard applies to all employees who are exposed to noise in excess of the action level on any day during the year. Audiometric testing for such employees may be delayed for up to six months unless the employer uses the mobile test van exception detailed in 29 CFR 1910.95(g)(5)(ii). For employers who utilize this mobile test van exception then audiometric testing may be delayed up to one year.

- VIII. Exposure Monitoring: Compliance Safety and Health Officers (CSHOs) may conduct noise exposure monitoring through representative sound level meter readings or through noise dosimetry. CSHOs who use sound level meter readings to document exposures shall assure that such readings are taken as close to the hearing zone of the employee as possible and that the period of time represented by each segment of exposure is documented. To the extent that the work allows, noise dosimetry is preferred for noise monitoring and shall be done for as much of the shift as possible to fully represent the exposures to employees. Note that dosimetry monitoring is to be limited to eight hours for compliance with the PEL of 90 dBA since the PEL is not adjusted for extended work shifts. Appendix B discusses this issue further.

In all worksites, no noise exposures in excess of 115 dBA are permissible without benefit of adequate hearing protection regardless of the exposure's duration. The 115 dBA level in Tables G-16 and D-2 is a ceiling level for unprotected occupational noise exposure whether it is continuous, intermittent, or transient in nature.

Impulse or impact noise has an additional ceiling value of 140 dB (peak) SPL. No noise exposure in excess of 140 dB (peak) SPL is permissible for any duration without benefit of adequate hearing protection.

The reference durations in 29 CFR 1910.95, Table G-16A reflect what a noise dosimeter or integrating sound level meter would use to compute an OSHA noise dose. They do not mean that OSHA permits noise exposures between 115 and 130 dBA without benefit of hearing protection for these very brief durations. For employees working longer than an 8-hour shift, the action level for hearing conservation (except in construction) is reduced proportionately from 85 dBA. Further discussion on this issue can be found in Appendix B of this Instruction.

Employers covered by 29 CFR 1910.95 are required under section (f) of that standard to

provide affected employees or their representatives the opportunity to observe any noise measurements.

Some employers may choose to assess exposures using Task-Based Noise Exposure Assessment Modeling (T-BEAM) in combination with an organized structured sampling strategy which meets the requirements and intent of 29 CFR 1910.95(d)(1)(i) and (d)(1)(ii). The T-BEAM approach assesses noise exposures for each task and then estimates the exposure for the employee based on the time spent on each task. When the T-BEAM assessment is properly performed, it could identify all employees who need to be included in a hearing conservation program, and facilitate proper selection of hearing protection. If the T-BEAM protocol is appropriate for the specific situation (i.e., well-defined tasks, durations and sound levels for specific job classifications) and the procedure is performed correctly, then it would comply with 29 CFR 1910.95(d). However, if the exposure situation is highly variable or the protocol is poorly executed, then full-shift personal monitoring would be necessary for compliance with 29 CFR 1910.95(d)(1)(ii).

IX. OSHA Log-Recording of Occupational Hearing Loss: Employers who are required by 29 CFR 1904 to keep the OSHA log must record occupationally related hearing loss on the log in accordance with the procedures of 29 CFR 1904, provided the hearing loss meets the following criteria:

- A. Hearing Loss recorded as an occupational injury must meet two criteria, both of which must be met to require entry on the OSHA Recordkeeping Log:
 - 1. The work-related hearing loss comes from an instantaneous exposure (acoustic trauma) to intense noise, impulse, impact, explosion or traumatic head injury, and
 - 2. The work-related hearing loss meets the requirements for recording of injuries as specified in 29 CFR 1904.

- B. Hearing loss recorded as an occupational illness: If the employee's current or historical daily noise exposure equals or exceeds the action level and the following criteria are met, then the hearing loss must be recorded on the OSHA Recordkeeping log:
 - 1. An OSHA Standard Threshold Shift (STS) equal to or greater than + 25 dB (averaged at frequencies of 2000, 3000, and 4000 Hertz) relative to the original baseline or to the revised baseline since the last recordable STS, in either or both ears, is present after correction for hearing loss thought to be due to the normal aging process (presbycusis), and
 - 2. no medical opinion exists from a physician or clinically-certified audiologist that the threshold shift is unrelated to workplace noise

exposure.

- C. Recording of reportable hearing loss: Any case not recorded on the OSHA Recordkeeping log where there is a written medical opinion of job-related hearing loss, which is based on less than what OSHA requires to be recorded as hearing loss, shall be considered de minimis.
- X. Technical and Economic Feasibility: Using a 90 dB threshold, if sampling indicates noise exposure greater than 90 but less than 100 dBA (8-hour TWA), then the use of hearing protection becomes mandatory and both the technical as well as the economic feasibility of engineering and administrative controls shall be determined. Engineering and administrative controls are considered as economically feasible when the cost of such controls is less than the cost of an audiometric testing program. Appendix C of this Instruction provides additional guidance concerning cost comparisons.

In addition, an effective hearing conservation program will be allowed in lieu of engineering and administrative controls if:

- A. the hearing conservation program is more economical as detailed in Appendix C of this Instruction, and
- B. hearing protection is available which meets the following criteria: Use Appendix B of 29 CFR 1910.95 to determine the laboratory-based noise reduction rating (NRR) for a given hearing protector, and apply a safety factor of 50 percent; i.e., divide the calculated laboratory-based NRR by 2. Applying the safety factor of 50% will provide protection to at least the PEL.

Hearing protection must be available that meets the safety factor criteria described above in order to allow the hearing conservation program to rely on hearing protection in lieu of engineering controls. If hearing protection is not available that meets this safety factor to provide protection to at least the PEL, then the option of using a hearing conservation program in lieu of engineering or administrative controls can not be considered.

Note this additional safety factor is used by OSHA solely to compare the acceptability of OSHA allowing the employer to rely on hearing protection as part of an audiometric program in lieu of requiring the employer to rely on engineering or administrative controls. Evaluation of hearing protection for compliance with the hearing protection requirements of 29 CFR 1910.95 does not consider this additional safety factor of 50% but rather relies on the criteria specified in Appendix B of the standard.

When technically and economically feasible, engineering and administrative controls must be implemented even if the controls do not reduce exposures to below the permissible exposure limit (PEL) and do not eliminate the need for a hearing conservation program.

An engineering or administrative control is not reasonably necessary when an employer has an ongoing hearing conservation program and the results of audiometric testing indicate that existing controls and hearing protectors are adequately protecting employees as determined by the results of the audiometric testing. (In making this decision such factors as the exposure levels in question, the number of employees tested, and the duration of the testing program shall be taken into consideration.)

For employers without an effective hearing conservation program (e.g., hearing loss is evident), citations for lack of engineering and administrative controls are always to be issued if such controls are technically and economically feasible and the 8-hour TWA is between 90 and 100 dBA. If the sampling indicates noise exposure in excess of 100 dBA (8-hour TWA), then the economic feasibility comparison of engineering and administrative controls vs. a hearing conservation program is not required; only the technical feasibility of engineering and administrative controls needs to be determined. The employer is always required to implement technically feasible engineering and administrative controls in situations where exposures are in excess of 100 dBA (8-hour TWA) including situations where the cost of an audiometric testing program is less than the cost of feasible engineering and administrative controls.

Consider the transient nature of the construction industry when determining economic and technical feasibility of engineering and administrative controls. Many construction employers are unable to implement a hearing conservation program which includes audiometric testing. Whenever construction employers have a hearing conservation program in place which includes an audiometric testing program or it is feasible to implement one, then this would be evidence that an audiometric testing program is feasible for the workplace and economic feasibility (for exposures of 100 dBA or less (8-hour TWA)) must be conducted for such construction employers before issuing citations for engineering and administrative controls.

- XI. Hearing Conservation Program For Employers Covered by 29 CFR 1910.95: If the employer fails to identify all employees who need to be in a hearing conservation program, then section 29 CFR 1910.95(d)(1) shall be cited.
- A. Employers must afford affected employees or their representatives the opportunity to observe the monitoring process. The employer is not required to afford both the employees and their representatives simultaneous rights to observe monitoring. Failure to let either affected employees or their representatives observe monitoring shall be cited under paragraph (f).
 - B. Noise exposure assessments should not be simply statements that sound exposure levels are above 85 dBA or above 90 dBA but rather should approximate the employee's exposure to noise either by definitive statements (e.g., 94 dBA 8-hour TWA, or a defined range such as 94-97dBA).

C. Audiometric Testing Program:

1. Baseline Audiograms: Full and part time employees covered by 29 CFR 1910.95(g) who are exposed to noise in excess of the action level on any day are to be included in the hearing conservation program. Such employees are to have available an audiometric testing program as detailed in 29 CFR 1910.95(g). The program would include receiving a valid baseline audiogram within six months of initial exposure to occupational noise at or above the action level unless the employer is subject to the mobile test van exception. Section (g)(5)(ii) allows the employer an additional six months, i.e., twelve months, to obtain the baseline only when mobile van testing is used. The current baseline, all revised baselines, and the original baseline audiograms must be designated in audiometric or medical files.
 - a. Since the portion of 29 CFR 1910.95 which requires a hearing conservation program did not become effective until April 7, 1983, an employer with an audiometric testing program in place prior to that date may choose to use the first valid audiogram obtained on or after April 7, 1983 as the original baseline audiogram. The preamble to the March 1983 Hearing Conservation Amendment was clear in its intent that historical audiometric baselines obtained before April 7, 1983 be grandfathered if they are still valid and were administered under conditions similar to those required in the noise standard. If an employer is selectively using post April 7, 1983 baselines on some employees to conceal STS's, but pre April 7, 1983 baseline audiograms on others, then the Assistant Regional Administrator (ARA) for Technical Support should be consulted.
2. Annual Audiograms: Annual audiograms must be obtained within 12 months of the previous audiogram. The standard does not provide a grace period for obtaining the annual audiogram. If an employee is on layoff, leave, or other reason and misses the annual hearing test, then a good faith effort is required to have the employee tested as soon as possible when the employee returns to the job,
 - a. Standard Threshold Shift: Comparing the annual audiogram to the baseline audiogram may reveal a standard threshold shift (STS). When an STS is present then section 29 CFR 1910.95(g)(8) states the employer:
 - (1) may obtain a retest within 30 days and then consider the results of the retest as the annual audiogram,

- (2) must notify the affected employee in writing within 21 calendar days that the audiogram shows a STS,
 - (3) shall fit employees not using hearing protection with the required hearing protection, train the employees in the use and care of hearing protection, and the employees must be required to use the hearing protection,
 - (4) refit the hearing protection for employees already using, retrained in the use of hearing protection, and the employees must be provided with hearing protection offering greater attenuation, if necessary,
 - (5) refer the employee for a clinical audiological evaluation or an otological examination, as appropriate, if additional testing is necessary or if the employer suspects that a medical pathology of the ear is caused or aggravated by the wearing of hearing protectors.
 - (6) inform the employee of the need for an otological examination if a medical pathology of the ear is suspected that is unrelated to the use of hearing protectors is suspected.
- b. An audiometric technician may conduct the initial review of audiograms. A physician, audiologist, or otolaryngologist must review problem audiograms to determine if there is a need for further evaluation. The person conducting the initial review should be questioned concerning how a determination is made concerning what constitutes an audiogram needing further evaluation, i.e., a “problem” audiogram. Examples of "problem" audiograms which the reviewer may feel need further evaluation or retesting may include invalid audiograms, audiograms manifesting ear pathologies, audiograms exhibiting monaural or binaural STS, significant differences in hearing between ears at two or more test frequencies, audiograms manifesting inconsistent, erratic, or atypical response, employees with unique audiological problems such as Meniere's disease, severe tinnitus, profound hearing loss monaurally or binaurally, deaf and mute, hearing aid users, etc. *The existence of any of the above problems does not automatically trigger an audiological or medical referral.* Referrals are made on the advice of the reviewing otolaryngologist, physician, or audiologist and not simply made due to detection of hearing loss. Section 29 CFR 1910.95(g)(8)(ii)(C) discusses referrals due to a

standard threshold shift in hearing after a review of the audiogram. Referrals are required if additional testing is necessary to or the employer suspects that a medical pathology of the ear is caused or aggravated by exposure. Note the employer must make the referral as recommended but the employer is not required to ensure the employee actually follows through with the referral. The employer is obligated to pay for referrals that are for the purpose of further identifying the effects of occupational noise exposure or any detrimental effects from wearing hearing protectors.

- c. If the annual audiogram indicates an STS, then a retest may be performed within 30 calendar days of the audiogram. No time period beyond that can be used even if the employer uses outside consultants to evaluate the audiograms. The results of this retest audiogram may be substituted for the original annual audiogram. If the annual audiogram when compared to the current baseline audiogram indicates an STS of 10 dB or more after correction for presbycusis, then the employee must be notified of this fact in writing within 21 calendar days of its determination, unless the 30-day retest option is invoked by the employer. If the employee is retested, then the 21-day clock on written notification does not begin until the retest confirms a persistent STS. The confirmation of the STS should be done by the technician at the time of the retest to preserve the 21-day written notification time line. If the retest does not confirm an STS, then written notification is not required; however, the cause of the non-persistent shift should be determined.
- d. The standard does not state a timeframe for the evaluation of the annual audiogram. An audiogram must be reviewed and evaluated as soon as is practical. Therefore, all annual audiograms should be professionally evaluated and the results communicated to management within 30 calendar days after the annual test date. If an annual audiogram has not been professionally evaluated within this 30-day period, then the CSHO shall determine the reason for the delay. Situations where it is evident that no attempts to conduct the review within this 30-day period would be considered in violation of the standard. In such cases, the compliance officer will evaluate the audiogram, and all elements that would have been triggered by this review shall be cited as appropriate in addition to 29 CFR 1910.95 (g)(7)(i).
- e. When written notification of an STS is required by 29 CFR 1910.95(g)(8)(i), it must be clear in the notification to the employee that the employee has suffered a standard threshold shift.

3. Revision of Baseline Audiograms:

- a. Section 29 CFR 1910.95(g)(9) allows a valid baseline audiogram to be revised in only two conditions: a positive STS (hearing loss) is persistent, or there is a significant and persistent improvement (e.g., negative STS) in hearing. As used in this directive, the word “persistent” means a consistent change in hearing thresholds evidenced in the reference audiogram and one or more subsequent audiograms . There must be retesting after an audiometric change which confirms this change for it to be considered persistent.
- b. The original baseline for compliance purposes will be the first valid audiogram meeting American National Standards Institute (ANSI) (1969) requirements. Audiograms designated as ISO (International Organization for Standardization) (1964) are essentially the same as ANSI (1969) and may also be used as the original baseline if they are valid. Employers may use valid historical audiograms obtained under the older American Standards Association (ASA) (1951) audiometer standard if the historical thresholds are normalized to ANSI (1969) reference thresholds for STS comparison purposes. See Appendix B in this directive for the threshold normalization values to convert ASA (1951) hearing threshold levels to ANSI (1969) hearing threshold levels.
- c. In the audiometric record the original baseline and any revised baselines as well as the current baseline audiogram should be clearly noted in the file. Documentation for each and all baseline revisions [(g)(5)(i)] should also be clearly presented.
- d. Any revised or changed baseline that lacks proper documentation or does not meet any of the three criteria listed above shall constitute a violation of 29 CFR 1910.95(g)(7)(i), for an inappropriate baseline revision. If a positive STS is confirmed by one or more subsequent tests, then the baseline may be revised to avoid the employee having an STS for the duration of employment. If the baseline is revised, without a confirmed positive STS, then paragraph (g)(7)(i) should be cited and grouped with paragraph (g)(9)(i).
- e. Baseline revision for “significant improvement” in hearing must either present a “confirmed through retest” negative STS or “confirmed improvement” in the physician's or audiologist's professional opinion to justify baseline revision. If the file indicates

significant improvement in hearing at two or more test frequencies in one or both ears that is confirmed on retest, then the CSHO shall attempt to determine if the improvement is due to inadequate test methods for establishment of the audiometric record. If improvement is due to inadequate test methods, then the employer shall be cited under section 29 CFR 1910.95(g)(5)(i) if it is determined that the baseline was invalid or, 29 CFR 1910.95 (g)(6) if it is determined that the annual audiogram is invalid.

- f. Standard Threshold Shift: For compliance purposes, all STS's will be based on a comparison of the current or most recent annual audiogram with the current baseline.
- g. Revision of Baselines for Each Ear: Baselines can be independently revised for each ear. OSHA also allows the baseline for both ears to be revised together when only one ear shows a standard threshold shift.

- 4. The acoustical calibration of the equipment must be done yearly. At this time it is advisable to check the octave band sound levels in the test room or booth. While it is not necessary to have a sound-proof booth for testing, the test room must meet the background levels found in Appendix D of 29 CFR 1910.95. If the test room does not meet the background sound pressure levels, then either a soundproof booth or earphones equipped with otocups or of the insert design must be used to meet the background sound levels. Otopup or insert earphones should not be used as a substitute for a sound-proof audiometric test booth unless it is not practical to use an audiometric booth. In a good hearing conservation program, these background levels are measured during the annual acoustical calibration of the audiometer. If the worksite does have on-site octave band data which is acceptable but not done annually, then the employer should be encouraged to verify the background levels annually. The standard does not specify any time frequency for retesting the background sound levels as it does relative to audiometer calibration. The exhaustive, ANSI, or laboratory calibration must be done at least every two years. Some employers may choose to do the exhaustive calibration on a yearly basis and eliminate the need for acoustical calibrations

- a. NOTE: An audiometer and its right and left earphones are calibrated as a unit. Each earphone and audiometer has a separate and unique serial number. Earphones may not be switched between audiometers. Such practices will void the calibration. If an earphone becomes broken, then it must be replaced and the audiometer/headset unit must receive an exhaustive calibration before further employee testing is resumed.

- b. The background sound pressure levels should be checked each time the audiometric test booth or mobile test van is moved to a different location. The background sound level as measured by octave band must never exceed the values in 29 CFR 1910.95, Appendix D, Table D-1. Citations will be issued for violation of 29 CFR 1910.95(h)(4).

- D. Hearing Protectors: When hearing protection is required, employers shall make hearing protection available at no cost to the employees. Section 29 CFR 1910.95(i) describes when an employer is required to provide hearing protection to employees in general industry worksites. Section 29 CFR 1910.95 (i)(3) requires that employees be able to select hearing protectors from a variety which is to include at least one type of insert plug and one type of ear muff.

Note that employees covered by 29 CFR 1910.95 and who are exposed above the action level and who are to be tested on an annual basis using a mobile test van are required to wear hearing protection once six months have passed since initial assignment to a job with exposures above the action level (TWA) until they receive their baseline audiogram.

Section 29 CFR 1910.95(j) requires the employer to evaluate hearing protector attenuation for the specific noise environments in which the protector will be used.

- E. Training Program: An annual training program is required for employees covered by 29 CFR 1910.95 and who are exposed to noise at or above an 8-hour TWA. must include all elements detailed in section 29 CFR 1910.95(k). The format of the training is up to the employer. It may be a formal lecture, toolbox or safety talk, booklet, slide-tape, movie, or video tape presentation. Selected employees shall be interviewed to determine the effectiveness of the training. If employees are illiterate, do not speak English, or have a sensory or learning disability, then the training must be modified to accommodate their unique limitations.

- F. In accordance with section 29 CFR 1910.95(l), the employer is required to post a copy of 29 CFR 1910.95 in workplaces covered by the standard.

XII. Recordkeeping:

- A. General Industry/Maritime: Operations covered by 29 CFR 1910.95 are subject to certain recordkeeping requirements. The employer is to follow the recordkeeping retention times specified in 29 CFR 1910.95 for records addressed by that standard as opposed to the more general Access to Employee Exposure and Medical Records standard, 29 CFR 1910.1020. Noise exposure measurement records must be retained for two years if kept separately from the audiogram in accordance with 29 CFR 1910.95(m)(3)(i). Noise exposure measurement records

are those documents on SLM and dosimeter calibration, field notes, engineering survey results, octave band data, survey methodology, etc. The results of the noise exposure measurement (e.g., exposure was 94dBA TWA as monitored on a particular date) must be kept with the audiogram in accordance with 29 CFR 1910.95(m)(2)(ii) and such records must be kept for the duration of employment in accordance with 29 CFR 1910.95(m)(3)(ii).

Note the difference between noise exposure measurement records and audiometric test records. Audiometric test records are to be retained for the duration of employment. Section 29 CFR 1910.95(m)(2)(ii) states that audiometric test records shall include: the name and job classification of the employee, the date of the audiogram, the examiner's name, the date of the last acoustic or exhaustive calibration of the audiometer, the employee's most recent noise exposure assessment, and an accurate record of the measurements of the background sound pressure levels in audiometric test rooms.

- B. Construction: Note that 29 CFR 1926.33 requires construction employers to comply with the recordkeeping requirements of 29 CFR 1910.1020. Thus, in the construction industry, employers who generate audiometric or exposure records related to noise are subject to potentially longer retention times for such records than employers covered by 29 CFR 1910.95. Construction employers who meet the retention periods specified in the general industry standard, 29 CFR 1910.95, will be considered as having de-minimis violations of the recordkeeping retention requirements of 29 CFR 1910.1020 for records specified in 29 CFR 1910.95. Employers who do not meet at least the retention periods specified in 29 CFR 1910.95 will be cited for violations of 29 CFR 1910.1020 with an abatement note that the employer can comply with the retention period in 29 CFR 1910.95 in order to abate the violation.
 - C. Records required by the noise standards may be kept in electronic form.
 - D. Employers in general industry, construction, and maritime who sell the business are required by 29 CFR 1910.1020(h)(1) to transfer records to the new owner/employer. In accordance with 29 CFR 1910.1020(h)(2), if the company ceases to exist then the company is to notify the National Institute for Occupational Safety and Health (NIOSH) three months in advance of disposal in order to provide NIOSH the opportunity to receive the records.
- XIII. Sampling Error and Issuance of Citations: Sound measuring instruments have error factors which must be taken into consideration before issuing citations. Most sound instruments used by OSHA are Type II sound measuring instruments which have an error factor of +/-2 dB. Citations shall not be issued unless the sampling indicates that the recorded sound exceeds the upper limit of error for the instrument. Thus, for Type II sound measuring instruments, citations related to exceeding the PEL shall not be issued unless the sound measuring instrument indicates levels in excess of 92 dBA (or 132%).

Citations related to exceeding the action level shall not be issued unless the sound measuring instruments indicate levels of at least 87 dBA (or 66%). Note 29 CFR 1910.95, Table G-16 states that exposure to impulsive or impact noise should not exceed 140 dB peak SPL (note usage of the word *should* vs. *shall*.)

XIV. Classification and Grouping of Violations: Classification and grouping of noise related violations shall follow the guidance in the Field Inspection Reference Manual (FIRM), CPL 2.103. Situations related to noise not specifically addressed in the FIRM should be classified in accordance with general classification and grouping procedures in the FIRM. The FIRM provides the following guidance specifically for noise:

A. When hearing protection is required but not used and employee exposure exceeds the limits of Table G-16, 29 CFR 1910.95(i)(2)(i) shall be cited and classified as serious whether or not the employer has instituted a hearing conservation program. 29 CFR 1910.95(a) shall not be cited except in the case of the oil and gas drilling industry.

Citations of 29 CFR 1910.95(i)(2)(ii)(b) shall also be classified as serious.

B. If the employer has not instituted a hearing conservation program and employee noise exposures equal or exceed an 8-hour time-weighted average of 85 dBA, a citation for 29 CFR 1910.95(c) only shall be issued.

C. Violations of 29 CFR 1910.95(i)(2)(i) may be grouped with violations of 29 CFR 1910.95(b)(1) and classified as serious when an employee is exposed to noise levels above the limits of Table G-16 and:

1. Hearing protection is not utilized or is not adequate to prevent overexposure to an employee; or
2. There is evidence of hearing loss which could reasonably be considered to be work-related, and to have been preventable, at least to some degree, if the employer had been in compliance with the cited provisions.

XV. Appendices:

A. Appendix A presents reference audiometric threshold levels to convert ASA (1951) levels to ANSI (1969) levels.

B. Appendix B discusses noise compliance for extended work shifts.

C. Appendix C discusses the economic feasibility of noise control engineering.

D. Appendix D discusses the field evaluation of hearing protection.

APPENDIX A

Reference Threshold Levels

The standard reference threshold levels for air conduction audiometry are presented in Table A-1. Audiometers and audiograms designated as calibrated to ISO(1964) are the same as ANSI (1969) values.

TABLE A-1

Frequency (Hz)	ASA (1951)	ANSI (1969) ISO (1964)	Difference
125	-54.5	-45.5	9
250	-39.5	-24.5	15
500	-25	-11	14
1000	-16.5	-6.5	10
2000	-17	-8.5	8.5
3000	-16	-7.5	8.5
4000	-15	-9	6
6000	-17.5	-8	9.5
8000	-21	-9.5	11.5

To convert historical audiometric data obtained under the obsolete ASA(1951) audiometer standard to current ANSI(1969) hearing thresholds for use in hearing conservation programs, perform the following computation:

$$\text{ASA(1951) Threshold} + \text{dB Difference} = \text{ANSI(1969) Threshold}$$

APPENDIX B

I. Extended Workshifts

- A. Background: The permissible exposure limit of 90dBA (8-hour TWA) is not adjusted for extended workshifts although the action level is adjusted. The action level of 85 dBA is adjusted for workshifts in excess of 8-hours since the standard references (in 29 CFR 1910.95(c)) a level of 85 dBA or 50% with further reference to Appendix A and Table G-16A of 29 CFR 1910.95.
- B. Determination of the Action Level: When employees routinely work shifts longer than 8-hours in duration, the following equation will allow one to calculate the new action level (AL) in A-weighted decibels using the formula:

$$AL = 90 + 16.61 \log \{ \% \text{ Dose} / 12.5(X \text{ hours }) \}$$

For the action level use:

$$AL = 90 + 16.61 \log \{ 50\% / 12.5(X \text{ hours }) \}$$

where x is the actual exposure duration in hours. Table B-1 presents the action levels associated with common extended workshifts.

TABLE B-1

Action level in dBA	Exposure Time in Hours
85	8
83.4	10
82.1	12
80	16

APPENDIX C

ECONOMIC FEASIBILITY OF NOISE CONTROL ENGINEERING

NOTE:

Dollar amounts quoted in this appendix are relative estimates for the purposes of determining whether a hearing conservation program or engineering controls is more economical. Actual costs will vary based on location, availability of supplies, varying cost inflation, etc. The CSHO should investigate local costs in situations where the relative cost differential is close as determined from this Appendix.

I. Background:

- A. OSHA has developed a policy to determine the economic feasibility of noise control engineering whenever the daily noise exposure exceeds 90 dBA and is no greater than 100 dBA as an 8-hour TWA (Reference the Field Inspection Reference Manual). If the daily noise levels exceed an 8-hour TWA of 100 dBA, then only the technical feasibility needs to be established to cite for violations of 29 CFR 1910.95(b)(1). In construction worksites wherein it is not feasible to do yearly audiometric surveillance, only technical feasibility needs to be documented for 29 CFR 1926.52(b) violations. The following tables and methodology are presented to assist the compliance officer in the determination of economic feasibility of noise control engineering relative to current enforcement policy and for pre-citation documentation purposes.

The tables in this appendix are approximations and should be considered only as relative estimates to consider economic feasibility of engineering controls vs. a hearing conservation program.

II. Assumptions for an Economic Analysis:

- A. In order to perform an economic analysis efficiently and realistically, several assumptions need to be made:
1. The life expectancy of an engineering noise control is twenty years.
 2. Unless actual costs for an engineering control are known to the compliance officer, the average cost in Table C-2 shall be used for cost estimating. This cost includes both materials and labor but does not include any engineering or design costs.
 3. The maintenance cost for an engineering control shall not exceed 5% of the initial cost per year over a 20 year time span.

4. Unless actual maintenance costs for an engineering control are known to the compliance officer, the percentage given in Table C-2 shall be used for cost estimating.
5. The least expensive control option or group of controls that will achieve a reduction of 3 dBA or more in the employee exposure shall be used for determining economic feasibility.
6. An engineering or administrative control is economically feasible if its total cost is less than or equal to the cost of a continuing effective hearing conservation program for all the employees who would benefit from the control's implementation, i.e., have a reduction in their noise exposure.
7. Unless the compliance officer has documentation concerning the cost of administrative controls, for cost estimation purposes, administrative controls where feasible, will cause no additional cost to the employer.
8. Unless the compliance officer has documentation that a control option will introduce a production penalty, no production penalty will be assumed for cost estimation purposes.
9. If a proposed noise control would also address another hazard, for example, machine guarding or ventilation hood, then the cost of the noise control shall be deemed feasible since these other controls do not require an economic feasibility analysis.
10. Hearing conservation costs per employee will be averaged over a 20 year period using an assumed figure of \$1,732 per employee. Use Table C-1 to adjust this unit cost based on the number of employees in the hearing conservation program at this worksite.
11. Maintenance problems, for example bad bearings or steam leaks, which result in excessive workplace noise levels are cited under the engineering/administrative control paragraph; however, these are deemed economically to be feasible regardless of the cost.
12. If engineering design for noise controls is done by the employer's engineering or industrial hygiene staff, then there will be no additional engineering costs applied to the control. Table C-2 values alone will determine the costs of an engineering control.
13. If outside or consulting engineering services are required to design and fine tune the control, then these costs must be estimated and added to Table C-2 values. For cost estimation, the hourly rate for a consulting acoustical engineer is assumed to be \$120. The day rate is assumed to be

\$800. Assume that the consulting engineer is local, therefore, no travel or per diem costs need be considered. For each day in the field, it is customary for a consulting engineer to charge one day of report/plan preparation.

III. General Principles: An engineering control is any physical alteration in the workplace that will reduce occupational noise exposure. An administrative control is any manipulation of the employee's work schedule, procedure, or practice which will result in a reduction in the daily noise dose.

IV. Examples: The following examples will serve to illustrate how and when economic feasibility analyses are necessary.

A. Dusty Foundry: There are 100 production employees exposed above 66%.

1. What is the cost of a hearing conservation program per employee for this foundry?

a. From Assumption 10 and Table C-1 we have:

$$\$1732 \times .05 + \$1732 = \$86 + \$1732 = \$1818$$

Therefore the cost of a hearing conservation program per employee at this foundry is \$1818.

2. In the cleaning department four employees grind small castings using hand-held pneumatic grinders. There are no engineering controls. The daily noise dose is 96 to 98 dBA on the sampled grinders. There are two shifts in this department. The grinders are side-by-side and place the castings on wooden work tables. The background noise when no one is grinding is 84 dBA. You determine that retrofit mufflers, barriers between adjacent grinders, and absorptive treatment to the cement block wall in front of the grinder tables will result in a noise reduction of three to 6 dBA to the employee. Are these controls economically feasible since the 8-hour TWA is less than 100 dBA?

a. Determine the cost of the pneumatic mufflers:

From Table C-2, the unit cost of such a muffler is \$ 17.50 with no maintenance or production penalty involved, therefore:

$$17.50 \times 4 \text{ grinders} = \$70$$

b. Determine the cost of the absorbers and barriers:

Four 4 x 4 foot areas of acoustical absorption are needed as well as three 8 x 8 foot barriers. There would be no production penalty and maintenance costs can be considered to be negligible, therefore:

$$64 \text{ sq ft absorption} \times \$7 = \$ 448 \text{ and}$$

$$192 \text{ sq ft barriers} \times \$15 = \$ 2880$$

- c. Determine the total cost of engineering controls:

$$70 + 448 + 2880 = \$ 3398$$
- d. Determine the cost of hearing conservation for all the employees who would benefit from these controls:

$$4 \text{ employees} \times 2 \text{ shifts} \times \$1818 = \$ 14544$$

Since the cost of engineering controls (\$3398) is less than the cost of hearing conservation (\$14544), these controls are both technically and economically feasible.

- B. In the shakeout area, full-shift noise levels are 98 to 100 dBA. Four employees work here on each of two shifts. Silica exposures for these employees are 3 to 4 times the PEL since there is no local exhaust ventilation provided. We propose a total enclosure of the shakeout that will be locally exhausted, mechanically isolated from the shaker table, and lined with some acoustically absorptive material. This control approach, if properly implemented, will reduce the noise exposures to 90 dBA and the silica exposures to one quarter of the PEL. Since the daily noise levels do not exceed 100 dBA, is enclosure of the shakeout economically feasible?

Because this engineering control will abate both silica and noise over-exposures at the same time, an economic analysis is not necessary. This control, therefore, is both economically and technically feasible.

- C. In the finishing department, two pedestal grinders were sampled for noise. Although both grinders were identical models finishing the same type castings, one operator's exposure was 89 dBA while the other one was 98 dBA. Further investigation demonstrated that the noisy grinder has defective idler bearings. Would bearing replacement be an economically feasible engineering control?

From Assumption 11, we do not need to do an economic analysis for bearing replacement on this pedestal grinder since the noise is from the defective idle bearings which need to be replaced. Therefore, this control is economically feasible and should be cited as a violation of (b)(1).

- D. Dusty Foundry Engineering Costs: In order to abate engineering violations, a small company must engage a consulting engineer. Consider problem 1.b above. The Dusty Foundry will need one day off site to evaluate and prepare an abatement report room. The cost for engineering will be:

$$\begin{aligned} & \$800 \times 2 \text{ days} = \$1600 \\ & \$1600 + \$3398 \text{ (cost of controls)} = \$4998 \end{aligned}$$

Therefore, the total cost for these controls with consulting engineering assistance is \$4998 which is still less than the cost of hearing conservation, \$14544. The engineering controls are still economically feasible

V. Rocking Chair Furniture Company: The company has 100 production workers exposed to daily noise exposures in excess of 50%.

A. A large wood planer is situated in the middle of the production area. A loader and off-bearer operate the machine. It has no noise controls. The sound levels vary from 98 dBA to 118 dBA depending on the type of wood (hard versus soft) and the surface area of the wood being finished. All production employees are exposed to the noise from the machine. Administrative controls limit everybody's daily dose to less than 400% or 100 dBA. Are engineering controls economically feasible?

1. One engineering option is to rebuild the drive mechanism and replace the cutters with those of a helical design. This will greatly improve the quality of the planed finish and reduce the noise level to about 90 dBA. A call to regional technical support produced a cost figure of \$10,000 per planer to retrofit with no maintenance or production penalty evolved.

2. A second engineering option is to enclose the existing planer with a plywood home-built affair lined with fiberglass. From Table C-2, we select the lower cost of \$4000 since the enclosure can be fabricated in-plant with a 5% maintenance cost over 20 years, the total cost will be cost of control + maintenance at 5% over 20 years, thus \$4000 + \$ 4000 or \$8000 total assumed cost.

3. Since all one-hundred employees will benefit from the implementation of this engineering control, the assumed cost for hearing conservation is calculated, from Table C-1 with a 5% increase in the cost of the hearing conservation program based on 100 employees participating :

$$(\$1732 \times .05) + \$1732 = \$1818 \text{ per employee,}$$
$$\$1818 \times 100 \text{ employees} = \$181,800 \text{ Total}$$

Since either engineering option is much less than the cost of hearing conservation, either option is economically feasible.

B. Consider the situation where the planer has been relocated to a room by itself. The room is treated with acoustical material to prevent reflected or reverberant noise. Both employees who operate the planer are administratively controlled to prevent their doses from exceeding 100 dBA. The planer is operated on both the first and second shifts. Are further engineering controls economically feasible?

1. The cost of hearing conservation is based on four employees is \$7272; the cost of the engineering options are \$10,000 and \$ 8,000 respectively.
2. Both controls exceed the cost of hearing conservation; therefore engineering controls are not economically feasible.

TABLE C-1

Corrections to Hearing Conservation Program Assumed Costs Per Year Per Number of Employees in the Program

Assume the cost per employee for a hearing conservation program to be estimated as \$1,732. Adjustments to this figure are made as follows:

Total Number of Employees at the Same Geographic Location	Percent Increase Per Employee Per Year Over the Unit Cost	Resulting Calculation Per Employee (with Unit Cost at \$1,732)
250+	0	$(\$1732 \times 0) + \$1732 = \$1,732$
100 to 249	5	$(\$1732 \times .05) + \$1732 = \$1818.60$
50-99	8	$(\$1732 \times .08) + \$1732 = \$1818.60$
20-49	75	$(\$1732 \times .75) + \$1732 = \$3031$
0-19	125	$(\$1732 \times 1.25) + \$1732 = \$3897$

Reference: Data were adapted from Table 7 in Regulatory Impact and Regulatory Flexibility Analysis of the Hearing Conservation Amendment, USDOL-OSHA, Office Regulatory Analysis, February 1983.

TABLE C-2 NOISE CONTROL ENGINEERING COST ASSUMPTIONS

CONTROL OPTION	dba REDUCTION	COST (IN \$)	PERCENT PRODUCTION PENALTY	MAINTENANCE COST PER YEAR
ABSORPTION	3-5	4-10/FT ²	NONE	2%
DAMPING	3-20	4/FT ²	NONE	NONE
BARRIERS	3-15	5-25/FT ²	NONE	2%
MUFFLERS, AIR EXHAUST	5-25	10-25/UNIT	NONE	5%
MUFFLERS, ENGINE	5-25	300/UNIT	NONE	NONE
MUFFLERS, SMALL FAN	5-25	1000/UNIT	NONE	NONE
MUFFLERS, LARGE FAN	5-25	5000-25,000/UNIT	NONE	NONE
VIBRATION MOUNTS	5-25	100-1000/UNIT	NONE	1%
QUIET VALVES	5-25	500-5000/UNIT	NONE	NONE
1 EMPLOYEE ENCLOSURE	5-20	1000-10,000/UNIT	NONE	5%
MULTIPLE EMPLOYEE ENCLOSURE	5-20	5,000-25,000/UNIT	NONE	5%
PROCESS ENCLOSURE (PARTIAL)	3-10	500-3500/UNIT	0-20	5%
PROCESS ENCLOSURE (TOTAL)	3-10	4000-25000/UNIT	0-20	5%

APPENDIX D

Hearing Protectors

- I. Introduction: Hearing protection which is adequate to attenuate noise exposure to the PEL must be worn whenever a worker's noise exposure equals or exceeds the PEL. In addition, in general industry and maritime, if the exposure equals or exceeds the action level and a baseline audiogram has not been obtained within six months of initial exposure (and six months have passed) or the annual audiogram indicates a standard threshold shift (STS), then hearing protection to attenuate exposure to the action level must be worn.

ANSI has developed national consensus standards to evaluate the attenuation of hearing protectors under laboratory conditions. These standards, Z24.22-1957 and S3.19-1974 (c) 1990), are referenced by NIOSH and the latter standard is incorporated in Appendix B of 29 CFR 1910.95.

Several methods to evaluate the adequacy of hearing protection are referenced in 29 CFR 1910.95, Appendix B.

The most common method to evaluate hearing protection is the Noise Reduction Rating (NRR). It is based on the difference between A-weighted and C-weighted sound levels averaged over thousands of industrial noise spectra. Most manufacturers of hearing protection indicate the NRR for their product on the box or protector package. Therefore, it does not have to be calculated by the compliance officer or employer. The calculation, however, assumes the occupational exposure spectrum to be pink noise. Pink noise is equal sound pressure level in each octave band. If the actual workplace noise spectrum deviates significantly from pink noise, then the NRR will overpredict the laboratory attenuation. The error introduced is greatest when the spectrum has most of its energy in the low frequency octave bands. Ear muffs or circumaural protectors are more susceptible to this error than ear plugs are. Thus, Appendix B in 29 CFR 1910.95 requires that 7 dB be subtracted from the NRR whenever A-weighted doses or A-weighted sound levels are used in place of C-weighted doses or levels. This -7 dB correction to the NRR is related to the spectral assumption of pink noise and has no connection with the adequacy of fit in the wearer's ear canal or the seal around the pinna.

- II. On-the-Job Effectiveness of Hearing Protection: The ANSI and NRR attenuation data for a given hearing protector are based on a brand new, out of the box protector that is evaluated under laboratory or ideal conditions.
- III. Evaluation of Hearing Protection for Compliance Purposes: The employer is allowed to use any of the NIOSH methods or several variations of the NRR method to determine protector adequacy. When dual protection is worn, that is both an earmuff and an earplug together; the resulting laboratory derived attenuation is generally accepted as 6 dB greater than the better hearing protector alone, although as a rule of thumb under actual usage in

the field, 5dB rather than 6 dB is usually used under field conditions to estimate noise attenuation.

- IV. Hearing Protection as Part of a Hearing Conservation Program in Lieu of Feasible Controls: An effective hearing conservation program will be allowed in lieu of engineering and administrative controls if:
- A. the hearing conservation program is more economical as detailed in Appendix C of this Instruction, and
 - B. hearing protection is available which meets the following criteria: Use Appendix B of 29 CFR 1910.95 to determine the laboratory-based noise reduction rating (NRR) for a given hearing protector, and apply a safety factor of 50 percent; i.e., divide the calculated laboratory-based NRR by 2. Applying the safety factor of 50% will provide protection to at least the PEL.

Hearing protection must be available that meets the safety factor criteria described above in order to allow the hearing conservation program to rely on hearing protection in lieu of engineering controls. If hearing protection is not available that meets this safety factor to provide protection to at least the PEL, then the option of using a hearing conservation program in lieu of engineering or administrative controls can not be considered.

Note this additional safety factor is used by OSHA solely to compare the acceptability of OSHA allowing the employer to rely on hearing protection as part of an audiometric program in lieu of requiring the employer to rely on engineering or administrative controls. Evaluation of hearing protection for compliance with the hearing protection requirements of 29 CFR 1910.95 does not consider this additional safety factor of 50% but rather relies on the criteria specified in Appendix B of the standard.

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