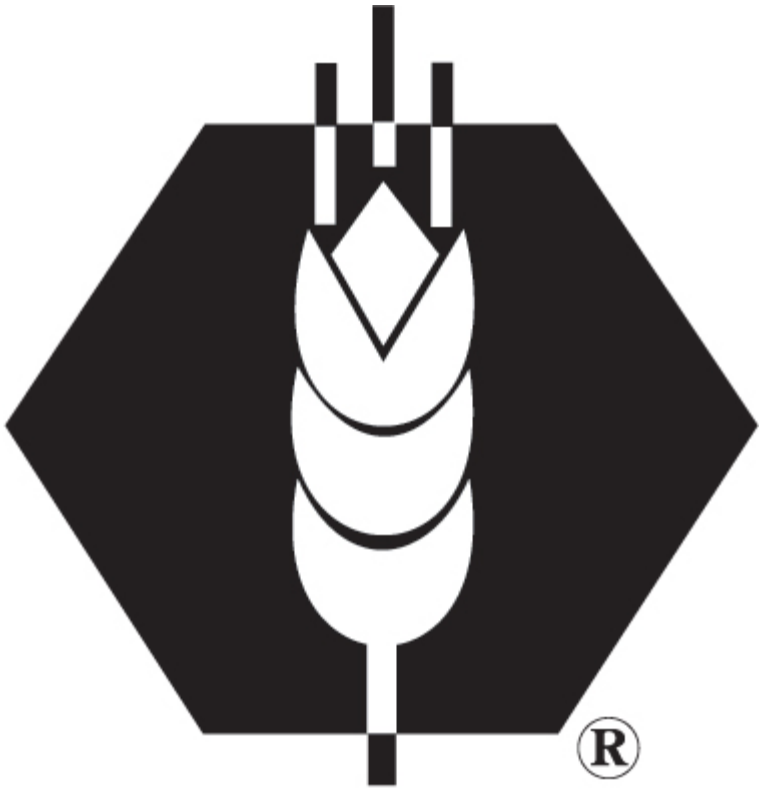
National Grain and Feed Association

Overview of Safety and Health Compliance Manual



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Grain Handling Facilities Standard

The Occupational Safety and Health Administration's grain handling standard contains both **operational** and **equipment** requirements. Most parts of the OSHA standard took effect on March 30, 1988, although some equipment-related requirements did not take effect until April, 1 1991.

The grain handling standard, with a few exceptions, applies to all grain-handling facilities – including grain elevators, feed mills, flour mills, rice mills, dust pelletizing plants, dry corn mills, soybean flaking operations and dry grinding operations of soycake.

The **operational requirements** (discussed starting on page 4) include provisions governing:

- Housekeeping
- Employee Training
- Emergency Action Plan
- Entry Into Bins, Silos, and Tanks
- Hot Works Procedures
- Contractor Notification
- Preventive Maintenance for Grain-Handling Operations

The **equipment requirements** (discussed starting on page 15) include provision governing

- Size Openings of Grates
- Grain Stream Processing Equipment
- Emergency Escape From Galleries and Tunnels
- Inside Bucket Elevator Monitoring
- Grain Dryers Located Inside the Facility
- Fabric Dust Collector Filters

Operational Requirements

Housekeeping

At **all facilities**, employers are required to *"develop and implement a written housekeeping program that establishes the frequency and method(s) determined best to reduce accumulations of fugitive grain dust on ledges, floors, equipment and other exposed surfaces"* throughout the entire facility.

At all **grain elevators only**, employers are required to *"address"* fugitive grain dust accumulations that exceed 1/8th-inch in any of ***three "priority" housekeeping areas***.

The standard defines a **grain elevator** as a "*facility engaged in the receipt, handling, storage and shipment of bulk raw agricultural commodities, such as corn, wheat, oats, barley, sunflower seeds and soybeans*." The term "grain elevator" can also apply to the bulk raw commodity receiving and storage areas of processing and milling facilities (silos, tanks, bucket elevators, conveyance, etc.)

OSHA's standard states that this 1/8th-inch action level applies to "*at least*" these three "*priority housekeeping areas*":

- **Priority Housekeeping Area 1: Floor areas within a 35-foot radius of "inside" bucket elevators** [defined as a bucket elevator that has the boot and more than 20 percent of the total leg height (above grade or ground level) located inside the grain elevator structure.]
- **Priority Housekeeping Area 2: Floors of enclosed areas containing grinding equipment.**
- **Priority Housekeeping Area 3: Floors of enclosed areas containing grain dryers located inside the facility.** There are no restrictions on radius dimensions.

Under OSHA's grain handling standard, employers are to comply with the 1/8th-inch action level requirement in one of two ways:

- *"Immediately remove any fugitive grain dust accumulations whenever they exceed 1/8th-inch at priority housekeeping areas, pursuant to the house- keeping programs"*; or

- *"demonstrate and assure through the development and implementation of the housekeeping program, that equivalent protection is provided."*

Oil additives may or may not be deemed by individual OSHA inspectors as providing protection that is "equivalent" to the 1/8th-inch action level in the three "priority housekeeping areas." Importantly, OSHA currently does **not** recognize explosion venting, suppression, aspiration or other types of technology designed to protect bucket elevator legs against explosions to be "equivalent protection."

What is Fugitive Dust? Generally, grain dust collected by dust collection systems or grain dust that becomes suspended during grain handling fits the description of fugitive dust. The standard defines

"fugitive grain dust" as dust that is combustible and small enough to pass through a U.S. Standard 40-mesh sieve. This equates to grain dust particles that are 425 microns in size or less.

Importantly, grain or grain product spills are **not** considered to be fugitive grain dust. However, the OSHA standard requires that employers address in their housekeeping program how grain or product spills are to be cleaned up and removed from the work area.

Housekeeping Compliance

OSHA's housekeeping requirements are written in such a way as to be "performance oriented." That is, employers have the flexibility to design housekeeping programs to achieve compliance through methods that are most effective for all individual facilities and operations.

There are two major considerations to keep in mind when developing a housekeeping program to comply with OSHA's grain handling standard:

- Employers are required to develop and adhere to housekeeping practices "determined best to reduce accumulations" of fugitive grain dust.
- Second, when developing the written house- keeping program for the facility, **employers are writing their own standards** which they will be required to comply. Simply put, employers will be cited for violating the housekeeping standard if OSHA finds that an employer's written housekeeping program is not being followed, no matter how comprehensive or idealistic it is.

In developing and implementing a written housekeeping program for a facility, employers should include the following three components:

1. Establish Frequency and Methods to Reduce Fugitive Grain Dust Accumulations

Under the OSHA standard, employers are required to specify in the written housekeeping program how frequently -- and by what method(s) -- grain dust accumulations will be minimized through- out the facility. All work spaces in the facility, including walls, beams and other exposed surfaces, should be addressed in the written housekeeping program.

- **Housekeeping Methods**: The methods used may include manual sweeping, vacuuming, wash down, blow down, pneumatic dust control systems, enclosed conveyors, pressurization of work areas, and/or oil additive systems. It is advisable to use methods that do not cause grain dust to be suspended in air during cleaning when ignition sources are present.

Compressed air also may be used for clean up if machinery in the area that could pose an ignition source is shut down or is dust-ignition proof. If equipment continues to operate during minor blow-down operations, the standard requires that bearings that can serve as

an ignition source be shut down or controlled. When major blow-down operations are to occur, all moving equipment should be shut down. If compressed air is used, the housekeeping plan must specify the use of personal protection equipment, such as eyewear and respiratory protection. Water wash-down also may be included as a cleaning method in the housekeeping program. For water wash-down, consider this technique only when it will not cause a grain quality problem.

- **Housekeeping Schedules**: Schedules should be developed that specify the frequency with which housekeeping will occur. The schedule can differ for various areas of the facility; for instance, it is likely that the employer will establish a more frequent schedule for cleaning to comply with the 1/8th-inch action level in the three "priority housekeeping areas" than for removing grain dust from other, more remote areas of the facility. (OSHA also recommends that housekeeping procedures should provide for concurrent cleaning of dust accumulation from motors, critical bearings and other potential ignition sources, as well as from around legs and milling equipment.)

- Areas of Particular Concern to OSHA: In addition to the three "priority housekeeping areas" where the 1/8th –inch action level applies, OSHA's field directive *(which instructs inspectors on how to enforce the standard)* cites the following areas of "particular concern" to be addressed in the housekeeping plan: "the grain transfer points, such a galleries (bin floors) and tunnels." Thus, if a dust collection system is installed, the employer may want to specify in the written housekeeping program that systems that malfunction or operate below design efficiency are to be corrected promptly.

Further, OSHA recommends -- but does not require -- that the housekeeping program contains a contingency plan should a dust system fail and accumulations from the system occur. Under the preventive maintenance section of the standard, the employer is required to promptly correct dust collection systems that are malfunctioning or operating below design efficiency.

- **Areas Not Covered**: Some areas outside the facility are **not** required to be addressed in the written **housekeeping program. These are:**

- Ship, barge and rail load-out and receiving areas outside of the facility

- Truck dumps that are open on at least two sides. The schedules established for cleaning other truck dumps not open on two sides can be restricted to times when grain or agricultural products are being unloaded

2. Specify Methods for Complying with 1/8th-Inch Action Level

The written housekeeping program also is to include a policy and provisions for cleaning up and

removing fugitive grain dust emissions whenever they exceed 1/8th-inch in the three "priority housekeeping areas" unless the housekeeping program provides "equivalent protection."

- **Areas Not Covered**: Priority housekeeping areas do **not** include sections of the facility that are separated by walls or partitions, such as control rooms or offices with positive pressure and self-closing doors.

The only alternative to this 1/8th-inch grain dust action level in the three priority housekeeping areas is if the manager can "demonstrate and assure...that equivalent protection is provided" through some other technology or method. However, OSHA does not sanction any specific type of "Equivalent protection"

- **When clean-up is to begin**: OSHA's compliance directive states that clean-up is required **whenever 1/8th-inch of grain dust accumulates in any part of a priority area, *"regardless of total amount."*** The directive also states that inspectors are to use "professional judgment" when assessing the extent of a hazard posed by a given accumulation of grain dust. The compliance directive states that small isolated piles of grain dust on the floor normally will not be cited as a "serious" violation of the standard. However, small piles of dust could be cited as "non-serious" or "di minimus" violations, which, if repeated, could lead to more serious citations and fines in the future

3. Cleaning Up Grain and Product Spills

The written housekeeping program also is to specify that grain and product spills are to be cleaned up "promptly."

The OSHA compliance directive states: "Prompt attention to product spills, especially in flour mill operations, is critical. These spills shall be cleaned up immediately after identification. Grain spills do not present the same hazard as product spills, and should be cleaned up as soon as possible…

Developing a Written Housekeeping Program--Important Points to Consider

There are several key points to remember when developing and implementing a written housekeeping program:

1. The housekeeping program written by the employer will be the standard with which your facility will be required to be in compliance when the plant is inspected by OSHA. Thus, it is important to use caution when developing the program so it does not specify housekeeping requirements

that cannot be achieved based upon the equipment, staffing, or other conditions or factors that exist at the facility.

2. The grain handling standard specifically states that the housekeeping program is to specify the frequency and method(s) that "best reduce" accumulations of grain dust on ledges, floors, equipment and other exposed surfaces.
3. The 1/8th-inch action level requirement in three "priority housekeeping areas" applies only to grain elevators and grain elevator portions of grain handling facilities. Importantly, however, it is unclear precisely how OSHA applies this action level requirement to facilities when the grain elevator is not clearly separated (either in a different building or by a solid wall) from the feed mill, flour mill or other type of processing plant where the 1/8th-inch action level does not apply.
4. The 1/8th-inch action level provision requires employers to order that action be initiated "immediately" whenever grain dust accumulations exceed 1/8th-inch on the floor areas of the three "priority housekeeping areas" in grain elevators and the grain elevator portion of grain handling facilities. The 1/8th-inch action level requirement does **not** apply to ledges, walls, or other exposed surfaces (other than floor areas) in the "priority housekeeping areas." However, the frequency and method(s) to be used to clean these non-floor surface areas are required to be addressed in the facility's overall written housekeeping program.
5. The facility manager or their designee is responsible to direct housekeeping activities when necessary. Be certain to exercise that authority when walk-through inspections indicated housekeeping is needed.
6. Consider maintaining a notebook to file "***Housekeeping Inspection Log***" sheets (enclosed as part of this program) turned into the facility manager by the employee(s) designated to perform walk-through inspections. This will be valuable in demonstrating to PSHA inspectors that the facility's management has implemented its housekeeping program. Be certain to have each "***Housekeeping Inspection Log***" sheet signed and dated by the employee performing the walk-through inspection
7. Review the housekeeping program periodically. As noted previously, the key for employers when devising a housekeeping program to comply with OSHA grain handling standard is to establish a plan that is realistic and achievable for the given facility, but at the same time meets the letter of the law and is not a "token" plan. Those are the criteria OSHA will use when enforcing the standard. That makes it advisable to review the housekeeping program periodically to determine if changes are warranted depending upon circumstances and/or operating experiences

The NGFA's "Housekeeping Program: - How it's Structured

The NGFA's "Housekeeping program" for grain handling facilities is divided into three major sections:

- **Preamble and Purpose:** This section of the document specifies the housekeeping requirements contained in OSHA's grain handling standard and the role of the written housekeeping program as one component in the employer's effort to provide a safe and healthful workplace.
- **Housekeeping Policy:** This portion of the document states the employer's policy concerning the role of the housekeeping in the facility's overall safety and health efforts. Further, it provides spaces where the manager is to list the specific floor areas of the facility (if any) subject to the $1/8^{th}$-inch grain dust action level.
- **Housekeeping Program:** This portion of the document provides spaces where the employer is to fill in: 1) the inspection frequency of certain areas of the facility to detect grain dust accumulations; 2) the cleaning frequency for which the "priority" and "nonpriority" housekeeping areas that have been identified in this written program. (Note: The manager should delete those housekeeping areas that are not relevant to the facility and add those areas that do apply); and 3) the method(s) of performing housekeeping authorized by the employer.

In addition, this **"Housekeeping Program"** is accompanied by two forms that can be used or modified by managers in conjunction with the written program:

- A ***"Housekeeping Inspection Log"*** that can be distributed by the facility manager to employees charged with conducting walk- through inspections of the facility to check for grain dust accumulations. The housekeeping inspection log should also document any actions taken to address grain dust accumulations, fugitive dust, etc.
- A ***"Compressed Air Permit"*** that may be distributed by the facility manager to approve the use of compressed air to reduce grain dust accumulations after initiating OSHA-specified precautions.

Employee Training

At **all facilities,** employers are required to provide training to employees "*at least*" annually and when employees change job assignments that will expose them to new hazards.

The Grain Handling standard requires that current employees and new employees, prior to starting work, be trained in "*at least*" the following:

- **General safety precautions** associated with the facility including "recognition and preventive measures for hazards related to dust accumulations and common ignition sources, such as smoking"; and
- **Specific procedures and safety practices** applicable to the employee's job tasks, "including , but not limited" to cleaning of grinding equipment, clearing of choked legs; housekeeping; hot work; preventive maintenance; and lock-out and tagging of equipment

Employers also are required to provide safety training to employees who are assigned **special tasks,** such as entry into grain bins and handling of flammable or toxic substances.

Emergency Action Plan

At **all facilities,** employers are required to develop and implement an "emergency action plan," designating the actions employers and employees are to take if a fire, explosion or other emergency occurs. The emergency action plan must meet the requirements of OSHA's general industry standard, [1910.38(a)] which includes minimum requirements for employee alarm systems; development of evacuation procedures; and training employees in actions to take during an emergency.

When establishing emergency escape (egress) routes, keep in mind that the means of egress should not lead personnel into other potentially hazardous areas (e.g., near propane tanks, etc.).

Factors to consider when establishing egress routes are:

- loss of electrical power
- presence of heat and toxic vapors/gases
- locations of storage areas for combustibles or other hazards to personnel.

Exits **not** to be used during an emergency also should be designated.

The emergency action plan must be **in writing** if the facility has **more than 10 employees**. If there are **10 or fewer employees,** the emergency action plan may be communicated orally.

Entry into Grain Storage Structures

At **all facilities,** employers are required to establish special procedures and provide personal protection equipment to employees who enter grain storage structures, such as bins, tanks and silos. Importantly, these requirements do not apply to employees entering a "*flat storage structure in which there is no toxicity, flammability, oxygen deficiency or other atmospheric hazards.*"

The following OSHA requirements apply to bin, silo and tank entry:

- **Permits:** Employers are required to issue a permit for entering bins, silos or tanks unless the employer or his or her representative (who otherwise would authorize the permit) is present during the entire operation. The permit, which OSHA requires be kept on file until the entry

operation is completed, is to certify that proper precautions have been implemented before the employee(s) begins entry.

- **Procedures:** All mechanical, electrical, hydraulic and pneumatic equipment feeding or emptying the bin or that "*presents a danger to employees inside bins, silos or tanks shall be disconnected, locked-out and tagged; blocked off; or prevented from operating by other means or methods."* The OSHA standard prohibits employees from entering bins, silos or tanks underneath a *"bridging condition or where a buildup of grain products on the sides could fall and bury them.*
- **Atmosphere Testing and Ventilation:** The atmosphere within a bin, silo or tank that is to be entered is to be tested for the presence of combustible gases, vapors and toxic agents **"when the employer has reason to believe they may be present**." Further, the atmosphere within a bin, silo or tank is to be tested for oxygen content *"unless there is continuous natural air movement or continuous forced-air ventilation before and during the period employees are inside.*

Ventilation is to be provided "*until the unsafe condition(s)...are eliminated, and...as long as there is a possibility of recurrence of the unsafe condition while the bin, silo or tank is occupied by employees*

If ventilation cannot eliminate the toxicity or oxygen deficiency, employees entering the bin, silo or tank are to wear an *"appropriate air supplied or self-contained breathing apparatus (SCBA)respirator"* meeting OSHA requirements contained in its general industry standard.

- **Personal Protective Equipment:** Employees entering grain storage structures are required to wear a body harness equipped with a lifeline, or use a boatswain's chair meeting OSHA specifications. Employers also must *"provide equipment for rescue operations...specifically suited for the bin, silo or tank being entered."*
- **Observers:** An observer *"equipped to provide assistance,"* is required to be stationed outside the bin, silo or tank during entry operations. The person serving as an observer is to *"be trained in rescue procedures, including notification methods for obtaining additional assistance.*

Entry into Flat Storage Structure

A flat storage structure means a grain storage building or structure that will not empty completely without mechanical equipment or manual means being used, and which can be entered from the ground level through regular or larger doorways or openings.

The following requirements apply to entry into all flat storage structures:

- **Personal Protective Equipment:** When the employee walks or stands on grain, the depth of which poses an engulfment hazard, the employee must wear a lifeline that will prevent the employee from sinking further than waist deep in the grain. However, when the employee is

standing or walking on a surface that is free from engulfment hazards (such as the concrete or steel bottom), the lifeline can be disconnected or removed.

- **Safety Procedures:** When walking or standing on grain of a depth that poses an engulfment hazard, all equipment which presents a danger to the employee shall be de-energized and disconnected, locked-out and tagged, blocked-off, or otherwise prevented from operating by equally effective means or methods. The OSHA standard prohibits employees from being either underneath a bridging condition or in any other location where an accumulation of grain on the sides or elsewhere could fall and engulf the employee.

Importantly, walking down grain and similar practices in which an employee walks on grain to make it flow within or out from the flat storage structure, or where the employee is on moving grain, is prohibited.

If actual or potential atmospheric hazards are present, the procedures covered under Entry into Grain Storage Structures are to be followed.

Preventive Maintenance

At **all facilities, a** preventive maintenance program is to be implemented that consists of:

- **Regularly scheduled inspections** of *"at least the mechanical and safety control equipment associated with dryers, grain stream processing equipment, (grain) dust collection equipment (including filter collectors) and bucket elevators.*
- **Lubrication and "other" appropriate maintenance** *in accordance with manufacturers' recommendations or as determined necessary by prior operating records.*"

A *"certification record"* is to be kept of the maintenance performed of each inspection, including the date of the inspection, name of the person who performed it, and the serial number (or other identification) of the above-listed equipment that was inspected.

Employers also are required to *"promptly correct, or remove from service*, ***overheated bearings and slipping or misaligned belts associated with inside bucket elevators."*** Employers are required to promptly correct **dust collection systems** that are malfunctioning or operating below design efficiency and also are required to implement procedures for using **both locks and tags** that will prevent *"the inadvertent application of energy or motion to equipment being repaired, serviced or adjusted which could result in employee injury."* The locks and tags are to be removed **only** by the employee installing them, or, if that person is unavailable, by the employee's supervisor.

While not specifically required by OSHA, there are several options managers may wish to consider including as part of their preventive maintenance program:

- **Work orders:** Work order permit is a method managers can use to ensure that scheduled routine inspections and preventive maintenance or repair equipment has been assigned and performed. The work order basically consists of a form that: 1) assigns inspection or maintenance tasks to a specific employee(s); and 2) provides instructions to employee(s) on the type of maintenance to be performed.

  OSHA's nonmandatory appendix to the grain handling standard states that a work order "would be an indication of an effective preventive maintenance program."

  A sample work order form that managers may wish to consider adapting to the facility and operations is found on page 14.

- **Monitoring Equipment**: Elevator managers may wish to consider using various motion- or temperature-detection devices (i.e., thermo- couples) on bearings or other equipment as a method to assist in monitoring equipment condition and performance. However, with the exception of inside-located bucket elevator legs, these devices are not required by OSHA and managers instead may wish to utilize a daily walk-through of the facility as a means of complying with the OSHA standard's inspection requirements.

Preventive Maintenance Work Order Form

(please return to manager's office for filing when work completed)

Order Number: _____

Date Assigned: _____

Date to be Performed: _____

1. Type of Equipment to be serviced: _____

   Equipment Serial No. or Identifier: _____ Location of Equipment: _____

   Assigned by: _____ Assigned to: _____

2. Description of Inspection/Maintenance to be Performed:

   _____
   _____
   _____
   _____

   Specific Instructions:

   _____
   _____
   _____
   _____

3. Inspection/Maintenance Completed

   Date Completed: _____ Hours Worked_____

   Employee (Repairman's) Remarks (include any follow-up needed)

   _____
   _____
   _____
   _____
   _____

   Employee's (Repairman's) Signature: _____

Hot Work

Employers are required to issue permits for all "hot work" (electric or gas welding, cutting, brazing or *"similar flame-producing operations"*) unless one or more of the following three conditions is met:

- The employer or his representative (*"who would otherwise authorize a permit"*) is present while the hot work is performed.
- The hot work is performed in welding shops authorized by the employer
- The hot work is performed in employer-designated areas outside the grain handling structure

The permit is required to certify that hot work requirements contained in OSHA's general industry standard [1910.252(d)] have been implemented.

Contractors

The standard requires contractors performing work at grain handling facilities to be informed by the employer about *"known potential fire and explosion hazards related to the contractor's work and work area."* The employer also is required to inform contractors of the applicable safety rules of the facility, including emergency procedures.

Equipment Requirements

Grate Openings

At **all facilities,** receiving pits -- such as truck and rail dump pits -- are required to have a maximum width opening of 2 1/2 inches. There is no length restriction on grate openings at receiving pits

Managers have several options if they discover their facility's grate openings do not comply with the 2 1/2-inch maximum width limit:

Equip grates with grate overlay. This consists of a metal grid pattern that when attached to the grate(s) provides a maximum 2 1/2-inch width. When selecting grate overlays, managers should ensure that they are designed to withstand the weight of vehicles if used in truck receiving areas

- **Retrofitting the grate.** Rebuilding the grate is also an acceptable alternative.

Grain Stream Processing Equipment

At **all facilities**, grain stream processing equipment is to be equipped with *"an effective means of removing ferrous material from the incoming grain stream."*

Importantly, this requirement pertains only to such processing equipment as hammer mills, grinders and pulverizers. **It does not apply to scalpers, screens or other cleaning equipment used at grain facilities.**

Although the standard does not mandate a specific means for complying with this requirement, OSHA states in its non-mandatory appendix that "acceptable means for removal of ferrous material include the use of permanent or electromagnets." However, the standard does **not** prohibit the use of other methods to remove ferrous materials, such as grain cleaners, screeners, gravity tables or other particle-separating equipment installed on grain processing streams.

Emergency Escapes from Galleries and Tunnels (Applies to Grain Elevators Only)

At **grain elevators only,** at least two means of emergency escape from galleries (bin decks) are to be provided. Tunnels in **existing facilities** need only have one means of emergency escape. However, tunnels in **elevators built after March 30, 1988** are required to have at least two means of escape.

The OSHA standard is written so as to provide managers with some flexibility to tailor the means of escape to their individual facilities. OSHA states in its non-mandatory appendix that emergency escape can consist of "any means of egress" consisting of access to an exit, the exit itself and a method of exiting in accordance with OSHA's general industry standard (Section 1910.35). The general industry standard requires that the two means of escape be located in different areas as much as practicable.

To comply with this requirement for **galleries**, OSHA suggests in its nonmandatory appendix that elevator managers utilize "controlled descent devices" or ladders from bin decks. "Controlled descent devices" consist of a combination of the following: 1) personnel harness; 2) cable; and 3) a mechanism to ensure that the person who is being lowered from the bin deck is moving at a constant rate which should be less than 15 feet per second.

To comply with the emergency escape requirement for **tunnels**, the exit should be identified and accessible.

OSHA also states in its non-mandatory appendix that "the means of emergency escape are to be addressed in the facility emergency action plan. Employees are to know the location of the nearest means of emergency escape and the actions they must take during an emergency."

Inside Bucket Elevators

Several requirements apply to grain elevators with **"inside" bucket elevators** [defined as a bucket elevator that has the boot and more than 20 percent of the total leg height (above grade or ground level) inside the grain elevator structure.] Other bucket elevators that are not "inside" are **exempt** from the equipment requirements.

Three major sets of equipment requirements apply to "inside" bucket elevators:

1. **Bearings** are to be mounted externally to the leg casing; **or** be equipped with motion- detection or temperature-monitoring devices or other means for monitoring *"the condition of those bearings mounted inside or partially inside the leg casing."*
2. **Motion-detection devices** are to be installed that shut down the "inside" bucket elevator when the belt speed is reduced by no more than 20 percent of the normal operating speed.
3. **Belt-alignment devices** are to be installed that will initiate an alarm to employees when the belt is not tracking properly; **or provide** another means of keeping the belt tracking properly, "*such as a system that provides constant alignment adjustment of belts."*

Exemptions: Exempt from all three of these requirements are "inside" bucket elevators that are**:**

- equipped with operational fire or explosion suppression systems capable of protecting the head and boot sections
- equipped with pneumatic **or other dust control systems** that maintain dust concentrations in the bucket elevator at least 25 percent below the lower explosive limit for grain dust at all times during operations.

Exempt from requirements 2 and 3 listed previously are facilities having a "permanent" storage capacity of less than 1 million bushels, **provided** a daily visual inspection is made of the bucket movement and tracking of the belt in these facilities.

Other Requirements:

The following requirements apply to all "inside" bucket elevators, regardless of special equipment or storage capacity:

- A means of access is to be provided to allow inspection of the head pulley, lagging, belt and discharge throat of the head section.
- A means of access is to be provided to allow cleaning and inspection of the boot section, pulley and belt.
- Jogging of choked inside bucket elevator legs is prohibited.
- Belts and lagging purchased after **March 30, 1988** for inside bucket elevators must be conductive.

Grain Dryers

At **grain elevators only**, all direct-heat continuous-flow bulk raw grain dryers are required to be equipped with automatic controls that:

- shut off the fuel supply in case of power or flame failure or interruption of air movement through the exhaust fan
- stop the grain from being fed into the dryer if excessive temperatures occur in the exhaust of the drying section.

All direct-heat grain dryers installed after March, 30 1988 are required to be:

- located outside the grain facility
- located in an area inside the grain facility protected by a fire or explosion suppression system
- located in an area inside the grain facility that is separated from other areas by construction having at least a one-hour fire-resistance rating

Fabric Dust Collector Filters

At **all facilities**, two equipment-related requirements apply to fabric filters used to collect fugitive grain dust (bag house filters).

- **Existing fabric dust collector filters** are to be equipped with a monitor that indicates the pressure drop across the filter surface.

OSHA does not require the use of a specific type of monitor. However, monitors commonly used in the industry and suggested by OSHA as being acceptable in its non-mandatory appendix are: photohelic gauges, magnehelic gauges; and manometers. OSHA further suggests that checking the pressure drop across fabric filters periodically, consistent with the manufacturer's recommendations, should be part of the facility's preventive maintenance program. As such, OSHA indicates that the monitors should be located so they are accessible and readings can be obtained as frequently as specified in the facility's preventive maintenance program.

Importantly, **not** covered by the OSHA requirement are filter collectors that are part of systems not designed to collect fugitive grain dust, such as cyclone filters or filters that collect product (as opposed to fugitive grain dust).

- **New fabric dust collector filters** installed on or after March 30, 1988 are to be:
    - located outside the facility

- located in an area protected by an explosion suppression system
- located in an area separated from the rest of the facility by a fire wall with at least a one-hour fire-resistance rating. If this option is chosen, the filters also are to be located adjacent to an outside wall and be vented to the outside. Venting and ductwork must be able to resist rupture caused by an explosion.

Permit-Required Confined Space Standard

OSHA's permit-required confined space standard (29 CFR 1910.146) requires employers to:

- Evaluate the workplace to determine if spaces are permit-required confined spaces. *[See definitions below on what constitutes a permit-required confined space.]* If permit-required spaces exist in the workplace, the employer must inform employees who may potentially enter these spaces of the existence, location and danger posed;
- Take effective measures to prevent employees from entering the permit-required space, if they are not allowed to do so. This can be accomplished by posting danger signs or by another equally effective means. For example, a sign reading, ***"Danger - Permit-Required Confined Space, Do Not Enter"*** or similar language would satisfy this requirement; and
- Develop a written program, if employees will or may enter the permit-required confined space.

Importantly, the requirements for permit-required confined spaces are incorporated into the sample compliance program for Critical Control Area 5 -- "Entry into Confined Spaces" -- found on pages II-28 through II-32 of this chapter.

Definitions of Permit-Required Confined Space

The term "permit-required confined space" refers to those workplaces that meet the definition of a "confined space" and pose the following health or safety hazards, thereby requiring a permit for entry:

- A **confined space** has limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These spaces may include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels and silos.
- **A permit –required confined space is one that** meets the definition of a **confined space** and has one or more of these characteristics:

- Contains or has the potential to contain a hazardous atmosphere. OSHA defines a "hazardous atmosphere" as being one that may endanger employees because it contains: 1) A flammable gas, vapor or mist in excess of 10 percent of its lower flammable limit; 2) airborne combustible dust at concentrations that meet or exceed its lower flammable limit (which OSHA equates to a condition in which the dust obscures vision at a distance of five feet or less): 3) atmospheric oxygen concentrations less than 19.5 percent or above 23.5 percent; 4) atmospheric concentrations of any substance for which a permissible exposure limit (PEL) is established and could result in employee exposure in excess of its PEL; and 5) any other atmospheric condition that poses an immediate danger to life or health of the employee.
- **Contains materials that have the potential for engulfing an entrant**
- **Has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section**
- **Contains any other recognized safety or health hazard**

Relationship with Grain Storage Entry Requirements in OSHA's Grain Handling Facilities Safety Standard

OSHA says that the procedures for entering grain and flat storage structures in the grain handling facilities standard take precedence over the entry procedures in the permit-required confined space standard. However, for other confined spaces at a grain elevator, mill or processing plant, the procedures in the permit-required confined space standard apply.

Requirements for a Written Program

If employees are allowed to enter a permit- required confined space, the employer is required to implement a written program that includes the following provisions:

- Identify and evaluate permit space hazards before allowing employees to enter
- Test conditions in the permit space before entry operations and monitor the space during entry
- Perform appropriate testing for the following atmospheric hazards: oxygen, combustible gases or vapors, and toxic gases or vapors
- Implement necessary measures to prevent unauthorized entry
- Establish and implement the means, procedures and practices such as specifying acceptable entry conditions, isolating the permit space, providing barriers, verifying acceptable entry conditions, purging, flushing or ventilating the space to eliminate or control hazards necessary for safe permit-required space entry

- Identify employee job duties
- Provide, maintain and require, at no cost to the employee, the use of personal protective equipment and any other equipment necessary for safe entry (e.g., testing, monitoring, communications, lighting, etc.)
- Ensure that at least one attendant is stationed outside the permit space for the duration of entry operations
- Coordinate entry operations when employees or more than one employer are working in the permit space
- Establish a written procedure for the issuance, use and cancellation of entry permits
- When an attendant is required to monitor multiple spaces, implement the procedures to be followed during an emergency in one or more of the permit-required confined spaces being monitored

Within one year after each entry into a confined space — or when there is reason to believe that the measures put in place may not protect employees adequately (e.g., an injury has occurred or a new hazard is detected) — the employer is required to reevaluate the confined space program. Under the standard, OSHA will permit an annual review of all entries performed during the preceding 12-month period.

Contractors are to be informed about the permit- required confined spaces that exist at the facility, as well as the entry requirements for, identified hazards in, and the employer's experience with the permit-required space. Contractors are to be informed about any precautions and procedures to observe when working in or near a permit-required confined space.

The Permit System

Before an employee is authorized to enter a permit-required confined space, the employer is required to develop and implement a written permit program.

The permit is required to:

- indicate that pre-entry preparations have been completed;
- specify the confined space that is to be entered;
- state the reason the confined space is being entered;
- State the date and duration of the entry procedure;
- list the names of the employee(s) authorized to enter the permit-required confined space, as well as the names of the attendants and entry supervisor;
- list the expected hazards the employee will encounter;
- list any other pertinent information;

- be signed by a company official who is supervising is supervising the entry into the confined space (the entry supervisor) ; and
- be posted at the entrance to the confined space, or otherwise be made available to all persons authorized to enter the space.

The permit is only in effect for the duration of the time required to complete the assigned task. Permits are required to be retained for at least one year and should note any problems encountered during the confined space entry operation. These notations will form the basis for appropriate revisions to the permit system.

Training and Education

Before the initial work assignment begins, the employer must provide proper training for all work- ers who are required to work in permit-required confined spaces.

Specifically, the standard requires training for the following personnel:

- **Employees authorized to enter permit-required confined spaces**: Training is to include information on the hazards that may be encountered, recognition of signs and symptoms of exposure, equipment to be used, communication methods used with attendees, how to exit the space when ordered by the attendant, and self-rescue techniques.
- **Employees assigned to serve as attendants(s)**: Training is to include information on: 1) the existing and potential hazards present in the confined space; 2) the mode of exposure, signs or symptoms, consequences of exposure and their physiological effects; and 3) the following specific responsibilities of the attendant:
- Maintain a count of, and continuous communication with, employee(s) performing entry procedures;
- Remain outside the confined space until relieved;
- Perform non-entry rescues when specified by the employer's rescue procedures;
- Order evacuation of the permit space when a prohibited condition exists, when a worker shows signs of adverse physiological effects of hazard exposure, when an emergency out- side the permit-required space exists, and when the attendant cannot effectively and safely perform required duties;
- Summon rescue and other services during an emergency;
- Ensure that unauthorized persons stay away from the permit spaces or exit immediately if they have entered the permit space;
- Inform authorized entrants and entry supervisor of entry by unauthorized persons; and
- Perform no other duties that interfere with the attendant's primary duties.
- **Entry Supervisor**: Training is to include information on: 1) the existing and potential hazards in the permit-required confined space, including information on the mode of exposure, signs or

symptoms and consequences of exposure; and 2) the following specific responsibilities of the entry supervisor:

- Verifying that all tests have been conducted and all procedures and equipment are in place before signing the entry permit;
- Terminating entry and canceling permits;
- Verifying that rescue services are available and the methods for summoning them are operable;
- Removing unauthorized individuals who enter the permit-required confined space;
- Ensuring that acceptable conditions specified in the permit remain in effect during the entry.

Upon completing the training, employers must ensure that employees have acquired the understanding, knowledge and skills necessary for the safe performance of their duties. Additional training is required when: 1) the employee's job duties change; 2) there is a change in the permit-required confined space program or the space covered by the permit presents a new hazard; and 3) when the employee's job performance shows deficiencies. Training, including CPR and first-aid training, also is required for rescue team members. The employer is to certify that the training has been accomplished.

Upon completion of training, employees are required to receive a certificate of training that includes the employee's name, signature or initials of the trainer(s) and dates of training. The certification is to be available for inspection by employees and their authorized representatives.

Emergency and Rescue Service Requirements

If the employer assigns employees to perform rescue and emergency services, the employer is to ensure that rescue service personnel are provided with and trained in the proper use of personal protective and rescue equipment (including respirators) necessary to perform rescues from the permit space, trained to perform assigned rescue duties, and have authorized entrant's training. The standard also requires that all rescuers be trained in first aid and CPR and, at a minimum, one rescue team member be currently certified in first aid and CPR. OSHA requires that simulated rescue operations be conducted at least every 12 months, in which removal of dummies, mannequins or actual persons takes place.

If persons other than the host employer's employees will perform rescue operations, the employer must inform the rescue service of the hazards they may encounter and provide access to all permit spaces for planning and training.

To facilitate rescues without having to resort to entering the confined space, the authorized entrant is required to wear a chest or full body harness with retrieval line attached to a mechanical device or fixed point outside the confined space, unless this equipment would increase the overall risk of entry or would not contribute to the rescue. In this situation, alternate but equally effective means of retrieval are permitted. A mechanical device must be available to retrieve personnel from vertical-type permit spaces more than five feet deep.

Further, the employer is required to provide medical personnel with the appropriate material safety data sheet(s) or other information kept at the workplace related to the hazards to which the authorized entrant(s) may be exposed.

General Requirements for Personal Protection Equipment

Employers are required to provide personal protection equipment to employees when:

- they are exposed to a work environment or process that presents or is likely to present a hazard to any part of their bodies; or
- they may come into contact with hazardous chemicals, radiation or mechanical irritants; **and**
- when their exposure or potential exposure cannot be eliminated through engineering, work practice or administrative controls.

This section discusses OSHA's requirements for protective equipment for eye and face, head, foot and hands. The agency's requirements concerning workplace respiratory and noise exposure hazards are discussed in Health section.

Hazard Analysis

Employers are required to perform a hazard analysis of the workplace to determine if hazards are, or are likely to be, present that may necessitate the use of personal protective equipment. The employer is required to verify, through written certification, that the required workplace hazard analysis has been performed .The written certifications are required to identify: 1) the workplace evaluated; 2) the person certifying that the evaluation has been performed; and 3) the date(s) the hazard assessment was done; and 4) the document as a hazard assessment. Hazard assessment guidelines are provided on page II-xx.

Damaged Personal Protective Equipment

All personal protective equipment is required to be of safe design and construction for its intended use. All defective or damaged equipment is to be removed from use immediately.

The employer also is responsible for ensuring the adequacy of employee-owned equipment used in the workplace, including its proper maintenance and sanitation.

Training

Before performing work requiring the use of personal protective equipment, employees are required to be trained in the following areas:

- Why personal protective equipment is necessary;
- How such equipment will protect them;
- The limitations of the equipment selected;
- When it must be worn;
- How to wear the equipment over personal corrective lenses;
- How to identify signs of wear and deterioration in the equipment; and
- How to clean and disinfect it.

Employers are required to certify in writing that training has been done and that employees understand it. Each written certification is to contain the name of each employee trained, the date(s) of training and identify the subject covered.

Hazard Assessment Guidelines

To determine if personal protective equipment is needed:

1. Conduct a walk-though survey of the workplace to identify potential sources of hazards to workers. Look for:
    - sources of motion such as machinery, tools, processes, or personnel that could result in injury.
    - sources of high temperatures that could result in burns, eye injury or ignition of protective equipment;
    - sources of chemical exposures
    - sources of harmful levels of dust
    - sources of light radiation, such as welding, cutting, heat treating, etc.;
    - sources of falling objects or the potential for dropping objects
    - sources of sharp objects that might pierce the feet or cut the hands;
    - sources of rolling or pinching objects which could crush the feet;
    - layout of the workplace and location of co- workers; and
    - electrical hazards.
2. Review injury and accident data to help identify problem areas.
3. Organize and analyze the data for the level of risk, seriousness of potential injury and employee exposure.
4. Select the appropriate personal protective equipment that ensures a level of protection greater than the minimum required to protect employees from the hazard.

5. Fit the user with personal protective equipment and provide instructions on its proper care and use

Periodically reassess the workplace to determine if the equipment being used is adequate.

Eye and Face Protection Standard

Employers are to provide suitable eye and face protectors when there is potential for injury to the employee from such workplace hazards as:

- dust or other flying particles, such as metal shavings or wool fibers
- molten metal that might splash
- liquid chemicals that might splash
- chemical gases or vapors
- intense light, such as that created by welding arcs or lasers

Eye and face protectors are to meet the following minimum requirements

- provide adequate protection against the particular hazards for which they are intended, including the use of side protectors when there is a hazard from flying objects (detachable side protectors, such as clip-on or slide-on side shields, are acceptable)
- be reasonably comfortable when worn under the designed conditions
- fit snugly without interfering with the movement or vision of the wearer
- be durable
- be capable of being disinfected
- be easily cleaned
- be kept clean and in good repair

Eye and face personal protective equipment purchased after July 5, 1994 is required to meet the requirements of ANSI Z87.1-1989. Equipment purchased before that date is required to comply with ANSI Z87.1-1968. It also is to be marked to clearly identify the manufacturer.

Lenses for Welding Helmets and Goggles: The intensity of light or radiant energy produced by welding, cutting or brazing operations varies depending upon such factors as the task producing the light, the electrodes' size and the arc current. Table 1 on page 27 shows the minimum protective shade required for filter lenses for a variety of welding, cutting and brazing operations. When selecting lenses, OSHA suggests that employers first choose a shade that is too dark to see the welding zone before trying lighter shades until one is found that allows a sufficient view of the welding zone while not violating the minimum protective shade.

Eyeglasses and Contact Lenses: OSHA does not consider eyeglasses designed for ordinary wear adequate to protect against workplace hazards. For employees who wear eyeglasses with corrective lenses, OSHA requires that special care be taken when choosing eye protectors, such as:

- spectacles with protective lenses that provide optical correction (see ANSI Z.87.1 standards noted above)
- goggles that can be fitted comfortable over corrective eyeglasses without disturbing the alignment of the eyeglass
- goggles that incorporate corrective lenses mounted behind protective lenses

OSHA requires employers to provide protective eyewear to employees who wear contact lenses and potentially are exposed to eye injury

Type of Operations	Electrode Size 1/32 in	Arc Current	Minimum* Protective Shade
Shielded Metal Arc Welding	Less than 3	Less than 60	7
	3-5	60-160	8
	5-8	160-250	10
	More than 8	250-550	11
Gas Metal Arc Welding & Flux Cored Arc Welding		Less than 60	7
		60-160	10
		160-250	10
		250-500	10
Gas Tungsten Arc Welding		Less than 50	8
		50-150	8
		150-500	10
Air Carbon Arc Cutting	(Light)	Less than 500	10
	(Heavy)	500-1,000	11
Plasma Arc Welding		Less than 20	6
		20-100	8
		100-400	10
		400-800	11
Plasma Arc Cutting	(Light)*	Less than 300	8
	(Medium)**	300-400	9
	(Heavy)***	400-800	10
Torch Brazing			3
Torch Soldering			2
Carbon Arc Welding			14

* As a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade that gives sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting, where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workplace.

Type of Operation	Electrode Size 1/32 in	Arc Current	Minimum* Protective Shade
Gas Welding:			
Light	Under 1/8	Under 3.2	4
Medium	1/8 to 1/2	3.2-12.7	5
Heavy	Over 1/2	Over 12.7	6
Oxygen Cutting:			
Light	Under 1	Under 25	3
Medium	1 to6	25 to 150	4
Heavy	Over 6	Over 150	5

* As a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade that gives sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting, where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workplace.

Head Protection Standard

Employers are required to provide head protection for employees if there is a potential for injuries from falling objects or from bumping against exposed pipes, beams, etc. Employers also are to provide employees with protective helmets designed to reduce electrical shock hazards if they are working near exposed electrical conductors.

If these or similar workplace hazards exist, employers can comply with OSHA requirements by obtaining protective headwear that meets the ANSI Z89.1-2003 standard.

Types of Head Protection: Hard hats are divided into three industrial classes:

- **Class G:** Hardhats for general service, which provide impact protection but limited voltage protection
- **Class E:** Hardhats for employees engaged in electrical work
- **Class C:** Hardhats Helmets provide protection from falling objects, but no protection against electrical shock

In addition, employers are to ensure that protective headwear (hard hats) continue to provide sufficient protection to employees. Employers should train employees in the proper use and maintenance of hard hats, including the importance of inspecting them daily. If employees identify any of the following conditions, the hard hat should be removed from service:

- Cracking, tearing or fraying of the suspension system
- The suspension system no longer holds the shell from 1 inch to 1 ¼ inch away from the employee's head
- The brim or shell is cracked, perforated or deformed
- The brim or shell show signs of exposure to heat, chemicals, ultraviolet light or other reaction

Foot Protection Standard

Employers are required to provide protective footwear to employees when there is a potential for foot injuries caused by:

- falling or rolling objects
- sharp objects, such as nails or spikes; that could pierce the soles or upper parts of ordinary shoes
- molten metal that could splash on feet or legs
- hot or wet surfaces
- slippery surfaces
- electrical hazards

If these or similar workplace hazards exist, employers can comply with OSHA requirements by requesting footwear that meets the ASTM F2413-11 Standards.

Hand Protection Standard

If a workplace hazard assessment reveals that employees risk injury to their hands or arms and engineering and/or workplace controls (such as guards or barriers) do not eliminate the hazards OSHA requires employers to provide appropriate protective equipment.

Workplace hazards to which employee hands and arms may be exposed include:

- Burns, bruises and abrasions
- Cuts, punctures and fractures
- Amputations
- Chemical exposure

Protective equipment for hand protection includes gloves and protective sleeves. OSHA has not established specific equipment specifications for gloves and protective sleeves, but requires employers to select equipment based upon the nature of the hazard. For example, leather gloves may be used to protect against sparks and moderate heat, while synthetic gloves can be used to protect against some acids.

Control of Hazardous Energy (Lockout/Tagout) Standards

OSHA's lockout/tagout standard – formally known as the control of hazardous energy standard (29 CFR1910.147) -- requires employers to establish procedures to isolate machines or equipment from their energy source and affix appropriate locks or tags to prevent any unexpected energization, startup or release of stored energy that could injure employees.

Specifically, the standard requires employers to develop a program to lock and tag energy-isolating devices that includes the following components:

- written energy-control procedures that ensure machines and equipment are isolated and inoperative before any employee performs service or maintenance on such equipment
- an employee training program
- periodic inspections to ensure the procedures are effective

Grain and Flat Storage Areas

A separate OSHA standard – the grain handling facilities standard (29 CFR 1910.272) – specifies the lockout/tagout procedures required for employees who enter grain and flat storage areas. Specifically, this standard requires that lockout and tagout be used on all equipment that poses a hazard to employees working in these areas.

Exemptions

The standard contains several exemptions from the lockout/tagout requirement:

- It does not apply when employees perform service or maintenance on cord- or plug-connected electrical equipment, provided the equipment is unplugged from the energy source and remains under the exclusive control of the employee performing the service
- It does not apply when the service or maintenance must be performed while the power is on, such as when making fine-tuning adjustments to equipment or when performing troubleshooting to diagnose a malfunction or check on its successful repair
- It does not apply when performing minor tool changes and adjustments, as well as other minor service, that are routine, repetitive and integral to the use of the production equipment and which occur during the normal operations, provided equally effective protection is provided to prevent injury
- Generally it does not apply to hazards encountered during normal production operations (activities that are governed by OSHA's general industry standard) or during service or maintenance, provided employees are not exposed to an unexpected release of hazardous energy

Importantly, however, the standard **does** apply in such situations if:

- an employee, when servicing equipment (such as lubricating, cleaning or unjamming production equipment): 1) removes or bypasses a guard or other safety device; 2) comes into contact with a machine or piece of equipment where service is being performed; or 3) is exposed to a danger zone associated with the machine operating cycle an employee performing other service or maintenance tasks – such as setting up equipment and/or making significant adjustments to machines – can be injured by unexpected energization or startup of the equipment

Energy Control Program

The standard requires that energy-control procedures be developed, documented and used to control potentially hazardous energy whenever employees perform activities covered by the standard.

The written procedures are to identify the information employees must know to control hazardous energy during servicing or maintenance. If this information is the same for various machines or equipment, or if other means of logical grouping exists, then a single energy-control procedure may be sufficient. If there are other conditions — such as multiple-energy sources, different connecting means, or a particular sequence that must be followed to shut down the machine or equipment — the employer is required to develop separate energy- control procedures to protect the employee.

Each written procedure is to include the following steps: 1) preparing for shutdown; 2) shutting down the machine or equipment; 3) isolating the machine or equipment from the energy source(s); 4) applying the lockout or tagout device(s) to machines or equipment by employees authorized by the employer to do so; 5) safely releasing all potentially hazardous stored or residual energy; and 6) verifying the isolation of the machine or equipment prior to the start of service or maintenance. If there is a possibility stored energy will reaccumulate to a hazardous level, verification of isolation must continue until the service or maintenance is completed, or until the possibility of such accumulation no longer exists.

In addition, before lockout or tagout devices are removed and energy is restored to the machines or equipment, the authorized employee is required to observe the following procedures: 1) inspect the work area to ensure that non-essential items have been removed and that machine or equipment components are intact and operating properly; 2) check the area around the machine or equipment to ensure that all employees are safely positioned or removed; 3) make sure that lockout or tagout devices are removed only by the authorized employee who applied the lockout or tagout device; and 4) notify operators and other employees who may be working in the area that lockout or tagout devices have been removed.

When the authorized employee who applied the lockout or tagout device is not available, the device may be removed under the direction of the employer, *provided* specific procedures and training for such removal have been developed, documented and incorporated into the energy-control program. These procedures must include verification that the authorized employee is not at the facility; and reasonable efforts have been made to inform the authorized employee that his or her lockout or tagout device has been removed before work resumes on the affected equipment or machine.

Group Lockout or Tagout: When service or maintenance is performed by a crew or group, the following procedures are to be followed:

- Primary responsibility for coordinating group lockout/tagout responsibilities rests with an authorized employee
- Designate an authorized employee to coordinate work activity when more than one group or crew is involved
- Ensure that each authorized employee affixes a personal lockout or tagout device to the group lockout device, group lock box, or comparable mechanism when beginning work. Also, ensure that these devices are removed when work is completed
- Implement specific changes to be utilized during shift or personnel changes to ensure continuity of lockout or tagout protection

Contractors: The onsite employer and the outside contractor are required to inform each other of their respective lockout or tagout procedures. Each employer is to ensure that its personnel understand and comply with all restrictions and/or prohibitions of the other employer's energy control program.

Energy-Isolating Device

An energy-isolating device is a mechanism that prevents the transmission or release of energy from a machine or piece of equipment to which locks or tags are attached. There are two types of energy-isolating devices: those capable of being locked and those that are not. When an energy-isolating device cannot be locked out, the employer must use tags.

Only authorized employees are allowed to attach lockout and tagout devices to the energy-isolating device. Lockout devices must be affixed so as to hold the energy-isolating device in a "safe" or "off" position. Tagout devices, when used, must be affixed in a way that clearly indicates that switching the energy-isolating device from the "safe" or "off" position is prohibited. If a tag cannot be affixed directly to the energy-isolating device, it must be located as close to the device as safely possible, situated so as to be obvious immediately to anyone attempting to operate it.

- If the energy-isolating device is lockable, the employer must use locks unless it can be demonstrated that the use of tags will provide equally effective protection. Equipment protection could include removing and isolating a circuit element, blocking a controlling switch, opening an extra disconnecting device, or removing a valve handle to reduce the potential for any inadvertent energization while tags are attached.
- After attaching locks or tags to the energy- isolating device, all potentially stored or residual energy must be relieved, disconnected, restrained and otherwise rendered safe

The standard also requires that whenever new equipment or machines are installed -- or existing equipment is replaced, repaired, renovated, or modified, the employer must ensure that all energy-isolating devices for such machines are lockable.

Requirements for Lockout/Tagout Devices

Lockout or tagout devices must meet the following requirements:

- Be supplied by the employer
- Be singularly identified
- Be the only devices used for controlling energy and not used for other purposes
- Be capable of withstanding the environment to which they will be exposed for the maximum duration of the expected exposure. Tagout devices must be constructed and printed so they do not deteriorate or become illegible, especially in corrosive or wet environments
- Be standardized by color, shape or size. Tagout devices attachable by hand, self-locking, and non-releasable, with a minimum unlocking strength of no less than 50 pounds. The device for attaching the tag also must have the general design and basic characteristics equivalent to a

one-piece nylon cable tie that will withstand all environments and conditions; and also must be standardized according to print and format

- Be substantial enough to minimize early or accidental removal. Locks must be substantial enough to prevent removal except by excessive force or special tools, such as bolt cutters or other metal cutting tools
- Be identifiable to the employee(s) who applies them

Tags also must warn against hazardous conditions if the machine or equipment is energized and must include a legend, such as the following: ***"Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate."***

Employee Training

The employer is required to provide initial training and retraining, as necessary, to ensure all employees understand the purpose, function and restrictions of the energy-control program, including the prohibition against restarting or reenergizing machines or equipment that are locked or tagged out

Retraining must be provided when:

- There is a change in job assignments, machines, equipment or processes that presents a new hazard
- when there is a change in the energy-control procedures
- the required periodic inspection reveals -- or whenever the employer has reason to believe -- that there are deviations from or inadequacies in the employee's knowledge about, or use of, the energy-control procedures

The employer is required to certify that such training has been given to employees covered by the standard. The certification is to include each employee's name and the dates of training

Authorized Employees: Training for authorized employees is to include the following topics:

- Recognition of applicable hazardous energy sources
- Details about the type and magnitude of the hazardous energy sources present
- The methods and means necessary to control those energy sources
- The means of verifying the effectiveness of energy control and the purpose of the procedures to be used

Affected Employees: Employees who operate, use or work in an area where machines or equipment on which service or maintenance may be performed under lockout or tagout are to be instructed in the purpose and use of the energy-control procedures

Other Employees: OSHA requires that employees who may be affected by the energy-control procedures be instructed about the procedures and importance of not attempting to start up or use the equipment, and that lockout/tagout equipment must not be removed or tampered with.

Special Tagout Training: When tagout procedures are being used, the employer is required to inform employees that:

- tags are essentially warning devices and do not provide the physical restraint of a lock
- tags attached to an energy-isolating device are not to be removed except by the person who applied them, and are never be bypassed, ignored or otherwise defeated
- tags are to be legible and understandable by all employees
- tags and their means of attachment are to be made of materials that will withstand the environmental conditions encountered in the workplace
- tags may invoke a false sense of security. Remember, tags are only part of an overall energy-control program
- tags must be securely attached to the energy- isolating devices to that they cannot be detached accidentally during use

Periodic Inspection

The employer is required to evaluate the energy- control procedures at least annually to ensure that each procedure continues to be implemented properly and that employees are familiar with their responsibilities.

Periodic inspections are to be performed by an authorized employee other than the one(s) using the energy-control procedures. The employer is to certify that the periodic inspection has been performed, including the date of inspection, the identity of the machine or equipment on which the energy- control procedure was used, the employees included in the inspection and the name of the person conducting the inspection.

For lockout procedures, the periodic inspection is to include a review, between the person conducting the periodic inspection and each authorized employee, of that employee's responsibilities under the energy-control procedures being inspected.

For tagout procedures, a review of the limitation of tags also must be included between the person conducting the inspection and each authorized employee, operator or other employees working at the facility.

Air Contaminants Standard

OSHA's air contaminants standard established permissible exposure limits covering employee exposure to 428 different substances.

Of importance to grain elevators, feed mills, and processing plants are the following two permissible exposure limits:

- 10 milligrams per cubic meter for wheat, oat and barley dust, based upon an eight- hour, time-weighted average
- 15 milligrams per cubic meter for other organic dusts *(such as corn or soybean dust)*, based upon an eight-hour, time- weighted average. Previously, this was been referred to as the "nuisance-dust" standard.

However, the air contaminants standard was overturned by a U.S. appeals court on July 8, 1992. The court ruled that OSHA had failed to adequately justify -- through substantial evidence and adequate explanation -- the specific permissible exposure limits contained in the standard. Specifically, the court held that OSHA failed to establish that existing workplace exposure limits for the sub- stances presented a significant risk of material impairment of employee health.

Importantly, however, OSHA on Aug. 5, 1993 issued a compliance and enforcement policy directive authorizing its inspectors to use the agency's general duty clause to cite employers for air contaminants in the workplace that exceed levels the agency considers to be healthful.

In the compliance and enforcement policy memorandum, OSHA told its inspectors that they still "may consider" issuing citations for violations of the permissible exposure limit levels under the "recognized hazard" provision of the agency's general duty clause.

"The employer's knowledge of a recognized hazard can be demonstrated by documenting industry recognition or employer recognition of the hazard," the OSHA directive stated. To demonstrate "hazard recognition" by employers, OSHA said inspectors could use, among other things, the threshold limit values established by the American Conference of Government Industrial Hygienists (ACGIH). Significantly, it was the ACGIH's threshold limit values that were incorporated by OSHA into its PEL standard.

The upshot of all this is that despite the appeals court decision invalidating the air contaminants standard, OSHA still is authorizing its inspectors to issue citations for the PEL levels under an alternative standard (the general duty clause).

Grain and Dust Permissible Exposure Limit

Importantly, however, this OSHA compliance directive does not apply to the grain, feed and processing industry, thanks to a joint settlement agreement reached by the National Grain and Feed Association, OSHA and the AFL-CIO in 1990.

The joint settlement agreement set the exposure limits at:

- **10 milligrams** per cubic meter for wheat, oat, and barley dust based upon an eight-hour, time-weighted average
- **15 milligrams** per cubic meter for other organic dusts (such as corn or soybean dust) based upon an eight-hour, time-weighted average
- Those limits compare to the 4- and 10-milli-gram-per-cubic-meter limits, respectively, set by ACGIH in its threshold limit values

Value of NGFA's Settlement Agreement

Importantly, under the landmark settlement agreement reached by the NGFA, OSHA and the AFL-CIO, managers of most sectors of the grain, feed and processing industry are provided additional flexibility to use personal protection devices, such as respirators (including dust masks) instead of costly engineering controls to comply with the permissible exposure limits.

Under the settlement agreement, OSHA pledged not to change the aforementioned permissible exposure limits unless scientific studies demonstrate significant health effects to employees justify different exposure limits. As of July 1998, no changes to these limits have been proposed

Specific industry segments granted additional compliance flexibility to use respirators instead of engineering controls are:

- grain elevators
- feed mills
- soybean processing plants
- flour mills
- dry corn mills
- wet corn mills
- rice mills
- pet food operations

The flexibility granted to managers to utilize respirators (including dust masks) in lieu of engineering controls (such as pneumatic dust control systems) to provide employee protection applies to:

- **all facilities *(regardless of type or size)* for several specific work tasks.** These work tasks include the following:
    1. collecting grain samples for inspection during unloading operations
    2. directing grain flow during loadout into railcars, barges and trucks, including the practice of "topping off" such conveyances.
    3. intermittent work tasks (such as maintenance, preventive maintenance, operational inspections and adjusting grain flow). Under the settlement agreement, for intermittent work tasks, managers are allowed to provide protection for employees for one hour per employee per work shift through the use of respirators
    4. blowdown operations in which grain dust is cleaned from the inside of facilities using compressed air pressure
    5. entering grain bins, tanks, or storage structures to remove residual grain or for cleaning operations

How to Determine if the Permissible Exposure Limit is Exceeded

Importantly, the employee permissible expo- sure limits of 10 milligrams per cubic meter (for wheat, oat and barley dust) and 15 milligrams per cubic meter (for other organic dusts) are calculated using an eight-hour, time-weighted average.

If the employer suspects that a certain area of the facility or certain job tasks subject exposed employees to dust in excess of the permissible exposure limits, a qualified industrial hygienist should perform personal monitoring to determine the degree of employee exposure. (Some facilities may want to do this on a periodic, regular basis.)

Typically, areas of a feed mill, grain elevator or processing facility where dust levels may exceed the permissible exposure limits are:

- in grain receiving areas where dust control or containment is not present
- in truck, rail or vessel-loading areas, when dust control is not present
- in areas where grain dust collectors are not provided and large amounts of dust are in suspension

Overview of Requirements

Evaluating the Workplace

Employees are required to evaluate their work- place to determine if respiratory hazards exist, such as the presence of airborne contaminants at levels that exceed OSHA's permissible exposure limits. If present, employers are to plan first priority on eliminating the hazards through engineering controls.

- Employers are required to identify and evaluate the respiratory hazards that may be present in the workplace. This includes making a reasonable estimate of employee exposure and identifying the potential contaminant's chemical state and physical form.
- Exposures must be characterized through methods that may include actual measurements of exposure at a worksite, exposure data from industry or supplier, and calculations of concentration

Data from industry wide surveys by trade associations may be used as long as they closely resemble the processes and work conditions as described in the survey. For example, the NGFA conducted a study in 1990 entitled **"Worker Exposure to Dust in the Grain Industry"** that contains information on grain dust exposure levels at different types of facilities. The standard does not specify how an employer is to make a reasonable estimate. Nor does it require the employer to measure employee exposure. (The comprehensive substance-specific health standards have employee exposure-monitoring requirements.) Even with actual measurements of exposure, some estimation still is involved, since monitoring only determines the exposure on a particular day for a specific employee

Written Program

If eliminating respiratory hazards with engineering controls is not feasible, or during installation of engineering controls, employers are permit- ted to utilize respirators **provided** they implement a *written* respiratory protection program. A written program also is required when an employer requires employees to wear respiratory protection, even through employees are not exposed to air- borne contaminants in excess of OSHA's permissible Exposure Limit (PEL).

When OSHA's PEL is not exceeded, employers are **not** required to provide respiratory protection. However, in a work situation when respirators are not required, employers are free to provide respirators at the request of employees or permit employees to use their own respirators. For voluntary use of a respirator other than a dust mask (filtering facepiece), the employer must implement the medical evaluation provision (see Requirement 3, page 41) and, if the respirator is reworn, supervise the cleaning, maintenance and storage components of the written program. Voluntary use of dust masks

does **not** require employee medical evaluations or compliance with any other provision of the written program. However, the employer is required to provide a copy of Appendix D of the standard (see page III-38 to employees who voluntarily use elastomeric and/or dust masks.

The written respiratory protection program is required to include the following components, which are discussed in subsequent requirements.

- Procedures for selecting respirators for use in the workplace
- Medical evaluation of employees required to use respirators
- Fit-test procedures for tight-fitting respirators
- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations
- Procedures and schedules for proper maintenance of respirators, including cleaning, disinfecting, storing, inspecting, repairing and discarding
- Procedures to ensure adequate quality, quantity and flow of breathing air for atmosphere-supplying respirators
- Training of employees about respiratory hazards to which they potentially are exposed during routine and emergency situations
- Training of employees on the proper use of respirators, including how to wear and remove respirators, limitations on their use and proper maintenance
- Procedures for regularly evaluating the effectiveness of the program

Respirator Selection

Employers are required to develop and implement a written respiratory protection program whenever respirator use is determined to be necessary (as the result of the workplace evaluation) or if the employer requires the use of respiratory- protection devices.

- When selecting a respirator, the employer is required to consider workplace and user factors such as facial sears temperature, humidity, worker exertion and the need for users to communicate — that might affect respirator effectiveness or fit
- The standard requires that the respirator be NIOSH-certified and be used in accordance with that certification
- For atmospheres that pose an immediate threat to life, would cause irreversible adverse health effects or would impair an individual's ability to escape from a dangerous atmosphere, the standard requires employees to wear: 1) a full facepiece pressure-demand self-contained breathing apparatus that is certified for 30 minutes; or 2) a combination full facepiece pressure-demand supplied air respirator, with an auxiliary self-contained air supply
- In less hazardous atmospheres, air-supplying respirators or air-purifying respirators equipped with a NIOSH-certified filter, canister or cartridge can be used. In atmospheres consisting

primarily of particles greater than 2 microns in size (which includes most grain dust atmospheres), an air-purifying respirator equipped with a filter certified by NIOSH for those particulates is acceptable (including a NIOSH-certified particulate respirator).

Medical Evaluation

The employer is required to have employees medically evaluated prior to fit testing and using respiratory equipment in the workplace. (These evaluations are required for all respirator users -- including seasonal employees -- except those who voluntarily use dust masks.)

The medical evaluation is to be conducted by a physician or licensed health care provider using the OSHA medical questionnaire or an initial examination that obtains the same information. A variety of health care professionals may perform this evaluation, depending on the scope of practice permitted by the state's licensing, registration or certification agencies. Each employer is to check with the state licensing agency to see if other health care professionals under their state law can independently perform this evaluation, or must do so under the direction of a licensed physician.

- The medical evaluation must obtain the information requested in an OSHA-supplied questionnaire and be administered confidentially at no cost to the employee during normal working hours (or at some other time and place convenient to the employee) and in a manner that is understandable to the employee.
- Employers are required to maintain records of medical evaluations of employees required to wear respirators. Such records are to be made available upon request to the employee, as well as state or federal regulators, for viewing and copying
- The employer is required to provide the employee with an opportunity to discuss the results of the questionnaire and examination with the health care provider performing the medical evaluation. To maintain strict confidentiality of the information obtained in the questionnaire, the employer's role is limited to distributing the blank questionnaire to the employee for him or her to fill out, or providing it to the professional licensed health care provider who will administer the questionnaire to the employee. If the employer provides the questionnaire to the employee, an addressed and postage-paid envelope should also be provided for the employee to mail it to the health care provider.

In addition, the employer is required to:

- obtain a written medical recommendation from the health care provider regarding the employee's ability to use the respirator
- provide additional follow-up medical evaluations and examinations (such as tests, consultations, and diagnostic tests) as needed to ensure that employees can safely use respiratory equipment

- The employer is to ensure the employee understands the questionnaire. The employer may have the physician or other licensed health care professional assist the employee in filling out the medical questionnaire or proceed directly to a physical examination.

Fit Testing

Before using a tight-fitting respirator, employees are first required to pass a fit test using the same make, model, style and size of respirator that will be used in the workplace. *OSHA defines a tight-fitting respirator as one with an inlet covering that forms a complete seal with the face.* The standard requires that employers provide a sufficient number of models and sizes (of respirators) to provide a sufficient range of sizes and configurations so that all users can achieve an acceptable fit. Employers must be able to choose respirators from "a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user." The standard contains detailed instructions on how to conduct fit tests.

- A respirator may be unacceptable if it causes irritation or pain to the employee, or if the employee is unable because of discomfort to wear the respirator for the time required, or if the employee is unable to maintain a proper seal.
- Additional fit testing is required, at least, annually and whenever any of the following apply: 1) a different facepiece is used (size, style, model or make); and 2) there are changes to the workplace or the employee's physical condition that could affect the fit or effectiveness of the respirator.
- The standard prohibits the use of tight-fitting respirators by employees who have: 1) facial hair (i.e. more than one-day's growth) that either comes between the sealing surface and the face or interferes with the respirator's valve function. Several types of respirators, such as loose-fitting hoods or helmets, accommodate facial hair. In addition, voluntary users are not prohibited from wearing a beard; or 2) other conditions, such as facial scarring or significant changes in body weight, that interfere with the face-to-facepiece seal. Further, corrective glasses or goggles, or other personal protective equipment, is to be worn in a way that will not interfere with the seal of the facepiece to the face
- Users also must perform an OSHA-prescribed seal check each time they choose a respirator.
- Employees are required to perform a seal check to ensure that an adequate seal is achieved each time the respirator is worn
- OSHA also requires employers to: 1) maintain surveillance of the workplace to ensure continued respirator effectiveness; 2) ensure employees leave the work area if vapor or gas break- through is detected; and 3) station one employee outside of spaces containing atmospheres immediately dangerous to employee life and health while employees are working inside.
- Employers are required to maintain records of the results of fit tests conducted in the work-place, as well as a copy of the written respiratory protection program. Fit test records need only

be retained until the next fit test is conducted. Such records are made available upon request to the employee, as well as to state or federal regulators, for viewing and copying.

Fit testing is not required for respirators worn voluntarily by the employee.

Maintenance and Care

Employers are required to provide respirators that are clean, sanitary and in good working order.

Emergency-use respirators and respirators used by several individuals are required to be cleaned after each use. Respirators issued for the exclusive use of an employee must be cleaned and sanitized as often as necessary to maintain it in a sanitary condition. Respirators are to be stored in a way that protects them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture and damaging chemicals. They also are to be packed in a way that prevents deformation of the facepiece and exhalation valve.

Respirators used routinely are to be inspected prior to each use. Other respirators, such as emergency-use respirators, are to be inspected monthly. Emergency escape-only respirators must be checked before being carried into the workplace. Respirators failing inspection are required to be removed from service and either discarded or repaired by a qualified individual using the manufacturer's NIOSH-approved parts.

The employer is required to ensure that com- pressed gas or air meets certain standards for purity specified in the standard. Further, compressors used to supply breathing air must be designed and located to prevent the entry of contaminated air into the air-supply system and constructed to meet certain air-quality criteria.

Employee Training

Employers are required to train employees in the proper use, cleaning, inspection, maintenance and storage of respirators, as well as on limitations on their effectiveness.

- This training requirement applies if the employer requires the employee to wear respiratory protection or if the employee voluntarily decides to do so
- Employees are to be trained before using the respirator and at least annually thereafter, as well as whenever the employer determines retraining is needed, such as when changes in the workplace render previous training obsolete or any other situation arises in which retraining appears advisable to ensure safe respirator use.

The employer is encouraged to maintain written training records.

Program Evaluation

The employer is required to designate an administrator to oversee the written respiratory protection program and conduct periodic evaluations of its effectiveness. The administrator is to have experience or education commensurate with the complexity of the program. The program administrator is required to conduct periodic evaluations of the workplace to ensure the continued effectiveness of the written program. Also, the program administrator regularly must consult with employees required to use respirators to assess their views on the program's effectiveness and to identify any problems with the program.

Respiratory Protection Standard

The sample Respiratory Protection Program developed by the National Grain and Feed Association is designed to assist grain elevators, feed mills and processing plants in complying with the requirements of OSHA's respiratory protection standard. It also contains elements relevant to the agency's air contaminants standard.

- **Section 1 – Program Administrator:** This section covers the qualifications, role and responsibilities of the respiratory protection program administrator that the employer is required to designate if a program is implemented at the facility
- **Section 2 – Medical Evaluations:** This section covers the requirements that employees undergo medical evaluations before using respiratory protection in the workplace. Exempted from the medical evaluation requirement are employees whose use of respiratory protection is limited to dust masks
- **Section 3 – Employee Use of Respirators:** This section specifies the locations and conditions within the facility where respirators may be required for the personal protection of employees
- **Section 4 – Respirator Selection:** This section specifies the evaluation process that is to occur when managers select the type and model of respirators to be used by employees. It also provides space for managers to indicate the workplace locations or conditions under which respirators are to be used by employees
- **Section 5 – Employee Fit Testing:** This section specifies the requirements and procedures that are to be used to fit test employees with respirators
- **Section 6 – Use of Respirators:** This section covers procedures to ensure that facepiece seal leakage does not occur

- **Section 7 – Respirator Maintenance and Care:** This section contains guidelines for cleaning, inspecting, storing and repairing respirators
- **Section 8 – Respirator Training:** This section specifies the subjects on which employees are to receive training before wearing respirators in the workplace. It also specifies the circumstances under which retraining is to occur

As with other sections of this book, the Respiratory Protection Program has been structured using a "fill-in-the-blank" format so it can be customized to meet the specific needs of the individual facility or employer.

Occupational Noise Exposure Standard

Monitoring

Employers are required to develop and implement a monitoring program that will identify employees who are exposed to workplace noise levels that equal or exceed 85 decibels (dB) averaged over an eight-hour day, if the employer has information indicating such may be the case.

If measurements are required:

- the exposure measurement is to include all continuous, intermittent and impulse noise[1] within an 80 dB to 130 dB range, and is to be taken during a typical work situation
- employers may rely on area monitoring, unless the following conditions exist: 1) high worker mobility in the area; 2) significant variability in sound level; or 3) significant impulse noise. If any of these conditions exist, the employer is to rely on representative sampling of the similarly exposed employees to determine the dosage level of noise to which they may be exposed to determine if they should be included in the hearing conservation program
- monitoring should be repeated when changes in production, process or controls could increase noise exposure to the extent that additional employees may be exposed to noise levels exceeding the 85 dB threshold. Similarly, monitoring is required if hearing protectors become inadequate to meet the requirements of the hearing conservation program
- instruments used for monitoring employee exposures are to be checked carefully, properly maintained and routinely calibrated to ensure accurate measurements
- employers are to notify employees exposed at or above the 85 dB TWA of the results of the monitoring

- employees or their representatives are entitled to observe the monitoring program

[1] Impulse or impact noises are defined as those that are not considered to be "continuous." Continuous noises are those where the interval between occurrences of the maximum noise is one second or less. If exposure to impulse or impact noise exceeds 140 dB, hearing conservation is required. Examples of potential impulse or impact noises include the sounds emitted from a powder-actuated nail gun, a punch press or a drop hammer.

Hearing Protection

Hearing protection is required to be provided to employees who are exposed to eight-hour TWA noise levels that equal or exceed 85 dB.

Specifically, such hearing protection is required to be worn by:

- employees who are exposed to noise levels exceeding the 85dB threshold for any period exceeding six months, until they receive a baseline audiogram
- employees who have incurred a standard threshold shift[2]
- employees exposed to noise levels that exceed those listed in the following table[3]

Table of Permissible Noise Exposures

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

[2] Defined as an average shift in either ear of 10 dB or more at 2,000, 3,000 and 4,000 hertz. Employees are required to be notified within 21 days from the time determination is made that their audiometric test results indicate the existence of a standard threshold shift.

[3] Generally, the louder the noise, the shorter the exposure time before hearing protection must be provided. For instance, employees may be exposed to a noise level of 90 dBA for eight hours per day before hearing protection is required. However, if the noise level reaches 115 dBA, hearing protection is required if their anticipated exposure exceeds 15 minutes

As with other types of hazards, OSHA requires that employers implement feasible engineering and administrative controls before resorting to hearing protection devices, such as earplugs or earmuffs. Administrative controls include rotating shifts or limiting noise exposure through such techniques as scheduling machine operating times so as to reduce the number of workers exposed to noise.

Engineering controls include such steps as substituting less noisy equipment, installing barriers, reducing equipment vibration, installing acoustical enclosures, and replacing or adjusting worn, loose or unbalanced parts on machines. If such engineering controls are infeasible or fail to reduce sound levels, appropriate hearing protectors are required.

Types of Hearing Protectors: OSHA requires that hearing protectors reduce employee exposure to at least 90 dB and to 85 dB when a standard threshold shift has occurred in the employee's hearing. Typically, hearing protectors consist of:

- **Single-Use Earplugs:** These are made of waxed cotton, foam or fiberglass wool, and are self-forming. When properly inserted, this type of hearing protector works as well as molded earplugs
- **Pre-Formed or Molded Earplugs:** These plugs must be fitted to each individual employee by a professional. They may be of either single use/disposable or non-disposable design. The non-disposable earplug should be cleaned after each use
- **Earmuffs:** This type of protector requires a perfect seal around the ear. Glasses, long sideburns, long hair and facial movements, caused, for instance, by chewing gum, may reduce the protective value of this device. Special earmuffs may be purchased for use with eyeglasses or beards

Selection of Hearing Protection: OSHA requires that employees be allowed to select from several different types of hearing protectors so tha0t they may find one that provides a comfortable fit, achieves satisfactory noise reduction and is suitable for the work environment. The employer is required to reevaluate the suitability of the employee's choice of a hearing protector whenever there is a change in working conditions that may cause the device to be inadequate. OSHA also requires that the hearing protector be provided at no cost to the employee.

Audiometric Testing

For employees who are exposed to noise levels exceeding 85 dB TWA, employers are required to provide, at no cost to the employee, an audiometric testing program that includes baseline and annual audiograms.

The following requirements apply to audiometric tests:

- Individuals conducting audiometric tests are require to be one of the following: 1) a licensed or certified audiologist; 2) an otolaryngologist (physician specializing in the diagnosis and treatment of disorders of the ear, nose and throat); 3) a physician; or 4) a technician certified by the Council of Accreditation in Occupational Hearing Conservation or who has satisfactorily demonstrated competence in administering audiometric examinations.

However, a technician operating a microprocessor audiometer need not be certified. The technician is required to be responsible to either the audiologist, otolaryngologist or physician. OSHA also requires that these professionals review problem audiograms to determine whether further referral is necessary.

- Audiometric tests should be conducted in specially designed rooms using approved, calibrated equipment (See Appendices C and D). In some cases, a quiet area at the facility can be satisfactory for such testing

Baseline Audiograms: If noise conditions warrant, OSHA requires that baseline audiograms be provided within six months after an employee's first exposure to noise that equals or exceeds an eight-hour TWA of 85dB. Testing to establish a baseline audiogram is to be preceded by at least 14 hours without exposure to workplace noise, unless the employee has worn hearing protectors during that 14-hour or longer time frame.

Annual Audiograms: Audiograms are required to be conducted within one year after the baseline audiogram. The results of the annual audiogram are to be compared to the baseline to determine whether it is valid and whether a standard threshold shift has occurred in the employee's hearing.

An annual audiogram may be substituted for the original baseline audiogram if it is determined that the employee's standard threshold shift is persistent. However, the original baseline audiogram is required to be retained for the length of the employee's employment to ensure the same shift is not repeatedly identified

Audiogram Evaluation: If a standard threshold shift is detected, employees are to be fitted or retrofitted with adequate hearing protectors, and required to wear them. They also are to be shown how to use them properly. Some employees who have experienced a standard threshold shift may need to be referred for further testing if it is determined that test results are questionable or if they have an ear medical problem believed to be caused or aggravated by wearing hearing protectors. If the suspected medical problem is not believed to be related to wearing hearing protection, employees are to be informed that they should see a physician. If subsequent audiometric tests confirm that the standard threshold shift is not persistent, employees whose exposure to noise is less than a TWA of 90dB may discontinue wearing hearing protection.

Training

Employees exposed to a TWA of 85 dB or more are required to be trained at least annually in the following:

- the effects of noise

- the purpose, advantages and disadvantages of various types of hearing protectors
- the selection, fit and care of protectors
- the purpose and procedures of audiometric testing

Recordkeeping

OSHA requires that employers retain records of noise exposure measurements for at least two years.

Audiometric test results on individual employees are required to be maintained for the employee's duration of employment. Audiometric test records are required to include: 1) the employee's name and job classification; 2) the date of the audiogram; 3) the examiner's name; 4) the date of the last acoustic or exhaustive calibration of the audiometer; and 5) the employee's most recent noise exposure assessment.

The employer is required to make all records available upon request to the affected employee(s) (current and former); the employee's representative; and to federal or state OSHA officials.

The employer also is required to make copies of the standard available to employees or their designated representatives. [See attached copy of the standard and related appendices.]

1910.95 Appendix A —

Noise Exposure Computation *(Mandatory)*

I. Computation of Employee Noise Exposure

(1) Noise dose is computed using Table G-16a as follows:

(i) When the sound level, L, is constant over the entire work shift, the noise dose, D, in percent, is given by: D=100 C/T where C is the total length of the work day, in hours, and T is the reference duration corresponding to the measured sound level, L, as given in Table G-16a or by the formula shown as a footnote to that table.

(ii) When the workshift noise exposure is composed of two or more periods of noise at different levels, the total noise dose over the work day is given by:

D = 100 (C(1)/T(1) + C(2)/T(2) + ... + C(n)/T(n)),

where C(n) indicates the total time of exposure at a specific noise level, and T(n) indicates the reference duration for that level as given by Table G-16a.

(2) The eight-hour time-weighted average sound level (TWA), in decibels, may be computed from the dose, in percent, by means of the formula: TWA = 16.61 log(10) (D/100) + 90. For an eight-hour workshift with the noise level constant over the entire shift, the TWA is equal to the measured sound level.

(3) A table relating dose and TWA is given in Section II.

TABLE G-16A

A-weighted sound level L (decibel)	Reference duration T (hour)	A-weighted sound level L (decibel)	Reference duration T (hour)
80	32	**106**	0.87
81	27.9	**107**	0.76
82	24.3	**108**	0.66
83	21.1	**109**	0.57
84	18.4	**110**	0.5
85	16	**111**	0.44
86	13.9	**112**	0.38
87	12.1	**113**	0.33
88	10.6	**114**	0.29
89	9.2	**115**	0.25
90	8	**116**	0.22
91	7.0	**117**	0.19
92	6.1	**118**	0.16
93	5.3	**119**	0.14
94	4.6	**120**	0.125
95	4	**121**	0.11
96	3.5	**122**	0.095
97	3.0	**123**	0.082
98	2.6	**124**	0.072
99	2.3	**125**	0.063
100	2	**126**	0.054
101	1.7	**127**	0.047
102	1.5	**128**	0.041
103	1.3	**129**	0.036
104	1.1	**130**	0.031
105	1		

In the above table the reference duration, T, is computed by

$$T = \frac{8}{2^{(L-90)/5}}$$

where L is the measured A-weighted sound level

II. Conversion Between "Dose" and "8-Hour Time-Weighted Average"

Sound Level

Compliance with paragraphs (c)-(r) of this regulation is determined by the amount of exposure to noise in the workplace. The amount of such exposure is usually measured with an audiodosimeter which gives readout in terms of "dose." In order to better understand the requirements of the amendment, dosimeter readings can be converted to an "8-hour time-weighted average sound level." (TWA).

In order to convert the reading of a dosimeter into TWA, see Table A-1, below. This table applies to dosimeters that are set by the manufacturer to calculate dose or percent exposure according to the relationships in Table G-16a. So, for example, a dose of 91 percent over an eight hour day results in a TWA of 89.3 dB, and, a dose of 50 percent corresponds to a TWA of 85 dB.

If the dose as read on the dosimeter is less than or greater than the values found in Table A-1, the TWA may be calculated by using the formula: TWA = 16.61 log(10) (D/100) + 90 where TWA=8-hour time-weighted average sound level and D = accumulated dose in percent exposure

TABLE A-1 - CONVERSION FROM "PERCENT NOISE EXPOSURE" OR "DOSE" TO "8-HOUR TIME WEIGHTED AVERAGE SOUND LEVEL" (TWA)

Dose or % noise exposure	TWA	Dose or % noise exposure	TWA
10	73.4	86	88.9
15	76.3	87	89.0
20	78.4	88	89.1
25	80.0	89	89.2
30	81.3	90	89.2
35	82.4	91	89.3
40	83.4	92	89.4
45	84.2	93	89.5
50	85.0	94	89.6
55	85.7	95	89.6
60	86.3	96	89.7
65	86.9	97	89.8
70	87.4	98	89.9
75	87.9	99	89.9
80	88.4	100	90.0
81	88.5	101	90.1
82	88.6	102	90.1
83	88.7	103	90.2
84	88.7	104	90.3

85	88.8	105	90.4
106	90.4	360	99.2
107	90.5	370	99.4
108	90.6	380	99.6
109	90.6	390	99.8
110	90.7	400	100.0
111	90.8	410	100.2
112	90.8	420	100.4
113	90.9	430	100.5
114	90.9	440	100.7
115	91.1	450	100.8
116	91.1	460	101.0
117	91.1	470	101.2
118	91.2	480	101.3
119	91.3	490	101.5
120	91.3	500	101.6
125	91.6	510	101.8
130	91.9	520	101.9
135	92.2	530	102.0
140	92.4	540	102.2
145	92.7	550	102.3
150	92.9	560	102.4
155	93.2	570	102.6
160	93.4	580	102.7
165	93.6	590	102.8
170	93.8	600	102.9
175	94.0	610	103.0
180	94.2	620	103.2
185	94.4	630	103.3
190	94.6	640	103.4
195	94.8	650	103.5
200	95.0	660	103.6
210	95.4	670	103.7
220	95.7	680	103.8
230	96.0	690	103.9
240	96.3	700	104.0
250	96.6	710	104.1
260	96.9	720	104.2
270	97.2	730	104.3
280	97.4	740	104.4
290	97.7	750	104.5
300	97.9	760	104.6
310	98.2	770	104.7
320	98.4	780	104.8
330	98.6	790	104.9
340	98.8	800	105.0

350	99.0	810	105.1
820	105.2	920	106.0
830	105.3	930	106.1
840	105.4	940	106.2
850	105.4	950	106.2
860	105.5	960	106.3
870	105.6	970	106.4
880	105.7	980	106.5
890	105.8	990	106.5
900	105.8	999	106.6
910	105.9		

1910.95 Appendix B — Methods for Estimating the Adequacy of Hearing Protector Attenuation *(Mandatory)*

For employees who have experienced a significant threshold shift, hearing protector attenuation must be sufficient to reduce employee exposure to a TWA of 85 dB. Employers must select one of the following methods by which to estimate the adequacy of hearing protector attenuation.

The most convenient method is the Noise Reduction Rating (NRR) developed by the Environmental Protection Agency (EPA). According to EPA regulation, the NRR must be shown on the hearing protector package. The NRR is then related to an individual worker's noise environment in order to assess the adequacy of the attenuation of a given hearing protector. This appendix describes four methods of using the NRR to determine whether a particular hearing protector provides adequate protection within a given exposure environment. Selection among the four procedures is dependent upon the employer's noise measuring instruments.

Instead of using the NRR, employers may evaluate the adequacy of hearing protector attenuation by using one of the three methods developed by the National Institute for Occupational Safety and Health (NIOSH), which are described in the "List of Personal Hearing Protectors and Attenuation Data," HEW Publication No. 76-120, 1975, pages 21-37. These methods are known as NIOSH methods No. 1, No. 2 and No. 3. The NRR described below is a simplification of NIOSH method No. 2. The most complex method is NIOSH method No. 1, which

is probably the most accurate method since it uses the largest amount of spectral information from the individual employee's noise environment. As in the case of the NRR method described below, if one of the NIOSH methods is used, the selected method must be applied to an individual's noise environment to assess the adequacy of the attenuation. Employers should be careful to take a sufficient number of measurements in order to achieve a representative sample for each time segment.

NOTE: The employer must remember that calculated attenuation values reflect realistic values only to the extent that the protectors are properly fitted and worn.

When using the NRR to assess hearing protector adequacy, one of the following methods must be used:

(i) When using a dosimeter that is capable of C-weighted measurements:

(A) Obtain the employee's C-weighted dose for the entire workshift, and convert to TWA (see appendix A, II).

(B) Subtract the NRR from the C-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(ii) When using a dosimeter that is not capable of C-weighted measurements, the following method may be used:

(A) Convert the A-weighted dose to TWA (see appendix A).

(B) Subtract 7 dB from the NRR.

(C) Subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(iii) When using a sound level meter set to the A-weighting network: (A) Obtain the employee's A-weighted TWA.

(B) Subtract 7 dB from the NRR, and subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(iv) When using a sound level meter set on the C-weighting network:

(A) Obtain a representative sample of the C-weighted sound levels in the employee's environment.

(B) Subtract the NRR from the C-weighted average sound level to obtain the estimated A-weighted TWA under the ear protector.

(v) When using area monitoring procedures and a sound level meter set to the A-weighing network. (A) Obtain a representative sound level for the area in question.

(B) Subtract 7 dB from the NRR and subtract the remainder from the A-weighted sound level for that area.

(vi) When using area monitoring procedures and a sound level meter set to the C-weighting network:

(A) Obtain a representative sound level for the area in question

(B) Subtract the NRR from the C-weighted sound level for that area

1910.95 Appendix C — Audiometric Measuring Instruments *(Mandatory)*

1. In the event that pulsed-tone audiometers are used, they shall have a tone on-time of at least 200 milliseconds.

2. Self-recording audiometers shall comply with the following requirements:

(A) The chart upon which the audiogram is traced shall have lines at positions corresponding to all multiples of 10 dB hearing level within the intensity range spanned by the audiometer. The lines shall be equally spaced and shall be separated by at least 1/4 inch. Additional increments are optional. The audiogram pen tracings shall not exceed 2 dB in width.

(B) It shall be possible to set the stylus manually at the 10-dB increment lines for calibration purposes.

(C) The slewing rate for the audiometer attenuator shall not be more than 6 dB/sec except that an initial slewing rate greater than 6 dB/sec is permitted at the beginning of each new test frequency, but only until the second subject response.

(D) The audiometer shall remain at each required test frequency for 30 seconds (+ or - 3 seconds). The audiogram shall be clearly marked at each change of frequency and the actual frequency change of the audiometer shall not deviate from the frequency boundaries marked on the audiogram by more than + or- 3 seconds.

(E) It must be possible at each test frequency to place a horizontal line segment parallel to the time axis on the audiogram, such that the audiometric tracing crosses the line segment at least

six times at that test frequency. At each test frequency the threshold shall be the average of the midpoints of the tracing excursions.

1910.95 Appendix D — Audiometric Test Rooms *(Mandatory)*

Rooms used for audiometric testing shall not have background sound pressure levels exceeding those in Table D-1 when measured by equipment conforming at least to the Type 2 requirements of American National Standard Specification for Sound Level Meters, S1.4-1971 (R1976), and to the Class II requirements of American National Standard Specification for Octave, Half-Octave, and Third-Octave Band Filter Sets, S1.11-1971 (R1976).

TABLE D-1 - MAXIMUM ALLOWABLE OCTAVE-BAND SOUND PRESSURE LEVELS FOR AUDIOMETRIC TEST ROOMS

Octave-band center frequency (Hz).....	500	1000	2000	4000	8000
Sound pressure level (dB) ...	40	40	47	57	62

1910.95 Appendix E —

Acoustic Calibration of Audiometers *(Mandatory)*

Audiometer calibration shall be checked acoustically, at least annually, according to the procedures described in this appendix. The equipment necessary to perform these measurements is a sound level meter, octave-band filter set, and a National Bureau of Standards 9A coupler. In making these measurements, the accuracy of the calibrating equipment shall be sufficient to determine that the audiometer is within the tolerances permitted by American Standard Specification for Audiometers, S3.6-1969.

(1) "Sound Pressure Output Check"

A. Place the earphone coupler over the microphone of the sound level meter and place the earphone on the coupler.

B. Set the audiometer's hearing threshold level (HTL) dial to 70 dB.

C. Measure the sound pressure level of the tones at each test frequency from 500 Hz through 6000 Hz for each earphone.

D. At each frequency the readout on the sound level meter should correspond to the levels in Table E-1 or Table E-2, as appropriate, for the type of earphone, in the column entitled "sound level meter reading."

(2) "Linearity Check"

A. With the earphone in place, set the frequency to 1000 Hz and the HTL dial on the audiometer to 70 dB.

B. Measure the sound levels in the coupler at each 10-dB decrement from 70 dB to 10 dB, noting the sound level meter reading at each setting.

C. For each 10-dB decrement on the audiometer the sound level meter should indicate a corresponding 10 dB decrease.

D. This measurement may be made electrically with a voltmeter connected to the earphone terminals.

(3) "Tolerances"

When any of the measured sound levels deviate from the levels in Table E-1 or Table E-2 by + or - 3 dB at any test frequency between 500 and 3000 Hz, 4 dB at 4000 Hz, or 5 dB at 6000 Hz, an exhaustive calibration is advised. An exhaustive calibration is required if the deviations are greater than 15 dB or greater at any test frequency.

TABLE E-1 - REFERENCE THRESHOLD LEVELS FOR TELEPHONICS — TDH-39 EARPHONES

Frequency, Hz	Reference threshold level for TDH-39 earphones, dB	meter reading, dB
500	11.5	81.5
1000	7	77
2000	9	79
3000	10	80
4000	9.5	79.5
6000	15.5	85.5

TABLE E-2 - REFERENCE THRESHOLD LEVELS FOR TELEPHONICS — TDH-49 EARPHONES

Frequency, Hz	Reference threshold level for TDH-49 earphones, dB	Sound level meter reading, dB
500	13.5	83.5
1000	7.5	77.5
2000	11	81.0
3000	9.5	79.5
4000	10.5	80.5
6000	13.5	83.5

1910.95 Appendix F — Calculations and Application of Age Corrections to Audiograms *(Mandatory)*

In determining whether a standard threshold shift has occurred, allowance may be made for the contribution of aging to the change in hearing level by adjusting the most recent audiogram. If the employer chooses to adjust the audiogram, the employer shall follow the procedure described below. This procedure and the age correction tables were developed by the National Institute for Occupational Safety and Health in the criteria document entitled "Criteria for a Recommended Standard . . . Occupational Exposure to Noise," ((HSM)-11001).

For each audiometric test frequency;

(i) Determine from Tables F-1 or F-2 the age correction values for the employee by:

(A) Finding the age at which the most recent audiogram was taken and recording the corresponding values of age corrections at 1000 Hz through 6000 Hz;

(B) Finding the age at which the baseline audiogram was taken and recording the corresponding values of age corrections at 1000 Hz through 6000 Hz.

(ii) Subtract the values found in step (i)(B) from the value found in step (i)(A).

(iii) The differences calculated in step (ii) represented that portion of the change in hearing that may be due to aging.

Example: Employee is a 32-year-old male. The audiometric history for his right ear is shown in decibels below:

Employee's age	1000	2000	3000	4000	6000
26	10	5	5	10	5
*27	0	0	0	5	5
28	0	0	0	10	5
29	5	0	5	15	5
30	0	5	10	20	10
31	5	10	20	15	15
*32	5	10	10	25	20

The audiogram at age 27 is considered the baseline since it shows the best hearing threshold levels. Asterisks have been used to identify the baseline and most recent audiogram. A threshold shift of 20 dB exists at 4000 Hz between the audiograms taken at ages 27 and 32.

(The threshold shift is computed by subtracting the hearing threshold at age 27, which was 5, from the hearing threshold at age 32, which is 25). A retest audiogram has confirmed this shift. The contribution of aging to this change in hearing may be estimated in the following manner:

Go to Table F-1 and find the age correction values (in dB) for 4000 Hz at age 27 and age 32.

Employee's age	1000	2000	3000	4000	6000
32	6	5	7	10	14
27	5	4	6	7	11
Difference	1	1	1	3	3

The difference represents the amount of hearing loss that may be attributed to aging in the time period between the baseline audiogram and the most recent audiogram. In this example, the difference at 4000 Hz is 3 dB. This value is subtracted from the hearing level at 4000 Hz, which in the most recent audiogram is 25, yielding 22 after adjustment. Then the hearing threshold in the baseline audiogram at 4000 Hz (5) is subtracted from the adjusted annual audiogram hearing threshold at 4000 Hz (22). Thus the age-corrected threshold shift would be 17 dB (as opposed to a threshold shift of 20 dB without age correction).

TABLE F-1 - AGE CORRECTION VALUES IN DECIBELS FOR MALES

	Audiometric Test Frequency (Hz)				
Years	1000	2000	3000	4000	6000
20 or younger	5	3	4	5	8
21	5	3	4	5	8
22	5	3	4	5	8
23	5	3	4	6	9
24	5	3	5	6	9
25	5	3	5	7	10
26	5	4	5	7	10
27	5	4	6	7	11
28	6	4	6	8	11
29	6	4	6	8	12
30	6	4	6	9	12
31	6	4	7	9	13
32	6	5	7	10	14
33	6	5	7	10	14
34	6	5	8	11	15
35	7	5	8	11	15
36	7	5	9	12	16
37	7	6	9	12	17
38	7	6	9	13	17
39	7	6	10	14	18
40	7	6	10	14	19
41	7	6	10	14	20
42	8	7	11	16	20
43	8	7	12	16	21
44	8	7	12	17	22
45	8	7	13	18	23
46	8	8	13	19	24
47	8	8	14	19	24
48	9		14	20	25
49	9	9	15	21	26
50	9	9	16	22	27
51	9	9	16	23	28
52	9	10	17	24	29
53	9	10	18	25	30
54	10	10	18	26	31
55	10	11	19	27	32
56	10	11	20	28	34
57	10	11	21	29	35
58	10	12	22	31	36
59	11	12	22	32	37
60 or older	11	13	23	33	38

TABLE F-2 - AGE CORRECTION VALUES IN DECIBELS FOR FEMALES

	Audiometric Test Frequency (Hz)				
Years	1000	2000	3000	4000	6000
20 or younger	7	4	3	3	6
21	7	4	4	3	6
22	7	4	4	4	6
23	7	5	4	4	7
24	7	5	4	4	7
25	8	5	4	4	7
26	8	5	5	4	8
27	8	5	5	5	8
28	8	5	5	5	8
29	8	5	5	5	9
30	8	6	5	5	9
31	8	6	6	5	9
32	9	6	6	6	10
33	9	6	6	6	10
34	9	6	6	6	10
35	9	6	7	7	11
36	9	7	7	7	11
37	9	7	7	7	12
38	10	7	7	7	12
39	10	7	8	8	12
40	10	7	8	8	13
41	10	8	8	8	13
42	11	8	9	9	13
43	11	8	9	9	14
44	11	8	9	9	14
45	11	8	10	10	15
46	11	9	10	10	15
47	11	9	10	11	16
48	12	9	11	11	16
49	12	9	11	11	16
50	12	10	11	12	17
51	12	10	12	12	17
52	12	10	12	13	18
53	13	10	13	13	18
54	13	11	13	14	19
55	13	11	14	14	19
56	13	11	14	15	20
57	13	11	15	15	20
58	14	12	15	16	21
59	14	12	16	16	21
60 or older	14	12	16	17	22

1910.95 Appendix G — Monitoring Noise Levels Non-Mandatory Informational Appendix

This appendix provides information to help employers comply with the noise monitoring obligations that are part of the hearing conservation amendment.

WHAT IS THE PURPOSE OF NOISE MONITORING?

This revised amendment requires that employees be placed in a hearing conservation program if they are exposed to average noise levels of 85 dB or greater during an 8 hour workday. In order to determine if exposures are at or above this level, it may be necessary to measure or monitor the actual noise levels in the workplace and to estimate the noise exposure or "dose" received by employees during the workday.

WHEN IS IT NECESSARY TO IMPLEMENT A NOISE MONITORING PROGRAM?

It is not necessary for every employer to measure workplace noise. Noise monitoring or measuring must be conducted only when exposures are at or above 85 dB. Factors which suggest that noise exposures in the workplace may be at this level include employee complaints about the loudness of noise, indications that employees are losing their hearing, or noisy conditions which make normal conversation difficult. The employer should also consider any information available regarding noise emitted from specific machines. In addition, actual workplace noise measurements can suggest whether or not a monitoring program should be initiated.

HOW IS NOISE MEASURED?

Basically, there are two different instruments to measure noise exposures: the sound level meter and the dosimeter. A sound level meter is a device that measures the intensity of sound at a given moment. Since sound level meters provide a measure of sound intensity at only one point in time, it is generally necessary to take a number of measurements at different times during the day to estimate noise exposure over a workday. If noise levels fluctuate, the amount of time noise remains at each of the various measured levels must be determined.

To estimate employee noise exposures with a sound level meter it is also generally necessary to take several measurements at different locations within the workplace. After appropriate

sound level meter readings are obtained, people sometimes draw "maps" of the sound levels within different areas of the workplace. By using a sound level "map" and information on

employee locations throughout the day, estimates of individual exposure levels can be developed. This measurement method is generally referred to as "area" noise monitoring.

A dosimeter is like a sound level meter except that it stores sound level measurements and integrates these measurements over time, providing an average noise exposure reading for a given period of time, such as an 8-hour workday. With a dosimeter, a microphone is attached to the employee's clothing and the exposure measurement is simply read at the end of the desired time period. A reader may be used to read-out the dosimeter's measurements. Since the dosimeter is worn by the employee, it measures noise levels in those locations in which the employee travels. A sound level meter can also be positioned within the immediate vicinity of the exposed worker to obtain an individual exposure estimate. Such procedures are generally referred to as "personal" noise monitoring.

Area monitoring can be used to estimate noise exposure when the noise levels are relatively constant and employees are not mobile. In workplaces where employees move about in different areas or where the noise intensity tends to fluctuate over time, noise exposure is generally more accurately estimated by the personal monitoring approach

In situations where personal monitoring is appropriate, proper positioning of the microphone is necessary to obtain accurate measurements. With a dosimeter, the microphone is generally located on the shoulder and remains in that position for the entire workday. With a sound level meter, the microphone is stationed near the employee's head, and the instrument is usually held by an individual who follows the employee as he or she moves about.

Manufacturer's instructions, contained in dosimeter and sound level meter operating manuals, should be followed for calibration and maintenance. To ensure accurate results, it is considered good professional practice to calibrate instruments before and after each use.

HOW OFTEN IS IT NECESSARY TO MONITOR NOISE LEVELS?

The amendment requires that when there are significant changes in machinery or production processes that may result in increased noise levels, remonitoring must be conducted to determine whether additional employees need to be included in the hearing conservation program. Many companies choose to remonitor periodically (once every year or two) to ensure that all exposed employees are included in their hearing conservation programs.

WHERE CAN EQUIPMENT AND TECHNICAL ADVICE BE OBTAINED?

Noise monitoring equipment may be either purchased or rented. Sound level meters cost about $500 to $1,000, while dosimeters range in price from about $750 to $1,500. Smaller companies may find it more economical to rent equipment rather than to purchase it. Names of equipment suppliers may be found in the telephone book (Yellow Pages) under headings such as: "Safety Equipment," "Industrial Hygiene," or "Engineers-Acoustical." In addition to providing information on obtaining noise monitoring equipment, many companies and individuals included under such listings can provide professional advice on how to conduct a valid noise monitoring program. Some audiological testing firms and industrial hygiene firms also provide noise monitoring services. Universities with audiology, industrial hygiene, or acoustical engineering departments may also provide information or may be able to help employers meet their obligations under this amendment.

Free, on-site assistance may be obtained from OSHA-supported state and private consultation organizations. These safety and health consultative entities generally give priority to the needs of small businesses.

1910.95 Appendix H — Availability of Referenced Documents

Paragraphs (c) through (o) of 29 CFR 1910.95 and the accompanying appendices contain provisions which incorporate publications by reference. Generally, the publications provide criteria for instruments to be used in monitoring and audiometric testing. These criteria are intended to be mandatory when so indicated in the applicable paragraphs of 1910.95 and appendices.

It should be noted that OSHA does not require that employers purchase a copy of the referenced publications. Employers, however, may desire to obtain a copy of the referenced publications for their own information.

The designation of the paragraph of the standard in which the referenced publications appear, the titles of the publications, and the availability of the publications are as follows:

Paragraph Designation	Referenced Publication	Available From
Appendix B	"List of Personal Hearing Protectors and Attenuation Data," HEW Pub. No. 76-120, 1975. NTIS-PB267461.	National Technical Information Service, Port Royal Road, Springfield, VA 22161.
Appendix D	"Specification for Sound Level Meters," S1.4-1971 (R1976).	American National Standards Institute, Inc., 1430 Broadway,
1910.95(k)(2),		
Appendix E	"Specifications for Audiometers," S3.6-1969.	American National Standards Institute, Inc., 1430 Broadway,
Appendix D	"Specification for Octave, Half-Octave and Third-Octave Band Filter Sets," S1.11-1971 (R1976).	Back Numbers Department, Dept. STD, American Institute of Physics, 333 E. 45th St., New York, NY 10017; American National Standards Institute, Inc., 1430 Broadway,

The referenced publications (or a microfiche of the publications) are available for review at many universities and public libraries throughout the country. These publications may also be examined at the OSHA Technical Data Center, Room N2439, United States Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210, (202) 219-7500 or at any OSHA Regional Office (see telephone directories under United States Government - Labor Department).

1910.95 App I - Definitions

These definitions apply to the following terms as used in paragraphs (c) through (n) of 29 CFR 1910.95.

Action Level	An 8-hour time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently, a dose of fifty percent
Audiogram	A chart, graph, or table resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency
Audiologist	A professional, specializing in the study and rehabilitation of hearing, who is certified by the American Speech-Language-Hearing Association or licensed by a state board of examiners
Baseline Audiogram	The audiogram against which future audiograms are compared
Criterion sound level	A sound level of 90 decibels
Decibel (dB)	Unit of measurement of sound level
Hertz (Hz)	Unit of measurement of frequency, numerically equal to cycles per second
Medical pathology	A disorder or disease. For purposes of this regulation, a condition or disease affecting the ear, which should be treated by a physician specialist
Noise dose	The ratio, expressed as a percentage, of (1) the time integral, over a stated time or event of the 0.6 power of the measured SLOW exponential time-averaged, squared A-weighted sound pressure and (2) the product of the criterion duration (8 hours)and the 0.6 power of the squared sound pressure corresponding to the criterion sound level (90 dB)
Noise dosimeter	An instrument that integrates a function of sound pressure over a period of time in such a manner that it directly indicates a noise dose
Otolaryngologist	A physician specializing in diagnosis and treatment of disorders of the ear, nose and throat
Representative exposure	Measurements of an employee's noise dose or 8-hour time-weighted average sound level that the employers deem to be representative of the exposures of

	other employees in the workplace
Sound level	Ten times the common logarithm of the ratio of the square of the measured A-weighted sound pressure to the square of the standard reference pressure of 20 micropascals. Unit: decibels (dB). For use with this regulation, SLOW time response, in accordance with ANSI S1.4-1971 (R1976), is required
Sound level meter	An instrument for the measurement of sound level
Time-weighted average sound level	That sound level, which if constant over an 8-hour exposure, would result in the same noise dose as is measured