Safety and Health on Bridge Repair, Renovation and Demolition Projects

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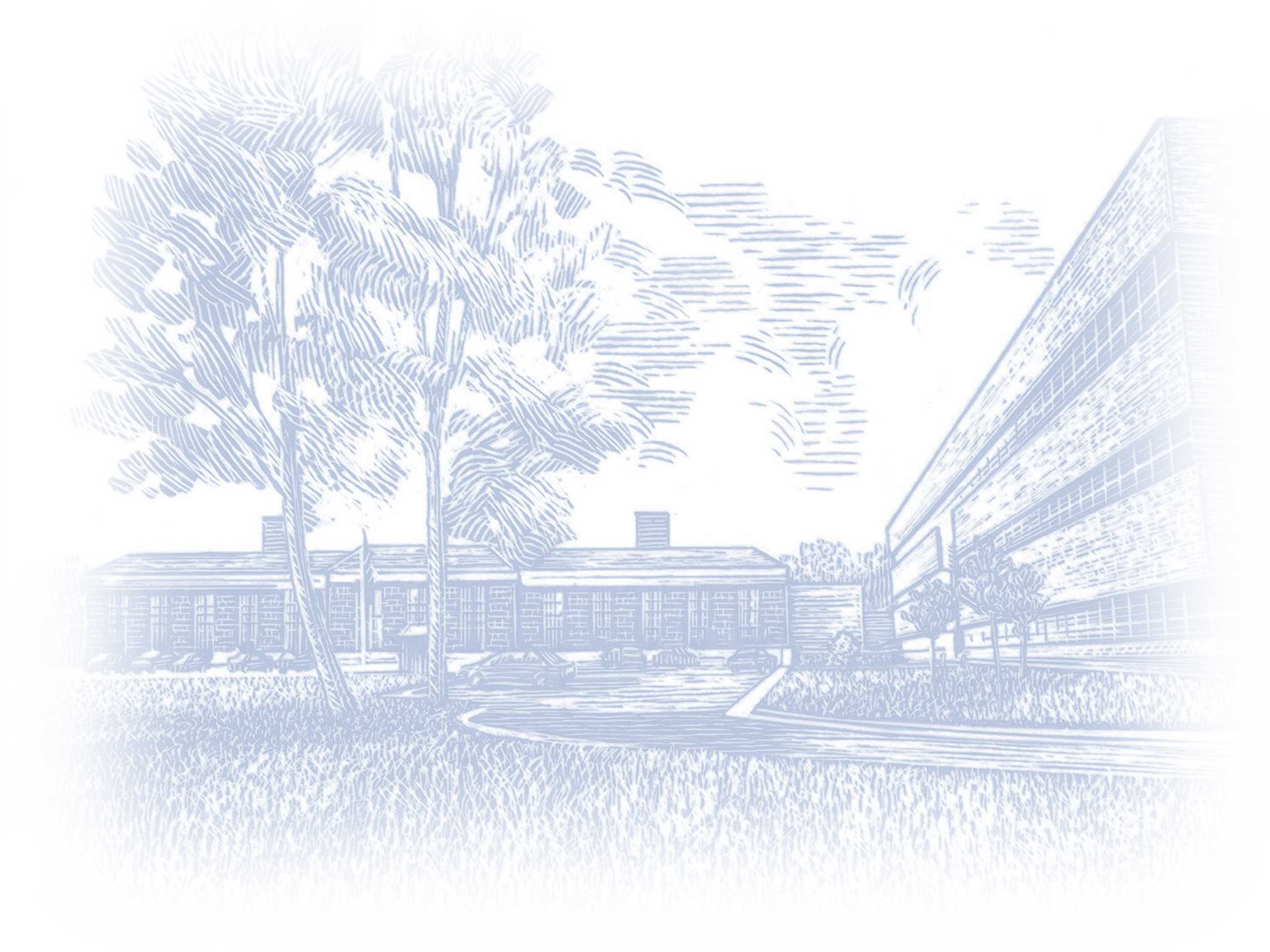

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Turner-Fairbank Highway Research Center
6300 Georgetown Pike, McLean, VA 22101

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Foreword

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905 16th Street, NW
Washington, DC 20006
202-628-5465
Edited By:
Ken Hoffner, CIH, CSP

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Chapter 1

Introduction

BACKGROUND, OBJECTIVE, AND PURPOSE OF THIS DOCUMENT

More than 5,000 bridge rehabilitation and repainting projects are performed each year that have the potential for exposing workers to lead. Laborers, ironworkers, and painters are the most severely lead-exposed worker populations associated with bridge renovation, repair, and demolition (RR&D) work. In recent years, lead exposures to some workers have increased to even greater levels than in the past as a result of their working inside containment structures that are required to reduce lead contamination to the environment.

In October 1992, Congress responded to the national lead-based paint hazard with the passage of the Residential Lead-Based Paint Hazard Reduction Act. That Act, commonly known as Title X, contains provisions specifically related to work performed on bridges and steel superstructures and to demolition. Among those provisions was the requirement that the Occupational Safety and Health Administration (OSHA) promulgate an Interim Final Standard for Lead in Construction applicable to all construction activities. On May 4, 1993, OSHA issued this interim final standard at 29 CFR Part 1926.62. That comprehensive standard applies to highway infrastructure projects activities where workers may be occupationally exposed to lead.

Work in the construction industry, including bridge repair and renovation projects, poses other safety risks to workers, including falls from elevations and being struck by vehicles. Construction work has the highest lost time injury rate of all the major economic sectors in the United States and accounts for billions of dollars of losses to workers and contractors each year.

In an effort to reduce the toll of fatalities, injuries, and illnesses in construction, increasing emphasis is being given to the creation and implementation of effective safety and health programs. The effective application of management practices in the implementation of safety and health programs is designed to benefit both employers and workers by reducing injuries and illnesses.

In a recent initiative, OSHA established a Focused Inspection Program for construction that recognizes the efforts of contractors who have implemented effective safety and health programs. Contractors with such programs will qualify for a Focused Inspection in which the OSHA compliance officer's inspection will "focus" only on the four leading causes of death and injury among construction workers (falls from elevation; struck by; caught in/between; and electrical hazards). For those contractors who do not have effective safety and health programs, the OSHA compliance officer will conduct the traditional "wall-to-wall" inspection. OSHA is also in the process of drafting a proposed regulation that would require contractors to develop comprehensive safety and health programs. With regard to construction lead, OSHA has recently instituted Special Emphasis Programs that focus specifically on its new construction lead standard, including inspections of bridge projects where lead-based coatings are being disturbed.

In an effort to help contractors develop effective safety and health programs for work on bridges involving lead paint disturbance, the Laborers' Health and Safety Fund of North America (LHSFNA) has received a grant from the Federal Highway Administration (FHWA) entitled "Health and Safety Related Aspects of Bridge Rehabilitation and Restoration" (Grant Agreement DTFH61-95-X-00004). Under this grant, the LHSFNA has prepared a written guideline document for the purpose of assisting bridge contractors in the development, improvement, and implementation of a comprehensive safety and health program for projects where lead-based coatings are to be disturbed. The guideline for establishing the safety and health program is intended to be comprehensive in that it addresses both health and safety hazards associated with work of this nature.

To prepare a guideline that addresses the specific concerns and issues affecting contractors who are engaged in this type of work, a technical workshop was held from May 31 to June 2, 1995. Workshop participants included invited safety and health experts from all the affected constituencies, including contractors, labor, government, and trade associations to prepare a consensus draft document (see Appendix O for list of attendees). This document, entitled "Safety and Health on Bridge Repair, Renovation, and Demolition Projects," is the resulting product of that technical workshop.

HOW TO USE THIS GUIDELINE

The "Safety and Health on Bridge Repair, Renovation, and Demolition Projects" guideline has been prepared for use by contractors who are engaged in work of this nature. It is designed to assist contractors in establishing, improving, and implementing a comprehensive safety and health program to address workplace hazards for workers who are employed on these projects. The overall objective is to provide guidance to contractors on establishing a management strategy and applying practices that are intended to eliminate, or reduce, fatalities, injuries and illnesses for construction workers performing activities and tasks associated with highway bridge projects.

The guideline is designed to be comprehensive in that it addresses both safety and health hazards that confront contractors and workers on the job site for work of this nature. As such, this guideline is not designed to address issues related to the impact that these projects may have on the environment nor the health and safety of the general public.

This document is, as its title states, a guidance reference for contractors to use for the establishment of and improvement in their management practices in the design and implementation of a safety and health program. It is not a "cookbook" document for contractors to "fill in the blanks" as a means to claim that a safety and health program is in effect. Rather, it is written in such a manner as to guide the bridge contractor through the elements and issues that must be considered in the establishment of their own safety and health program.

The manual is organized by chapters that move sequentially from the general requirements for essential elements in any safety and health management program (chapter 2), to safety and health programs, practices, and procedures (chapters 3 and 4), to compliance with lead-specific issues encountered in this work (chapter 5). In addition, a number of items in the Appendices are provided to further assist contractors in developing their own programs.

Because the guideline deals with workplace health and safety issues affecting employees who work on bridge maintenance and construction projects, references are made to the relevant OSHA regulations that are applicable to construction work. Where workplace conditions on a given job create or have the potential to create hazards where OSHA standards apply, employers are required to comply, as a minimum, with these OSHA requirements. Nevertheless, contractors may wish to consider implementing practices and policies that go beyond that required by OSHA if they represent sound industry practice.

The guideline attempts to comprehensively address the health and safety issues that are reasonably anticipated to occur on highway bridge work where lead paint is disturbed. All such issues will not affect all contractors nor will all hazards be present on any given job site. Those who use this guideline are advised to utilize those chapters and sections that are applicable to the work they perform on a specific project. Likewise, the guideline outlines only some elements of some of the OSHA regulations that may typically be applicable to this work. In that regard, in order to fully comply with applicable OSHA requirements, contractors must consult with the most recent publication of Federal or State construction standards for the purpose of achieving compliance. This guideline is not to be used as a substitute for those legal responsibilities of the employer.

Chapter 2

General Requirements for Safety and Health Programs

SECTION 1: MANAGEMENT COMMITMENT AND LEADERSHIP

Safety and health is a management function that requires management's leadership in planning, setting objectives, organizing, directing, and controlling the program. Management's commitment to safety and health is evidenced in every decision the company makes and every action the company takes. Therefore, the management of the company must assume primary responsibility for implementing and ensuring the effectiveness of a safety and health program. The best evidence of a company's commitment to safety and health is a policy that places the prevention of workplace injuries and illnesses equal to any of the other fundamental corporate operating policies.

Management's leadership role in implementing a safety and health policy is carried out by each member of the management team, from the CEO to the jobsite foreman. The company must provide the necessary resources and leadership to ensure the effectiveness of established safety and health programs. However, each employee's active participation in the safety and health program is also desired and necessary.

The following is an example of a generic company safety and health policy:

A. Policy Statement

To all Employees:

This company is committed to providing safe and healthful workplaces that are free from recognized hazards. The safety and health of our employees is one of the highest priorities of the company. It is the policy of this company to maintain jobsites that are free from recognized safety and health hazards and ensure that accident prevention will be given primary importance in all phases of operation and administration. Therefore, management has developed safety and health programs to reduce the injuries and illnesses that are prevalent in construction.

The effectiveness of this program depends upon the cooperation and communication of management officials, supervisors, and employees. Everyone must be capable of recognizing hazards in the workplace and each must understand their roles and assigned responsibilities. Each supervisor will make the safety and health of all employees an integral part of his/her regular management function, and supervisors will be evaluated on safety and health performance. In addition, each employee will adhere to established company safety rules and procedures. Participation of all employees is essential in order to ensure the effectiveness of this program.

Management will make every effort to provide adequate safety training to employees prior to allowing an employee to begin work. Employees in doubt about how to do a job or task safely are required to ask a qualified person for assistance. Employees must report all injuries and unsafe conditions to management as soon as possible. Corrective measures will be taken to prevent future accidents, and there will be no management retribution or retaliation against employees who report safety and health concerns.

Please read this safety and health program and follow the safe work procedures described. Safety is everyone's business, and everyone (management officials, supervisors, employees) will be held accountable for participating in this program.

Please think Safety and always work safely.

President

The employer's safety and health policy should be communicated to its employees regularly. More importantly, however, employees should be able to see that the written policy is regularly reflected in the actions, decisions, and operations of the management team.

B. Company Safety Goals and Objectives

On each construction project jobsite, the project manager and site superintendent should be accountable to the CEO for achieving the company's safety and health objectives and measurable goals. Part of a manager's yearly evaluation should consider the degree to which safety and health goals were achieved on the jobsites he or she supervised.

Suggested company safety and health objectives are to:

- Ensure that the work does not impair the health of employees.
- Keep safety a paramount part of the workers' daily activities.
- Improve morale and productivity.
- Enhance the company's image by working safely.
- Recognize and reward safe work practices.

Measurable goals to assess progress toward meeting these objectives include:

- Having no fatalities or serious injuries.
- Reducing injuries, lost workday accidents, and workers' compensation claims.
- Accurately recording reports of all near misses and actual injuries.
- Preventing damage or destruction to company property or equipment.
- Increasing productivity through reduction of injuries.
- Reducing worker's compensation costs.
- Carrying out provisions of the company's safety and health plan in areas such as training, recordkeeping, hazard analysis, and hazard abatement.

C. Safety Enforcement Policy

Whenever a violation of safety rules occurs, the following enforcement policy (or something similar) should be implemented:

FIRST OFFENSE - Verbal warning and proper instruction pertaining to the specific safety violation. (A notation of the violation may be made and placed in the employee's personnel file.)

SECOND OFFENSE - Written warning with a copy placed in the employee's personnel file.

THIRD OFFENSE - Receipt of two written reprimands in any 12-month period may result in suspension.

FOURTH OFFENSE - Dismissal from employment.

The company reserves the right to terminate immediately any employee who acts unsafely on its jobsites.

Note: Each State may have its own rules and regulations regarding the dismissal of employees. Please refer to the State and local labor laws in your own jurisdiction to clarify dismissal procedures in your own State.

D. Drug and Alcohol Policy

Many employers establish substance abuse programs. These programs may require pre-employment testing for illegal drug use, as well as random periodic drug or alcohol testing for "safety sensitive" job functions. Testing also may be required for those involved in a workplace death or injury event, or other "for cause" reasons.

Other components of a comprehensive company drug and alcohol program include employee drug and alcohol training programs, Employee Assistance Programs, and the provision of drug and alcohol treatment programs. Any successful company drug and alcohol policy must be clearly defined and communicated to all affected employees. Furthermore, all testing, collection, and analysis procedures should adhere to the U.S. Department of Health and Human Services guidelines for Federal programs.

SECTION 2: ASSIGNMENT OF RESPONSIBILITY

To accomplish the company's safety and health objectives and goals, the participation of everyone in the company and others on the jobsite is required. The roles and responsibilities of major stakeholders in the company's safety and health structure are described below:

A. Chief Executive Officer (CEO) or President

In every organization, the CEO or president has the final authority for ensuring that the workplace is free of recognized safety and health hazards. To accomplish this function the president:

- Establishes a company safety and health policy.
- Allocates sufficient resources to implement programs deemed necessary to carry forth the established safety and health policy.
- Delegates responsibilities as necessary to ensure that programs, procedures, and practices are developed and implemented to carry forth the safety and health policy.
- Holds accountable those responsible for implementing safety and health programs on the job.

B. Safety and Health Director

The primary function of the safety and health director is to establish, communicate, and assess the effectiveness of programs necessary to implement the company's safety and health policy. These programs must address the entire scope of activities performed to effectively prevent injuries and illnesses.

This guideline is specifically designed to help safety and health directors (and others with safety and health leadership responsibilities) establish and communicate safety and health programs applicable to bridge repair, renovation, and demolition (RR&D) jobsites.

Typical functions of the safety and health director include:

- Identifying necessary safety and health programs for all work operations, i.e., electrical safety, fall protection, confined space, respiratory protection, Right-to-know, etc.
- Establishing program procedures and practices to prevent injuries and illnesses.
- Communicating programs and their associated procedures and practices to all employees. This function is typically performed through training and education.
- Regularly visiting worksites to assess the implementation and effectiveness of programs applicable to the worksite.

In order to be effective in these functions, the safety and health director should:

- Become thoroughly familiar with all OSHA standards, consensus standards, and other resources relevant to the safety and health programs established at the jobsite.
- Maintain accurate injury, illness, and near-miss records and review them for trends.
- Direct major accident investigations.
- Assist supervisors in accident and near-miss investigations, and use information gained to improve safety and health programs.
- Attend meetings, courses, and conferences to become more knowledgeable in applicable safety and health topics.
- Work with all government officials during accident investigations and safety inspections.

C. Non-Field Personnel and Other Managers

This group of employees includes project managers, engineers, and estimators who have responsibilities for the overall direction and success of company activities, including safety and health. In order for many of the established safety and health programs to function properly during actual construction, this group of people must anticipate and incorporate applicable safety and health programs in all their planning, design, and estimating activities. This group also must select subcontractors who will perform the work safely and abide by all site safety and health requirements. And finally, these employees must ensure the ongoing success of the safety and health efforts by organizing periodic project safety meetings.

As an example of the importance of considering safety and health in pre-planning, before employees can use personal fall arrest systems, the location and configuration of suitable anchor points for safety lanyards or lifelines must be determined and may have to be fabricated or designed into structural elements. Shielding, sloping, or shoring methods must be specified for excavations below 4 ft (1.2 m) in depth, and hardware such as trench boxes must be obtained prior to work. Containment structures must be properly designed and reviewed by a professional engineer to prevent collapses from wind. Costs for implementing safety and health programs on the jobsite must also be factored into any bids by estimators. In summary, these employees:

- Include safety as a part of pre-job planning and scheduling.
- Evaluate job specifications for potential safety and health hazards and review such anticipated hazards with the safety and health director.
- Ensure that bids include accurate estimates for labor, equipment, and material costs necessary to implement necessary safety and health programs.
- Select contractors who have established safety and health programs and who work safely.
- Initiate and maintain initial and periodic (at least monthly) project safety meetings (see Hazard Identification and Control Section).

D. Field Supervisors

The day-to-day safety and health of employees is a primary responsibility of field supervisors, including superintendents, project supervisors, and foremen. To accomplish this obligation, this group:

- Ensures that all safety and health rules, regulations, policies, and procedures are understood by conducting pre-job safety orientations with all workers and reviewing rules as the job or conditions change or when individual workers show a specific need.
- Requires the proper care and use of all necessary personal protective equipment to protect workers from hazards.
- Identifies and eliminates job hazards expeditiously.
- Receives and take initial action on employee suggestions, awards, or disciplinary measures.
- Conducts foreman/crew meetings during the first 5 minutes of each work shift to discuss safety matters and work plans for the work day.
- Trains employees (both new and experienced) in safe and efficient methods to accomplish each job or task.
- Reviews accident trends and establishes prevention measures.
- Attends safety meetings and actively participates in the proceedings.
- Conducts accident investigations and safety inspections.
- Promotes employee participation in the employer's safety and health program.
- Actively follows the progress of injured workers and displays an interest in their rapid recovery and return to work.
- Maintains ongoing communication with the home office or safety and health director regarding on-site safety and health issues.

E. Workers

Safety is everyone's responsibility, with management accountable for the establishment of a culture that enables all employees to go home in the same or better condition than they arrived in. Part of establishing this culture is effectively communicating that each employee is expected, as a condition of employment for which he/she is paid, to work in a manner that will not cause injury to themselves or to fellow workers. Each employee must understand that responsibility for his/her own safety is an integral job requirement. Each employee shall:

- Observe and comply with all safety rules and regulations that apply to his/her trade.
- Report all on-the-job accidents and injuries to his/her supervisor immediately.
- Report all equipment damage to his/her supervisor immediately.
- Follow instructions and ask questions of his/her supervisor when in doubt about any aspect of his/her job.
- Report all unsafe conditions or situations that are potentially hazardous.
- Operate only equipment or machinery that he/she is qualified to operate. When in doubt, ask for directions.
- Know what emergency telephone numbers to call in case of fire and/or personal injury.
- Help to maintain a safe and clean work area.

F. Competent/Qualified Persons

The OSHA Construction Standards (29 CFR 1926) require every employer to designate competent persons to conduct frequent and regular inspections of the jobsite, materials, and equipment. In addition, specific construction operations such as, but not limited to, lead remediation, excavation, the use of cranes and rigging, underground construction, and mechanical demolition require oversight by "competent persons."

According to OSHA, a "competent person" means "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them." A qualified person is one who, by experience or training, is familiar with the operations and equipment associated with a particular operation or activity.

On construction jobsites, a variety of persons may perform the functions of qualified or competent persons. These include the safety director, non-field management, field management, designated workers, and possibly outside vendors and consultants. In any case, the qualified and competent persons must have the necessary training, experience, and authority to control hazards on the jobsite.

Competent/qualified persons should be designated for each project and listed on the appropriate assignment form (See appendices A-1 and A-2). These forms should be completed during the preparation of the Site-specific Safety Plan (appendix M) and displayed at jobsites where activities requiring the presence of a competent/qualified person are performed. These people can then act as resources for employees who need guidance and informed advice on how to perform specific operations. The form should be updated and replaced as necessary to reflect current designated competent/qualified persons and their area of expertise and responsibility.

On bridge renovation and demolition sites, a competent person must frequently and regularly assess the effectiveness of all controls used to limit lead exposures to employees. The controls are addressed in the company's written Lead Compliance Program. These controls may include engineering measures such as local exhaust ventilation systems, containment structures and ventilation systems, wet methods, vacuum-blast systems, or other commonly used engineering controls. The competent person also inspects the adequacy of hygiene facilities, work practice controls, personal protective equipment, administrative controls (such as job rotation, if used), and respiratory protection programs.

G. Labor/Management Safety and Health Committee

A joint labor/management safety and health committee or some other employee participation structure should be established on each construction jobsite to assist with implementation of the employer's safety and health program and the control of identified hazards. The joint safety and health committee should be composed of employees and management representatives. The committee should meet regularly, but not less than once a month. Written minutes from safety and health committee meetings should be available and posted on the project bulletin board for all employees to see.

The safety and health committee participates in periodic inspections to review the effectiveness of the safety programs and make recommendations for improvement of unsafe and unhealthy conditions. In short, the committee monitors the effectiveness of the safety and health programs.

The committee reviews safety inspection, near-miss, and accident investigation reports and complaints about unsafe or unhealthy working conditions. Where appropriate, the committee submits suggestions for further action. The committee also, upon request from OSHA, may verify abatement action taken by the company in response to safety and health citations.

The objectives of the joint project labor/management safety and health committee are to:

- Prevent accidents and illnesses by identifying and eliminating as many unsafe conditions and acts as possible.
- Promote employee training in areas of recognition, avoidance, and prevention of workplace hazards.
- Encourage employee participation in the company safety and health program.

- Establish a line of communication for the worker to voice his/her concern(s) on existing or potential hazards and receive positive feedback.
- Develop a mechanism that enables workers to provide suggestions on how to improve safety and health on the jobsite.
- Provide a forum for joint labor-management cooperation on safety and health issues in the workplace.
- Involve workers in problem solving.
- Communicate accident prevention information to the workforce.
- Review reports of recent accidents.
- Assist in identifying the causes of hazards.
- Regularly review minutes of previous meetings to ensure that action has been taken.
- Identify hazardous conditions and practices for corrections by management.
- Examine accident and injury statistics and participate in the setting of safety objectives based on the injury profile.

You may wish to consult your labor attorney before establishing labor/management safety and health committees. Forming such committees could have an impact on your business.

H. Subcontractors

The selection of subcontractors should be based in part on the subcontractor's past safety and health performance. Has the subcontractor's health and safety program on previous lead projects demonstrated effectiveness? Has the subcontractor been cited for OSHA violations? What is the experience modification rate (EMR) for the subcontractor? These items of concern should be addressed in addition to a review of the subcontractor's safety and health resources such as equipment and staff.

When applicable work quality standards exist, such as the Steel Structures Painting Council (SSPC) Painting Contractors Certification Program QP 2(I), consideration should be given to subcontractors who have completed the program or similar quality assurance programs. Evidence of a comprehensive lead protection program must be required of subcontractors performing work that exposes employees to lead in order to protect their employees and other employees from lead hazards.

Each subcontractor should conduct a physical survey of the jobsite, prior to the start of work, and make a survey of the work to be performed by reviewing the drawings and conducting discussions with the owner, engineer, general contractor, and construction manager.

The general contractor's management team is responsible for informing all subcontractors of hazards present on the worksite so that the subcontractor can adequately protect his or her employees. General worksite safety programs that impact multiple employers such as lockout/tagout, right-to-know, and site emergency/evacuation procedures need to be covered with each subcontractor prior to the commencement of work. Arrangements for shared lead compliance provisions such as hygiene facilities, laundering facilities, personal protection equipment, and medical monitoring must be discussed in detail with prospective subcontractors.

SECTION 3: HAZARD IDENTIFICATION, ANALYSIS AND CONTROL

Effective hazard identification, analysis, and control strategies prevent workplace injuries and illnesses. The following activities are often used by employers to identify and control workplace hazards:

- Site-specific safety plans.
- Jobsite safety inspections and industrial hygiene monitoring.

- Injury and illness records reviews.
- Accident and illness investigations.
- Project safety meetings.
- Hazard correction plans.

A. Site-Specific Safety Plans

A written site-specific safety plan should be developed from the outset of work to describe the construction sequence and consider safety and health programs needed as the site progresses. Preparing a site-specific safety plan also ensures that preplanning for fire, rescue, first aid, and site evacuation are considered. In addition, a site-specific safety plan helps to identify activities that will require employee training.

In general, a site-specific safety plan is developed in the following manner:

1. Prior to the beginning of any work, a step-by-step sequence of the construction activities is prepared. Using this plan of construction activities, a hazard analysis is conducted to describe the potential hazards associated with each step and the actions required to control the identified hazards. Necessary safety programs are identified, including generic programs such as electrical safety, and job-specific programs such as lead-in-construction are identified. A summary of the necessary safety and health programs used in the job should be included in the written site-specific safety plan.
2. All affected contractors meet to coordinate and assign responsibility for all programs identified in the hazard analysis.
3. Emergency and rescue procedures for the site are worked out. Emergency evacuation routes, alarms, post-evacuation assembly sites, and specialized rescue procedures (such as for confined spaces) must be considered prior to any work. Evacuation procedures should be posted at the entrance to jobsites.
4. The needs for designated competent and qualified persons are determined. People with the requisite experience, training, and authority are identified as competent or qualified persons and their identities posted using the forms in appendices A-1 and A-2 or equivalent forms.

A model site-specific safety plan for a bridge RR&D site is found in appendix M.

B. Jobsite Safety Inspections and Industrial Hygiene Monitoring

Safety inspections of the jobsite need to occur regularly and frequently, and especially when jobsite conditions change or whenever a new process or procedure is implemented. These inspections should focus on the identification and correction of potential safety and health hazards. Recently, OSHA has begun a program to inspect jobsites for the four types of hazards that most often cause fatalities and serious injuries on jobsites. This program, called the "Construction Focused Inspections Initiative" focuses on falls, struck-by hazards, caught-in or between hazards, and electrical hazards. A summary of the Focused Inspections Initiative is found in appendix L; however, OSHA's policies regarding focused inspections change frequently. The nearest OSHA Area Office should be consulted for the most current policy regarding focused inspections. Focused inspection issues are highlighted in chapter 3 of this guide, "Safety Programs, Practices, and Procedures."

Sometimes, health hazards are identified that require industrial hygiene assistance to evaluate and control the hazards, and the necessary industrial hygiene resources should be obtained. For small contractors, OSHA 7(C)(1) consultants and many workers' compensation insurance carriers can provide free or low-cost industrial hygiene services.

Qualified or competent persons conducting jobsite safety and health inspections should use the site evaluation worksheet (see appendix K). In addition, the "Safety Hazard Programs, Practices, and Procedures" in chapter 3 should be reviewed and mastered by personnel conducting safety inspections of the jobsite. Other tools that are useful in conducting inspections of worksites to determine the need for hazard control programs include job hazard analyses (see appendix P), failure mode and effect analyses (FMEA), operations hazard analyses (OHA), and fault-tree analyses.

As part of this safety and health program, the qualified/competent persons for each company jobsite:

- Identify "high hazard" areas of operation and determine inspection priorities.
- Establish inspection responsibilities and schedules.
- Develop and use administrative systems to review, analyze, and take corrective action on inspection findings.
- Identify and implement safety and health programs to eliminate or control identified hazards.
- Safety and health inspections should be documented. Reported defective conditions and hazardous conditions should also be documented to reveal that corrective action has taken place.
- All workers should be instructed to report hazardous conditions whenever they occur. Corrective action orders must be immediately issued to evaluate and abate the identified conditions. Where corrective action cannot be immediately implemented and the hazardous condition may result in injury, the area should be posted as "no entry" until such time as the management official declares the work area suitable for entry. Defective equipment such as a defective ladder can be tagged "out of service" and removed from work areas until a replacement is installed.

C. Injury and Illness Records Review

Records collected on a project should be subject to a continuing analysis to detect illness and injury trends and to spot potential hazards that have not been addressed on the worksite. Examples of records that are useful in detecting injury trends and identifying workplace hazards include:

- OSHA 200 injury and illness logs.
- Workers' compensation first reports of injuries.
- Industrial hygiene monitoring results.
- First aid logs.
- Medical monitoring records [hearing conservation, blood lead and zinc protoporphyrin (ZPP) levels].
- Waste handling records and manifests.
- Environmental analysis reports.
- Near-miss records.

A thorough review of these records will allow for process and work practice changes to take place before an injury or illness occurs. Safety injury and illness records must be reviewed on a frequent basis.

D. Accident and Illness Investigations

All accidents and illnesses should be investigated to determine causal factors and prevent future recurrences. In addition, near misses that could have resulted in injuries and illnesses should also be investigated.

Whenever an accident is reported, the supervisor of the injured worker(s) should respond to the scene of the accident as soon as possible. After prompt medical attention has been provided to the injured, a copy of the supervisor's injury and illness report must be filled out (see appendix B). All witnesses should be interviewed privately as soon as possible after the accident. If possible, the supervisor should interview the worker(s) at the scene of the accident so that events leading up to the accident can be reconstructed. Photographs should be taken as soon as possible after the accident and include the time and date taken.

Any accident that involves a fatality or the hospitalization of three or more employees for in-patient treatment must be reported within 8 hours to the State or Federal OSHA office that has jurisdiction over the location of the jobsite.

A written report of investigation findings should be prepared by each injured employee's supervisor and submitted to management (the site superintendent) for review. Written reports for accidents resulting in fatalities or serious injuries should also be submitted to company attorneys.

An effective accident investigation report answers the questions: who, what, when, where and how:

- Who was involved? The investigation report should identify the injured worker'(s) name and occupation.
- What happened? The investigation report should describe the accident, the injury sustained, eyewitnesses, the date, time, and location of the accident.
- When did the accident occur?
- Where did the accident occur?
- How did the accident occur? All the facts surrounding the accident should be included here, including the following:

  ✓ What caused the situation to occur?

  ✓ Was/Were the worker(s) qualified to perform the function involved in the accident?

  ✓ Were they properly trained?

  ✓ Were operating procedures established for the task involved?

  ✓ Were procedures followed, and if not, why not?

- Where else might this or a similar situation exist, and how can it be avoided?
- What has been done? A follow-up report should be completed by the site safety representative to determine if the suggested action was implemented, and if so, whether similar accidents were prevented as a result of such implementation.
- What should be done? Methods for preventing future accidents of a similar nature should be identified.

E. Project Safety Meetings

A periodic (at least monthly) project safety and health meeting should be conducted on each construction project to provide all affected parties with relevant information concerning existing or potential jobsite hazards, corrective actions, and/or abatement. Minutes for each from these meetings should be recorded and a copy sent to the corporate safety office. Copies of the meeting minutes should also be posted on bulletin boards accessible to employees.

The following parties should attend these monthly safety meetings:

- General contractor.
- Owners representative.

- Site superintendent.
- Project manager.
- Project safety and health representative.
- Subcontractor's senior supervisor.

F. Hazard Correction Plans

Many employers have found it useful to incorporate into their safety and health efforts a formal plan to ensure that hazardous conditions are promptly corrected and not ignored. An example of such a plan follows:

"Unsafe or unhealthy work conditions, practices, or procedures shall be corrected in a timely manner based on the severity of the hazards. Hazards shall be corrected according to the following procedures:

1. When observed or discovered.
2. When an imminent hazard exists that cannot be immediately abated without endangering employee(s) and or property, we will remove all exposed workers from the area except those necessary to correct the existing condition. Workers necessary to correct the hazardous condition shall be provided with the necessary protection.
3. All such actions taken and dates they are completed shall be documented on the appropriate forms.

SECTION 4: TRAINING AND EDUCATION

All employees, from superintendents to journeymen and apprentices, must receive safety education and training for the work they perform. The training needs to meet certification requirements where specific training requirements apply, such as for lead-in-construction and right-to-know. Any training provided to employees should be documented with dates, attendees, and an outline of topics covered. Additionally, all training must be provided by qualified instructors. Common types of safety training include:

A. New-Hire Safety Orientation

New employees or current employees who are transferred from another project should attend a project specific new-hire safety orientation prior to the start of work. This program provides each employee the basic information about the company project-specific safety and health plan, Federal and State OSHA standards, and other applicable safety rules and regulations. Employee attendance is mandatory prior to working on the construction project. To adequately document the new-hire training, a form such as the New Hire Safety Orientation Form (appendix C) should be filled out by the person providing the training. Following the training, the form should be signed by the employee, and a copy of the form provided to the employee. The original signed copy should be kept by the employer.

The project safety orientation program should introduce new employees to:

- Company safety and health policy and programs.
- The construction project and the employee's role within it.
- Hazard communication requirements.
- Emergency procedures.
- Location of first aid stations, fire extinguishers, telephone, lunchroom, washroom, and parking.
- Site-specific hazards, including lead hazards.
- Safety and health responsibilities.

- Reporting of injuries and hazardous conditions.
- Use of personal protective equipment.
- Tool handling and storage.
- Review of each safety and health rule applicable to the job.
- Introduction to safety and health representative(s).
- Introduction to supervisor.
- Site tour or map where appropriate.

B. Employee Training

In addition to participating in the new-hire safety orientation, the employee should complete refresher training at intervals established by the employer. Any refresher training or new-skills training should also be documented as discussed above. A form similar to appendix D can be used to record and document training activities.

Additional training should be completed if workers:

- Receive assignment to a new task.
- Receive assignment requiring a new type of personal protective equipment.
- Need to improve their skill levels.
- Receive instruction in new tools, equipment, or special process equipment.

C. Supervisor Training

The supervisor/foreman is responsible for the prevention of accidents for tasks under his/her direction, as well as thorough accident prevention and safety training for employees he/she supervises. Therefore, all supervisors/foremen must receive training so they have a sound theoretical and practical understanding of the following:

- Site-specific safety programs.
- Occupational Health and Safety (OH&S) Act and construction regulations.
- OSHA Hazard Communication standard.
- Site emergency response plans, including OSHA's 1926.65 standard (Hazardous Waste Operations and Emergency Response) when the potential exists for releases of hazardous materials requiring emergency responses.
- First aid and CPR.
- Accident and injury reporting and investigation procedures.
- Hazard assessment in their areas of expertise, and topics appropriate for toolbox talks.
- OSHA recordkeeping requirements.
- Communication techniques.

In addition to the training requirements described above, site superintendents should receive additional training on, but not limited to, the following topics:

- Implementation and monitoring of a site-specific construction safety program.
- Personnel selection techniques.
- Jobsite planning.
- Contractor construction documents.
- OSHA recordkeeping requirements.
- Subjects they will need to know as a "competent person" on the site.

Similar to training provided to employees, any training provided to supervisors should also be documented. The form in appendix D can be adapted to document supervisor training.

D. Safety Bulletin Board

A safety bulletin board should be located on each jobsite where it will be visible to all employees. The bulletin board should contain information such as:

- Safety and health committee meeting minutes.
- Safety promotions/awards.
- Safety meeting dates and times.
- OSHA 200 Form (February of each year).
- Available safety training.
- Safety inspection findings.
- Emergency phone numbers.
- Hazard communication/right-to-know information.

Additional items may be posted with the site superintendent's approval.

As part of the safety bulletin board, a Safety Suggestion Box could also be mounted to solicit suggestions regarding any safety and health issues of concern to workers.

E. Toolbox Meetings

Supervisors/foremen should conduct weekly work group sessions, also known as toolbox meetings. These toolbox meetings may be held more frequently depending on the circumstances (i.e., injuries, new operations, etc.) On large jobsites with multiple crews, the supervisor/ foreman provides appropriate materials (handouts, audio/visual aids) to discussion leaders in advance of each meeting. Discussion leaders should be selected for each meeting by the supervisor/foreman and trained in the materials they will present.

These weekly meetings should be short - 15 to 30 minutes - but long enough to cover the training topic. Active employee participation and a question-and-answer session are recommended during each meeting. The content of the toolbox meetings should reinforce the basic safety and health training provided prior to the beginning of a job, and should cover topics pertinent to the nature of the ongoing work and hazards. Possible discussion and training resources for toolbox safety meetings include:

- Pre-prepared toolbox safety meeting materials from various vendors.
- Subject-specific training pamphlets or videos from vendors.
- Materials supplied by the safety director.
- Articles from trade journals, newspapers, or magazines related to the work performed.

Meetings should also be scheduled whenever new operations are introduced into the workplace to ensure that all employees are familiar with the procedures and requirements for performing the job safely.

Employee attendance at toolbox meetings should be recorded on the Employee Training Record Form (see appendix D) or a similar form. If discussion at the meeting identifies a suspected safety or health hazard that cannot be corrected immediately or requires expertise, a notice of the hazard must be forwarded to the site superintendent and/or safety and health committee so that steps can be taken to eliminate or manage the hazard.

Various types of reports are necessary to meet the recordkeeping requirements of OSHA, insurance carriers, and other government regulatory agencies. Additionally, some clients may require additional site recordkeeping requirements.

The company should establish uniform recordkeeping procedures for all jobsites to measure the overall safety and health performance of each project.

A. Injury and Illness Records

OSHA requires each employer with 10 or more employees to record and maintain injury and illness records. These records are used by management to evaluate the effectiveness of the safety and health programs. The safety director or equivalent management officer shall be responsible for the following:

- Obtaining records of near misses.
- Obtaining a report on every injury or illness requiring medical treatment.
- Recording each injury or illness on the OSHA Log and Summary of Occupational Injuries & Illnesses (Form 200).
- Preparing a supplementary record of the occupational injuries and illnesses on an Employer's Report of Injury or Illness (Supplementary Record, Form 101 or its equivalent).
- Preparing the summary OSHA Form 200, posting it no later than February 1, and keeping it posted where employees can see it until March 1; providing copies as required or requested.
- Maintaining these records in company files for 5 years.

B. Medical and Exposure Records

In accordance with OSHA requirements, medical and exposure records have to be maintained for 30 years from the time of the end of an employee's employment unless a different retention period is specified by a specific standard. These records are confidential information and should remain in the custody of the safety director or other designated individual. Information from an employee's medical record should only be disclosed to the employee, his/her designated representative with written consent from the employee, and to company officials with an occupational health need for gaining access to those records.

C. Training Records

Training records should be maintained by designated persons such as the safety coordinator or site superintendent. Exactly who maintains the records is a matter of organizational preference; however, the location of the records should be known to all. Training records should be made available for review by employees and other interested parties upon request.

D. Employee Access to Records

Each employee, or their designated representative as defined by 1926.33(c)(3), has the right to review all medical records developed in compliance with health and safety standards. These records may consist of documents such as baseline audiometric testing records and medical surveillance records such as specific tests for blood lead levels. All records are kept confidential to ensure the privacy of the worker. Employees must be given access to their medical and exposure records, but must also give reasonable time to the employer to produce these records.

All employees must be informed by posted notice of the existence, location, and availability of medical exposure records at the time of initial employment and at least annually thereafter. The name of the individual responsible for maintaining and providing access to these records must also be communicated annually.

SECTION 6: EMERGENCY PLANNING

Each construction project must have adequate procedures for contingencies such as fire, medical emergencies, communication, rescue, and evacuation. Provisions for these programs should be determined before work begins and should be outlined in the site-specific safety plan. (see appendix M)

A. Jobsite First Aid Log

First aid supplies and certified, trained personnel must be available for the treatment of personnel injured on the job. It is also imperative that all treatments are documented in the construction first aid log. Prompt medical attention should be sought for any serious injury or if there is doubt of an employee's condition. A first aid log (see appendix E for sample log) should be maintained in the site first aid facility or another designated location. This log should reflect the following information:

- Injured employee's name.
- Immediate supervisor.
- Date and time of injury.
- Nature of the injury.
- Injured employee's job classification.
- Treatment rendered and disposition of employee (returned to work or sent for medical attention).
- Location where treatment was rendered (e.g., site, walk-in medical facility, hospital).

It should be noted that the cases noted on the first aid log are usually not entered into the OSHA 200 log unless follow-up medical treatment is provided. According to OSHA (as referenced in its April 1986 publication "Recordkeeping Guidelines for Occupational Injuries and Illnesses"), medical treatment includes "treatment (other than first aid) administered by a physician or by registered professional personnel under the standing orders of a physician." It does NOT include first aid treatment even though it is administered by a physician or registered professional personnel.

B. Emergency Procedures

<u>Emergency Phone Numbers</u>

At each jobsite, the emergency phone numbers of police, fire, and ambulance services should be conspicuously posted. Medical treatment facilities near the jobsite such as hospitals, walk-in emergency centers, or industrial medical centers should be identified, and their phone numbers posted. In addition, the emergency phone numbers for top company management should be available on the site.

<u>Injury and Illness</u>

All employees need to be told the locations of the first aid stations on each construction project. Instructions for using first aid equipment should be located in each station. In the event of an emergency, employees should contact any supervisor or individual who is trained in first aid. Supervisors and employees trained in first aid should be available, visible, and identifiable. Trained first-aiders may be identified by wearing a first aid emblem on their hard hat or jacket. First aid providers must also have the capability of requesting the immediate assistance of outside emergency medical technician and rescue personnel.

Fire

Prompt reaction to, and rapid suppression of, any fire is essential. According to OSHA's 1926.24, the company must develop an effective fire protection and prevention program at the jobsite throughout all phases of the construction. The program should at least provide for effective firefighting equipment to be available without delay and that is designed to effectively meet incipient-stage fire hazards as they occur. In addition the fire protection program shall require that:

- All firefighting equipment is conspicuously located and readily available at all times.
- The firefighting equipment is inspected and maintained in operating condition. The fire protection equipment should be inspected no less than once monthly, with documentation maintained for each piece of equipment inspected.
- Discharged extinguishers or damaged equipment are immediately removed from service and replaced with operable equipment.
- All supervisors and employees seek out potential fire hazards and coordinate their abatement as rapidly as possible.
- Each individual expected to fight incipient (beginning) stage fires receives hands-on training to properly recognize fire hazards, implement evacuation procedures, summon higher-level fire fighting resources, and inspect, maintain, and properly use fire extinguishers.

If necessary, a trained and equipped firefighting brigade must be established to ensure an adequate fire protection level.

Evacuation

Some emergencies may require company personnel to evacuate the jobsite. In the event of an emergency that requires evacuation, an alarm or other notification system must sound to alert employees to evacuate the site. All employees are required to go the area adjacent to the project that has been designated as the "safe area." It should be noted that the safe areas can change from day to day depending on wind directions and other factors. The alarm system signal and safe areas for each project must be determined and communicated to employees and subcontractors as part of the basic safety and health training covered in the project safety meetings prior to the beginning of the job and must be updated as necessary. (See appendix M).

Job-Specific Rescue Requirements

In addition to these general emergency response procedures, some construction activities may require special rescue and emergency response procedures. For example, specific rescue and response procedures apply for:

- Working over or near water (1926.106).
- Permit-required confined space activities (1910.146(k)).
- Employees who have fallen during the use of personal fall arrest systems (1926.502(d)(20)).
- Trenching and excavation work where hazardous atmospheres may exist (1926.651(g)(2)).

- Responding to the release of a hazardous substance that requires an emergency response (1926.65(q)).

Some of these rescue activities may be accomplished by company employees who have received proper training in rescue procedures, while other types of rescue and emergency response may require outside help from the fire department or rescue squad. Prior to each job, however, special rescue and emergency response requirements must be considered in the site-specific safety plan. (See appendix M)

Chapter 3. Safety Hazard Programs, Practices, and Procedures

INTRODUCTION

Construction work is often hazardous. In addition to the lead hazards on bridge renovation and demolition sites, there are many other safety and health concerns. The following sections point out safety hazards that are often present during bridge RR&D work. Preventing injuries requires the establishment of safety programs, practices, and procedures for identified hazards. These programs, practices, and procedures must also be communicated, implemented, and enforced on all company project's to protect the safety and health of workers.

The following sections summarize the general requirements of applicable OSHA regulations for various hazards; however, the standards themselves should be referenced for more details. In addition to OSHA regulations, publications by other authorities, such as State and local governments, the American National Standards Institute (ANSI), the National Fire Protection Association (NFPA), and trade associations, should be consulted to provide more comprehensive and current information regarding safe work practices for specific hazards, since many of the OSHA regulations are outdated.

Prior to the beginning of each job where unfamiliar processes, hazards, or situations are present, and periodically thereafter, a hazard analysis should be conducted by a competent person (or team thereof) to characterize the nature of the hazards likely to be encountered on the jobsite. Project safety meetings are well-suited for the purpose of discussing likely hazards on the job.

A competent person as defined by OSHA regulation 1926.32 is "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous or dangerous to employees." This person also has "authorization to take prompt corrective measures to eliminate" all identified hazards. The results of the hazard analysis should be summarized in a written site-specific safety plan as discussed in chapter 2 and appendix M.

This chapter contains information regarding many of the most common safety hazards found on bridge renovation and demolition sites. However, if activities such as blasting with explosives, asbestos abatement, tunneling, or confined space high hazard entries are performed, additional information and standards should be consulted.

SECTION 1: PERSONAL PROTECTIVE EQUIPMENT

Applicable Standards: 1926.28, 1926.52, and 1926.95 through 107

OSHA Focused Inspection Issues: Struck-by, Electrical, Falls

All employees must be provided with appropriate personal protective equipment (PPE) as specified by OSHA regulations and as necessary to control or eliminate hazardous exposures that may cause injury or illness. Personal protective equipment includes all clothing and other work accessories designed to create a barrier against workplace hazards. Selection of the proper type of personal protective equipment is important for protecting employees from workplace hazards. Employees should receive training on the purpose and limitations of any prescribed equipment, and records of the training should be kept using a form similar to appendix D.

To prevent injuries and illnesses, supervisors/foremen must implement and enforce the use of personal protective equipment on all company construction projects. Any employee who willfully refuses to use or willfully damages the prescribed personal protective equipment should be subject to the company safety enforcement policy (see chapter 2).

A. Head Protection

Applicable Standard: 1926.100

Head injuries are caused by falling or flying objects, or by bumping the head against a fixed object. Head protection must resist penetration and absorb the shock of a blow. Recent standards for protective helmets are contained in ANSI Requirements for Industrial Head Protection, Z89.1-1986. The following points should be included in a head protection program:

- All employees and visitors should wear protective helmets while on company projects unless otherwise indicated in the site-specific safety plan. Protective helmets are worn to protect employees and visitors from potential head injury caused from impact, falling or flying objects, or electrical shock and burns.
- Employees should not use paint or cleaning materials on their helmets. Some paints and cleaning materials may damage the shell and reduce protection by physically weakening it or negating electrical resistance.
- Helmet shells should be cleaned by dipping them in hot water containing a good detergent for at least 1 minute. Shells can then be scrubbed and rinsed in clear hot water. After rinsing, the shell should be carefully inspected for any signs of damage.
- All components, shells, suspensions, headbands, sweatbands, and any other accessories should be visually inspected daily by the employee for signs of dents, cracks, penetrations, or any other damage that may reduce the protection originally provided.
- If damage is suspected, helmets should be turned in and a new one issued.
- Employees should never store or carry their helmets on the rear-window shelf of an automobile, since sunlight and extreme heat may adversely affect the degree of protection provided by the helmet.

B. Hearing Protection

Applicable Standards: 1926.52, 101

During some operations it is not feasible to reduce the noise levels or duration of employee exposure to levels specified in Table D-2, Permissible Noise Exposures, of OSHA 29 CFR 1926.52. Exposure to high noise levels can cause hearing loss or impairment. It can also create physical and psychological stress. There is no cure for noise-induced hearing loss.

For noise exposures above 90 decibels (A scale), all employees must use hearing protection and must be included in a hearing conservation program (see chapter 4). Hearing protection devices (ear plugs or muffs) must be fitted or determined individually by a competent person. Ear muffs or plugs should be used for operations where the employee is exposed to excessive noise levels for extended periods of time. Cotton is not an acceptable substitute for prescribed hearing protection.

Additional information on a hearing conservation program can be found in 29 CFR 1910.95 - Occupational Noise Exposure and chapter 4, section 7 of this guideline.

C. Eye and Face Protection

Applicable Standard: 1926.102

Eye and face protection is required wherever there is a reasonable probability of preventable injury. The design, construction, testing, and use of eye and face protection should be in accordance with ANSI Z87.1-1989, and must be in accordance with ANSI Z87.1-1968 as referenced in 29 CFR 1926.102. Eye and face protectors must:

- Provide adequate protection against hazards for which they are designed.
- Be reasonably comfortable when worn under the designated conditions.
- Fit snugly and not unduly interfere with movements of the wearer.
- Be durable.
- Be capable of being disinfected.
- Be easily cleanable.
- Be maintained in clean and good condition.

All employees must be provided with or be required to purchase appropriate eye and face protection equipment for any operations that present potential eye or face injury from physical, chemical, or radiation agents. The eye and face protection designated in the site-specific safety plan shall be worn at all times while in the construction work areas.

Employees must wear full face shields, along with safety glasses that are equipped with side shields whenever involved in grinding, chipping, or where flying particles create hazards to the eyes and face.

Safety glasses, safety goggles, or prescriptive eye wear that do not comply with at least the requirements of ANSI-Z87.1-1968 are not suitable eye protection on any company construction project.

D. Foot Protection

Applicable Standard: 1926.96

Foot and leg injuries from falling or rolling objects, sharp objects, molten metal, hot surfaces, and wet slippery surfaces can be prevented through the use of appropriate foot guards, safety shoes, or boots and leggings. The following safety practices should be implemented and enforced on all company projects.

- All employees and visitors are required to wear foot protection while on the jobsite.
- Safety footwear should meet minimum requirements and specifications in ANSI for men's Safety-Toe Footwear, Z41.1-1991, and must meet the requirements of ANSI Z41.1-1967 as referenced by 29 CFR 1910.136.
- Safety shoes must have an impact-resistant toe. Shoes with metatarsal guards are recommended to provide additional protection to the foot.
- Employees engaged in asphalt paving or any other operation that exposes them to hot surfaces are required to wear heat-resistant soled shoes.

E. Hand Protection

Applicable Standards: 1926.95, 1910.138

Gloves must be required when employees' hands are exposed to hazards such as skin permeable harmful substances, severe cuts or lacerations, severe abrasions, punctures, electrical shocks, chemical burns, thermal burns, and harmful temperature extremes. Gloves may lessen the ergonomic hazards of many vibrating construction tools by increasing gripping abilities and insulating the hands and arms from excessive vibration. However, improperly selected gloves can also lessen gripping abilities, and can be sources of entanglement danger in work around rotating and moving parts.

The degree to which the gloves are helpful or hazardous is dependent on the proper selection of the gloves. The site-specific safety plan should include information regarding the appropriate gloves to be worn for various tasks, conditions, and hazards identified on each jobsite.

Wearing jewelry on the hands can present an entanglement hazard around moving equipment, and should be discouraged where such hazards exist.

SECTION 2: FALL PROTECTION

Applicable Standards: 1926.500, 501, 502, 503; 1926.106

OSHA FOCUSED INSPECTION ISSUE: Falls

To access high and low places on jobsites, a variety of equipment may be used such as ladders, scaffolding, suspended platforms, aerial lifts, stairways, and climbing lines. The use of these access systems often presents fall hazards. In addition, employees may be exposed to falls while working on elevated structures, climbing onto and off of equipment, and even while walking by falling through holes or by slipping or tripping.

To protect employees when they are exposed to fall hazards, some form of fall protection must be used. The most common forms of fall protection are guardrails, personal fall arrest systems, hole covers, and safety nets. Any one or all of these forms of fall protection may be used on construction worksites. The current OSHA standards also require that employees receive training regarding fall protection issues, and that the training is documented. An alternate fall arrest program may be implemented in cases where none of the traditional methods of fall protection are feasible.

A. Major Components of a Fall Protection Program

Personal Fall Arrest System - The three main parts of a personal fall arrest system are the body belt or harness, the lanyard/lifeline, and a suitable anchorage. Particular attention must be paid to the anchorage point(s) to ensure that they are capable of supporting 5,000 lb. (22.2 kN) or two times the maximum load on an engineered system.

Guardrail Systems - Guardrail systems consist of a toprail, midrail, and if necessary a toeboard. Guardrail systems can be made of various materials.

Safety Nets - Safety nets need to be provided for all workplaces 25 ft (7.6 m) or more above surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical. Safety nets must extend 8 ft (2.4 m) beyond the edge of the surface where employees are exposed. Nets shall be hung no more than 25 ft (7.6 m) below the work surface with sufficient clearance to prevent user's contact with the surfaces or structures below. Safety nets must be impact load tested prior to commencing operations.

Training - All employees must receive training on the nature of the fall hazards at the site and on how to avoid falls. Employees should be familiar with the use of all personal fall arrest systems and must wear the equipment when necessary.

To meet the OSHA requirements, one employer has developed a written fall protection program and implemented the following requirements to protect workers from fall hazards on bridge construction and RR&D worksites:

The requirements of all applicable OSHA regulations notwithstanding, the minimum fall protection requirements on this project shall include the following:

1. All fall protection systems must meet the requirements of Part 1926, Subpart M.
2. For situations where lifelines are interrupted, double lanyards are necessary to ensure that the worker is continuously protected from falling by attaching one lanyard ahead of the discontinuity prior to unhooking the trailing lanyard.
3. Ladders or stairways are required at all points of personnel access where there is a change in elevation of 19 in (483 mm) or more, and no ramp, runway, sloped embankment, or personnel hoist is provided. These devices must meet the requirements of Part 1926 Subpart X. Climbing on forms, falsework, or the structure to gain access to work areas is expressly prohibited. However, it is not intended to prohibit the use of ladders for access to work areas, provided the operation is in compliance with OSHA Part 1926 Subpart X and other relevant requirements.
4. Where scaffolds are necessary to provide temporary access to work areas, they must be in compliance with §1926.451. Scaffolds must include a toprail, midrail, and toeboard in compliance with §1926.451, on all open sides and ends. Personal fall arrest systems meeting the criteria of Part 1926 Subpart M are required to protect workers during installation and removal of the railings, and in situations where physical restrictions preclude installation of a standard railing.
5. Suspended scaffolds may be used for bridge painting or other purposes only if personnel lifts, scaffolds, or other means are not practical, and only if they meet the requirements of §1926.451. Specifically, the scaffold must be secured to the suspension cables at all times. All personnel working on a suspended scaffold must be provided fall protection by means of personal fall arrest systems, or other means meeting the criteria of Part 1926 Subpart M.
6. Fall protection is required for open sides or ends of floors or bridge decks, and for openings in floors or bridge decks, as required in Part 1926 Subpart M. In no case shall a height of fall 6 ft (1829 mm) or greater from the side, end, or opening in a floor or bridge deck remain unprotected.
7. All workers in approved personnel aerial lifts must use a personal fall arrest system meeting the criteria of Part 1926 Subpart M, with the lanyard attached to the boom or basket, as required by OSHA §1926.556.
8. Because falls from structural members constitute a serious and clearly recognizable hazard, fall protection for all steel or concrete beams and other structural elements must be in place prior to erection to provide fall protection for workers involved in the initial erection and in subsequent operations until the deck forms are in place. This fall protection shall consist of personal fall arrest systems, safety nets, or other means meeting the requirements of Part 1926 Subpart M.

   During the initial connection of structural elements, workers exposed to moving members shall be required to tie off only if they are not exposed to a greater risk from the moving member. Initial connection is defined as that period during placement or removal of structural members when the member is supported by a crane or other lifting device.

9. During the installation of bridge deck forms, either wood or stay-in-place (SIP) corrugated metal, all workers must be protected from falls 6 ft (1829 mm) or greater in height by means of personal fall arrest systems, safety nets, guardrail systems, or other means meeting the requirements of Part 1926 Subpart M. If the contractor can demonstrate that using one of the conventional fall protection systems described in Subpart M would create a greater safety hazard or is infeasible, i.e., impossible to construct or would prevent the performance of the required work, an alternate system may be used. The contractor must develop and implement a written fall protection plan meeting the requirements of §1926.502
10. Instances in which it is impossible to provide fall protection for workers are rare. Where an individual worker must rig the fall protection system, and it cannot be accomplished from an aerial

lift or by tying-off to the existing structure, momentary exposure to a fall hazard may be unavoidable. It is essential that adequate planning of construction procedures minimize such occurrence of unprotected exposure to fall hazards. It is equally essential that the fall protection systems utilized actually enhance safety, rather than creating a secondary hazard.

The following table summarizes commonly encountered situations where fall protection is required, the heights at which fall protection must be provided, and the OSHA reference for that requirement.

Table 1. Fall protection requirements in commonly encountered situations.

Situation	Height Requiring Fall Protection	OSHA Reference
Scaffold (>45 in wide)	10 ft (3.0 m)	1926.451(a)(4)
Scaffold (<45 in wide)	4 ft to 10 ft (1.3 - 3.0 m)	1926.451(a)(4)
Swinging scaffold (painter's scaffold)	6 ft (1.8 m)	1926.451 (I)(8); personal fall protection provided must satisfy criteria in 1926.502
Impalement hazard	Any exposure	1926.20(a)(1)
Bridge decks, unprotected sides and edges	6 ft (1.8 m)	1926.500(b)(1)
Bridge decks, form installation	6 ft (1.8 m)	1926.500(b)(2)
Tall steel bridges	6 ft (1.8 m)	1926.501(b)(1); 1926.502(c)
Form work and reinforcing steel	6 ft (1.8 m)	1926.501(b)(5)
Precast concrete erection	6 ft (1.8 m)	1926.501(b)(12)
Ramps, walkways, and runways	6 ft (1.8 m)	1926.501(b)(7)
Aerial lifts	All situations	1926.556(b)(2)(v); personal fall protection must satisfy criteria in 1926.502
Ladders	Varies	1926 Subpart X
Holes and floor openings	6 ft (1.8 m)	1926.501(b)(4)
Working above dangerous equipment	All situations	1926.501(b)(8)
Any situation with potential for tripping, impalement, or other severe hazard	Any height	1926.20(a)(1), 1926.28(a)

SECTION 3: ELECTRICAL

Applicable Standards: 1926.400 through 449, 1910.301 through 399, 1926.550(a)(15)

OSHA Focused Inspection Issue: Electrical

Electricity is a serious workplace hazard that must be respected at all times. It is important to remember that exposure to even a little electric current can kill! The best protection around electricity is distance--ample distance between the worker and the conductive materials. The following safe work practices and procedures will help prevent electrical accidents on the jobsite.

A. General Requirements

- Employees should receive instructions on the electrical equipment they are authorized to use.
- When handling electrical storage batteries containing acid, face shields and protective clothing such as rubber gloves and aprons must be worn. Eyewashes (plumbed or portable) with a 15-minute supply of water should be available to immediately flush any acid coming into contact with the eyes.
- Workers should observe and strictly obey all warning and danger signs around electrical apparatus. They should never close a switch that has a danger tag on it signed by or placed there by someone else.
- Untrained people must not open any electrical enclosures. The one exception is that the door on a circuit breaker panel board may be opened to operate the switches, but other types of electrical enclosures should not be opened.
- Extension cords or any power tools or equipment must not be used when the cords are frayed, worn out, or the wires are bare. Defective equipment should be reported to the supervisor and turned in for repair.
- Report all unguarded or broken light bulbs. Do not hang lights by their cords unless the light was designed to be suspended in that manner.

B. Lockout and Tagging of Equipment

- Equipment or circuits that are de-energized must be rendered inoperative and have locks attached at all points where such equipment or circuits can be energized.
- Locks must have the name of the person and the date that work is being performed. The lock may only be removed by the person who placed it on the equipment

C. Installation Safety Requirements

- Live parts of electrical equipment operating at 50 volts or more must be guarded against accidental contact.
- Entrance to rooms and other guarded locations containing exposed live parts must be marked with conspicuous warning signs forbidding unqualified persons from entering.
- All pull boxes and breaker boxes must be labeled to indicate the equipment they switch.
- Electric installations that exceed 600 volts and that are open to unqualified persons must be made with metal-enclosed equipment or enclosed in a vault or area controlled by a lock. In addition, equipment must be marked with appropriate caution signs.
- Conductors and equipment must be protected from overcurrent in accordance with their ability to safely conduct current, and the conductors must have sufficient current carrying capacity to carry the load.
- Fuses and circuit breakers must also be located or shielded so that employees will not be burned or otherwise injured by their operation.

D. Safety-Related Maintenance and Environmental Considerations

- All wiring components and utilization equipment in hazardous locations must be maintained in a dust-tight, dust ignition-proof, or explosion-proof condition without loose or missing screws, gaskets, threaded connections, seals, or other impairments to a tight condition.
- Unless identified for use in the operating environment, no conductors or equipment can be located:

✓ In damp or wet locations.

✓ Where exposed to gases, fumes, vapors, liquids, or other agents having a deteriorating effect on the conductors or equipment.

✓ Where exposed to excessive temperatures.

E. Use of Ground Fault Circuit Interrupters and Assured Equipment Grounding Program

To ensure electrical safety from shocks on all construction sites, all 120-volt, single-phase, 15- and 20-amp receptacle outlets must be protected by ground fault circuit interrupters (GFCIs), or an assured equipment grounding conductor program must be established.

In an assured equipment grounding program, one or more competent persons must be designated to implement and enforce the following assured equipment grounding safety procedures at all construction jobsites.

1. Each 120-volt extension cord, tool, piece of equipment, and receptacle needs to be inspected and tested by a designated individual:
    2.
    - Before first use.
    - Before equipment is returned to service following repairs.
    - Before equipment is used after any incident that can be reasonably suspected to have caused damage.
    - Every 3 months.

    - A continuous ground circuit.
    - The equipment conductors are connected properly.
    - There is no ground fault.
    - The cord is "heavy duty" for construction.
3. The purpose of the inspection and testing is to ensure:
4. Each extension cord, tool, or piece of equipment should be visually inspected by the user before each day's use to determine signs of damage.
5. Equipment found to be damaged or defective (frayed or damaged insulation, crushed cable, loose or missing covers or screws, and missing ground prong on plugs, etc.) must not be used until repaired.
6. Equipment suspected to be damaged or defective should be inspected and tested prior to use.

Color	Quarter	Expiration Date
White	First	March 31
Green	Second	June 30
Red	Third	September 30
Orange	Fourth	December 31

7. (Brown will be used to verify that repair is needed.)
8. To verify inspection and testing, a piece of color coded tape may be affixed each time equipment is inspected. Four colors of tape can be used, one for each quarter of the year. The color coding system is as follows:
9. Inspection tape must not be used for any other purpose. Storage of tape should be strictly controlled by the site superintendent.
10. Only persons designated by the site superintendent are authorized to remove inspection tape. Unauthorized removal or defacing of inspection tape should be cause for disciplinary action.

F. Overhead Transmission and Distribution Lines

Applicable Standards: 1926.550, various State regulations

A significant hazard on construction jobsites is the accidental contact of moving equipment with live overhead power distribution and service lines . In general, all overhead electrical lines on a site must be re-routed or de-energized where possible, and the presence of overhead lines should be addressed in the site-specific safety plan. When re-routing or de-energizing of the lines on an entire site is not possible, the overhead lines in close proximity to work activities should be moved or de-energized. Eliminating the potential for overhead contact through re-routing or de-energization is always the preferable means of controlling overhead electrical hazards.

Where work must be done near live lines, the movement of all equipment such as cranes, hoists, derricks, elevators, and other equipment must be guided by an observer who can observe the clearance of the equipment from energized lines and give timely warning to equipment operators.

The minimum clearance between live lines and any jobsite equipment is 10 ft (3.0 m), and the clearance increases with increasing line voltages.

SECTION 4: SCAFFOLDS

Applicable Standards: 1926.451 through 454

OSHA Focused Inspection Issues: Falls, Electrocutions, Struck-By Events

Use of scaffolds exposes workers to a number of different hazards. According to OSHA, the two predominant hazards when working on scaffolds are falling from the scaffold and being struck by a falling object while working on or below a scaffold. The falls are most commonly caused by either the planking or scaffold support structures giving way, or by falling off the edges of the work platforms. In addition to the fall hazards, workers have been electrocuted when either the scaffold structures or conductive tools and materials being used on the scaffold have come into contact with electrical sources.

In 1996 OSHA issued a revised Subpart L that includes revised safety standards for scaffolds. These standards provide general requirements that apply to all scaffolds, additional requirements applicable to specific types of scaffolds, and training requirements for all scaffold work. Requirements for work on aerial lifts were also included in Subpart L.

In the OSHA standards all scaffolds are divided into two general classes: supported scaffolds or suspension scaffolds. A supported scaffold means "one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support." A suspension scaffold means "one or more platforms suspended by ropes or other non-rigid means from an overhead structure(s)."

A key requirement in the OSHA standards is that scaffolds can only be erected, moved, dismantled, or altered under the supervision of a competent person. Such activities can only be performed by experienced and trained employees selected by the competent person. Other duties of the competent person include:

- Determining if scaffold components from different manufacturers can be used together.
- Determining if galvanic actions are taking place when scaffolding materials of dissimilar metals are used together.
- Inspecting the inboard connections of outriggers to support structures before using suspension scaffolds.
- Inspecting wire ropes on suspension scaffolds before and after every shift.
- Evaluating how to keep suspension scaffolds from swaying.
- Determining whether and how a safe means of access can be provided to scaffold erectors.
- Determining when the weather is too severe to work on scaffolds.
- Determining when and how fall protection can be provided to employees erecting and dismantling scaffolds.
- Inspecting manila and synthetic ropes used as toprails and midrails for strength requirements as frequently as necessary.
- Providing work skills and safety training to all employees in scaffold work.

General Requirements

The general requirements for all scaffolds are covered in 1926.451. Guidance regarding scaffold capacities, platform construction, access, use, and fall protection are covered in this section. There are also generic criteria for all supported and suspended scaffolds. Some highlights of this section, including the scaffold issues most commonly cited by OSHA during inspections, include the following points:

- Each scaffold and scaffold component must be capable of supporting, without failure, its own weight and at least four times the maximum intended load applied or transmitted to it.
- Each suspension rope, including connecting hardware, used on adjustable suspension scaffolds shall be capable of supporting, without failure, at least six times the maximum intended load applied or transmitted to that rope.
- Scaffolds must be designed by a qualified person and shall be constructed and loaded in accordance with that design.
- Each platform shall be fully planked or decked between the front uprights and the guardrails at the rear of the scaffold. The front edge of all platforms shall not be more than 14 in (34.3 cm) from the face of the work, unless employees are provided some form of fall protection. Each end of a platform, unless it is cleated or hooked, must extend over the centerline of its support at least 6 in (15.2 cm) to ensure that the platform does not slip off its support.
- When a supported scaffold height-to-base-width ratio exceeds four to one (4:1), the scaffold must be restrained from tipping by guying, tying, bracing, or equivalent means.
- Supported scaffold poles, legs, posts, frames, and uprights shall bear on base plates, mud sills, or other adequate firm foundation. Footings shall be level, sound, rigid, and capable of supporting the loaded scaffold without settling or displacement.
- Suspension scaffold outriggers must securely support the scaffold. Requirements for outrigger connections to the roof or deck, counterweights, outrigger beams, wire ropes, hoists, and other suspension scaffold support devices are given in 1926.451(d).
- When scaffold platforms are more than 2 ft (0.6 m) **above or below** a point of access, portable ladders, hook-on ladders, stair towers (scaffold stairways/towers), stairway-type ladders (such as ladder stands), ramps, walkways, integral prefabricated scaffold access, or direct access from another scaffold, structure, personnel hoist, or similar surface shall be used. Crossbraces shall not be used as a means of access.
- Safe means of access for each employee erecting or dismantling a scaffold (using the devices or methods above) must be provided, where the provision of safe access is feasible and does not

present a greater hazard. The competent person must determine the feasibility and safety of providing the various means of access.

- Scaffolds shall not be moved horizontally while employees are on them, unless the scaffolds have been specifically designed for such movement.
- Scaffolds shall not be erected, used, dismantled, altered, or moved such that they or any conductive material handled on them might come closer to exposed and energized power lines than 10 ft (3.0 m) plus 4 in (10.2 cm) for each 1 kilovolt (kv) of line voltage greater than 50 kv. For live insulated lines with less than 300 volts, the minimum distance shall be 3 ft (0.9 m). Where possible, electrical lines should be de-energized or moved prior to the erection and use of scaffolds near the lines.
- Ladders shall not be used on scaffolds to increase the working level height of employees. Ladders may, under certain circumstances, be used on “large area scaffolds.” A large area scaffold is a supported scaffold erected over substantially the entire work area.
- Each employee on a scaffold more than 10 ft (3.0 m) above a lower level shall be protected from falling to that lower level. Guardrail and/or personal fall arrest systems must be used as a means of fall protection.
- To the extent feasible and safe, each employee erecting or dismantling a supported scaffold must be provided fall protection. The competent person must determine the feasibility and safety of providing the fall protection during supported scaffold erection. During the deployment of suspension scaffolds, fall protection must also be provided whenever employees are exposed to a fall of 6 ft (1.8 m) or more.
- In addition to wearing hardhats, each employee on a scaffold shall be provided with additional protection from falling hand tools, debris, and other small objects through the installation of toeboards, screens, or guardrail systems, or through the erection of debris nets, catch platforms, or canopy structures that contain or deflect the falling objects. Alternatively, employees must be kept out of areas where falling objects may strike them.

In addition to these general requirements for all types of scaffolding, there are additional safety considerations for specific scaffold types. The following OSHA regulations reference the specific requirements for the various types of scaffolds that may be used on bridge RR&D jobsites:

1926.452 (a): Pole scaffolds

1926.452 (b): Tube and coupler scaffolds

1926.452 (c): Fabricated frame scaffolds

1926.452 (d): Plasterers’, decorators’, and large area scaffolds

1926.452 (e): Bricklayers’ square scaffolds

1926.452 (f): Horse scaffolds

1926.452 (g): Form scaffolds and carpenters’ bracket scaffolds

1926.452 (h): Roof bracket scaffolds

1926.452 (I): Outrigger scaffolds

1926.452 (j): Pump jack scaffolds

1926.452 (k): Ladder jack scaffolds

1926.452 (l): Window jack scaffolds

1926.452 (m): Crawling boards

1926.452 (n): Step, platform, and trestle ladder scaffolds

1926.452 (o): Single-point adjustable suspension scaffolds

1926.452 (p): Two-point adjustable suspension scaffolds

1926.452 (q): Multi-point adjustable suspension scaffolds, stonesetters' multi-point adjustable suspension scaffolds, and masons' multi-point adjustable suspension scaffolds

1926.452 (r): Catenary scaffolds

1926.452 (s): Float (ship) scaffolds

1926.452 (t): Interior hung scaffolds

1926.452 (u): Needle beam scaffolds

1926.452 (v): Multi-level suspended scaffolds

1926.452 (w): Mobile scaffolds

1926.452 (x): Repair bracket scaffolds

1926.452 (y): Stilts

Training

The scaffold standard requires general training for all employees who perform work while on scaffolds. These employees must be trained by a qualified person, and the training shall include information about the nature of the electrical hazards, fall hazards, and falling object hazards associated with working on scaffolds.

Additional training must be provided to those employees involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold. This additional training must be provided by a competent person, and shall cover the safe means for accomplishing the tasks above. The training must also focus on the need for access provisions and fall protection during scaffold set-up, take-down, and maintenance activities.

SECTION 5: MOTOR VEHICLES AND MECHANIZED EQUIPMENT

Applicable Standards: 1926.600 through 606, 1926.1000 through 1003

OSHA Focused Inspection Issues: Struck-by, caught-between, electrocutions

Many potential hazards are associated with the use of motor vehicles and mechanized equipment on construction projects. Motor vehicles may be involved in accidents due to mechanical failures or operator errors, resulting in injuries to operators themselves or to bystanders. To minimize accidents resulting from the use of motor vehicles, the following safety procedures need to be implemented and enforced on all company projects:

1. All equipment left unattended at night, adjacent to highways or construction areas, should have lights, reflectors, and/or barricades to identify location of the equipment.
2. Supervisory personnel shall ensure that all machinery and equipment is inspected prior to each use to verify that it is in safe operating condition.
3. Rated load capacities and recommended rules of operation must be conspicuously posted on all equipment at the operator's station.
4. Wire rope must be taken out of service when one of the following conditions exist:
    - In running ropes, six random distributed broken wires in one lay or three broken wires in one strand or one lay.
    - Wear of one-third the original diameter or outside individual wires.
    - Kinking, crushing, hoist caging, heat damage, or any other damage resulting in distortion of the rope structure.
    - In standing ropes, more than two broken wires in one lay in sections beyond connections, or more than one broken wire at an end connection.
5. A fire extinguisher of 5 BC rating or higher should be available at all operator stations. Where ordinary combustible materials (wood, paper, plastics) are present, an extinguisher suitable for class A fires should also be available for use.
6. When vehicles or mobile equipment are stopped or parked, the parking brake must be set. Equipment on inclines must have the wheels chocked as well as the parking brake set.
7. All vehicles or combinations of vehicles must have in operable condition at least:
    - Two headlights.
    - Two taillights.
    - Brake lights.
    - Audible warning device at operator's station.
    - Seat belts properly installed.
    - Appropriate number of seats for occupants.
    - Service, parking, and emergency brake system.
    - The vehicle is equipped with an audible, functioning reverse signal alarm.
    - The vehicle is backed up only under the guidance of an observer who says that it is safe to do so.
8. Operators should not travel in reverse with motor equipment having an obstructed rear view unless:
9. Only those trained in the use of a specific type of machinery should be allowed to operate the machinery. Operators of heavy equipment and trucks greater than 26,000 lbs (11,794 kg) gross vehicle weight used in traffic must have a commercial drivers license.
10. Materials handling equipment such as scrapers, front-end loaders, dozers, and similar equipment must be provided with Rollover Protective Structures (ROPS).
11. Accessible areas within the swing radius of cranes, backhoes, and other rotating machinery need to be barricaded to prevent employees from being struck or crushed by the rotating parts of the machinery or their loads.
12. Employees should not ride on or in motor vehicles unless seats with seat belts are provided.

SECTION 6: HAND AND POWER TOOLS

Applicable Standards: 1926.300 through 307

OSHA Focused Inspection issues: Electrical, Struck-by, Caught-between

Tools are such a common part of construction work that it is difficult to remember that they may pose hazards. Workers must learn to recognize the hazards associated with the different types of tools and the safety precautions necessary to prevent injuries from those hazards. To prevent accidents resulting from the use of hand- and power-operated hand tools, management personnel need to implement and enforce the following safe work procedures on all construction jobsites.

A. General Requirements

- Broken, defective, burned, or mushroomed tools should not be used. They should be reported and turned in for replacement.
- The proper tool and equipment should be selected and used for each task. For example, a wrench should not be used as a hammer or a screwdriver as a chisel.
- Leaving tools on scaffolds, ladders, or any overhead working surfaces is hazardous because they may fall. Racks, bins, hooks, or other suitable storage space must be provided to permit convenient arrangement of tools.
- Striking two hardened steel surfaces together is hazardous because pieces of metal may break off; i.e., two hammers, or a hammer and hardened steel shafts should not be struck together.
- The practice of throwing tools from one location to another, from one employee to another, or dropping them to lower levels should be prohibited. When it is necessary to pass tools or material under the above conditions, suitable containers and/or ropes must be used.
- Wooden tool handles must be sound, smooth, and in good condition and securely fastened to the tool.
- Sharp-edged or pointed tools should never be carried in employee's pockets.
- Only non-sparking tools shall be used in locations where sources of ignition may cause a fire or explosion.
- Tools requiring heat treating should be tempered, formed, dressed, and sharpened by workmen experienced in these operations.
- Tools designed to accommodate guards must be equipped with such guards when in use.
- All rotating, reciprocating or moving parts of equipment (belts, gears, shafts, flywheels, etc.) must be guarded to prevent contact by employees using such equipment. Guarding must meet requirements set forth in ANSI B15.1-1953.
- All hand-held power tools (e.g., circular saws, chain saws, and percussion tools) without a positive accessory holding means must be equipped with a constant pressure switch that will shut off the power when pressure is released.
- A positive "on-off" control must be provided on the following hand-held powered tools:

  ✓ Platen sanders, grinders with wheels 2 in (5.1 cm) in diameter or less.

  ✓ Routers, planers, laminate trimmers, nibblers, shears, scroll saws, and jigsaws with blade shanks ¼ in (0.6 cm) wide or less.

- A momentary contact "on-off" control must be provided on all hand-held powered drills, tapers, fasteners drivers, horizontal, vertical and angle grinders with wheels greater than 2 in (5.1 cm) in diameter.

- Besides safety hazards, the use of power tools sometimes creates potential health hazards as well. The use of jackhammer and chiseling equipment often results in silica and nuisance dust exposures that can sometimes be controlled by wetting the work surfaces. Many times, however, the use of dust/mist respirators is required to prevent overexposures.
- In addition to dust hazards, the hand vibration inherent in the use of some power tools may result in a restriction of bloodflow to the hands and fingers, causing numbness or tingling. If workers consistently experience these symptoms after the use of power tools, they should contact their supervisor so that steps may be taken to prevent further harm to the nerves and blood vessels in their hands. The use of a different tool, changes to the offending tool to reduce vibrations, and/or the use of special gloves may be recommended to deal with the vibration problems.

B. Electric Tools

Electric tools present several dangers to the user; the most serious is the possibility of electrocution. The following safe work procedures for electric tools must be implemented and enforced at all company construction projects.

- Tools must: (1) have a three-wire cord with ground and be grounded, or (2) be double insulated, or (3) be powered by a low-voltage isolation transformer. A Ground Fault Circuit Interrupter (GFCI) must be used or the tool must be double-insulated to prevent the worker from electrical shock hazards.
- Never remove the third prong from the plug.
- Electric tools should be operated within their design limitations.
- In general, gloves and safety footwear are recommended during use of electric tools. However, gloves should not be worn when they are a potential entanglement hazard with reciprocating or rotating tools.
- When not in use, tools should be stored in a dry place.
- Electric tools should not be used in damp or wet locations.
- Work areas should be well lighted.

C. Powered Abrasive Wheel Tools

Power abrasive wheel tools present a special safety problem because they may throw off flying fragments. The following safe work procedures for powered abrasive wheel tools need to be implemented and enforced at all company construction projects.

- Portable grinding tools must be equipped with safety guards to protect workers from flying fragments as well as the moving wheel surface.
- Inspecting and sound- or ring-testing abrasive wheels prior to mounting is required to ensure that they are free from cracks or defects. Checking to ensure that the abrasive wheel RPM rating is appropriate for the tool will also help prevent wheel failures.
- The following work rules are appropriate for using a powered grinder:

  ✓ Always use eye protection and a face shield.

  ✓ Turn off the power when not in use.

  ✓ Never clamp a hand-held grinder in a vise.

  ✓ To prevent the wheel from cracking, the user should ensure that it fits freely on the spindle.

✓ Grinding wheel users should never stand directly in front of the wheel during start-up because there is always a possibility that the wheel may disintegrate (explode) when accelerating to full speed.

D. Pneumatic Tools

Pneumatic tools are powered by compressed air and include chippers, drills, hammers, and sanders. The following safe work procedures for pneumatic tools must be implemented and enforced at all company construction projects.

- Pneumatic tools that shoot nails, rivets, or staples and operate at pressures more than 100 lbs/in^2 (7.0 kg/cm^2) must be equipped with a special device to keep fasteners from being ejected unless the muzzle is pressed against the work surface.
- Eye protection is required and face protection recommended for employees working with pneumatic tools.
- Hearing protection is required when working with noisy tools such as jackhammers.
- When using pneumatic tools, users should check to see that the tools are fastened securely to the hose to prevent the hose from becoming disconnected. All hoses exceeding ½ in (1.2 cm) inside diameter must have a safety device at the supply source or branch line to reduce pressure in the event of hose failure.
- Airless spray guns that atomize paints and fluids at high pressures (1,000 lbs or more per in^2) (70.3 kg/cm^2) must be equipped with automatic or visual manual safety devices that will prevent pulling the trigger until the safety device is manually released.
- Workers operating a jackhammer are required to wear safety glasses, safety footwear, and hearing protection.
- Compressed air guns should never be pointed toward anyone.
- A safety clip or retainer must be installed to prevent attachments from being unintentionally shot from the barrel of the tool.

E. Liquid-Fueled Tools

Liquid-fueled tools are usually powered by gasoline. Vapors that can burn or explode and give off dangerous exhaust gases are the most serious hazards associated with liquid-fuel tools. The following safe work procedures for liquid-fueled tools need to be implemented and enforced at all company construction projects.

- Gas or fuel should be handled, transported, and stored in approved flammable liquid containers. These containers, also known as safety cans, are no more than 5 gallons (18. 9 l) in capacity and have a spring-closing lid and spout cover that will safely relieve internal pressure when subjected to fire exposure.
- Before refilling the tank for a fuel-powered tool, the user must shut down the engine and allow it to cool to prevent accidental ignition of hazardous vapors.
- Effective ventilation and/or personal protective equipment is necessary when using a fuel-powered tool inside a closed area. Fire extinguishers must be readily available in the work area.

F. Powder-Actuated Tools

Powder-actuated tools operate like a loaded gun and should be treated with the same respect and precautions. Only assigned, qualified operators should operate powder-actuated tools. The following safe work practices and procedures for powder-actuated tools need to be implemented and enforced at all company construction projects.

- All powder-actuated tools must meet ANSI A10.3 requirements for design, operation, and maintenance.
- Powder-actuated tools must never be used in an explosive or flammable atmosphere.
- Before using a powder-actuated tool, the worker should inspect it to determine that it is clean, that all moving parts operate freely, and that the barrel is free from obstructions.
- Never point the tool at anyone.
- Do not load a tool unless it is to be used immediately. Never leave a loaded tool unattended, especially where it would be available to unauthorized persons.
- Suitable eye and face protection are essential when using a powder-actuated tool.
- In case of misfire, the operator should hold the tool in the operating position for at least 30 s, then attempt to operate the tool for a second time. If the tool misfires again, wait another 30 s (still holding the tool in the operating position) and then proceed to remove the explosive load from the tool in strict accordance with the manufacturer's instructions.
- If the tool develops a defect during use, it should be tagged and taken out of service immediately until it is properly repaired.
- Warning signs should be posted within the area of operation of any powder-actuated tool.
- Powder-actuated tool operators must be qualified and carry a card certifying this fact at all times. Failure to comply with any or all safety procedures governing the use of powder-actuated tools will be sufficient cause for the immediate revocation of the operator's card.

SECTION 7: FIRE PROTECTION AND PREVENTION

Applicable Standards: 1926.150 through 159

OSHA Focused Inspection Issue: Electrical

Fire on construction projects is a constant hazard that can cause loss of life, equipment and material. To assist in preventing fires on construction projects, all personnel must comply with the following safe work practices and procedures:

A. Fire Protection

- Access to all available firefighting equipment must be maintained at all times.
- Firefighting equipment must be inspected monthly and maintained in operating condition. Defective or exhausted equipment must be replaced immediately.

- All firefighting equipment should be conspicuously located at each jobsite.

- One fire extinguisher, rated not less than 2A, should be provided for each 3,000 sq ft (279 m^2) of the protected work area. Travel distance from any point of the protected area to the nearest fire extinguisher must not exceed 100 ft. One 55-gallon open drum of water with two fire pails may be substituted for a fire extinguisher having a 2A rating.
- Extinguisher and water drums exposed to freezing conditions shall be protected from freezing.
- Employees should not remove or tamper with fire extinguishers installed on equipment or vehicles or in other locations unless authorized to do so or in case of fire. After using a fire extinguisher, it must be recharged or replaced with another fully charged extinguisher.

- Extinguishers must be selected based on the anticipated fire hazards. To aid in the proper selection of fire extinguishers, the classes of fires are as follows:

- Class A (wood, paper, trash) - use water, dry chemical, or foam extinguisher.
- Class B (flammable liquids, gas, oil, paints, grease) - use foam, carbon dioxide, or dry chemical extinguisher.
- Class C (electrical) - use carbon dioxide or dry chemical extinguisher.
- Class D (combustible metals) - use dry powder extinguisher only.

B. Fire Prevention

- Internal combustion engine-powered equipment should be located so that exhausts are away from combustible materials.
- Smoking is prohibited at or in the vicinity of operations that constitute a fire hazard. Such operations must be conspicuously posted: "No Smoking or Open Flame."
- Portable battery-powered lighting equipment must be approved for the type of hazardous locations encountered.
- Combustible materials must be piled no higher than 20 ft (6.1 m). Depending on the stability of the material being piled, this height may be reduced.
- Driveways between and around combustible storage piles must be at least 15 ft (4.6 m) wide and kept free from accumulations of rubbish, equipment, or other materials.
- Portable fire extinguishing equipment, suitable for anticipated fire hazards on the jobsite, must be provided at convenient, conspicuously accessible locations.
- Firefighting equipment must be kept free from obstacles, equipment, materials, and debris that could delay emergency use of such equipment. Employees should familiarize themselves with the location and use of the project's firefighting equipment.
- All oily rags, waste, and similar combustible materials must be placed in metal containers. The containers must be emptied on a daily basis.
- Storage of flammable substances on equipment or vehicles should be prohibited unless such unit has adequate storage area designed for such use.

C. Flammable and Combustible Liquids

- Explosive liquids, such as gasoline, shall not be used as cleaning agents.
- Gasoline and similar combustible liquids must be stored, transported, and handled in approved and labeled containers in well-ventilated areas free from heat sources.
- Approved wooden or metal storage cabinets must be labeled in conspicuous lettering: "Flammable-Keep Fire Away."
- More than 60 gallons (227.1 l) of flammable or 120 gallons (454.2 l) of combustible liquids should not be stored in any one approved storage cabinet.
- Storage of containers shall not exceed 1,100 gallons in any one pile or area. Separate piles or groups of containers by a 5 ft (1.5 m) clearance. Never place a pile or group within 20 ft (6.1 m) of a building. A 12 ft (3.7 m) wide access way must be provided within 200 ft (61.0 m) of each container pile to permit approach of fire control apparatus.
- The use of flammable liquids and spray finishing needs to conform to the requirements of 1926.66 and 1926.152. Paints and reducers should be stored away from heat sources and out of the sun. Airless spray painting apparatus should be of a type approved for hazardous locations. Any electrically or fuel-powered equipment used to mix, convey, and spray

flammable and combustible liquids must carry an approval from a nationally recognized testing laboratory . Pneumatically operated equipment is usually suitable for use with flammable and combustible finishes.

SECTION 8: SANITATION

Applicable OSHA Standard: 1926.51

OSHA FOCUSED INSPECTION ISSUE: NONE

The following sanitation provisions apply to construction jobsites:

- Employees should not be required to perform work under unsanitary conditions. Adequate supplies of potable water shall be provided at the jobsite. Containers used for drinking water will be clearly marked and not used for any other purpose. Cups must not be shared by employees.
- Outlets for non-potable water (i.e., firefighting purposes) are not to be used by employees for drinking, washing, or cooking purposes.
- All construction projects must have an adequate number of toilets on the jobsite according to the following:

20 or less workers	- 1 toilet
20 or more workers	- 1 toilet seat and 1 urinal per 40 workers
200 or more workers	- 1 toilet seat and 1 urinal per 50 workers

- Handwashing facilities need to be provided in near proximity to the jobsite for employees working where lead is present. Handwashing facilities should also be present when employees are applying paints, coatings, herbicides, and insecticides or in other operations where contaminants may be harmful to the employees. Sinks shall have hot and cold or tepid running water, with soap and hand drying means provided.
- On bridge renovation and demolition sites where lead is present, showers must be provided where feasible-at least one shower for each 10 employees. Shower facilities must have hot and cold running water, with soap and towels provided. Employees must also wash their hands before eating, drinking, and smoking on lead-contaminated bridge RR&D sites. Where showers are provided, employees have to shower at the end of the shift.

Although portable hygiene trailers make it feasible to supply washing and shower facilities at virtually any location, alternatives to having showers on site include using other shower facilities at hotels or campgrounds, provided proper hygiene practices are followed. Where a shower is not located on site, employees must wash their hands and face before leaving the site, and remove all lead-contaminated clothing and shoes before going to the non-site shower facility.

Removing work clothing and shoes protects the employees' cars and the public's health from lead contamination.

SECTION 9: CONTROL OF HAZARDOUS ENERGY

Applicable Standard: 1910.147

OSHA Focused Inspection Issues: Electrical, Struck-by, Caught-between

Whenever maintenance, servicing, or repairs are done to tools and machinery, there is a potential for injury from the accidental energization or movement of the equipment. Prior to beginning any work on equipment, steps must be taken to identify the energy sources present in the equipment, and to ensure that the energy sources are neutralized.

Hazardous energy sources fall into categories such as electrical, pneumatic, hydraulic, and potential (gravity, springs, etc.). One simple control in the construction industry has been to unplug cord-connected equipment. Vehicles and other motorized equipment can be protected from accidental starting by disconnecting the battery. Other controls include the use of identifiable padlocks on disconnects, breaker switches, and valves. Stored energy has the potential for release with great kinetic force and potential for injury. A classic construction injury has occurred when a mechanic working under the raised bed of a dump truck releases the hydraulic pressure in the system and the bed falls, immediately crushing the mechanic.

Although the OSHA construction standards do not currently require a written program for the control of hazardous energy for machinery repair and maintenance, the electrical standards do have a lockout/tagout requirement for work on electrical circuits (1926.417).

SECTION 10: CONFINED SPACE ENTRY

Applicable Standards: 1910.146, 1926.21(b)(6)

OSHA Focused Inspection Issues: Struck-by, Caught-between, Electrical

Although it is not common, some bridge renovation/demolition jobsites may require employees to work in confined spaces. A confined space means a space that:

1. Is large enough and so configured that an employee can bodily enter and performed assigned work.
2. Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).
3. Is not designed for continuous employee occupancy.

Simply working in a confined space is not necessarily a hazard. However, if certain hazardous conditions exist prior to, or are created during entry, then the confined space must be treated with utmost care. Conditions that make a confined space especially dangerous (i.e., make it a permit-required space) are that the confined space:

1. Contains or has the potential to contain a hazardous atmosphere.
2. Contains a material that has the potential for engulfing an entrant.
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section.

4. Contains any other recognized serious safety or health hazard.

A hazardous atmosphere includes spaces that may expose employees to flammable gases, vapors mists, or dusts; to an oxygen deficiency (<19.5 percent) or oxygen enriched environment (>23.5 percent); to air contaminants in excess of the PEL, or to any other atmospheric condition that is an immediate danger to life and health (IDLH).

When a permit-required space is present, the following hierarchy of controls should be used on the space:

1. Try to avoid entry.
2. Eliminate the hazards that make the confined space a permit-required space. Ventilation, lockout/tagout, block and bleed, and other procedures can be used to eliminate hazards. Hazard elimination must be verified by air monitoring and other test procedures.
3. Eliminate the hazards to the point that only atmospheric hazards remain. Use the "atmospheric hazard only" procedures entry system discussed in 1910.146(c)(5).
4. Minimize and control hazards to the fullest extent possible, and enter only after the requirements of a full permit entry have been satisfied. An example describing a full-permit entry is provided in appendix F along with a sample permit entry form.

Should steps 3 or 4 be required, employees must receive training on confined spaces so that they will acquire the understanding, knowledge, and skills necessary for a safe entry into the confined space. Confined space training should be documented on a form similar to appendix D. A sample confined space entry permit is found in appendix F.

SECTION 11: WELDING AND CUTTING

Applicable Standards: 1926.350 through 354, 1926.62, 1926.55, 1926.1127, 1926.102 and 103

OSHA Focused Inspection Issue: Electrical

Welding and cutting operations present various safety and health hazards. On bridge renovation/demolition sites, welding and cutting operations on lead-painted surfaces often create lead fumes by "boiling off" the lead. These lead fumes may cause lead poisoning if inhaled or ingested in excessive amounts. Other metal fumes such as iron oxide, chromium, zinc, manganese, and cadmium may also be present during welding and cutting operations. The health hazards created during bridge renovation/demolition work will be discussed in further detail later in chapters 4 and 5.

Safety hazards such as fire may result in fatalities, serious injuries, and/or property damage. Therefore, in an effort to eliminate or reduce the hazards associated with welding and cutting operations, the following rules and procedures should be included and enforced in any welding safety program.

A. General Rules and Requirements for Employees Performing Welding and Cutting

- Only qualified welders should be authorized to do welding, heating, or cutting.
- Inspect work areas for fire hazards and proper ventilation before welding or cutting.
- Avoid welding or cutting sparks and hot slag. Be alert to hot surfaces and avoid touching metal surfaces until they have cooled.

- Place compressed gas cylinders in an upright position and secure in place to prevent dropping or falling. Handle with extreme care and do not store near any sources of heat.

- Remove any combustibles when welding or cutting must be done. If removal is not feasible, cover combustibles with a noncombustible material. When welding near any combustible material, another employee must be posted to serve as a fire watch. Make sure this person has a fire extinguisher available and keep him/her in the area after welding/cutting is completed until all danger of fire is past. A hot-work permit system may be used at some jobsites, such as welding in permit-required confined spaces or welding on bridges that have pipelines containing hazardous materials.
- When working in the vicinity of welding operations, wear approved eyewear and avoid looking directly at the flash as serious flash burns could result.
- When opening valves on tanks that have regulators installed, be sure the pressure adjustment screw is all the way out and do not stand in front of the regulator. An internal failure could rupture the regulator and cause the adjustment screw to become a missile.
- Primers, paints, and other coatings should be removed, where feasible, from the area to be heated and for at least 4 in (10.2 cm) on all sides. When working with thin pieces of metal, it may be necessary to remove coatings even more than 4 in (10.2 cm) from the area to be heated

B. Specific Rules and Requirements for Employees Performing Gas Welding and Cutting

- When transporting, moving, and storing compressed gas cylinders, always ensure that the valve protection caps are in place and secured.

- Secure cylinders on a cradle, slingboard, or pallet when hoisting. Never hoist or transport the cylinders by means of magnet or choker slings.

- Move cylinders by tilting and rolling them on their bottom edges. Do not allow cylinders to be dropped, struck, or come into contact with other cylinders violently.

- Secure cylinders in an upright (vertical) position when transporting by powered vehicles.
- Do not hoist cylinders by lifting on the valve protection caps.
- Do not use bars under valves or valve protection caps to pry cylinders loose when frozen. Use warm, not boiling, water to thaw cylinders loose.
- Remove regulators and secure valve protection caps prior to moving cylinders, unless cylinders are firmly secured on a special carrier intended for transport.
- Close the cylinder valve when work is finished, when cylinders are empty, or when cylinders are moved at any time.
- Secure compressed gas cylinders in an upright position (vertical) except when cylinders are actually being hoisted or carried.
- Oxygen cylinders should be stored at least 20 ft (6.1 m) from other combustible materials such as acetylene. Alternatively, oxygen and fuel gas cylinders may be separated by a 5 ft-high (1.5 m) non-combustible barrier with at least a 30-minute fire resistance rating.

C. Specific Rules and Requirements for Employees Performing Arc Welding and Cutting

- Use only manual electrode holders that are specifically designed for arc welding and cutting.
- All current-carrying parts passing through the portion of the holder must be fully insulated against the maximum voltage encountered to ground.
- All arc welding and cutting cables must be completely insulated, flexible type, and capable of handling the maximum current requirements of the work in progress.

- Employees should report any defective equipment to their supervisor immediately and refrain from using such equipment.
- Shield all arc welding and cutting operations, whenever feasible, by noncombustible or flameproof screens to protect employees and other persons working in the vicinity from the direct rays of the arc.

D. General Rules for Fire Prevention

- Welders should locate the nearest fire extinguisher in their work area in case of a fire emergency. Fire extinguishing equipment must be immediately available in the work area.
- Never use matches or cigarette lighters to light torches. Use only friction lighters to light torches.
- Never strike an arc on gas cylinders.
- Move objects to be welded, cut, or heated to a designated safe location. If the objects cannot be readily moved, then all movable fire hazards in the vicinity must be taken to a safe place or otherwise protected.
- Fuel lines should have flashback arresters.
- Do not weld, cut, or heat where the application of flammable paints, or the presence of other flammable compounds, or heavy dust concentrations creates a hazard.
- Additional employees must be assigned to guard against fire while the actual welding, cutting, or heating is being performed when the operation is such that normal fire prevention precautions are not sufficient.
- Prior to applying heat to a drum, container, or hollow structure, provide a vent or opening to release any built-up pressure during the application of heat.
- Never cut, weld, or heat on drums, tanks, process lines, or containers that have contained flammable liquids until they have been purged and cleaned.

SECTION 12: FLOOR AND WALL OPENINGS

Applicable Standards: 1926.500 through 503

OSHA Focused Inspection Issues: Falls

Because of the potential hazards involved in floor and wall openings, the following safe work procedures need to be implemented and enforced at all company projects:

A. General Requirements

- All floor openings must be guarded by a standard railing and toeboards or cover.
- Ladderway floor openings or platforms must be guarded by standard railings with toeboards on all exposed sides, except at entrance to opening, where a swinging gate allows passage through the railing.
- Barricades for warning workers of hazards must be at least 6 ft (1.8 m) back from the edge of the hazard and 42 in (106.7 cm) high.
- Hole covers must be strong enough to support possible loads and secured in place to prevent slipping.
- Guard all open-sided floors or platforms 6 ft (1.8 m) or more above the adjacent floor or ground level with a toprail, midrail, and toeboard.
- Guard all wall openings that have a drop of more than 4 ft (1.2 m), and where the bottom of the opening is less than 3 ft (0.9 m) above the working surface with a toprail, midrail, and toeboard.
- Do not store materials within 6 ft (1.8 m) of floor openings or the roof.

SECTION 13: EXCAVATIONS

Applicable Standards: 1926.650 through 652

OSHA Focused Inspection Issues: Struck-by, Caught-between, Falls, Electrical

Trenching and excavation work presents a serious risk to all employees. The greatest risk is the cave-in of a trench or excavation. Cave-in accidents are much more likely to result in worker fatalities than any other excavation-related accidents. Other hazards include contact with buried utilities. Because of the hazards associated with excavation work, the following safe work practices and procedures must be implemented and enforced at all company construction projects:

- Remove or support all surface encumbrances whenever their location creates a hazard to employees.
- Identify underground installation (e.g., sewer, utility, fuel) locations prior to opening an excavation. Contact utility companies or owners to advise on the proposed work and ask for the locations of utility underground installations prior to opening an excavation. Additionally, the Underground Facilities Protection Organization (UFPO) can be contacted at 1-800-962-7962 for assistance in identifying utilities in your area.
- Protect, support, or remove underground installations, as necessary, to safeguard employees working in open excavations.
- Structural ramps used by employees as a means of access or egress from excavations must be designed by a competent person.
- Structural ramps for access and egress of equipment must be designed by a competent person qualified in structural design.
- All excavations or trenches that are 4 ft (1.2 m) or more in depth must have a stairway, ladder, ramp, or other safe means of access and egress within 25 ft (7.6 m) of travel in any direction.
- The edges of a trench or excavation must be barricaded when the excavation is not readily seen because of plant growth or some other visual barrier.
- No employees are permitted underneath loads handled by lifting or digging equipment.
- A warning system (e.g., barricades, signals, or stop logs) must be used when mobile equipment is operated adjacent to an excavation.
- Testing must be conducted in excavations where oxygen-deficient atmospheres exist or could reasonably be expected to exist before employees are permitted to enter excavations greater than 4 ft (1.2 m) in depth.
- Take adequate precautions, such as proper respiratory protection or ventilation, to prevent employee exposure to oxygen-deficient and other hazardous atmospheres. Emergency rescue equipment must be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation.
- Never work in excavations where water has accumulated or is accumulating, unless adequate precautions have been taken to protect you against the hazards posed by water accumulation.
- A competent person must:

  ✓ Classify soil types to determine sloping and shoring needs.

  ✓ Monitor water removal equipment and operations.

  ✓ Inspect excavations subject to runoff from heavy rains.

  ✓ Conduct daily inspections of excavations.

- A competent person must conduct inspections of excavations prior to the start of work and as necessary throughout each shift. Inspections must also be made after every rainstorm. Precautions must be taken before employees enter a trench of any depth that shows signs of water accumulation or wall-sloughing due to moisture. Preventive precautions include the use of support or shield systems to prevent cave-ins, and the use of water removal pumps.
- Trenches 5 ft (1.5 m) or more in depth must be shored or sloped back to an angle of incline required to prevent cave-ins. The angle of incline required varies with differences in the soil type, environmental conditions of exposure, and the application of surcharge loads. Any excavation in unstable soil may require shoring or sloping.
- Backfilling and removal of trench boxes or supports shall progress together from the bottom of the trench. Jacks, supports, or braces shall be released slowly, and in unstable soil, ropes shall be used to pull out the jacks and braces from above and clear of the excavation. All personnel shall be clear of the trench.
- Materials must be placed 2 ft (0.6 m) or more from the edge of the excavation. Precautions must be taken to prevent such materials from falling into the excavation.

SECTION 14: STAIRWAYS AND LADDERS

Applicable Standards: 1926.1050 through 1060

OSHA Focused Inspection Issue: Falls

Stairways and ladders are a major source of injuries and fatalities among construction workers. Because of the potential hazards involved in using stairways and ladders, the following safety practices and procedures need to be implemented and enforced at all construction projects.

A. General Requirements

- Ladders that project into passageways or doorways where they could be struck by personnel, moving equipment, or materials being handled must be secured to prevent accidental displacement or be protected by barricades.
- Workers should always face the ladder and use both hands when going up and down ladders. Materials and tools should be lowered or raised by a rope or other mechanical means.
- Hold on to the railing on stairways.
- The areas around the top and base of ladders must be free of tripping hazards such as loose materials, trash, and electrical cords. The same holds true for the bottom of stairways and on stairway platforms.

B. Ladders

- Ladders must be capable of supporting four times the maximum intended load.
- Ladder rungs, cleats, and steps must be parallel, level, and uniformly spaced (not less than 10 in (25.4 cm) nor more than 14 in (35.6 cm)).
- Do not tie or fasten ladders together to provide longer sections unless they are specifically designed for such use.
- All stepladders must be equipped with a metal spreader or locking device.

- Do not paint wooden ladders, except to stencil for identification.
- Maintain ladders free from oil, grease, and other slipping hazards.
- Ladders must extend at least 3 ft (0.9 m) above the upper landing surface and be secured.
- The horizontal distance for the base of the ladder should extend 1 ft (0.3 m) for every 4 ft (1.2 m) in vertical distance.
- Wood job-made ladders must be used at an angle so that the horizontal distance is one-eighth the working length of the ladder.
- Do not use ladders on slippery surfaces unless they have been properly secured or provided with slip-resistant ft.
- Do not move, shift, or extend ladder while occupied.
- Never stand on the top step of a stepladder.
- Ladders must be inspected by a competent person on a periodic basis and after any occurrence that could affect their performance.
- Ladders with structural defects must be tagged with "Do Not Use" or similar language and withdrawn from service until repaired.
- Never use a metal ladder when working on electrical equipment or near electrical equipment where contact is possible.
- Any employee who uses a ladder or stairway must receive training by a competent person in the following areas:

  ✓ Types of fall hazards.

  ✓ Correct procedures for erecting, securing, maintaining, and disassembling fall protection systems.

  ✓ Proper construction (man-made), use, placement, and handling.

  ✓ Maximum intended load-carrying capacities.

  ✓ Requirements contained within 29 CFR 1926 Subpart X.

C. Stairways

- Stairways that are not permanent parts of the structure must have landings of not less than 30 in (76.2 cm) in the direction of travel.
- A platform must be provided where doors or gates open directly on a stairway.

- Metal pan landings and metal pan treads must be filled in with wood or other materials if they are to be used prior to being finished.

- Maintain all parts of stairways free from hazardous projections, such as protruding nails.

- Eliminate slippery conditions on stairways before the stairways are used to reach other levels.

SECTION 15: MATERIALS HANDLING, STORAGE, USE, AND DISPOSAL

Applicable Standards: 1926.250 through 252

OSHA Focused Inspection Issue: Struck-by, Caught-between

Materials handling accounts for 40 percent of lost-time incidents that occur in the construction industry. These injuries are often a result of inadequate planning, administrative, and/or engineering approaches. Therefore, in an effort to reduce workplace injuries, the following safe work practices and procedures will need to be implemented and enforced at all construction projects.

A. General Storage Requirements

- Stack, rack, block, interlock, or otherwise secure all materials and supplies to prevent sliding, falling, or collapse.
- Post the maximum safe load limits for floors within buildings and structures in a conspicuous location. Never exceed the maximum safe load limit.
- Keep aisles and passageways clear to provide for the free and safe movement of material handling equipment and employees.
- Use ramps, blocking, or grading when a difference in road or working levels exists to ensure the safe movement of vehicles between the two levels.
- Do not place material within 6 ft (1.8 m) of any hoistway or floor opening inside buildings under construction, nor within 10 ft (3.0 m) of an exterior wall that does not extend above the material being stored.
- Stack bagged materials by stepping back the layers and cross-keying the bags at least every 10 bags high.
- Do not store materials on scaffolds or runways in excess of supplies needed for immediate operations.
- Remove all nails from used lumber prior to stacking.
- Stack lumber on level and solidly supported sills.
- Do not stack lumber higher than 20 ft (6.1 m) (16 ft (4.9 m) if handled manually).
- Stack and block structural steel, poles, pipe, bar stock, and other cylindrical materials, unless racked, so as to prevent spreading or tilting.
- Attach handles or holders to the load to reduce the possibility of pinching or smashing fingers.
- Unload materials close to the point of final use to avoid unnecessary lifting.
- Do not stack non-compatible materials in the same pile.

B. Manual Materials Handling

- Employees working alone should not attempt to lift or move a load that is too heavy for one person - get help!

- When working with materials stored in silos, hoppers, tanks, or similar storage areas, be aware that confined spaces may exist.
- Attach handles or holders to the load to reduce the possibility of pinching or smashing fingers.
- Wear protective gloves and clothing (i.e., aprons), if necessary, when handling loads with sharp or rough edges.
- When pulling or prying objects, workers should be properly positioned.
- Riding loads, slings, the ball, crane hook, or other material hoisting equipment is prohibited.

C. Training

Employees should receive instructions on proper materials handling practices during weekly tool-box meetings so that they are aware of the following types of injuries associated with manual handling of materials:

- Strains and sprains from lifting loads improperly, or from carrying loads that are too heavy or large.
- Fractures and bruises caused by dropping or flying materials, or getting hands caught in pinch points.
- Cuts and abrasions caused by falling materials that have been improperly stored, or by cutting securing devices incorrectly.

D. Engineering Controls

Engineering controls should be used, if feasible, to redesign the job so that the lifting task becomes less hazardous. This includes reducing the size or weight of the object lifted, changing the height of a pallet or shelf, or installing a mechanical lifting aid. (See chapter 4)

E. Rigging

OSHA standard 1926.251 provides guidance about the limitations and uses of slings used in conjunction with other material handling equipment for the movement of material by hoisting. Slings covered by this standard include those made of alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope, and synthetic web (nylon, polyester, and polypropylene). Some general work practices related to rigging include:

- Rigging equipment must be inspected prior to use on each shift and during its use to ensure that it is safe. Defective rigging equipment shall be removed from service.
- Rigging equipment must not be loaded in excess of its recommended safe working load. The standard provides load capacity tables for various types of slings and associated hardware.

- Rigging equipment, when not in use, must be removed from the immediate work area.

- Custom rigging must be marked to indicate the safe working loads and shall be proof-tested prior to use to 125 percent of their rated load.

In addition to these general guidelines, the standard has specific requirements related to alloy steel chains, wire rope, natural and synthetic rope, and synthetic webbing. Employees performing rigging work should be adequately trained in the safety and functional aspects of rigging for materials handling operations.

SECTION 16: SIGNS, SIGNALS, AND BARRICADES

Applicable Standards: 1026.200 - 203; Dept. of Transportation Manual on Uniform Traffic Control Devices (MUTCD)

OSHA Focused Inspection Issues: Struck-by, Caught-between

The use of signs, signals, and barricades is essential to make employees aware that an immediate or potential hazard exists. Both traffic and health hazards such as airborne lead are examples of hazards on bridge renovation/demolition sites that require signs and other devices. The following sections discuss the primary ways that employees are made aware of hazards in their work areas. Signs, signals, regulated areas, and barricades must be used on each construction project as appropriate.

A. Accident Prevention Signs/Tags

- Danger Signs are used wherever an immediate hazard (i.e., exposed electrical conductor) exists. The danger signs must have red as the predominant color in the upper panel and a white lower panel for additional sign wording.
- Caution Signs are used to warn against potential hazards or to caution against unsafe practices. The caution signs must have yellow as the predominant color with a black upper panel (yellow lettering of "caution" on the upper panel) and a yellow lower panel for additional sign wording.
- Exit Signs, when required, should be in legible red ¾-in (1.9 cm) stroke letters, not less than 6 in (15.2 cm) high, on a white field.
- Safety Instruction Signs, when used, must be white with a green upper panel and white lettering to convey the principal message. Any additional wording must be in black lettering on the white background.
- Directional Signals must be white with a black panel and a white directional symbol. Any additional wording must be in black lettering on the white background.
- Traffic Signs must be posted at points of hazards in all construction areas. All traffic control signs or devices must conform to the DOT MUTCD and ANSI D6.1-1971, Manual on Uniform Traffic Control Devices for Streets and Highways.
- Accident Prevention Tags are used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc.
- Out of Order Tags are used to designate equipment that requires repair or maintenance. Equipment with such a tag may not be used until the tag is removed.

Additional rules, not specifically prescribed in this section, are contained in ANSI Z35.1-1968, Specifications for Accident Prevention Signs, and Z35.2-1968, Specifications for Accident Prevention Tags.

B. Signaling

- Flagmen or other appropriate traffic controls must be provided for operations where signs, signals, and barricades do not provide the necessary protection on or adjacent to a highway or street.

- Signaling directions must conform to DOT Manual on Uniform Traffic Control Devices (MUTCD) and ANSI D6.1-1971, Manual on Uniform Traffic Control Devices for Streets and Highways.
- Stop/Slow sign paddles must be used by flagmen when hand signaling. Red flags, at least 18 in (45.7 cm) square, may be temporarily used in traffic control.
- Flagmen are required to wear a red or orange reflective warning vest and a hard hat while flagging.
- Required signs and symbols must be visible at all times when work is being done, and removed or covered promptly when the hazard no longer exists.

C. Cones, Barrels, Barricades, and Barriers

- Channelizing devices such as cones, barrels, or barricades are required for jobsite roadways presenting a hazard to motorized equipment or vehicles. Barriers may also provide a greater degree of work zone protection. Consult traffic control resources such as the DOT MUTCD for guidance on establishing and working in road construction work zones.
- Channelizing devices must conform to sections in the DOT MUTCD and ANSI D6.1-1971.

D. Regulated Work Areas

- In and adjacent to areas where overexposures to the lead PEL exist, warning signs informing employees and visitors of the lead hazards must be posted. The signs should read:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

SECTION 17: CRANES, DERRICKS, AND HOISTS

Applicable Standards: 1926.550 - 556

OSHA Focused Inspection Issues: Struck-by, Electrical, Falls

Accidents involving cranes often are caused by human actions or inaction. Therefore, each company must employ competent and careful operators who are physically and mentally fit and thoroughly trained in the safe operation of crane and rigging equipment and the safe handling of loads. Upon employment, the crane operator should be initially assigned to work with the crane and rigging foreman only on selected work, and he/she should be monitored closely for a period of not less than 1 week.

A. General Requirements

The target goal of a crane safety program is zero crane accidents. To achieve this goal, the following safe work procedures must be implemented and enforced at all company projects:

- Crane operators are required to comply with crane manufacturer's specifications and limitations applicable to the operation of any and all cranes, derricks, and hoists.
- Rated load limits and recommended operating speeds, special hazard warnings, or instructions must be posted on all equipment.

- Hand signals to crane and derrick operators must conform with the applicable ANSI standard for the type of crane being used.
- A competent person who is knowledgeable in proper crane setup and operation activities must inspect all machinery and equipment prior to each use, and during use, to ensure it is in safe operating condition.
- Any defective parts must be repaired or replaced before use.
- A competent person who is knowledgeable in crane inspection techniques must perform an annual inspection of the hoisting machinery and provide a copy of the dates and results of inspections for each hoisting machine and piece of equipment to the site superintendent.
- All moving parts or equipment (belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheel, etc.) must be guarded to prevent contact by employees.
- Accessible areas within the swing radius of the rotating superstructure of the crane must be barricaded to prevent an employee from being struck or crushed by the crane.
- Exhaust pipes must be guarded or insulated to prevent contact by employees.
- Windows in cabs must be of safety glass, or equivalent, that introduces no visible distortions.
- Where necessary, a ladder or steps must be provided to allow access to a cab roof.
- Platforms and walkways must have anti-skid surfaces.
- A fire extinguisher of 5BC rating must be accessible at all operator stations or cabs of equipment.No part of a crane or load is permitted within 10 ft (3.0 m) of electric power lines, except where electrical distribution and transmission lines have been de-energized and visibly grounded. A person will be designated to observe clearance of the equipment and provide timely warning to the crane operator.
- No employee is permitted to work beneath a suspended load.

B. Site Superintendent Responsibilities

As part of a crane safety program, site superintendents are required to:

- Develop a working knowledge of the client's requirements for operating construction cranes, derricks, or hoists on project property.
- Conduct a detailed crane standards review meeting with supervisory staff members.
- Provide a copy of company crane and rigging procedures to supervisory personnel, crane operators, and riggers.
- Interview prospective crane operators prior to site employment to ascertain competence and qualifications.
- Check the prospective crane operator's past experience with previous employers, if possible.
- Ensure that the crane operator meets Interstate Commerce Commission physical requirements. Place only those applicants who have passed the medical examination in crane operations.
- Conduct daily inspections to observe compliance with established company and client crane and rigging procedures.
- Immediately shut down any crane operations that jeopardize the safety of any jobsite personnel.
- Immediately notify the corporate safety director of any crane or rigging accidents and operational problems that are not resolved by the operator and site supervisor.
- Ensure that crane equipment rental companies furnish:

  ✓ Current "Crane Hook Magna Flux Certificate" authorized by a certified testing laboratory, manufacturer, or metallurgist.

  ✓ Copy of last annual inspection of crane as required by OSHA.

  ✓ Results of crane operator's physical examination (if crane operator is to be furnished by rental company).

- ✓ Load diagrams for the crane.

C. Crane or Derrick Suspended Personnel Platforms

During some bridge work, crane or derrick suspended personnel platforms may be used to provide access to parts of the bridge structure when no other means of access is feasible. The safe use of suspended platforms requires the use of specially designed platforms, appropriate cranes and rigging, and properly trained crane operators and platform users. The requirements governing platforms, cranes, and proper work practices related to suspended personnel platforms found in 1926.550 (g) must be implemented.

Cranes

Because people are being lifted by the crane on the platform, stringent crane and rigging criteria are required to ensure the safety of the suspended platform occupants.

- Load line wire ropes must be capable of supporting over 10 times the maximum intended load.
- The total weight of the fully loaded personnel platform must not exceed 50 percent of the rated capacity for a given radius and boom angle.
- Cranes must be equipped with boom angle indicators, boom length indicators, and anti-two-block devices.
- The load line hoist drum must have a system or device on the powertrain, other than the load hoist brake, which regulates the lowering rate of speed of the hoist mechanism.
- The crane must be uniformly level within 1 percent of level grade, and outriggers must be fully extended.

Platforms

The suspended personnel platforms are designed specifically for hoisting employees, tools, and the materials necessary to perform the work. They should not be used for any other purposes. Platforms must be equipped with:

- Standard guardrails and toeboards with the space between the toeboard and midrail enclosed.
- Safety lanyard anchor points.
- Grab rails around the perimeter of the platform.
- Adequate headroom and overhead protection as necessary.
- A plate or marking that clearly indicates the weight of the platform and its rated load capacity.

Work Practices

A variety of work practices must be employed during the use of suspended personnel platforms to ensure the safety of the occupants:

- Prior to the use of a platform, a trial lift must be conducted on an unoccupied platform loaded to the anticipated maximum load weight. A competent person who is familiar with the issues regarding crane safety and suspended personnel platforms should conduct the trial lift.
- All parts of the body should be kept inside the platform structure during lifts.
- Where possible, the platform must be secured to the work structure before starting work.
- Following the lift, the crane operator must engage load and boom hoist drum brakes, swing brakes, and locking devices such as pawls or dogs when the platform is in a stationary working position.

- The crane operator must stay at the controls at all times when the crane engine is running and the platform is occupied. Some form of communication (visual, radio, signal person) must be employed at all times.
- All occupants of the platform must use a body harness and lanyard attached to a suitable anchor point.
- Prior to all lifts when the crane has been initially set or moved to a new location, all participants (crane operators, platform users, signal personnel) must have pre-lift meeting to ensure that the proper platform lifting procedures are followed.

SECTION 18: DEMOLITION

Applicable OSHA standards: 1926.850 - 860

OSHA Focused Inspection Issues: Falls, Struck-by, Caught-between, Electrical

A. Preparatory Operations

- Prior to starting demolition operations, an engineering survey must be performed by a competent person to determine the condition of the framing, floors, and walls. In some jurisdictions, the competent person must be a professional engineer.
- All electric, gas, water, steam, sewer, and other service lines must be shut off, capped, or otherwise controlled.
- If hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in pipes, tanks, or other equipment on the property, testing and purging must be performed to eliminate the hazard prior to demolition.

B. Stairs, Passageways, and Ladders

- Only use stairways, passageways, and ladders designated as means of access to the structure of a building.
- Stairs, passageways, ladders, and incidental equipment must be periodically inspected and maintained in a clean and safe condition.
- Stairwells must be properly illuminated and completely and substantially covered over at a point not less than two floors below the floor on which work is being performed.

C. Mechanical Demolition

- Employees should never enter any area that may be adversely affected by demolition operations when balling or clamming is being performed, unless they are needed to perform these operations.
- During demolition, a competent person must make continued inspections as the work progresses to detect hazards resulting from weakened or deteriorated floors, or walls, or loosened material

SECTION 19: ILLUMINATION

Applicable OSHA Standards: 1926.26, 1926.56, 1926.404, 1926.405

OSHA Focused Inspection Issue: Electrical

The proper illumination of bridge renovation/demolition worksites sometimes requires special types of lighting equipment and wiring. Within blasting containment enclosures, visibility may be severely limited and artificial lighting is often a necessity. Containment enclosures should be designed to eliminate lighting blind spots. In addition, if organic abrasive blasting materials are used, the lighting used in the enclosure must be approved for Class 2, Division 1 locations.

Portable lighting used in wet and other conductive locations can be a possible shock hazard should conductors become damaged and wet. Therefore, all 120-volt lighting fixtures on construction jobsites must be protected by ground fault circuit interrupters (GFCIs). Alternatively, 12-volt DC systems may be used for lighting.

Within 20 ft (6.1 m) horizontally, and 10 ft (3.0 m) vertically, of painting operations with flammable and combustible coatings, all portable lighting equipment must be suitable for hazardous locations.

Construction areas, aisles, stairs, ramps, runways, corridors, offices, shops, and storage areas where work is in progress shall be lighted to at least the following levels with either natural or artificial illumination:

General construction areas	5 ft candles (53.8 lux)
Indoors	5 ft candles (53.8 lux)
General construction plants and shops	10 ft candles (107.6 lux)

Where work requires exacting detail and visual acuity, these requirements shall be treated only as the absolute minimum and increasing foot candle illumination should be provided. Illumination throughout the jobsite should be inspected periodically for adequacy.

SECTION 20: HOUSEKEEPING

Applicable OSHA Standard: 1910.25

OSHA Focused Inspection Issue: NONE

A policy of trash removal and the maintenance of good housekeeping practices should be implemented on all jobsites. The accumulation of construction debris may pose a significant fire hazard in addition to tripping and falling hazards.

Good housekeeping practices are the result of planning and organization. The general contractor and all subcontractors on the site must work together to maintain a clean worksite. The prompt removal of waste materials will permit a free flow of traffic through the work areas. Daily or more frequent inspections shall be conducted by the general contractor to verify that the housekeeping controls are in place and being enforced.

Fires can be prevented by limiting “stacks” of combustible materials and never storing incompatible materials together.

Housekeeping activities in themselves may pose health hazards such as exposures to dusts, biological agents, and discarded chemicals. Liquid and solid waste chemicals must be placed in leak-proof containers for proper disposal.

Some of the bridge structures involved in renovation and demolition activities may be contaminated with bird droppings. In addition to being an unpleasant and unsightly mess, the droppings can harbor disease-causing organisms. Before working in areas fouled with bird droppings, the areas should be thoroughly cleaned with soap and water using high-pressure spray methods.

Cleaning up lead-contaminated equipment, materials, and wastes often creates the potential for excessive lead exposures. Therefore, before performing housekeeping duties on a jobsite where there is lead contamination, employees should be trained in the use of special housekeeping and clean-up procedures such as the use of High Efficiency Particulate Air (HEPA) vacuum systems and wet methods of cleanup to minimize dust exposures. Lead-contaminated dirt and debris must be properly disposed of according to applicable environmental regulations.

SECTION 21: DIVING SAFETY

Applicable OSHA Standards: 1926.1071 through 1092

OSHA Focused Inspection Issue(s): NONE

Construction work on bridges may involve the use of diving operations. The standards listed above contain specific guidelines for safely conducting diving operations for the most common modes of diving such as scuba, surface-supplied air, and mixed gas diving. Diving at depths or under conditions that require decompression involve substantial planning and oversight to avoid illnesses due to narcosis.

Prior to conducting all diving operations, the company must assemble a qualified dive team, suitable equipment, and develop a safe diving practices manual. In addition, specific procedures must be followed before, during, and after each dive. Records of any injuries sustained in diving operations must also be maintained. The following sections briefly summarize some main points addressed in conducting safe diving operations.

A. Dive Team Qualifications

- Each dive team member must have the experience or training necessary to safely perform assigned tasks.
- Training for all dive team members shall ensure that each member knows and can demonstrate properly:

  ✓ The use of all tools, equipment, and systems relevant to the assigned tasks.

  ✓ Techniques of the assigned diving mode.

✓ Diving operations and emergency procedures.

✓ Cardiopulmonary resuscitation (CPR).

✓ Principles of diving-related physics and physiology for dives involving hyperbaric conditions.

- Employees must not be assigned to tasks beyond their training, experience, or capabilities.
- All dives must be supervised by a designated person-in-charge who has the final responsibility for all dive activities.

B. Safe Practices Manual

The company must develop and maintain an accessible safe practices manual that is kept at each dive location. The manual must contain at least the following information for each diving mode:

- Safety procedures and checklists for diving operations.
- Assignments and responsibilities of the dive team members.
- Equipment procedures and checklists.
- Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

C. Pre-Dive Procedures

Prior to any dive, a variety of preparations must take place to ensure the safety of the dive. These include:

- Preparing a list that contains the telephone numbers of an operational decompression chamber, accessible hospitals, available physicians, available means of transportation, and the nearest Coast Guard Rescue Coordination Center.
- Collecting first aid supplies approved by a physician.
- Making a dive plan and assessment, which includes considering diving modes, environmental factors, tasks to be performed, personnel/diving team needs, equipment needs, and emergency plans.
- Briefing employees on the dive plan above and assessing the health status of dive team members.
- Inspecting all equipment to be used in the dive. Equipment must be properly selected and maintained in accordance with 1926.1090.
- Establishing a warning signal in the dive area.

D. Procedures During the Dive

During the dive, practices and procedures must be developed to:

1. Allow for safe entry and exit from the water.
2. Establish communications between dive teams members, and communications with outside emergency providers.
3. Keep dive profiles on each diver, and ensure that decompression tables are available.
4. Ensure the safe use of equipment such as power tools, welding and burning equipment, and explosives.
5. Terminate a dive when diver(s) request a termination or when other hazards arise such as broken communications.

E. Post-Dive Procedures

Many of the procedures followed after a dive ensure that employees do not experience decompression sickness. These procedures include:

1. Checking the physical condition of the diver after each dive.
2. Ensuring that divers are aware of the location of the decompression chambers and of the hazards associated with flying after diving.
3. Providing decompression chambers where specified in 1926.1083(c)(1) and (c)(2).
4. Preparing dive records for each dive as specified in 1926.1083(d).

F. Specifications for Specific Diving Modes

In addition to the general provisions above, there are specific requirements for scuba (1926.1084), surface-supplied air (1926.1085), and mixed-gas diving (1926.1086). These specifications generally set diving depth limits and safe diving procedures for each of these types of diving. The appropriate sections must be consulted during the dive pre-planning process.

SECTION 22: CONTAINMENT

Applicable OSHA Standards: 1926.450 through 453, 550 through 556, and 1050 through 1060.

OSHA Focused Inspection Issues: Falls, Electrical

Blasting areas on bridge renovation/demolition sites are enveloped in containment structures to limit environmental contamination and protect the public and adjacent workers from lead dusts. These structures also aid in collecting blasting debris for classification, disposal, and reuse.

Containment systems generally consist of internal support structures and external enclosure components. Support structures may be flexible such as cables, or rigid such as scaffolding or structural members of the bridge itself. Enclosure materials may also be flexible or rigid such as tarps, wind screens, plywood, or rigid panels made of plastic or metal. Even heat-activated shrink-wrap plastic is being used for containment enclosures. The insides of containment structures are generally kept under negative pressure to the outside to limit the escape of blasting dusts and debris. (See the article by Leroy Mickelsen regarding ventilating containment structures in appendix N for more information.) Enclosures may envelop large areas of the structure or partial areas such as micro- or mini-enclosures.

Whatever containment system is used, it is important that the structure be designed to enable the safe erection and use of the structure. Typical expectations of a safely and properly engineered enclosure include:

- Preventing the emissions of dust and debris that pollute the environment and expose the public and workers adjacent to the structure.
- Allowing for the removal of rust and existing paint from the bridge surfaces.
- Permitting the rapid erection, dismantling, and transfer of the containment structure along the bridge as necessary.
- Withstanding heavy winds and weather conditions that can be expected at the project site.
- Being designed to accommodate the nature and integrity of the bridge, its load-bearing capacity, and its elevation.

- Being designed to consider the proximity of the containment to other structures, and to areas of public access.
- Being designed to permit the continued operation of the bridge during renovation or repair activities.
- Being designed to control, to the best extent possible, exposures to workers inside the containment and to allow for adequate lighting.
- Being designed to be compatible for the method of surface preparation used, such as wet methods or high-pressure methods.
- Allowing for accessibility to work surfaces for both employees and inspectors.
- Being affordable.
- Enabling safe and quick exit from the structure in the event of an emergency.
- Not being readily combustible.
- Not violating any regulations or ordinances.

To accomplish these expectations, pre-planning is required and should be incorporated in the preparation of the site-specific safety plan discussed in chapter 2 and illustrated in appendix M. A pre-planning design team consisting of a structural engineer, mechanical engineer, coatings specialist, and an industrial hygienist should be formed to ensure that the containment system is safe and effective.

Once a containment system has been designed, care must be taken to ensure that it is properly set up, and that employees entering the containment system understand the purpose and use of the containment system. The use of entryways and air-locks and egress methods should be clearly communicated to all workers before they enter the system.

SECTION 23: CONTROL/PERMIT SYSTEMS

Applicable OSHA Standards: 1910.146, 1926.24, 1926.352

OSHA Focused Inspection Issues: None

When a high degree of control is necessary to limit access and regulate activities in work areas because of the nature of the hazards present in these work areas, permit systems can be developed. Typically, permit systems are used for welding, grinding, and other hot work performed in work areas where flammables and combustibles are present. Similarly, access and activities in confined spaces can be regulated through a permit system. On bridge RR&D sites, both permit-required confined spaces and structures or pipelines containing combustibles or flammables may be present, and permit systems should be used.

A typical permit system utilizes a designated person or persons as "gatekeepers" to oversee all access and operations in the permitted work area. Usually the permitted work areas are demarcated by signs, tape, cones, barricades, or other indicators. A written permit that minimally documents that a hazard analysis has been conducted and control measures instituted must be signed by the gatekeeper before access and activities can begin.

Confined Spaces

When hazards cannot be eliminated in a confined space before entry, a permit system must be established to ensure the safety of entrants. In permit-required confined space entries, OSHA specifies that the following information must be included on the confined space entry permit (see 1910.146 (f) and appendix F).

- A description of the permit space to be entered.
- The purpose of the entry.
- The date and the authorized duration of the entry permit.
- The personnel, by name, serving as attendants outside the permit-required space.
- The name of the entry supervisor and his/her signature.
- The hazards of the permit space entered.
- Measures taken to isolate the permit space and to eliminate or control permit space hazards before entry.
- Acceptable entry conditions.
- The results of initial and periodic tests performed for air contaminants.
- A summary of rescue and emergency services that can be summoned and the means to contact the providers.
- Communication procedures between entrants and attendants.
- Equipment used for entry such as air monitoring devices, personal protective equipment, rescue equipment, and communications equipment.
- A list of any other permits used in the space, including hot work permits.
- Any other pertinent information.

Hot Work

Hot work permits are generally issued when hot operations are conducted in areas where flammables and combustibles are present in or near the work area.

Prior to beginning hot operations, a "gatekeeper" or permit authorizing authority must be designated. This person must ensure, preferably through a written permit, that:

- Authorization for hot work from the owner/operator has been obtained.
- The area has been inspected for combustible or flammable materials present in the work location.
- The area has also been evaluated for the presence of ducts and pipes that could inadvertently transmit heat and sparks to other hazardous areas.
- Combustibles or flammables noted in the area have been protected from ignition by:

  ✓ Moving the hot work away from the combustibles/flammables.

  ✓ Moving the combustibles/flammables away from welding operations.

  ✓ Rescheduling operations so that operations that might liberate flammable or combustible materials are not present.

  ✓ Purging or inerting pipes, tanks, and other structures containing combustibles or flammables in the work area.

  ✓ Using guards to confine heat, sparks, and slag.

- Fire extinguishers are available in the area.
- A fire watch has been established.
- Workers have been trained in the use of their equipment and the permit system.
- Other subcontractors in the area affected by the hot operations have been advised.

SECTION 24: WORK OVER WATER

Applicable OSHA Standards: 1926.106; 1926.500,501,502,503

OSHA Focused Inspection Issues: Falls

When work takes place over water, both of the following must be in place:

- A skiff or boat for emergency rescue operations, equipped with paddle or oars, a ring buoy or other life preserver, and a reach extension device. Where water current exists, the skiff or boat must be motorized or occupied at all times. A safety line may be connected between the boat and a structural member capable of maintaining the position of the boat. Under all conditions, the skiff or boat must be located such that it is available for immediate use if an emergency arises. It must not be kept locked or otherwise unavailable.
- One or more ring buoys, with at least 90 ft (27.4 m) of line attached, located at 200 ft (61.0 m) intervals across the distance of the work area that is over water.

In addition, workers exposed to a risk of falling into the water from a height of 6 ft (1.8 m) or more, and not protected by railings or netting, must be protected by a OSHA-approved fall arrest system (lanyard and harness or belt attached to a life-line or other suitable tie-off point), as required by 1926 Subpart M.

Employees should not work alone, where practical, in situations where a drowning hazard exists.

All safety equipment and personal protective equipment must meet OSHA standards. Equipment includes personal fall arrest systems, safety lines, safety nets, life preservers and personal flotation devices, and safety boats. Safety equipment must be inspected prior to and periodically during each use. Equipment showing signs of mildew, broken fibers, deterioration, excessive wear or damage, which could materially affect its strength, must be removed from service. Equipment should not be allowed to become wet, and should be stored in a dry location away from caustics or corrosives, or other sources of damage. If equipment does become wet, it must be thoroughly dried before storing.

Drowning protection must be provided for workers in areas where the danger of drowning exists and passive fall protection (OSHA-specified nets or railing) are not present to prevent workers from entering the water. When active fall protection (lanyards, etc.) is provided, or the workers must work outside the railing, drowning protection is required.

OSHA does not provide specific criteria to determine when the risk of drowning is present. It is considered to exist at any time the depth of water exceeds 5 ft (1.5 m) (or is subject to sudden depth fluctuations to 5 ft (1.5 m) or greater). For depths less than 5 ft (1.5 m), the risk of drowning may exist if swift currents are present, or if a fall into the water may result in the person becoming unconscious or otherwise disabled. Even for depths as shallow as 2 ft (0.6 m) or less, drowning protection may be required under some conditions.

Any workers who may be exposed to accidentally entering the water must wear a U.S. Coast Guard-approved life jacket or buoyant work vest at all times.

Chapter 4. Health Hazard Programs, Practices, and Procedures

SECTION 1: INTRODUCTION

The purpose of this chapter is to discuss the various health hazards found on bridge RR&D sites and to outline programs that will prevent illnesses to workers from recognized health hazards. Potential health hazards abound for workers on bridge RR&D sites. Lead hazards may be created by abrasive blasting, burning, and welding activities. Silica, noise, nuisance dust, carbon monoxide, heat stress, solvent exposures, metal fumes, and ergonomic hazards may also be present on bridge RR&D sites. Many of these hazards can be controlled or eliminated with proper planning and the implementation of effective industrial hygiene programs.

SECTION 2: GENERAL PRINCIPLES OF HEALTH HAZARD CONTROL

Exposure Routes and Limits

Employees on bridge RR&D sites are generally exposed to health hazards through three major routes: inhalation, ingestion, and skin absorption. For example, lead most commonly enters bridge workers' bodies through the inhalation of lead fumes or dust, and through the ingestion of lead-contaminated foods. Solvents in paints and coatings may be absorbed through the skin.

Assessing the extent of exposure through inhalation routes is commonly done by air sampling methods. In air sampling, a known volume of air is drawn through a collection device such as a filter cassette clipped to an employee's collar. The filter is then analyzed for a particular contaminant or contaminants, and an exposure level can be found. When several sampling filters (or other collection devices) are worn by an employee throughout the day, the results of the individual samples can be combined to determine the employee's time weighted average (TWA) exposure level. If 8 hours of sampling is conducted using one or more filters, an 8-hour TWA exposure can be determined. These TWA exposure levels are used to figure out whether exposures are a health hazard by comparing the employee's TWA exposure with established occupational exposure limits. Most established occupational exposure limits, including those for lead, are expressed as 8-hour TWA exposure limits. The limits may be reduced due to longer work days.

Assessing exposures through ingestion and skin absorption are mainly done indirectly, by measuring the level of the contaminant (or its metabolite) in the blood, urine, or other body medium.

For inhalation, ingestion, and sometimes skin absorption routes of exposure, occupational exposure limits have been established that roughly define when the exposure becomes hazardous. Many different groups recommend exposure limits, including OSHA, the National Institute for Occupational Safety and Health (NIOSH), and the American Conference of Governmental Industrial Hygienists (ACGIH). The particular limits may be called by various names such as permissible exposure limits (PELs), threshold limit values (TLVs), occupational exposure levels (OELs), and recommended exposure limits (RELs).

Many occupational exposure limits refer to excessive exposure conditions outside the body, such as the OSHA PEL of 50 micrograms (µg) per cubic meter (m^3) for lead fumes or dust in the air. Other exposure limits, known as biological exposure limits, help detect excessive levels of a contaminant in the body, whatever the route of exposure. The OSHA medical removal trigger point for lead in the blood of 50 µg/deciliter of blood is an example of a biological exposure limit. In this chapter, discussions of various hazards will primarily refer to the OSHA PELs and biological exposure limits where they exist.

Basic Hazard Control Principles

When a hazardous exposure condition is detected through air or biological sampling, a hierarchy of controls is employed to eliminate or reduce the hazard to employees. A hierarchy means that there is a priority order for the controls. In industrial hygiene, the first types of controls usually employed are engineering controls.

A. Engineering Controls

Ventilation: The most prominent engineering control used to eliminate industrial hygiene hazards is ventilation. There are two general types of ventilation controls-general and local exhaust. General ventilation uses non-contaminated air to dilute the levels of a contaminant in the air to a level that is not hazardous. The non-contaminated air can either be blown into the work area, or it can come in on its own by drawing out large amounts of contaminated air from the work area. An example of dilution ventilation on a bridge RR&D site would be providing a supply of clean air into the containment area.

Local exhaust ventilation typically uses smaller amounts of air directed at the source of the problem to control contaminants. An example includes the use of vacuum abrasive blasting systems that capture and recover the spent abrasive and removed substrate materials.

Substitution: Replacing a material that creates a health or safety hazard with a less toxic or safer material is a very useful engineering control technique. Silica hazards from the use of sand in abrasive blasting can be eliminated by substituting a non-silica-based abrasive such as slag, steel shot, organic abrasives, or non-silica-bearing minerals. Flammable solvent-based paints can sometimes be replaced by water-glycol based paints.

Isolation: Employees can sometimes be isolated from a hazardous environment by enclosing or isolating employee work stations from the general environment.

B. Administrative Controls

When engineering controls are not feasible, available, or completely effective, administrative controls may be used. Administrative controls rely on reducing scheduled work times in a contaminated area, thus reducing exposures. Employees may be rotated from a contaminated area to a non-contaminated area to reduce exposure times and, hence, 8-hour TWA exposure levels.

C. Work Practice Controls

Exposures to hazards can be reduced by doing jobs in ways that minimize the creation of hazardous conditions. Vacuuming dusts instead of sweeping or cleaning with compressed air reduces exposures. Using wet methods to clean up contaminated areas may also reduce exposures to dusts.

D. Personal Protective Equipment

When the control measures above have been used and hazardous exposure conditions still exist, various forms of personal protective equipment may be used to protect employees. The use of personal protective equipment is usually a last choice because its effectiveness depends on the proper selection, use, and maintenance of the equipment. All these factors are subject to the laws of entropy and they take a large amount of effort to maintain effectiveness.

Personal protective equipment exists for virtually every part of the body. Commonly used personal protective equipment on bridge RR&D sites includes respirators, ear plugs, safety glasses, gloves, coveralls, safety footwear, and personal fall arrest systems.

E. Respiratory Protection

Before respirators are chosen as a hazard control measure, several steps must be taken. The first step in controlling any potentially hazardous airborne exposure is to measure the concentration of the contaminant through air sampling techniques. Air sampling provides information about whether the contaminant is hazardous to unprotected employees through the airborne route of exposure. Sampling results are compared with published exposure limits such as OSHA's PELs or the ACGIH's TLVs to determine if the contaminant levels in the workplace may be hazardous to workers. For example, OSHA's PEL for lead fumes and dusts is 50 $\mu g/m^3$. OSHA does not require an employer to institute engineering controls or provide respirators when employees are exposed to air contaminant levels below the PEL. However, if an employer chooses to require respirators even when they are not required (e.g., at exposure levels below the PEL), the OSHA respiratory protection requirements in 1910.134 must be followed.

If contaminant levels exceed the PEL, OSHA requires that engineering and work practice controls be applied first to reduce contaminant levels to below the PEL. Only after it has been shown that engineering and work practice controls are unable to reduce exposures to below the PEL, or that these controls are unfeasible, may respiratory protection be considered as an exposure control means.

Once it has been determined that respirators are necessary or required, care must be taken to properly select, use, and maintain the respiratory protection equipment. Both the nature of the air contaminant and its exposure concentration must be considered in properly selecting a respirator.

Employees must be provided training in the proper use and care of the respirators they are provided, and must be medically fit to wear the respirator. The employer must designate a respiratory protection program administrator who is responsible for overseeing the employer's respirator program and conducting the required evaluations of the program's effectiveness. The requirements for an effective respiratory protection program are found in OSHA's 1910.134 regulation. This standard was updated in 1997, and became effective in April 1998. A copy of the 1998 respiratory protection standard and its appendices is found in appendix S.

According to 1910.134, whenever respirators are necessary to protect the health of employees, or whenever an employer requires the use of respirators, the employer must have a written respiratory protection program that covers certain required worksite-specific procedures for respirator use. Note that the written program must be worksite-specific, and in most cases a generic type of program will not suffice unless all of the employer's worksites are identical in nature. The basic elements that must be covered in a written respiratory protection program are:

- Procedures for selecting respirators in the workplace.

- Medical evaluations of employees required to use respirators.
- Fit testing procedures for tight-fitting respirators.

- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations.
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators.

- Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators.
- Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations.

- Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance.

- Procedures for regularly evaluating the effectiveness of the program.

All of the procedures spelled out in the written program must then be implemented.

If employees on a worksite casually use respirators, but they are not required to use them because of worksite overexposure conditions or by employer policy, the employer still has a few obligations. First, the employer must determine that the employee's voluntary or non-mandatory respirator use will not create a hazard. Second, the information provided in appendix D of 1910.134 must be provided to all employees who use respirators not mandatorily worn. Third, an abbreviated respiratory protection program must be implemented that includes provisions for initial medical screening of the voluntary respirator user, means and training so that the user can properly clean, store, and maintain the respirator. And lastly, unless the voluntarily used respirator is a filtering facepiece respirator (e.g., paper dust mask), a short written program must be put together that discusses how the previous three items will be accomplished.

The OSHA respiratory protection standard (1910.134) that went into effect in April 1998 differs from its predecessor significantly in the area of medical evaluations for individuals prior to respirator use. For some employees, the additional stresses on the cardiovascular system associated with using a respirator may be unhealthy. Therefore, the standard requires that, even before an employee is fit tested for a respirator, the employer shall provide a medical evaluation to determine the employee's ability to use a respirator.

The medical evaluation must be done by a physician or other licensed health care professional who uses a mandatory medical questionnaire (found in appendix C of 1910.134) or an initial medical examination that obtains the same information as the medical questionnaire. Prior to giving the medical questionnaire, the health care provider must be given the following information:

- The type and weight of the respirator to be used by the employee.

- The frequency and duration of respirator use.
- The expected physical work effort.
- Additional protective clothing and equipment worn.

- Temperature and humidity extremes that may be encountered.

- A copy of the employer's written respiratory protection program.

- A copy of the 1910.134 standard.

Any positive response to a question on the questionnaire by the prospective respirator wearer triggers a follow-up medical examination by the health care provider.

Upon completion of the initial evaluation (and follow-up exam if necessary), the health care provider must make a medical determination regarding the employee's ability to use a respirator, and provide a written report to the employer regarding the employee's ability to use a respirator, any limitations on respirator use, the need for any further medical evaluations, and a statement that the provider has given the employee a copy of the written medical determination report that is provided to the employer.

The 1998 respirator standard also contains detailed sections on respirator fit testing; the proper use of respirators; the use of respirators in emergency situations; the maintenance, care, cleaning, storage and inspection of respirators; breathing air quality and use in supplied-air type respirators; training; program evaluation; and recordkeeping.

Setting up and maintaining an effective respiratory protection program is hard work, but the effort is necessary in light of the function that respirators serve to protect workers from airborne contaminants. You may want to consult a qualified industrial hygienist to set up an initial respiratory protection program, and training company personnel to administer an ongoing program. A sample written respiratory protection program is provided in appendix U.

SECTION 3: HAZARD COMMUNICATION

Construction projects often require the use of materials and chemicals that are hazardous. Employees must be aware of the identity and hazards of the chemicals they use. The company must establish a Hazard Communication Program in accordance with 29 CFR 1926.59 to ensure that employees understand the nature of the chemical materials they use. A hazard communication program has four main components.

1. A Written Hazard Communication program. The company must prepare a written hazard communication program that contains:
    2.
    - Organizational responsibilities.
    - Designation of a program manager/coordinator.
    - Chemical inventory list (job-site-specific).
    - Material safety data sheet (MSDS) policy.
    - Container labeling policy.
    - Employee information and training.
    - Emergency procedures.
    - Multi-employer jobsites.
3. Material Safety Data Sheets (MSDSs). MSDSs are information and fact sheets prepared by the product manufacturer that inform users of the properties, hazards, and handling requirements for the product. A material safety data sheet must be kept on site (or immediately accessible) for each product that is considered a hazardous material.
4. Employee Training and Education. Employees must be trained to understand how the company hazard communication program functions, the hazards of the materials they use, and their rights under the hazard communication standard.

5. Labeling of Containers and Materials. All hazardous materials used on the worksite must be labeled with identity and hazard warning information. In most cases, the manufacturer's label is a satisfactory label. However, if materials are transferred to a portable container for use by more than one person or for more than one shift, the portable container must also be labeled with identification and hazard information.

SECTION 4: LEAD

Introduction

Lead is a toxic substance that may enter the body by breathing or swallowing lead dusts, fumes, or mists. Once in the body, lead enters the bloodstream and may be carried to all parts of the body. It can especially affect the proper functioning of the kidneys, liver, brain, blood forming, and reproductive systems. Lead poisoning can occur from acute (short term, high level) or chronic (longer term, lower level) exposures. The body can eliminate some of the lead, but if there is continuing exposure to lead, the lead is stored in the body, and it may cause irreversible damage to cells, organs, and whole body systems. After exposure stops, it takes months or even years for all lead to be removed from the body.

Many of the bridges in this country have been primed and painted for years with lead-based coatings. In bridge RR&D work the operations that most often generate lead dust and fume exposures include:

- Flame-torch cutting (burning).
- Welding.
- Sanding, needle gunning, and grinding lead-painted surfaces.
- Abrasive blasting and pot tending.
- Housekeeping activities, such as the clean up of dry, expendable abrasives.
- Abrasive blasting enclosure movement and removal.
- Spray finishing with lead-based coatings (not recommended).

In addition, workers on bridge RR&D sites may be exposed to lead when eating, smoking, or drinking if their food, drink, cigarettes, or hands are contaminated with lead.

In response to these hazards, OSHA established an occupational health standard to protect workers from the adverse health effects associated with lead exposures-Lead in Construction (1926.62). To encourage employers to comply with this standard, OSHA also began a compliance Special Emphasis Program in March 1996 to conduct targeted inspections in construction workplaces where there are lead exposures. A copy of this special emphasis directive (CPL 2.105) is found in appendix R.

Contractor Compliance Program Summary

A. Look for Lead

Perhaps the most important step in preventing lead poisoning is finding out before the job begins if lead is present on structures where welding, burning, abrasive blasting, or any other lead-exposing activities will be performed. Many times the owner will have already determined if lead is present in the structural components or coatings. In Connecticut, potential contractors are informed of the presence of lead on bridge structures, and are required to provide evidence of programs that protect employees from the hazards of lead (see appendix H). Model contract specifications have also been developed for owners of lead-painted bridges who are seeking contractors for RR&D work. The "Model Specifications for the Protection of Workers from Lead on Steel Structures" developed by the Center to Protect Workers' Rights (appendix I) is an example of these contract specifications. These specifications are usually included in contract information to advise potential contractors of the lead hazards present on the jobsite.

If information is not available about the nature of old coatings on bridges, the contractor must make an initial determination to see if lead is present. A visual inspection of the paint layers can sometimes reveal the presence of a red primer coating, which may indicate that a "red lead" primer was used. The presence of lead in coatings can be more definitively determined by taking paint chip samples and having them analyzed for lead, looking at prior maintenance records for indications of lead paint use, and the use of other assessment techniques such as X-ray fluorescence analyzers.

In general, it is probably wise on bridge RR&D sites to assume the presence of lead until exposure monitoring shows otherwise, and contractors should never assume that lead is not present solely on the basis of visual paint characteristics.

B. Lead is Found or Presumed on the Structure, but Potential Employee Exposure Levels are Unknown

When lead is present on the structure (or when there is doubt that the initial screening detected all the lead present), and when there are no prior lead employee exposure level data for similar projects within the last 12 months, an interim basic level lead protection program (LPP) must be established for employees performing certain activities before the structure is disturbed. This basic LPP needs to be set up prior to the commencement of work and kept in place until actual lead exposures can be determined. The basic program consists of:

- Written Compliance Plan and Identification of Exposure Controls. The purpose of a written plan is to pre-plan how the construction activities will be performed to minimize exposures to lead, especially through the use of engineering, administrative, and work practice controls. For example, in planning a job, hydraulic shears could be used for cutting pipes instead of torch cutting, thereby minimizing the creation of lead fumes. Any controls identified to minimize exposures must then be implemented. The written compliance plan is best developed during the preparation of a site-specific safety plan as described in the Hazard Identification, Analysis, and Control section of chapter 2.
- Respiratory Protection Plan. A respiratory protection program compliant with 29 CFR 1910.134 must be established. Respirators must be selected on the basis of assumed exposures for various activities, or on actual historical sampling data for similar jobs. For example, all employees performing abrasive blasting, torch burning, welding, and cutting must be provided with respirators suitable for protection from lead exposures above 2,500 $\mu g/m^3$ of air.
- Personal Protective Equipment and Clothing. Gloves, overalls, hats, shoe covers, and other appropriate personal protective equipment must be provided to and used by employees. The personal protective equipment must protect employees' skin from lead contamination and provide protection from eye and other hazards.
- Change Areas. Areas must be provided so that employees can change into work clothing and other personal protective equipment, and avoid contaminating their own clothes and shoes.
- Hand Washing Facilities. Soap, water and towels must be provided so employees can wash up before eating, smoking, drinking, and leaving the site.
- Initial Blood Lead Tests. Pre-job blood testing must be offered to determine blood lead and zinc protoporphyrin (ZPP) levels.
- Employee Training. Employees must be made aware of the hazards of lead, the use of personal protective equipment, the use of hygiene and change facilities, and the engineering, work practice, and administrative controls that will be used on the site to minimize lead exposures.

The basis for requiring this interim basic LPP is that, until lead monitoring is completed, employees performing the various lead-disturbing activities listed below on leaded structures have exposures presumed to be above the PEL. The following exposures are presumed until monitoring shows differently:

Presumed Exposure = 50 to 500 µg/m³ for the following activities:

- Manual demolition of structures.
- Manual scraping.
- Manual sanding.

- Heat gun application.

- Power tool cleaning with dust collection systems.

- Spray painting with lead.

Presumed Exposure > 500 µg/m³ for the following activities:

- Using lead-containing mortar.
- Lead burning.

- Rivet busting.
- Power tool cleaning without dust collection systems.
- Cleanup activities where dry, expendable abrasives are used.
- Abrasive blasting enclosure movement and removal.

Presumed Exposure > 2500 µg/m³ for the following activities:

- Abrasive blasting.

- Welding.
- Cutting.
- Torch burning.

C. Exposure Monitoring

When lead has been found during the initial screening process, employees' actual lead exposures must be determined through either historical exposure data obtained within the last 12 months or by actual exposure monitoring. Many contractors rely on historical data from past bridge RR&D jobs reflecting lead exposures above the PEL to justify establishing a full lead protection program on subsequent jobs. Extreme care must be exercised, however, when using sampling data from past jobs that show exposures below the lead action level or PEL to justify the establishment of no or a minimal lead protection program on a subsequent job. Factors such as the amount of lead in the paint and substrate, the number of prior paint coatings on the structure, and the nature of the work can vary greatly from structure to structure, rendering historical data unsuitable for determining lead exposures on subsequent jobs.

If historical exposure data are used, an exposure-appropriate lead protection plan as summarized in one of the sections D,E, or F below can be implemented prior to the beginning of the work. If no historical data exist, and employee lead exposure levels are unknown, the interim lead protection program must be established for lead-disturbing activities, and lead exposure monitoring must be done.

Exposure monitoring results can generally be grouped into three categories:

1. Exposures less than the Action Level of 30 µg/m³.

2. Exposures between the Action Level and the PEL of 50 µg/m³.

3. Exposures greater than the PEL of 50 µg/m³.

Exposure monitoring may at first be conducted on a few representative employees who are believed to have the highest exposures. If exposures are found to be above the action level, additional exposure monitoring may have to be done to establish the exposures of each job classification on the site. Periodic monitoring is required for exposures above the action level. All monitoring must consist of personal samples conducted for a full shift, and must represent an employee's regular, daily exposure to lead.

D. Lead Exposures Less than the Action Level

If lead exposure levels are less than the action level, the basic interim lead protection program can be cut back to consist of only the following elements:

- Use of Exposure Controls. Engineering, administrative, and work practice controls implemented to reduce or limit exposures were effective and must be continued.
- Handwashing Facilities. Soap, water, and towels must be provided so employees can wash up before eating, smoking, drinking, and leaving the site.
- Basic right-to-know training on the hazards of lead.
- Records of the lead screening and personal monitoring results must be kept.

E. Lead Exposures Between the Action Level and the PEL

For lead exposures between the action level and PEL, the basic interim lead protection program must be modified somewhat to consist of the following:

- The Use of Exposure Controls. Engineering, administrative, and work practice controls implemented to reduce or limit exposures were partially effective at controlling lead exposures and must be continued.

- Handwashing Facilities. Soap, water, and towels must be provided so employees can wash up before eating, smoking, drinking, and leaving the site.
- Employee Information and Training. Employees must be made aware of the hazards of lead, the use of personal protective equipment, the use of hygiene and change facilities, and the engineering, work practice, and administrative controls that are used on the site to minimize lead exposures. The lead standard must be explained to employees. Training must be repeated annually.
- Medical Surveillance Program. In addition to the initial monitoring for blood lead levels and ZPP, periodic blood monitoring must be provided at a frequency dependent on the employee's blood lead levels. If employees complain of signs or symptoms associated with lead intoxication or if they have blood lead levels above 40µg/dl, medical exams must be provided as soon as possible. Participation by employees in the employer's medical monitoring program is not mandatory. Employees must be provided medical removal protection benefits when they have persistently high blood lead levels or when removal from exposure is recommended by a physician (or through the multiple physician review mechanism).

- Lead screening, personal monitoring, and medical monitoring program results must be kept in accordance with the provisions of 1926.33.

F. Lead Exposures Above the PEL

For lead exposures above the PEL, the basic interim lead protection program must be expanded somewhat to consist of the following:

- Written Compliance Plan and Use of Exposure Controls. Engineering, administrative, and work practice controls implemented to reduce or limit exposures were partially effective in controlling lead exposures and must be continued. Even when the work practice and engineering controls have not fully reduced exposers to below the PEL, these controls must still be fully implemented to reduce exposures as much as possible before considering the use of respirators. The exposure controls used to limit exposures must be summarized in writing. A competent person must inspect the jobsite for adherence to the lead protection program provisions.
- Respiratory Protection Plan. A respiratory protection program compliant with 29 CFR 1910.134 must be established. Respirators must be selected on the basis of the measured exposures for various activities. Table 1 in 1926.62 should be consulted for the proper selection of respiratory protection.
- Personal Protective Equipment and Clothing. Gloves, overalls, hats, shoe covers, and other appropriate personal protective equipment must be provided to and used by employees. The personal protective equipment must protect employees' skin from lead contamination and provide protection from eye and other hazards. If not disposable, equipment must be laundered. Lead-contaminated personal protective equipment should not be taken outside of the job areas.
- Showers and Handwashing Facilities. Soap, water, and towels must be provided so employees can wash up before eating, smoking, drinking, and leaving the site. In addition, when employees are exposed to levels above the PEL, shower facilities must be provided and used where feasible.
- Change Areas. Areas must be provided so that employees can change into work clothing and other personal protective equipment, and avoid contaminating their own clothes and shoes.
- Eating Areas. Eating, drinking, and smoking is prohibited in the job area, and a separate eating and drinking area must be established and kept clean from lead accumulations.

- Employee Information and Training. Employees must be made aware of the hazards of lead, the use of personal protective equipment, the use of hygiene and change facilities, and the engineering, work practice, and administrative controls that are used on the site to minimize lead exposures. The lead standard must be explained to employees. Training must be repeated annually.
- Warning Signs. Warning signs saying "WARNING, LEAD WORK AREA, POISON, NO SMOKING OR EATING" must be placed in the lead work zones.
- Medical Surveillance Program. In addition to the initial monitoring for blood lead levels and ZPP, periodic blood monitoring must be provided at a frequency dependent on the employee's blood lead levels. If employees complain of signs or symptoms associated with lead intoxication or if they have blood lead levels above 40 µg/dl, medical exams must be provided as soon as possible. Participation by employees in the employer's medical monitoring program is not mandatory. Employees must be provided medical removal protection benefits when they have persistently high blood lead levels or when removal from exposure is recommended by a physician (or through the multiple physician review mechanism).

- Records of the lead screening and personal monitoring results must be kept. Medical monitoring results must also be maintained in accordance with 1926.33.

Further details and information about establishing and maintaining a full lead protection program will be discussed in the next chapter. Many organizations have published guidelines and overviews of the lead standard and its provisions. Appendix G provides summary information on the lead standard and its provisions, including a decision tree regarding medical monitoring.

SECTION 5: OTHER METAL FUMES

In addition to creating lead fumes and dusts, blasting, burning, and welding operations may expose employees to other metallic fumes and dusts. Existing paints may contain heavy metals such as chromium, arsenic, cadmium, and zinc, and the metal structure itself may be composed of heavy metal components and iron. Blasting agents, such as metal slags, may also contain toxic metal contaminants such as beryllium and cadmium.

A variety of sampling and biological monitoring methods exist to measure exposures to these contaminants, and sampling may be employed as necessary to assess exposures. Laboratory analysis for many of these metals can be done using the same air sampling filter used to determine airborne lead exposures. Contractors should ask the lab or industrial hygienist collecting the samples about obtaining exposure results for these other metals at the same time lead sampling is conducted.

The following PELs have been established for exposures to metals:

Substance*	Exposure Limit/duration	Type
Chromium (Hexavalent)	0.1 mg/m³ (ceiling level)	PEL
Chromium (Hex., non-sol)	0.01 mg/m³ (8-hour TWA)	TLV
Chromium (total metal)	1.0 mg/m³(8-hour TWA)	PEL
Zinc Oxide Fume	5 mg/m³ 8-hour TWA)	PEL
Cadmium	5 µg/m³(8-hour TWA)	PEL
Arsenic	10 µg/m³(8-hour TWA)	PEL
Iron Oxide	10 mg/m³ (8-hour TWA)	PEL
Total Welding Fume	5 mg/m³ (8-hour TWA)	TLV
Beryllium	2 µg/m³ (8-hour TWA)	PEL

*Because of their toxicities, OSHA has promulgated specific standards for cadmium and arsenic. Please refer to 1926.1127 for cadmium and 1926.1118 for arsenic. Biological exposure indices are also available for many of these substances.

As with most other air contaminants, a variety of engineering, administrative, work practice, and personal protective equipment controls should be used to eliminate the hazards or protect workers from hazardous exposures to these substance.

SECTION 6: SILICA AND OTHER DUSTS

In bridge RR&D work, abrasive blasting is often employed to remove old paints, coatings, and corrosion from steel structures. Employees who perform abrasive blasting and those who tend abrasive blasting operations are often exposed to excessive abrasive dust levels while performing their duties, in addition to the excessive lead levels.

If silica sand is used as the abrasive blasting material, employees must be protected from the silica hazards created during abrasive blasting because exposures to silica exceeding the PEL are common. The current silica dust PEL established by OSHA for the total respirable dust concentration is 10 $mg/m^3 \div (\%SiO_2 + 2)$. The use of other abrasive blasting materials often creates dust hazards as well. Most substitute materials have a PEL of 5 mg/m^3 for the respirable fraction or 15 mg/m^3 for the total dust.

Breathing dust containing crystalline silica particles in excess of the PEL may cause a disabling or fatal chronic lung disease known as silicosis. The dust can cause fibrosis or scar tissue formations in the lungs that reduce the lungs' ability to work to extract oxygen from the air. Exposure to silica may cause lung cancer as well.

Early stages of silicosis may go unnoticed. Continued exposure may result in a shortness of breath on exercising, possible fever, and occasionally bluish skin at the ear lobes or lips. Silicosis makes a person more susceptible to infectious diseases of the lungs such as tuberculosis. Progression of silicosis leads to fatigue, extreme shortness of breath, loss of appetite, pain in the chest, and respiratory failure, which may cause death. Acute silicosis may develop after short periods of exposure. Chronic silicosis usually occurs after 10 or more years of exposure to lower levels of quartz.

Silicosis is a preventable disease. In mid-1996 several governmental agencies such as NIOSH, Mine Safety and Health Administration (MSHA), and OSHA began programs to encourage the eradication of silicosis in the United States. In May 1996, OSHA began a Special Emphasis Program (SEP) for silicosis. This program directed OSHA Area Offices and State Plan States to begin conducting targeted inspections in industries where silica exposures are found. In construction, activities such as jack hammering, rock drilling, abrasive blasting, concrete mixing, concrete drilling, brick and concrete block or slab cutting, and guniting were targeted for inspection activities. A copy of the directive establishing the SEP is found in appendix Q.

To control exposures to silica the hierarchy of controls is used. For engineering controls, non-silica abrasives can sometimes be used to eliminate the silica hazard. Vacuum-blasting locally exhausts silica and other abrasive dusts at the point of operation. Water sprays alone or in combination with abrasive materials can also be used. Needle peening can be used to limit the creation of silica dusts.

Work practice controls may also be employed to reduce blasting dust exposures. Perhaps blasting can be performed on only portions of a steel structure, while combinations of grinding and peening and could be used elsewhere. Abrasive blasting tenders should limit cleanup operations that create dusts such as sweeping or compressed air clean up.

Administrative controls limiting exposure times to blasters are not usually effective since the dust levels created in abrasive blasting are so high. Rotating pot-tending and cleanup employees into non-exposure areas is, however, often effective in reducing daily exposures to abrasive dusts.

When engineering, work practice, and administrative controls are not employed or they are insufficient to fully control exposures to levels below the PEL, an effective crystalline silica control program needs to be established. An effective silica control program should include the following elements:

- An ongoing personal air monitoring program.*
- An ongoing medical surveillance program.
- Providing training and information to workers on crystalline silica.*
- Making available air and medical surveillance data to workers.*

- An effective respiratory protection program.*
- Providing and requiring the use of hygiene facilities and clothing change areas.
- Appropriate recordkeeping.*

- Instituting an effective housekeeping program.*
- In construction, establishing a safety and health program.*

- Establishing regulated areas.

* Required by specific OSHA standards if an overexposure to crystalline silica exists.

In most cases, abrasive blasting with dry materials requires the use of respiratory protection because of the high exposures generated in blasting. Abrasive blasters are usually simultaneously overexposed to lead and to silica, and respirators selected must be capable of protecting employees from both hazards. The most suitable respirator for dually-overexposed employees is the Type CE supplied air abrasive blasting respirator operated in the pressure demand mode. Helpers and cleaners may also be overexposed to silica and a suitable air-purifying dust respirator can be used, provided exposures don't exceed the protection factor of the respirator.

Regardless of the type of abrasive used, employees must be protected from the high impact velocity of the abrasives through the use of suitable personal protective equipment such as leather gloves, aprons, and chaps. Safety shoes should also be worn if heavy pieces of work are handled. In most cases, abrasive blasting with dry materials requires the use of respiratory protection because of the high exposures generated in blasting.

SECTION 7: NOISE

Noise is a common hazard on most bridge RR&D sites. Air compressors, blasting equipment, and pneumatic hand tools may emit noise in excess of 90 decibels on the A scale (dBA). When employees are exposed to average workday noise levels above 90 dBA, permanent hearing loss could occur unless interventions such as engineering controls, personal protective equipment, and hearing conservation programs are implemented. The OSHA requirements for noise exposures on construction sites are found in 1926.52.

Administrative or engineering controls must be utilized to reduce noise exposures exceeding the permissible noise exposure of 90 dBA for an 8-hour TWA (see table below) when feasible. An example of a frequently used engineering control in construction is the use of a muffler on the exhaust port of pneumatic equipment. If such controls are not effective in reducing sound levels to within the levels specified in the table, personal protective equipment (ear plugs or muffs) must be provided to and used by each affected employee, and employees must participate in a hearing conservation program.

Employees must be allowed to select from a variety of hearing protection devices such as ear plugs or ear muffs. If the types of plugs provided to employees have several sizes, employees' ear canals must be measured to ensure the proper fit of the plug. Many one-size-fits-all type plugs are available, and thus eliminate the need for sizing plugs. The use of hearing protection devices is mandatory in work areas where average noise levels exceed 90 dBA. They should be worn in all areas above 85 dBA as well, since some employees may experience hearing losses at exposures to noise levels between 85 and 90 dBA.

In addition to requiring the use of hearing protection at average noise levels above 90 dBA, the employer must implement a hearing conservation program for employees working in areas with noise levels above 90 dBA. The following elements are included in a hearing conservation program:

- Noise Monitoring Program: A monitoring program to determine ambient noise levels in work areas must be developed and implemented whenever information indicates that an employee's exposure may equal or exceed an 8-hour TWA of 90 decibels. A sampling strategy must be designed to identify employees for inclusion into the hearing conservation program while enabling the proper selection of hearing protection. Trained company personnel or contracted services should perform this monitoring. Affected employees or their representatives must have the opportunity to observe any noise measurements, and employees found to be exposed at or above an 8-hour TWA of 90 decibels must be notified of the results of the monitoring.
- Audiometric Testing Program: Audiometric testing must be available, at no cost, to all employees whose exposures equal or exceed an 8-hour TWA of 90 decibels. Employees may refuse to participate in the audiometric testing, but a declination statement from the employee should be obtained to document that the service was offered but refused. These audiometric tests must be performed by a licensed or certified audiologist, otolaryngologist, or other physician or technician certified by the Council of Accreditation in Occupational Hearing Conservation. All noise monitoring and audiometric testing records MUST be retained as part of employees' medical records according to 1926.33.
- Noise Training: All employees in the hearing conservation must be given training regarding:
    -
    - The effects of noise on hearing.
    - The purpose of hearing protectors; the advantages, disadvantages, and attenuation of various types; and instructions on selection, fitting, use, and care of the hearing protectors. (Employees should also be given an opportunity to wear the personal protective equipment in a non-noisy environment.)
    - The purpose of audiometric testing, and an explanation of the test procedures.

All training should be documented on a form similar to that found in appendix D.

PERMISSIBLE NOISE EXPOSURES

Duration per day, (hours)	Sound level dBA
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

SECTION 8: HEAT STRESS

Bridge RR&D activities during the summer months is hot work in many parts of the country. High ambient temperatures combined with the use of protective clothing in a containment enclosure is a recipe for heat illness if employees are not properly informed and protected.

Heat illnesses arise when the body's heat dissipation mechanisms such as sweating and increased bloodflow to the skin are unable to sufficiently remove heat due to metabolic, radiant, and conductive heat sources. When internal body temperatures rise, employees may experience heat-related disorders such as heat cramps, fainting, heat exhaustion, and heat stroke.

Heat exhaustion is characterized by heavy sweating, weakness, fatigue, nausea, and headache. In more serious cases, the victim can vomit or may become unconscious. Recognizing the onset of heat exhaustion and taking steps to cool the body are vitally important in reversing the deadly march toward heat stroke. Employees should rest in a cool or shady place and drink plenty of liquids until symptoms subside.

If the warnings of heat exhaustion are not heeded, employees may lapse into heat stroke, which is often fatal. In heat stroke, the body's temperature regulatory system fails and sweating often ceases because it is inadequate to remove accumulated heat. In heat stroke, internal body temperatures can reach 105ºF (40.6ºC) or higher, and the victim is often mentally confused and delirious or unconscious. Unless immediate steps are taken to reduce body core temperatures through means such as cooling the victim in water or placing the victim in an air conditioned area, brain damage or death could occur.

Like most health hazards, heat exposures are typically controlled through the use of engineering, administrative, and work practice controls. Avoiding exposure to hot ambient conditions is the best prevention-and perhaps work can be performed at night or in the early morning or later afternoon. When work in hot environments cannot be avoided, however, a general heat stress program that utilizes a combination of engineering, administrative, and work practice controls should be employed.

The heat stress program shall consist of at least:

- Acclimatization. Employees who have not been working in hot environments need a 7 to 10 day acclimatization period during which they need to take extra time to rest and replenish fluids.
- Heat Alert Days. Whenever the National Weather Service or other forecasters predict temperatures above 95ºF (35ºC), heat alert days should be declared. On heat alert days the normal production activities take a back seat to avoiding heat illnesses. Employees should be allowed to self-regulate heat exposures through rest periods and the liberal consumption of fluids.
- Heat Stress Engineering Controls When Applicable. The following devices are useful to decrease heat exposures:

  ✓ Respirator vortex cooling tubes used with air-supplied type respirators.

  ✓ Cold jackets that incorporate reusable cold packs placed in pockets throughout the jacket.

- Training and Education. Employees exposed to hot conditions must be trained in:

  ✓ The hazards of heat.

  ✓ Predisposing factors and signs and symptoms of heat injury and illness.

  ✓ Proper work practices, including the use of rest periods and fluid consumption to cool the body.

  ✓ First aid procedures for treating heat illnesses.

- Proper Heat Control Work Practices. The following heat control work practices should be employed on heat alert days:

✓ Limiting the time the employee spends each day in the hot environment by decreasing exposure time and increasing rest time in a cooler environment.

✓ Reducing the metabolic demands of the job by such procedures as mechanization, use of special tools, or increasing the number of workers per task.

✓ Providing adequate amounts of cool water near the work area and encouraging workers to drink a cup of water every 15 to 20 minutes.

✓ Implementing a buddy system in which workers are responsible for observing fellow workers for early signs and symptoms of heat disorders.

Recommended work/rest regimens for various heat exposures have been established by the ACGIH based on the work loads of the employees. The most recent TLV booklet may be consulted to perform a heat stress survey.

SECTION 9: CARBON MONOXIDE

The presence of internal combustion engines, containment systems, and compressor-fed, supplied-air respirators on a bridge RR&D site sets up a potential for carbon monoxide problems. Carbon monoxide produced by gasoline and diesel engines may enter containment systems or the air intakes of supplied-air respirators.

Containment areas must be kept free of internal combustion engines and fuel-fired heaters. In addition, when the containment areas are kept under negative pressure to the outside (i.e., air is being sucked into the structure), care must be taken to locate internal combustion engines away from air intakes to the containment.

To avoid carbon monoxide contamination of breathing air to airline type respirators, the air intake for the system must be located away from all contaminant sources. In addition, the air must be periodically tested to ensure that carbon monoxide is not entering the system. The air quality section of the respiratory protection standard, 1926.103(f), provides additional considerations that must be followed to ensure purity of the breathing air to employees using supplied-air respirators.

SECTION 10: ERGONOMIC HAZARDS

The ergonomic hazards most anticipated on bridge RR&D sites include back strains and sprains from lifting, pushing, pulling and moving tools and materials, vibration-related disorders from the use of power tools, and repetitive motion disorders, especially resulting from work in awkward postures.

Back Injury Hazards

Back injuries may occur from repetitive lifting tasks or from a one-time event. NIOSH has published a Manual Lifting Guide which describes the variables that must be considered to effect safe lifts. These variables include the weight of the object lifted, size and configuration of the object, beginning height of the lift, ending height of the lift, number of lift repetitions, and several other factors. The importance of these factors must be understood by employees doing manual material handling tasks to avoid back injuries due to lifting, and lifts must be designed to stay within the recommended lifting limits.

Vibration-Related Disorders

The use of vibrating hand tools such as jackhammers, chippers, and grinders is associated with damage to the small blood vessels in the hand. The damage can lead to a disorder called Raynaud's disease. Raynaud's disease is characterized by a blanching or whitening of the fingers upon exposure to cold, and a temporary loss of sensation. The condition can often be prevented by using tools that vibrate less or by insulating the hands from the vibratory surface through the use of impact-absorbing materials.

Awkward Postures

Much work on bridge RR&D sites involves work on overhead structures. The act of repeatedly raising the hands above the heart level is a risk factor for the development of cumulative trauma and shoulder disorders. Efforts should be made to ensure that work surfaces are between the knee and heart level to avoid awkward postures.

Ergonomics Resources

Several potential resources exist for employers who are trying to address ergonomic issues at their jobsites. Workers' compensation insurance carriers often have people on staff who are knowledgeable in back injury prevention and other good ergonomic practices. At the employer's request, an ergonomics specialist from the insurance company can often visit a site or observe a troublesome job to suggest ways of avoiding back injuries or repetitive strain injuries. Some State and Federal OSHA 7(c)(1) consultation programs also provide ergonomics assistance to employers.

SECTION 11: SOLVENT EXPOSURES

The use of solvent-based paints may present health hazards to workers on bridge RR&D sites, especially if the paints are applied by spray apparatus in the containment enclosure. Spray finishing with combustible and flammable materials is also a fire risk. Other solvent exposures may arise from the use of chemical paint stripping agents.

Material safety data sheets (MSDSs) should be reviewed prior to painting or using chemical strippers to determine the solvents present in the products used on the job. Air monitoring should be conducted, especially in enclosed situations, to assess the level of solvent exposures to employees. Any overexposure conditions revealed by the monitoring should be corrected by using the engineering control, administrative control, work practice control, personal protective equipment hierarchy.

Chapter 5. Lead Compliance Guideline

SECTION 1: INTRODUCTION

This section of the guideline discusses the specific elements covered in the OSHA lead-in-construction standard, 29 CFR 1926.62, which aims to protect all workers from the potentially harmful effects of lead exposure. A copy of 1926.62 and its appendices is found in appendix J. Additional requirements may be required by State and local regulations.

Lead is a well-known poison that will severely and permanently damage blood, kidneys, and the central nervous and reproductive systems. Extreme caution must be taken whenever working on lead-coated surfaces because of the high exposures that can be expected while performing most tasks that involve work on structural steel.

Operations that generate lead dust and fumes when performed on lead-painted surfaces include the following:

- Flame-torch cutting.
- Welding.
- The use of heat guns.
- Sanding, scraping, and grinding.
- Abrasive blasting.

The employer of construction workers is responsible for the development and implementation of a worker protection program in accordance with 29 CFR 1926.20 and 29 CFR 1926.62(e). This program is essential in minimizing worker risk of lead exposure. Construction projects vary in their scope and potential for exposing workers to lead and other hazards. Some bridge projects may involve limited exposure, such as the removal of paint from a small area for inspection or repair. Others may involve the removal, or stripping off, of substantial quantities of lead -based paints on large bridges. The employer should, as needed, consult a qualified safety and health professional* to develop and implement an effective worker protection program.

The most effective way to protect workers is to minimize exposure through the use of engineering controls and good work practices. It is OSHA policy that respirators are not to be used in lieu of engineering and work practices to reduce employee exposures to below the PEL. Respirators can only be used in combination with engineering controls and work practices to control employee exposures.

OSHA's PEL for lead in construction limits worker exposures to 50 $\mu g/m^3$ of air averaged over an 8-hour workday.

At the minimum, the following elements should be included in the employer's worker protection program for employees exposed to lead:

- Hazard determination, including exposure assessment.
- Engineering and work practice controls.
- Respiratory protection.
- Protective clothing and equipment.
- Housekeeping.

- Hygiene facilities and practices.
- Medical surveillance and provisions for medical removal.
- Training.
- Signs.
- Recordkeeping.

To implement the worker protection program properly, the employer needs to designate a competent person, i.e., one who is capable of identifying existing and predictable hazards or working conditions that are hazardous or dangerous to employees, in accordance with the general safety and health provisions of OSHA's construction standards. The competent person must have the authorization to take prompt corrective measures to eliminate such problems. Qualified medical personnel must be available to advise the employer and employees on the health effects of employee lead exposure and supervise the medical surveillance program.

* Sources for professional safety and health advice include insurance carriers, trade organizations, State 7(c)(1) on -site consultation programs, and consultants.

SECTION 2: ASSESSING EXPOSURES

OSHA requires employers to do an initial exposure assessment to determine the levels of exposure for employees on the job. There are two ways to do this:

- Task-based assessment.
- Data-based assessment.

Task-Based Assessment

This method uses OSHA's breakout of tasks and mandatory interim protective measures to determine the levels of exposure for employees on each job. OSHA has identified certain tasks, including many common operations, that have the potential to create exposures at the PEL or above. These tasks are grouped into three lists according to their potential exposure level.

Each task group is associated with a list of mandatory interim protective measures to protect employees while exposure assessment monitoring is being done. OSHA requires these interim protective measures to be implemented during the initial exposure assessment period. The measures can only be discontinued if monitoring results show that the exposure level on the job is below the PEL. Once the exposure monitoring is completed, the interim protective measures can be tailored to fit the measured exposure levels.

The task-based assessment assumes a level of exposure that may be higher than the levels that actually exist, so the protective measures listed will offer maximum protection for employees.

If the task performed is in one of the following OSHA groups, the protective measures you need to take during exposure assessment are listed here. Note the respirator level change in each group.

Group 1 Tasks:

- Manual demolition of building components (e.g., dry wall) coated with lead-based paint.

- Manual dry scraping and dry sanding of surfaces coated with lead-based paint.
- Heat gun applications on surfaces coated with lead-based paint.
- Power tool cleaning with dust collection systems.
- Spray painting with lead-based paint.
- When employer has reason to believe employee is doing job activity where lead exposure may be above PEL.

Protective Measures:

- Appropriate personal protective clothing and equipment.
- Change areas.
- Handwashing facilities and showers.
- Biological monitoring for lead and ZPP.
- Appropriate training under the Hazard Communication Standard, in respiratory protection, and in safety.

* Respiratory protection rated for exposures up to 500 µg/m³ (minimum protection factor of 10) such as an air-purifying, half-mask respirator with twin N, P, or R 100 cartridges. (A simple dust facemask is NOT sufficient.)

Group 2 Tasks:

- Using mortar that contains lead.
- Lead burning.
- Rivet busting on steel coated with lead-based paint.
- Power tool cleaning without dust collection systems where surfaces are coated with lead-based paint.
- Cleanup activities where dry, expendable abrasives are used on surfaces coated with lead-based paint.
- Abrasive blasting enclosure movement and removal on structures coated with lead-based paint.

Protective Measures:

- Appropriate personal protective clothing and equipment.
- Change areas.
- Handwashing facilities and showers.
- Biological monitoring for lead and ZPP.
- Appropriate training under the Hazard Communication Standard, in respiratory protection, and in safety.

* Respiratory protection rated for exposures of 500-2,500 µg/m³ (minimum protection factor of 25) such as a powered air purifying respirator (PAPR).

Group 3 Tasks:

- Abrasive blasting of structures coated with lead-based paint.
- Welding, cutting, torch burning of structures coated with lead-based paint.

Protective Measures:

- Appropriate personal protective clothing and equipment.

- Change areas.

- Handwashing facilities and showers.
- Biological monitoring for lead and ZPP.
- Appropriate training under the Hazard Communication Standard, in respiratory protection, and in safety.

* Respiratory protection rated for exposures greater than 2,500 µg/m³ (protection factor above 50) such as a supplied-air positive pressure respirator.

Data-Based Assessment

This type of assessment may be handled in a number of ways. Depending on the nature of the job, initial exposure assessment may be based on:

- Air monitoring done under current on-site job conditions.

- Air monitoring results obtained under essentially the same conditions on another job within the past 12 months.
- Objective data from outside industry sources where exposures are consistently below the PEL (trade associations, insurance companies, and suppliers).

If the data demonstrate conclusively that no employee, using the specific materials and processes under the conditions of the work site, can be exposed to lead above the action level (30 µg/m³ TWA), an employer is not required to take any further measures unless conditions change.

Previous Air Monitoring

If the task performed is on one of the OSHA lists, the employer can use results of previous on-site air monitoring done by his/her company:

- Within the past 12 months.
- Under workplace conditions closely resembling those of the current job (including processes, type of material, control methods, work practices, and environmental conditions).

Although monitoring data may indicate different exposure levels than OSHA's assumptions, the employer is still required to implement protective measures that are appropriate to the level of exposure indicated by the monitoring data. (See Section 3 for more details on specific protective measures.)

Objective Data from Outside Sources

IF THE TASK PERFORMED IS <u>NOT</u> ON ONE OF OSHA'S LISTS:

The employer can use objective data from outside sources (trade associations, insurance companies and suppliers), to establish exposure levels. In all cases where previous air monitoring data or outside objective data are used, an employer is required to maintain accurate records showing how the data are relevant to the conditions of the job being done.

It is very important to remember that initial air monitoring must still be performed, whether or not the work that is taking place falls within the three trigger tasks or not.

Below is a summary of the protective measures that are required based on the concentration of lead in the breathing zone of all workers.

Table 2. Lead protection measures by exposure levels.

Control Practice	Exposure below 30 µg/m³ (AL)	Exposure between AL and PEL	Exposure above 50 µg/m³ (PEL)
Determination of the Presence of Lead	X	X	X
Competent Person			X
Exposure Monitoring and Associated Recordkeeping[1]	X	X	X
Mechanical Ventilation			X
Local Exhaust Ventilation			X
Enclosures/Containment Systems[2]			X
HEPA Vacuums	X	X	X
Wetting Agents	X	X	X
Written Compliance Program			X
Warning Signs			X
Worker Training		X	X
Notification of Other Employers	X	X	X
Respiratory Protection			X
Protective Clothes/Gloves/Shoe Covers			
Handwashing Facilities Only	X	X	X
Change Areas with Storage Facilities			X
Decontamination Facilities Including Showers			X
Eating Areas and Facilities			X
Biological Monitoring and Associated Recordkeeping		X	X
Medical Examinations and Associated Recordkeeping[3]			X

[1] Exemption is possible if objective data show that exposures are below the action level or if the employer has relevant data from the past 12 months.

[2] Enclosures are only assumed to be needed indoors on projects using mechanical ventilation. Outdoor enclosures are covered by EPA regulations on environmental release of lead.

[3] Medical removal is dependent on worker blood level.

SECTION 3: ENGINEERING AND WORK PRACTICE CONTROLS

Because lead is a cumulative and persistent toxic substance and because lead-related illnesses may result from low levels of exposure over prolonged periods of time, engineering controls and good work practices must be used where feasible to minimize employee exposure to lead. At a minimum, exposures must not exceed the OSHA interim final PEL of 50 µg/m³ averaged over an 8-hour period. When feasible engineering controls and work practice controls cannot reduce worker exposure to lead to or below 50 µg/m³, respirators must be used to supplement the use of engineering and work practice controls.

Engineering Controls

A competent person should review all site operations and stipulate the specific engineering controls and work practices designed to reduce worker exposure to lead. Engineering measures include local and general exhaust ventilation, process and equipment modification, material substitution, component replacement, and isolation or automation. Examples of recommended engineering controls that can be used to reduce worker exposure to lead are as follows:

- Exhaust Ventilation

  Power tools used for the removal of lead-based paint should be equipped with dust collection shrouds or other attachments exhausted through a HEPA vacuum system. Operations such as welding, cutting/burning, and heating should be provided with local exhaust ventilation. HEPA vacuums should be used during cleanup activities.
  For abrasive blasting operations where full containment exists or is required, the containment structure should be designed to optimize the flow of ventilation air past the worker(s), so that the airborne concentration of lead is reduced and the visibility is increased. The affected area should be maintained under negative pressure to reduce the chances that lead dust will contaminate areas outside the enclosure. A containment structure should be equipped with dust collection and an air- cleaning device to control emissions of particulate matter to the environment.
  Mini-enclosures that contain only that portion of a structure that can be blasted and painted in 1 day should be used where possible. These mini-enclosures are moved as the work progresses.

- Encapsulation

  Perhaps the structural steel does not need to have the coatings removed down to the metal substrate. Lead-based paint can be made inaccessible by encapsulating it with a material that bonds to the surface, such as acrylic or epoxy coatings.
  In cases where the lead-based coatings have not been removed, the owner, or other responsible person, should ensure that maintenance staffs and contractors doing subsequent work on the bridge are aware that lead hazards still exist on the bridge with dust or fume-creating tasks.

- Substitution

  Zinc-containing primers covered by an epoxy intermediate coat and polyurethane topcoat are commonly used instead of lead-containing coatings.
  Mobile hydraulic shears can be substituted for torch cutting under certain circumstances.

Surface preparation equipment, such as needle guns with multiple reciprocating needles completely enclosed within an adjustable shroud, can be substituted for abrasive blasting under certain operations. The shroud captures dust and debris at the cutting edge and can be equipped with a HEPA vacuum filtration system with a self-drumming feature. One such commercial unit can remove lead-based paint from flat steel and concrete surfaces, outside edges, inside corners, and pipes.
Chemical strippers can be used on surfaces involving carvings or molding, or intricate iron works, in place of hand scraping or using a heat gun. Chemical removal generates less airborne lead dust. These strippers, however, can be hazardous and the material safety data sheets (MSDSs) for the products used must be reviewed by the employer for information on worker exposure hazards from the chemical ingredients and protective measures recommended by the manufacturer.

- Component Replacement

  Some lead-based painted bridge components (i.e., guardrails, expansion joints, light fixtures, etc.) can be replaced either with new components free of lead-containing paint or with the same components after the paint has been removed off-site.

- Process/Equipment Modification
-

  Blasting techniques that are less dusty than abrasive blasting and that can be effective under some conditions include:

✓ Wet-blasting using high-pressure water with an abrasive, or surrounding the blast nozzle with a ring of water.

✓ Vacuum blasting where a vacuum hood for material removal is positioned around the exterior of the blasting nozzle.

✓ High- and ultra-high pressure water jetting using water pressures from 20,000 to 50,000 psi (137,900 - 344,750 kPa) to remove loose paint and rust.

✓ Sponge jetting using specialized blasting equipment that propels a combination of abrasive material encased in a soft sponge (form) medium. The high-density foam cleaning medium is absorptive and can be used wet or dry.

✓ Carbon dioxide (dry ice) blasting using dry ice pellets propelled at a high velocity through a blasting nozzle. These pellets remove the paint from the surface and, when the dry ice evaporates, only the leaded debris remains.

When vacuum blasting, care should be taken to ensure that the configuration of the heads on the blasting/vacuum nozzle match the configuration of the substrate so that the vacuum is effective in containing debris.

Heat guns can be used to remove lead-based paints in small areas or on combustible substrates. The guns used should be the flameless electrical softener type. Heat guns should have electronically controlled temperature settings to allow usage below 700°F (371°C). Heat guns should be equipped with various nozzles to cover all common applications and to limit overheating the work area.

The use of longer cutting torches increases the distance between the worker and the source of lead, and decreases lead exposures.

Using pneumatic tools, whenever possible, to remove nuts and bolts or rivets rather than burning or torch-cutting eliminates the creation of lead-containing fumes.

Brush/roller application of lead paints or other lead-containing coatings is a safer method than spraying. (Note: Most States and the Federal government prohibit the use of lead-based paints to repaint bridges after lead-based coatings have been removed.) This method of application introduces little or no paint mist into the air where the mist can present a lead inhalation hazard.

Non-silica-containing abrasive (e.g., steel or iron shot/grit) should be used where practical instead of sand in abrasive blasting operations. The free silica portion of the dust presents a respiratory health hazard.

- Isolation

  Although it is not feasible to completely enclose and ventilate some abrasive blasting operations, it is possible to isolate many operations to help reduce the potential for exposure to lead. Isolation, in this instance, consists of keeping employees not involved in the blasting operations as far away as possible from the work area. By placing the employees at a greater distance from the source of lead exposure, their exposures will be reduced.

Work Practice Controls

Work practices involve the way a task is performed. Good work practices can be a vital aid in achieving compliance with the PEL. Some fundamental and easily implemented work practices are: (1) housekeeping, (2) periodic inspection and maintenance of process and control equipment, (3) proper procedures to perform a task, (4) supervision to ensure that the proper procedures are followed, and (5) administrative controls.

- Housekeeping

  A rigorous housekeeping program is necessary in many jobs to keep airborne lead levels below permissible limits. This involves a regular housekeeping schedule to remove accumulations of lead dust and lead-containing debris, and should be adapted to exposure conditions at a particular site.

  All surfaces should be maintained as free as practicable of accumulations of lead dust. Lead dust in the workplace on overhead ledges, equipment, floors, and other surfaces must be removed before some disruption such as traffic, vibration, or random air currents causes the dust to become airborne again. A regularly scheduled cleanup is important because it minimizes the accumulation of lead dust.

  Cleaning operations should be conducted during regularly scheduled cleanups or whenever large amounts of dust or debris build up. In general, cleanup operations can create significant lead exposures to workers. All persons doing the cleanup should be provided with suitable respiratory protection and personal protective clothing to protect themselves from airborne lead.

  Vacuuming is considered to be the most reliable method of cleaning surfaces on which dust accumulates, but any effective method that minimizes the likelihood of lead becoming airborne may be used (for example, a wet floor scrubber). When vacuuming equipment is used, the vacuums must be equipped with HEPA filters. Blowing with compressed air is generally prohibited as a cleaning method, unless the compressed air is used in conjunction with a ventilation system designed to capture the airborne dust created by the compressed air (e.g., dust "blowdown" inside a contaminant structure).

All lead-containing debris and contaminated items accumulated for disposal should be collected and put into sealed impermeable bags or other closed impermeable containers. Bags and containers must be appropriately labeled as lead-containing waste, and properly disposed of according to local environmental regulations.

- Periodic Inspection and Maintenance

  Periodic inspection and maintenance of process equipment and control equipment, such as ventilation systems, is another important work practice control. At worksites where total containment is used as an engineering control, the failure of the ventilation system for the containment area can result in hazardous exposures in the enclosure. Breaches in the containment structures themselves may cause an increase in the lead exposures to workers outside the containment, as well as an increase in lead emissions from fugitive dusts. Frequently, equipment that is near failure or is in disrepair will not perform normally. Regular inspections can detect abnormal conditions so that timely maintenance can then be performed. If equipment is routinely inspected, maintained, and repaired, or replaced before failure is likely, there is less chance that hazardous exposures will occur.

- Proper Performance of Task

  In addition to the above work practice controls, workers must know the proper way to perform their job tasks to minimize their exposure to lead and to maximize the effectiveness of engineering controls. For example, if a worker inappropriately performs a task away from an exhaust hood, the control measure will be of no use. Wetting surfaces with water mist prior to sanding, scraping, or sawing lead-containing structural components will minimize airborne lead dust generations. Removing paints and coatings within 4 in (10.2 cm) of all areas to be torch cut, welded, or heated will also decrease exposures. For thin pieces of steel, it may be necessary to remove an even larger area of paint. Failure to properly operate engineering controls may also contaminate the work area. Workers can be alerted to safe operating procedures through fact sheets, discussions at safety meetings, and other educational means.

- Supervision

  Good supervision is another important work practice. It provides needed support for ensuring that proper work practices are followed by workers. By directing a worker to position the exhaust hood properly or to improve work practices, such as having the worker stand to the side or upwind of the cutting torch to avoid the smoke plume (whenever the configuration of the job permits), a supervisor can do much to minimize unnecessary exposure to airborne contaminants. Furthermore, the current OSHA standard requires frequent and regular inspections of job sites, materials, and equipment by a competent person. A competent person is one who is capable of identifying existing and predictable lead hazards and who has authorization to take prompt corrective measures to eliminate them.

- Administrative Controls

  Administrative controls are another form of work practice controls that can be used to influence the way a task is performed. For example, employees' exposures can be controlled by scheduling production and/or workers' tasks in ways that minimize employee exposure levels. One method the employer can use is to schedule certain operations at a time when the fewest employees are present. Thus, clean-up operations to remove lead dust and debris might be performed at night or other times when the production staff is not present.

  Another method is worker rotation, which circulates employees into and out of contaminated areas during a shift, thereby reducing the exposure to the individual employee. These workers can be rescheduled to different areas of the worksite after a period of time to control the cumulative effects of lead exposure. If this method is used to control worker exposure to lead, the lead standard requires that the employer implement a job rotation schedule that: (1) identifies each affected worker, (2) lists the duration and exposure levels at each job or work station where each affected employee is located, and (3) lists any other information that may be useful in assessing the reliability of administrative controls to reduce exposure to lead.

SECTION 4: RESPIRATORY PROTECTION

Although engineering and work practice controls are the primary means of protecting workers, controlling lead dusts and fumes at their source is often not sufficient to keep workers' lead exposures below the PEL. Currently, in the construction industry, respirators must often be used to supplement engineering controls and work practices whenever these controls are technologically incapable of reducing worker exposures to lead to or below 50 µg/m³.

There are generally two major classes of respirators: air purifying and air supplying respirators. Air purifying respirators have an air cleaning filter or scrubbing medium in cartridges or canisters to remove contaminants from ambient air. The ambient air can be drawn through the cartridges or canisters by breathing, or by a battery-powered air pump in the case of powered air purifying respirators. To get air to move through the cartridges or canister by breathing, a negative pressure is created inside the respirator facepiece when the wearer inhales. Because of the suction created inside the respirator facepiece during inhalation, these types of respirators are called negative pressure respirators. Powered air purifying respirators suck air through the cleaners, then blow filtered air into the facepiece at a pressure that is theoretically greater than the negative pressure created in breathing, hence they are called positive pressure type respirators.

Air supply respirators use regulators to control the flow of clean supply air into the wearer’s respirator. Supply air must be Compressed Gas Association Grade D breathing quality (see 1926.103), and usually comes from compressed air tanks, or compressors with special air cleaning features. Some regulators allow a continuous flow of air to constantly flow through the facepiece, and these are called continuous flow respirators. Some regulators allow air only to enter the facepiece when a negative suction pressure is created inside the facepiece by breathing in. These are demand type respirators. Some regulators maintain a constant positive pressure inside the respirator facepiece at all times, and let more air in during inhalation. These types of respirators are known as pressure-demand respirators. These terms are used in the respirator selection chart for lead hazards later in this section.

To provide adequate respiratory protection, respirators must be donned before entering the work area and should not be removed until the worker has left the area, or as part of a decontamination procedure. Employers must ensure that the respirator issued to the employee is properly selected and properly fitted so that it exhibits minimum facepiece leakage. Respirators must be supplied by the employer at no cost to employees.

Employers must perform either qualitative or quantitative fit tests for each employee wearing negative pressure respirators. Fit testing is to be performed at the time of the initial fitting and at least semi-annually thereafter. In qualitative fit testing, the user wears the respirator in a test atmosphere containing identifiable substances such as isoamyl acetate or irritant smoke, and reports whether or not the test material is smelled or sensed during a variety of exercises. In quantitative fit testing, a probe is placed inside the respirator facepiece to measure the leakage of the test atmosphere into the facepiece during several exercises such as talking, jogging, and moving the head. A numerical fit-factor is then calculated. See appendix D of 1926.62 for a complete description of fit-testing respirators.

Respirator Program

When respirators are provided, the employer must establish a respiratory protection program in accordance with the OSHA standard on respirator protection, 29 CFR 1926.103.

Minimum requirements for an acceptable respirator program for lead include the following elements:

- Written standard operating procedures governing the selection and use of respirators.
- Selection of respirators on the basis of hazards to which the worker is exposed.
- Instruction and training in the proper use of respirators and their limitations.
- Regular inspection and cleaning, maintenance, and disinfection; worn or deteriorated parts must be replaced, including replacement of the filter element in an air purifying respirator whenever an increase in breathing resistance is detected.
- Storage in a convenient, clean, and sanitary location, and protection against sunlight and physical damage.
- Appropriate surveillance of work area conditions and degree of worker exposure or stress (physiological or psychological) must be maintained.
- Evaluation to determine the continued effectiveness of the program.
- Physician's determination that the employee is physically able to perform the work and wear a respirator while performing the work (respirator user's medical capacity to wear and work with a respirator should be reviewed annually).
- Use of MSHA/NIOSH certified respirators.
- Fit testing of negative-pressure respirators.
- No facial hair such as beards and long mustaches that could interfere with the fit of a tight-fitting elastomeric respirator facepiece.
- Breathing air used for supplied-air respirators that meets the requirements prescribed in 1926.103(f).
- Standing permission for employees to leave the work area to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

Respirator Selection

Lead concentrations may vary substantially throughout a workshift as well as from day to day. The highest anticipated work concentration is to be used in the initial selection of an appropriate respirator.

The table below provides specific recommendations for the type of respirator to use when the actual workplace exposure reaches certain multiples of the 50 µg/m³ PEL. When an employer finds that exposures are lower or higher by personal air monitoring, then respirator selection can be adjusted accordingly.

Table 3. NIOSH - recommended respiratory protection for lead aerosols.

Airborne concentration of lead or condition of use	Required respirator[1]
Not in excess of 500 µg/m³	- ½ mask air purifying respirator with high efficiency filters [2,3] - ½ mask supplied-air respirator operated in demand (negative pressure) mode.
Not in excess of 1,250 µg/m³	- Loose fitting hood or helmet powered air purifying respirator with high efficiency filters[3]. - Hood or helmet supplied-air respirator operated in a continuous-flow mode, e.g., Type CE abrasive blasting respirators operated in a continuous-flow mode.
Not in excess of 2,500 µg/m³	- Full facepiece air purifying respirator with high efficiency filters[3]. - Tight fitting powered air purifying respirator with high efficiency filters[3]. - Full facepiece supplied-air respirator operated in demand mode. - ½ mask or full facepiece supplied-air respirator operated in a continuous-flow mode. - Full facepiece self-contained breathing apparatus (SCBA) operated in demand mode.
Not in excess of 50,000 µg/m³	- ½ mask supplied-air respirator operated in pressure demand or other positive pressure mode.
Not in excess of 100,000 µg/m³	- Full facepiece supplied-air respirator operated in pressure demand or other positive-pressure mode, e.g., Type CE abrasive blasting respirators operated in a positive pressure mode
Greater than 100,000 µg/m³	- Full facepiece SCBA operated in pressure demand or other positive pressure mode.

[1] Respirators specified for higher concentrations can be used at lower concentrations of lead.

[2] Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

[3] A HEPA filter means a filter that is a 99.97 percent efficient against particles of 0.3 micron size or larger.

If exposure monitoring or experience indicates airborne exposures to contaminants other than lead, such as solvents or polyurethane coatings, these exposures must be considered when selecting respiratory protection as well. A reevaluation of the respiratory protection program is required when a worker demonstrates a continued increase in blood lead levels.

Abrasive Blasting and Related Operations

NIOSH Type CE respirators are required for use by abrasive blasting operators. Currently, NIOSH certifies both continuous-flow and positive pressure respirators for abrasive blasting operations. Most continuous-flow respirators are recommended by NIOSH only for airborne lead concentrations less than or equal to 25 times the OSHA PEL (i.e., up to 1250 µg/m³). However, some manufacturers have shown that their continuous-flow Type CE respirators can offer protection greater than 25 times the PEL.

OSHA has accepted the use of some continuous-flow Type CE abrasive blasting respirators for exposures up to 1,000 times the PEL, when the manufacturer has proven that the respirator affords the greater protection factor. Before selecting a Type CE continuous-flow abrasive blasting respirator for use on a bridge RR&D site, it would be wise to call the nearest OSHA Area Office to determine if the respirator is acceptable for exposures greater than 25 times the PEL.

Positive pressure respirators are recommended by NIOSH for airborne concentrations less than 2,000 times the OSHA PEL (50 µg/m³). Furthermore, manufacturer's instructions regarding quality of air, air pressure, and inside diameter and length of hoses must be strictly followed. Use of longer hoses or smaller inside diameter hoses than the manufacturer's specifications, or hoses with bends or kinks, may restrict the flow of air to a respirator and negate the NIOSH approval.

SECTION 5: OTHER PERSONAL PROTECTIVE EQUIPMENT

At no cost to employees, employers must provide workers who are exposed to lead above the PEL and for whom the possibility of skin contamination or skin or eye irritation exist, clean, dry protective work clothing and equipment. Appropriate changing facilities must also be provided. Appropriate protective work clothing and equipment used on construction sites can include:

- Coveralls or other full-body work clothing.
- Gloves.
- Vented goggles or face shields with protective spectacles or goggles.
- Welding or blasting helmets, when required.

Disposable coveralls and separate shoe covers may be used, if appropriate, to avoid the need for laundering. Non-disposable coveralls must be replaced daily if exposure levels exceed 200 µg/m³, and weekly for exposure levels from 50 to 200 µg/m³. If an employee leaves the work area wearing protective clothing, the clothing should be cleaned with HEPA filter vacuum equipment to remove loose particle contamination; or as an alternative, the coveralls should be removed. Before respirators are removed, HEPA vacuuming or another suitable method, such as damp wiping, shall be used to remove loose particle contamination on the respirator and at the face-mask seal. Use work garments of appropriate size, and use duct tape to reinforce their seams (e.g., underarm, crotch, and back).

Contaminated clothing that is to be cleaned, laundered, or disposed of shall be placed in closed containers. Containers shall be labeled with the following warning:

CAUTION: Clothing contaminated with lead. Do not remove dust by blowing or shaking. Dispose of lead-contaminated wash water in accordance with applicable local, State, or Federal regulations.

Persons responsible for handling contaminated clothing shall be informed of the potential hazard in writing. At no time shall lead be removed from protective clothing or equipment by any means that disperses lead into the work area, such as brushing, shaking, or blowing.

At no time shall workers be allowed to leave the worksite wearing lead-contaminated clothing or equipment, e.g., shoes, coveralls, or head gear.

All contaminated clothing and equipment shall be prevented from reaching the worker's home or vehicle. This is an essential step in reducing the movement of lead contamination from the workplace into a worker's home and provides added protection to employees and their families.

Gloves and protective clothing should be appropriate for the specific chemical exposure (e.g., solvents and caustics). Cotton gloves provide some protection against the contamination of hands and cuticles with lead dust. Workers should wear clothing that is appropriate for existing weather and temperature conditions under the protective clothing.

Heat stress: Workers wearing protective clothing can face risk from heat stress. Additionally, heat stress may be an important concern when working in a hot environment or within containment structures. Heat stress is caused by a number of interacting factors, including environmental conditions, type of protective clothing worn, the work activity required, and the individual characteristics of the employee.

In situations where heat stress is a concern, employers should use appropriate work/rest regimens and provide heat stress monitoring that includes measuring employee's heart rates, body temperatures, and weight loss. (See chapter 4)

A source of water or electrolytic drink shall be close to the work area (in a non-contaminated eating/drinking area) so that it will be used often. Workers should wash their hands and face prior to drinking any fluid. Frequent fluid intake throughout the day will replace body fluids lost to evaporation. If such measures are used to control heat stress, protective clothing can be safely worn to provide the needed protection against lead exposure. The possibility of heat stress and its signs and symptoms should be discussed with all workers.

SECTION 6: HOUSEKEEPING AND PERSONAL HYGIENE PRACTICES

Lead is a cumulative and persistent toxic substance that poses a serious health risk. A rigorous housekeeping program and adherence to basic personal hygiene practices will minimize employee exposure to lead. In addition, these two elements of the worker protection program will help to prevent taking lead-contaminated dust out of the worksite and home to the workers' families, thus ensuring that the duration of lead exposure does not extend beyond the workshift and providing added protection to employees and their families.

Housekeeping

An effective housekeeping program involves at least daily removal of accumulations of lead dust and lead-containing debris. Vacuuming lead dust with HEPA filtered equipment or wetting it with water before sweeping are effective control measures. Such cleaning operations should be conducted, whenever possible, at the end of the day, after normal operations cease. Furthermore, all persons doing the clean up should be provided with suitable respiratory protection and personal protective clothing to prevent contact with lead.

In addition, all lead-containing debris and contaminated items accumulated for disposal should be collected and put into sealed impermeable bags or other closed impermeable containers. Bags and containers should be appropriately labeled as lead- containing waste. These measures are especially important as they minimize additional sources of exposure that engineering controls generally are not designed to control.

Personal Hygiene Practices

To minimize exposure to lead, special attention should be given to workers' personal hygiene. The employer must provide and ensure that workers use washing facilities. Clean change areas, and separate non-contaminated eating areas must also be provided. Cars should be parked where they will not be contaminated with lead. These measures will reduce the worker's period of exposure to lead and the ingestion of lead, ensure that the duration of lead exposure does not extend beyond the workshift, significantly reduce the movement of lead from the worksite, and provide added protection to employees and their families.

Change Areas: The employer must provide a clean change area equipped with storage facilities for street clothes and a separate area with facilities for the removal and storage of lead-contaminated protective work clothing and equipment. This separation is essential in preventing cross-contamination of the employee's clothing.

Clean change areas are to be used for taking off street clothes, suiting up in clean working clothes (protective clothing), donning respirators prior to beginning work, and dressing in street clothes after work. No lead-contaminated items should enter this area.

Work clothing must not be worn away from the jobsite. Under no circumstances shall lead-contaminated work clothes be laundered at home or be taken from the worksite, except to be laundered professionally or properly disposed of following applicable Federal, State, and local regulations.

Showers: When there is potential for extensive contamination of the employees' skin, hair, and protective clothing, shower facilities must be provided if feasible so that exposed employees can wash lead from their skin and hair prior to leaving the worksite. Where showers are provided, employees must change out of their work clothes and shower before changing into their street clothes and leaving the worksite.

Workers who do not change into clean clothing before leaving the worksite may contaminate their homes and automobiles with lead dust. Other members of the household may then be exposed to harmful amounts of lead.

Because of lead contamination, some environmental jurisdictions may require that shower wash water be treated before disposal to decrease lead levels in the water.

Personal Practices (eating, drinking, etc.): The employer must ensure that employees who work with lead either clean or remove their protective clothing and wash their hands and face prior to eating, drinking, smoking, or applying cosmetics and that these latter practices are never permitted while in the work area or in areas subject to the accumulation of lead. HEPA vacuuming can be used to remove loose contamination from the work clothing prior to eating.

Washing Facilities: Adequate washing facilities shall be provided for employees. Such facilities shall be in near proximity to the worksite and be provided with water, soap, and clean towels to enable employees to remove lead contamination from their skin. Contaminated water from washing facilities and showers must be disposed of in accordance with applicable local, State, or Federal regulations.

End-of-Day Procedures: Workers who are exposed to lead should follow these procedures upon finishing work for the day:

- Place disposable coveralls and shoe covers in labeled waste containers.

- Place lead-contaminated clothes, including work shoes, and personal protective equipment for laundering/cleaning (by the employer) in a closed container.
- Take a shower and wash hair.
- Change into street clothes.

SECTION 7: MEDICAL SURVEILLANCE

Introduction

Establishing a medical surveillance program for lead in the construction industry is challenging. The constantly changing nature of the work and transitory personnel can make it difficult to administer a medical surveillance program; however, a basic understanding of the medical surveillance requirements is essential in designing a program that will work for each construction situation.

Blood lead levels are currently the best indicator of personal lead exposure. By monitoring blood lead levels, an employer can determine whether all of the prevention measures, such as engineering and work practice controls, respiratory protection, and good hygiene practices, are preventing lead poisoning in employees. When employees are known or presumed to be exposed to lead levels at or above the action level of 30 $\mu g/m^3$, blood tests that monitor for lead and an enzyme called zinc protoporphyrin (ZPP) must be provided for workers. The results of these blood monitoring tests then guide whether further medical follow-up actions such as a referral to a physician for a medical examination, need to be taken. Other factors such as health complaints and reproductive concerns voiced by lead-exposed workers can also trigger medical examinations.

Appendix C, Part II of the OSHA Lead Standard provides a good summary of the adverse health effects associated with various blood lead levels. Excessive exposure to lead affects many of the body's organ systems, including the blood formation, nervous, gastrointestinal, renal, and reproductive systems. The purpose of a medical surveillance program is to protect workers from these adverse health effects through regular blood monitoring tests, medical examinations, and even removal of workers from lead exposure when necessary. This chapter discusses the basic principles of medical surveillance for lead.

Medical Surveillance Service Providers

Prior to beginning any medical surveillance program, it is essential that the employer identify a medical provider who can provide both biological monitoring and medical examinations so that the program can be organized and coordinated. It is often helpful to interview several physicians to assess their familiarity with lead-in-construction issues and to determine their past experience levels in administering lead medical surveillance and examination programs. All medical examinations and consultations shall be performed by or under the direct supervision of a qualified physician. A qualified physician is a doctor of medicine (M.D.) or osteopathy (D.O.) familiar with the objectives and requirements of a medical surveillance program for lead exposure.

It is also important to ensure that the laboratory providing an analysis of the blood is approved by OSHA. A current list of approved labs in your area may be obtained from the OSHA Technical Center at (801) 487-0267, or at the following address:

OSHA Technical Center
P.O. Box 65200
Salt Lake City, UT 84165.

Overview of Lead Medical Surveillance Procedures

The primary driver of the medical surveillance program is biological monitoring for blood lead and ZPP levels. ZPP is a chemical substance in the blood that becomes elevated when lead has interfered with the body's blood forming mechanism. It is a better indicator of long-term lead absorption than blood lead levels. Blood lead measurements typically reflect shorter-term lead absorption that has occurred over the past days or weeks of exposure.

The blood lead and ZPP monitoring are done prior to exposure to lead above the action level, during exposure, and after exposure has ended. Medical exams need not be provided unless blood lead levels rise above 40 µg/dl, or when lead-related medical signs, symptoms, illnesses, or other medical issues arise. All medical surveillance procedures and exams must be made available to employees; however, participation by employees in the program is not mandatory. If employees do not participate in the program, it is useful to have the employee sign a waiver declining participation in the program. As a result of high blood lead levels or a physician's examination findings, employees may be required to be removed from lead exposure areas.

Initial Surveillance

The standard requires that baseline blood lead and ZPP levels must be determined for all workers that are exposed to airborne lead levels greater than the action level

(30 µg/m^3) on any one day, or are engaged in lead work covered by any one of the three presumed exposure category work tasks. (Some States, such as Maryland, have different participation criteria.)

The blood lead and ZPP levels should be determined prior to, or no later than the end of the second day of lead exposure. This baseline sample serves as a reference to which all future samples can be compared.

Periodic Biological Monitoring Requirements

For workers exposed to lead at or above the action level for more than 30 days annually, biological monitoring is required once every 2 months during the lead exposure job for the first 6 months and once every 6 months thereafter.

In the event that any worker's blood lead increases to or above 40 µg/dl, biological monitoring needs to continue every 2 months until the blood lead level drops below 40 µg/dl for two consecutive samples taken less than 2 weeks apart.

Employees must be informed of the blood test results in writing within 5 working days after the employer receives the information. Anyone whose blood lead level exceeds 40 µg/dl shall also be notified of the need for medical follow-up.

Medical Examination and Consultation

Medical examinations are provided to all workers who are exposed to lead at or above the action level more than 30 days in any consecutive 12-month period in accordance with the following schedule:

- Immediately, when a worker has a blood lead level greater than or equal to 40 µg/dl.
- Annually for each worker who had a blood lead level of 40 µg/dl or more during the preceding 12 months.
- When a worker has signs or symptoms associated with lead poisoning, or believes he or she may be lead poisoned.
- When a worker requests medical advice on reproductive effects of lead that he/she may be experiencing.
- When a worker has problems breathing when wearing a respirator.
- When a worker is pregnant.
- When a worker has other medical conditions, unrelated to lead poisoning, that can possibly become worse with lead exposure.

Medical examinations must be provided to the worker free of charge and during normal work hours.

Content of Medical Examinations

The medical examination for anyone whose blood lead level reaches or exceeds 40 µg/dl or who experiences the medical issues above, must consist of the following elements:

- A detailed work and medical history with particular attention to past lead exposure (occupational and non-occupational), personal habits such as smoking and hygiene, and past gastrointestinal, hematologic, renal, cardiovascular, reproductive, and neurological problems.

- A thorough physical exam with particular attention to teeth, gums, gastrointestinal, hematologic, renal, cardiovascular, reproductive and neurological systems. Pulmonary status should be evaluated if respiratory protection is used.
- Blood pressure measurement.

- A blood test that determines:

  ✓ Blood lead level.

  ✓ Hemoglobin and hematocrit determinations, red cell indices, and examination of peripheral smear morphology.

  ✓ Zinc protoporphyrin.

  ✓ Blood urea nitrogen.

  ✓ Serum creatinine.

- A routine urinalysis with microscopic examination.

- Any other test that the examining physician deems necessary by sound medical practice.

The content of other medical exams shall be determined by the examining physician, and, if requested by the employee, shall include pregnancy testing or laboratory evaluation of male fertility.

Information Provided to Examining and Consulting Physicians

The initial physician conducting a lead-related examination or consultation must be provided with the following information:

- A copy of the applicable regulation for lead.
- A description of the employee's duties as they relate to lead exposure.
- The employee's exposure level to lead and any other toxic substances (if applicable).
- A description of personal protective equipment used.
- The employee's prior blood lead levels.

- All prior written medical opinions concerning the employee's lead exposure.

This information must also be provided to other physicians involved in the case, if requested by the employee or his or her physician.

Medical Opinion

The employee must be provided with a written medical opinion from each examining or consulting physician that contains the following information:

- Any detected medical conditions that increase the risk of harm to the employee, if he/she is exposed to lead.

- Any recommended special protective measures or limitations to control the employee's exposure to lead.

- Any limitation on the use of respirators. Can the employee wear a negative pressure respirator? If not, can he/she wear a powered air purifying respirator?

- The results of blood lead levels.

To protect both the health and privacy of the employees, physicians shall be instructed to directly advise an employee of any medical condition (occupational or non-occupational) that requires further medical care. Physicians shall <u>not</u> reveal to the employer any information unrelated to the employee's occupational lead exposure.

Multiple Physician Review

If the employer selects the initial physician to conduct any of the required medical examinations or consultations, then the employee may select a second physician to review the findings, determinations, and recommendations of the initial physician. This second physician may perform whatever examinations, consultations, and laboratory tests are necessary to complete this review.

Each employee must be promptly notified in writing of the right to obtain a second opinion after each exam or consultation provided by the company-selected physician. The employee has 15 days after receiving both this notification and a written medical opinion from the initial physician to take steps to obtain a second opinion. During this 15-day period, he/she must notify his/her superintendent that he/she intends to obtain a second opinion and must call a doctor to set up an appointment. The employer need not pay for the second opinion or abide by its findings, if the employee does not meet these requirements.

If the findings, determinations, or recommendations of the second physician differ from those of the initial physician, then the employer shall request the two physicians to resolve any disagreement. If the two physicians are unable to quickly resolve their disagreement, then they shall designate a third physician to review the findings, determinations, and recommendation of the prior physicians.

This third physician shall conduct any examinations, consultations, tests, and discussions with the prior physicians that he/she deems necessary to resolve the disagreement. The employer shall act consistently with the findings, determinations and recommendations of the third physician unless the employer reaches an agreement with the employee that agrees with the recommendations of at least one of the three physicians.

Medical Removal Protection

An employee must be removed from lead exposure when any of the following conditions exists:

a. The latest blood test and a follow-up test done within 2 weeks indicates a blood lead level at or above 50 µg/dl.
b. When the initial physician or the final determination of a multiple physician review decides that the employee shall be removed from lead exposure due to a medical condition that increases his or her risk of harm from lead.

For an employee removed due to condition “a”, that employee may not return to work involving lead exposure until two consecutive blood lead tests indicate blood lead levels less than or equal to 40 µg/dl. For condition “b”, the employee may return when the initial physician authorizes the return. If the employee has sought a second opinion, then he/she cannot return until the multiple physician review panel makes that determination.

Medical Removal Benefits

The contractor must provide medical removal benefits each time an employee is removed from lead exposure. These benefits apply even in cases where an employee is removed from lead exposure before the regulations actually require removal.

Medical removal protection benefits consist of maintaining the earnings, seniority, and other rights and benefits of an employee as though he or she had not been removed from lead exposure. The contractor can provide these benefits by transferring the employee to a job that has no lead exposure greater than what is normally found off the job.

Medical removal benefits cannot be halted until at least one of the following conditions exists:

- The employee fails to participate in the medical surveillance program provided by the company physician.

- When two consecutive blood lead samples taken at least 2 weeks apart are below 40 µg/dl.
- The company physician--or, when the employee obtains a second opinion, the final determination of the multiple physician review-authorizes the employee's return to lead work.
- The company physician--or when the employee obtains a second opinion, the final determination of the "multiple physician review"--determines that the employee may never return to work

involving lead exposure. In this case, a settlement will be reached through worker's compensation.

Putting It All Together

Employers who have little changeover in personnel and a steady stream of lead-exposing projects can set up an ongoing year-after-year medical surveillance program. Other employers who have sporadic lead-exposing jobs and greater turnover in personnel will have to tailor the medical surveillance program to their needs within the parameters of the lead standard. For the latter employers, it is sometimes helpful to identify a core group of workers who will most likely be on any lead-exposing jobsite and place them in an ongoing medical surveillance program. This ongoing "core group program" can be coupled with a "seasonal or job-specific" medical surveillance program for employees who are temporarily hired or who move between lead-exposing and non-lead-exposing jobs. Nevertheless, each company must find a system for providing medical services to all employees who are exposed to lead above the action level.

Prior to beginning a medical surveillance program, it is essential that the employer identify and establish a good working relationship with a medical provider. Arrangements should be made with the provider regarding scheduling of employee visits and the content of medical exams as discussed above. Pertinent information should be shared with the provider as discussed above. Each employer should also discuss with the physician(s) how the following issues will be handled:

- Medical confidentiality related to medical exams.

- Procedures for medical removal because of high blood lead levels or lead intoxication symptoms.
- Reproductive health issues for lead-exposed employees.
- Procedures for a multiple physician review process.
- Procedures for dealing with non-compliant personnel.

Regardless of the exposure level or the duration of time that employees are exposed to lead, all new employees should be provided with biological monitoring before the start of a job to determine that they are not coming into the job with elevated lead levels. Failure to take this precaution may result in the employer having to remove the blood-lead elevated employee from lead exposure areas soon after beginning the job, and provide him/her with full wages and benefits until blood lead levels drop below 40 µg/dl. In addition, employees should be given exit blood lead testing to document their blood lead and ZPP levels before they leave employment.

SECTION 8: EMPLOYEE INFORMATION AND TRAINING

Each employer is required to provide an information and training program for all employees exposed to lead above the action level or who may suffer skin or eye irritation from lead compounds such as lead arsenate or lead azide. The training should begin with basic right-to-know training on the hazards of lead. The trainer can use an MSDS for lead or a lead-based paint as a starting point. In addition, training must provide the following information and cover the following items:

- Copies of the 1926.62 lead standard, its appendices, and all applicable State regulations.

- A list of specific operations (burning, welding, etc.) that result in lead exposure.
- The purpose, proper selection, fitting, use, and limitations of respirators.

- The purpose and a description of the medical surveillance and medical removal protection programs.
- Information on health problems associated with excessive lead exposure. Particular emphasis should be placed on the reproductive problems that lead can cause in both men and women.
- Engineering controls and work practices that will be used to control lead exposure.
- The contents of the company's lead exposure control program.
- A warning that chelating agents should not routinely be used to remove lead from employees' bodies and should only be used under the direction of a licensed physician.

All employees must be trained prior to initial assignment to areas where there is a possibility of exposure over the action level. This training program must also be provided at least annually thereafter unless further exposure above the action level will not occur.

In designing a training program, employees should be given an opportunity to actually perform in the training session what the employees are expected to do on the jobsite. For instance, employees using supplied-air type airline respirators should demonstrate that they know how to properly set up the airlines and filters, check carbon monoxide levels and wear the respirator. Employees should be able to demonstrate the proper use of exposure-reducing controls such as vacuum blasting equipment. The correct use of other personal protective equipment such as coveralls, protective eyewear and headwear should be demonstrated by each employee.

Employees should show that they know how to remove contaminated PPE without exposing themselves to lead. Finally, employees should actually perform their work functions utilizing all the lead-control measures in a non-hazardous atmosphere to show that they can perform the work safely.

SECTION 9: RECORDKEEPING

Each employer is required to keep all records of exposure monitoring for airborne lead. These records must include:

- The name, Social Security Number, and job classification of employees measured and the employee group the exposure monitoring represents.
- Details of the sampling and analytical techniques, including a description of the sampling and analytical methods and their accuracies.
- The results of sampling, including dates, numbers of samples, locations, personal versus area sampling, sampling results, TWAs and durations of samples.
- The type of respiratory protection being worn by the person sampled.
- Descriptions of environmental barriers that could affect the sampling results.
- The name and contact information of the person(s) taking the samples.

Such records are to be retained for at least 30 years.

Each employer is also required to keep all records of biological monitoring and medical examination results. These records must include:

- The names, Social Security Numbers, and job duties of the employees receiving biological monitoring and medical exams.

- A copy of the physician's written opinion following a medical exam.

- Results of any airborne exposure monitoring done on or for an employee who receives a medical exam.
- Any employee medical complaints related to lead.

In addition, the employer or the physician must keep (subject to by medical confidentiality principles):

- A copy of the results of the medical examination and work history.
- A brief description of lab procedures and copies of standards or guidelines used to interpret test results.
- Copies of biological monitoring results.

Medical records must be preserved and maintained for the duration of employment plus 30 years. However, if the employee's duration of employment is less than 1 year, the employer need not retain that employee's medical records beyond the period of employment if the records are provided to the employee upon termination of employment.

Recordkeeping is also required if an employee is temporarily removed from his/her job under the medical removal protection program. This record must include:

- The name and Social Security Number of the removed employee.

- The date of removal and return.
- How the removal was or is being accomplished.
- Whether or not the reason for the removal was an elevated blood lead level.

The employer is required to keep each medical removal record only for as long as the duration of an employee's employment.

The lead standard also requires that if an employee requests to see or copy environmental monitoring, blood lead level monitoring, or medical removal records, they must be made available to the requesting employee or a representative authorized by that employee.

The employee's union also has access to these records. Medical records other than blood lead levels must also be provided upon request to an employee, to his/her physician, or to any other person designated by that employee. A union does not have access to an employee's personal medical records, including medical exam results, unless authorized by the employee.

REFERENCES

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American Road and Transportation Builders Association. *Construction Safety Management Manual*, 1994.

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29 CFR Part 1926. Safety and Health Regulations for Construction.

OSHA, Instruction CPL 2-2.58, Inspection and Compliance Procedures regarding 1926.62 for Lead Exposure in Construction.

OSHA, Fact Sheet No. OSHA 93-47. Lead Exposure in Construction, Worker Protection Programs, #1 of 6.

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OSHA, Fact Sheet No. OSHA 93-51. Lead Exposure in Construction, Respiratory Protection, #5 of 6.

OSHA, Fact Sheet No. OSHA 93-52. Lead Exposure in Construction, Medical Surveillance, #6 of 6.

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MOSH, Lead in Construction Fact Sheet, 11/94.

MOSH, Occupational Health Standard for Lead in Construction, 5/94.

Laborers-AGC Education and Training Fund, *Lead in Construction--Worker Manual for Structural Steel*, 5/94.

Accident Prevention Manual for Industrial Operations: Administration and Programs. Chapters 4 and 9. National Safety Council, 1988.

APPENDICES

APPENDIX A-1

COMPETENT PERSON ASSIGNMENT FORM

PROJECT:____________________________

SENIOR PROJECT MANAGER:________________________________

The following activities require the oversight of designated **competent persons**. A competent person is someone who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The following marked activities are applicable to this project, and the designated competent person for the activity is listed.

Subpart/Activity	Applies?	Designated Competent Person(s)
1926. 20: Jobsite Inspections	X	
1926.53: Ionizing Radiation		
1926.62: Lead Compliance Plan/IH		
1926.101: Hearing Conservation/IH		
1926.103: Respiratory Protection/IH		
1926.251: Rigging/Materials Handling		
1926.354: Welding/IH		
1926.404: Electrical Grounding Assurance		
1926.451: Scaffolding		
1926.500-503: Fall Protection		
1926.550: Cranes—Annual Inspection		
1926.552: Hoists—Inspections and Tests		
1926.650-652: Trenching and Excavation		
1926.705: Lift-slab Construction		
1926.752: Ironwork/Structural Steel		
1926.800-803: Underground Construction		
1926.850-859: Demolition		
1926.900: Blasting		
1926.1053-1060: Ladders		
1926.1101: Asbestos		
1926.1127: Cadmium		

APPENDIX A-2

QUALIFIED PERSON DESIGNATION FORM

PROJECT:_____________________________

SENIOR PROJECT MANAGER:__________________________________

The following activities require the oversight or participation of designated **qualified persons**. A qualified person is one who is familiar with the construction and operation of equipment and the hazards involved in the use of the equipment. Additionally, a qualified person is one who by reason of experience or training is familiar with the operation to be performed and the hazards involved. The following marked activities are applicable to this project, and the designated qualified person(s) for the activity is/are listed.

Subpart/Activity	Applies?	Designated Qualified Person(s)
1926.54: Laser Operations		
1925.55: Assessment of Exposures to Gases, Vapors Fumes, Dusts and Mists		
1926.65: Hazardous Waste Operations and Emergency Response		
1926. 403-449: Electrical Safety		
1926.500-503: Fall Protection		
1926.550: Cranes and Derricks		
1926.701: Concrete and Masonry Construction		
1926.800: Underground Construction		
1926.900: Blasting and Explosives		
1926.960: Electrical Power Transmission and Distribution		

SUPERVISOR'S REPORT OF INJURIES AND ILLNESSES

Employee's name	
Social Security number	
Job position/title	
Supervisor's name	
Date and time of injury/illness	
Location	
Task being performed at time of injury/illness	
Date and time injury/illness reported to you	
Name(s) of witnesses	

Incident resulted in: ☐ Injury ☐ Illness ☐ Fatality ☐ Property Damage

First aid given?________ Medical treatment required?_________ Workdays lost__________

Describe how the incident occurred: ____________________________________

What actions, events, or conditions contributed most directly to this incident? __________

Prior to this incident, were any warning events or near misses reported? If so, please describe the events and the dates they were reported. ____________________________

Could anything be done to prevent incidents of this type? If so, what? ______________

Signature of Supervisor

Date

NEW HIRE SAFETY ORIENTATION PROGRAM

Training was provided for the following topics at the New Hire Safety Orientation held on

____________________(Date) for ______________________________ (Employee's Name).

Topic	Covered?
Company safety and health policy and programs	
The construction project and the new employee's role in the project	
Hazard communication requirements	
Emergency procedures for first aid, evacuation, rescue, etc.	
Location of first-aid stations, fire extinguishers, telephone, lunchroom, washroom, showers, and parking facilities	
Site-specific hazards: (please list)	
Safety and health responsibilities (supervisors, competent persons, qualified persons, safety director, safety and health committee, etc.)	
Reporting of injuries and hazardous conditions	
Use of personal protective equipment: (please list)	
Tool handling and storage	
Review of safety and health rules and practices applicable to the job	

Employee Acknowledgement of Training: __________________________________(Signature)

Trainer's Name and Title:____

APPENDIX D

EMPLOYEE TRAINING RECORD FORM

Employee Name: ____

Social Security Number:

____

Job Classification	Date of Training	Topic of Training
Location of Training	Expiration Date of Training (if applicable)	Certification Issued? Yes No Type:
Number of Hours of Training	Name and Title of Trainer	
Signature of Trainee:		

Job Classification	Date of Training	Topic of Training
Location of Training	Expiration Date of Training (if applicable)	Certification Issued? Yes No Type:
Number of Hours of Training	Name and Title of Trainer	
Signature of Trainee:		

Job Classification	Date of Training	Topic of Training
Location of Training	Expiration Date of Training (if applicable)	Certification Issued? Yes No Type:
Number of Hours of Training	Name and Title of Trainer	
Signature of Trainee:		

Job Classification	Date of Training	Topic of Training
Location of Training	Expiration Date of Training (if applicable)	Certification Issued? Yes No Type:
Number of Hours of Training	Name and Title of Trainer	
Signature of Trainee:		

Job Classification	Date of Training	Topic of Training
Location of Training	Expiration Date of Training (if applicable)	Certification Issued? Yes No Type:
Number of Hours of Training	Name and Title of Trainer	
Signature of Trainee:		

Job Classification	Date of Training	Topic of Training
Location of Training	Expiration Date of Training (if applicable)	Certification Issued? Yes No Type:
Number of Hours of Training	Name and Title of Trainer	
Signature of Trainee:		

Job Classification	Date of Training	Topic of Training
Location of Training	Expiration Date of Training (if applicable)	Certification Issued? Yes No Type:
Number of Hours of Training	Name and Title of Trainer	
Signature of Trainee:		

Job Classification	Date of Training	Topic of Training
Location of Training	Expiration Date of Training (if applicable)	Certification Issued? Yes No Type:
Number of Hours of Training	Name and Title of Trainer	
Signature of Trainee:		

FIRST AID LOG

Project Name: ______________________________________

Employee's Name	Job Classification	Immediate Supervisor	Date of Injury	Time of Injury	Nature of Injury	Treatment Rendered	Place of Treatment

REPORTED BY: ____ DATE: _________________________

APPENDIX F

SAMPLE PERMIT - REQUIRED CONFINED SPACE PROGRAM

Workplace. Sewer entry.

Potential hazards. The employees could be exposed to the following:

Engulfment.

Presence of toxic gases. Equal to or more than 10 ppm hydrogen sulfide measured as an 8-hour time-weighted average. If the presence of other toxic contaminants is suspected, specific monitoring programs will be developed.

Presence of explosive/flammable gases. Equal to or greater than 10 percent of the lower flammable limit (LFL).

Oxygen deficiency. A concentration of oxygen in the atmosphere equal to or less than 19.5 percent by volume.

A. ENTRY WITHOUT PERMIT/ATTENDANT

Certification. Confined spaces may be entered without the need for a written permit or attendant provided that the space can be maintained in a safe condition for entry by mechanical ventilation alone, as provided in 1910.146(c)(5). All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. Any employee required or permitted to pre-check or enter an enclosed/confined space shall have successfully completed, as a minimum, the training as required by the following sections of these procedures. A written copy of operating and rescue procedures as required by these procedures shall be at the work site for the duration of the job. The Confined Space Pre-Entry Checklist must be completed by the LEAD WORKER before entry into a confined space. This list verifies completion of items listed below. This checklist shall be kept at the jobsite for duration of the job. If circumstances dictate an interruption in the work, the permit space must be re-evaluated and a new checklist must be completed.

Control of atmospheric and engulfment hazards.

Pumps and Lines. All pumps and lines that may reasonably cause contaminants to flow into the space shall be disconnected, blinded, and locked out, or effectively isolated by other means to prevent development of dangerous air contamination or engulfment. Not all laterals to sewers or storm drains require blocking; however, where experience or knowledge of industrial use indicates there is a reasonable potential for contamination of air or engulfment into an occupied sewer, then all affected laterals shall be blocked. If blocking and/or isolation requires entry into the space, the provisions for entry into a permit-required confined space must be implemented.

Surveillance. The surrounding area shall be surveyed to avoid hazards such as drifting vapors from the tanks, piping, or sewers.

Testing. The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. Detector tubes, alarm only gas monitors, and explosion meters are examples of monitoring equipment that may be used to test permit space atmospheres. Testing shall be performed by the LEAD WORKER who has successfully completed the gas detector training for the monitor he will use. The minimum parameters to be monitored are oxygen deficiency, LFL, and hydrogen sulfide concentration. A written record of the pre-entry test results shall be made and kept at the work site for the duration of the job. The supervisor will certify in writing, based upon the results of the pre-entry testing, that all hazards have been eliminated. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connecting spaces.

Entry Procedures. If there are no non-atmospheric hazards present and if the pre-entry tests show there is no dangerous air contamination and/or oxygen deficiency within the space and there is no reason to believe that any is likely to develop, entry into and work within may proceed. Continuous testing of the atmosphere in the immediate vicinity of the workers within the space shall be accomplished. The workers will immediately leave the permit space when any of the gas monitor alarm set points are reached as defined. Workers will not return to the area until a SUPERVISOR who has completed the gas detector training has used a direct reading gas detector to evaluate the situation and has determined that it is safe to enter.

Rescue. Arrangements for rescue services are not required where there is no attendant. See the rescue portion of section B., below, for instructions regarding rescue planning where an entry permit is required.

B. ENTRY PERMIT REQUIRED

Permits. Confined Space Entry Permit. All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. Any employee required or permitted to pre-check or enter a permit-required confined space shall have successfully completed, as a minimum, the training as required by the following sections of these procedures. A written copy of operating and rescue procedures as required by these procedures shall be at the work site for the duration of the job. The Confined Space Entry Permit must be completed before approval can be given to enter a permit-required confined space. This permit verifies completion of items listed below. This permit shall be kept at the job site for the duration of the job. If circumstances cause an interruption in the work or a change in the alarm conditions for which entry was approved, a new Confined Space Entry Permit must be completed.

Control of atmospheric and engulfment hazards.

Pumps and Lines. All pumps and lines that may reasonably cause contaminants to flow into the space shall be disconnected, blinded, and locked out, or effectively isolated by other means to prevent development of dangerous air contamination or engulfment. Not all laterals to sewers or storm drains require blocking; however, where experience or knowledge of industrial use indicates there is a reasonable potential for contamination of air or engulfment into an occupied sewer, then all affected laterals shall be blocked. If blocking and/or isolation requires entry into the space, the provisions for entry into a permit-required confined space must be implemented.

Surveillance. The surrounding area shall be surveyed to avoid hazards such as drifting vapors from tanks, piping, or sewers.

Testing. The confined space atmosphere shall be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. A direct reading gas monitor shall be used. Testing shall be performed by the SUPERVISOR who has successfully completed the gas detector training for the monitor he will use. The minimum parameters to be monitored are oxygen deficiency, LFL, and hydrogen sulfide concentration. A written record of the pre-entry test results shall be made and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connected spaces.

Space Ventilation. Mechanical ventilation systems, where applicable, shall be set at 100 percent outside air. Where possible, open additional manholes to increase air circulation. Use portable blowers to augment natural circulation if needed. After a suitable ventilating period, repeat the testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

Entry Procedures. The following procedure shall be observed under any of the following conditions:

1.) Testing demonstrates the existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels;

2.) The atmosphere tests as safe but unsafe conditions can reasonably be expected to develop;

3.) It is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems and it is not practical or safe to deactivate such systems; or

4.) An emergency exists and it is not feasible to wait for pre-entry procedures to take effect.

All personnel must be trained. A self-contained breathing apparatus shall be worn by any person entering the space. At least one worker shall stand by the outside of the space ready to give assistance in case of emergency. The standby worker shall have a self-contained breathing apparatus available for immediate use. There shall be at least one additional worker within sight or call of the standby worker. Continuous powered communications shall be maintained between the worker within the confined space and standby personnel. If at any time there is any questionable action or non-movement by the worker inside, a verbal check will be made. If there is no response, the worker will be moved immediately. Exception: If the worker is disabled due to falling or impact, he/she shall not be removed from the confined space unless there is immediate danger to his/her life. Local fire department rescue personnel shall be notified immediately. The standby worker may only enter the confined space in case of an emergency (wearing the self-contained breathing apparatus) and only after being relieved by another worker. Safety belt or harness with attached lifeline shall be used by all workers entering the space with the free end of the line secured outside the entry opening. The standby worker shall attempt to remove a disabled worker via his or her lifeline before entering the space.

When practical, these spaces shall be entered through side openings -- those within 3 1/2 feet (1.07 m) of the bottom. When entry must be through a top opening, the safety belt shall be of the harness type that suspends a person upright, and a hoisting device or similar apparatus shall be available for lifting workers out of the space.

In any situation where their use may endanger the worker, use of a hoisting device or safety belt and attached lifeline may be discontinued.

When dangerous air contamination is attributable to flammable and/or explosive substances, lighting and electrical equipment shall be Class 1, Division 1 rated per National Electrical Code and no ignition sources shall be introduced into the area.

Continuous gas monitoring shall be performed during all confined space operations. If alarm conditions change adversely, entry personnel shall exit the confined space and a new confined space permit issued.

Rescue. Call the fire department services for rescue. Where immediate hazards to injured personnel are present, workers at the site shall implement emergency procedures to fit the situation.

SAMPLE ENTRY PERMIT

PERMIT VALID FOR 8 HOURS ONLY. ALL COPIES OF PERMIT WILL REMAIN AT THE JOBSITE UNTIL JOB IS COMPLETED

DATE: - - SITE LOCATION and DESCRIPTION ______________________________

PURPOSE OF ENTRY____

SUPERVISOR(S) in charge of crews Type of Crew Phone #

____

____

COMMUNICATION PROCEDURES____

RESCUE PROCEDURES (PHONE NUMBERS AT BOTTOM) _____________________

____

REQUIREMENTS COMPLETED	DATE	TIME
Lock Out/De-energize/Try-out	______	______
Line(s) Broken-Capped-Blanked	______	______
Ventilation	______	______
Secure Area (Post and Flag)	______	______
Breathing Apparatus	______	______
Resuscitator - Inhalator	______	______
Standby Safety Personnel	______	______
Full Body Harness w/"D" ring	______	______
Emergency Escape Retrieval Equip	______	______
Lifelines	______	______
Fire Extinguishers	______	______
Lighting (Explosive Proof)	______	______
Protective Clothing	______	______
Respirator(s) (Air Purifying)	______	______
Burning and Welding Permit	______	______
Note: For items that do not apply, enter N/A	______	______

ATMOSPHERIC TEST(S) TO BE TAKEN

TEST	*ACCEPTABLE LEVEL*		*MEASURED LEVELS (TAKEN INITIALLY AND EVERY 2 HOURS)*
PERCENT OF OXYGEN	19.5% to 23.5%		___ ___ ___ ___ ___ ___ ___ ___
LOWER FLAMMABLE LIMIT		Under 10%	___ ___ ___ ___ ___ ___ ___ ___
CARBON MONOXIDE	+35 PPM		___ ___ ___ ___ ___ ___ ___ ___
Aromatic Hydrocarbon	+ 1 PPM	* 5PPM	___ ___ ___ ___ ___ ___ ___ ___
Hydrogen Cyanide	(Skin)	* 4PPM	___ ___ ___ ___ ___ ___ ___ ___
Hydrogen Sulfide	+10 PPM	* 15PPM	___ ___ ___ ___ ___ ___ ___ ___
Sulfur Dioxide	+ 2 PPM	* 5PPM	___ ___ ___ ___ ___ ___ ___ ___
Ammonia		* 35PPM	___ ___ ___ ___ ___ ___ ___ ___

* Short-term exposure limit: Employee can work in the area up to 15 minutes.
+ 8-hr Time Weighted Avg.: Employee can work in area 8 hr (longer with appropriate respiratory protection).

REMARKS:____

GAS TESTER NAME & CHECK #	INSTRUMENT(S) USED	MODEL &/OR TYPE	SERIAL &/OR UNIT #
______________	______________	__________	______________
______________	______________	__________	______________

SAFETY STANDBY PERSON IS REQUIRED FOR ALL CONFINED SPACE WORK

SAFETY STANDBY PERSON(S)	CHECK #	CONFINED SPACE ENTRANT(S)	CHECK #	CONFINED SPACE ENTRANT(S)	CHECK #
____________	_____	_________	______	_________	_____
____________	_____	_________	______	_________	_____

SUPERVISOR AUTHORIZING - ALL CONDITIONS SATISFIED_____________________

DEPARTMENT/PHONE ____________________________

AMBULANCE, FIRE: 911 Safety: 888-427-2929 (888-GAS-AWAY)

APPENDIX G

EMPLOYEE LEAD IN CONSTRUCTION FACT SHEET

Lead is a toxic substance that may enter the body through breathing or swallowing lead dusts, fumes, or mists. If food, cigarettes, or your hands have lead on them, lead may be swallowed while you are eating, drinking, or smoking. Once in the body, lead enters the bloodstream and may be carried to all parts of the body. The body can eliminate some of this lead, but any remaining stored lead may cause irreversible damage to cells, organs and whole body systems. After exposure stops, it takes months or even years for all lead to be removed from the body.

What Are the Symptoms?

Exposure to lead may affect each person differently. Even before symptoms appear, lead may cause unseen injury to the body. During early stages of lead poisoning, mild symptoms may be overlooked as everyday medical complaints, including:

Loss of appetite	Joint and muscle aches
Trouble sleeping	Metallic taste
Irritability	Decreased sex drive
Fatigue	Lack of concentration
Headache	Moodiness

Brief intense exposure or prolonged overexposure may result in severe damage to your blood-forming, nervous, urinary, and reproductive systems. Some noticeable medical problems include:

Stomach pains	Tremors
Wrist or foot drop	Convulsions or seizures
High blood pressure	Anemia
Nausea	Constipation or diarrhea

What Protection Do I Have?

The Lead in Construction Standard 29 CFR (1926.62) is designed to protect you if you are exposed to lead on the job. The permissible exposure limit for airborne lead is an 8-hour time weighted average of 50 µg/m³ (micrograms per cubic meter of air). However, the permissible exposure limit is lower if your workday exceeds 8 hours.

Regardless of your exposure, your employer is required to do the following:

- inform you of the hazards of lead
- provide handwashing facilities
- provide clean protective clothing where skin or eye irritation exists
- provide you with a respirator when you want one

Exposure at or above 30 µg/m³ (the action level) requires the following:

- periodic air monitoring
- periodic testing of the level of lead in your blood
- medical examinations and consultations
- removal from exposure, with your wages and benefits protected, when your blood lead level exceeds 50 µg/dl
- more detailed training

Additionally, exposure in excess of the permissible exposure limit requires:

- engineering and work practice controls to minimize exposure
- properly selected and fitted respiratory protection
- clean protective clothing
- clean change areas
- showers (where feasible)

How Do I Know If I'm Overexposed?

Your employer is required to assess your exposure whenever you may be exposed to lead. However, until your employer demonstrates otherwise, it is presumed that you are exposed in excess of the permissible exposure limit if you:

- spray paint with lead paint
- use lead-containing mortar
- engage in lead burning
- or perform any of the following activities where lead-containing coatings or paint are present:
    - manual demolition of structures
    - manual scraping
    - manual sandingh
    - heat gun applications
    - power tool cleaning
    - river busting
    - welding
    - torch burning
    - abrasive blasting
    - cleanup activities where dry, expendable abrasives are used
    - abrasive blasting enclosure movement and removal

This fact sheet is intended to highlight the major aspects of the Lead in Construction Standard and is not to be interpreted as the complete requirements under the standards.

LEAD IN CONSTRUCTION COMPLIANCE TABLE

The Federal Lead Exposure in Construction Standard, 29 CFR 1926.62, requires that before beginning any construction work that may result in lead exposure, an employer must determine if any employee may be exposed to lead at or above the action level (30 mg/m³). If any employee may be exposed at or above the action level, the employer must conduct air sampling at the start of the operation that may involve lead exposure. The major requirements of the Lead in Construction Standard are detailed below.

Table. Lead in Construction Standard.

Any Airborne Lead	At or Above Action Level (30 μmg/m³)	Above PEL (50 μg/m³)	
			CONDUCT EXPOSURE MONITORING
	X	X	- at start of job
	X		- every 6 months
		X	- every quarter
X	X	X	- when job change may result in new or additional exposure
X	X	X	- if employee complains of symptoms related to lead exposure
			Whenever exposure monitoring is performed, employee must be provided with written notice of results.
		X	USE FEASIBLE ENGINEERING AND WORK PRACTICE CONTROLS
		X	DEVELOP WRITTEN COMPLIANCE PROGRAM AND REVIEW EVERY 6 MONTHS
		X	PROVIDE RESPIRATORY PROTECTION
		X	- as interim measure
		X	- to supplement engineering and work practice controls
		X	- when controls not feasible
		X	- upon employee request
			When respirators are provided, a respiratory protection program in accordance with 29 CFR 1910.134(b), (d), (e), and (f) must be established and fit testing must be conducted. A medical examination must be provided if an employee exhibits difficulty breathing during respirator fit test or use. An employer must provide a powdered air purifying respirator at the employee's request.

		X X X X X	PROVIDE APPROPRIATE PROTECTING CLOTHING AND EQUIPMENT - clean clothing weekly (daily if exposure above 200 µg/m³) - ensure protective clothing removed at end of shift - ensure appropriate laundering or disposal - clean and repair equipment *Protective clothing and equipment must also be provided when the possibility of skin or eye irritation exists.*
		X X X X	MAINTAIN ALL SURFACES AS FREE OF LEAD AS POSSIBLE - prohibit cleaning by compressed air - use vacuuming or other equally effective cleaning methods - use wet methods when vacuuming not feasible
		X X X X	PROHIBIT EATING, DRINKING, AND SMOKING IN JOB AREA - provide eating and drinking area - ensure employees wash prior to eating or drinking - ensure employees do not enter eating area in lead-contaminated clothing
     X X	 X X	X X X X X	PROVIDE CHANGE AREAS AND STORAGE - ensure employees do not leave job area in contaminated clothes PROVIDE WASH FACILITIES [29 CFR 1926.51(f)] - be sure employees wash at end of shift PROVIDE LAVATORY FACILITIES [29 CFR 1926.51(c)]
	X X X X	X X X X	INSTITUTE MEDICAL SURVEILLANCE PROGRAM Biological monitoring (Blood Lead + ZPP or FEP Levels) - prior to assignment - every 2 months for first 6 months of exposure - written notification of results to employee *Medical examination must be provided when exposure is above action level and employee has*

U.S. Department of Transportation
Federal Highway Administration

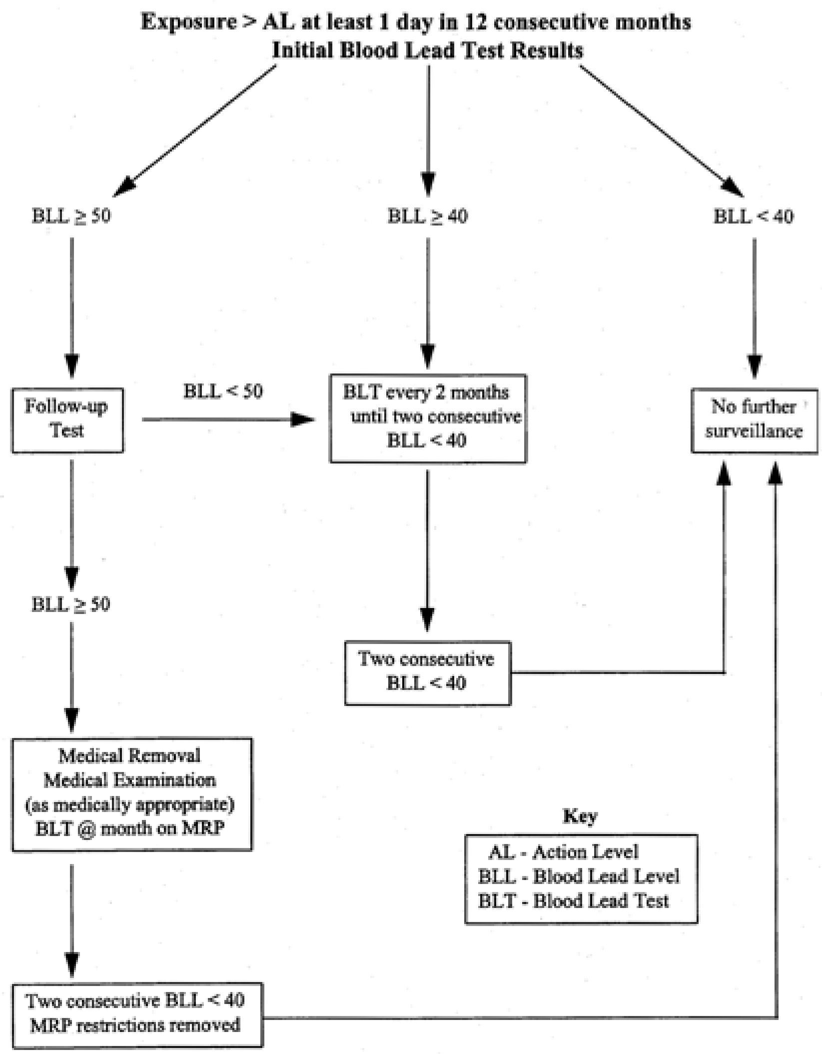
			developed signs or symptoms associated with lead intoxication, desires advice on effects of exposure on ability to procreate, or employee's blood lead level is at or above 40 mg/100 g. A medical examination must also be provided when an employee exhibits difficulty breathing during respirator fit test or use.
	 X X	 X X	PROVIDE MEDICAL REMOVAL AND PROTECTION - if blood lead level is at or above 50 mg/100 g - if indicated by a final medical determination
X X	X X	X X	INFORM EMPLOYEES OF STANDARD - make available a copy of standard
	X	X	PROVIDE TRAINING PROGRAM *Training must also be made available if the possibility of skin or eye irritation exists.*
		X	POST WARNING SIGNS
 X X	 X X X X	 X X X X	MAINTAIN RECORDS OF - initial determination - exposure monitoring - medical surveillance - medical removal

This chart is intended to summarize the Federal Lead Exposure in Construction Standard, 29 CFR 1926.62, and is not to be interpreted as the complete requirements under the standard.

Table. APPLICABLE PARAGRAPHS OF 1926.62 RELATED TO SPECIFIC AIR LEAD LEVELS

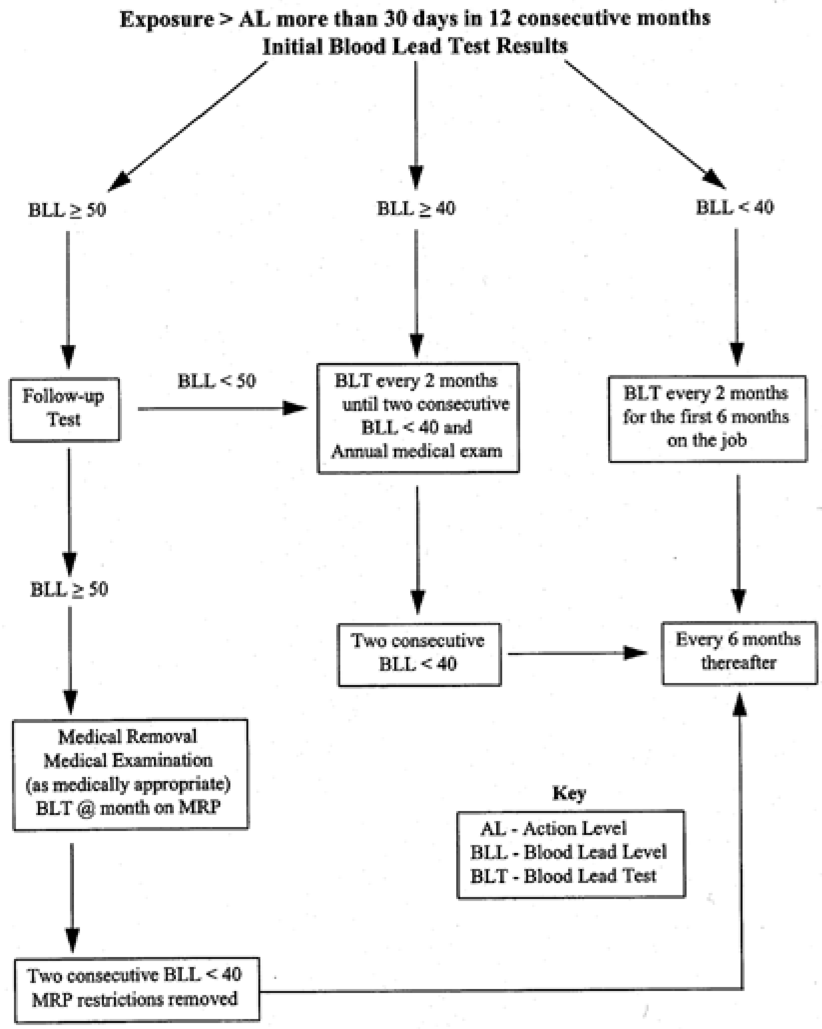
Regardless of Level	For Specific Air Lead Levels: ≥ AL, 1-30 Days	For Specific Air Lead Levels: ≥ AL, > 30 Days	For Specific Air Lead Levels: > PEL	For Specific Air Lead Levels: > 4 X PEL	During Assessment of Trigger Tasks
1926.62(d) - Exposure Assessment and Interim Protection 1926.62(h) - Housekeeping 1926.62(l)(5) - Handwashing Facilities 1926.62(l)(1)(i) - Hazcom Training (and/or 1926.21 - Safety Training and Education)	1926.62(d)(4) - Monitoring Representative of Exposure for Each Exposed Employee 1926.62(j)(1)(i) - Initial Medical Surveillance 1926.62(j)(2)(ii) - Follow-up Blood Sampling 1926.62(k) - Temporary Removal Due to Elevated Blood Lead 1926.62(l)(1)(ii) -(iv) - Information and Training	1926.62(j)(1)(ii) - Medical Surveillance Program 1926.62(j)(3) - Medical Exams and Consultation (if required)	1926.62(e) - Engineering and Work Practice Controls 1926.62(f) - Respiratory Protection 1926.62(g) - Protective Clothing and Equipment 1926.62(l) - Hygiene Facilities and Practices 1926.62(m) - Signs	1926.62(g)(2) - Clean Protective Clothing Daily	1926.62(f) - Appropriate Respiratory Protection 1926.62(g) - Protective Clothing and Equipment 1926.62(i)(2) - Change Areas 1926.62(l)(5) - Handwashing Facilities 1926.62(j)(1)(i) - Biological Monitoring 1926.62(l)(1)(i) - Hazcom Training 1926.62(l)(2)(iii) - Respirator Training

Lead Standard Medical Surveillance Requirements



Medical Surveillance Flowchart I

Lead Standard Medical Surveillance Requirements



Medical Surveillance Flowchart II

APPENDIX H

CRISP-CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT

LEAD HEALTH PROTECTION PROGRAM (LHPP)

Description: The structure(s) on this project are coated with paint containing lead Any work that disturbs the paint coating may expose workers to health hazards. The Contractor is fully responsible for the protection of employees and ConnDOT project-related employees from exposure to lead under OSHA regulations At least 20 working days prior to performing any work on the structure, the Contractor shall submit to the Engineer and to the Connecticut Road Industry Surveillance Project (CRISP) a written Site-specific Lead Health Protection Program (LHPP) prepared by a Certified Industrial Hygienist (CIH) that covers all workers on the project (Contractor, Subcontractor, and Connecticut Department of Transportation (ConnDOT) representatives) The CIH shall be listed by the American Board of Industrial Hygiene The LHPP shall include procedures for medical surveillance of the contractors and the state project- related representatives, hazard communication procedures, employee training, protective equipment, and all other procedures that may be necessary to comply with 29 CFR part 1926.62 pertaining to lead exposure in construction.

Typical work tasks that pose a lead exposure risk consist of, but are not limited to, welding, burning paint, flame cutting, abrasive blast cleaning, grinding, chipping, needle gun cleaning, lead burning, manual scraping and sanding, manual demolition of structures, heat gun cleaning, peening on existing structural steel, abrasive blasting debris cleanup, using lead-containing mortar, abrasive blasting enclosure movement and removal, power tool cleaning, lead removal equipment cleaning, decontamination trailer cleaning, rehabilitation of existing structural steel, gouging, and rivet busting.

The Contractor shall comply with the requirements of the OSHA Standard for Lead in Construction, 29 CFR 1926.62, and any other applicable Federal and State laws. Additional Federal regulations that must be followed with respect to lead and this specification include, but are not limited to:

29 CFR Part 1910.1000 (a, b, c Tables Z-1-A, Z-2, and Z-3 as currently in effect.)	Air Contaminants
29 CFR Part 1926.154	Temporary Heating Devices
29 CFR Part 1910.20	Access to Employee Exposure and Medical Records
29 CFR Part 1910.120	Hazardous Waste Operations & Emergency Response
29 CFR Part 1910.134	Respiratory Protection
29 CFR Part 1910.141	Sanitation
29 CFR Part 1910.146	Permit Required Confined Spaces
29 CFR Part 1910.94	Abrasive Blasting
29 CFR Part 1926.16	Rules of Construction
29 CFR Part 1926.20	General Safety and Health Provisions

29 CFR Part 1926.21	Safety Training
29 CFR Part 1926.28	Personal Protective Equipment
29 CFR Part 1926.32	Competent Person
29 CFR Part 1926.51	Sanitation
29 CFR Part 1926.55	Gases, Vapors, Fumes, Dusts and Mists
29 CFR Part 1926.57	Ventilation
29 CFR Part 1926.59	Hazard Communication
29 CFR Part 1926.103	Respiratory Protection
29 CFR Part 1926.200	Accident Prevention Signs and Tags
29 CFR Part 1926.353	Ventilation and Protection in Welding, Cutting and Heating
29 CFR Part 1926.354	Welding, Cutting and Heating in Way of Preservative Coatings

The Contractor shall also comply with all current CRISP guidelines and protocols.

FAILURE OF THE CONTRACTOR OR HIS/HER SUBCONTRACTORS TO COMPLY WITH THE PROVISIONS OF THIS SECTION WILL AFFECT WHETHER THE CONTRACTOR OR HIS/HER SUBCONTRACTOR WILL BE CONSIDERED A RESPONSIBLE CONTRACTOR OR SUBCONTRACTOR ON FUTURE WORK INVOLVING STRUCTURE REHABILITATION AND REMOVAL OF LEAD PAINT COATINGS ON DEPARTMENT OF TRANSPORTATION PROJECTS.

CRISP personnel shall be allowed access to each work site covered by the provisions of the LHPP and shall be furnished with such information and assistance by the contractor as is required to make a complete and detailed inspection.

Materials: Respiratory protective equipment shall conform to 30 CFR PART 11, 29 CFR PART 1910.134, and 29 CFR PART 1926.62. The requirement for protective clothing shall be in conformance with 29 CFR PART 1910.132 and 1910.133. The minimum protective clothing required shall be head covering, coveralls (reusable or disposable clothing), gloves, dedicated workboots or disposable overboots, eye protection, hearing protection, and hardhat There will be no direct payment for protective clothing under this item. The cost of protective clothing shall be considered included in the general cost of the contract.

All projects where employee lead exposure without regard to the use of respirators, may exceed the action level, that is, employee exposure to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 $\mu g/m^3$) averaged over an 8-hour period (i.e., removal of paint containing lead, bearing replacement , etc.) must have a decontamination facility as described in the Item “Decontamination Facility” on site and portable handwash facility as described in the item “Portable Handwash Facility” as directed by the engineer.

Construction Methods: Within 20 calendar days of the award of the contract, the contractor shall submit to the engineer written quotes from a minimum of three industrial hygiene firms (IH firms) for the performance of work under this item. The quotes shall be furnished on the proposal form made a part of these specifications.

State of Connecticut, Department of Transportation, Bureau of Engineering and Highway Operations

PROPOSAL FORM FROM INDUSTRIAL HYGIENE FIRM TO PROVIDE SERVICES TO

(Contractor Name)

ON A CONTRACT DESCRIBED AS FOLLOWS:

Town: ______________________ Project: ______________________
Address: ______________________ Tel. No. ______________________
____
____

Please provide quotes to furnish the following services required under the specifications for Item No. _______ on the above listed contract.

Description	Unit	Unit Price
Written Lead Health Protection Program Procedures to include as a minimum the following: Lead Health Protection Program Procedures, Records of all employees that are participating in LHPP. Procedures for instituting medical surveillance, procedure of employee notification, employee exposure assessment with 29 CFR 1926.62 and CRISP guidelines, procedure for selection of appropriate respirator equipment and protective clothing, procedure for conducting employee training (on-site services only), hazard communication procedures, personal hygiene procedures, monthly certifications, monthly compliance reports, annual reports/summary report, and all changes, updates, and modifications to LHPP required.	Lump Sum	
Employee Training Class to include costs for labor, material, equipment, and services involved to provide employee training class at project site location. Minimum class size is to be five.	Each	

In the space below indicate the Title, Certified Payroll Rate, and Hourly Rate to be charged for personnel you will be using to provide on-site services. Attach copies of certified payrolls and current audit. Note: Hourly rates charged cannot exceed 245 percent of certified payrolls and these rates shall include the costs of monitoring and maintaining the LHPP as well as all compensation for overhead, profit, and direct and indirect costs. In addition, profit shall not exceed 7 percent. Principal's maximum hourly rate shall not exceed $35.

Title	Certified Payroll Rate	Hourly Rate

(attach additional sheet if required)

Attach to this Proposal a brief statement of your firm's qualifications and previous experience in lead abatement/removal project(s) or activities. Also provide resumes of key personnel to be assigned to the project.

If this Proposal is accepted, ______________________ agrees to follow as a minimum the testing guidelines provided by CRISP and to use the forms provided by CRISP for collecting and reporting data to ConnDOT and CRISP.

______________________ ______________________
Signature Title

The quotes shall contain the following information:

- Name, address, phone number of firm.
- Qualifications of the firm, including previous experience in lead abatement/removal project(s) or activities.
- Resumes of key personnel to be assigned to the project.
- A lump sum fee to prepare and furnish the following for the LHPP:
    - Written LHPP procedures.

- Written records of all employees who are participating in the LHPP.
- Procedure for instituting medical surveillance, including method and personnel involved.
- Procedure for employee notification.
- Procedure for employee exposure assessment with 29 CFR 1926.62 and CRISP guidelines.
- Selection and justification of appropriate respiratory equipment and protective clothing.
- Procedure for conducting employee training (on-site services).
- Written hazard communication procedures.
- Written personal hygiene procedures.
- Monthly certification.
- Monthly compliance report.
- Summary report and/or annual reports.
- A quote to provide employee training as required under the LHPP to be paid as each group of employees trained.
- Hourly rate for on-site services performed by the CIH, the IH, and/or their supervised technicians, etc., to comply with and monitor the LHPP procedures This includes weekly inspections and certification that respirators are being cleaned properly Also included are investigation requirements for medical removal, intervention, and recommended implementation of intervention measures A listing by title of those personnel to be on-site shall be furnished with copies of certified payrolls that will be in effect for the duration of the project Overhead as documented by a CPA and profit (7 percent maximum) shall not exceed 145 percent of these payrolls and shall include all direct and indirect costs related to this work and recommended implementation of intervention measures. Travel costs will not be paid. Hourly rates for principals of the company shall not exceed $35/hr including overhead and profit.
- Agreement to use the forms provided by CRISP for collecting and reporting data to ConnDOT and to CRISP.
- Agreement to follow as a minimum the testing guidelines provided by CRISP.

The engineer will review the proposals submitted and notify the contractor in writing of the firm(s) acceptance within ten (10) calendar days of receipt of the proposals.

Definitions:

“Action level” means employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 $\mu g/m^3$) averaged over an 8-hour period.

“Permissible Exposure Limit” (PEL) means employee exposure to airborne concentrations of lead equal to or greater than 50 micrograms per cubic meter of air (50 $\mu g/m^3$) averaged over an 8-hour period If an employee is exposed to lead for more than 8 hours in any work day, the permissible exposure limit, as a time weighted average (TWA) for that day, shall be reduced according to the following formula: Maximum permissible limit (in µg/m³) = 400/number of hours worked in the day.

"Employee" means all workers on the project, including contractor, subcontractors and ConnDOT representatives.

"Lead" means metallic lead, all inorganic lead compounds, and organic lead soaps.

"Employee Lead Exposure" is that exposure that would occur if the employee were not using a respirator.

Lead Health Protection Program:

The LHPP consists of written LHPP procedures and on-site inspections, occupational air sampling, wide sampling, and reporting of the procedures by a CIH The frequency of the on-site surveillance and monitoring shall be dependent upon the type of work to be performed and shall be detailed in the written LHPP procedures.

At the outset of a given job, the IH firm must send to CRISP and ConnDOT all written procedures under this item If there are changes to these procedures, they shall be resubmitted.

The written LHPP procedures consist of, but are not limited to:

1. A written record of all employees involved in work tasks that pose an airborne lead exposure risk at the work site or who may on any day have an exposure exceeding the Action Level. Tasks where 30 µg/m³ may be exceeded include but are not limited to: welding, burning paint, flame cutting, gouging, abrasive blasting, grinding, chipping, needle gun cleaning, lead burning, manual scraping and sanding, manual demolition of structures, heat gun cleaning, peening on existing structural steel, abrasive blasting debris cleanup, using lead-containing mortar, containment moving and removal, power tool cleaning, lead removal equipment cleaning, decontamination trailer cleaning, rivet busting, etc Those working in the vicinity of these tasks may also be exposed.

For this purpose a daily sign in/out log provided by CRISP that identifies persons by name, Social Security Number, affiliation, and work task for all employees who were at the site during the reporting period must be maintained at the work site and submitted monthly to DOT and CRISP.

All workers exposed to airborne lead at or above the Action Level on any day will be required to participate in the medical surveillance program. The IH firm shall determine levels of airborne exposure by breathing zone air sampling for airborne lead exposure over a full representative shift In addition, all workers except those specifically exempted from the comprehensive medical surveillance program who do have or may be anticipated to have lead exposure will be enrolled in the comprehensive medical surveillance program. Those who are exempted from the comprehensive medical surveillance program will be enrolled in the limited medical surveillance program and the listed justification for their exemption by the site CIH will be submitted to ConnDOT and CRISP within 5 working days of the decision to exempt.

2. Procedures for instituting a medical surveillance program in accordance with 29 CFR 1926.62(j) except as noted herein Frequency of medical examination shall conform to 1926.62(j) except where additional testing is specified Medical surveillance will consist of, but not be limited to, an entry/annual testing protocol, an exit testing protocol, interval and comprehensive examination testing as indicated based upon exposure and prior surveillance data blood lead level and Zinc Protoporphyrin levels The medical surveillance data acquired under this special provision shall be collected according to current CRISP protocol and submitted by the CIH to the Department of Public Health and Addiction Services - CRISP Program Coordinator at the following address, CRISP, 150 Washington Street, Hartford, CT

06106. The General Contractor and any and all subcontractors shall cooperate fully and in a timely manner with the project IH firm to share information regarding blood lead levels on covered employees so that results are submitted accurately and in a timely manner to CRISP. The General Contractor and any and all subcontractors and IH firm will cooperate by identifying to the participating CRISP clinic the individuals who will be scheduling the CRISP examinations (the General Contractor or the CIH) All medical examinations and testing will be done at a CRISP- listed medical facility using appropriate CRISP protocols and forms.

3. An entry/annual testing protocol shall apply to workers covered under this specification and shall include the following:

A. Complete medical and occupational exposure history focused on lead.

B. Complete medical examination by a physician trained or experienced in occupational medicine. The records from a previous complete medical examination (conducted within 3 months), which meets the requirements of 1926.62(j), are acceptable in place of another complete medical examination provided that the previous medical examination was conducted by a physician trained or experienced in occupational medicine, utilized appropriate CRISP protocol and forms, and includes vital signs.

C. Lab testing to include complete blood count (CBC), chemistry screen, blood lead level, Zinc Protoporphyrin level, spirometry, and urinalysis including microscopic examination. Other laboratory work or testing dictated by sound medical practice shall be included Subsequent testing shall include a blood lead and Zinc Protoporphyrin level monthly for the first 4 months after the Entry/Annual exam and at month 6 If the blood lead level remains less than 25 µg/dl for all previous months and at month 6, testing shall be conducted at 3-month intervals, and there shall be an exit test for blood lead and Zinc Protoporphyrin level. For projects lasting longer than 1 month, exit tests must be done on the employee's last day of employment on the project.

If, at any time during testing, a blood lead level of 20 µg/dl or greater is detected, those workers with blood lead levels greater than 25 µg/dl shall be monitored with blood lead and Zinc Protoporphyrin levels monthly until the blood lead level is less than 25 µg/dl These workers must also be given one-on-one intervention training by an Industrial Hygienist (IH) on the job Material discussed should include a determination of how the worker may have gotten the elevated level, including specific tasks or practices, and what must be done to prevent future excessive exposure. The IH shall report the results of such determination to ConnDOT and to CRISP as part of the monthly compliance report.

D. Other medical and/or other testing as required and approved by the engineer.

4. The medical removal requirements shall be as follows:

Blood Lead Level for Removal from Lead Exposure

Calendar Year	(Medical Removal Protection)
1994	35 µg/dl
1995 and beyond	30 µg/dl

For any employee with a blood lead level at or above 35 µg/dl (1994), every effort must be made to reduce exposure. The reasons for blood lead level will be investigated by the IH and the worker and a plan of action for reducing exposures will be developed and followed.

This will include: 1) Determination of the reasons for the elevated blood lead level will be made by the IH in consultation with the worker; 2) Development of a plan of action for reducing the exposures; 3) Implementation of the plan.

Should the employee's blood lead level not decrease to below 30 µg/dl on subsequent testing, the employee can be moved to a non-lead-exposed job or removed from the exposure at the employer's expense if the doctor, in consultation with CRISP, so determines based on medical finding. Medical removal protection shall conform at a minimum, to 29 CFR 19.205.62(k) with the exception that medical removal may be required at 35 µg/dl. ConnDOT will not pay for any and all costs associated with the medical removal of an employee.

Employees removed for medical protection may return to their former job status as specified in 1926.62(k) with the exception that two consecutive test results taken at least 1 week apart indicate a level below 25 µg/dl.

5. Intervention. For any employee with a blood lead level at or above 35 µg/dl for 1994 (30 µg/dl for 1995 and beyond), the IH firm shall be immediately informed by the responsible clinic or medical facility and shall be responsible for determining the cause of the elevated lead level and instituting additional protective and hygiene measures against lead exposure at the jobsite A written statement of these determinations shall be sent to ConnDOT and the CRISP coordinator, with the monthly compliance report using the CRISP.

6. Procedures for employee notification. Within five (5) working days of receipt of the medical surveillance results, the employer shall notify all tested employees in writing of the results of their tests Also, the employee shall be immediately notified by the employer (within 24 hours of receipt of results) of the blood lead levels that require removal from lead exposure.

7. Employees' exposures should be assessed in accordance with OSHA Part 1926.62(d) and the current CRISP guidelines for air and wipe sampling Airborne lead samples shall be analyzed by a laboratory accredited by the American Industrial Hygiene Association (AIHA) for the analysis of lead in air. Wipe and chip samples may alternatively be analyzed by a laboratory meeting the proficiency requirement of the ELPAT program The results of all testing shall be reported to the CRISP Coordinator as part of the monthly compliance report.

8. The CIH shall determine and recommend the implementation of intervention measures based on the airborne lead exposure, wipe sampling, blood lead levels, and the observation of work practices. The determination and recommendations should not rely solely on airborne exposure levels (See Part 1926.62(h) & (j)).

9. Procedures for the selection of appropriate respiratory equipment and protective clothing for the particular work task shall be developed in conformance with 29 CFR 1926.62. The minimum respiratory protective equipment required shall conform to 29 CFR 1926.62 for particular work tasks unless a higher level protection is required by the project IH firm. If a higher level of protection is recommended, the CIH shall provide written justification of its need. The CIH will ensure that proper testing, training, cleaning/storage, or replacement and disposal of the utilized articles will be in accordance with 29 CFR 1926.62(f) and (g), especially 29 CFR 1926.62(g)(2) (ii-viii) The IH firm shall monitor the selection and use of respiratory equipment and protective clothing during on-site surveillance and monitoring inspections. The IH firm will conduct weekly inspections and the CIH will certify that the respirators are being cleaned properly. If the cleaning is found be unacceptable by the IH firm or the CIH, the Contractor will correct the situation, and the cost for reinspection by the IH firm or CIH will not be eligible for reimbursement by ConnDOT.

10. Procedures for conducting employee training on lead hazards in accordance with 29 CFR 1926.62(l). This training will cover a minimum of, but not limited to, those topics specified in 29 CFR 1926.62(1)(2)(i-

viii) and the Lead Standard 29 CFR 1926.62. Employees must be given access to 29 CFR 1926.62 and its appendices and all relevant materials. The procedures shall define the site personnel requiring training, the frequency of training, maintenance and training records, and qualifications required of the instructor performing the training. In addition, a blood lead level >25 μg/dl will trigger a special retraining session where the IH works with the individual to determine the cause of the elevation and another session where the IH discusses with the individual the result of that determination and the protective measures instituted.

11. The Contractor shall establish and have available at the work site a written Hazard Communication Procedure in accordance with 29 CFR 1926.59 This written procedure shall describe how warning signs, labels, material safety data sheets, and employee training will be provided. It must also contain proper work practices for working around hazardous materials. Also contained in this procedure will be a list of hazardous materials generated by a work task, i.e., lead fumes, lead dust, etc Any training required to meet 1926.59 above that required of 1926.62 shall be provided.

12. A written Personal Hygiene Procedure shall be available at the work site and must be in accordance with 29 CFR 1926.62(e)(2)(ii)(F), paragraph (h) Housekeeping and paragraph (i) Hygiene Facilities and Practices of 29 CFR 1926.62 Workers will not be allowed to eat, drink, or smoke, or apply cosmetics in areas where there is a potential for lead exposure. The Contractor shall provide a climate-controlled decontamination facility containing washing and shower facilities with clean hot and cold water, soap, and disposable towels, which the workers will use to wash their hands and face before eating, drinking, or smoking and after each working shift In addition, portable wash units will be provided as the site dictates for use during breaks for personal hygiene. The Contractor shall provide a clean area for eating and drinking and a separate clothes-changing area to reduce the chance for lead cross contamination. After employees change clothes and shower, the work clothing, shoes, and protective equipment shall remain at the jobsite until properly cleaned or disposed of. The written plan shall also include procedures for cleaning and ensuring cleanliness of these facilities.

On a monthly basis, the CIH shall submit to CRISP and ConnDOT the following:

a) Certification that all requirements of the LHPP and CRISP guidelines and protocols, including occupational air and wipe sampling, training medical surveillance, and elevated blood lead level intervention and reporting, have been followed.

b) A monthly report including:

1. Results of all air and wipe sampling done during the past month reported on the forms or diskette using the format provided by CRISP.
2. A narrative report describing progress on the jobsite, interpreting the sampling results, and making any recommendations necessary.
3. Blood lead and Zinc Protoporphyrin levels for all employees listed by name and Social Security number and a listing of exempted workers by name with justification for exemption. Copy furnished to ConnDOT shall not include employee's name or Social Security number.
4. Reports of the investigations made subsequent to any employees having blood level at or above 25 μg/dl, including determination of cause and plan of action for remedy. Copy furnished to ConnDOT shall not include employee's name or Social Security number.
5. The daily sign in/out log of people working on the jobsite for the past month.
6. Submission of required monthly CRISP reporting forms.

Projects lasting less than 1 year will provide a project summary report at the close of lead-related work, and projects lasting more than 1 year will provide and annual report.

The reports will include the following:

1. All occupational air and wipe sampling and other pertinent data gathered.

2. All blood lead level and Zinc Protoporphyrin data generated for workers and others on the site identified by name and Social Security number and presented in chronological order, in a format showing job title/activity for each worker, and describing activities undertaken to limit exposures when elevated blood lead levels are identified, and the results of those activities. Copy furnished to ConnDOT shall not include employee's name or Social Security number.

3. A listing of all workers who were medically removed by name and Social Security numbers and resulting actions. Copy furnished to ConnDOT shall not include employee's name or Social Security number.

4. Unusual and/or interesting findings on the bridge project that you have discovered/evaluated/identified that would be valuable to your colleagues, CRISP, and/or ConnDOT in the management and control of lead exposure on future bridge projects.

5. Summarize recommendations and comments that are designed to improve the capabilities of the LHPP to more efficiently and effectively control blood lead levels on ConnDOT bridge work.

Method of Measurement. This work will be measured for payment as follows:

1. Written LHPP Procedures: The written LHPP procedures prepared by the CIH will be measured for payment on a lump sum basis and shall include the following:

- LHPP procedures
- Records of all employees who are participating in the LHPP
- Procedure for instituting medical surveillance
- Procedure of employee notification
- Employee exposure assessment with OSHA 1926.62 and CRISP guidelines
- Procedures for selection of appropriate respiratory equipment and protective clothing
- Procedure for conducting employee training (on-site services only)
- Hazard communication procedures
- Personal hygiene procedures
- Monthly certifications
- Monthly compliance reports
- Annual reports/summary report

- All changes, updates, and modifications to LHPP required during project

2. Employee Training Class: Employee training classes will be measured for payment by the number of classes given by the CIH, IH and/or supervised technicians To be considered an employee training class the class must be site specific, held at the project site, and have a minimum of five trainees The engineer must be notified when a training class is scheduled. If the engineer is not notified, the class will not be measured for payment.

3. On-Site Services Performed by IH Firm: On-site services performed by the CIH, IH and/or supervised technicians to comply with and monitor the LHPP shall be measured for payment by the number of hours worked on-site by title of person providing service On-site services performed by the CIH, IH and/or supervised technicians for reinspection and recertification will not be measured for payment by the State.

4. Medical Examinations and Testing by Independent Clinics: Medical examinations and testing by independent clinics required under CRISP protocol and/or other testing as required and approved by the engineer shall be measured for payment by actual cost (receipted bills) plus allowable markup These examinations and tests shall include:

- Complete medical and occupational exposure history
- Complete medical examinations
- Lab Testing
    -
    - Complete blood count
    - Chemistry screen
    - Blood lead level
    - Zinc Protoporphyrin
    - Spirometry
    - Urinalysis including microscopic examination
    - Other medical and/or testing approved by the engineer

5. Equipment: The following equipment may be measured for payment on a monthly rental basis if an acceptable rental rate can be agreed upon by the contractor and engineer. If an acceptable rental rate cannot be agreed upon, the equipment shall be measured for payment by actual cost (receipted bills). Only new equipment will be eligible for reimbursement if rental rate cannot be agreed upon.

- Respiratory equipment, other than blast hoods, with Protection Factor of 10 or greater, excluding air supply hoses and compressor
- HEPA vacuum system
- Filtration devices utilized to provide Grade D breathing air, excluding air supply hoses and compressor

Basis of Payment: The sum of money shown on the estimate and in the itemized proposal as “estimated cost” for this work will be considered the bid price even though payment will be made as described below. The estimated cost figure is not to be altered in any manner by the bidder Should the bidder alter the amount shown, the altered figures will be disregarded and the original price will be used to determine the total amount for the contract The basis of payment for this work shall be as follows:

1. Written LHPP procedures: The written LHPP procedures will be paid a lump sum fee submitted by the selected IH firm plus 7 percent for overhead and profit, for the contractor. This price shall include all costs

for labor, material, equipment, and services involved for the CIH to prepare, maintain, and revise the written LHPP as required.

2. Employee Training Class: Employee training classes will be paid the unit price submitted by the selected IH firm This price shall include all costs for labor, materials equipment, and services involved for the IH firm to provide an employee training class. There will be no markup allowed for the contractor on employee training classes.

3. On-Site Services Performed by IH Firm: On-site services performed by the CIH, IH, and/or supervised technicians will be paid at the appropriate unit price per hour submitted by the selected CIH based on the title of the person performing service Hourly rates shall not exceed 245 percent of certified payrolls and these rates shall include the costs of monitoring and maintaining the LHPP as well as all compensation for overhead, profit and direct and indirect costs related to this work. The IH firm's profit shall not exceed 7 percent The hourly rate for a company principal $35. No payment will be made by State services provided to reinspect and/or recertify contractor responsible reimburse IH firmThere markup allowed on-site performed firm.

4. Medical Examinations and Testing by Independent Clinics: Medical examinations and testing by independent clinics will be paid at the actual cost (receipted bills) incurred by the IH Firm or contractor plus 7 percent markup The allowable 7 percent markup will only be applied to actual receipted bills received from medical clinics and laboratories.

5. Equipment: Payment for equipment shall be as follows:

Respiratory equipment, excluding air supply hoses and compressors, will be paid at the agreed upon rental rate or the actual cost (receipted bills) if rental rate cannot be agreed upon Blast hoods will not be paid for under this item There will be no direct payment for air supply hoses, compressors, or replacement parts to maintain respiratory equipment in working condition. These costs shall be considered included in the general cost of the contract There will be no markup allowed for respiratory equipment.

HEPA vacuum system will be paid at the agreed upon rental rate or the actual cost (receipted bills) if rental rate cannot be agreed upon. There will be no direct payment to maintain HEPA vacuum system in working condition; this includes replacement parts. These costs shall be considered included in the general cost of the contract There will be no markup allowed for HEPA vacuum system.

Filtration devices, excluding air supply hoses and compressors, will be paid at the agreed upon rental rate or the actual cost (receipted bills) if rental rate cannot be agreed upon There will be no direct payment for air supply hoses, compressors, or replacement parts to maintain filtration devices in working condition These costs shall be considered included in the general cost of the contract There will be no markup allowed for filtration devices.

The intent of these specifications is to provide reimbursement for only those items listed The costs to contractors and subcontractors of having their personnel attend any training, retraining, or refresher courses, receive any testing or emitting of equipment, take any personal hygiene measures, time required for dress up and dress down, and of any other activity under the LHPP that requires or entails attendance of contractors' or subcontractorspersonnel will not be paid for under this item.All such costs considered included in the general cost of contract.

ITEM #603273A - PORTABLE HANDWASH FACILITY

Description: Under this item, the contractor shall provide for the duration of the work where employees will be exposed to lead a portable handwash facility(ies) The number of facilities to be provided will be dictated by the site and approved by the engineer The facility will provide hot and cold clean water, hand soap or similar cleansing agents, and individual hand towels or sections made of cloth or paper, warm air blowers, or clean individual sections of continuous cloth toweling that the workers will use to wash and dry their hands, face, and any exposed skin prior to eating, drinking, smoking or applying cosmetics The facility shall be located as close to the work site as is physically possible Ownership of and liability for the facility shall remain with the contractor throughout the duration of the project The facility shall comply with 29 CFR Part 1926.51.

Materials: Materials shall be of satisfactory quality for the purpose intended and shall be approved by the engineer.

Requirements: The portable handwash facility shall be trailer, skid, or cart-mounted and have a minimum of one sink with a fresh water tank and a holding tank Hand soap or similar cleansing agents and individual hand towels or sections made of cloth or paper, warm air blowers, or clean individual sections of continuous cloth toweling shall be provided The facility will also be equipped with hot water heater, eye wash station, storage cabinets, lights for night use, an electric or pneumatic water pump, and lead filtration system Containers for the collection and disposal of refuse generated at the facility shall also be provided.

The facility shall be kept in a sanitary condition and clean as defined in the current CRISP protocol As a minimum, the facility shall be cleaned after every shift.

Method of Measurement: The furnishing of the portable handwash facility(ies) that are approved will be measured for payment by the number of calendar months that each facility is in place, operational, and being used by employees who are exposed to lead above the Action Level of 30 µg/m³, or have blood levels above 20 µg/dl or who have been directed by the CIH A portable handwash facility that is in operation for only a portion of a month will be measured for payment for the entire month.

Basis of Payment: The furnishing of the portable handwash facility will be paid for at the contract unit price per month for each “Portable Handwash Facility” as specified, which price shall include all material, equipment, labor, sampling, testing, treatment, and disposal of wastewater, cleaning, maintenance, disposal, cost of the CIH for monitoring the cleanliness of the facility, and work incidental thereto.

Pay Item	Pay Unit
Portable Handwash Facility	Month

#603272A - DECONTAMINATION FACILITY

Description: Under this item, the contractor shall provide for the duration of the work where employees will be exposed to lead a climate-controlled decontamination facility The decontamination facility shall consist of a “clean” area where workers can remove and store clean street clothing when they arrive on site for work, shower room with hot and cold running water, soap and towels, and a “dirty” area where work clothing and personal protective equipment may be stored The showers shall be located between the two areas The facility shall be used by all employees as defined in Item “Lead Health Protection Program” who are exposed to lead above the Action Level of 30 µg/m³ or have blood levels above 20 µg/dl or who are directed by the CIH. The facility shall have adequate clean storage for all employees who are required to use the facility to store their non-work clothing The facility shall be located as close to the work site as is physically possible. If the contractor is unable to locate the decontamination facility close to specific work areas, a designated shuttle vehicle shall be provided This vehicle shall be classified as contaminated and shall remain at the jobsite in the decontamination zone This vehicle shall be operated and maintained to eliminate any possibility of cross contamination with the support zone The vehicle shall be cleaned as defined in the current CRISP protocol. Ownership of and liability for the facility and shuttle vehicle shall remain with the contractor throughout The facility shall comply with 29 CFR Part 1926.51.

Materials: Materials shall be of satisfactory quality for the purpose intended and shall be approved by the engineer. The walls, ceiling, and floors shall be constructed of impervious material to aid in the cleaning of the facility such as, but not limited to, fiberglass and plastic.

Requirements: The decontamination facility shall have adequate square feet of floor space to accommodate the workforce and a minimum ceiling height of 2.13 meters Windows shall be of a type that will open and close conveniently, shall be sufficient in number and size to provide adequate light and ventilation, and shall be fitted with locking devices and screens The entrance shall be secure, screened, and fitted with a lock.

The facility shall be provided with a lavatory with hot and cold running water or tepid running water and a lead filtration system. It shall also include hand soap or similar cleansing agents. Individual hand towels, paper or cloth, warm air blowers, or clean individual sections of continuous cloth toweling shall be provided.

Showers shall be provided for each 10 employees of each sex or numerical fraction thereof, who are required to shower during the same shift. Body soap or other appropriate cleansing agents convenient to the shower shall be provided. Showers shall be provided with hot and cold water feeding a common discharge line Employees using showers shall be provided with individual clean towels.

Where working clothes are provided by the employer and become wet or are washed between shifts, provision shall be made to ensure that such clothing is dry before reuse.

The decontamination facility and shuttle vehicle shall be cleaned as required or at least once a week The "clean" area shall be as defined in the current CRISP protocol. If wipe sampling shows that cleaning must be conducted more frequently to maintain this standard, then the frequency of cleaning must be increased. Any wastewater that is generated shall be filtered/ treated to be acceptable to current State and/or local standards for discharge into the existing public wastewater system.

The contractor shall equip the facility with an adequate and safe climate-controlled system, including all necessary fuel, adequate waterproof lighting fixtures, and waterproof electrical outlets. All electrical circuits shall be ground fault protected. The contractor shall also provide exterior illumination of the decontamination facility site. The minimum illumination level shall be 21 lux for a minimum distance of 3 meters on each side of the facility The contractor will provide proper trash receptacles and disposal.

If the decontamination facility remains in service through periods of winter weather, the contractor shall provide snow and ice removal services for the facility site, including but not limited to, driveways, walkways, parking areas, and adjacent sidewalks.

Method of Measurement: The furnishing of the decontamination facility and shuttle vehicle specified will be measured for payment by the number of calendar months that the facility and shuttle vehicle are in place, operational, and being used by employees who are exposed to lead above the action level of 30 $\mu g/m^3$, or have blood levels above 20 µg/dl, or who have been directed by the CIH A decontamination facility and shuttle vehicle that are in operation for only a portion of a month will be measured for payment for the entire month.

Basis of Payment: The furnishing of the decontamination facility and shuttle vehicle will be paid for at the contract unit price per month for “Decontamination Facility” as specified, which price shall include all material, equipment, labor, cleaning, sampling, testing, treatment, and disposal of wastewater, utilities, maintenance, services, cost of CIH to perform wipe sampling, and work incidental thereto.

The cost of providing external illumination, trash removal, and snow and ice removal shall also be included in the monthly unit price bid for the item “Decontamination Facility” as specified.

Pay Item	Pay Unit
Decontamination Facility	Month

CRISP

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT
150 Washington Street Hartford, CT 06106 Tel: 203-566-1454

CRISP OBJECTIVES

The fundamental objective of CRISP (Connecticut Road Industry Surveillance Project) is to limit the toxicity from lead exposure in bridge repair and rehabilitation workers in the State of Connecticut It performs this function through active surveillance of the cohort of bridge workers on bridge sites at any given moment in the State.

Clinical Protocols

The authority for medical visits and examinations is provided through Connecticut Department of Transportation (CONNDOT) bid contract specifications. These specifications provide for a Lead Health Protection Program (LHPP) in all circumstances where lead exposure is possible on a construction site.

In general, the workers screened through this program will be painters, blasters, and ironworkers These general groups do the most direct lead-associated work on the bridge sites. However, since the potential exposures to lead generated by these activities are so great (10,000 µg/m^3 is not uncommon in burning activities), bystander exposures are also very important For example, a carpenter building forms near an ironworker replacing a bearing may receive substantial “bystander” exposure.

CRISP provides for five basic medical evaluations for workers in this cohort. The forms include the following:

- Entry/Annual Evaluation
- Medical Evaluation for Respirator Use
- Interval Evaluation
- Comprehensive Evaluation
- Exit Evaluation

The ENTRY/ANNUAL EVALUATION is designed to provide baseline medical information, to identify medical conditions that might be worsened by lead exposure, and to provide for medical certification for respirator wear It includes a section on occupational and medical history, physical examination findings, laboratory values, and recommendations For data management purposes, the five medical evaluation forms are used to record this information and enable accurate records to be kept and data management to be undertaken. Demographic data for each worker must be completely and accurately documented. This not only includes name, address, and so forth, but also includes jobsite/work site information and employer data This is important so that when a worker is identified with a high lead level, access to the site and worker for intervention will be expeditious The MEDICAL EVALUATION FOR RESPIRATOR USE is completed at the time of the Entry/Annual Evaluation.

The laboratory values required under the CONNDOT specifications include the following:

- CBC
- Chemistry Screen (Chemzyme)
- Urinalysis with microscopic examination
- Blood Lead Level (BLL)
- Zinc Protoporphyrin (ZPP)
- Spirometry

The physical examination is meant to examine and report findings on those organ systems that are known to be subject to harm from elevated lead exposure (i.e., neurologic, GI, etc.).

The INTERVAL EVALUATION is conducted on a variable protocol For all workers entered into the system (those seen by one of the participating CRISP clinics) monthly BLL and ZPP testing is required for the first 4 months and at month 6. If, after 6 months of testing, the BLL remains below 25 µg/dl, the worker is switched to a quarterly schedule and BLL and ZPP are drawn every 3 months. If at any time in the quarterly schedule, the BLL exceeds 25 µg/dl, the worker is switched to a monthly testing interval.

The Interval Evaluation form is designed to record the most recent BLL and ZPP levels and to update the workers' demographic/work site information and symptoms listing Hence, the form is designed to include those sections of the Entry/Annual Evaluation form relevant to these needs The only labs drawn at this time are the BLL and ZPP, except, of course, if the physician recommends additional work-up for an abnormal finding.

The COMPREHENSIVE EVALUATION is completed for all workers found to have lead levels in blood greater than 35 µg/dl. Again, the format of the reporting document closely parallels the Entry/Annual Evaluation form except that the occupational history is more expansive (to include direct and more comprehensive questions regarding work history). More information is gathered regarding the workers' possible alternate and prior lead exposures, and all of the demographic and past medical history information will be updated. Laboratories replicate those noted above except for spirometry.

These workers continue on a monthly BLL and ZPP testing interval and their lab and examination results initiate an intervention by the IH component of the project If a lead-toxicity related finding is detected on this or other evaluations, the worker is referred for specialty follow-up to one of the academic occupational medical clinics for specialist evaluation.

The EXIT EVALUATION is completed within 5 days of the completion of a project, or after the employee's last day employed on a project, or if an employee is terminated by his/her employer Exit Evaluation shall be required only for projects lasting 1 month or longer. The format of the examination is similar to the Interval Evaluation but does not require information on recommendations for working conditions. BLL and ZPP tests are performed.

In summary, the CRISP protocol includes the use of five separate documentation and reporting forms:

Entry/Annual Evaluation form is used only for entry of a particular worker into the system or for the worker's first evaluation of the construction season.

Medical Evaluation for Respirator Use form is used in conjunction with the Entry/Annual Evaluation form to record spirometry results.

Interval Evaluation form is utilized whenever a worker returns to the clinic system for repeat BLL and ZPP levels This form is intended only to serve as a reporting form for the most recent BLL and ZPP data and as an update to existing demographic, jobsite, and symptomatology information.

Comprehensive Evaluation form is utilized once the worker's BLL passes 35 µg/dl.It is not used for follow-up subsequent to this unless a lead-related abnormality found at an interval visit or the noted have increased.

Exit Evaluation form is used when a worker changes his/her work setting or employer or a project is completed.

Finally, CRISP and the CRISP medical examination protocol are not designed nor are they intended to serve as a pre-placement examination system to evaluate workers for fitness to work, except that medical problems that would be worsened by lead exposure are identified and considered If lead-related toxicity is detected in a worker, the CRISP system (Department of Public Health and Addiction Services and CRISP Project Director) manages the appropriate work site intervention strategy, including an IH investigation Any worker ill as a result of lead-related toxicity will be referred to an occupational medicine diagnostic clinic for full evaluation and will usually be placed in a medical removal classification

Changes to the CRISP Protocol for Administrative/Management Personnel

1. Administrative/management personnel regularly involved in on-site activities (these may include several different sites) three or fewer days per week, who do not enter the restricted access work area on any of the work sites, and who are not anticipated to receive lead exposure may, but are not required to, be enrolled in the standard CRISP medical protocol.

2. Rather, individuals meeting the criteria noted above will be required to have blood lead and Zinc Protoporphyrin levels drawn annually to serve as baseline levels and will be asked at that time to complete a questionnaire for individuals potentially involved in lead exposure work.

3. Administrative/management personnel regularly assigned to the worksite on a day-to-day basis but removed from direct contact with the lead-exposed work area may be removed from the standard CRISP medical protocol and placed on an every 3-month protocol if the following are met:

    a. The administrative/management personnel work place is located more than 500 yards and generally upwind from active bridge work;

    b. If active bridge work progresses to 500 yards or nearer to the administrative/ management personnel work place, these workers will be enrolled in the standard CRISP protocol until work progresses to greater than 500 yards away;

    c. Periodic wipe sampling is routinely conducted on surfaces in the administrative/management personnel work place, and results not meeting CRISP's industrial hygiene criteria are immediately reported to CRISPand appropriate medical evaluations are conducted; and

d. On-site workers and others who regularly work inside the lead control area do not enter the administrative/management personnel work place without passing through the on-site decontamination facility.

4. Administrative/management personnel who elect to be medically managed utilizing the standard CRISP protocol will be allowed to be enrolled in that protocol.

5. All applicable provisions of the Interim Final Rule for Lead Exposure in Construction (29 CFR 1926.62) apply in this setting.

CRISP

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT
150 Washington Street Hartford, CT 06106 Tel: 203-566-1454

CRISP Protocol and Financial Responsibility for Medical Evaluation

1. Contract with a CRISP Clinic to follow CRISP Medical Protocol.

2.
- Under CRISP protocol, your employee will be given an Entry/Annual Evaluation before starting on the job. There will be only one per year. The evaluation will include a baseline medical evaluation for lead exposure and for respirator wear.

- There will be four more Interval Evaluations scheduled, one each month and one at month six. After month six, if the blood lead level (BLL) remains below 25 µg/dl (micrograms per deciliter of blood) he/she will go to a quarterly schedule (testing every 3 months).

- If your employee's BLL equals or exceeds 25 µg/dl, he/she will be kept on a monthly Interval Evaluation schedule until the level drops below 25 µg/dl.

- If at any time your employee's BLL exceeds 35 µg/dl, he/she will be given a Comprehensive Evaluation Under Connecticut Department of Transportation (CONNDOT) Lead Health Protection Program (LHPP), the Comprehensive Evaluation is initiated when the BLL exceeds 35 µg/dl.

- When your employee terminates from the job or the job is completed, an Exit Evaluation is given.

- $200.00 for Entry/Annual Evaluation
- $40.00 - $50.00 for the Interval Evaluation
- $225.00 - $250.00 for the Comprehensive Evaluation
- $40.00 - $50.00 for the Exit Evaluation

If working under a CONNDOT contract that includes the LHPP specifications, the cost of Industrial Hygiene monitoring as well as the medical surveillance is reimbursed according to CONNDOT contract Each individual construction company, however, is responsible for direct payment to the provider of medical services.

3. Although CRISP does not assign charges for the examinations, it recommends guidelines to each clinic. These recommendations are approximately:

4. Because CRISP is a federally funded project for managing blood lead data, each lead exposed worker must sign a consent form at the clinic to allow CRISP to add the medical data to the database.

5. In case of known lead exposure from a previous worksite, the company responsible for the lead exposure should be responsible to pay the medical costs.

6. Both you and your employee will be sent blood lead level test results along with medical certification for respirator wear.

7. If you have any questions, please call CRISP at (203) 566-1454.

CRISP EXAMINATION VISIT TIMELINE

Revised 3/20/95

*	=	Start of employment with responsible employer
#'s	=	Month from start of employment with responsible employer
E	=	Entry Examination (H&P, UA, BLL/ZPP, CBC & SMAC, PFT)
I	=	Interval Examination (BLL/ZPP)
A	=	Annual Examination (H&P, UA, BLL/ZPP, CBC & SMAC, PFT)
X	=	Exit Examination (BLL/ZPP)
C	=	Comprehensive Examination
H&P	=	History and Physical Exam
PFT	=	Spirometry

Biological monitoring under the OSHA Lead Rule is triggered from the time of employment CRISP has adapted its schedule to conform with the rule Therefore, once an employee begins a new job, he/she needs a baseline and four subsequent monthly visits, etc The annual exam is performed to determine medical fitness for respirator use (PE, PFT) and to perform annual bloodwork to evaluate for anemia, kidney disease, etc. (UA & Micro, CBC, SMAC) The annual exam is performed in addition to an interval screen when 12 or more months have elapsed since the last annual/entry exam.

Some examples follow:

Example 1

A worker starts a job at month 0. There are four monthly interval exams and interval exams at month 6, 9, and 12 as long as BLLs remain less than 20 µg/dl. At month 12, an annual exam is performed since it has been 12 months since the entry exam. If the job continues past 1 year, the cycle of biological monitoring will repeat that of the first year (monthly interval exams, interval exams at month 6, 9, and 12 as long as BLL remain less than 20 µg/dl).

First- and second-year monitoring program:

Start of Work	*																		
Month	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Type of Exam	E	I	I	I	I		I			I			AI	I	I	I	I		I

Example 2

A worker starts a job at month 0. There are monthly interval exams and an exit exam at month 6 (as long as BLL's remain less than 20 µg/dl). There is no other monitoring if the exit BLL is less than 20 µg/dl At month 7, the worker is hired by another employer. This triggers four monthly interval exams from month 8 thru 11, an interval at 6 , 9, and 12 from the date of the most recent hire (13, 16, and 18 months from entry into the CRISP system). At month 13, an annual exam is performed since it has been 12 months since the entry exam. If the job continues past this point, revert to the first year cycle of screening.

Start of Work	*							*												
Month	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Type of Exam	E	I	I	I	I		X	I	I	I	I	I		AI			I		I	I

Example 3

A worker starts at month zero There are two monthly interval exams and then an exit exam when he/she is laid off. There is no other monitoring if the exit BLL is less than 20 µg/dl The worker is re-hired twice more at month 6 or 10 for one-month jobs An entry annual exam is not needed to re-enter at month 6 or 10 Rather, interval exams are performed at these times. At month 13, the worker starts another job At this point, an annual (it has been 12 months since the last one) and interval (start of new monitoring schedule) exam are both needed This new job triggers subsequent interval exams from month 14 thru 17. An exit is performed at month 18 when the worker is laid off There is no other monitoring if the exit BLL is less than 20 µg/dl.

Start of Work	*							*				*				*			
Month	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Type of Exam	E	I	I	XI	I		I				I			IA	I	I	I	I	X

Example 4

A worker starts a job at month 0 There are monthly interval exams and an interval exam at month 6. At month 6, the BLL is greater than 30 µg/dl, triggering a comprehensive exam Monthly interval exams are performed after the comprehensive exam until the BLL is less than 20 µg/dl (at month 8). At this point, the worker resumes the normal monitoring schedule (month 9 and 12) that was initiated at the time of hire on month 0 At month 12, an annual exam is performed since it has been 12 months since the entry exam. If the job continues past this point, revert to example 1 for guidance on the intensity of biological monitoring in the second year of the current job An exit exam is performed at month 13 when the worker is laid off. There is no other monitoring if the exit BLL is less than 20 µg/dl.

Example 5

Start of Work	*																		
Month	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Type of Exam	E	I	I	I	I		IC	I	I	I			AI	X					

A worker starts a job at month 0 There are monthly interval exams and an interval at month 6. At month 6, the BLL is greater than 20 µg/dl. This triggers monthly interval exams at month 7 and 8 until the BLL is less than 20 µg/dl at month 8 At this point, the worker resumes the normal monitoring schedule (month 9 and 12) that was initiated at the time of hire at month 0 At month 12, an annual exam is performed since it has been 12 months since the entry exam If the job continues past this point, revert to example 1 for guidance on biological monitoring during the second year of the current job An exit exam is performed at month 15 when the worker is laid off. There is no other monitoring if the exit BLL is less than 20 µg/dl.

Start of Work	*																		
Month	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Type of Exam	E	I	I	I	I		I	I	I	I			AI	I	I	X			

Example 6

A worker starts a job at month 0 There are three monthly interval exams and an exit exam at month 4 when the worker is laid off At exit exam on month 4, the BLL is greater than 20 µg/dl This triggers monthly interval exams at month 5 and 6 until the BLL is less than 20 µg/dl at month 6. Even though the worker has stopped working for the employer at month 4, he/she is not allowed to exit the CRISP system until the BLL is less than 20 µg/dl There is no other monitoring after month 6 since the exit BLL is less than 20 µg/dl at month 6.

Start of Work	*																		
Month	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Type of Exam	E	I	I	I	X	I	I												

CRISP

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT
150 Washington Street   Hartford, CT 06106   Tel: 203-566-1454

WIPE SAMPLE PROTOCOL

Wipe samples should be done using the technique specified in HUD using moistened wipes, and wiping flat surfaces of 1 square foot (so using a template, HUD suggests two passes over the surface in opposite directions, without scrubbing.) Wipe samples of non-flat surfaces should be done as follows:

- Hands: front and back surface of hands and fingers of both hands on one sample.
- Steering Wheel: entire surface of circular wheel, not to include surface of crosspieces.
- Half-Face Respirator: entire inside surface, as much as possible.
- Full-Face Respirator: entire inside surface of respirator, including view plate
- Blast Helmet: inside surface of view plate.

Wipe sampling is conducted to ensure that areas are clean. The definition of clean for CRISP protocol is less than or equal to 100 µg/square foot (sq ft) for flat surfaces Areas that should always be clean (i.e., clean side of decontamination facility, eating area) should be below this level all the time, whereas areas expected to get dirty (i.e., dirty side of decontamination facility, portable handwash facility, hands) should be below this level after cleaning Steering wheels, insides of respirators, and blast helmets should also be maintained at less than 100 µg/sample.

Frequency of minimum sampling requested:

Decontamination facility
Clean side - Clean side of decontamination trailer should be maintained below 100 µg/sq ft Adequate samples must be taken to determine cleaning schedule to maintain all surfaces at less than 100 µg/sq ft at all times After that, sampling may be reduced to once per week or less, and done just before scheduled cleaning.

Dirty side - At least one floor and one outside-of-locker or bench sample should be taken just after cleaning at least once per week until 3 consecutive weeks of samples have all been below 100 µg/sq ft After that, dirty side samples may be reduced to one per month just after cleaning.

Guidelines for Installation and Operation of the CRISP IH Computer Reporting Program

1. Each IH firm will be assigned a unique letter Use this letter as the first character in all your sample numbers and use unique numbers for all your samples.

2. Enter all time values as xx:xxa or xx:xxp, that is, 7:15 am should be entered as 07:15a.

3. The field data must be entered before the laboratory results.

4. Flow rates must be entered into the Pump Calibration Form.

5. Leave the IH Firm field blank - your firm name will automatically be entered when the system prints out forms and reports.

6. When you have finished entering data onto the Personal Sampling Form's first screen (the “header”), the computer will ask if you want to save the data, type “N” in order to proceed. At this point any sample numbers not entered in the first data entry cannot be added later.

7. You cannot use the edit function to add sample numbers to the Personal Sampling Form or the Area Sampling Form, although you can use the edit function in the Laboratory Results Form.

8. The “PROJECT NAME” field is case sensitive Use all CAPITAL LETTERS.

9. A list of the form numbers previously entered in the database are available for the Personal Sampling Form and the Wipe Sample Form Forms not able to produce listings are the Area Sampling Form, Pump Calibration Form, and the Laboratory Results Form.

10. The flow rate must be entered on the Pump Calibration Form for the value to be used in calculations.

11. The Laboratory Results Form has a field for lead test results in micrograms A field for lead concentration is also provided but may be left blank and will be calculated when a report is generated.

12. To exit the CRISP program use the left pointing arrow key (<-).

13. For further information regarding this program, contact either Kathie Hammond, PhD (508-856-5730) or Bob Iden (614-431-9217).

CRISP

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT
150 Washington Street   Hartford, CT 06106   Tel: 203-566-1454

Guidelines for Installation and Operation of the CRISP Industrial Hygiene (IH) Computer Reporting Program

To use the CRISP IH Database System you must have an IBM clone personal computer with the following minimum SYSTEM REQUIREMENTS:

- DOS-based operating system (version 5 or above);
- Windows is not required;
- 3.5" floppy drive;
- Hard drive with a minimum of 4 MB free disk space; and
- RAM memory of 2 MB.

To INSTALL the CRISP IH Database System (Do NOT install the CRISP IH Database System on more than one computer Request additional diskettes from Bob Iden or Kathie Hammond, PhD, if you want to install the program on more than one computer):

1. Insert Disk 1 into drive A (or B).
2. Change to the A (or B) directory by typing A: (or B:).
3. Type INSTALL <return>
4. After Disk 1 is installed, follow the instructions on the screen, which will direct you to insert Disk 2 into drive A and to type INSTL <return>.
5. When Disk 2 is installed, follow the instructions on the screen, which will direct you to change your directory to C:1 CRISPDIR, where the program was installed, and then to type CRISP <return> to start the CRISP IH Database System.

General Information: How Do I?

- The system will print data gathering forms (Wipe Sample Form, Pump Calibration Form, Personal Sampling Form, Area Sampling Form, and Laboratory Results Form) and number each with a unique number This was done so that if the data needs to be revised, you will be able to easily identify where to edit the information. Because of this type of tracking system, DO NOT PHOTOCOPY THESE FORMS but print them as you need them.

- In order to fit all of the information on the Area Sampling Form and Personal Sampling Form pages, set your printer to condensed type before you print these forms.

CRISP
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CRISP Industrial Hygiene (IH) Forms

A listing of the Industrial Hygiene Forms required for CRISP and where to locate the forms are explained below.

The following forms are contained on the CRISP IH Computer Data Reporting Program disks (the disks will be available at the time of contract award):

- Wipe Sample Form;
- Pump Calibration Form;
- Personal Sampling Form;
- Area Sampling Form; and
- Laboratory Results Form.

Each one of these forms is generated with unique form numbers. The forms listed above must NOT be photocopied.

Several forms not included on the disks but required for IH monthly reporting are the following:

- Field Notes - Form for Sampling Days (2 pages);
- Monthly Field Notes for Equipment at Site, Respirators, Hygiene Facilities, and Protective Work Clothing and Equipment (5 pages);
- Report of Investigation of Individual's Elevated Blood Lead Level; and
- LHPP Site Register.

These forms may be photocopied If new forms are needed they may be obtained from the CRISP IH, Judy Sparer.

Note: *Information required by the CRISP IH for inclusion in monthly reports is detailed in the Connecticut Department of Transportation's Lead Health Protection Program (LHPP).*

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT
LABORATORY RESULTS

Form # _____
Date _____

IH Firm Submitting Sample and to whom results should be reported ____________________
Address ____
Contact Person ________________________ Phone Number ______________________
Laboratory Analyzing Samples ____

Contact Person ________________________ Phone Number ______________________
Analysis Dates ____

Filter Samples Wipe Samples Paint Chips
Limit of Detection: _____ ug lead ______ ug lead

Sample No.	ug Lead	Sample No.	ug Lead	Sample No.	% Lead

Relinquished by: ____________________ Date: ______________ Time: ______
Received by: ____________________ Date: ______________ Time: ______
Relinquished by: ____________________ Date: ______________ Time: ______
Received by: ____________________ Date: ______________ Time: ______

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT

PUMP CALIBRATION FORM

Form Number: 1000262

Project No. ___________ IH Firm: ___________________ Date: _______________
DOT T#: ____________ Calibrator's Name: ________________________________

Calibration Date	Pump #	Flow Rate (lpm) Before	After	Comment

U.S. Department of Transportation
Federal Highway Administration

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT

AREA SAMPLING FORM

Form Number: 1000275

Project No. _______________ IH Firm: CRISP Date: __________________
DOT T#: ________________ Sampler's Name: ________________________________
Blank sample #'s: _____________ _______________ ______________ ____________

Sample #	Pump #	Start and Stop Times On	Off	On	Off	Tasks Performed Nearby During Sampling				Fail (Y/N)

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT

PERSONAL SAMPLING FORM

Form Number: 1000145

Project No. ______________ IH Firm: CRISP Date: _________________
DOT #: ________________ Sampler's Name: ______________________________
Blank sample #'s: ____________ ______________ _____________ ___________

Employee's name: SSN: Hrs. Wkd today Cigarettes smoked today

First: ___________ _________ ______________ __________ ___________

Exposure during unsampled time should be assumed to be: _________
1 = no exposure
2 = same exposure as sampled time
3 = higher exposure than sampled time
4 = lower exposure than sampled time

Personal Protective Equipment:
Gloves: _________ Coveralls __________ Disposable? ___________
Head Protection: ______ Head covering? ________ Disposable? ___________
P (plugs) M (muffs)
Blasting hood cape _____ Shoe coverings _________ Disposable? ___________
Sample inside or outside hood/helmet/resp? _________ (I inside, O outside)

Start and Stop Times Time Flow Tasks Performed and Respirator Worn
Sample# Pump# On Off On Off Contain L/M Tsk1 Resp1 Eng1 Resp2 Task2 Eng 2 Comment

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT

WIPE SAMPLING FORM

Form Number: 1000015

Project No. _______________ IH Firm: CRISP Date: __________________
DOT #: ___________________ Sampler's Name: ________________________________
Blank sample #'s: _____________ _______________ ______________ ____________

LOCATION:	Sample #	Area (sq/ft)	Comment/Whose desk or car?
Decon. Trailer: Clean side floor			
Clean side bench/ Locker			
Desk in trailers: DOT Contractor Subcontractor Inspector IH			
Lunch Site:			
Vehicle floor, drivers's			
Vehicle steering wheel			
Other 1:			
Other 2:			

INSIDE RESPIRATORS

Before/ After	Resp Type	Sample No.	Previous Task 1	Task 2	Task 3	Comment

HANDS AFTER WASHING

Employee Name	Sample No.	Previous Task 1	Task 2	Task 3	Comment

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT

MONTHLY FIELD NOTES

Project: ______________ IH Firm: ____________ Date: _________ Form No. _________

DOT No.: _____________ Sampler's Name: ______________________________________

Contractor __________________ Person in charge ______________ Phone No. __________

Subcontractors _____________ Person in charge ______________ Phone No. __________
_____________ Person in charge ______________ Phone No. __________
_____________ Person in charge ______________ Phone No. __________

What is being done at this site? ____
____

Are there safety and health specifications in the contract? ______________________________

What level of containment is being used? ______________ DOT _______________ SSPC

Containment dimensions ____________________________

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT

MONTHLY FIELD NOTES

Project: _______________ IH Firm: _____________ Date: __________ Form No. __________

DOT No.: ______________ Sampler's Name: ____

Contractor ____________________ Person in charge _______________ Phone No. _____________

Subcontractors ______________ Person in charge _______________ Phone No. _____________
______________ Person in charge _______________ Phone No. ____________
______________ Person in charge _______________ Phone No. ____________

What is being done at this site? ____

Are there safety and health specifications in the contract? ______________________________
Is there a clearly marked, controlled, "lead exposure" or access area? __________________
If yes - fenced Y or N
signs only ________________
other _____________________

Containment Characteristics

What level of containment is being used? __________ CT DOT _____________ SSPC
Containment Dimensions _________________________
Manufacturer of containment _____________________
Negative pressure visible Y N
Visible emission Y N
_______ Impermeable (tarps, drapes, plastic sheets, panels) or
_______ Permeable (woven material designed to be permeable)

Seams are (check all that apply)
_______ mated or tied
_______ overlapped
_______ folded, caulked, taped

Entry is via
_________ fully sealed entry with air lock
_________ through overlapping tarps or sheets
_________ no special entry

Make up air
_______ passive (holes; open entry points)
_______ baffles/louvers/flap seals/ducts to preclude inadvertent escape of debris
_______ supplied with fan

Form # _____

EQUIPMENT AT SITE

______ IPEC _______ Other (specify) ___________ List manufacturer for each
______ ECS

_________ Containment ventilation _____ cfm ___
_________ Grit recycling ______________
_________ Classifier
_________ Dust Collector _____________
_________ Blasting _________________
_______ Wet
_______ Dry
_______ Other ____________

Abrasive blasting equipment
abrasive:

_______ black beauty (or other coal slag)
_______ steel shot
_______ steel grit
_______ silicates
_______ other _______

_______ grit pot
_______ needle gun
LEV (Y/N)
_______ welding machine
_______ vacuum cleaner
HEPA filters used? Y/N _______

Structural Steel related activities:

_______ gouger
_______ flame cutter
_______ stud gun
_______ torquing gun
_______ grinder LEV (Y/N)
_______ Hell Dogs
_______ Other

Supplied air respirators used? (Y/N) _______

Form # _____

RESPIRATORS

_______ Check if no change from last month

List the respirators used on site, the activities for which they are used, and the types of fit testing employed:

RESPIRATORS		ACTIVITIES For which Respirator Use is:		
Type	Mfg. & Model	Required	Recommended	Optional
_______	____________	________	_____________	_______
		________	_____________	_______
		________	_____________	_______
		________	_____________	_______
_______	____________	________	_____________	_______
		________	_____________	_______
		________	_____________	_______
		________	_____________	_______
_______	____________	________	_____________	_______
		________	_____________	_______
		________	_____________	_______
		________	_____________	_______

Fit testing:
Describe the fit testing employed for each of the respirators above:

Qualitative Fit Testing:

Quantitative Fit Testing:

How often and when are workers trained and fit tested?
Who changes filters, and how often?
Who cleans the respirators, how often, and how?

Respirator Type	Who Cleans	Frequency	How	Filter Change
__________	________	_________	_________	____________
__________	________	_________	_________	____________
__________	________	_________	_________	____________
__________	________	_________	_________	____________

Form # ____

HYGIENE FACILITIES

______ Check here if no change from last month

Handwashing facilities
- hot water available? Yes No
- flowing water? Yes No

Are nonwater cleaners used _____

Hands dried on
- ______ Paper towels
- ______ Cloth towels
- ______ Other ______

distance from worksite:
- ______ within 25'
- ______ 25-200'
- ______ more than 200' away

Eating area: Employee eats
- ______ in an on-site area designated for eating
- ______ in a vehicle
- ______ near or at his work
- ______ off-site
- ______ other (specify) ______

Employee changes clothes:
- ______ in a designated change area
- ______ in a trailer
- ______ in another location (specify) ______
- ______ does not change clothes on site

Shower/decontamination facilities:

distance from worksite: Who cleans shower & storage facilities? ______
- ______ within 25'
- ______ 25-200'
- ______ › 200'

Form # ______

PROTECTIVE WORK CLOTHING AND EQUIPMENT

______ No change from last month

Is the employee provided with:

Gloves ______ Hats ______ Shoe Coverings ______
Head Cover ______ Dedicated Work Shoes ______

Coveralls ______ Hearing Protection ______
______ Disposable Type ______
______ Reusable

Who launders protective clothing? ______ employee ______ contractor ______ IH firm

How often is clean and dry PPE provided to workers exposed to greater than 200 $\mu g/m^3$ of lead?

CONNECTICUT ROAD INDUSTRY SURVEILLANCE PROJECT

FIELD NOTES - FORM FOR SAMPLING DAYS

Project: ____________ IH Firm: ___________ Date: ______ Form No. ______

DOT No.: __________ Sampler's Name: ____________________________________

Number of workers on site today _____ Number of workers in containment today ______

Work Hours ___ to ____ (All shifts) Temperature ____ F C Relative Humidity _____

Wind direction ________ Speed ____ mi/h

Precipitation: ________ none ____ rain _____ snow _____ sleet _________________

Other notable weather conditions ____

Other comments ____

____

Operations Performed Today:

________ PAINTING (PNTG) PAINT TYPE USED

Indicate with a "C" if inside containment

________	Mixing paint (PMIX)	________	Zinc primer
________	Spray painting (PSPY)	________	Epoxy based
________	Hand painting (PHND)	________	Polyurethane/Isocyanate based
________	Other - Specify ________	________	Other - Specify ________

________ CONTAINMENT

________ Erecting containment (CNTE)

________ Moving/Taking down containment (CNTM)

________ SURFACE PREPARATION (SURF) - Indicate with a "C" if inside containment

________	Abrasive blasting (BLST)	________	Burning (BURN)
________	Chipping (CHIP)	________	Chisel (CHSL)
________	Grinding (GRND)	________	Tending grit pot(s) (TEND)
________	Hammer scaling (HMSL)	________	High-pressure water scaling (HPWS)
________	High pressure air cleaning (HPAC)		
________	Needle scaling (NDLS)	________	Sweeping bare steel (SWP)
________	Other - Specify ________	________	Wire brushing (WIRE)

________ IRON WORK - Indicate with a "C" if inside containment

- ________ Stud gun operation (STUD)
- ________ Flame cutting (FLAM)
- ________ Welding (WELD)
- ________ Heat Straightening (HTST)
- ________ De-rigging (DRIG)
- ________ Rivet Busting (RIVT)
- ________ Peening (PEEN)
- ________ Torquing fastener bolts (TORQ)
- ________ Gouging (GOUG)
- ________ Tacking (TACK)
- ________ Rigging (RIG)
- ________ Other, Specify ________

________ BEARING REPLACEMENT/REPAIR (BEAR)

Indicate with a "C" if inside containment

- ________ Jacking (JACK)
- ________ Cleaning (CLN)
- ________ Replacing pads (RPAD)
- ________ Cutting (CUT)
- ________ Greasing (GRS)
- ________ Other, Specify ________

________ CLEAN UP - Indicate with a "C" if inside containment

- ________ Shoveling (SHVL)
- ________ Vacuuming (VACM)
- ________ HEPA, yes/no
- ________ Scooping with pay loader (SCOP)
- ________ Other, Specify ________
- ________ Sweeping (SWEP)
- ________ Cleaning with hand tools (CHTL)
- ________ Filling barrels (FILL)

Indicate with "Pb" if within 100 ft (30 m) of lead generating activities

________ LABORING and CARPENTRY

- ________ Pouring concrete (CONC)
- ________ Building scaffolds (SCAF)
- ________ Joining Pipes (JNPP)
- ________ Breaking pavement (PAVE)
- ________ Stripping forms or flat arches (STRP)
- ________ Laying drain pipes (LAYP)
- ________ Jackhammering (JCKH)
- ________ Other, Specify ________

________ VEHICLE OPERATION (TRCK)

________ ELECTRICAL (ELEC)

________ MASONRY (MASN)

REPORT OF INVESTIGATION
OF INDIVIDUAL'S ELEVATED BLOOD LEAD LEVEL

Please use this form to report the results of the investigation of cause of elevated Blood Lead Levels (BBL)>25 µg/dl and the plan for reducing exposure.

Name of Employee ______________________ Most recent BLL ________ Date _______
Job Title ______________________________ Trade ______________________________
Job Site(s) _____________________________ DOT Project Number(s) ______________
Employer ______________________________ Contact/Phone Number _______________

<u>BLOOD LEAD LEVELS</u>

Entry BLL ______ Date ________
Interval BLL ____ Date ________
Interval BLL ____ Date ________
Interval BLL ____ Date ________
Interval BLL ____ Date ________
Interval BLL ____ Date ________

<u>TASKS</u> the employee has been engaged in since his/her last blood test.

1. _________________ % Time ________
2. _________________ % Time ________
3. _________________ % Time ________

<u>AIR LEAD LEVELS</u> _______ Date _________
________ Date _________
________ Date _________

<u>WIPE SAMPLES</u>

Date _______ 1. Car: a) Steering Wheel _________b) Floor __________
2. Hands (clean) _________________
3. Inside of Respirator: a) Pre-clean ______ b) Post-clean _____

I have reviewed his tasks and work practices with the employee and we have determined the most likely causes for his/her rising blood lead level to be:
____
____

The following steps will be taken to reduce his/her exposure to lead:
1. ____
2. ____
3. ____

Signed: ___________________________ Title ___________________________
IH Company _______________________ Phone Number ______________________
Contractor ____

RETURN FORM TO: CRISP, 150 Washington Street, Hartford, CT 06106

<u>LHPP Site Register [ ] / [19]</u>
Month Year

Job Site:
DOT Project Number:
Employer:

Worker Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Please mark the number of hours worked on the jobsite on the appropriate date.

APPENDIX I

Model Specifications For the Protection of Workers From Lead on Steel Structures

1996

The Center to Protect Workers' Rights (CPWR) is the research arm of the Building and Construction Trades Department, AFL-CIO. CPWR is uniquely situated to serve workers, contractors, and the scientific community. The first edition of this publication was developed by the Working Group for Model Specifications convened by CPWR in collaboration with the Occupational Health Foundation and the Steel Structures Painting Council in 1993. That meeting and the 1993 document were made possible by grant number U60/CCU306169 from the National Institute for Occupational Safety and Health (NIOSH). This revised version of the Model Specifications was developed by a second Working Group meeting convened in 1995, following the implementation and evaluation of the 1993 Model Specs. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NIOSH. It should be noted that this document is still in the process of revision.

Abbreviations

CFR	Code of Federal Regulations
DOT	U.S. Department of Transportation
EPA	US Environmental Protection Agency
LHASP	Lead health and safety plan
NIOSH	National Institute for Occupational Safety and Health
OSHA	US Occupational Safety and Health Administration
PEL	Permissible exposure level
ug/dl	Microgram(s) per deciliter
ug/m^3	Microgram(s) per cubic meter

Introduction: A Comprehensive Approach

The deteriorating condition of the nation's infrastructure combined with the potential for high lead exposures associated with work on lead painted bridges point to an epidemic of lead poisoning unless comprehensive measures are employed to control worker exposures.

Work involving lead paint may pose serious health risks. Health risks associated with exposure to lead include impaired blood synthesis, nervous system disorders, gastrointestinal effects, malformation of sperm and offspring and kidney damage.

OSHA has estimated that over 5000 bridge repainting and rehabilitation projects involving lead exposure will occur each year (Federal Register). In addition, exposures greater than 400 times the current OSHA Permissible Exposure Limit (PEL) for construction have been documented during torch burning and abrasive blasting - activities common to bridge rehabilitation and demolition work.

Owners and contractors have a clear interest and responsibility in ensuring that work on lead painted structures does not endanger the health and well-being of workers, their families, the community and the environment.

Reliance on regulatory enforcement alone by agencies such as OSHA and EPA is an ineffective approach since 1) enforcement activities are scarce in relation to the volume of work underway, and 2) compliance approaches often identify problems after harmful exposures have already occurred. This document outlines a comprehensive, proactive approach to occupational lead poisoning prevention centered around the use of contract specifications.

As owners, state and federal transportation agencies, city and county governments, and turnpike commissions, play a critical role in how work on lead painted bridges and elevated highways is conducted. Development of specifications which require suitably protective work practices and controls, selection of a qualified contractor and enforcement of the terms of the specifications are the responsibilities of the owner. Execution of these activities with the intent of protecting workers from harmful exposures to lead ensures that work is carried out in a manner that doesn't jeopardize the health of workers or their families.

Specifications govern the terms of work in construction. They define how a job will be carried out and what activities will be compensated. Elevating worker protection to a detailed element of specifications for which owners are willing to pay for is the mechanism that is most likely to fully integrate safety and health into this type of work.

While these specifications may be applied to work on lead painted structures owned by municipalities, private industry or other government agencies, the primary purpose for their development is to assist state and federal transportation agencies involved in the rehabilitation, repainting and demolition of lead painted bridges and elevated highways. Although this document addresses the hazards associated with work on lead painted structures, contract specifications are a useful mechanism for protecting construction workers from a much broader spectrum of health and safety hazards.

These Model Specifications for the Protection of Workers from Lead on Steel Structures are intended to serve primarily as guidelines for language governing lead health and safety contractor requirements. In addition, some of the hazards commonly encountered during infrastructure repair, maintenance and demolition have also been addressed. The first version of this document was developed by a diverse group of public health experts, contractors, industry trade associations, government agencies and labor representatives in 1993. A roster of participants appears in Appendix A. Where applicable, the language of the OSHA Interim Lead in Construction Standard (29 CFR 1926.62) was incorporated. In addition, the recommendations of the Working Group, which may exceed the requirements of the standard, were included to assist agencies who are interested in providing more than the minimum requirements of protection to contract employees.

Following the development and widespread dissemination of the 1993 Model Specifications, the guidance language was revised with the interest of continuously improving their content. Under a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), the Center to Protect Workers' Rights implemented the Model Specifications on a lead abatement project at NASA Lewis Research Center in Cleveland, OH. In addition, a survey of state transportation and health agencies and a review of "Best Practices" for effective safety and health programs were conducted. Based on the outcome of these efforts, a second Working Group meeting was convened in 1995 to make recommendations on how to improve the language developed in 1993. A roster of participants in the 1995 Working Group meeting appears in Appendix B. This revised document reflects the conclusions and recommendations resulting from that process.

The need for effective interventions aimed at preventing illness and injuries in construction is great. Representing only about 5-6% of the workforce but 16% of occupational fatalities, construction workers bear a disproportionate burden of deaths in the workplace[1]. They also are disproportionately represented among
workers with blood lead levels greater that 40 ug/dl with 63% of workers in this category being construction workers[2]. The number one recommendation resulting from the Second National Conference on Ergonomics, Safety and Health in Construction was that "the industry needs to develop a greater culture of safety to encompass owners, contractors at various tiers, workers and their unions"[3].

This revised version of the Model Specifications has incorporated new language that:

- goes beyond a single focus on lead to addresses some of the most serious hazards encountered on industrial lead abatement projects;

- establishes a system for communicating and coordinating among the numerous interests present on any construction site; and

- builds the necessary personnel and organizational structures to ensure that safety and health programs are effective in reducing injury and illness.

The consensus of the 1995 Working Group responsible for updating the Model Specifications, was that "owners of public/private works are key to change in the construction industry". Specifications are an essential contractual tool that can be used towards the achievement of positive change in the industry. However, they are only one piece of the puzzle. As the controlling interest in construction projects, owners have enormous power to reverse the rate of illness, injuries and deaths by ensuring that:

- contractors are aware of the potential hazards associated with the rehabilitation, maintenance and demolition of lead painted structures;

- contractors are qualified to perform work safely; and

- contractors conduct work in such a manner that workers, their families, the environment and the community are protected from exposures to lead and that their employees are guaranteed their right to a safe and healthful workplace.

Ensuring that all of these requirements are met involves integration of safety and health in each and every phase of construction, including project design and planning.

I. Pre-bid Phase

A. Job Planning

1) Owners should develop a written safety and health plan that identifies all recognized hazards and minimum requirements for controlling those hazards for each project prior to the selection of contractors.

2) Owners should designate a qualified safety and health planning coordinator to develop the plan and communicate and deliver the plan to the constructor.

It's common to talk about the "life" of a structure in the context of maintenance and planning for continued safe use by the public. Information about a given structure over its "lifetime" rests with the owner. While a number of contractors may have worked on a structure over a period of several decades, the owner is the entity which is responsible for the structure and which provides continuity between projects. It is in the interest of the owner, the public, contractors and their employees to maintain a living file on such structures which documents the hazards associated with work on a particular structure and procedures, either planned are completed, for controlling those hazards. The information contained in the file should be communicated to prospective contract bidders to ensure that the means for controlling identified hazards are built into the project design.

The European Community has developed “minimum safety requirements for construction” which mandate specific owner responsibilities aimed at preventing injuries and illnesses once work begins on a structure. These directives as they have been applied in the United Kingdom simply establish a procedure whereby the owner:

- identifies potential hazards;
- develops a written project safety and health plan for projects and for notifying authorities;
- designates personnel for development of the plan and coordination of the plan; and
- communicates the plan to the contractor and ensures they have adequate resources with which to execute it[4].

Even in our country, the Occupational Safety and Health Administration has begun to recognize the important role that owners play in influencing contractor performance in 29 CFR 1926.64: Process Safety Management of Highly Hazardous Chemicals[5]. This standard requires that employers covered by the standard evaluate contractor safety performance before selection, communicate hazards to the contractor and periodically review contractor’s performance with respect to the “employers” plan in the event of a chemical release. The “employers” addressed by this standard are construction owner/clients much like highway agencies. Although this standard is aimed at the prevention of catastrophic events in the chemical processing industry, there is a clear parallel in that owners responsible for lead-painted structures can prevent contamination of the environment, surrounding communities and workers by having:

- more active involvement in contractor selection and oversight
- greater involvement in planning and communicating hazards associated with their structures.

B. Mandatory Pre-bid Meetings

3) Owners should communicate identified hazards and minimum requirements for abating hazards to contractors interested in bidding work.

Pre-bid meetings provide an opportunity for owners to inform contractors of the potential for lead exposure and to discuss the worker, community and environmental protection measures, which must be employed, on these projects. If feasible, contractors should be required to visit the proposed work site.

Instead of holding a pre-bid meeting for each project, owners may prefer instead to conduct an annual general meeting that all potential contractors must attend. During this meeting, the requirements of a lead health and safety plan, owner expectations for contractor performance and enforcement mechanisms would be outlined.

C. Pre-qualification and Contractor Selection Requirements

4) Only contractors that can demonstrate they are capable of performing work on lead painted structures without creating a hazard to their employees, the public or the environment should be permitted to submit bids.

As an example, use of the Steel Structures Painting Council (SSPC), Painting Contractors Certification Program (PCCP) certification QP 2(I) should be considered for pre-qualifying painting contractors. The PCCP QP 2(I) certification has been available to contractors since August of 1993[6].

Departments of transportation at the state and federal level (the DOT) should notify contractors of state and federal training certification regulations. Only contractors who can demonstrate their ability to comply with these regulations should be permitted to bid on work on lead-painted structures.

A contractor's past performance should be evaluated, including:

- Health and safety programs of previous lead projects
- Prior serious or willful OSHA citations
- Workers' compensation ratings
- Experience modification rating (EMR)
- OSHA 200 and 101 logs
- Environmental citations issued by the EPA, federal and state pollution control agencies, and other regulatory agencies

Contractors whose previous experience indicates poor performance in the area of safety and health should be considered non-responsive during the pre-bid stage for the next contract season.

D. Submittals

5) Owners should require that prospective bidders submit preliminary materials describing their health and safety plan.

The Interim Lead Standard requires that employers prepare a written lead compliance plan prior to the commencement of the job where employee exposure to lead is likely to exceed the PEL. Thus, contractors should be required to submit an outline of their Lead Health and Safety Plan (LHASP) as well as other documentation (e.g. worker/supervisor training certifications) in response to the specifications with the bid.

Alternatively, the owner could require that bidders complete a 1-2 page form that forces contractors to address how they will address each element of the LHASP. Information on the contractor's experience in executing a Lead Health and Safety Program could be collected through this medium. This approach will insure that each element of the program is included in the bid price and also assist DOT agencies in assessing contractor experience.

6) Owners should review preliminary materials with the intent of selecting only reasonably qualified contractors to submit bids.

Only those contractors which have submitted a bid which can reasonably be expected to provide adequate protection to workers shall be considered for contract awards.

7) Owners should review bids to ensure that contractor personnel have adequate training and technical capability and sufficient labor hours have been estimated to perform the functions described in the contractors health and safety plan.

A health and safety professional, such as an industrial hygienist, is best equipped to critically review a LHASP. DOT agencies could best perform this function with in-house support and/or in concert with the assistance of state health agencies. For instance, some state DOT agencies have an industrial hygienist on staff to carry out this task. An alternative approach is to retain an on-call professional consultant to act in an "owner's representative" capacity. The DOT should ensure that consultants are independent from bidding contractors in order to prevent any potential conflict of interest from arising. One approach to assure that conflict of interest does not arise is for the DOT to contract directly with the consultant.

II. Pre-construction Phase

A. Verification and Approval of Contractor's Lead Health and Safety Plan (LHASP)

8) Owners should verify the contractor's mobilization of adequate materials, procedures and qualified personnel necessary for implementation of the LHASP.

At this point a pre-qualified contractor has been selected and a preliminary outline for the LHASP has been approved by the DOT. The DOT would now verify the mobilization of appropriate and adequate resources relevant to worker protection (e.g. ventilation equipment, personal protective equipment, etc).

9) Owners should have qualified personnel on staff to review and approve the contractor's Lead Health and Safety Plan (LHASP) prior to the start of work.

The DOT should review the contractor's full written LHASP prior to the initiation of work. Qualifications of the on-site Construction Safety and Health Specialist, Industrial Hygienist and other personnel as well as documentation verifying pre-assignment training, medical surveillance and respiratory fit testing should be reviewed. Once the written LHASP and all other documentation required by the specifications have been approved by the DOT, the contractor would be authorized to move into the construction phase.

B. Notification of Project Startup to Appropriate Agencies

10) Owners should notify the appropriate regulatory agency responsible for worker protection of upcoming project start dates and regulated hazards at least 10 days prior to the start of work.

State and federal agencies responsible for worker protection can be an important resource of DOTs. Consultation programs are available which may be useful in project planning and to provide support throughout the duration of projects. In addition, they are the primary enforcement agency responsible for worker protection. Given the transient nature of construction, the large number of sites and limited OSHA staffing, Dots can greatly assist worker protection agencies by giving adequate advance notice of project start dates.

III. Construction Phase

11) Owners should work in concert with state health and labor agencies to monitor the performance of contractors and intervene when necessary.

While not a substitute for exposure monitoring, worker blood lead levels (BLLs) are one barometer of how effective a contractor's LHASP is in practice. Certified copies of all employee BLLs which do not contain the names or social security numbers of individual workers shall be forwarded to both the DOT and the state blood lead registry office in states where they exist no later than 5 days after receipt. State lead registries provide a useful means of tracking job sites with elevated BLLs. Interagency cooperation between state health and transportation agencies is necessary to insure that lead registries are effectively used in identifying problem job sites and intervening to prevent further exposure to workers. Specifically, in states where blood lead registries exist, state health departments should report those sites with elevated BLLs to the DOT. This additional source of BLL information to Dots can facilitate followup site visits aimed at identifying the problem. Interagency cooperation can extend further to involve the efforts of the DOL in enforcing worker safety laws or in providing consultation services to the contractor looking for constructive assistance.

12) Owners should designate a Project Safety and Health Coordinator to ensure that the written plan prepared by the Planning Coordinator is being followed.

Enforcement of the project specifications is the responsibility of the owner. Therefore, DOT personnel, or their authorized representatives, should serve as the front line inspectors of contractor compliance with the LHASP. Although Dots will need to train and maintain qualified staff, or retain outside professional support, coating or welding inspectors could be utilized for much of this work. For example, professional industrial hygienists (in-house or on a consulting basis) could develop site-specific enforcement checklists, which would be used by trained DOT inspectors.

13) A Project Committee should be established made up of co-chairs of the joint safety and health committee established by the contractor, the Construction Safety and Health Specialist and the owner's Project Safety and Health Coordinator. The Committee should meet at least once per month.

14) Owners should use contract provisions to withhold payment or remove contractors from the job-site who fail to comply with the written safety and health program.

In order to ensure that the LHASP is being complied with, the following provision should be part of the construction contract:

If BLLs exceed 35 ug/dl[7] for 2 or more workers, the contractor shall be required to submit a plan of corrective action within one week of receipt of results. If BLLs exceed 50 µg/dl[8] for any worker, a percentage of the bid amount should be held on a monthly basis until controls have been upgraded to maintain BLLs below 50 µg/dl. In addition, the medical removal protection (MRP) provisions of the OSHA Interim Lead in Construction Standard requires that when a worker's periodic and follow-up blood lead test results in a BLL equal to or greater than 50 µg/dl that worker shall be removed from exposure without loss of pay for up to 18 months.

The costs of not protecting workers are painfully real but hard to measure. As such, it would be of value for owners to track payroll costs for contractor provision of Medical Removal Protection Benefits. In addition, it would be useful for state blood lead registries to tract the amount of Medical Removal Protection Benefits paid.

I. General Information

A. Introduction

Work under this item shall consist of implementation of a Lead Health and Safety Plan. This special provision is applicable on any job where an employee may be occupationally exposed to lead. The intent of this special provision is to prevent employee absorption of harmful amounts of lead in any form by inhalation or ingestion and to prevent lead exposure to the families of workers through contaminated clothing, vehicles or other personal items, such as tools or lunch boxes. The contractor will be fully responsible for the protection of his or her employees and any subcontractor personnel from exposure to lead as well as other recognized safety and health hazards.

B. Applicable Documents

The contractor shall comply with the requirements of the Interim Final Rule for Lead Exposure in Construction (29 CFR 1926.62) of the US Occupational Safety and Health Administration (OSHA) and any other applicable federal or state laws. Additional Federal regulations which must be complied with include, but are not limited to[9]:

29 CFR Part 1926.16	Rules of Construction
29 CFR Part 1926.59	Hazard Communication
29 CFR Part 1910.20	Access to Employee Exposure and Medical Records
29 CFR Part 1910.134	Respiratory Protection
29 CFR Part 1910.94	Abrasive Blasting
29 CFR Part 1926.20	General Safety and Health Provisions
29 CFR Part 1926.21	Safety Training
29 CFR Part 1926.28	Personal Protective Equipment
29 CFR Part 1926.51	Sanitation
29 CFR Part 1926.55	Gases, Vapors, Fumes, Dusts and Mists
29 CFR Part 1926.57	Ventilation
29 CFR Part 1926.103	Respiratory Protection
29 CFR Part 1926.200	Accident Prevention Signs and Tags
29 CFR Part 1926.353	Ventilation and Protection in Welding, Cutting and Heating
29 CFR Part 1926.354	Welding, Cutting and Heating in Way of Preservative Coatings
29 CFR Part 1926.32	Competent Person
29 CFR Part 1910.120	Hazardous Waste Operations & Emergency Response
29 CFR Part 1910.141	Sanitation

C. Definitions

Industrial Hygienist (IH). Industrial hygienists shall have the following qualifications: current certification by the American Board of Industrial Hygiene with field and sampling experience, preferably in the construction industry; or hold a Master's degree from an accredited college or university in the field of engineering, chemistry, physics, biological sciences, industrial hygiene, toxicology, the environmental sciences or a related field and have at least two years of full-time experience as an industrial hygienist, including field and sampling experience, preferably in the construction industry: or hold a Bachelor's degree in the field of engineering, chemistry, physics, biological sciences, industrial hygiene, toxicology, the environmental sciences or a related field and have at least three years of experience as an industrial hygienist, including field and sampling experience, preferably in the construction industry.

Construction Safety and Health Specialist (CSHS). Construction Safety and Health Specialist shall be capable of identifying hazardous or dangerous conditions. The individual shall have experience in the construction industry (preferably in highway and bridge rehabilitation), and formal training and experience in safety and health. Such formal training and experience shall include at a minimum:

- five years experience working at the construction trades
- a minimum of 32 hours of lead abatement training for "superstructures"
- 30 hours of general safety and health training equivalent to the OSHA 500 Course
- 24 hours of Construction Safety and Health Specialist Training (to include air monitoring for lead)

In addition to meeting these requirements, personnel employed by the contractor responsible for safety and health should have qualifications consistent with federal and state regulations.

While the contractor may elect to train and authorize the CSHS to serve as the competent person as defined by 29 CFR Part 1926.32, these specifications do not require that the CSHS serve in this capacity.

D. Submittals

1) Lead Health and Safety Plan

A Lead Health and Safety Plan (LHASP) must be submitted to the DOT prior to the initiation of work and should be specific to the job site. Filing of the plan will not constitute approval by the DOT. A copy of the Interim Lead Standard and other prevailing regulations should be submitted with this plan. Material Safety Data Sheets (MSDSs) for any chemical products to be used on the site should be submitted. The contractor's project supervisor shall be able to demonstrate that he or she has read and understands these documents. Training certifications for supervisors and employees should be submitted as well as SSPC Contractor Certifications, where applicable. A copy of the LHASP, applicable standards, MSDSs and Certifications must be on site at all times.

The LHASP must include, but is not limited to

a. General Introduction
b. Lead Health and Safety Organization and Responsibilities
c. Exposure Monitoring for Lead and Other Known Hazards
d. Engineering and Administrative Controls
e. Respiratory Protection
f. Protective Work Clothing and Equipment
g. Hygiene Facilities and Practices
h. Housekeeping
i. Medical Surveillance Program, including Medical Removal Protections and Appropriate Worker Notification Procedures
j. Decontamination Procedures

k. Employee Information and Training Procedures
l. Record Keeping

The following documents may provide useful guidance for developing a LHASP. Their inclusion in these specifications is for reference only and not to be interpreted as a requirement.

Industrial Lead Paint Removal Handbook 2nd Edition. K. Trimber, (1991) SSPC 93-02. Steel Structures Painting Council, 4516 Henry St., Suite 301, Pittsburgh, PA 15213.

Minimum Criteria for Hazardous Waste Operations and Emergency Response Training Programs NIEHS (1991). National Clearing House for Worker Safety and Health Training for Hazardous Materials, Waste Operations, and Emergency Response. George Meany Center for Labor Studies, 10000 New Hampshire Avenue, Silver Spring, MD 20903. 301-431-5425.

The 100 Most Frequently Cited OSHA Construction Standards in 1991: A Guide for the Abatement of the Top 25 Associated Physical Hazards (1993). US Department of Labor, Occupational Safety and Health Administration. For sale by US Government Printing Office, Superintendent of Documents, Mail Stop SSOP, Washington, D.C. 20402-9328.

Preventing Lead Poisoning in Construction Workers (1992). National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226 (513) 533-8287.

Preventing Silicosis and Deaths from Sandblasting (1992). National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226. 513-533-8287.

Protecting Workers and their Communities from Lead Hazards: A Guide for Protective Work Practices and Effective Worker Training (1993). Society for Occupational and Environmental Health, 6728 Old McLean Village Drive, McLean, VA 22101.

Working with Lead in the Construction Industry OSHA 3142 (1993). US Department of Labor, Occupational Safety and Health Administration. Call OSHA Publications Office, 202-219-4667 or write to Publications Office, Room N3101, Department of Labor, 200 Constitution Ave. NW., Washington, DC 20210.

2) Comprehensive Safety and Health Program

Contractors shall incorporate lead hazard prevention program into a larger safety and health program aimed at preventing occupational exposure to all other hazards generated by this work. The contractor shall submit a written plan which addresses, at the minimum, the hazards described below prior to the start of work:

a. Fall hazards. Falls account for 25% of occupational fatalities in construction[10]. A Fall prevention plan must identify potential fall hazards and how they are to be addressed prior to the start of work. Plans must address fall arrest systems. Where a fall arrest system is required, body harnesses should be used in lieu of body belts. Identification of fall hazards shall be incorporated into periodic walkaround inspections as an integral part of the written plan.

b. Heat stress. Temperatures in containment structures during warm weather can reach levels that present a serious hazard to workers. Contractors shall implement a heat stress prevention program which follows the guidelines published by the American Conference of Governmental Industrial Hygienists[11].

c. Noise. Noise induced hearing loss is suffered by construction workers in epidemic proportions. Personal exposures in excess of the OSHA Permissible Exposure Limit of 90 dBA have been measured during use of abrasive blasting equipment. Contractors shall incorporate a hearing conservation program into their general safety and health program. Contractors shall consider equipment noise generation rates as an important factor in equipment selection and procurement.

d. Ergonomic hazards. There is a considerable amount of information showing that construction workers suffer from a high rate of musculoskeletal disorders and that these injuries could be prevented by better design and organization of work. Any plan for prevention of lead exposure must deal with the ergonomics of the job and the consequences of the controls which are specified. In addition, ergonomic hazards associated with all aspects of the job should be identified and controlled. The contractor's safety and health program should include requirements aimed at reducing: i) manual handling of heavy loads (e.g. through use of hoists and dollies); ii) awkward postures in combination of forceful exertions (e.g. through proper tool selection) and iii) vibration (e.g. use of vibration dampened tools). Work practices (e.g. encouraging individuals to seek help before lifting heavy equipment and materials) and administrative controls (e.g. rest breaks and job rotation) should also be included in the safety and health program.

e. Heavy metals. Airborne concentrations of cadmium, chromium and other heavy metals other than lead have been measured at levels in excess of current occupational exposure limits during abrasive blasting of bridges[12]. The principle source of metal exposure is likely to be in the paint being removed. However, the use of slag abrasive may also be a source of metal hazards. The contractors exposure assessment program should include characterization of the full range of metals which pose a potential hazard. In addition, selection of abrasive media during the project planning phase should take into account the possibility of heavy metal exposure. Manufacturer's specifications on heavy metal concentrations should be verified with spot bulk sample checks if slag abrasives are used.

E. Quality Assurance

1. Joint Safety and Health Committee (JSHC). Meaningful employee participation and regular communication between labor and management are essential for effective safety and health programs. Joint Safety and Health Committees are necessary for a regular and systematic exchange of information between contractors and their employees. The general or prime contractor shall establish a site-based joint safety and health committee upon the onset of work. If there is no general or prime contractor on site, the owner shall establish a JSHC made up of individual contractors and their employees engaged in work on the site.

Each craft and each sub-contractor present on site will be represented on the JSHC, except in the case of projects less than one month in duration in which case the committee should consist of one labor and one management representative. On union sites, the labor representative should be a safety steward and assigned by the local Building and Construction Trades Council. On non-union sites the labor representative should be elected by the work force.

The JSHC shall be composed of at least 50% worker representatives and shall be co-chaired by both a management and labor representative. Those individuals serving as chairpersons of the Joint Safety and Health Committee shall have received training in Joint Safety and Health Committee Representative

Training. Chairpersons shall be given adequate preparation time to prepare for meetings (at least one hour). The JSHC shall meet at a regular frequency, at least once per month.

Committee Chairpersons and the Chief Safety and Health Representative or Steward shall have the power to remove workers from unsafe work conditions for which there is a reasonable cause to believe that an imminent danger exists.

A Workers' Trade Committee shall be established composed of one representative from each craft on site. On union jobs, such representatives should be designated as safety stewards. On nonunion jobs, the craft representative should be elected by members of their respective craft serving in a non-supervisory capacity. The Workers' Trade Committee shall meet at least once per month at least 48 hours prior to the JSHC.

Representatives serving on the Workers Trade Committee and the foremen for the subcontractor to which they are employed should conduct regular walk-throughs (at least once per week) for the purpose of: 1) communicating with the trades they represent and employ, respectively; and 2) to monitor site conditions.

The JS&HC will review reports made by safety and health personnel employed by the contractor and provide regular input into the implementation of the site safety and health program. The JSHC will provide direction to occupational safety and health personnel employed by the contractor. Recommendations of the committee must be acted on in a timely manner. The presence of a JSHC does not supercede nor negate the contractor's duty to provide a safe and healthful workplace.

2. Industrial Hygienist (IH). Contractors shall engage a qualified IH to:

a. Develop a written LHASP
b. Review adequacy of the LHASP on a regular basis and update accordingly with respect to changing site conditions.
c. Develop and oversee an exposure assessment strategy that includes personal air monitoring, wipe sampling and evaluation of the effectiveness of engineering and work practice controls.
d. Prepare monthly reports to be presented to the JSHC which summarize industrial hygiene activities including air and wipe sampling and biological monitoring
e. Develop and oversee the implementation of a respiratory protection program that complies with 29 CFR 1926.103
f. Review blood lead monitoring results as necessary with the physician in order to assess the efficacy of controls. (Placement of workers with elevated BLLs should be based on collaboration of the JSHC, IH, CSHS, physician and contractor).
g. Develop detailed check lists to be used by the CSHS in verifying compliance with the LHASP, periodically monitor the work site, and inform the contractor and JSHC of any deficiency noted as well as suggest corrective actions.
h. Evaluate the effectiveness of controls and other interventions.
i. Conduct monthly follow up training with employees based on input of JSHC

While the CSHS may serve as the primary on-site monitor of the LHASP, the IH must be on site at least once a week during activities which have been associated with or can reasonably be expected to create lead exposures in excess of 30 $\mu g/m^3$. The IH may be required to be on site more frequently at the start of the project or when site conditions or work practices change until exposure monitoring indicates that exposures are being effectively controlled. An increase greater than 10 ug/dl in worker BLLs will prompt more frequent site visits by the IH until corrective measures have successfully reduced BLLs.

The IH shall certify monthly in writing, within 5 days after the end of the month, to the DOT that the contractor has performed all of the listed requirements of the Lead Health and Safety Plan and any actions taken on any deficiencies found. The IH shall approve any changes to the LHASP. The DOT shall be immediately informed by the IH or CSHS of all major decisions regarding any changes to the LHASP.

The IH shall also evaluate potential exposure hazards related to the use of chemical products, including new paint coatings - and institute effective controls.

Construction Safety and Health Specialist (CSHS) The contractor shall designate a CSHS, not the project superintendent or foreman, to ensure that the LHASP is implemented on a daily basis and that all work conducted on site is in compliance with the LHASP. The Construction Safety and Health Specialist shall be designated as the Chief Safety & Health Steward on union jobs to enable performance of their job without fear of retribution. On nonunion jobs the CSHS will serve as the Chief Safety and Health Representative. The CSHS shall be provided with adequate duty-time. Determination of duty time will be dependent on the specific responsibilities of the CSHS, the nature of the site and site-specific hazards.

The CSHS will be responsible for:

a. Implementing and monitoring compliance with the LHASP on a daily basis
b. Communicating with the JSHC and IH regarding implementation of the LHASP and areas needing improvement
c. Assisting IH in exposure assessment activities
d. Communicating results of IH monitoring to workers on a regular basis with the support of the IH as needed
e. Ensuring daily compliance with respiratory protection program
f. Utilizing developed check lists under the direction of the IH
g. Working with JSHC and IH in the implementation and evaluation of interventions and control technologies
h. Convening regular tool box talks to address identified problems and provide ongoing training on safety and health program elements
i. Maintaining a log of all personnel entering work areas with potential lead exposures. The log shall include the name and social security number of the individual, the date, the time at which they enter and leave the area, the task/job being performed and exposure monitoring data, if any has been collected.

4. Medical Surveillance. The contractor shall institute medical surveillance in accordance with the Interim Lead Standard. All medical procedures required by this program shall be provided by the contractor at no cost to the employee.

Medical surveillance does not replace exposure monitoring, rather it is a method of verifying that workers are not being adversely impacted by lead despite low airborne concentrations. The medical surveillance program must be overseen by a licensed physician. It is recommended that an occupational physician, board certified by the American Board of Preventive Medicine, oversee the medical surveillance program.

The employer shall notify each employee in writing of their biological monitoring results within 5 working days of receipt of such results. Employees with BLLs greater than 40 µg/dl shall be notified of their right to medical removal protection when their BLL exceeds the criterion defined in the Interim Lead Standard. The standard requires that biological monitoring occur at the following frequency:

i. initial monitoring;

ii. at least every two months for the first 6 months and every six months thereafter;

iii. at least every two months for those workers whose last BLL was at or above 40 µg/dl until two consecutive blood samples indicate a BLL below 40 µg/dl, and

iv. at least monthly for any worker who is removed from exposure to lead due to an elevated BLL .

Because of the high lead exposures associated with work activities performed during bridge rehabilitation and demolition, the schedule for blood monitoring required by the standard may be too infrequent to capture steep rises in BLL in a timely manner. In order to prevent this from occurring, the Working Group has recommended that the following schedule be followed:

i. Baseline: upon hire or start of job- all workers (unless documentation of a blood lead test conducted by an OSHA approved laboratory within the past 2 weeks is presented). A worker with a BLL greater than 40 ug/dl on an initial exam shall see an occupational physician to determine whether or not that worker should be assigned to leaded areas.

ii. Second test: 2 to 4[13] weeks later - all workers.

iii. Third test: 2 weeks later - all workers whose second blood lead increased more than 10 ug/dl from baseline level.

iv. Subsequent testing: monthly for 6 months if BLLs are stable and job site operations or work procedures do not change.

v. If at the end of 6 months blood lead levels have remained below 25 µg/dl for three consecutive months and the job site operation and work practices do not change, biological monitoring may occur every 2 months. If at any time a blood lead level of 25 µg/dl or greater is detected, biological monitoring will be conducted monthly until 3 consecutive tests are below 25 µg/dl.

vi. Exit testing shall be required and consist of a blood lead test when a worker is terminated from the job. All blood tests shall be provided at no expense to the worker at a reasonable time and location. Employees shall receive full wages for all time involved in medical testing. Workers shall be notified of BLL results within 5 working days after being tested.

In addition, the following provisions shall be implemented:

i. an increase of 10 µg/dl from one test to another shall trigger a work site evaluation by the CSHS and the IH to identify problem areas and implement appropriate control measures that effectively reduce BLLs to less than 25 µg/dl.

ii. if at any time during testing, a blood lead level of 40 µg/dl or greater is detected, the employee shall be examined by the occupational health physician. Such an employee shall have blood lead tests at a frequency of every two weeks until two consecutive tests indicate BLLs equal to or below 30 µg/dl.

Contractors shall ensure that all physicians conducting blood monitoring shall have all samples analyzed by an OSHA approved lab that has demonstrated proficiency in blood lead analysis. A list of the approved labs can be obtained from OSHA.[14]

Certified copies of all blood lead level results shall be forwarded to the DOT no later than 5 days after receipt. In the interest of protecting the privacy of workers, individual names and social security numbers should not be included in the information sent to the DOT. Elevated BLL results shall be forwarded to the state blood lead registry office in states where they exist no later than 5 days after receipt.

The Interim Lead Standard requires that a medical exam be made available at least annually to any worker for whom a blood lead sample was found to be at or above 40 µg/dl during the preceding 12 months. According to the standard, such an exam must include:

i. a detailed work and medical history, with particular attention to past lead exposure;

ii. a thorough physical exam with particular attention to teeth, gums, hematologic, gastrointestinal, renal, cardiovascular, and neurological systems. Pulmonary status should be evaluated if respiratory protection is to be used;

iii. a blood pressure measurement;

iv. a blood sample and analysis to determine: blood lead level, hemoglobin and hematocrit determinations, red cell indices, and examination of peripheral smear morphology; zinc protoporphyrin, blood urea nitrogen and serum creatinine;

v. a routine urinalysis with microscopic examinations;

vi. any laboratory or other test relevant to lead exposure which the examining physician deems necessary by sound medical practice.

Since health effects may occur at BLLs lower than 40 µg/dl and because workers may be employed by a number of contractors at different job sites, each of which will have varying levels of exposures and controls, it is recommended that contractors make the preceding tests available to employees before making job assignments to newly hired workers.

F. Site Conditions

The paint contained on this structure contains lead. Lead has been shown to have serious health effects on workers if caution and attention to details are not followed. Other hazards which may be associated with work on this structure include, but are not limited to, heat stress, noise, ergonomic hazards, heavy metals other than lead, and falls. (This section of the specifications should explicitly state the potential hazards associated with a specific project, thereby putting the prospective bidder on notice. Structure specific information on lead paint concentrations could be included in this section to provide contractors with a more definitive estimate of the potential hazard).

II. Products

Abrasive blasting with abrasive containing crystalline silica can cause serious or fatal respiratory disease. The National Institute for Occupational Safety and Health (NIOSH) has recommended that the use of abrasive containing more than 1% crystalline silica be prohibited. NIOSH has also reported 99 cases of silicosis from exposure to silica during sandblasting. Fourteen of the 99 cases have already died, and the remaining 85 may die of silicosis or related complications[15]. Alternative technologies such as the use of recyclable steel grit or shot abrasives do exist. Given the severity of the hazard associated with silica-containing abrasive, the use of silica as an abrasive medium is prohibited.

The Consumer Product Safety Commission (CPSC) designates a concentration for paint application products of less than 0.06% lead by weight for consumer use[16]. The potential exposure hazards related to the use of chemical products, including new paint coatings, must be evaluated by the IH and effective controls must be instituted. This language should appear in all paint application specifications.

III. Execution

A. Engineering and Work Practice Controls

Engineering and work practice controls shall be the primary control methods to limit exposure to lead and other occupational hazards. Where feasible, preference shall be given to those paint removal and surface preparation methods which capture debris at the source. Lead based paint must be removed prior to welding or torch cutting of surfaces. 29 CFR Part 1926.354 requires that paint be removed at least 4 inches from the area of heat application in enclosed spaces. In the open air, employees shall be protected by a respirator. All power tools used for paint removal shall be equipped with vacuum shrouds which capture fine dust at the point and time of generation, and transport the dust to collection systems equipped with HEPA filters. such tools include needle guns, scrapers, and roto peeners. Extended handles should be used on cutting tools whenever possible to reduce exposure.

B. Respiratory Protection Program

The contractor shall implement a respiratory protection program in accordance with the provisions of 29 CFR 1910.134. The minimum respiratory protective equipment shall be selected based upon the task that a worker performs as specified in the Interim Lead Standard (29 CFR 1926.62(d)).

These requirements can be modified if, and only if, the IH can verify that exposures permit the use of other less protective respirators. Contractors must supply workers with respirators that are NIOSH and MSHA certified at no expense to the worker.

C. Hygiene Facilities and Practices

The IH shall establish a written personnel hygiene procedure available at the work site and in accordance with 29 CFR 1926.62 paragraphs (h) and (I) and other applicable standards. The Contractor shall provide at no cost to the employee:

1) Hygiene Facilities. The OSHA Interim Lead Standard requires that showers be provided where feasible. Where showers are provided, they must be equipped with hot and cold water. Such facilities must be readily available in the immediate work area. Hand washing facilities must also be provided in accordance with 29 CFR 1926.51. Hygiene facilities must conform to the requirements specified in 29 CFR 1910.141, the OSHA Sanitation Standard.

Because of the potential for taking lead home on clothing and personal belongings, the Working Group recommends that where exposures exceed 50 $\mu g/m^3$ showers be mandated. Also, washing facilities shall be equipped with clean, hot and cold water, soap and disposable towels which the workers will use to wash their hands and faces before eating, drinking or smoking and after each work shift.

2) A clean area for eating, drinking and smoking. According to the Standard, smoking, eating and drinking in lead contaminated areas is to be prohibited.

3) A separate clean change room equipped with wash up facilities and separate lockers for work and street clothes. No street clothing shall be worn in contaminated areas.

4) Protective clothing and equipment with provisions for cleaning them. In accordance with 29 CFR Part 1926.62, clean work clothes must be provided at least weekly to all employees whose exposure levels are above the PEL and daily to those above 200 µg/m³ as an 8-hour TWA. To provide greater protection against the risk of taking home lead to children, the Working Group recommends that protective clothing be provided when exposures exceed 50 µg/m³. Protective clothing and equipment must be repaired or replaced as needed to maintain its effectiveness. Protective clothing and equipment must be removed at the completion of a work shift only in change areas provided for that purpose. Contaminated clothing is to be cleaned, laundered or disposed of and shall be placed in a closed labeled container. Persons responsible for handling contaminated clothing shall be informed of potential hazards. At no time shall lead be removed from protective clothing or equipment by any means that will put lead into the work area, such as brushing, shaking, blowing or using a regular vacuum cleaner. All protective clothing and equipment must remain on the work site, and thus cannot be worn home.

5) Workers shall be allowed sufficient pre-job preparation time to change into protective clothing and sufficient clean-up time as part of the work day.

D. Training

All workers and foreman on site shall have been trained in General Construction Safety and Health, such training shall be at a minimum equivalent to the OSHA 10 hour construction course as well as lead specific. Lead specific training should at a minimum, satisfy existing federal and state regulations. Training on other specific hazards identified on the site shall also be provided.

The employer must have a written plan developed for conducting employee training of lead hazards in accordance with 29 CFR 1926.62(l). The training will cover, at a minimum:

- The content of the interim lead standard and its appendices;
- The sources and degree of lead exposure associated with specific tasks;
- The purpose, proper selection, fitting, use and limitations of respirators;
- The purpose and description of medical surveillance and medical removal protection including the health effects of lead;
- Engineering controls and work practices associated with the employee's job assignment including training on work practices that reduce lead exposure;
- The contents of the LHASP
- Instructions that chelating agents should never be used except under the direction of a licensed physician and never as a routine method of removing lead from the body;
- The right of employees and their designated representatives to exposure and medical records in a timely manner as specified in 29 CFR 1910.20.

Training content and duration must comply with EPA Standards, or state and local standards which are at least as protective as the EPA standards, . Documentation which verifies that training for workers and supervisors is current and valid must be on site at all times. Contractors must utilize workers and supervisors who have been trained in programs which have been accredited by the appropriate state or federal agency. Training must be presented in a language that is understandable to workers.

Training programs should comply with the training principles presented in the following documents: "Protecting Workers and their Communities from Lead Hazards: A Guide for Protective Work Practices and Effective Worker Training" (SOEH, 1993) and "Minimum Criteria for Hazardous Waste Operations and Emergency Response Training Programs" (NIEHS, 1991). SOEH recommends that industrial lead abatement training for workers be 32 hours in duration with 8 hours dedicated to hands-on training.   Hands-on training should include activities involving trade specific operations (e.g. using shrouded needle-guns).

Initial training should be conducted in an area with seating for all workers, provisions for audio-visual aids and surfaces for writing. In addition to initial training, follow-up training will be conducted monthly by the IH or the CS&HS with the support of the IH. This training will consist of a review of the contents of the IH's monthly report.

E. Worker Exposure Assessment

1) Air monitoring. Personal air monitoring is one means of assessing worker exposure to lead dust and fume. In general, air monitoring at bridge rehabilitation and demolition sites is conducted in order to determine the range of lead concentrations to which workers are potentially exposed when performing different tasks and/or to measure the efficacy of controls in reducing airborne concentrations of lead.

The Interim Lead Standard requires that at a minimum this strategy include sampling one full shift for each job classification in each work area. Each shift must be sampled or the shift which is expected to have the highest exposure must be sampled. The standard also requires that samples be representative of the monitored worker's daily exposure. If exposures are less than the OSHA Action Level monitoring may cease. If exposures are greater than the Action Level but less than the PEL, monitoring is required to occur every 6 months. If exposures are greater than the PEL then monitoring must occur every 3 months.

Additional monitoring is also required when conditions change. The Standard further requires that workers must receive notification of results within 5 working days after completion of the assessment. When exposures are greater than the PEL, employers must provide written notice to workers as to how they plan to reduce exposures.

Because of the great variability in conditions which influence worker exposure in construction and because of the extremely high exposures associated with bridge projects, exposures may vary dramatically from week to week or even day to day. Therefore, the 1993 Working Group has determined that an effective strategy for accurate characterization of worker exposures is likely to require collecting multiple randomly collected samples over time for each job classification. This strategy should be in writing, and must accompany all reports containing air sampling results. Specific reasons for conducting air sampling include:

i. as a method of characterizing exposures for the purposes of devising effective control strategies for the prevention of elevated blood lead levels.

ii. to characterize work tasks and areas to which workers with elevated blood lead levels can be assigned to reduce their exposure to airborne lead particulate.

iii. to assess exposures during work tasks where increases in blood lead test results indicate a problem.

iv. to assess any change in operations or procedures that may affect exposure levels.

v. to determine the effectiveness of engineering controls.

vi. to assist in the selection of respiratory protection.

All air monitoring and analysis must be performed in accordance with NIOSH approved methods.

2) Wipe sampling. Because even small amounts of lead ingested from hand-to-mouth contact can contribute to total body burdens and because surface lead dust can easily become airborne, it is important to assess contamination of surfaces. Wipe sampling is one technique which may be used to assess potential contamination in areas which should be "clean"[17]. Such areas include change rooms and hygiene facilities. The contaminated area can be cleaned up by HEPA vacuuming followed by wet wiping. Wipe sampling may be required at the beginning of the job, and monthly thereafter, depending upon the blood lead results and the observations made by the IH. NIOSH method 0700 will provide a validated protocol for wipe sampling and will be available after January 1, 1994.

3) The OSHA Interim Standard requires that workers performing specific tasks be protected until exposure assessment is complete. These tasks and the presumed exposures which must be controlled for are as follows:

i. Protection must be based on exposures between 50 µg/m³ and 500 µg/m³:

  a. where lead coatings or paint are present and the following tasks are occurring: manual demolition of structures, manual scraping, manual sanding, heat gun applications, power tool cleaning with dust collection systems

  b. when spray painting with lead paint.

ii. Protection must be based on exposures greater than 500 µg/m³ when:

  a. using lead containing mortar

  b. lead burning

  c. where lead containing coatings or paint are present and the following tasks are being performed: rivet busting, power tool cleaning without dust collection systems, cleanup activities where dry expendable abrasive are used, abrasive blasting enclosure movement and removal.

iii. Protection must be based on exposures greater than 2500 µg/m³ where lead containing coatings or paint are present and the following tasks are being performed:

  a. abrasive blasting

  b. welding

  c. cutting and torch burning

4) The contractor shall develop and implement an exposure assessment program for other identified hazards including noise, heat stress, solvents, total and respirable particulate and metal fumes associated with welding and thermal cutting.

IV. Basis of Payment

All elements of the contractor's safety and health plan shall be paid for as cost plus or lump sum payment with an established minimum bid.

V. References

DHHS (1990). Healthy People 2000: National Health Promotion and Disease Objectives. Washington, DC: US Dept. of Health and Human Services, Public Health Service, DHHS Publication No. (PHS) 91-50212.

Federal Register (1993). Volume 58, Number 84, May 4, 1993.

USDOL (1991). OSHA List of laboratories approved for blood lead analysis.

VI. Additional Sources of Information

State, County and Municipal health agencies may be able to assist you in locating industrial hygienists and occupational physicians in your area. In addition, the following associations may be helpful in obtaining technical support:

American Conference of Governmental Industrial Hygienists
6500 Glenway Ave., Bldg. D-7, Cincinnati, OH 45211-4438
(513) 661-7881.

American Industrial Hygienists Association
2700 Prosperity Ave., Suite 250, Fairfax,VA 22031
(703) 849-8888, FAX 207-3561.

Association of Occupational and Environmental Clinics
1010 Vermont Ave., NW, #513, Washington, DC 20005
(202) 347-4976, FAX 347-4950.

American College of Occupational and Environmental Medicine
55 West Seegers Road, Arlington Heights, IL 60005
(708) 228-6850, FAX 228-1856.

Appendices

Appendix A: 1993 Working Group Participants

Mr. Daniel P. Adley
KTA Environmental
115 Technologies Drive
Pittsburgh, PA 15275
(412) 788-1300 x 831

Mr. Bernie Appleman
Steel Structures
Painting Council

Ms. Nora Leyland
Sherman, Dunn and Cohen
1125 15th Street, N.W.
Washington, DC 20005
(202) 785-9300
FAX (202) 775-1950

Mr. Louis G. Lyras, President
Corcon, Inc.

4516 Henry Street, Suite 301
Pittsburgh, PA 15213-3728
(412) 687-1113
FAX (412) 687-1153

Mr. Peter Barlow, P.E.
ConnDot Bridge Design
160 Pascone Pl.
Newington, CT 06111
(203) 666-7338
FAX (203) 666-7362

Mr. William Bergfeld
Laborers-AGC
37 Deerfield Road
P.O. Box 37
Pomfret Center, CT 06259
(203) 974-0800
FAX (203) 974-1459

Mr. Daniel M. Boody, President
Buffalo Building & Construction
Trades Council
12 Elmwood Avenue
Buffalo, NY 14201
(716) 886-3984
FAX (716) 886-3602

Mr. Ted Brucker
California Dept. of Transportation
Division of Structures
Maintenance
PO Box 942874
Sacramento, CA 94274-0001
(916) 654-7053
FAX (916) 227-8357

Mr. L. Brian Castler
Connecticut Department of Transportation
24 Wolcott Hill Road
Wethersfield, CT 06109
(203) 566-7005
FAX 203/566-8944

Mr. George Cesarini
St. Paul Fire & Marine Insurance Co.
1 Jericho Plaza
Jericho, NY 11753
(516) 935-3700
FAX (516) 935-3816

Ms. Ellen Coe, R.N., M.P.H.
Health Registries Division
Maryland Department of the Environment

P.O. Box 106
Lowellville, OH 44436
(216) 536-2133
FAX (216) 536-6875

Dr. Kathy Maurer, Project Director
Connecticut Road Industry Surveillance Project
(CRISP)
150 Washington Street
Hartford, CT 06106
(203) 566-1454
FAX (203) 566-1656

Mr. R. Leroy Mickelsen
National Institute for Occupational
Safety and Health
4676 Columbia Parkway R-5
Cincinnati, OH 45226
(513) 841-4380
FAX (513) 841-9506

Mr. John Moran
Laborers' Health & Safety Fund
905 16th Street, N.W.
Washington, DC 20006
(202) 628-2596
FAX (202) 628-2613

Mr. Charles Most
Ironworkers' National Fund
1750 New York Avenue, Suite 400
Washington, DC 20006
(202) 383-4870
FAX (202) 347-5256

Ms. Debbie Nagin
NY Dept. of Health
Bureau of Occupational Health
5 Penn Plaza, Rm. 405
NY, NY 10001
(212) 613-2456
FAX (212) 613-2477

Ms. Ana Maria Osorio, M.D., M.P.H.
Occupational Health Branch
California Dept of Health Services
2151 Berkeley Way, Annex 11
Berkeley, CA 94704
(510) 540-2115
FAX (510) 540-3472

Mr. Anthony D. Pellegrino
New Jersey Dept of Transportation
1035 Parkway Ave., CN600

2500 Broening Highway
Baltimore, MD 21224
(410) 631-3852
FAX (410) 631-4112

Mr. Steve Cooper
Safety and Health Director
International Association of Bridge,
Structural & Ornamental Iron Workers
1750 New York Ave., N.W., Suite 400
Washington, DC 20036
(202) 383-4800
FAX (202) 638-4856

Mr. Michael Damiano
Manager, Painting Contractor
Certification Program
Steel Structures Painting Council
4516 Henry St., Suite 301
Pittsburgh, PA 15213-3728
(412) 687-1113 ext. 103
FAX 687-1153

Mr. Denny Dobbin
NIEHS Worker Training Program
P.O. Box 12233 (MD1802)
Research Triangle Park, NC 27709
(919) 541-0752

Mr. Alan Echt, CIH
National Institute
of Occupational Safety and Health
DSHEFS / NIOSH
4676 Columbia Parkway, MS R-11
Cincinnati, OH 45226
(513) 841-4374
FAX (513) 841-4488

Ms. Barbara Gerwel, M.D.
New Jersey Department of Health
CN360
Trenton, NJ 08625-0360
(609) 984-1863
FAX (609) 984-2218

Mr. Matt Gillen
Environmental Protection Agency/OPPT
401 M Street, S.W., (TS-799)
Washington, DC 20460
(202) 260-1801
FAX (202) 260-2219

Dr. Mark Goldberg
Mt. Sinai School of Medicine
Trenton, NJ 08625
(609) 530-5472
FAX (609) 530-8294

Mr. Paul Perkins, Asst Chief
Maryland State Highway Administration
707 North Calvert Street
Baltimore, MD 21203-0717
(410) 333-1550
FAX (410) 333-3139

Mr. Richard Rabin
Mass. Department of Labor and Industries
Division of Occupational Hygiene
1001 Watertown Street
Newton, MA 02165
(617) 969-7177
FAX (617) 727-4581

Dr. Knut Ringen
Center to Protect Workers' Rights
111 Massachusetts Avenue, N.W., Suite 509
Washington, D.C. 20001
(202) 962-8490
FAX (202) 962-8499

Mr. Brad Sant
Assistant Safety & Health Director
Building & Construction Trades Department
815 16th Street, N.W., Room 603
Washington, DC 20006
(202) 347-1461
FAX (202) 628-0724

Mr. Scott Schneider
Center to Protect Workers' Rights
111 Massachusetts Avenue, N.W., Suite 509
Washington, D.C. 20001
(202) 962-8490
FAX (202) 962-8499

Mr. David M. Serra
Pennsylvania Dept of Transportation
715 Jordan Avenue
Montoursville, PA 17754
(717) 368-5645
FAX (717) 368-5643

Mr. Paul J. Seligman, MD, MPH
National Institute for Occupational
Safety and Health
4676 Columbia Parkway R-21
Cincinnati, OH 45226

Box 1057
1 Gustave Levy Place
New, York, NY 10029
(212) 241-6173
FAX (212) 996-0407

Ms. Janie Gordon
University of Maryland Medical Center
405 W. Redwood, 2nd Fl.
Baltimore, MD 21201
(410) 706-6178
FAX (410) 706-4078

Mr. Joe Durst, Director
UBC Health & Safety Fund
of North America
101 Constitution Avenue, N.W.
Washington, DC 20001
(202) 546-6206
FAX (202) 546-7802

Mr. John P. Hausoul
Environmental Protection Specialist
U.S. Environmental Protection Agency
401 M Street, S.W. (TS-799)
Washington, D.C. 20460
(202) 260-3457
FAX (202) 260-2219

Mr. George L. Hudspeth, Jr.
Florida Building & Construction
Trades Council
927 Belvedere Road
West Palm Beach, FL 33405
(407) 833-2461
FAX (407) 833-6377

Mr. Bill Kojola
Laborers' Health & Safety Fund
905 16th Street, N.W.
Washington, DC 20006
(202) 628-5465
FAX (202) 628-2613

Mr. John Kolaya
Yonkers Contracting Co., Inc.
140 Plymouth Street
Brooklyn, NY 11201
(718) 624-1770
FAX (718) 624-5838

Mr. Jerry Langone
Massachusetts Highway Department
519 Appleton Street

(513) 841-4353
FAX (513) 841-4489

Dr. Irene Smith, CRISP
376 Summit Street
New Haven, CT 06513(203)445-4551
FAX (203) 445-0340

Mr. Tom Smith
Yonkers Contracting Co., Inc.
140 Plymouth Street
Brooklyn, NY 11201
(718) 624-1770
FAX (718) 624-5838

Mr. Pete Stafford
Center to Protect Workers' Rights
111 Massachusetts Avenue, N.W., Suite 509
Washington, D.C. 20001
(202) 962-8490
FAX (202) 962-8499

Ms. Pam Susi
Center to Protect Workers' Rights
111 Massachusetts Avenue, N.W., Suite 509
Washington, D.C. 20001
(202) 962-8490
FAX (202) 962-8499

Ms. Ellen Tohn
Alliance to End Childhood Lead Poisoning
600 Pennsylvania Avenue, S.E., Suite 100
Washington, DC 20003
(202) 543-1147
FAX (202) 543-4466

Mr. David J. Valiante
New Jersey Dept. of Health CN-360
Trenton, New Jersey 08625
(609) 984-1863
FAX (609) 984-2218

Dr. Laura Welch, MD
Division of Occupational and
Environmental Medicine
The George Washington University
2300 K Street, N.W. Room 201
Washington, D.C. 20037
(202) 994-1734
FAX (202) 994-3949

Ms. Teresa M. Willis
Environmental Epidemiology Program
Texas Department of Health

Arlington, MA 02174
(617) 648-6100
FAX (617) 643-0477

Mr. Elihu Leifer
Sherman, Dunn and Cohen
1125 15th Street, N.W.
Washington, DC 20005
(202) 785-9300
FAX (202) 775-1950

Dr. Stephen Levin, MD
Mt. Sinai Medical Center
Occupational Medicine
1 Gustave Levy Place
Box 1057 / 10 E 102nd Street
New York, NY 10029
(212) 241-7809
FAX (212) 996-0407

1100 West 49th Street
Austin, TX 78756
(512) 458-7269
FAX (512) 458-7601

Appendix B: 1995 Working Group Participants

Mike Blotzer, MS, CIH, CSP
Chief, Industrial Hygiene Office
NASA Lewis Research Center
21000 Brookpark Road, MS 6-4
Cleveland, OH 44135
P: 216- 433-8159
F: 216-433-8719

Joni Calla
Contract Office Technical Representative
NASA Lewis Research Center
21000 Brookpark Road
Cleveland, OH 44132
(216) 433-3123
F: 216-433-5208

Marty Cohen
Industrial Hygienist
Washington Dept. of Labor and Industries
POB 44330
Olympia, WA 98504-4330
P: 360-902-4957
F: 360-902-5672

Pierre Erville
Alliance to End Childhood Lead Poisoning
227 Massachusetts Ave., NE, Ste. 200
Washington, DC 20002
P: 202-543-1147
F: 202-543-4466

Barbara Materna
Industrial Hygienist
California Dept. Of Health Services
2151 Berkeley Way, Annex 11
Berkeley, CA 94704
P: 510-450-2400
F: 510-450-2411

Dooley Merrick
Project Manager, Paint Safe
Northwest Painters Conference
10750 San Point Way, NE
Seattle, WA 98125
P: 206-368-8938
F: 206-368-8268

Thomas Nunziata
Lead & Asbestos Program Spec.
Laborers-AGC Education & Training Tund
37 Deerfield Road
P.O. Box 37
Ponfret, CT 06259
P: 203-974-0800
F: 203-974-1459

Andrea Okun
Senior Prevention Specialist
NIOSH
R.A. Taft Labs
4676 Columbia Pkwy.
Cincinnati, OH 45226

Lynda M. Ewers, PhD
Research Industrial Hygienist
NIOSH
4676 Columbia Parkway
Cincinnati, OH 45226
P: 513-841-4580
F: 513-841-4486

Bob Farrington
Secretary-Treasurer
Ohio State Building and Construction Trades Council
236 E. Town Street, Ste. 120
Columbus, OH 43215
P: 614-221-3682
F: 614-461-1328

Jack Finklea, M.D.
Medical Officer
Center to Protect Workers' Rights
111 Massachusetts Ave., N.W., Ste. 509
Washington, DC 20001
P: 202-962-8490
F: 202-962-8499

Shamus Flynn
Apprentice Coordinator
Ironworkers Local #17
1700 Dennison Ave., Rm. 202
Cleveland, OH 44109
P: 212-749-6160

Mark Goldberg
Assistant Professor
Mt. Sinai School of Medicine
Box 1057
1 Gustave Levy Place
New York, NY 10029
P: 212-241-4697
F: 212-996-0407

Heather Grob
Economics Research Coordinator
Center to Protect Workers' Rights
111 Massachusetts Ave., N.W., Ste. 509
Washington, DC 20001
P: 202-962-8490
F: 202-962-8499

Keith Gromen
Safety & Health Coordinator
Ohio Department of Health
246 N. High Street
Columbus, OH 43215
P: 513-841-4523
F: 513-841-4486

Herman Panigutti
Cleveland Building Trades Council
1417 East 25th Street
Cleveland, OH 44114-4710
P: 216-771-3929
F: 216-771-1572

Ray Price
Business Manager
IBPAT D.C. #6
2605 Detroit Ave.
Cleveland, OH 44113
P: 216-771-4896
F: 216-771-1970

Rick Rabin
Coordinator
Lead Registry
MA Department of Labor
8 Sawin Street
Arlington, MA 02174
P: 617-969-7177
F: 617-727-4581

Cora Roelofs
Industrial Hygienist
Mt. Sinai School of Medicine
Box 1057
1 Gustave Levy Pl.
New York, NY 10029
P: 212-241-4697
F: 212-996-0407

Robert Roscoe
Supervisory Epidemiologist
Surveillance Branch
NIOSH/SHEFS
4676 Columbia Pkwy., MS R-21
Cincinnati, OH 45225-1988
P: 513-841-4424
F: 513-841-4489

Tim St. Clair
Safety Consultant
Book Division of Safety & Hygiene
6729 Americana Pkwy.
Columbus, OH 45225-1988
P: 614-575-1190
F: 614-575-1198

P: 614-466-5274
F: 614-644-7740

Joe Guadagno
IH Technician
UAW Local 774
2939 Niagara Street
Buffalo, NY 14207
P: 716-873-4715
F: 716-873-8341

Bill Howe, PE
Civil Engineer II
NYS Dept. Of Transportation
Construction Division
1220 Washington Ave., 4-101
Albany, NY 12232-0410
P: 518-485-1834
F: 518-485-1833

Jerry Langone
Civil Engineer II
Massachusetts Highway Department
519 Appleton Street
Arlington, MA 02174
P: 617-648-6100
F: 617-643-0477

George Macaluso
Senior Industrial Hygienist
Laborers Health & Saftey Fund
1225 Eye St., N.W., Ste. 900
Washington, DC 20005
P: 202-628-5465
F: 202-628-2613

Pam Susi
Program Director
Exposure Assessment
Center to Protect Workers' Rights
111 Massachusetts Ave., N.W., Ste. 509
Washington, DC 20001
P: 202-962-8490
F: 202-962-8499

Joe Ventura
Labor Liaison
Blue Cross Blue Shield of Ohio
Rock Run North
5700 Lombardo Centre, Ste.140
Seven Hills, OH 44131-2587
P: 216-573-6615
F: 216-642-3575

Nidia Villalba, MD, IH, OHST
Program Coordinator
Safety & Health
Electrical Industries
158 Harry Van Arsdale Jr. Ave.
Flushing, NY 11365
P: 718-591-3234
F: 718-380-7741

Jean Weiner
Project Coordinator
Mount Sinai Medical Center
Box 1057
1 Gustave Levy Pl.
New York, NY 10029
P: 212-241-9485
F: 212-996-0407

Philip Woods
Field Consultant
Construction Safety Assoc. Of Ontario
21 Voyager Court South
Etobicoke, Ontario, Canada M9W 5M7
P: 416-674-2726
F: 416-674-8866

[1]Bureau of Labor Statistics, U.S. Dept. of Labor, National Census of Fatal Occupational Injuries, 1994, Washington, D.C., news release issued August 3, 1995.

[2]Commonwealth of Massachusetts, Dept. of Labor, Lead at Work: Elevated Blood Lead Levels in Massachusetts Workers, April 1991-April 1993. November 1994.

[3]Center to Protect Workers' Rights: Building a Safety Culture. Report of the Second National Conference on Ergonomics, Safety and Health in Construction. CPWR Report G4-95; Washington, D.C. 1995.

[4]Presentation by Neil Murray, Head of Construction Policy Health and Safety Executive, Great Britain. Center to Protect Workers' Rights Second National Conference on Ergonomics, Safety and Health in Construction, June 18-21, 1995, Washington, D.C.

[5]U.S. Department of Labor, Occupational Safety and Health Administration: Title 29 Code of Federal Regulations, Part 1926.64: Process Safety Management of Highly Hazardous Chemicals.

[6]Steel Structures Painting Council Qualification Procedure No. 2(I): Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint. Steel Structures Painting Council. SSPC 92-14, Pittsburgh, PA, 1992.

[7]The Department of Health and Human Service has established 25 µg/dl as a specific goal above which workers' blood levels should not exceed (DHHS, 1990). The OSHA criteria for approving laboratories for blood lead analysis includes a requirement that individual BLLs sample analysis results be within 6 µg/dl of the all method mean if the mean is less than 40 µg/dl (USDOL, 1991). Therefore, a level of 35 µg/dl indicates that an increase in BLL above acceptable levels which is not a result of analytical error has clearly occurred.

[8]Penalty should be waived if the worker's entry BLL is greater than 35 µg/dl. If the worker has been employed at that site for more than two months the penalty may be levied regardless of entry BLL.

[9]On June 30, 1993, OSHA officially incorporated all applicable General Industry Standards (Part 1910) into the Construction Industry Standards (Part 1926). OSHA revised Part 1926 by adding the applicable Part 1910 Standards to part 1926. These changes are due to appear in the revision of the Code of Federal Regulations scheduled for publication in October, 1993. Copies of Federal regulations can be obtained from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

[10]Robinson, C.F.; Halperin, W.E.; Alterman, T; Braddee, R.W.; Burnett, C.A.; Fosbroke, D.E.; Kisner, S.M.; Lalich, N.R.; Roscoe, R.J.; Seligman, P.F.; Sestito, J.P.; Stern, F.B. and Stout, N.A. Mortality patterns among construction workers in the United States. Occupational Medicine: State of the Art Reviews; Vol 10, No. 2, April 1995. Philadelphia, Hanley and Belfus, Inc.

[11]ACGIH (1994) 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. American Conference of Governmental Industrial Hygienist, Cincinnati, OH.

[12]Conroy, L.M.; Lindsay, R.M.M.; And Sullivan, P.M. Lead, chromium and cadmium emission factors during abrasive blasting operations by bridge painters. Am.Ind. Hyg. Assoc. J. (56), March 1995.

[13]Projects vary in the likelihood and degree of lead exposures, level of control and resulting risk to workers. The second blood lead test should never occur more than one month from the baseline measurement. Where activities are such that high exposures may occur or exposures are highly variable, a second test should occur within two weeks of the baseline. Examples of high exposure tasks include welding, burning, rivet busting and abrasive blasting. Exposures would also be expected to increase as the degree of enclosure increases.

[14]To obtain a current list of the approved labs contact: Bill Babcock, OSHA Technical Center, P.O. Box 65200, Salt Lake City, Utah, 84165-0200. (801) 487-0267.

[15]DHHS. (1992) Preventing silicosis and deaths from sandblasting. National Institute for Occupational Safety and Health.Publication No. 92-102.

[16]There is not set standard for industrial use of lead based paint at this time. However, both ASTM and legislative activities are underway which will establish definitions for industrial lead paint products. The Federal Highway Authority has prohibited the use of lead paint on Federal aid projects authorized after June 1, 1993.

[17]While there are currently no Federal standards for lead in surface dust, the Department of Housing and Urban Development (HUD) sets a clearance level of 200 µg/ft² for floors. The new OSHA Compliance Directive for Lead (due out in October of 1993) is expected to provide more definitive criteria for evaluating effective decontamination of hygiene facilities.

APPENDIX J

1926.62	
Title	**Lead**
Subpart	**D**
Subpart Title	**Occupational Health and Environmental Controls**

a. Scope.

This section applies to all construction work where an employee may be occupationally exposed to lead. All construction work excluded from coverage in the general industry standard for lead by 29 CFR 1910.1025(a)(2) is covered by this standard. Construction work is defined as work for construction, alteration and/or repair, including painting and decorating. It includes but is not limited to the following:

(1) Demolition or salvage of structures where lead or materials containing lead are present;

(2) Removal or encapsulation of materials containing lead;

(3) New construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead;

(4) Installation of products containing lead;

(5) Lead contamination/emergency cleanup;

(6) Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed, and

(7) Maintenance operations associated with the construction activities described in this paragraph.

(b) "Definitions".

"Action level" means employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 $\mu g/m^3$) calculated as an 8-hour time-weighted average (TWA).

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Competent person" means one who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions and who has authorization to take prompt corrective measures to eliminate them.

"Director" means the Director, National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health and Human Services, or designee.

"Lead" means metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.

"This section" means this standard.

(c) "Permissible exposure limit".

(1) The employer shall assure that no employee is exposed to lead at concentrations greater than fifty micrograms per cubic meter of air (50 $\mu g/m^3$) averaged over an 8-hour period.

(2) If an employee is exposed to lead for more than 8 hours in any work day the employees' allowable exposure, as a time weighted average (TWA) for that day, shall be reduced according to the following formula:

Allowable employee exposure (in $\mu g/m^3$) = 400 divided by hours worked in the day.

(3) When respirators are used to limit employee exposure as required under paragraph (c) of this section and all the requirements of paragraphs (e)(1) and (f) of this section have been met, employee exposure may be considered to be at the level provided by the protection factor of the respirator for those periods the respirator is worn. Those periods may be averaged with exposure levels during periods when respirators are not worn to determine the employee's daily TWA

(d) "Exposure assessment".

(1) "General".

(i) Each employer who has a workplace or operation covered by this standard shall initially determine if any employee may be exposed to lead at or above the action level.

(ii) For the purposes of paragraph (d) of this section, employee exposure is that exposure which would occur if the employee were not using a respirator.

(iii) With the exception of monitoring under paragraph (d)(3), where monitoring is required under this section, the employer shall collect personal samples representative of a full shift including at least one sample for each job classification in each work area either for each shift or for the shift with the highest exposure level.

(iv) Full shift personal samples shall be representative of the monitored employee's regular, daily exposure to lead.

(2) "Protection of employees during assessment of exposure".

> **(i)** With respect to the lead related tasks listed in this paragraph (d)(2)(i) of this section, where lead is present, until the employer performs an employee exposure assessment as required in paragraph (d) of this section and documents that the employee performing any of the listed tasks is not exposed above the PEL, the employer shall treat the employee as if the employee were exposed above the

PEL, and not in excess of ten (10) times the PEL, and shall implement employee protective measures prescribed in paragraph (d)(2)(v) of this section. The tasks covered by this requirement are:

(A) Where lead containing coatings or paint are present: Manual demolition of structures (e.g, dry wall), manual scraping, manual sanding, heat gun applications, and power tool cleaning with dust collection systems;
(B) Spray painting with lead paint

(ii) In addition, with regard to tasks not listed in paragraph (d)(2)(i), where the employer has any reason to believe that an employee performing the task may be exposed to lead in excess of the PEL, until the employer performs an employee exposure assessment as required by paragraph (d) of this section and documents that the employee's lead exposure is not above the PEL the employer shall treat the employee as if the employee were exposed above the PEL and shall implement employee protective measures as prescribed in paragraph (d)(2)(v) of this section.

(iii) With respect to the tasks listed in this paragraph (d)(2)(iii) of this section, where lead is present, until the employer performs an employee exposure assessment as required in paragraph (d) of this section, and documents that the employee performing any of the listed tasks is not exposed in excess of 500 $\mu g/m^3$, the employer shall treat the employee as if the employee were exposed to lead in excess of 500 $\mu g/m^3$ and shall implement employee protective measures as prescribed in paragraph (d)(2)(v) of this section. Where the employer does establish that the employee is exposed to levels of lead below 500 $\mu g/m^3$, the employer may provide the exposed employee with the appropriate respirator prescribed for such use at such lower exposures, in accordance with Table 1 of this section. The tasks covered by this requirement are:

(A) Using lead containing mortar; lead burning
(B) Where lead containing coatings or paint are present: rivet busting; power tool cleaning without dust collection systems; cleanup activities where dry expendable abrasives are used; and abrasive blasting enclosure movement and removal.

(iv) With respect to the tasks listed in this paragraph (d)(2)(iv) of this section, where lead is present, until the employer performs an employee exposure assessment as required in paragraph (d) of this section and documents that the employee performing any of the listed tasks is not exposed to lead in excess of 2,500 $\mu g/m^3$ (50 x PEL), the employer shall treat the employee as if the employee were exposed to lead in excess of 2,500 $\mu g/m^3$ and shall implement employee protective measures as prescribed in paragraph (d)(2)(v) of this section. Where the employer does establish that the employee is exposed to levels of lead below 2,500 $\mu g/m^3$, the employer may provide the exposed employee with the appropriate respirator prescribed for use at such lower exposures, in accordance with Table I of this section. Interim protection as described in this paragraph is required where lead containing coatings or paint are present on structures when performing:

(A) Abrasive blasting,
(B) Welding,
(C) Cutting, and
(D) Torch burning.

(v) Until the employer performs an employee exposure assessment as required under paragraph (d) of this section and determines actual employee exposure, the employer shall provide to employees performing the tasks described in paragraphs (d)(2)(i), (d)(2)(ii), (d)(2)(iii) and (d)(2)(iv) of this section with interim protection as follows:

(A) Appropriate respiratory protection in accordance with paragraph (f) of this section.
(B) Appropriate personal protective clothing and equipment in accordance with paragraph (g) of this section.
(C) Change areas in accordance with paragraph (i)(2) of this section.
(D) Hand washing facilities in accordance with paragraph (i)(5) of this section.
(E) Biological monitoring in accordance with paragraph (j)(1)(i) of this section, to consist of blood sampling and analysis for lead and zinc protoporphyrin levels, and
(F) Training as required under paragraph (l)(1)(i) of this section regarding 29 CFR 1926.59, Hazard Communication; training as required under paragraph (l)(2)(ii)(C) of this section, regarding use of respirators; and training in accordance with 29 CFR 1926.21, Safety training and education.

(3) "Basis of initial determination".

(i) Except as provided under paragraphs (d)(3)(iii) and (d)(3)(iv) of this section the employer shall monitor employee exposures and shall base initial determinations on the employee exposure monitoring results and any of the following, relevant considerations:

(A) Any information, observations, or calculations which would indicate employee exposure to lead;
(B) Any previous measurements of airborne lead; and
(C) Any employee complaints of symptoms which may be attributable to exposure to lead.

(ii) Monitoring for the initial determination where performed may be limited to a representative sample of the exposed employees who the employer reasonably believes are exposed to the greatest airborne concentrations of lead in the workplace.

(iii) Where the employer has previously monitored for lead exposures, and the data were obtained within the past 12 months during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraphs (d)(3)(i) and (d)(6) of this section if the sampling and analytical methods meet the accuracy and confidence levels of paragraph (d)(10) of this section.

(iv) Where the employer has objective data, demonstrating that a particular product or material containing lead or a specific process, operation or activity involving lead cannot result in employee exposure to lead at or above the action level during processing, use, or handling, the employer may rely upon such data instead of implementing initial monitoring.

(A) The employer shall establish and maintain an accurate record documenting the nature and relevancy of objective data as specified in paragraph (n)(4) of this section, where used in assessing employee exposure in lieu of exposure monitoring.
(B) Objective data, as described in this paragraph (d)(3)(iv) of this section, is not permitted to be used for exposure assessment in connection with paragraph (d)(2) of this section.

(4) "Positive initial determination and initial monitoring".

(i) Where a determination conducted under paragraphs (d)(1), (2) and (3) of this section shows the possibility of any employee exposure at or above the action level the employer shall conduct monitoring which is representative of the exposure for each employee in the workplace who is exposed to lead.

(ii) Where the employer has previously monitored for lead exposure, and the data were obtained within the past 12 months during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (d)(4)(i) of this section if the sampling and analytical methods meet the accuracy and confidence levels of paragraph (d)(10) of this section.

(5) "Negative initial determination". Where a determination, conducted under paragraphs (d)(1), (2), and (3) of this section is made that no employee is exposed to airborne concentrations of lead at or above the action level the employer shall make a written record of such determination. The record shall include at least the information specified in paragraph (d)(3)(i) of this section and shall also include the date of determination, location within the worksite, and the name and social security number of each employee monitored.

(6) "Frequency".

(i) If the initial determination reveals employee exposure to be below the action level further exposure determination need not be repeated except as otherwise provided in paragraph (d)(7) of this section.

(ii) If the initial determination or subsequent determination reveals employee exposure to be at or above the action level but at or below the PEL the employer shall perform monitoring in accordance with this paragraph at least every 6 months. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least 7 days apart, are below the action level at which time the employer may discontinue monitoring for that employee except as otherwise provided in paragraph (d)(7) of this section.

(iii) If the initial determination reveals that employee exposure is above the PEL the employer shall perform monitoring quarterly. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least 7 days apart, are at or below the PEL but at or above the action level at which time the employer shall repeat monitoring for that employee at the frequency specified in paragraph (d)(6)(ii) of this section, except as otherwise provided in paragraph (d)(7) of this section. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least 7 days apart, are below the action level at which time the employer may discontinue monitoring for that employee except as otherwise provided in paragraph (d)(7) of this section.

(7) "Additional exposure assessments". Whenever there has been a change of equipment, process, control, personnel or a new task has been initiated that may result in additional employees being exposed to lead at or above the action level or may result in employees already exposed at or above the action level being exposed above the PEL, the employer shall conduct additional monitoring in accordance with this paragraph.

(8) "Employee notification".

(i) Within 5 working days after completion of the exposure assessment the employer shall notify each employee in writing of the results which represent that employee's exposure.

(ii) Whenever the results indicate that the representative employee exposure, without regard to respirators, is at or above the PEL the employer shall include in the written notice a statement that the employees exposure was at or above that level and a description of the corrective action taken or to be taken to reduce exposure to below that level.

(9) "Accuracy of measurement". The employer shall use a method of monitoring and analysis which has an accuracy (to a confidence level of 95 percent) of not less than plus or minus 25 percent for airborne concentrations of lead equal to or greater than 30 $\mu g/m^3$.

(e) "Methods of compliance"

(1) "Engineering and work practice controls." The employer shall implement engineering and work practice controls, including administrative controls, to reduce and maintain employee exposure to lead to or below the permissible exposure limit to the extent that such controls are feasible. Wherever all feasible engineering and work practices controls that can be instituted are not sufficient to reduce employee exposure to or below the permissible exposure limit prescribed in paragraph (c) of this section, the employer shall nonetheless use them to reduce employee exposure to the lowest feasible level and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (f) of this section.

(2) "Compliance program".

(i) Prior to commencement of the job each employer shall establish and implement a written compliance program to achieve compliance with paragraph (c) of this section.

(ii) Written plans for these compliance programs shall include at least the following:

(A) A description of each activity in which lead is emitted; e.g. equipment used, material involved, controls in place, crew size, employee job responsibilities, operating procedures and maintenance practices;
(B) A description of the specific means that will be employed to achieve compliance and, where engineering controls are required engineering plans and studies used to determine methods selected for controlling exposure to lead;
(C) A report of the technology considered in meeting the PEL;
(D) Air monitoring data which documents the source of lead emissions;
(E) A detailed schedule for implementation of the program, including documentation such as copies of purchase orders for equipment, construction contracts, etc.;
(F) A work practice program which includes items required under paragraphs (g), (h) and (i) of this section and incorporates other relevant work practices such as those specified in paragraph (e)(5) of this section;
(G) An administrative control schedule required by paragraph (e)(4) of this section, if applicable;
(H) A description of arrangements made among contractors on multi-contractor sites with respect to informing affected employees of potential exposure to lead and with respect to responsibility for compliance with this section as set-forth in 1926.16.
(I) Other relevant information.

(iii) The compliance program shall provide for frequent and regular inspections of job sites, materials, and equipment to be made by a competent person.

(iv) Written programs shall be submitted upon request to any affected employee or authorized employee representatives, to the Assistant Secretary and the Director, and shall be available at the worksite for examination and copying by the Assistant Secretary and the Director.

(v) Written programs shall be revised and updated at least every 6 months to reflect the current status of the program.

(3) "Mechanical ventilation". When ventilation is used to control lead exposure, the employer shall evaluate the mechanical performance of the system in controlling exposure as necessary to maintain its effectiveness.

(4) "Administrative controls". If administrative controls are used as a means of reducing employees TWA exposure to lead, the employer shall establish and implement a job rotation schedule which includes:

(i) Name or identification number of each affected employee;

(ii) Duration and exposure levels at each job or work station where each affected employee is located; and

(iii) Any other information which may be useful in assessing the reliability of administrative controls to reduce exposure to lead.

(5) The employer shall ensure that, to the extent relevant, employees follow good work practices such as described in Appendix B of this section.

(f) "Respiratory protection"

(1) "General". Where the use of respirators is required under this section the employer shall provide, at no cost to the employee, and assure the use of respirators which comply with the requirements of this paragraph. Respirators shall be used in the following circumstances:

(i) Whenever an employee's exposure to lead exceeds the PEL;

(ii) In work situations in which engineering controls and work practices are not sufficient to reduce exposures to or below the PEL;

(iii) Whenever an employee requests a respirator; and

(iv) An interim protection for employees performing tasks as specified in paragraph (d)(2) of this section.

(2) "Respirator selection"

(i) Where respirators are used under this section the employer shall select the appropriate respirator or combination of respirators from Table I below.

(ii) The employer shall provide a powered, air-purifying respirator in lieu of the respirator specified in Table I whenever:

(A) An employee chooses to use this type of respirator; and
(B) This respirator will provide adequate protection to the employee.

(iii) The employer shall select respirators from among those approved for protection against lead dust, fume, and mist by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

TABLE 1. - RESPIRATORY PROTECTION FOR LEAD AEROSOLS

Airborne concentration of lead or condition of use	Required respirator(1)
Not in excess of 500 µg/m³	- ½ mask air purifying respirator with high efficiency filters(2)(3). - ½ mask supplied air respirator operated in demand (negative pressure) mode.
Not in excess of 1,250 µg/m³	- Loose fitting hood or helmet powered air purifying respirator with high efficiency filters(3). - Hood or helmet supplied air respirator operated in a continuous-flow mode - e.g., type CE abrasive blasting respirators operated in a continuous-flow mode.
Not in excess of 2,500 µg/m³	- Full facepiece air purifying respirator with high efficiency filters(3). - Tight fitting powered air purifying respirator with high efficiency filters(3). - Full facepiece supplied air respirator operated in demand mode. - ½ mask or full facepiece supplied air respirator operated in a continuous-flow mode.
Not in excess of 50,000 µg/m³	- ½ mask or full facepiece supplied air respirator operated in a continuous-flow mode.
Not in excess of 100,000 µg/m³	- Full facepiece self-contained breathing apparatus (SCBA) operated in demand mode. - ½ mask supplied air respirator operated in pressure demand or other positive-pressure mode.
Greater than 100,000 µg/m³ unknown concentration, or fire fighting	- Full facepiece supplied air respirator operated in pressure demand or other positive-pressure mode - e.g., type CE abrasive blasting respirators operated in a positive-pressure mode.

	- Full facepiece SCBA operated in pressure demand or other positive-pressure mode

Footnote (1) Respirators specified for higher concentrations can be used at lower concentrations of lead.
Footnote (2) Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.
Footnote (3) A high efficiency particulate filter (HEPA) means a filter that is a 99.97 percent efficient against particles of 0.3 micron size or larger.

(3) "Respirator usage"

(i) The employer shall assure that the respirator issued to the employee exhibits minimum facepiece leakage and that the respirator is fitted properly.

(ii) Employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every six months thereafter for each employee wearing negative pressure respirators. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, and shall be conducted in accordance with appendix D. The tests shall be used to select facepieces that provide the required protection as prescribed in Table I

(iii) If an employee exhibits difficulty in breathing during the fitting test or during use, the employer shall make available to the employee an examination in accordance with paragraph (j)(3)(i)(B) of this section to determine whether the employee can wear a respirator while performing the required duty.

(4) "Respirator program"

(i) The employer shall institute a respiratory protection program in accordance with 29 CFR 1910.134 (b), (d), (e) and (f).

(ii) The employer shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their face and respirator facepiece whenever necessary to prevent skin irritation associated with respirator use.

(g) "Protective work clothing and equipment"

(1) "Provision and use". Where an employee is exposed to lead above the PEL without regard to the use of respirators, where employees are exposed to lead compounds which may cause skin or eye irritation (e.g. lead arsenate, lead azide), and as interim protection for employees performing tasks as specified in paragraph (d)(2) of this section, the employer shall provide at no cost to the employee and assure that the employee uses appropriate protective work clothing and equipment that prevents contamination of the employee and the employee's garments such as, but not limited to:

(i) Coveralls or similar full-body work clothing;

(ii) Gloves, hats, and shoes or disposable shoe coverlets; and

(iii) Face shields, vented goggles, or other appropriate protective equipment which complies with 1910.133 of this chapter.

(2) "Cleaning and replacement"

(i) The employer shall provide the protective clothing required in paragraph (g)(1) of this section in a clean and dry condition at least weekly, and daily to employees whose exposure levels without regard to a respirator are over 200 $\mu g/m^3$of lead as an 8-hour TWA.

(ii) The employer shall provide for the cleaning, laundering, and disposal of protective clothing and equipment required by paragraph (g)(1) of this section.

(iii) The employer shall repair or replace required protective clothing and equipment as needed to maintain their effectiveness.

(iv) The employer shall assure that all protective clothing is removed at the completion of a work shift only in change areas provided for that purpose as prescribed in paragraph (i)(2) of this section.

(v) The employer shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change area which prevents dispersion of lead outside the container.

(vi) The employer shall inform in writing any person who cleans or launders protective clothing or equipment of the potentially harmful effects of exposure to lead.

(vii) The employer shall assure that the containers of contaminated protective clothing and equipment required by paragraph (g)(2)(v) of this section are labeled as follows:

Caution: Clothing contaminated with lead. Do not remove dust by blowing or shaking. Dispose of lead contaminated wash water in accordance with applicable local, state, or federal regulations.

(viii) The employer shall prohibit the removal of lead from protective clothing or equipment by blowing, shaking, or any other means which disperses lead into the air.

(h) "Housekeeping"

(1) "All surfaces shall be maintained as free as practicable of accumulations of lead".

(2) Clean-up of floors and other surfaces where lead accumulates shall wherever possible, be cleaned by vacuuming or other methods that minimize the likelihood of lead becoming airborne.

(3) Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or other equally effective methods have been tried and found not to be effective.

(4) Where vacuuming methods are selected, the vacuums shall be equipped with HEPA filters and used and emptied in a manner which minimizes the reentry of lead into the workplace.

(5) Compressed air shall not be used to remove lead from any surface unless the compressed air is used in conjunction with a ventilation system designed to capture the airborne dust created by the compressed air.

(i) "Hygiene facilities and practices"

(1) The employer shall assure that in areas where employees are exposed to lead above the PEL without regard to the use of respirators, food or beverage is not present or consumed, tobacco products are not present or used, and cosmetics are not applied.

(2) "Change areas"

(i) The employer shall provide clean change areas for employees whose airborne exposure to lead is above the PEL, and as interim protection for employees performing tasks as specified in paragraph (d)(2) of this section, without regard to the use of respirators.

(ii) The employer shall assure that change areas are equipped with separate storage facilities for protective work clothing and equipment and for street clothes which prevent cross - contamination.

(iii) The employer shall assure that employees do not leave the workplace wearing any protective clothing or equipment that is required to be worn during the work shift.

(3) "Showers"

(i) The employer shall provide shower facilities, where feasible, for use by employees whose airborne exposure to lead is above the PEL.

(ii) The employer shall assure, where shower facilities are available, that employees shower at the end of the work shift and shall provide an adequate supply of cleansing agents and towels for use by affected employees.

(4) "Eating facilities"

(i) The employer shall provide lunchroom facilities or eating areas for employees whose airborne exposure to lead is above the PEL, without regard to the use of respirators.

(ii) The employer shall assure that lunchroom facilities or eating areas are as free as practicable from lead contamination and are readily accessible to employees.

(iii) The employer shall assure that employees whose airborne exposure to lead is above the PEL, without regard to the use of a respirator, wash their hands and face prior to eating, drinking, smoking or applying cosmetics.

(iv) The employer shall assure that employees do not enter lunchroom facilities or eating areas with protective work clothing or equipment unless surface lead dust has been removed by vacuuming, downdraft booth, or other cleaning method that limits dispersion of lead dust.

(5) "Hand Washing facilities"

(i) The employer shall provide adequate handwashing facilities for use by employees exposed to lead in accordance with 29 CFR 1926.51(f).

(ii) Where showers are not provided the employer shall assure that employees wash their hands and face at the end of the work - shift.

(j) "Medical surveillance"

(1) "General"

(i) The employer shall make available initial medical surveillance to employees occupationally exposed on any day to lead at or above the action level. Initial medical surveillance consists of biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels.

(ii) The employer shall institute a medical surveillance program in accordance with paragraphs (j)(2) and (j)(3) of this section for all employees who are or may be exposed by the employer at or above the action level for more than 30 days in any consecutive 12 months;

(iii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician.

(iv) The employer shall make available the required medical surveillance including multiple physician review under paragraph (j)(3)(iii) without cost to employees and at a reasonable time and place.

(2) "Biological monitoring"

(i) "Blood lead and ZPP level sampling and analysis". The employer shall make available biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels to each employee covered under paragraphs (j)(1)(i) and (ii) of this section on the following schedule:

(A) For each employee covered under paragraph (j)(1)(ii) of this section, at least every 2 months for the first 6 months and every 6 months thereafter;
(B) For each employee covered under paragraphs (j)(1)(i) or (ii) of this section whose last blood sampling and analysis indicated a blood lead level at or above 40 μg/dl, at least every two months. This frequency shall continue until two consecutive blood samples and analyses indicate a blood lead level below 40 μg/dl; and
(C) For each employee who is removed from exposure to lead due to an elevated blood lead level at least monthly during the removal period.

(ii) "Follow-up blood sampling tests". Whenever the results of a blood lead level test indicate that an employee's blood lead level exceeds the numerical criterion for medical removal under paragraph (k)(1)(i) of this section, the employer shall provide a second (follow-up) blood sampling test within two weeks after the employer receives the results of the first blood sampling test.

(iii) "Accuracy of blood lead level sampling and analysis". Blood lead level sampling and analysis provided pursuant to this section shall have an accuracy (to a confidence level of 95 percent) within plus or minus 15 percent or 6 μg/dl, whichever is greater, and shall be conducted by a laboratory approved by OSHA.

(iv) "Employee notification"

(A) Within five working days after the receipt of biological monitoring results, the employer shall notify each employee in writing of his or her blood lead level; and
(B) the employer shall notify each employee whose blood lead level exceeds 40 *µ*g/dl that the standard requires temporary medical removal with Medical Removal Protection benefits when an employee's blood lead level exceeds the numerical criterion for medical removal under paragraph (k)(1)(i) of this section.

(3) "Medical examinations and consultations"

(i) "Frequency". The employer shall make available medical examinations and consultations to each employee covered under paragraph (j)(1)(ii) of this section on the following schedule:

(A) At least annually for each employee for whom a blood sampling test conducted at any time during the preceding 12 months indicated a blood lead level at or above 40 *µ*g/dl;
(B) As soon as possible, upon notification by an employee either that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee desires medical advice concerning the effects of current or past exposure to lead on the employee's ability to procreate a healthy child, that the employee is pregnant, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during use; and
(C) As medically appropriate for each employee either removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited pursuant to a final medical determination.

(ii) "Content". The content of medical examinations made available pursuant to paragraph (j)(3)(i)(B) - (C) of this section shall be determined by an examining physician and, if requested by an employee, shall include pregnancy testing or laboratory evaluation of male fertility. Medical examinations made available pursuant to paragraph (j)(3)(i)(A) of this section shall include the following elements:

(A) A detailed work history and a medical history, with particular attention to past lead exposure (occupational and non-occupational), personal habits (smoking, hygiene), and past gastrointestinal, hematologic, renal, cardiovascular, reproductive and neurological problems;
(B) A thorough physical examination, with particular attention to teeth, gums, hematologic, gastrointestinal, renal, cardiovascular, and neurological systems. Pulmonary status should be evaluated if respiratory protection will be used;
(C) A blood pressure measurement;
(D) A blood sample and analysis which determines:

{1} Blood lead level;
{2} Hemoglobin and hematocrit determinations, red cell indices, and examination of peripheral smear morphology;
{3} Zinc protoporphyrin;
{4} Blood urea nitrogen; and,
{5} Serum creatinine;

(E) A routine urinalysis with microscopic examination; and
(F) Any laboratory or other test relevant to lead exposure which the examining physician deems necessary by sound medical practice.

(iii) "Multiple physician review mechanism."

(A) If the employer selects the initial physician who conducts any medical examination or consultation provided to an employee under this section, the employee may designate a second physician:

{1} To review any findings, determinations or recommendations of the initial physician; and
{2} To conduct such examinations, consultations, and laboratory tests as the second physician deems necessary to facilitate this review.

(B) The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician conducts a medical examination or consultation pursuant to this section. The employer may condition its participation in, and payment for, the multiple physician review mechanism upon the employee doing the following within fifteen (15) days after receipt of the foregoing notification, or receipt of the initial physician's written opinion, whichever is later:

{1} The employee informing the employer that he or she intends to seek a second medical opinion, and
{2} The employee initiating steps to make an appointment with a second physician.

(C) If the findings, determinations or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve any disagreement.
(D) If the two physicians have been unable to quickly resolve their disagreement, then the employer and the employee through their respective physicians shall designate a third physician:

{1} To review any findings, determinations or recommendations of the prior physicians; and
{2} To conduct such examinations, consultations, laboratory tests and discussions with the prior physicians as the third physician deems necessary to resolve the disagreement of the prior physicians.

(E) The employer shall act consistent with the findings, determinations and recommendations of the third physician, unless the employer and the employee reach an agreement which is otherwise consistent with the recommendations of at least one of the three physicians.

(iv) "Information provided to examining and consulting physicians".

(A) The employer shall provide an initial physician conducting a medical examination or consultation under this section with the following information:

{1} A copy of this regulation for lead including all Appendices;
{2} A description of the affected employee's duties as they relate to the employee's exposure;
{3} The employee's exposure level or anticipated exposure level to lead and to any other toxic substance (if applicable);
{4} A description of any personal protective equipment used or to be used;
{5} Prior blood lead determinations; and
{6} All prior written medical opinions concerning the employee in the employer's possession or control.

(B) The employer shall provide the foregoing information to a second or third physician conducting a medical examination or consultation under this section upon request either by the second or third physician, or by the employee.

(v) "Written medical opinions"

(A) The employer shall obtain and furnish the employee with a copy of a written medical opinion from each examining or consulting physician which contains only the following information:

{1} The physician's opinion as to whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from exposure to lead;
{2} Any recommended special protective measures to be provided to the employee, or limitations to be placed upon the employee's exposure to lead;
{3} Any recommended limitation upon the employee's use of respirators, including a determination of whether the employee can wear a powered air purifying respirator if a physician determines that the employee cannot wear a negative pressure respirator; and
{4} The results of the blood lead determinations.

(B) The employer shall instruct each examining and consulting physician to:

{1} Not reveal either in the written opinion or orally, or in any other means of communication with the employer, findings, including laboratory results, or diagnoses unrelated to an employee's occupational exposure to lead; and
{2} Advise the employee of any medical condition, occupational or nonoccupational, which dictates further medical examination or treatment.

(vi) "Alternate physician determination mechanisms". The employer and an employee or authorized employee representative may agree upon the use of any alternate physician determination mechanism in lieu of the multiple physician review mechanism provided by paragraph (j)(3)(iii) of this section so long as the alternate mechanism is as expeditious and protective as the requirements contained in this paragraph.

(4) "Chelation"

(i) The employer shall assure that any person whom he retains, employs, supervises or controls does not engage in prophylactic chelation of any employee at any time.

(ii) If therapeutic or diagnostic chelation is to be performed by any person in paragraph (j)(4)(i) of this section, the employer shall assure that it be done under the supervision of a licensed physician in a clinical setting with thorough and appropriate medical monitoring and that the employee is notified in writing prior to its occurrence.

(k) "Medical removal protection"

(1) "Temporary medical removal and return of an employee"

(i) "Temporary removal due to elevated blood lead level". The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a periodic and a follow-up blood sampling test conducted pursuant to this section indicate that the employee's blood lead level is at or above 50 µg/dl; and,

(ii) "Temporary removal due to a final medical determination".

(A) The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a final medical determination results in a medical finding, determination, or opinion that the employee has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.
(B) For the purposes of this section, the phrase "final medical determination" means the written medical opinion on the employees' health status by the examining physician or, where relevant, the outcome of the multiple physician review mechanism or alternate medical determination mechanism used pursuant to the medical surveillance provisions of this section.
(C) Where a final medical determination results in any recommended special protective measures for an employee, or limitations on an employee's exposure to lead, the employer shall implement and act consistent with the recommendation.

(iii) "Return of the employee to former job status".

(A) The employer shall return an employee to his or her former job status:

{1} For an employee removed due to a blood lead level at or above 50 µg/dl when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 40 µg/dl;
{2} For an employee removed due to a final medical determination, when a subsequent final medical determination results in a medical finding, determination, or opinion that the employee no longer has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.
(B) For the purposes of this section, the requirement that an employer return an employee to his or her former job status is not intended to expand upon or restrict any rights an employee has or would have had, absent temporary medical removal, to a specific job classification or position under the terms of a collective bargaining agreement.

(iv) "Removal of other employee special protective measure or limitations". The employer shall remove any limitations placed on an employee or end any special protective measures provided to an employee pursuant to a final medical determination when a subsequent final medical determination indicates that the limitations or special protective measures are no longer necessary.

(v) "Employer options pending a final medical determination". Where the multiple physician review mechanism, or alternate medical determination mechanism used pursuant to the medical surveillance provisions of this section, has not yet resulted in a final medical determination with respect to an employee, the employer shall act as follows:

(A) "Removal". The employer may remove the employee from exposure to lead, provide special protective measures to the employee, or place limitations upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status.
(B) "Return". The employer may return the employee to his or her former job status, end any special protective measures provided to the employee, and remove any limitations placed upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status, with two exceptions.

{1} If the initial removal, special protection, or limitation of the employee resulted from a final medical determination which differed from the findings, determinations, or recommendations of the initial physician or;
{2} If the employee has been on removal status for the preceding eighteen months due to an elevated blood lead level, then the employer shall await a final medical determination.

(2) "Medical removal protection benefits"

(i) "Provision of medical removal protection benefits". The employer shall provide an employee up to eighteen (18) months of medical removal protection benefits on each occasion that an employee is removed from exposure to lead or otherwise limited pursuant to this section.

(ii) "Definition of medical removal protection benefits". For the purposes of this section, the requirement that an employer provide medical removal protection benefits means that, as long as the job the employee was removed from continues, the employer shall maintain the total normal earnings, seniority and other employment rights and benefits of an employee, including the employee's right to his or her former job status as though the employee had not been medically removed from the employee's job or otherwise medically limited.

(iii) "Follow-up medical surveillance during the period of employee removal or limitation." During the period of time that an employee is medically removed from his or her job or otherwise medically limited, the employer may condition the provision of medical removal protection benefits upon the employee's participation in follow-up medical surveillance made available pursuant to this section.

(iv) "Workers' compensation claims". If a removed employee files a claim for workers' compensation payments for a lead - related disability, then the employer shall continue to provide medical removal protection benefits pending disposition of the claim. To the extent that an award is made to the employee for earnings lost during the period of removal, the employer's medical removal protection obligation shall be reduced by such amount. The employer shall receive no credit for workers' compensation payments received by the employee for treatment - related expenses.

(v) "Other credits". The employer's obligation to provide medical removal protection benefits to a removed employee shall be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer - funded compensation program, or receives income from employment with another employer made possible by virtue of the employee's removal.

(vi) "Voluntary removal or restriction of an employee". Where an employer, although not required by this section to do so, removes an employee from exposure to lead or otherwise places limitations on an employee due to the effects of lead exposure on the employee's medical condition, the employer shall provide medical removal protection benefits to the employee equal to that required by paragraph (k)(2)(i) and (ii) of this section.

(l) "Employee information and training"

(1) "General"

(i) The employer shall communicate information concerning lead hazards according to the requirements of OSHA's Hazard Communication Standard for the construction industry, 29 CFR 1926.59, including but not limited to the requirements concerning warning signs and labels, material safety data sheets (MSDS), and employee information and training. In addition, employers shall comply with the following requirements:

(ii) For all employees who are subject to exposure to lead at or above the action level on any day or who are subject to exposure to lead compounds which may cause skin or eye irritation (e.g. lead arsenate, lead azide), the employer shall provide a training program in accordance with paragraph (l)(2) of this section and assure employee participation.

(iii) The employer shall provide the training program as initial training prior to the time of job assignment or prior to the start up date for this requirement, whichever comes last.

(iv) The employer shall also provide the training program at least annually for each employee who is subject to lead exposure at or above the action level on any day.

(2) "Training program". The employer shall assure that each employee is trained in the following:

(i) The content of this standard and its appendices;

(ii) The specific nature of the operations which could result in exposure to lead above the action level;

(iii) The purpose, proper selection, fitting, use, and limitations of respirators;

(iv) The purpose and a description of the medical surveillance program, and the medical removal protection program including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant);

(v) The engineering controls and work practices associated with the employee's job assignment including training of employees to follow relevant good work practices described in Appendix B of this section;

(vi) The contents of any compliance plan in effect;

(vii) Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician; and

(viii) The employee's right of access to records under 29 CFR 1910.20.

(3) "Access to information and training materials."

(i) The employer shall make readily available to all affected employees a copy of this standard and its appendices.

(ii) The employer shall provide, upon request, all materials relating to the employee information and training program to affected employees and their designated representatives, and to the Assistant Secretary and the Director.

(m) "Signs"

(1) "General"

(i) The employer may use signs required by other statutes, regulations or ordinances in addition to, or in combination with, signs required by this paragraph.

(ii) The employer shall assure that no statement appears on or near any sign required by this paragraph which contradicts or detracts from the meaning of the required sign.

(2) "Signs"

(i) The employer shall post the following warning signs in each work area where an employees exposure to lead is above the PEL.

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

(ii) The employer shall assure that signs required by this paragraph are illuminated and cleaned as necessary so that the legend is readily visible.

(n) "Recordkeeping"

(1) "Exposure assessment"

(i) The employer shall establish and maintain an accurate record of all monitoring and other data used in conducting employee exposure assessments as required in paragraph (d) of this section.

(ii) Exposure monitoring records shall include:

(A) The date(s), number, duration, location and results of each of the samples taken if any, including a description of the sampling procedure used to determine representative employee exposure where applicable;
(B) A description of the sampling and analytical methods used and evidence of their accuracy;
(C) The type of respiratory protective devices worn, if any;
(D) Name, social security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent; and
(E) The environmental variables that could affect the measurement of employee exposure.

(iii) The employer shall maintain monitoring and other exposure assessment records in accordance with the provisions of 29 CFR 1910.20.

(2) "Medical surveillance"

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by paragraph (j) of this section.

(ii) This record shall include:

(A) The name, social security number, and description of the duties of the employee;
(B) A copy of the physician's written opinions;
(C) Results of any airborne exposure monitoring done on or for that employee and provided to the physician; and
(D) Any employee medical complaints related to exposure to lead.

(iii) The employer shall keep, or assure that the examining physician keeps, the following medical records:

(A) A copy of the medical examination results including medical and work history required under paragraph (j) of this section;
(B) A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to that information;
(C) A copy of the results of biological monitoring.

(iv) The employer shall maintain or assure that the physician maintains medical records in accordance with the provisions of 29 CFR 1910.20.

(3) "Medical removals"

(i) The employer shall establish and maintain an accurate record for each employee removed from current exposure to lead pursuant to paragraph (k) of this section.

(ii) Each record shall include:

(A) The name and social security number of the employee;
(B) The date of each occasion that the employee was removed from current exposure to lead as well as the corresponding date on which the employee was returned to his or her former job status;
(C) A brief explanation of how each removal was or is being accomplished; and
(D) A statement with respect to each removal indicating whether or not the reason for the removal was an elevated blood lead level.

(iii) The employer shall maintain each medical removal record for at least the duration of an employee's employment.

(4) "Objective data for exemption from requirement for initial monitoring".

(i) For purposes of this section, objective data are information demonstrating that a particular product or material containing lead or a specific process, operation, or activity involving lead cannot release dust or fumes in concentrations at or above the action level under any expected conditions of use. Objective data can be obtained from an industry - wide study or from laboratory product test results from manufacturers of lead containing products or materials. The data the employer uses from an industry - wide survey must be obtained under workplace conditions closely resembling the processes, types of material, control methods, work practices and environmental conditions in the employer's current operations.

(ii) The employer shall maintain the record of the objective data relied upon for at least 30 years.

(5) "Availability". The employer shall make available upon request all records required to be maintained by paragraph (n) of this section to affected employees, former employees, and their designated representatives, and to the Assistant Secretary and the Director for examination and copying.

(6) "Transfer of records"

(i) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by paragraph (n) of this section.

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records required to be maintained by this section for the prescribed period, these records shall be transmitted to the Director.

(iii) At the expiration of the retention period for the records required to be maintained by this section, the employer shall notify the Director at least 3 months prior to the disposal of such records and shall transmit those records to the Director if requested within the period.

(iv) The employer shall also comply with any additional requirements involving transfer of records set forth in 29 CFR 1910.20(h).

(o) "Observation of monitoring"

(1) Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to lead conducted pursuant to paragraph (d) of this section.

(2) "Observation procedures"

(i) Whenever observation of the monitoring of employee exposure to lead requires entry into an area where the use of respirators, protective clothing or equipment is required, the employer shall provide the observer with and assure the use of such respirators, clothing and equipment, and shall require the observer to comply with all other applicable safety and health procedures.

(ii) Without interfering with the monitoring, observers shall be entitled to:

(A) Receive an explanation of the measurement procedures;
(B) Observe all steps related to the monitoring of lead performed at the place of exposure; and
(C) Record the results obtained or receive copies of the results when returned by the laboratory.

(p) "Effective date".

This standard (1926.62) shall become effective June 3, 1993.

(q) "Appendices".

The information contained in the appendices to this section is not intended by itself, to create any additional obligations not otherwise imposed by this standard nor detract from any existing obligation.

(r) "Startup dates".

(1) The requirements of paragraphs (c) through (o) of this section, including administrative controls and feasible work practice controls, but not including engineering controls specified in paragraph (e)(1) of this section, shall be complied with as soon as possible, but no later than 60 days from the effective date of this section.

(2) Feasible engineering controls specified by paragraph (e)(1) of this section shall be implemented as soon as possible, but no later than 120 days from the effective date of this section.

[57 FR 26627, May 4, 1993, as amended at 58 FR 34218, June 24, 1993; 61 FR 5507, Feb. 13, 1996]

1926.62 App A	
Title	Substance Data Sheet for Occupational Exposure to Lead
Subpart	D
Subpart Title	Occupational Health and Environmental Controls

I. SUBSTANCE IDENTIFICATION

A. "Substance": Pure lead (Pb) is a heavy metal at room temperature and pressure and is a basic chemical element. It can combine with various other substances to form numerous lead compounds.

B. "Compounds Covered by the Standard": The word "lead" when used in this interim final standard means elemental lead, all inorganic lead compounds and a class of organic lead compounds called lead soaps. This standard does not apply to other organic lead compounds.

C. "Uses": Exposure to lead occurs in several different occupations in the construction industry, including demolition or salvage of structures where lead or lead - containing materials are present; removal or encapsulation of lead - containing materials, new construction, alteration, repair, or renovation of structures that contain lead or materials containing lead; installation of products containing lead. In addition, there are construction related activities where exposure to lead may occur, including transportation, disposal, storage, or containment of lead or materials containing lead on construction sites, and maintenance operations associated with construction activities.

D. "Permissible Exposure": The permissible exposure limit (PEL) set by the standard is 50 micrograms of lead per cubic meter of air (50 μg/ m^3), averaged over an 8-hour workday.

E. "Action Level": The interim final standard establishes an action level of 30 micrograms of lead per cubic meter of air (30 μg/ m^3), averaged over an 8-hour workday. The action level triggers several ancillary provisions of the standard such as exposure monitoring, medical surveillance, and training.

II. HEALTH HAZARD DATA

A. "Ways in which lead enters your body". When absorbed into your body in certain doses, lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect you not only from the immediate toxic effects of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed. Lead can be absorbed into your body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin. When lead is scattered in the air as a dust, fume, or mist it can be inhaled and absorbed through you lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if lead gets into your mouth and is swallowed. If you handle food, cigarettes, chewing tobacco, or make-up which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion. A significant portion of the lead that you inhale or ingest gets into your blood stream. Once in your blood stream, lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in the blood and other tissues. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to your organs and whole body systems.

B. "Effects of overexposure to lead" - **(1)** "Short term (acute) overexposure". Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardiorespiratory arrest. A short term dose of lead can lead to acute encephalopathy. Short term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects which take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease which arise after periods of exposure as short as days or as long as several years.
(2) "Long-term (chronic) overexposure". Chronic overexposure to lead may result in severe damage to your blood - forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic there may be severe abdominal pain. Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy. Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible. Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood. Overexposure to lead

also disrupts the blood - forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood.

(3) "Health protection goals of the standard". Prevention of adverse health effects for most workers from exposure to lead throughout a working lifetime requires that a worker's blood lead level (BLL, also expressed as PbB) be maintained at or below forty micrograms per deciliter of whole blood (40 μg/dl). The blood lead levels of workers (both male and female workers) who intend to have children should be maintained below 30 μg/dl to minimize adverse reproductive health effects to the parents and to the developing fetus. The measurement of your blood lead level (BLL) is the most useful indicator of the amount of lead being absorbed by your body. Blood lead levels are most often reported in units of milligrams (mg) or micrograms (μg) of lead (1 mg=1000 μg) per 100 grams (100g), 100 milliliters (100 ml) or deciliter (dl) of blood. These three units are essentially the same. Sometime BLLs are expressed in the form of mg percent or μg percent. This is a shorthand notation for 100g, 100 ml, or dl. (References to BLL measurements in this standard are expressed in the form of μg/dl.)

BLL measurements show the amount of lead circulating in your blood stream, but do not give any information about the amount of lead stored in your various tissues. BLL measurements merely show current absorption of lead, not the effect that lead is having on your body or the effects that past lead exposure may have already caused. Past research into lead - related diseases, however, has focused heavily on associations between BLLs and various diseases. As a result, your BLL is an important indicator of the likelihood that you will gradually acquire a lead - related health impairment or disease.

Once your blood lead level climbs above 40 μg/dl, your risk of disease increases. There is a wide variability of individual response to lead, thus it is difficult to say that a particular BLL in a given person will cause a particular effect. Studies have associated fatal encephalopathy with BLLs as low as 150 μg/dl. Other studies have shown other forms of diseases in some workers with BLLs well below 80 μg/dl. Your BLL is a crucial indicator of the risks to your health, but one other factor is also extremely important. This factor is the length of time you have had elevated BLLs. The longer you have an elevated BLL, the greater the risk that large quantities of lead are being gradually stored in your organs and tissues (body burden). The greater your overall body burden, the greater the chances of substantial permanent damage. The best way to prevent all forms of lead - related impairments and diseases -- both short term and long term -- is to maintain your BLL below 40 μg/dl. The provisions of the standard are designed with this end in mind.

Your employer has prime responsibility to assure that the provisions of the standard are complied with both by the company and by individual workers. You, as a worker, however, also have a responsibility to assist your employer in complying with the standard. You can play a key role in protecting your own health by learning about the lead hazards and their control, learning what the standard requires, following the standard where it governs your own actions, and seeing that your employer complies with provisions governing his or her actions.

(4) "Reporting signs and symptoms of health problems". You should immediately notify your employer if you develop signs or symptoms associated with lead poisoning or if you desire medical advice concerning the effects of current or past exposure to lead or your ability to have a healthy child. You should also notify your employer if you have difficulty breathing during a respirator fit test or while wearing a respirator. In each of these cases, your employer must make available to you appropriate medical examinations or consultations. These must be provided at no cost to you and at a reasonable time and place. The standard contains a procedure whereby you can obtain a second opinion by a physician of your choice if your employer selected the initial physician.

[57 FR 26627, May 4, 1993, as amended at 58 FR 34218, June 24, 1993]

1926.62 App B	
Title	Employee Standard Summary
Subpart	D
Subpart Title	Occupational Health and Environmental Controls

This appendix summarizes key provisions of the interim final standard for lead in construction that you as a worker should become familiar with.

I. Permissible Exposure Limit (PEL) - Paragraph (C)

The standard sets a permissible exposure limit (PEL) of 50 micrograms of lead per cubic meter of air (50 $\mu g/\ m^3$), averaged over an 8-hour workday which is referred to as a time-weighted average (TWA). This is the highest level of lead in air to which you may be permissibly exposed over an 8-hour workday. However, since this is an 8-hour average, short exposures above the PEL are permitted so long as for each 8-hour work day your average exposure does not exceed this level. This interim final standard, however, takes into account the fact that your daily exposure to lead can extend beyond a typical 8-hour workday as the result of overtime or other alterations in your work schedule. To deal with this situation, the standard contains a formula which reduces your permissible exposure when you are exposed more than 8 hours. For example, if you are exposed to lead for 10 hours a day, the maximum permitted average exposure would be 40 $\mu g/\ m^3$.

II. Exposure Assessment - Paragraph (D)

If lead is present in your workplace in any quantity, your employer is required to make an initial determination of whether any employee's exposure to lead exceeds the action level (30 $\mu g/\ m^3$ averaged over an 8-hour day). Employee exposure is that exposure which would occur if the employee were not using a respirator. This initial determination requires your employer to monitor workers' exposures unless he or she has objective data which can demonstrate conclusively that no employee will be exposed to lead in excess of the action level. Where objective data is used in lieu of actual monitoring the employer must establish and maintain an accurate record, documenting its relevancy in assessing exposure levels for current job conditions. If such objective data is available, the employer need proceed no further on employee exposure assessment until such time that conditions have changed and the determination is no longer valid.

Objective date may be compiled from various sources, e.g., insurance companies and trade associations and information from suppliers or exposure data collected from similar operations. Objective data may also comprise previously - collected sampling data including area monitoring. If it cannot be determined through using objective data that worker exposure is less than the action level, your employer must conduct monitoring or must rely on relevant previous personal sampling, if available. Where monitoring is required for the initial determination, it may be limited to a representative number of employees who are reasonably expected to have the highest exposure levels. If your employer has conducted appropriate air sampling for lead in the past 12 months, he or she may use these results, provided they are applicable to the same employee tasks and exposure conditions and meet the requirements for accuracy as specified in the standard. As with objective data, if such results are relied upon for the initial determination, your employer must establish and maintain a record as to the relevancy of such data to current job conditions.

If there have been any employee complaints of symptoms which may be attributable to exposure to lead or if there is any other information or observations which would indicate employee exposure to lead, this must also be considered as part of the initial determination.

If this initial determination shows that a reasonable possibility exists that any employee may be exposed, without regard to respirators, over the action level, your employer must set up an air monitoring program to determine the exposure level representative of each employee exposed to lead at your workplace. In carrying out this air monitoring program, your employer is not required to monitor the exposure of every employee, but he or she must monitor a representative number of employees and job types. Enough sampling must be done to enable each employee's exposure level to be reasonably represent full shift exposure. In addition, these air samples must be taken under conditions which represent each employee's regular, daily exposure to lead. Sampling performed in the past 12 months may be used to determine exposures above the action level if such sampling was conducted during work activities essentially similar to present work conditions.

The standard lists certain tasks which may likely result in exposures to lead in excess of the PEL and, in some cases, exposures in excess of 50 times the PEL. If you are performing any of these tasks, your employer must provide you with appropriate respiratory protection, protective clothing and equipment, change areas, hand washing facilities, biological monitoring, and training until such time that an exposure assessment is conducted which demonstrates that your exposure level is below the PEL.

If you are exposed to lead and air sampling is performed, your employer is required to notify you in writing within 5 working days of the air monitoring results which represent your exposure. If the results indicate that your exposure exceeds the PEL (without regard to your use of a respirator), then your employer must also notify you of this in writing, and provide you with a description of the corrective action that has been taken or will be taken to reduce your exposure.

Your exposure must be rechecked by monitoring, at least every six months if your exposure is at or over the action level but below the PEL. Your employer may discontinue monitoring for you if 2 consecutive measurements, taken at least 7 days apart, are at or below the action level. Air monitoring must be repeated every 3 months if you are exposed over the PEL. Your employer must continue monitoring for you at this frequency until 2 consecutive measurements, taken at least 7 days apart, are below the PEL but above the action level, at which time your employer must repeat monitoring of your exposure every six months and may discontinue monitoring only after your exposure drops to or below the action level. However, whenever there is a change of equipment, process, control, or personnel or a new type of job is added at your workplace which may result in new or additional exposure to lead, your employer must perform additional monitoring.

III. Methods of Compliance - Paragraph (E)

Your employer is required to assure that no employee is exposed to lead in excess of the PEL as an 8-hour TWA. The interim final standard for lead in construction requires employers to institute engineering and work practice controls including administrative controls to the extent feasible to reduce employee exposure to lead. Where such controls are feasible but not adequate to reduce exposures below the PEL they must be used nonetheless to reduce exposures to the lowest level that can be accomplished by these means and then supplemented with appropriate respiratory protection.

Your employer is required to develop and implement a written compliance program prior to the commencement of any job where employee exposures may reach the PEL as an 8-hour TWA. The interim final standard identifies the various elements that must be included in the plan. For example, employers are required to include a description of operations in which lead is emitted, detailing other relevant information about the operation such as the type of equipment used, the type of material involved, employee job responsibilities, operating procedures and maintenance practices. In addition, your employer's compliance plan must specify the means that will be used to achieve compliance and, where engineering controls are required, include any engineering plans or studies that have been used to select the control methods. If administrative controls involving job rotation are used to reduce employee exposure to lead, the job rotation schedule must be included in the compliance plan. The plan must also detail the type of protective clothing and equipment, including respirators, housekeeping and hygiene practices that will be used to protect you from the adverse effects of exposure to lead.

The written compliance program must be made available, upon request, to affected employees and their designated representatives, the Assistant Secretary and the Director.

Finally, the plan must be reviewed and updated at least every 6 months to assure it reflects the current status in exposure control.

IV. Respiratory Protection - Paragraph (F)

Your employer is required to provide and assure your use of respirators when your exposure to lead is not controlled below the PEL by other means. The employer must pay the cost of the respirator. Whenever you request one, your employer is also required to provide you a respirator even if your air exposure level is not above the PEL. You might desire a respirator when, for example, you have received medical advice that your lead absorption should be decreased. Or, you may intend to have children in the near future, and want to reduce the level of lead in your body to minimize adverse reproductive effects. While respirators are the least satisfactory means of controlling your exposure, they are capable of providing significant protection if properly chosen, fitted, worn, cleaned, maintained, and replaced when they stop providing adequate protection.

Your employer is required to select respirators from the types listed in Table I of the Respiratory Protection section of the standard. Any respirator chosen must be approved by the Mine Safety and Health Administration (MSHA) or the National Institute for Occupational Safety and Health (NIOSH). This respirator selection table will enable your employer to choose a type of respirator which will give you a proper amount of protection based on your airborne lead exposure. Your employer may select a type of respirator that provides greater protection than that required by the standard; that is, one recommended for a higher concentration of lead than is present in your workplace. For example, a powered air purifying respirator (PAPR) is much more protective than a typical negative pressure respirator, and may also be more comfortable to wear. A PAPR has a filter, cartridge or canister to clean the air, and a power source which continuously blows filtered air into your breathing zone. Your employer might make a PAPR available to you to ease the burden of having to wear a respirator for long periods of time. The standard provides that you can obtain a PAPR upon request.

Your employer must also start a Respiratory Protection Program. This program must include written procedures for the proper selection, use, cleaning, storage, and maintenance of respirators.

Your employer must assure that your respirator facepiece fits properly. Proper fit of a respirator facepiece is critical. Obtaining a proper fit on each employee may require your employer to make available two or three different mask types. In order to assure that your respirator fits properly and that facepiece leakage is minimized, your employer must give you either a qualitative fit test or a quantitative fit test (if you use a negative pressure respirator) in accordance with Appendix D. Any respirator which has a filter, cartridge or canister which cleans the work room air before you breathe it and which requires the force of your inhalation to draw air thru the filtering element is a negative pressure respirator. A positive pressure respirator supplies air to you directly. A quantitative fit test uses a sophisticated machine to measure the amount, if any, of test material that leaks into the facepiece of your respirator.

You must also receive from your employer proper training in the use of respirators. Your employer is required to teach you how to wear a respirator, to know why it is needed, and to understand its limitations.

Your employer must test the effectiveness of your negative pressure respirator initially and at least every six months thereafter with a "qualitative fit test." In this test, the fit of the facepiece is checked by seeing if you can smell a substance placed outside the respirator. If you can, there is appreciable leakage where the facepiece meets your face.

The standard provides that if your respirator uses filter elements, you must be given an opportunity to change the filter elements whenever an increase in breathing resistance is detected. You also must be permitted to periodically leave your work area to wash your face and respirator facepiece whenever necessary to prevent skin irritation. If you ever have difficulty in breathing during a fit test or while using a respirator, your employer must make a medical examination available to you to determine whether you can safely wear a respirator. The result of this examination may be to give you a positive pressure respirator (which reduces breathing resistance) or to provide alternative means of protection.

V. Protective Work Clothing and Equipment - Paragraph (G)

If you are exposed to lead above the PEL as an 8-hour TWA, without regard to your use of a respirator, or if you are exposed to lead compounds such as lead arsenate or lead azide which can cause skin and eye irritation, your employer must provide you with protective work clothing and equipment appropriate for the hazard. If work clothing is provided, it must be provided in a clean and dry condition at least weekly, and daily if your airborne exposure to lead is greater than 200 $\mu g/m^3$. Appropriate protective work clothing and equipment can include coveralls or similar full-body work clothing, gloves, hats, shoes or disposable shoe coverlets, and face shields or vented goggles. Your employer is required to provide all such equipment at no cost to you. In addition, your employer is responsible for providing repairs and replacement as necessary, and also is responsible for the cleaning, laundering or disposal of protective clothing and equipment.

The interim final standard requires that your employer assure that you follow good work practices when you are working in areas where your exposure to lead may exceed the PEL. With respect to protective clothing and equipment, where appropriate, the following procedures should be observed prior to beginning work:

1. Change into work clothing and shoe covers in the clean section of the designated changing areas;
2. Use work garments of appropriate protective gear, including respirators before entering the work area; and
3. Store any clothing not worn under protective clothing in the designated changing area.

Workers should follow these procedures upon leaving the work area:

1. HEPA vacuum heavily contaminated protective work clothing while it is still being worn. At no time may lead be removed from protective clothing by any means which result in uncontrolled dispersal of lead into the air;
2. Remove shoe covers and leave them in the work area;
3. Remove protective clothing and gear in the dirty area of the designated changing area. Remove protective coveralls by carefully rolling down the garment to reduce exposure to dust.

4. Remove respirators last; and
5. Wash hands and face.

Workers should follow these procedures upon finishing work for the day (in addition to procedures described above):

1. Where applicable, place disposal coveralls and shoe covers with the abatement waste;
2. Contaminated clothing which is to be cleaned, laundered or disposed of must be placed in closed containers in the change room.
3. Clean protective gear, including respirators, according to standard procedures;
4. Wash hands and face again. If showers are available, take a shower and wash hair. If shower facilities are not available at the work site, shower immediately at home and wash hair.

VI. Housekeeping - Paragraph (H)

Your employer must establish a housekeeping program sufficient to maintain all surfaces as free as practicable of accumulations of lead dust. Vacuuming is the preferred method of meeting this requirement, and the use of compressed air to clean floors and other surfaces is generally prohibited unless removal with compressed air is done in conjunction with ventilation systems designed to contain dispersal of the lead dust. Dry or wet sweeping, shoveling, or brushing may not be used except where vacuuming or other equally effective methods have been tried and do not work. Vacuums must be used equipped with a special filter called a high-efficiency particulate air (HEPA) filter and emptied in a manner which minimizes the reentry of lead into the workplace.

VII. Hygiene Facilities and Practices - Paragraph (I)

The standard requires that hand washing facilities be provided where occupational exposure to lead occurs. In addition, change areas, showers (where feasible), and lunchrooms or eating areas are to be made available to workers exposed to lead above the PEL. Your employer must assure that except in these facilities, food and beverage is not present or consumed, tobacco products are not present or used, and cosmetics are not applied, where airborne exposures are above the PEL. Change rooms provided by your employer must be equipped with separate storage facilities for your protective clothing and equipment and street clothes to avoid cross-contamination. After showering, no required protective clothing or equipment worn during the shift may be worn home. It is important that contaminated clothing or equipment be removed in change areas and not be worn home or you will extend your exposure and expose your family since lead from your clothing can accumulate in your house, car, etc.

Lunchrooms or eating areas may not be entered with protective clothing or equipment unless surface dust has been removed by vacuuming, downdraft booth, or other cleaning method. Finally, workers exposed above the PEL must wash both their hands and faces prior to eating, drinking, smoking or applying cosmetics.

All of the facilities and hygiene practices just discussed are essential to minimize additional sources of lead absorption from inhalation or ingestion of lead that may accumulate on you, your clothes, or your possessions. Strict compliance with these provisions can virtually eliminate several sources of lead exposure which significantly contribute to excessive lead absorption.

VIII. Medical surveillance - Paragraph (J)

The medical surveillance program is part of the standard's comprehensive approach to the prevention of lead-related disease. Its purpose is to supplement the main thrust of the standard which is aimed at minimizing airborne concentrations of lead and sources of ingestion. Only medical surveillance can determine if the other provisions of the standard have effectively protected you as an individual. Compliance with the standard's provision will protect most workers from the adverse effects of lead exposure, but may not be satisfactory to protect individual workers (1) who have high body burdens of lead acquired over past years, (2) who have additional uncontrolled sources of non-occupational lead exposure, (3) who exhibit unusual variations in lead absorption rates, or (4) who have specific non-work related medical conditions which could be aggravated by lead exposure (e.g., renal disease, anemia). In addition, control systems may fail, or hygiene and respirator programs may be inadequate. Periodic medical surveillance of individual workers will help detect those failures. Medical surveillance will also be important to protect your reproductive ability - regardless of whether you are a man or woman.

All medical surveillance required by the interim final standard must be performed by or under the supervision of a licensed physician. The employer must provide required medical surveillance without cost to employees and at a reasonable time and place. The standard's medical surveillance program has two parts -- periodic biological monitoring and medical examinations. Your employer's obligation to offer you medical surveillance is triggered by the results of the air monitoring program. Full medical surveillance must be made available to all employees who are or may be exposed to lead in excess of the action level for more than 30 days a year and whose blood lead level exceeds 40 μg/dl. Initial medical surveillance consisting of blood sampling and analysis for lead and zinc protoporphyrin must be provided to all employees exposed at any time (1 day) above the action level.

Biological monitoring under the standard must be provided at least every 2 months for the first 6 months and every 6 months thereafter until your blood lead level is below 40 μg/dl. A zinc protoporphyrin (ZPP) test is a very useful blood test which measures an adverse metabolic effect of lead on your body and is therefore an indicator of lead toxicity.

If your BLL exceeds 40 μg/dl the monitoring frequency must be increased from every 6 months to at least every 2 months and not reduced until two consecutive BLLs indicate a blood lead level below 40 μg/dl. Each time your BLL is determined to be over 40 μg/dl, your employer must notify you of this in writing within five working days of his or her receipt of the test results. The employer must also inform you that the standard requires temporary medical removal with economic protection when your BLL exceeds 50 μg/dl. (See Discussion of Medical Removal Protection - Paragraph (k).) Anytime your BLL exceeds 50 μg/dl your employer must make available to you within two weeks of receipt of these test results a second follow-up BLL test to confirm your BLL. If the two tests both exceed 50 μg/dl, and you are temporarily removed, then your employer must make successive BLL tests available to you on a monthly basis during the period of your removal.

Medical examinations beyond the initial one must be made available on an annual basis if your blood lead level exceeds 40 μg/dl at any time during the preceding year and you are being exposed above the airborne action level of 30 μg/ m^3 for 30 or more days per year. The initial examination will provide information to establish a baseline to which subsequent data can be compared.

An initial medical examination to consist of blood sampling and analysis for lead and zinc protoporphyrin must also be made available (prior to assignment) for each employee being assigned for the first time to an area where the airborne concentration of lead equals or exceeds the action level at any time. In addition, a medical examination or consultation must be made available as soon as possible if you notify your employer that you are experiencing signs or symptoms commonly associated with lead poisoning or that you have difficulty breathing while wearing a respirator or during a respirator fit test. You must also be provided a medical examination or consultation if you notify your employer that you desire medical advice concerning the effects of current or past exposure to lead on your ability to procreate a healthy child.

Finally, appropriate follow-up medical examinations or consultations may also be provided for employees who have been temporarily removed from exposure under the medical removal protection provisions of the standard. (See Part IX, below.)

The standard specifies the minimum content of pre-assignment and annual medical examinations. The content of other types of medical examinations and consultations is left up to the sound discretion of the examining physician. Pre-assignment and annual medical examinations must include (1) a detailed work history and medical history; (2) a thorough physical examination, including an evaluation of your pulmonary status if you will be required to use a respirator; (3) a blood pressure measurement; and (4) a series of laboratory tests designed to check your blood chemistry and your kidney function. In addition, at any time upon your request, a laboratory evaluation of male fertility will be made (microscopic examination of a sperm sample), or a pregnancy test will be given.

The standard does not require that you participate in any of the medical procedures, tests, etc. which your employer is required to make available to you. Medical surveillance can, however, play a very important role in protecting your health. You are strongly encouraged, therefore, to participate in a meaningful fashion. The standard contains a multiple physician review mechanism which will give you a chance to have a physician of your choice directly participate in the medical surveillance program. If you are dissatisfied with an examination by a physician chosen by your employer, you can select a second physician to conduct an independent analysis. The two doctors would attempt to resolve any differences of opinion, and select a third physician to resolve any firm dispute. Generally your employer will choose the physician who conducts medical surveillance under the lead standard - unless you and your employer can agree on the choice of a physician or physicians. Some companies and unions have agreed in advance, for example, to use certain independent medical laboratories or panels of physicians. Any of these arrangements are acceptable so long as required medical surveillance is made available to workers.

The standard requires your employer to provide certain information to a physician to aid in his or her examination of you. This information includes (1) the standard and its appendices, (2) a description of your duties as they relate to occupational lead exposure, (3) your exposure level or anticipated exposure level, (4) a description of any personal protective equipment you wear, (5) prior blood lead level results, and (6) prior written medical opinions concerning you that the employer has. After a medical examination or consultation the physician must prepare a written report which must contain (1) the physician's opinion as to whether you have any medical condition which places you at increased risk of material impairment to health from exposure to lead, (2) any recommended special protective measures to be provided to you, (3) any blood lead level determinations, and (4) any recommended limitation on your use of respirators. This last element must include a determination of whether you can wear a powered air purifying respirator (PAPR) if you are found unable to wear a negative pressure respirator.

The medical surveillance program of the interim lead standard may at some point in time serve to notify certain workers that they have acquired a disease or other adverse medical condition as a result of occupational lead exposure. If this is true, these workers might have legal rights to compensation from public agencies, their employers, firms that supply hazardous products to their employers, or other persons. Some states have laws, including worker compensation laws, that disallow a worker who learns of a job - related health impairment to sue, unless the worker sues within a short period of time after learning of the impairment. (This period of time may be a matter of months or years.) An attorney can be consulted about these possibilities. It should be stressed that OSHA is in no way trying to either encourage or discourage claims or lawsuits. However, since results of the standard's medical surveillance program can significantly affect the legal remedies of a worker who has acquired a job - related disease or impairment, it is proper for OSHA to make you aware of this.

The medical surveillance section of the standard also contains provisions dealing with chelation. Chelation is the use of certain drugs (administered in pill form or injected into the body) to reduce the amount of lead absorbed in body tissues. Experience accumulated by the medical and scientific communities has largely confirmed the effectiveness of this type of therapy for the treatment of very severe lead poisoning. On the other hand, it has also been established that there can be a long list of extremely harmful side effects associated with the use of chelating agents. The medical community has balanced the advantages and disadvantages resulting from the use of chelating agents in various circumstances and has established when the use of these agents is acceptable. The standard includes these accepted limitations due to a history of abuse of chelation therapy by some lead companies. The most widely used chelating agents are calcium disodium EDTA, (Ca Na2 EDTA), Calcium Disodium Versenate (Versenate), and d-penicillamine (penicillamine or Cupramine).

The standard prohibits "prophylactic chelation" of any employee by any person the employer retains, supervises or controls. "Prophylactic chelation" is the routine use of chelating or similarly acting drugs to prevent elevated blood levels in workers who are occupationally exposed to lead, or the use of these drugs to routinely lower blood lead levels to predesignated concentrations believed to be "safe". It should be emphasized that where an employer takes a worker who has no symptoms of lead poisoning and has chelation carried out by a physician (either inside or outside of a hospital) solely to reduce the worker's blood lead level, that will generally be considered prophylactic chelation. The use of a hospital and a physician does not mean that prophylactic chelation is not being performed. Routine chelation to prevent increased or reduce current blood lead levels is unacceptable whatever the setting.

The standard allows the use of "therapeutic" or "diagnostic" chelation if administered under the supervision of a licensed physician in a clinical setting with thorough and appropriate medical monitoring. Therapeutic chelation responds to severe lead poisoning where there are marked symptoms. Diagnostic chelation involved giving a patient a dose of the drug then collecting all urine excreted for some period of time as an aid to the diagnosis of lead poisoning.

In cases where the examining physician determines that chelation is appropriate, you must be notified in writing of this fact before such treatment. This will inform you of a potentially harmful treatment, and allow you to obtain a second opinion.

IX. Medical Removal Protection - Paragraph (K)

Excessive lead absorption subjects you to increased risk of disease. Medical removal protection (MRP) is a means of protecting you when, for whatever reasons, other methods, such as engineering controls, work practices, and respirators, have failed to provide the protection you need. MRP involves the temporary removal of a worker from his or her regular job to a place of significantly lower exposure without any loss of earnings, seniority, or other employment rights or benefits. The purpose of this program is to cease further lead absorption and allow your body to naturally excrete lead which has previously been absorbed. Temporary medical removal can result from an elevated blood lead level, or a medical opinion. For up to 18 months, or for as long as the job the employee was removed from lasts, protection is provided as a result of either form of removal. The vast majority of removed workers, however, will return to their former jobs long before this eighteen month period expires.

You may also be removed from exposure even if your blood lead level is below 50 μg/dl if a final medical determination indicates that you temporarily need reduced lead exposure for medical reasons. If the physician who is implementing your employers medical program makes a final written opinion recommending your removal or other special protective measures, your employer must implement the physician's recommendation. If you are removed in this manner, you may only be returned when the doctor indicates that it is safe for you to do so.

The standard does not give specific instructions dealing with what an employer must do with a removed worker. Your job assignment upon removal is a matter for you, your employer and your union (if any) to work out consistent with existing procedures for job assignments. Each removal must be accomplished in a manner consistent with existing collective bargaining relationships. Your employer is given broad discretion to implement temporary removals so long as no attempt is made to override existing agreements. Similarly, a removed worker is provided no right to veto an employer's choice which satisfies the standard.

In most cases, employers will likely transfer removed employees to other jobs with sufficiently low lead exposure. Alternatively, a worker's hours may be reduced so that the time weighted average exposure is reduced, or he or she may be temporarily laid off if no other alternative is feasible.

In all of these situation, MRP benefits must be provided during the period of removal - i.e., you continue to receive the same earnings, seniority, and other rights and benefits you would have had if you had not been removed. Earnings includes more than just your base wage; it includes overtime, shift differentials, incentives, and other compensation you would have earned if you had not been removed. During the period of removal you must also be provided with appropriate follow-up medical surveillance. If you were removed because your blood lead level was too high, you must be provided with a monthly blood test. If a medical opinion caused your removal, you must be provided medical tests or examinations that the doctor believes to be appropriate. If you do not participate in this follow up medical surveillance, you may lose your eligibility for MRP benefits.

When you are medically eligible to return to your former job, your employer must return you to your "former job status." This means that you are entitled to the position, wages, benefits, etc., you would have had if you had not been removed. If you would still be in your old job if no removal had occurred that is where you go back. If not, you are returned consistent with whatever job assignment discretion your employer would have had if no removal had occurred. MRP only seeks to maintain your rights, not expand them or diminish them.

If you are removed under MRP and you are also eligible for worker compensation or other compensation for lost wages, your employer's MRP benefits obligation is reduced by the amount that you actually receive from these other sources. This is also true if you obtain other employment during the time you are laid off with MRP benefits.

The standard also covers situations where an employer voluntarily removes a worker from exposure to lead due to the effects of lead on the employee's medical condition, even though the standard does not require removal. In these situations MRP benefits must still be provided as though the standard required removal. Finally, it is important to note that in all cases where removal is required, respirators cannot be used as a substitute. Respirators may be used before removal becomes necessary, but not as an alternative to a transfer to a low exposure job, or to a lay-off with MRP benefits.

X. Employee Information and Training - Paragraph (L)

Your employer is required to provide an information and training program for all employees exposed to lead above the action level or who may suffer skin or eye irritation from lead compounds such as lead arsenate or lead azide. The program must train these employees regarding the specific hazards associated with their work environment, protective measures which can be taken, including the contents of any compliance plan in effect, the danger of lead to their bodies (including their reproductive systems), and their rights under the standard. All employees must be trained prior to initial assignment to areas where there is a possibility of exposure over the action level.

This training program must also be provided at least annually thereafter unless further exposure above the action level will not occur.

XI. Signs - Paragraph (M)

The standard requires that the following warning sign be posted in work areas where the exposure to lead exceeds the PEL:

WARNING LEAD WORK AREA POISON NO SMOKING OR EATING

These signs are to be posted and maintained in a manner which assures that the legend is readily visible.

XII. Recordkeeping - Paragraph (N)

Your employer is required to keep all records of exposure monitoring for airborne lead. These records must include the name and job classification of employees measured, details of the sampling and analytical techniques, the results of this sampling, and the type of respiratory protection being worn by the person sampled. Such records are to be retained for at least 30 years. Your employer is also required to keep all records of biological monitoring and medical examination results. These records must include the names of the employees, the physician's written opinion, and a copy of the results of the examination. Medical records must be preserved and maintained for the duration of employment plus 30 years. However, if the employee's duration of employment is less than one year, the employer need not retain that employee's medical records beyond the period of employment if they are provided to the employee upon termination of employment.

Recordkeeping is also required if you are temporarily removed from your job under the medical removal protection program. This record must include your name and social security number, the date of your removal and return, how the removal was or is being accomplished, and whether or not the reason for the removal was an elevated blood lead level. Your employer is required to keep each medical removal record only for as long as the duration of an employee's employment.

The standard requires that if you request to see or copy environmental monitoring, blood lead level monitoring, or medical removal records, they must be made available to you or to a representative that you authorize. Your union also has access to these records. Medical records other than BLL's must also be provided upon request to you, to your physician or to any other person whom you may specifically designate. Your union does not have access to your personal medical records unless you authorize their access.

XIII. Observation of Monitoring - Paragraph (O)

When air monitoring for lead is performed at your workplace as required by this standard, your employer must allow you or someone you designate to act as an observer of the monitoring. Observers are entitled to an explanation of the measurement procedure, and to record the results obtained. Since results will not normally be available at the time of the monitoring, observers are entitled to record or receive the results of the monitoring when returned by the laboratory. Your employer is required to provide the observer with any personal protective devices required to be worn by employees working in the area that is being monitored. The employer must require the observer to wear all such equipment and to comply with all other applicable safety and health procedures.

XIV. Effective Date - Paragraph (P)

The standard's effective data is June 3, 1993. Employer obligations under the standard begin as of that date with full implementation of engineering controls as soon as possible but no later than within 4 months, and all other provisions completed as soon as possible, but no later than within 2 months from the effective date.

XV. For Additional Information

A. A copy of the interim standard for lead in construction can be obtained free of charge by calling or writing the OSHA Office of Publications, room N-3101, United States Department of Labor, Washington, D.C. 20210: Telephone (202) 219-4667.

B. Additional information about the standard, its enforcement, and your employer's compliance can be obtained from the nearest OSHA Area Office listed in your telephone directory under United States Government/Department of Labor.

[57 FR 26627, May 4, 1993, as amended at 58 FR 34218, June 24, 1993]

1926.62 App C	
Title	Medical Surveillance Guidelines
Subpart	D
Subpart Title	Occupational Health and Environmental Controls

Introduction

The primary purpose of the Occupational Safety and Health Act of 1970 is to assure, so far as possible, safe and healthful working conditions for every working man and woman. The interim final occupational health standard for lead in construction is designed to protect workers exposed to inorganic lead including metallic lead, all inorganic lead compounds and organic lead soaps.

Under this interim final standard occupational exposure to inorganic lead is to be limited to 50 μg/ m³ (micrograms per cubic meter) based on an 8 hour time-weighted average (TWA). This permissible exposure limit (PEL) must be achieved through a combination of engineering, work practice and administrative controls to the extent feasible. Where these controls are in place but are found not to reduce employee exposures to or below the PEL, they must be used nonetheless, and supplemented with respirators to meet the 50 μg/ m³ exposure limit.

The standard also provides for a program of biological monitoring for employees exposed to lead above the action level at any time, and additional medical surveillance for all employees exposed to levels of inorganic lead above 30 μg/ m³ (TWA) for more than 30 days per year and whose BLL exceeds 40 μg/dl.

The purpose of this document is to outline the medical surveillance provisions of the interim standard for inorganic lead in construction, and to provide further information to the physician regarding the examination and evaluation of workers exposed to inorganic lead.

Section 1 provides a detailed description of the monitoring procedure including the required frequency of blood testing for exposed workers, provisions for medical removal protection (MRP), the recommended right of the employee to a second medical opinion, and notification and recordkeeping requirements of the employer. A discussion of the requirements for respirator use and respirator monitoring and OSHA's position on prophylactic chelation therapy are also included in this section.

Section 2 discusses the toxic effects and clinical manifestations of lead poisoning and effects of lead intoxication on enzymatic pathways in heme synthesis. The adverse effects on both male and female reproductive capacity and on the fetus are also discussed.

Section 3 outlines the recommended medical evaluation of the worker exposed to inorganic lead, including details of the medical history, physical examination, and recommended laboratory tests, which are based on the toxic effects of lead as discussed in Section 2.

Section 4 provides detailed information concerning the laboratory tests available for the monitoring of exposed workers. Included also is a discussion of the relative value of each test and the limitations and precautions which are necessary in the interpretation of the laboratory results.

I. Medical Surveillance and Monitoring Requirements for Workers Exposed to Inorganic Lead

Under the interim final standard for inorganic lead in the construction industry, initial medical surveillance consisting of biological monitoring to include blood lead and ZPP level determination shall be provided to employees exposed to lead at or above the action level on any one day. In addition, a program of biological monitoring is to be made available to all employees exposed above the action level at any time and additional medical surveillance is to be made available to all employees exposed to lead above 30 μg/ m³ TWA for more than 30 days each year and whose BLL exceeds 40 μg/dl. This program consists of periodic blood sampling and medical evaluation to be performed on a schedule which is defined by previous laboratory results, worker complaints or concerns, and the clinical assessment of the examining physician.

Under this program, the blood lead level (BLL) of all employees who are exposed to lead above 30 μg/ m³ for more than 30 days per year or whose blood lead is above 40 μg/dl but exposed for no more than 30 days per year is to be determined at least every two months for the first six months of exposure and every six months thereafter. The frequency is increased to every two months for employees whose last blood lead level was 40 μg/dl or above. For employees who are removed from exposure to lead due to an elevated blood lead, a new blood lead level must be measured monthly. A zinc protoporphyrin (ZPP) measurement is strongly recommended on each occasion that a blood lead level measurement is made.

An annual medical examination and consultation performed under the guidelines discussed in Section 3 is to be made available to each employee exposed above 30 μg/ m³ for more than 30 days per year for whom a blood test conducted at any time during the preceding 12 months indicated a blood lead level at or above 40 μg/dl. Also, an examination is to be given to all employees prior to their assignment to an area in which airborne lead concentrations reach or exceed the 30 μg/ m³ for more than 30 days per year. In addition, a medical examination must be provided as soon as possible after notification by an employee that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee desires medical advice regarding lead exposure and the ability to procreate a healthy child, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during respirator use. An examination is also to be made available to each employee removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited or specially protected pursuant to medical recommendations.

Results of biological monitoring or the recommendations of an examining physician may necessitate removal of an employee from further lead exposure pursuant to the standard's medical removal protection (MRP) program. The object of the MRP program is to provide temporary medical removal to workers either with substantially elevated blood lead levels or otherwise at risk of sustaining material health impairment from continued substantial exposure to lead.

Under the standard's ultimate worker removal criteria, a worker is to be removed from any work having an eight hour TWA exposure to lead of 30 μg/ m³ when his or her blood lead level reaches 50 μg/dl and is confirmed by a second follow-up blood lead level performed within two weeks after the employer receives the results of the first blood sampling test. Return of the employee to his or her job status depends on a worker's blood lead level declining to 40 μg/dl.

As part of the interim standard, the employer is required to notify in writing each employee whose blood lead level exceeds 40 μg/dl. In addition each such employee is to be informed that the standard requires medical removal with MRP benefits, discussed below, when an employee's blood lead level exceeds the above defined limit.

In addition to the above blood lead level criterion, temporary worker removal may also take place as a result of medical determinations and recommendations. Written medical opinions must be prepared after each examination pursuant to the standard. If the examining physician includes a medical finding, determination or opinion that the employee has a medical condition which places the employee at increased risk of material health impairment from exposure to lead, then the employee must be removed from exposure to lead at or above 30 μg/ m³. Alternatively, if the examining physician recommends special protective measures for an employee (e.g., use of a powered air purifying respirator) or recommends limitations on an employee's exposure to lead, then the employer must implement these recommendations.

Recommendations may be more stringent than the specific provisions of the standard. The examining physician, therefore, is given broad flexibility to tailor special protective procedures to the needs of individual employees. This flexibility extends to the evaluation and management of pregnant workers and male and female workers who are planning to raise children. Based on the history, physical examination, and laboratory studies, the physician might recommend special protective measures or medical removal for an employee who is pregnant or who is planning to conceive a child when, in the physician's judgment, continued exposure to lead at the current job would pose a significant risk. The return of the employee to his or her former job status, or the removal of special protections or limitations, depends upon the examining physician determining that the employee is no longer at increased risk of material impairment or that special measures are no longer needed.

During the period of any form of special protection or removal, the employer must maintain the worker's earnings, seniority, and other employment rights and benefits (as though the worker had not been removed) for a period of up to 18 months or for as long as the job the employee was removed from lasts if less than 18 months. This economic protection will maximize meaningful worker participation in the medical surveillance program, and is appropriate as part of the employer's overall obligation to provide a safe and healthful workplace. The provisions of MRP benefits during the employee's removal period may, however, be conditioned upon participation in medical surveillance.

The lead standard provides for a multiple physician review in cases where the employee wishes a second opinion concerning potential lead poisoning or toxicity. If an employee wishes a second opinion, he or she can make an appointment with a physician of his or her choice. This second physician will review the findings, recommendations or determinations of the first physician and conduct any examinations, consultations or tests deemed necessary in an attempt to make a final medical determination. If the first and second physicians do not agree in their assessment they must try to resolve their differences. If they cannot reach an agreement then they must designate a third physician to resolve the dispute.

The employer must provide examining and consulting physicians with the following specific information: a copy of the lead regulations and all appendices, a description of the employee's duties as related to exposure, the exposure level or anticipated level to lead and any other toxic substances (if applicable), a description of personal protective equipment used, blood lead levels, and all prior written medical opinions regarding the employee in the employer's possession or control. The employer must also obtain from the physician and provide the employee with a written medical opinion containing blood lead levels, the physician's opinion as to whether the employee is at risk of material impairment to health, any recommended protective measures for the employee if further exposure is permitted, as well as any recommended limitations upon an employee's use of respirators.

Employers must instruct each physician not to reveal to the employer in writing or in any other way his or her findings, laboratory results, or diagnoses which are felt to be unrelated to occupational lead exposure. They must also instruct each physician to advise the employee of any occupationally or non-occupationally related medical condition requiring further treatment or evaluation.

The standard provides for the use of respirators where engineering and other primary controls are not effective. However, the use of respirator protection shall not be used in lieu of temporary medical removal due to elevated blood lead levels or findings that an employee is at risk of material health impairment. This is based on the numerous inadequacies of respirators including skin rash where the facepiece makes contact with the skin, unacceptable stress to breathing in some workers with underlying cardiopulmonary impairment, difficulty in providing adequate fit, the tendency for respirators to create additional hazards by interfering with vision, hearing, and mobility, and the difficulties of assuring the maximum effectiveness of a complicated work practice program involving respirators. Respirators do, however, serve a useful function where engineering and work practice controls are inadequate by providing supplementary, interim, or short-term protection, provided they are properly selected for the environment in which the employee will be working, properly fitted to the employee, maintained and cleaned periodically, and worn by the employee when required.

In its interim final standard on occupational exposure to inorganic lead in the construction industry, OSHA has prohibited prophylactic chelation. Diagnostic and therapeutic chelation are permitted only under the supervision of a licensed physician with appropriate medical monitoring in an acceptable clinical setting. The decision to initiate chelation therapy must be made on an individual basis and take into account the severity of symptoms felt to be a result of lead toxicity along with blood lead levels, ZPP levels, and other laboratory tests as appropriate. EDTA and penicillamine which are the primary chelating agents used in the therapy of occupational lead poisoning have significant potential side effects and their use must be justified on the basis of expected benefits to the worker. Unless frank and severe symptoms are present, therapeutic chelation is not recommended, given the opportunity to remove a worker from exposure and allow the body to naturally excrete accumulated lead. As a diagnostic aid, the chelation mobilization test using CA-EDTA has limited applicability. According to some investigators, the test can differentiate between lead - induced and other nephropathies. The test may also provide an estimation of the mobile fraction of the total body lead burden.

Employers are required to assure that accurate records are maintained on exposure assessment, including environmental monitoring, medical surveillance, and medical removal for each employee. Exposure assessment records must be kept for at least 30 years. Medical surveillance records must be kept for the duration of employment plus 30 years except in cases where the employment was less than one year. If duration of employment is less than one year, the employer need not retain this record beyond the term of employment if the record is provided to the employee upon termination of employment. Medical removal records also must be maintained for the duration of employment. All records required under the standard must be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health. Employers must also make environmental and biological monitoring and medical removal records available to affected employees and to former employees or their authorized employee representatives. Employees or their specifically designated representatives have access to their entire medical surveillance records.

In addition, the standard requires that the employer inform all workers exposed to lead at or above 30 μg/m³ of the provisions of the standard and all its appendices, the purpose and description of medical surveillance and provisions for medical removal protection if temporary removal is required. An understanding of the potential health effects of lead exposure by all exposed employees along with full understanding of their rights under the lead standard is essential for an effective monitoring program.

II. Adverse Health Effects of Inorganic Lead

Although the toxicity of lead has been known for 2,000 years, the knowledge of the complex relationship between lead exposure and human response is still being refined. Significant research into the toxic properties of lead continues throughout the world, and it should be anticipated that our understanding of thresholds of effects and margins of safety will be improved in future years. The provisions of the lead standard are founded on two prime medical judgments: first, the prevention of adverse health effects from exposure to lead throughout a working lifetime requires that worker blood lead levels be maintained at or below 40 μg/dl and second, the blood lead levels of workers, male or female, who intend to parent in the near future should be maintained below 30 μg/dl to minimize adverse reproductive health effects to the parents and developing fetus. The adverse effects of lead on reproduction are being actively researched and OSHA encourages the physician to remain abreast of recent developments in the area to best advise pregnant workers or workers planning to conceive children.

The spectrum of health effects caused by lead exposure can be subdivided into five developmental stages: normal, physiological changes of uncertain significance, pathophysiological changes, overt symptoms (morbidity), and mortality. Within this process there are no sharp distinctions, but rather a continuum of effects. Boundaries between categories overlap due to the wide variation of individual responses and exposures in the working population. OSHA's development of the lead standard focused on pathophysiological changes as well as later stages of disease.

1. Heme Synthesis Inhibition. The earliest demonstrated effect of lead involves its ability to inhibit at least two enzymes of the heme synthesis pathway at very low blood levels. Inhibition of delta aminolevulinic acid dehydrase (ALA-D) which catalyzes the conversion of delta-aminolevulinic acid (ALA) to protoporphyrin is observed at a blood lead level below 20 μg/dl. At a blood lead level of 40 μg/dl, more than 20 percent of the population would have 70 percent inhibition of ALA-D. There is an exponential increase in ALA excretion at blood lead levels greater than 40 μg/dl.

Another enzyme, ferrochelatase, is also inhibited at low blood lead levels. Inhibition of ferrochelatase leads to increased free erythrocyte protoporphyrin (FEP) in the blood which can then bind to zinc to yield zinc protoporphyrin. At a blood lead level of 50 μg/dl or greater, nearly 100 percent of the population will have an increase in FEP. There is also an exponential relationship between blood lead levels greater than 40 μg/dl and the associated ZPP level, which has led to the development of the ZPP screening test for lead exposure.

While the significance of these effects is subject to debate, it is OSHA's position that these enzyme disturbances are early stages of a disease process which may eventually result in the clinical symptoms of lead poisoning. Whether or not the effects do progress to the later stages of clinical disease, disruption of these enzyme processes over a working lifetime is considered to be a material impairment of health.

One of the eventual results of lead - induced inhibition of enzymes in the heme synthesis pathway is anemia which can be asymptomatic if mild but associated with a wide array of symptoms including dizziness, fatigue, and tachycardia when more severe. Studies have indicated that lead levels as low as 50 μg/dl can be associated with a definite decreased hemoglobin, although most cases of lead - induced anemia, as well as shortened red-cell survival times, occur at lead levels exceeding 80 μg/dl. Inhibited hemoglobin synthesis is more common in chronic cases whereas shortened erythrocyte life span is more common in acute cases.

In lead - induced anemias, there is usually a reticulocytosis along with the presence of basophilic stippling, and ringed sideroblasts, although none of the above are pathognomonic for lead - induced anemia.

2. Neurological Effects. Inorganic lead has been found to have toxic effects on both the central and peripheral nervous systems. The earliest stages of lead - induced central nervous system effects first manifest themselves in the form of behavioral disturbances and central nervous system symptoms including irritability, restlessness, insomnia and other sleep disturbances, fatigue, vertigo, headache, poor memory, tremor, depression, and apathy. With more severe exposure, symptoms can progress to drowsiness, stupor, hallucinations, delirium, convulsions and coma.

The most severe and acute form of lead poisoning which usually follows ingestion or inhalation of large amounts of lead is acute encephalopathy which may arise precipitously with the onset of intractable seizures, coma, cardiorespiratory arrest, and death within 48 hours.

While there is disagreement about what exposure levels are needed to produce the earliest symptoms, most experts agree that symptoms definitely can occur at blood lead levels of 60 μg/dl whole blood and therefore recommend a 40 μg/dl maximum. The central nervous system effects frequently are not reversible following discontinued exposure or chelation therapy and when improvement does occur, it is almost always only partial.

The peripheral neuropathy resulting from lead exposure characteristically involves only motor function with minimal sensory damage and has a marked predilection for the extensor muscles of the most active extremity. The peripheral neuropathy can occur with varying degrees of severity. The earliest and mildest form which can be detected in workers with blood lead levels as low as 50 μg/dl is manifested by slowing of motor nerve conduction velocity often without clinical symptoms. With progression of the neuropathy there is development of painless extensor muscle weakness usually involving the extensor muscles of the fingers and hand in the most active upper extremity, followed in severe cases by wrist drop or, much less commonly, foot drop.

In addition to slowing of nerve conduction, electromyographical studies in patients with blood lead levels greater than 50 μg/dl have demonstrated a decrease in the number of acting motor unit potentials, an increase in the duration of motor unit potentials, and spontaneous pathological activity including fibrillations and fasciculations. Whether these effects occur at levels of 40 μg/dl is undetermined.

While the peripheral neuropathies can occasionally be reversed with therapy, again such recovery is not assured particularly in the more severe neuropathies and often improvement is only partial. The lack of reversibility is felt to be due in part to segmental demyelination.

3. Gastrointestinal. Lead may also affect the gastrointestinal system producing abdominal colic or diffuse abdominal pain, constipation, obstipation, diarrhea, anorexia, nausea and vomiting. Lead colic rarely develops at blood lead levels below 80 μg/dl.

4. Renal. Renal toxicity represents one of the most serious health effects of lead poisoning. In the early stages of disease nuclear inclusion bodies can frequently be identified in proximal renal tubular cells. Renal function remains normal and the changes in this stage are probably reversible. With more advanced disease there is progressive interstitial fibrosis and impaired renal function. Eventually extensive interstitial fibrosis ensues with sclerotic glomeruli and dilated and atrophied proximal tubules; all represent end stage kidney disease. Azotemia can be progressive, eventually resulting in frank uremia necessitating dialysis. There is occasionally associated hypertension and hyperuricemia with or without gout.

Early kidney disease is difficult to detect. The urinalysis is normal in early lead nephropathy and the blood urea nitrogen and serum creatinine increase only when two-thirds of kidney function is lost. Measurement of creatinine clearance can often detect earlier disease as can other methods of measurement of glomerular filtration rate. An abnormal Ca-EDTA mobilization test has been used to differentiate between lead - induced and other nephropathies, but this procedure is not widely accepted. A form of Fanconi syndrome with aminoaciduria, glycosuria, and hyperphosphaturia indicating severe injury to the proximal renal tubules is occasionally seen in children.

5. Reproductive effects. Exposure to lead can have serious effects on reproductive function in both males and females. In male workers exposed to lead there can be a decrease in sexual drive, impotence, decreased ability to produce healthy sperm, and sterility. Malformed sperm (teratospermia), decreased number of sperm (hypospermia), and sperm with decreased motility (asthenospermia) can all occur. Teratospermia has been noted at mean blood lead levels of 53 μg/dl and hypospermia and asthenospermia at 41 μg/dl. Furthermore, there appears to be a dose - response relationship for teratospermia in lead exposed workers.

Women exposed to lead may experience menstrual disturbances including dysmenorrhea, menorrhagia and amenorrhea. Following exposure to lead, women have a higher frequency of sterility, premature births, spontaneous miscarriages, and stillbirths.

Germ cells can be affected by lead and cause genetic damage in the egg or sperm cells before conception and result in failure to implant, miscarriage, stillbirth, or birth defects.

Infants of mothers with lead poisoning have a higher mortality during the first year and suffer from lowered birth weights, slower growth, and nervous system disorders.

Lead can pass through the placental barrier and lead levels in the mother's blood are comparable to concentrations of lead in the umbilical cord at birth. Transplacental passage becomes detectable at 12-14 weeks of gestation and increases until birth.

There is little direct data on damage to the fetus from exposure to lead but it is generally assumed that the fetus and newborn would be at least as susceptible to neurological damage as young children. Blood lead levels of 50-60 μg/dl in children can cause significant neurobehavioral impairments and there is evidence of hyperactivity at blood levels as low as 25 μg/dl. Given the overall body of literature concerning the adverse health effects of lead in children, OSHA feels that the blood lead level in children should be maintained below 30 μg /dl with a population mean of 15 μg/dl. Blood lead levels in the fetus and newborn likewise should not exceed 30 μg/dl.

Because of lead's ability to pass through the placental barrier and also because of the demonstrated adverse effects of lead on reproductive function in both the male and female as well as the risk of genetic damage of lead on both the ovum and sperm, OSHA recommends a 30 μg/dl maximum permissible blood lead level in both males and females who wish to bear children.

6. Other toxic effects. Debate and research continue on the effects of lead on the human body. Hypertension has frequently been noted in occupationally exposed individuals although it is difficult to assess whether this is due to lead's adverse effects on the kidney or if some other mechanism is involved. Vascular and electrocardiographic changes have been detected but have not been well characterized. Lead is thought to impair thyroid function and interfere with the pituitary-adrenal axis, but again these effects have not been well defined.

III. Medical Evaluation

The most important principle in evaluating a worker for any occupational disease including lead poisoning is a high index of suspicion on the part of the examining physician. As discussed in Section 2, lead can affect numerous organ systems and produce a wide array of signs and symptoms, most of which are non-specific and subtle in nature at least in the early stages of disease. Unless serious concern for lead toxicity is present, many of the early clues to diagnosis may easily be overlooked.

The crucial initial step in the medical evaluation is recognizing that a worker's employment can result in exposure to lead. The worker will frequently be able to define exposures to lead and lead containing materials but often will not volunteer this information unless specifically asked. In other situations the worker may not know of any exposures to lead but the suspicion might be raised on the part of the physician because of the industry or occupation of the worker. Potential occupational exposure to lead and its compounds occur in many occupations in the construction industry, including demolition and salvaging operations, removal or encapsulation of materials containing lead, construction, alteration, repair or renovation of structures containing lead, transportation, disposal, storage or containment of lead or lead - containing materials on construction sites, and maintenance operations associated with construction activities.

Once the possibility for lead exposure is raised, the focus can then be directed toward eliciting information from the medical history, physical exam, and finally from laboratory data to evaluate the worker for potential lead toxicity.

A complete and detailed work history is important in the initial evaluation. A listing of all previous employment with information on job description, exposure to fumes or dust, known exposures to lead or other toxic substances, a description of any personal protective equipment used, and previous medical surveillance should all be included in the worker's record. Where exposure to lead is suspected, information concerning on-the-job personal hygiene, smoking or eating habits in work areas, laundry procedures, and use of any protective clothing or respiratory protection equipment should be noted. A complete work history is essential in the medical evaluation of a worker with suspected lead toxicity, especially when long term effects such as neurotoxicity and nephrotoxicity are considered.

The medical history is also of fundamental importance and should include a listing of all past and current medical conditions, current medications including proprietary drug intake, previous surgeries and hospitalizations, allergies, smoking history, alcohol consumption, and also non-occupational lead exposures such as hobbies (hunting, riflery). Also known childhood exposures should be elicited. Any previous history of hematological, neurological, gastrointestinal, renal, psychological, gynecological, genetic, or reproductive problems should be specifically noted.

A careful and complete review of systems must be performed to assess both recognized complaints and subtle or slowly acquired symptoms which the worker might not appreciate as being significant. The review of symptoms should include the following:

1. General - weight loss, fatigue, decreased appetite.

2. Head, Eyes, Ears, Nose, Throat (HEENT) - headaches, visual disturbances or decreased visual acuity, hearing deficits or tinnitus, pigmentation of the oral mucosa, or metallic taste in mouth.

3. Cardio-pulmonary - shortness of breath, cough, chest pains, palpitations, or orthopnea.

4. Gastrointestinal - nausea, vomiting, heartburn, abdominal pain, constipation or diarrhea.

5. Neurologic - irritability, insomnia, weakness (fatigue), dizziness, loss of memory, confusion, hallucinations, incoordination, ataxia, decreased strength in hands or feet, disturbances in gait, difficulty in climbing stairs, or seizures.

6. Hematologic - pallor, easy fatigability, abnormal blood loss, melena.

7. Reproductive (male and female and spouse where relevant) - history of infertility, impotence, loss of libido, abnormal menstrual periods, history of miscarriages, stillbirths, or children with birth defects.

8. Musculo-skeletal - muscle and joint pains.

The physical examination should emphasize the neurological, gastrointestinal, and cardiovascular systems. The worker's weight and blood pressure should be recorded and the oral mucosa checked for pigmentation characteristic of a possible Burtonian or lead line on the gingiva. It should be noted, however, that the lead line may not be present even in severe lead poisoning if good oral hygiene is practiced.

The presence of pallor on skin examination may indicate an anemia which, if severe, might also be associated with a tachycardia. If an anemia is suspected, an active search for blood loss should be undertaken including potential blood loss through the gastrointestinal tract.

A complete neurological examination should include an adequate mental status evaluation including a search for behavioral and psychological disturbances, memory testing, evaluation for irritability, insomnia, hallucinations, and mental clouding. Gait and coordination should be examined along with close observation for tremor. A detailed evaluation of peripheral nerve function including careful sensory and motor function testing is warranted. Strength testing particularly of extensor muscle groups of all extremities is of fundamental importance.

Cranial nerve evaluation should also be included in the routine examination.

The abdominal examination should include auscultation for bowel sounds and abdominal bruits and palpation for organomegaly, masses, and diffuse abdominal tenderness.

Cardiovascular examination should evaluate possible early signs of congestive heart failure. Pulmonary status should be addressed particularly if respirator protection is contemplated.

As part of the medical evaluation, the interim lead standard requires the following laboratory studies:

1. Blood lead level

2. Hemoglobin and hematocrit determinations, red cell indices, and examination of the peripheral blood smear to evaluate red blood cell morphology
3. Blood urea nitrogen
4. Serum creatinine
5. Routine urinalysis with microscopic examination.
6. A zinc protoporphyrin level.

In addition to the above, the physician is authorized to order any further laboratory or other tests which he or she deems necessary in accordance with sound medical practice. The evaluation must also include pregnancy testing or laboratory evaluation of male fertility if requested by the employee. Additional tests which are probably not warranted on a routine basis but may be appropriate when blood lead and ZPP levels are equivocal include delta aminolevulinic acid and coproporphyrin concentrations in the urine, and dark-field illumination for detection of basophilic stippling in red blood cells.

If an anemia is detected further studies including a careful examination of the peripheral smear, reticulocyte count, stool for occult blood, serum iron, total iron binding capacity, bilirubin, and, if appropriate, vitamin B12 and folate may be of value in attempting to identify the cause of the anemia.

If a peripheral neuropathy is suspected, nerve conduction studies are warranted both for diagnosis and as a basis to monitor any therapy.

If renal disease is questioned, a 24 hour urine collection for creatinine clearance, protein, and electrolytes may be indicated. Elevated uric acid levels may result from lead - induced renal disease and a serum uric acid level might be performed.

An electrocardiogram and chest x-ray may be obtained as deemed appropriate.

Sophisticated and highly specialized testing should not be done routinely and where indicated should be under the direction of a specialist.

IV. Laboratory Evaluation

The blood lead level at present remains the single most important test to monitor lead exposure and is the test used in the medical surveillance program under the lead standard to guide employee medical removal. The ZPP has several advantages over the blood lead level. Because of its relatively recent development and the lack of extensive data concerning its interpretation, the ZPP currently remains an ancillary test.

This section will discuss the blood lead level and ZPP in detail and will outline their relative advantages and disadvantages. Other blood tests currently available to evaluate lead exposure will also be reviewed.

The blood lead level is a good index of current or recent lead absorption when there is no anemia present and when the worker has not taken any chelating agents. However, blood lead levels along with urinary lead levels do not necessarily indicate the total body burden of lead and are not adequate measures of past exposure. One reason for this is that lead has a high affinity for bone and up to 90 percent of the body's total lead is deposited there. A very important component of the total lead body burden is lead in soft tissue (liver, kidney, and brain). This fraction of the lead body burden, the biologically active lead, is not entirely reflected by blood lead levels since it is a function of the dynamics of lead absorption, distribution, deposition in bone and excretion. Following discontinuation of exposure to lead, the excess body burden is only slowly mobilized from bone and other relatively stable body stores and excreted. Consequently, a high blood lead level may only represent recent heavy exposure to lead without a significant total body excess and likewise a low blood lead level does not exclude an elevated total body burden of lead.

Also due to its correlation with recent exposures, the blood lead level may vary considerably over short time intervals.

To minimize laboratory error and erroneous results due to contamination, blood specimens must be carefully collected after thorough cleaning of the skin with appropriate methods using lead - free blood containers and analyzed by a reliable laboratory. Under the standard, samples must be analyzed in laboratories which are approved by OSHA. Analysis is to be made using atomic absorption spectrophotometry, anodic stripping voltammetry or any method which meets the accuracy requirements set forth by the standard.

The determination of lead in urine is generally considered a less reliable monitoring technique than analysis of whole blood primarily due to individual variability in urinary excretion capacity as well as the technical difficulty of obtaining accurate 24 hour urine collections. In addition, workers with renal insufficiency, whether due to lead or some other cause, may have decreased lead clearance and consequently urine lead levels may underestimate the true lead burden. Therefore, urine lead levels should not be used as a routine test.

The zinc protoporphyrin test, unlike the blood lead determination, measures an adverse metabolic effect of lead and as such is a better indicator of lead toxicity than the level of blood lead itself. The level of ZPP reflects lead absorption over the preceding 3 to 4 months, and therefore is a better indicator of lead body burden. The ZPP requires more time than the blood lead to read significantly elevated levels; the return to normal after discontinuing lead exposure is also slower. Furthermore, the ZPP test is simpler, faster, and less expensive to perform and no contamination is possible. Many investigators believe it is the most reliable means of monitoring chronic lead absorption.

Zinc protoporphyrin results from the inhibition of the enzyme ferrochelatase which catalyzes the insertion of an iron molecule into the protoporphyrin molecule, which then becomes heme. If iron is not inserted into the molecule then zinc, having a greater affinity for protoporphyrin, takes the place of the iron, forming ZPP.

An elevation in the level of circulating ZPP may occur at blood lead levels as low as 20-30 μg/dl in some workers. Once the blood lead level has reached 40 μg/dl there is more marked rise in the ZPP value from its normal range of less than 100 μg/dl 100 ml. Increases in blood lead levels beyond 40 μg/100 g are associated with exponential increases in ZPP.

Whereas blood lead levels fluctuate over short time spans, ZPP levels remain relatively stable. ZPP is measured directly in red blood cells and is present for the cell's entire 120 day life-span. Therefore, the ZPP level in blood reflects the average ZPP production over the previous 3-4 months and consequently the average lead exposure during that time interval.

It is recommended that a hematocrit be determined whenever a confirmed ZPP of 50 μg/100 ml whole blood is obtained to rule out a significant underlying anemia. If the ZPP is in excess of 100 μg/100 ml and not associated with abnormal elevations in blood lead levels, the laboratory should be checked to be sure that blood leads were determined using atomic absorption spectrophotometry anodic stripping voltammetry, or any method which meets the accuracy requirements set forth by the standard by an OSHA approved laboratory which is experienced in lead level determinations. Repeat periodic blood lead studies should be obtained in all individuals with elevated ZPP levels to be certain that an associated elevated blood lead level has not been missed due to transient fluctuations in blood leads.

ZPP has a characteristic fluorescence spectrum with a peak at 594 nm which is detectable with a hematofluorimeter. The hematofluorimeter is accurate and portable and can provide on-site, instantaneous results for workers who can be frequently tested via a finger prick.

However, careful attention must be given to calibration and quality control procedures. Limited data on blood lead-ZPP correlations and the ZPP levels which are associated with the adverse health effects discussed in Section 2 are the major limitations of the test. Also it is difficult to correlate ZPP levels with environmental exposure and there is some variation of response with age and sex. Nevertheless, the ZPP promises to be an important diagnostic test for the early detection of lead toxicity and its value will increase as more data is collected regarding its relationship to other manifestations of lead poisoning.

Levels of delta-aminolevulinic acid (ALA) in the urine are also used as a measure of lead exposure. Increasing concentrations of ALA are believed to result from the inhibition of the enzyme delta-aminolevulinic acid dehydrase (ALA-D). Although the test is relatively easy to perform, inexpensive, and rapid, the disadvantages include variability in results, the necessity to collect a complete 24 hour urine sample which has a specific gravity greater than 1.010, and also the fact that ALA decomposes in the presence of light.

The pattern of porphyrin excretion in the urine can also be helpful in identifying lead intoxication. With lead poisoning, the urine concentrations of coproporphyrins I and II, porphobilinogen and uroporphyrin I rise. The most important increase, however, is that of coproporphyrin III; levels may exceed 5,000 μg/1 in the urine in lead poisoned individuals, but its correlation with blood lead levels and ZPP are not as good as those of ALA. Increases in urinary porphyrins are not diagnostic of lead toxicity and may be seen in porphyria, some liver diseases, and in patients with high reticulocyte counts.

Summary. The Occupational Safety and Health Administration's interim standard for inorganic lead in the construction industry places significant emphasis on the medical surveillance of all workers exposed to levels of inorganic lead above 30 μg/ m^3 TWA. The physician has a fundamental role in this surveillance program, and in the operation of the medical removal protection program.

Even with adequate worker education on the adverse health effects of lead and appropriate training in work practices, personal hygiene and other control measures, the physician has a primary responsibility for evaluating potential lead toxicity in the worker. It is only through a careful and detailed medical and work history, a complete physical examination and appropriate laboratory testing that an accurate assessment can be made. Many of the adverse health effects of lead toxicity are either irreversible or only partially reversible and therefore early detection of disease is very important.

This document outlines the medical monitoring program as defined by the occupational safety and health standard for inorganic lead. It reviews the adverse health effects of lead poisoning and describes the important elements of the history and physical examinations as they relate to these adverse effects. Finally, the appropriate laboratory testing for evaluating lead exposure and toxicity is presented.

It is hoped that this review and discussion will give the physician a better understanding of the OSHA standard with the ultimate goal of protecting the health and well-being of the worker exposed to lead under his or her care.

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1926.62 App D	
Title	Qualitative and Quantitative Fit Test Protocols
Subpart	D
Subpart Title	Occupational Health and Environmental Controls

I. Fit Test Protocols

A. General: The employer shall include the following provisions in the fit test procedures. These provisions apply to both qualitative fit testing (QLFT) and quantitative fit testing (QNFT) permissible for compliance with paragraph (f)(3)(ii) of 1926.62. All testing is to be conducted annually.

1. The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least three sizes of elastomeric facepieces of the type of respirator that is to be tested, i.e., three sizes of half mask; or three sizes of full facepiece. Respirators of each size must be provided from at least two manufacturers.

2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a comfortable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

3. The test subject shall be informed that he/she is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape, and if fitted, maintained and used properly, will provide adequate protection.

4. The test subject shall be instructed to hold each facepiece up to the face and eliminate those which obviously do not give a comfortable fit.

5. The more comfortable facepieces are noted; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in item 6 below. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

(a) position of the mask on the nose;

(b) room for eye protection;

(c) room to talk; and

(d) position of mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

(a) chin properly placed;

(b) adequate strap tension, not overly tightened;

(c) fit across nose bridge;

(d) respirator of proper size to span distance from nose to chin;

(e) tendency of respirator to slip; and

(f) self-observation in mirror to evaluate fit and respirator position.

8. The test subject shall conduct the negative and positive pressure fit checks as described below or in ANSI Z88.2-1980. Before conducting the negative or positive pressure test, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the fit check tests.

(a) "Positive pressure check". Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

(b) "Negative pressure check". Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, or long sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician to determine whether the test subject can wear a respirator while performing her or his duties.

11. If at any time within the first two week of use the respirator becomes uncomfortable, the test subject shall be given the opportunity to select a different facepiece and to be retested.

12. The employer shall maintain a record of the fit test administered to an employee. The record shall contain at least the following information.:

(a) name of employee;

(b) type of respirator;

(c) brand, size of respirator;

(d) date of test;

(e) where QNFT is used: the fit factor, strip chart recording or other recording of the results of the test. The record shall be maintained until the next fit test is administered.

13. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

14. Test Exercises. The test subject shall perform exercises, in the test environment, in the manner described below:

(a) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

(b) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as to not hyperventilate.

(c) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(d) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(e) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage (see below), count backward from 100, or recite a memorized poem or song.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(f) Grimace. The test subject shall grimace by smiling or frowning.

(g) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT units which prohibit bending at the waist.

(h) Normal breathing. Same as exercise 1.

Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become uncomfortable, another model of respirator shall be tried.

B. Qualitative Fit Test (QLFT) Protocols.

1. "General"

(a) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator qualitative fit test program.

(b) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and assure that test equipment is in proper working order.

(c) The employer shall assure that QLFT equipment is kept clean and well maintained so as to operate at the parameters for which it was designed.

2. "Isoamyl Acetate Protocol".

(a) Odor threshold screening. The odor threshold screening test, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate.

(1) Three 1 liter glass jars with metal lids are required.
(2) Odor free water (e.g. distilled or spring water) at approximately 25 degrees C shall be used for the solutions.
(3) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a 1 liter jar and shaking for 30 seconds. A new solution shall be prepared at least weekly.
(4) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.
(5) The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.
(6) A test blank shall be prepared in a third jar by adding 500 cc of odor free water.
(7) The odor test and test blank jars shall be labeled 1 and 2 for jar identification. Labels shall be placed on the lids so they can be periodically peeled, dried off and switched to maintain the integrity of the test.
(8) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."
(9) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.
(10) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.
(11) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(b) Isoamyl acetate fit test

(1) The fit test chamber shall be similar to a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.
(2) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.
(3) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and

respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.
(4) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.
(5) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.
(6) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the head exercises; or to demonstrate some of the exercises.
(7) If at any time during the test, the subject detects the banana like odor of IAA, the test has failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.
(8) If the test has failed, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber and again begin the procedure described in (I)(B)(2)(b)(1) through (7) of this appendix. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.
(9) When a respirator is found that passes the test, its efficiency shall be demonstrated for the subject by having the subject break the face seal and take a breath before exiting the chamber.
(10) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the test area from becoming contaminated, the used towels shall be kept in a self sealing bag so there is no significant IAA concentration build-up in the test chamber during subsequent tests.

3. "Saccharin Solution Aerosol Protocol". The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Taste threshold screening. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.
(2) The test enclosure shall have a 3/4-inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her wide open mouth with tongue extended.
(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.
(5) The threshold check solution consists of 0.83 grams of sodium saccharin USP in 1 cc of warm water. It can be prepared by putting 1 cc of the fit test solution (see (b)(5) below) in 100 cc of distilled water.
(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.
(7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.
(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.
(9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.
(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject may not perform the saccharin fit test.
(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
(13) Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.
(14) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Saccharin solution aerosol fit test procedure

(1) The test subject may not eat, drink (except plain water), or chew gum for 15 minutes before the test.
(2) The fit test uses the same enclosure described in I.B.3.(a) above.
(3) The test subject shall don the enclosure while wearing the respirator selected in section I.B.3.(a) above. The respirator shall be properly adjusted and equipped with a particulate filter(s).
(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.
(5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.
(6) As before, the test subject shall breathe through the wide open mouth with tongue extended.
(7) The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same number of squeezes required to elicit a taste response in the screening test.
(8) After generating the aerosol the test subject shall be instructed to perform the exercises in section I.A.14 above.
(9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes as initially.
(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.
(11) If the taste of saccharin is detected, the fit is deemed unsatisfactory and a different respirator shall be tried.
(12) Successful completion of the test protocol shall allow the use of the tested respirator in contaminated atmospheres up to 10 times the PEL. In other words, this protocol may be sued for assigned protection factors no higher than 10.

4. "Irritant Fume Protocol"

(a) The respirator to be tested shall be equipped with high-efficiency particulate air (HEPA) filters.

(b) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its characteristic odor.

(c) Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part No. 5645, or equivalent. Attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute.

(d) Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep his/her eyes closed while the test is performed.

(e) The test conductor shall direct the stream of irritant smoke from the smoke tube towards the face seal area of the test subject. He/She shall begin at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

(f) The exercises identified in section I.A.14 above shall be performed by the test subject while the respirator seal is being challenged by the smoke.

(g) Each test subject passing the smoke test without evidence of a response shall be given a sensitivity check of the smoke from the same tube once the respirator has been removed to determine whether he/she reacts to the smoke. Failure to evoke a response shall void the fit test.

(h) The fit test shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agent. C. Quantitative Fit Test (QNFT) Protocol.

1. General.

(a) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator quantitative fit test program.

(b) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and assure that test equipment is in proper working order.

(c) The employer shall assure that QNFT equipment is kept clean and well maintained so as to operate at the parameters for which it was designed.

2. Definitions

(a) Quantitative fit test. The test is performed in a test chamber. The normal air-purifying element of the respirator is replaced by a high-efficiency particulate air (HEPA) filter in the case of particulate QNFT aerosols or a sorbent offering contaminant penetration protection equivalent to high-efficiency filters where the QNFT test agent is a gas or vapor.

(b) Challenge agent means the aerosol, gas or vapor introduced into a test chamber so that its concentration inside and outside the respirator may be measured.

(c) Test subject means the person wearing the respirator for quantitative fit testing.

(d) Normal standing position means standing erect and straight with arms down along the sides and looking straight ahead.

(e) Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.

(f) Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers which calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.

(g) "Fit Factor" means the ration of challenge agent concentration outside with respect to the inside of a respirator inlet covering (facepiece or enclosure).

3. Apparatus.

(a) Instrumentation. Aerosol generation, dilution, and measurement systems using corn oil or sodium chloride as test aerosols shall be used for quantitative fit testing.

(b) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(c) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particulate filter supplied by the same manufacturer.

(d) The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of the challenge agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers which integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(e) The combination of substitute air-purifying elements, challenge agent and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of an established exposure limit for the challenge agent at any time during the testing process.

(f) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g. where the respirator is probed), a free air flow is allowed into the sampling line at all times and so that there is no interference with the fit or performance of the respirator.

(g) The test chamber and test set up shall permit the person administering the test to observe the test subject inside the chamber during the test.

(h) The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent inside the test chamber constant to within a 10 percent variation for the duration of the test.

(i) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event inside the test chamber and its being recorded.

(j) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(k) The exhaust flow from the test chamber shall pass through a high-efficiency filter before release.

(l) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

(m) The limitations of instrument detection shall be taken into account when determining the fit factor.

(n) Test respirators shall be maintained in proper working order and inspected for deficiencies such as cracks, missing valves and gaskets, etc.

4. Procedural Requirements.

(a) When performing the initial positive or negative pressure test the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these tests.

(b) An abbreviated screening isoamyl acetate test or irritant fume test may be utilized in order to quickly identify poor fitting respirators which passed the positive and/or negative pressure test and thus reduce the amount of QNFT time. When performing a screening isoamyl acetate test, combination high-efficiency organic vapor cartridges/canisters shall be used.

(c) A reasonably stable challenge agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain type of test units the determination of the challenge agent stability may be established after the test subject has entered the test environment.

(d) Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full facepiece respirator.

(e) A stable challenge concentration shall be obtained prior to the actual start of testing.

(f) Respirator restraining straps shall not be over tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonable comfortable fit typical of normal use.

(g) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject shall be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate.

(h) In order to successfully complete a QNFT, three successful fit tests are required. The results of each of the three independent fit tests must exceed the minimum fit factor needed for the class of respirator (e.g. half mask respirator, full facepiece respirator).

(i) Calculation of fit factors.

(1) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration inside the respirator.
(2) The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and of the end of the test.
(3) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:
(i) Average peak concentration
(ii) Maximum peak concentration
(iii) Integration by calculation of the area under the individual peak for each exercise. This includes computerized integration.

(j) Interpretation of test results. The fit factor established by the quantitative fit testing shall be the lowest of the three fit factor values calculated from the three required fit tests.

(k) The test subject shall not be permitted to wear a half mask, or full facepiece respirator unless a minimum fit factor equivalent to at least 10 times the hazardous exposure level is obtained.

(l) Filters used for quantitative fit testing shall be replaced at least weekly, or whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media. Organic vapor cartridges/canisters shall be replaced daily (when used) or sooner if there is any indication of breakthrough by a test agent.

(Approved by the Office of Management and Budget under control number 1218-0189.)

[57 FR 26627, May 4, 1993, as amended at 58 FR 34218, June 24, 1993]

APPENDIX K

CONSTRUCTION CHECKLIST FOR SELF-INSPECTION

Life Lines & Safety Belts

		YES	NEEDS ACTION
1.	Are life lines, safety belts, and lanyards used to prevent fall risks	☐	☐
2.	Are life lines capable of supporting a minimum dead weight of 5,400 lbs (2449 kg)?	☐	☐
3.	Are safety belt lanyards of such length as not to permit a drop of more than 6 ft (1.8 m)?	☐	☐
4.	Are life lines secured to a firm anchorage above the point of operation?	☐	☐

Safety Nets

		YES	NEEDS ACTION
1.	Are safety nets provided when workplaces are more than 25 ft (7.6 m) above ground or water surface where other means of safety are impractical?	☐	☐
2.	Is the net mesh size less than 6 in x 6 in (15.2 cm x 15.2 cm)?	☐	☐
3.	Do all nets meet the 17,500 foot-pounds (23,730 J) minimum impact resistance?	☐	☐

Floor & Wall Openings & Stairs

		YES	NEEDS ACTION
1.	Are floor openings guarded with a standard railing? Are floor holes guarded or covered?	☐	☐
2.	Are open-sided floors and platforms 6 ft (1.8 m) or more above the floor or ground guarded by a standard railing or the equivalent?	☐	☐
3.	Are there standard railings on runways that are 4 ft (1.2 m) or more above floor or ground level?	☐	☐
4.	Are the tops of standard railings about 42 in (106.7 cm) from the floor?	☐	☐
5.	Will standard railings withstand a 200 lb (896 N) impact at any point?	☐	☐
6.	Are stairways in good condition and standard railings provided for every flight having four or more risers?	☐	☐
7.	Are hollow pan stair treads filled in with solid material to eliminate tripping?	☐	☐

Lead in Construction

	YES	NEEDS ACTION
1. Has a determination been made as to the possibility of airborne lead exposure on the job? (Significant airborne lead exposures can occur when welding, cutting, and grinding are performed during structural street demolition and renovation.)	☐	☐
2. If it has been determined that employees may be exposed to airborne lead, have you:		
a. become familiar with OSHA's Lead in Construction regulation?	☐	☐
b. conducted representative personal monitoring to determine employee exposures?	☐	☐
3. If exposures exceed the action level:		
a. have employees been provided with the required training?	☐	☐
b. has a medical surveillance program been established?	☐	☐
c. have provisions been made for the required periodic air monitoring?	☐	☐
4. If exposures exceed the permissible exposure level, have the following additional requirements been met?		
a. use of engineering and work practice controls to reduce exposures	☐	☐
b. use of adequate personal protective equipment, including respiratory protection	☐	☐
c. prohibition of food and beverage consumption and smoking in exposure areas	☐	☐
d. establishment of a food and beverage consumption area	☐	☐
e. establishment of a change area with storage facilities	☐	☐
f. provision of washing facilities	☐	☐
g. posting of warning signs at the exposure area	☐	☐

Ladders

	YES	NEEDS ACTION
1. Are employees made aware that metal ladders are not to be used where they may contact electrical conductors or equipment?	☐	☐
Are they also aware that metal ladders cannot be used when working on or near electrical equipment such as changing light bulbs or fluorescent tubes?	☐	☐
2. Are ladders with broken or missing rungs or split side rails tagged and taken out of service?	☐	☐
3. Are metal ladders inspected for damage or signs of corrosion?	☐	☐
4. Are portable wood ladders and metal ladders adequate for their purpose, in good condition, and provided with secure footing?	☐	☐
5. Are areas around the top and bottom of the ladder kept clear?	☐	☐
6. Are portable ladders used at such a pitch that the horizontal distance from the top bearing to the foot of the ladder is about 1/4 of the working length of the ladder?	☐	☐
7. Are ladders prohibited from being used in a horizontal position as platforms, runways or scaffolds?	☐	☐

		YES	NEEDS ACTION
8.	Are portable ladders tied, blocked or otherwise secured against movement?	☐	☐
9.	Are filler blocks placed between the cleats of job-made wooden ladders?	☐	☐
10.	If simultaneous two-way traffic is expected, is a double cleat ladder installed?	☐	☐
11.	Are double cleat ladders 24 feet or less in length?	☐	☐
12.	Are single cleat ladders 30 feet or less in length?	☐	☐
13.	Is the width of single cleat ladders at least 15 inches, but not more than 20 inches?	☐	☐
14.	Are the rungs of ladders uniformly spaced at 12 inches center to center?	☐	☐
15.	Are the side rails of the ladder extending at least 36 inches above the landing?	☐	☐

Lift Trucks

		YES	NEEDS ACTION
1.	Are powered industrial trucks examined before being placed into service for any conditions that may adversely affect the safety of the vehicle?	☐	☐
2.	Are defective powered industrial trucks immediately repaired or removed from service?	☐	☐
3.	Are the high lift rider trucks equipped with an overhead guard to protect the operator?	☐	☐
4.	Is a vertical load backrest provided to prevent raised loads from falling rearward?	☐	☐
5.	Are powered industrial trucks provided with an audible warning device to alert others in the area of their presence?	☐	☐
6.	Are only trained and qualified personnel permitted to operate powered industrial trucks?	☐	☐
7.	Are the rated load capacities of the powered industrial trucks clearly marked and not exceeded?	☐	☐
8.	Are raised loads kept as close to the ground as possible to prevent tipping while traveling?	☐	☐
9.	Are trucks driven with the load facing upgrade when ascending or descending grades in excess of 10 percent?	☐	☐
10.	Are the load engaging means fully lowered, controls neutralized, power shut off, and brakes set on unattended powered industrial trucks?	☐	☐
11.	Are unauthorized riders prohibited from riding on lift trucks?	☐	☐

Material Hoists

		YES	NEEDS ACTION
1.	Are workers prohibited from riding the hoist?	☐	☐
2.	Is overhead protection provided over the case or platform and the operator's position?	☐	☐
3.	Is a load rating plate attached to the hoist?	☐	☐
4.	Has wire rope been inspected for harmful defects?	☐	☐
5.	Are there at least three full wraps on the winding drum when the platform is at the lowest point of travel?	☐	☐
6.	Is there at least three feet of clearance between the cathead sheave and the top of cage when it is at the uppermost terminal or landing?	☐	☐
7.	Are sheave bearings well lubricated?	☐	☐
8.	Are brakes capable of stopping and holding 125 percent of the rated load?	☐	☐
9.	Does the operator remain at the controls while the load is suspended or the master clutch is engaged?	☐	☐
10.	Are gears on the hoisting machine well guarded?	☐	☐
11.	Are entrances to hoistway guarded or barricaded?	☐	☐

Flagpersons

		YES	NEEDS ACTION
1.	Are flagpersons provided with and made to wear orange or red warning garments while working in vehicular traffic?	☐	☐
2.	Are the warning garments of reflectorized material?	☐	☐
3.	Are flagpersons knowledgeable of standard flag signals to control traffic effectively?	☐	☐

Trenches & Excavations

		YES	NEEDS ACTION
1.	Has the utility company been notified of intended digging?	☐	☐
2.	Are daily inspections made of the excavation to determine the possibility of a cave-in and are necessary steps taken to protect employees?	☐	☐
3.	Are shoring or sloping systems used to support the walls and faces of the excavations sufficient to insure against cave-ins?	☐	☐
4.	Is there a ladder in the excavation?	☐	☐

Cranes

		YES	NEEDS ACTION
1.	Are cranes and derricks restricted from operating within 10 ft (3.0 m) of any electrical powerline?	☐	☐
2.	Are rated load capacities, operating speed, and instructions posted and visible to the operator?	☐	☐
3.	Does the operator understand and use the load chart?	☐	☐
4.	Is the operator able to determine the angle and length of the crane boom at all times?	☐	☐
5.	Is the crane machinery and other rigging equipment inspected daily prior to use to make sure that it is in good condition?	☐	☐
6.	Are accessible areas within the swing radius barricaded?	☐	☐
7.	Are tag lines being used to prevent dangerous swing or spin of materials when raised or lowered by crane or derrick?	☐	☐
8.	Is a fire extinguisher of at least 5BC rating provided on the crane?	☐	☐
9.	Are illustrations of hand signals to crane and derrick operators posted on the job site?	☐	☐
10.	Does the hook-man use correct signals for the crane operator to follow?	☐	☐
11.	Are crane outriggers used as required?	☐	☐
12.	Do crane platforms and walkways have antiskid surfaces?	☐	☐
13.	Is broken, worn, or damaged wire rope removed from service?	☐	☐
14.	Are exhaust pipes guarded or insulated where employees might contact them?	☐	☐
15.	Are guard rails, hand holds, and steps provided for save and easy access to all areas of the crane?	☐	☐
16.	Are trolley and two block limits on hammerhead tower cranes working?	☐	☐
17.	Have tower bolts been properly torqued?	☐	☐
18.	Have overload limits been tested and correctly set?	☐	☐
19.	Do personnel platforms suspended from crane hooks conform to OSHA requirements?	☐	☐
20.	Does the crane operation comply with manufacturer's specifications?	☐	☐

Scaffolding

		YES	NEEDS ACTION
1.	Is the footing of the scaffold sound, rigid, and capable of carrying the maximum intended load?	☐	☐
2.	Is the scaffold erected under the supervision of someone competent in scaffold erection?	☐	☐
3.	Are guardrails and toeboards provided on scaffolds more than 10 ft (3.0 m) above the ground?	☐	☐
4.	Are heavy loads placed over or near the bearers and not on center plank?	☐	☐
5.	Is planking of sufficient stress grade or scaffold grade timber?	☐	☐
6.	Is planking of platforms overlapped not less than 6 in (15.2 cm) or more than 12 in (30.5 cm) or secured from movement?	☐	☐
7.	Where persons work under scaffold, is ½ in (1.3 cm) mesh screen provided between toeboard and guardrail?	☐	☐
8.	Are poles, legs, or uprights of scaffolds plumb and securely braced to prevent swaying and displacement?	☐	☐
9.	Are defective parts on scaffolds immediately replaced or repaired?	☐	☐
10.	Are guardrails and toeboards installed on all open sides and ends of scaffold platforms?	☐	☐
11.	Are railings protecting floor openings, platforms, or scaffolds equipped with toeboards wherever there is a possibility that falling material could cause a hazard?	☐	☐
12.	Are toeboards at least 4 in (10.2 cm) in height?	☐	☐
13.	When employees are working on suspended scaffolds, are life lines firmly anchored to an overhead structure and not to the scaffold?	☐	☐
14.	Are employees wearing safety belts attached to life lines?	☐	☐

Hand and Power Tools

Accidents with hand tools comprise 5 percent to 10 percent of compensable injuries. Many of these injuries could be avoided with the proper care, maintenance, and use of hand tools.

		YES	NEEDS ACTION
1.	Are hand tools and other equipment regularly inspected for safe condition?	☐	☐
2.	Are tool handles free of splits and cracks?	☐	☐
3.	Are handles wedged tightly in the heads of all tools?	☐	☐
4.	Are impact tools free of mushroomed heads?	☐	☐
5.	Are the heads of chisels or punches ground periodically to prevent mushrooming?	☐	☐
6.	Are cutting edges kept sharp so the tool will move smoothly without binding or skipping?	☐	☐
7.	Is sharpening, redressing, or repairing tools done properly, using tools suited to each purpose?	☐	☐
8.	When compressed air is used for cleaning purposes is nozzle pressure safely reduced to less than 30 psi (206.8 kPa)?	☐	☐
9.	Are power saws and similar equipment provided with safety guards?	☐	☐
10.	Are tools used with the correct shield, guard, or attachments recommended by the manufacturer?	☐	☐
11.	Are abrasive wheel grinders provided with safety guards that cover the spindle ends, nut, and flange projections?	☐	☐
12.	Are portable circular saws equipped with guards above and below the base or shoe?	☐	☐
13.	Are saw guards checked to ensure they are not wedged up thereby leaving an unguarded lower portion of the blade?	☐	☐
	Are springs checked for wear?	☐	☐
14.	Are guards kept in place and in working order?	☐	☐
15.	Are rotating or moving parts of equipment guarded to prevent contact by employees?	☐	☐
16.	Do operators wear eye and face protection when grinding?	☐	☐
17.	Is the pneumatic hose line secured to the pneumatic tool?	☐	☐
	Are the tool bits secured by use of safety clips or retainers to prevent accidental disconnecting?	☐	☐
18.	Are appropriate ground-fault circuit interrupters provided at the job site? *Or*	☐	☐
19.	Is an assured equipment grounding conductor program established and implemented at the job site?	☐	☐
20.	Are electric powered tools double-insulated or properly grounded?	☐	☐
21.	Is eye and face protection used when driving hardened or tempered studs or nails?	☐	☐
22	Are tools stored in a dry, secure location where they won't be tampered with?	☐	☐

Powder Actuated Tools

	YES	NEEDS ACTION
23. Do all users of powder actuated tools possess an "Operator's Card" to demonstrate that they have been trained?	☐	☐
24. Are tools left unloaded until they are ready for immediate use?	☐	☐
25. Are tools inspect each day for defects or obstructions prior to use?	☐	☐
26. Are the following types of personal protective equipment used by operators and others in area of tool use?		
Hard hats?	☐	☐
Safety goggles?	☐	☐
Safety shoes?	☐	☐
Ear protection when making fastenings in confined areas such as small rooms, tanks, vaults or ship compartments?	☐	☐

Concrete

	YES	NEEDS ACTION
1. Is formwork and shoring adequate to support all intended loads during concrete placement?	☐	☐
2. Are protruding rebars covered or bent over where work must be performed overhead?	☐	☐
3. Do employees wear gloves and eye protection during form stripping operations?	☐	☐
4. Are nails removed or bent over from stripped forms?	☐	☐
5. Are clear pathways maintained through stripping areas?	☐	☐

Steel Erection

	YES	NEEDS ACTION
1. Is a tightly planked temporary floor installed above 30 ft (9.1 m) or two stories when steel erection work is being accomplished?	☐	☐
2. Are safety nets installed where the potential fall distance exceeds two stories or 25 ft (7.6 m)?	☐	☐
3. Is a safety railing installed around temporarily floored buildings?	☐	☐
4. Are tag lines being used to prevent dangerous swing or spin of materials when raised or lowered by crane or derrick?	☐	☐

Dust, Gases, Vapors, Fumes & Mists

	YES	NEEDS ACTION
1. Are material safety data sheets maintained on each product in use at the construction site?	☐	☐
2. Are agents identified that may cause harm by inhalation, ingestion, skin absorption, or contact?	☐	☐
3. Can a less harmful method or product be used?	☐	☐
4. Is adequate ventilation provided?	☐	☐
5. Is protective equipment used to protect against over-exposures?	☐	☐

		YES	NEEDS ACTION
6.	Are employees made knowledgeable of the hazards when working with harmful agents?	☐	☐

Asbestos

		YES	NEEDS ACTION
1.	Is air monitoring being conducted in areas where there may be asbestos exposure?	☐	☐
2.	When employees may be exposed to asbestos, has a program been established that includes:		
	Training in the recognition of asbestos, the hazards of exposure, and the control of exposure?	☐	☐
	Caution labels and signs?	☐	☐
	Use of appropriate respirators?	☐	☐
	• Protective clothing?	☐	☐
	• Change areas and storage for street and work clothing?	☐	☐
	• Medical surveillance?	☐	☐
	• Proper maintenance of monitoring, medical, and training records?	☐	☐
3.	Wherever airborne concentrations of asbestos exceed the 8-hour TWA of 0.2 f/cc or the 30 minute TWA of 1 f/cc, have regulated areas been established?	☐	☐
4.	Where appropriate, are the following methods used to minimize asbestos exposure?		
	Local exhaust systems?	☐	☐
	Vacuum cleaners with HEPA filters?	☐	☐
	Enclosure or isolation?	☐	☐
	Wet methods?	☐	☐
	Wetting agents?	☐	☐
5.	Is the use of tools, such as compressed air and high speed abrasive disc saws, that create uncontrolled airborne asbestos dust prohibited?	☐	☐
6.	Is waste promptly placed in sealed, labeled, impermeable bags?	☐	☐
7.	Are all activities involving asbestos being conducted in compliance with regulations established by the Department of the Environment?	☐	☐

Silica

		YES	NEEDS ACTION
1.	Is adequate exhaust provided to remove silica dust particles from the work area or operation?	☐	☐
2.	Are respirators provided to employees who may be over-exposed to silica dust particles?	☐	☐
3.	Can certain grinding, sandblasting, or mixing operations be performed by wet method to reduce the airborne silica hazard?	☐	☐

Noise

		YES	NEEDS ACTION
1.	Are hearing protectors and a hearing conservation program provided for noise levels above 90 decibels?	☐	☐
2.	Have administrative or engineering controls been applied to eliminate or reduce the excessive noise?	☐	☐
3.	If administrative or engineering controls are not feasible, is personal hearing protection provided to reduce sound levels?	☐	☐
4.	Is the use of hearing protection equipment enforced?	☐	☐
5.	Is hearing protection equipment correctly fitted and maintained in a clean and sanitary condition?	☐	☐
6.	Is an audiometric testing program in effect?	☐	☐
7.	Are employees instructed in the effects of noise on hearing, the signs of over-exposure to noise, and proper use of hearing protectors?	☐	☐

Carbon Monoxide

		YES	NEEDS ACTION
1.	Are salamanders and fire pots vented to the outside atmosphere?	☐	☐
2.	Are exhaust manifolds, pipes, and mufflers in good repair to eliminate harmful leakage of the engine exhaust?	☐	☐
3.	Is equipment maintained in good repair to reduce the amount of unburned hydrocarbons, which result in the manufacture of carbon monoxide?	☐	☐
4.	Are pipings to the outdoors used when engines must be run for repairs or adjustments while they are in enclosed areas?	☐	☐
5.	Are carbon monoxide levels checked regularly?	☐	☐
6.	Is employee exposure well below the allowable 50 parts per million?	☐	☐
7.	Is natural or mechanical ventilation provided to remove harmful carbon monoxide gases?	☐	☐

Lighting

		YES	NEEDS ACTION
1.	Are 5 foot-candles of illumination provided throughout the general construction area?	☐	☐
2.	Are the workshops and storerooms provided with 10 foot-candles (107.6 LUX) of illumination?	☐	☐
3.	Is the first aid station illuminated to 30 foot-candles (322.8 LUX)?	☐	☐
4.	Are light guards provided where there is a possibility of breakage?	☐	☐
5.	Are the light fixtures raised above the workers' heads?	☐	☐
6.	Are wire guards grounded to the electrical grounding system?	☐	☐
7.	Are stairways, floor opening, and wall opening areas well illuminated?	☐	☐

Lasers

		YES	NEEDS ACTION
1.	Are only trained and qualified employees assigned to operate laser equipment?	☐	☐
2.	Do laser operators carry proof of qualification?	☐	☐
3.	Are employees who may be potentially exposed provided with antilaser eye protection?	☐	☐
4.	Are placards warning of lasers posted in the laser use area?	☐	☐
5.	When the laser is not in use are beam shutters or caps used or is the unit turned off?	☐	☐
6.	Is it a strict requirement that the laser beam shall never be directed at employees?	☐	☐

Confined Spaces

		YES	NEEDS ACTION
1.	Is the internal atmosphere tested to ensure an oxygen level of not less than 19.5 percent?	☐	☐
2.	If the confined space is a manhole, is it impossible for vehicular exhaust or carbon monoxide to creep into the space?	☐	☐
3.	Has the space been examined for decaying vegetation or animal matter that may produce methane?	☐	☐
4.	Has the space been surveyed for possible industrial waste that may contribute to the accumulation of a toxic or combustible atmosphere?	☐	☐
5.	When there is inadequate natural air movement and forced ventilation is not provided, is the internal atmosphere tested for combustible gas and air contaminants?	☐	☐
6.	Is the space ventilated to a safe level before employees enter?	☐	☐
7.	If ventilation does not reduce or remove the hazardous substance, do employees wear an appropriate approved respirator to enter the space?	☐	☐
8.	Are employees trained in the use of respirators?	☐	☐
9.	Are electrical services other than lights made inoperable by padlock and tagging?	☐	☐
10.	Are employees inside and outside the confined space trained in rescue and CPR procedures?	☐	☐
11.	Is rescue equipment readily available for immediate use?	☐	☐
12.	Is there constant communication with employees in the immediate vicinity who are not in the confined space?	☐	☐
13.	Is there a written procedure covering entry under emergency conditions?	☐	☐

Access to Information About Hazardous & Toxic Substances

		YES	NEEDS ACTION
1.	Have you evaluated your work site for compliance with this law?	☐	☐
2.	Has a chemical information list been compiled?	☐	☐
3.	Have material safety data sheets (MSDS) been obtained or developed for all substances on the chemical information list?	☐	☐
4.	Are the chemical information list and the MSDS maintained in a manner that is accessible to employees within 1 working day? Is a copy provided within 5 days of a request?	☐	☐
5.	When new substances are brought on-site, are additional MSDS obtained?	☐	☐
6.	Has each employer provided for the exchange of information regarding hazardous chemicals used or stored on-site with all other employers at that site?	☐	☐
7.	Have employees been informed of their rights under this Law and procedures for obtaining information on hazardous substances?	☐	☐
8.	Have employees been trained about the hazards of the substances, appropriate work practices, control programs, protective measures, and emergency procedures?	☐	☐

Protecting the Workers' Health

Although many safety hazards are apparent upon a simple examination of equipment and procedures, occupational health hazards require a more thorough evaluation. **Identification** and **recognition** of the hazard, **evaluation** of the potential problems, and the **workplace control** of exposures are key elements in protecting workers' health.

RECOGNITION - Read the labels from all materials in the workplace for material, composition, and precautions. Request a "material safety data sheet" for each material from a distributor or from the manufacturer. Listed will be corresponding OSHA exposure limits (PELs) or "threshold limit values" (TLVs) and information on personal protective equipment such as respirators, gloves, aprons, safety glasses; emergency spills; labeling criteria; and emergency information.

EVALUATION - Study the work process in which the material is used to determine if a hazard has been created. Evaluate the way workers handle the materials. *Does the worker breathe this substance or does the substance go through his or her skin? Are workers exposed to enough of this substance to create a problem?*

WORKPLACE CONTROL - In order to prevent health problems before they start, certain measures can be taken to control exposure. *Are ventilation or process controls used when feasible? If the material is extremely toxic, can a less toxic substance be substituted? Are hazardous substances labeled and are workers knowledgeable of the hazard? Are appropriate personal protective devices provided when engineering and/or administrative controls are not adequate or feasible? Are medical exams provided when workers are exposed to certain substances?*

APPENDIX L

MEMORANDUM FOR: REGIONAL ADMINISTRATORS

FROM: JAMES W. STANLEY
Deputy Assistant Secretary

SUBJECT: Guidance to Compliance Officers for
Focused
Inspections in the Construction Industry

This memorandum provides basic guidance to compliance officers for determining which projects are eligible for focused construction inspections and how those inspections are to be conducted. It is intended to be supplemented locally by training and, if appropriate, through local emphasis programs. The policy set forth herein supersedes anything issued previously that is to the contrary.

BACKGROUND:

Under previous agency policy all construction inspections were comprehensive in scope, addressing all areas of the workplace and by inference all classes of hazards. This guidance may have caused compliance officers to spend too much time and effort on a few projects looking for all violations and, thus, too little time overall on many projects inspecting for hazards which are most likely to cause fatalities and serious injuries to workers. Previously, a contractor was likely to be cited for hazards that were unrelated to the four leading causes of death that make up 90% of all construction fatalities (falls from elevations -- 33%; struck by -- 22%; caught in/between -- 18%; electrical shock -- 17%). Although these other conditions are important, the time and resources spent to pursue them on a few projects can be better spent pursuing conditions on many projects related to the four hazard areas most likely to cause fatalities or serious injuries. The goal of OSHA's construction inspections is to make a difference in the safety and health of employees at the worksite.

To accomplish this, the CSHO's time will be more effectively spent inspecting the most hazardous workplace conditions. The CSHO shall conduct comprehensive, resource intensive inspections only on those projects where there is inadequate contractor commitment to safety and health. It is this group of employers that will receive our full attention.

ACTION:

1. Effective October 1, 1994, all construction inspections shall have opening conferences consistent with current agency procedures, and then shall proceed as follows:

   a. During all inspections, CSHO's shall determine whether or not there is project coordination by the general contractor, prime contractor, or other such entity that includes:

      a) an adequate safety and health program/plan that meets the guidelines set forth below, and

      b) a designated competent person responsible for and capable of implementing the program/plan.

      If the above general contractor, prime contractor, or other such entity meets both of these criteria, then a focused inspection shall be made. When either of these criteria is not met, then the inspection shall proceed in accordance with previously established procedures for comprehensive inspections as stated in CPL 2.103, September 26, 1994, Field Inspection Reference Manual (FIRM), chapter II section A.1.b.

      Inspectors are to take the time necessary to conduct comprehensive inspections based on the conditions of the project and the effectiveness of any safety and health program/plan.

If the project does not qualify for a focused inspection, then the CSHO is to conduct the same type of inspection that would have been conducted previous to the focused inspection policy.

b. During all safety: fatality/catastrophe, complaint, and referral inspections, the CSHO shall inspect the worksite in regard to the fatality/complaint/referral item(s), and then will proceed in accordance with paragraph 1. a., above.

c. All health inspections shall be conducted in accordance with current agency procedures.

2. Assessment of safety and health programs/plan shall consider:

a. the comprehensiveness of the program/plan;

b. the degree of program/plan implementation;

c. the designation of competent persons as are required by relevant standards; and

d. how the program/plan is enforced, including management policies and activities, effective employee involvement, and training.

Employees shall be interviewed during the walkaround to aid in the evaluation of the program/plan. Examples of safety and health programs can be found in the Safety and Health Program Management Guidelines published January 26, 1989 in the Federal Register (54 FR 3904), in the ANSI A10.33 "Safety and Health Program Requirements for Multi-Employer Projects", and in Owner and Contractor Association model programs that meet the 29 CFR 1926 Subpart C standards.

3. Focused inspections shall concentrate on the project safety and health program/plan and the four leading hazards that account for the most fatalities and serious injuries in the construction industry: falls; electrical hazards; caught in/between hazards (such as trenching); and "struck-by" hazards (such as materials handling equipment and construction vehicles).

During the course of focused inspections, citations shall be proposed for the four leading hazards and any other serious hazards observed.

Other-than-serious hazards that are abated immediately, and this abatement is observed by the CSHO, shall not normally be cited.

If during the walkaround the CSHO determines that the number of serious and other-than-serious hazards found on the project indicates that the safety and health program/plan is inadequate or is ineffectively implemented, then the inspection shall be comprehensive.

4. Regional Administrators shall provide a copy of this policy memorandum to each of their state designees and discuss the policy and its Federal implementation with them. States are encouraged to adopt a parallel policy, but, at a minimum, must assure that safety and health program/plan requirements and the four hazards that will be the focus of Federal inspections will receive primary emphasis in all State construction inspections. State designees shall be asked to advise the Regional Administrator within 30 days of receipt of this memorandum of their intent. An appropriate plan change supplement implementing these procedures or a State's alternative policy, shall be submitted as soon as possible but no later than 6 months from the date of issuance of this memorandum or upon state adoption of the policy.

INSTRUCTIONAL MATERIALS CONSTRUCTION FOCUSED INSPECTIONS INITIATIVE

A. GENERAL GUIDELINES

1. The Focused Inspections Initiative that became effective October 1, 1994 is a significant departure from how OSHA has previously conducted construction inspections. This Initiative will recognize the efforts of responsible contractors who have implemented effective safety and health programs/plans, and will encourage other contractors to adopt similar programs. The number of inspections is no longer driving the construction inspection program. The measure of success of this new policy will be an overall improvement in construction jobsite safety and health.

2. The Focused Inspections Initiative will enable OSHA to focus on the leading hazards that cause 90% of the injuries and deaths.

The leading hazards are:

- falls, (e.g., floors, platforms, roofs)
- struck by, (e.g., falling objects, vehicles)
- caught in/between (e.g., cave-ins, unguarded machinery, equipment)
- electrical (e.g., overhead power lines, power tools and cords, outlets, temporary wiring)

3. Under the Focused Inspection Initiative, CSHO's shall determine whether or not there is project coordination by the general contractor, prime contractor, or other such entity and conduct a brief review of the project's safety and health program/plan to determine whether or not the project qualifies for a Focused Inspection.

In order to qualify, the following conditions must be met:

a. the project safety and health program/plan meets the requirements of 29 CFR 1926 Subpart C General Safety and Health Provisions, and

b. there is a designated competent person responsible for and capable of implementing the program/plan.

4. If the project meets the above criteria, an abbreviated walk-around inspection shall be conducted focusing on:

a. verification of the safety and health program/plan effectiveness by interviews and observation;

b. the four leading hazards listed above, and

c. other serious hazards observed by the CSHO

d. The CSHO conducting a Focused Inspection is not required to inspect the entire project. Only a representative portion of the project need be inspected as stated in CPL 2.103, September 26, 1994, FIRM, chapter II section A.1.b.

5. The CSHO shall make the determination as to whether a project's safety and health program/plan is effective, but if conditions observed on the project indicate otherwise, the CSHO shall immediately terminate the Focused Inspection and conduct a comprehensive inspection. The discovery of serious violations during a Focused Inspection need not automatically convert the Focused Inspection into a comprehensive inspection. These decisions will be based on the professional judgment of the CSHO.

6. The Focused Inspection Initiative should be publicized to the maximum extent possible so as to encourage contractors to establish effective safety and health programs/plans and concentrate on the four leading hazards prior to being inspected.

7. The Focused Inspection Initiative will be continuously evaluated and modified based on experience .

B. SPECIFIC GUIDELINES

1. The Focused Inspections Initiative policy applies only to construction safety inspections. Construction health inspections will continue to be conducted in accordance with current agency procedures.

2. A project determined not to be eligible for a Focused Inspection shall be given a comprehensive inspection with the necessary time and resources to identify and document violations.

3. A comprehensive inspection shall be conducted when there is no coordination by the general contractor, prime contractor or other such entity to ensure that all employers provide adequate protection for their employees.

4. A request for a warrant will not affect the determination as to whether a project will receive a Focused Inspection.

5. On jobsites where unprogrammed inspections (complaints, fatalities, etc.) are being conducted, the determination as to whether to conduct a Focused Inspection shall be made only after the complaint or fatality has first been addressed.

6. All contractors and employee representatives shall, at some time during the inspection, be informed, why a focused or a comprehensive inspection is being conducted. This may be accomplished either by personal contact or posting the "Handout for contractors and employees" (see attachments, per FIRM, Chapter II, section A. 3.)

7. A brief justification will be included in each case file as to why a Focused Inspection was or was not conducted. The optional "Construction Focused Inspection Guideline" may be used for this purpose.

8. Although the walk-around inspection shall focus on the four leading hazards, citations shall be issued for any serious violations found during a Focused Inspection, and for any other-than-serious violations that are not immediately abated. Other-than-serious violations that are immediately abated shall not normally be cited nor documented.

9. Only contractors on projects that qualify for a Focused Inspection will be eligible to receive a full "good faith" adjustment of 25%.

10. For Focused Inspections an OSHA-1 will be completed in accordance with the multi-employer policy as stated in the Field Inspection Reference Manual for the:

a. general contractor, prime contractor or other such entity and

b. each employer that is issued a citation.

11. For coding purposes on the OSHA-1, a Focused Inspection will:

a. be considered to be a partial inspection.

b. the IMIS code for Focused Inspections shall include the identification of the general contractor, prime contractor or other such entity; and

c. record Focus, C for the general contractor, prime contractor or other such entity and shall include a notation of the total number of employers affected (i.e., general contractor plus subcontractors on site). For example, if there is a general and three subcontractors, the inspection would be recorded as follows:

TypeIDValueN14Focus, C, 4

For each subcontractor issued a citation on a focused inspection the subcontractor's inspection (record Focus, S for the subcontractor) shall be recorded as follows:

TypeIDValueN14Focus, S

Note: OMDS procedures for entering the general contractor, prime contractor or other such entity, and the project identification number on each OSHA-1 in the optional information code boxes will continue to be followed. (See ADM 1-1.31, September 20, 1993.)

REFERENCES:

The following resources can provide assistance in developing and evaluating safety and health programs/plans:

Safety and Health Program Management Guidelines published January 26, 1989 in the Federal Register (54 FR 3904).

STD 3-1.1 "Clarification of Citation Policy Regarding 29 CFR 1926.20, 29 CFR 1926.21 and Related General Safety and Health Provisions."

ANSI A10.33: "Safety and Health Program Requirements for Multi-Employer Projects".

ANSI A10.38: "Basic elements of an employer program to provide a safe and healthful work environment".

Owner and Contractor Association Model Safety and Health Programs.

CONSTRUCTION FOCUSED INSPECTIONS INITIATIVE

Handout for contractors and employees

The goal of Focused Inspections is to reduce injuries, illness and fatalities by concentrating OSHA enforcement on those projects that do not have effective safety and health programs/plan and limiting OSHA's time spent on projects with effective programs/plans.

To qualify for a Focused Inspection the project safety and health program/plan will be reviewed and a walkaround will be made of the jobsite to verify that the program/plan is being fully implemented.

During the walkaround the compliance officer will focus on the four leading hazards that cause 90% of deaths and injuries in construction. The leading hazards are:

- falls, (e.g., floors, platforms, roofs)
- struck by, (e.g., falling objects, vehicles)
- caught in/between (e.g., cave-ins, unguarded machinery, equipment)
- electrical (e.g., overhead power lines, power tools and cords, outlets, temporary wiring.)

The compliance officer will interview employees to determine their knowledge of the safety and health program/plan, their awareness of potential jobsite hazards, their training in hazard recognition and their understanding of applicable OSHA standards.

If the project safety and health program/plan is found to be effectively implemented the compliance officer will terminate the inspection.

If the project does not qualify for a Focused Inspection, the compliance officer will conduct a comprehensive inspection of the entire project.

If you have any questions or concerns related to the inspection or conditions on the project you are encouraged to bring them to the immediate attention of the compliance officer or call the area office at ____________________.

____________________ qualified as a FOCUSED PROJECT.

Project/site____

________________ ______________________________
Date AREA DIRECTOR

This document should be distributed at the site and given to the Contractor for posting.

CONSTRUCTION FOCUSED INSPECTION GUIDELINE

[illegible]
[illegible]

	[illegible]
PROJECT SAFETY AND HEALTH COORDINATION: Are there procedures in place by the general contractor, prime contractor or other such entity to ensure that all employers provide adequate protection for their employees?	
Is there a **DESIGNATED COMPETENT PERSON** responsible for the implementation and monitoring of the project safety and health plan who is capable of identifying existing and predictable hazards and has authority to take prompt corrective measures?	
PROJECT SAFETY AND HEALTH PROGRAM/PLAN* that complies with 1926 Subpart C and addresses, based upon the size and complexity of the project, the following:	

____ Project Safety Analysis at initiation and at critical stages that describes the sequence, procedures, and responsible individuals for safe construction.

____ Identification of work/activities requiring planning, design, inspection or supervision by an engineer, competent person or other professional.

Evaluation/monitoring of subcontractors to determine conformance with the Project Plan. (The Project Plan may include, or be utilized by subcontractors.)

____ Supervisor and employee training according to the Project Plan including recognition, reporting and avoidance of hazards, and applicable standards.

Procedures for controlling hazardous operations such as: cranes, scaffolding, trenches, confined spaces, hot work, explosives, hazardous materials, leading edges, etc.

____ Documentation of: training, permits, hazard reports, inspections, uncorrected hazards, incidents and near misses.

Employee involvement in hazard: analysis, prevention, avoidance, correction and reporting.

__ Project emergency response plan.

* [illegible]

The walkaround and interviews confirmed that the Plan has been implemented, including:

_ The four leading hazards are addressed: falls, struck by, caught in/between, electrical.

Hazards are identified and corrected with preventative measures instituted in a timely manner.

____ Employees and supervisors are knowledgeable of the project safety and health plan, avoidance of hazards, applicable standards, and their rights and responsibilities.

THE PROJECT QUALIFIED FOR A FOCUSED INSPECTION.

MEMORANDUM FOR: REGIONAL ADMINISTRATORS

FROM: James W. Stanley
Deputy Assistant Secretary

SUBJECT: Focused Inspections in Construction
September 20, 1995 Revision

1. The August 22, 1994 memorandum, revised January 11, 1995 is modified as follows:

a. The January 11, 1995 modifications have been included in this memorandum.

i. The additions for 1. a. to e. have been incorporated.

ii. Comment #2 that appeared in the January 11, 1995 modification memorandum has been incorporated into section "Action" #1. a.

b. Throughout the memorandum the term "controlling contractor" has been changed to "general contractor, prime contractor, or other such entity" for clarification. This was done to eliminate any inconsistency in the use of the terms "controlling contractor" and "controlling employer" (see FIRM (CPL 2.103, September 26, 1994) Chapter III, "Multi-employer sites".)

c. Throughout the memorandum the term "guidelines" when used in reference to the conduct of OSHA inspection has been changed to "procedures" to be consistent with the FIRM, (CPL 2.103, September 26, 1994) and to eliminate confusion with the use of the term "guidelines" in this memorandum.

d. Throughout the memorandum the term "controlling contractor('s) safety and health program" has been replaced with "project safety and health program/plan". And "safety and health program" has been replaced with "safety and health program/plan"

e. Throughout the memorandum the term competent person has been add when the term designated is used.

f. The following section under "Action" has been modified:

i. #1.a., has been changed as stated in 1.b. and the following has been added, "...there is project coordination by the general contractor ..."

ii. #1.b., the word programmed has been removed.

iii. #2., "...Owner ..." had been added to the list of examples.

iv. #3., the second paragraph has been modified.

g. The referenced sections under "Instructional Materials: contain the following modifications:

i. A. 4.: a. the word "abbreviated" has been added and

a. "verification of the safety and health program/plan effectiveness ..." has been included;

b. "other" has been added.

ii. A. 7., "...concentrate on the four leading hazards" has been added.

iii. B. 3., has been rewritten for clarity.

iv. B. 6., "advised" is replaced with "informed, either by personal contact or posting the "Handout for contractors and employees ..."

v. B. 7., the following has been added "The optional "Construction Focused Inspection Guideline" may be used for this purpose.

vi. B. 12., has been changed to incorporate the February 21, 1995, IMIS coding memorandum. The February 21 memo has been modified for clarity.

h. The section "Note" has been changed to "References" and "Owner and Contractor Association Model ..." added.

i. Other editorial and/or grammatical changes.

2. A non-mandatory CONSTRUCTION FOCUSED INSPECTION GUIDELINES has been included in the "Focused Inspections in Construction Instructional Materials". This guideline is to assist the professional judgement of the compliance officer to determine if a project qualifies for a Focused Inspection.

APPENDIX M

A SITE-SPECIFIC SAFETY PLAN FOR THE REPAINTING OF THE 59TH STREET BRIDGE

FOR DECOLORES PAINTING CO., INC.

Project Manager: Phil Adelphia — Phone: 1-800-BYE-LEAD

Site Supervisor: Sandy Francisco — Phone: 1-301-CEL-PHON

WORK FLOW SAFETY PLAN

ACTIVITY	HAZARDS	PROGRAMS/ CONTROLS	RESPONSIBLE INDIVIDUAL(S)
1. Establish Work Zones: A combination of Barrels, Advance Warning signs, and concrete barriers will be used to establish the work zone boundaries.	1. Errant Vehicles 2. Worksite Motor Vehicles (Falls, Struck-by)	1A. Manual on Uniform Traffic Control Devices, Part VI 1B. Visible clothing/vests 2A. Motor Vehicle Safety Program	Site Supervisor/DOT Engineer Site Supervisor Site Supervisor
2. Erect Containment: Cable-supported bridge-to-grade containment will be used. Access to bridge structures will be by truck-mounted extendable lift.	A. Falls B. Electrocution	A1. Personal Fall arrest systems will be used on all fall exposures over six feet, including work in the man-lifts. B. Re-route All Overhead Power Lines near bridge structure	A1. Erecting Containment: Site Supervisor A2. Assuring Ventilation rates and Containment sufficiency: IH Contractor B. DOT(Owner)
3. Blast and Clean Structure: The structural steel elements will be blasted to near-white metal using steel shot abrasive. Abrasive will be vacuumed from the bottom of	A. Health Hazards (Lead, Silica, Metal Fumes, Noise)	A1. Lead Compliance Program A2. Respiratory Protection Program A3. Hearing Protection	Site Supervisor, IH Consultant

the containment area, classified, and re-used. An air filtration system will be used for dust control in the enclosure. Tarps will be white allowing natural light to penetrate into the enclosure.	B. Falls	Program B1. Fall Protection Program B2. Ladder Safety Program	
4. Repaint Structure:. Non-lead primers and finishes will be applied to the structures by a pneumatic pump type airless spray system. Painting will be done inside the containment to confine overspray. Other areas will be painted by brush.	A. Fire, Flammables B. Solvent Exposures	A. Use only pneumatic tools B. Respiratory Protection Program (Pressure Demand Airline Respirators)	A. Site Supervisor B. IH Consultant
5. Dismantle Site: Equipment will be vacuumed prior to removal from the site. Spent abrasives and lead contaminated PPE will be disposed of as lead-contaminated waste by XYZ Environmental Co.	A. Falls B. Health Hazards (Lead, Silica Dusts) C. Errant Vehicles	A1. Fall Protection Program A2. Ladder Safety Program B1. Lead Compliance Plan B2. Respiratory Protection Program C. Work-zone Safety Program (MUTCD)	A. Site Supervisor B. IH Consultant C. Site Supervisor/DOT

SITE EMERGENCY/RESCUE PROVISIONS:

Evacuation: An evacuation signal of three short blasts followed by three long blasts of the company equipment truck will alert employees outside of containment of the need to evacuate the area. Because they cannot hear external audible alarms, employees inside the containment area will be alerted to the need to evacuate by signaling through the blast nozzle, closing the nozzle supply valve at the pot according to the same signal above. Evacuating employees will meet at the hygiene trailer for further instructions.

Fall Protection Rescue: Employees who are suspended by lanyards after a fall will be winched to safety using a portable winch if they are conscious. The aerial lift or outside rescue services may also be used to effect a rescue.

Fire: Employees are expected to fight small, incipient stage fires according to training provided. ABC Fire extinguishers will be located in the hygiene trailer and in company vehicles.

First Aid and Emergency Care: A first aid kit will be maintained by the Site Supervisor. At least one employee who has received basic first-aid training will be on site at all times. Minor care can be obtained by taking employees to the Fix-em Minor Emergency Care Center located three blocks from the site on 62nd Avenue. EMT services should be accessed by cellular phone by calling 911. EMTs should be directed to take employees to the Good Samaritan Hospital nearest the worksite.

TRAINING MODULES NECESSARY FOR ALL EMPLOYEES ON THE SITE:

Hazard communication	Hearing conservation
Respiratory protection	Hand-tool safety
Lead training	Flammable liquids
Basic fall protection	Incipient fire-fighting
Ladder safety	Evacuation/first-aid/rescue
Basic electrical safety	Aerial lift safety
Personal protective equipment	Rigging/wire rope fundamentals
Work-zone safety	

SPECIALIZED TRAINING REQUIRED: Blasters: Abrasive Blasting Safety, Respirator Supplied Air Quality Fundamentals

NECESSARY COMPETENT/QUALIFIED PERSONS: See Attached Assignment Sheets

MEETINGS:

Meeting:	*Participants:*
Prepare Site-specific Safety Plan	Project Management, Safety
Pre-bid meeting to identify hazards and cost out control/protection costs	Project Management, Safety, Accounting
Pre-job safety meeting to review/modify the Site-specific Safety Plan Safety Personnel,	Project Manager, Joint S/H Committee, Site Supervisor, DOT
Pre-job safety modules training (see above)	Project Mgr., Safety Personnel, Site Supervisor, Employees
Monthly Project Safety Mtg.	Project Mgr., Joint S/H Committee, Site Supv., Safety Personnel, DOT
Weekly Toolbox	Site Supervisor, Employees
Post-job Assessment	Project Manager, Safety Personnel, Site Supervisor, DOT

SITE INSPECTIONS:

Jobsite inspections will be conducted weekly by a three person team consisting of Les Risk, Safety Director, Sandy Francisco, Site Supervisor and a rotating member of the Joint S/H Committee.

ATTACHMENTS:

Written Hazard Communication Program
Written Lead Compliance Plan
Written Respirator Program
Competent/Qualified Persons Designation Forms

COMPETENT PERSON ASSIGNMENT FORM

PROJECT: 59th Street Bridge Repair and Repainting

SENIOR PROJECT MANAGER: Phil Adelphia

The following activities require the oversight of designated **competent persons**. A competent person is someone who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The following marked activities are applicable to this project, and the designated competent person for the activity is listed.

Subpart/Activity	Applies?	Designated Competent Person(s)
1926. 20: Jobsite Inspections	X	Site Supv: Sandy Francisco Safety Mgr.: Les Risk
1926.53: Ionizing Radiation		
1926.62: Lead Compliance Plan/IH	X	Safety Mgr.: Les Risk Consultants: Industrial Hyenas Consulting Co./L.D. Fiftee, CIH
1926.101: Hearing Conservation/IH	X	Safety Mgr.: Les Risk
1926.103: Respiratory Protection/IH	X	Safety Mgr.: Les Risk IH Consultants: Industrial Hyenas
1926.251: Rigging/Materials Handling	X	Sandy Francisco, Les Risk
1926.354: Welding/IH		
1926.404: Electrical Grounding Assurance		Not NecessaryCGFCIs used throughout site
1926.451: Scaffolding		
1926.500-503: Fall Protection	X	Les Risk, Sandy Francisco
1926.550: Cranes-Annual Inspection		
1926.552: Hoists-Inspections and Tests	X	Les Risk, Sandy Francisco
1926.650-652: Trenching and Excavation		
1926.705: Lift-slab Construction		

1926.752: Ironwork/Structural Steel		
1926.800-803: Underground Construction		
1926.850-859: Demolition		
1926.900: Blasting		
1926.1053-1060: Ladders	X	Les Risk, Sandy Francisco
1926.1101: Asbestos		
1926.1127: Cadmium		

QUALIFIED PERSON DESIGNATION FORM

PROJECT: 59th Street Bridge Repair and Repainting

SENIOR PROJECT MANAGER: Phil Adelphia

The following activities require the oversight or participation of designated **qualified persons**. A qualified person is one who is familiar with the construction and operation of equipment and the hazards involved in the use of the equipment. Additionally, a qualified person is one who by reason of experience or training is familiar with the operation to be performed and the hazards involved.

The following marked activities are applicable to this project, and the designated qualified person(s) for the activity is/are listed.

Subpart/Activity	Applies?	Designated Qualified Person(s)
1926.54: Laser Operations		
1925.55: Assessment of Exposures to Gases, Vapors Fumes, Dusts and Mists	X	Consultants: Industrial Hyenas Consulting Co./L.D. Fiftee CIH
1926.65: Hazardous Waste Operations and Emergency Response		
1926. 403-449: Electrical Safety	X	Safety Director: Les Risk
1926.500-503: Fall Protection	X	Safety Director: Les Risk
1926.550: Cranes and Derricks		
1926.701: Concrete and Masonry Construction		
1926.800: Underground Construction		
1926.900: Blasting and Explosives		
1926.960: Electrical Power Transmission and Distribution		

APPENDIX N

The Use of Ventilated Containment Structures
During Abrasive Blasting

R. Leroy Mickelsen

U.S. Department of Health and Human Services
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Division of Physical Sciences and Engineering
4676 Columbia Parkway - R5
Cincinnati, Ohio 45226
REPORT DATE:
May 12, 1995
REPORT NO.:
ECTB 183-05g
MANUSCRIPT PREPARED BY:
Debra A. Lipps
Published in the Journal of Protective
Coatings and Linings, July 1995

The Use of Ventilated Containment Structures
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4676 Columbia Parkway - R5
Cincinnati, Ohio 45226

ABSTRACT

Three separate ventilated containment systems were evaluated for their effectiveness in minimizing worker lead exposures during abrasive blasting of steel structures. These ventilation containment systems include ventilation during lead paint removal from an oil refinery process tank and two different ventilation systems at a bridge site. Results from these three sites demonstrate that general ventilation alone is not an effective means for controlling the high concentrations of airborne lead generated during abrasive blasting of lead-coated steel structures.

INTRODUCTION

Researchers in the National Institute for Occupational Safety and Health (NIOSH), Division of Physical Sciences and Engineering (DPSE), Engineering Control Technology Branch (ECTB), located in Cincinnati, Ohio, conducted a study of the engineering controls for protecting workers from lead exposure during maintenance of steel structures coated with lead-based paint. As part of this study, three separate ventilated containment systems were evaluated for their effectiveness in minimizing lead exposure during lead paint removal from an oil refinery process tank and two different bridge sites.

A basic need for nearly all steel structures is protection from corrosion. Historically, lead-containing coating systems were used because they were low cost, aesthetically appealing, and corrosion resistant. Periodically, such coating systems must be maintained or completely replaced. To adequately prepare the steel surface to receive a new coating system, the old coating is usually removed.(1) The cleaning process has traditionally been achieved by unconfined abrasive blasting. Abrasive blast devices are designed to deliver a high-velocity stream of abrasive to remove the coating as well as impart an anchor pattern on the metal surface. The workers direct the blasting nozzles at the surface to be cleaned. As the paint is removed, small particles of lead paint, silica (silica from abrasive or from surface coatings), and other debris become airborne. Workers exposed to lead, silica, arsenic, chromium, nickel, zinc, and other health hazards during the paint removal processes frequently exhibit health effects linked to their workplace exposure.(2)

Two environmental requirements have been driving forces for contractors to contain paint chips, dust, and used abrasive during paint removal processes. The Resource Conservation and Recovery Act (RCRA) requires that waste material must be collected, tested, and classified as hazardous or not hazardous.(3) Another requirement, the Clean Air Act, limits levels of particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM10) to a maximum of 150 mg/m³ average concentration over a 24-hour period.(4) The Clean Air Act also limits the amount of airborne lead to 1.5 mg/m³, evaluated as a maximum arithmetic mean averaged over a calendar quarter. Containing environmental emissions has concentrated the contaminants in and around the paint removal containment structures and increased workers' risk of occupational exposure to lead and other waste materials. The primary goal of most ventilation systems at lead paint removal sites is to reduce environmental release, not reduce the occupational exposure.

Occupational exposure to airborne lead at construction sites is regulated by OSHA to no more than 50 mg/m³ as an 8-hour time weighted average.(5) The regulation prescribes air monitoring for workers potentially exposed to lead, blood lead testing for workers exposed to 30 mg/m³ or greater, and medical removal conditions to protect workers who have elevated blood lead levels. The OSHA lead in construction standard should be consulted for details of blood lead monitoring and other requirements.

Exhaust ventilation systems in industrial settings are of two types: local exhaust and general exhaust. Local exhaust systems capture the contaminant near the source of generation; local exhaust systems are not evaluated in this study. The local exhaust system is the preferred control method because a large portion of the contaminant can be captured before it reaches the worker. Examples of local exhaust systems in the paint removal industry are vacuum blast systems and ventilated power tool systems.

General exhaust systems can be used to remove contaminants from the work space by flushing out large quantities of air and replacing it with uncontaminated air. The clean air mixes with the contaminated air resulting in the average concentration of contaminant in the work space being reduced. A ventilation system must supply clean makeup air, maintain air flow within the containment, and exhaust contaminated air.

General ventilation systems are not as effective in controlling contaminants as are local exhaust systems.(6) General ventilation requires large volumes of air for dilution of contaminants. For most abrasive blasting processes, it is impractical to supply the amount of air required to dilute airborne lead concentrations to permissible levels. Good general ventilation design necessitates locating the supply inlets and exhaust outlets so that the worker stays upwind from the dust generation source. In processes where the worker is stationary, this may be easily accomplished. However, for lead paint removal where the workers are constantly on the move through a complex structure, it is practically impossible to stay upwind from the dust generation source at all times.

CASE STUDIES

Sampling Methods

The control techniques were evaluated by collecting and analyzing bulk samples of paint and abrasive along with personal air samples of workers performing the blasting. The bulk samples were collected to determine the amount of lead in the paint and abrasive. The air samples were collected to determine the level of exposure.

Old paint was collected from the steel structures by scraping the surface with a sharp chisel. The bulk paint collection process removed the top and intermediate paint coatings, leaving a metal surface with only traces of the primer coating (less than 10 percent of the surface was covered by thin traces of paint). Bulk samples of unused abrasive were obtained from freshly opened packages. The used abrasive samples were collected by mixing abrasive from five locations within the storage bins or from the containment floor, and taking one sample from the mixture for analysis.

Air samples were collected and analyzed using NIOSH method 7300.[(7)] Filter cassettes were placed outside the loose-fitting hood respirator of blast workers. Earlier personal sampling at abrasive blast work sites resulted in a large number of lost samples. In an attempt to reduce the likelihood of having the cassettes knocked off the workers' lapels and to reduce the likelihood of pinching the tubing between the worker and the scaffolding or steel members, cassettes were attached to the back of the blasters' outer clothing, rather than on the front lapels. This is a deviation from NIOSH testing methods and should not be done if at all possible.

Area air samples for total lead were collected using the same equipment as the personal samples, but were located at fixed points within or adjacent to the containment structure. In addition to the integrated area samples, a Real-time Aerosol Monitor (RAM) was used to measure the respirable dust concentrations inside the containments immediately following abrasive blasting. Output from this instrument is qualitative in nature, providing only relative measures of respirable dust concentrations.

Ventilated Containment for an Oil Refinery Process Tank

Lead-based paint was removed from a process tank at an oil refinery. The tank, about 4.5 feet (1.4 m) in diameter and 12 feet (3.6 m) tall, was mounted on a concrete, 2-foot high (0.6 m) octagonal base. Piping extended above the tank, reaching about 20 feet (6.2 m) above grade (Figure 1). Abrasive blasting with Starblast7 XL (DuPont Company), a staurolite sand typically containing less than 1 percent quartz, was used inside a ventilated containment. The blaster used a type CE, continuous-flow, air-supplied blasting respirator. An adjacent tank similar in size had been blasted previously; however, a quick blast was needed to remove the rust prior to painting. An aluminum scaffold approximately 17 feet (5.2 m) long, 9 feet (2.7 m) wide, and 21 feet (6.4 m) high was erected around the two tanks. A scaffold extension approximately 6 feet (1.8 m) long and 3 feet (0.9 m) wide was added to one side providing room for a ladder to access two plywood platforms which were constructed approximately 8 and 15 feet (2.4 and 4.6 m) from the ground. Personnel from the painting contractor constructed the containment by enclosing the scaffold with 6-mil (0.15 mm) nylon-reinforced polyethylene; a double flap entry was provided in the ladder extension area.

The enclosure was exhausted through three high efficiency particulate air (HEPA) filters by means of pneumatic driven blowers attached to 12-inch (0.3 m) wire-reinforced, polyethylene ducts installed in the east, north, and west sides of the containment. Two of the ducts were preceded by a 2-foot (0.6 m) square prefilter inside the enclosure. Each blower was rated at 2000 cubic feet per minute (cfm) (57 m^3/min) when driven by 90 psi ($6.2*10^5$ N/m^2) air. Fresh air entered through two slits cut into the top of the containment. The slits formed an X-shape opening approximately 4 square feet (0.4 m^2).

The enclosure and exhaust ventilation system contained the particulate and prevent visible environmental release except on a few occasions when the blasting nozzle was directed at the entry flaps or at a weak seal in the containment; at these times visible emissions were observed. Four of five area air samples, located outside and adjacent to the containment, measured less than 1 mg/m^3 of lead. The fifth sample measured 4 mg/m^3 of lead. Assuming an air flow of 6000 cfm (170 m^3/min) evenly distributed over the cross-sectional area of the containment (130 ft^2 [12 m^2]), the average velocity would be about 46 feet (14 m) per minute (fpm). Measured air velocities using a hot-wire anemometer ranged from 20 to 120 (6 to 37 m per minute) fpm (average = 80 fpm) at the opening between the platforms and the structure.

One area sample, located inside the containment on the first plywood platform, collected a lead concentration of 10,000 mg/m^3during the blasting process. The personal exposure sample outside the helmet of the blaster was 22,000 mg/m^3; higher than the area result since the personal sampler was closer to the lead generation source throughout the blasting process. The bulk samples of old paint from the refinery tank averaged 25 (range 23-26) percent lead by weight. Dust levels, as measured by a respirable particulate counter, inside containment decayed rapidly when blasting ceased, dropping 90 percent in the first minute.

Large Ventilated Containment at a Bridge Site

Two separate engineering controls were evaluated at one bridge site consisting of two separate containment, ventilation, and abrasive blasting systems. One control system consisted of abrasive blasting with low silica (<1% by weight) sand, Starblast7 XL (DuPont Company), in a large enclosure made of interconnected canvas tarps suspended from the top of the roadway down to the ground, creating an enclosure with a volume of approximately 200,000 cubic feet (5700 m^3) (Figure 2). The enclosure was ventilated with two 20-inch (0.5 m) diameter exhaust ducts which were suspended from a street light pole; this placed the duct openings approximately 12 feet (3.7 m) above the ground while the abrasive blasting proceeded approximately 40 feet (12.2 m) above the ground. There were no provisions for supply inlets; the seams of the side tarps and other unplanned openings (most openings were at ground level where the side tarps were not adequately fastened to the ground tarps) acted as supply air inlets. Dust was observed regularly escaping this large-bridge containment. The blast equipment area, 15 feet (4.6m) from the containment, had an airborne lead concentration of 210 mg/m^3. The abrasive was used one time and allowed to settle to the floor tarps along with other wastes created by the paint removal process, then it was collected for disposal. The workers donned a continuous-flow, loose-fitting hood respirator prior to entering the containment.

NIOSH researchers, used a fog generator to visually evaluate the air-flow patterns within each containment. Fog within several feet of the exhaust duct vents flowed into the vents. But throughout the rest of the large containment, there was no obvious airflow pattern (mostly stagnant air was observed). The air velocity at the face of each exhaust vent was 5,500 feet (1700 m) per minute (fpm), and the volumetric flow rate was 24,000 cubic feet (680 m^3) per minute (cfm) through the two 20-inch (0.5 m) diameter exhaust ducts. Within the large containment, the average lead exposure of the four blasters' personal samples was 6200 mg/m^3. The dust levels took 17 minutes to decrease 90 percent after dry abrasive blasting ceased. Two concentration decay curves are shown in Figure 3. Quick reductions in dust levels after blasting ceases can result in lower exposures to personnel who enter the containment after blasting. A quick reduction in dust level was obtained at the oil refinery case study site where supply air and air-flow patterns through the containment were considered in the design of the containment and ventilation system.

Small Containment at a Bridge Site

Another system at the bridge site consisted of abrasive blasting with recyclable steel grit in a 3,000 ft^3 (85 m^3) enclosure (8' X 8' X 48') made of an alloy piping for the frame, rigid corrugated polycarbonate panels for the sides, and an aluminum grating floor. The enclosure was suspended from two adjacent I-beams under the bridge (Figure 4). This small enclosure had a supply air fan at one end and an exhaust duct and fan at the other. The sloping walls under the grate flooring directed the used abrasive and wastes to the bottom center of the containment where the materials were removed from the containment. The steel grit was cleaned in an air wash and stored for reuse.

The flow of air within the containment ran perpendicular to structural cross members that connected the two I-beans. Air flow near these cross members was stagnant in some areas and turbulent in others. The average air velocities across the working cross-section were 110 fpm (34 m/minute). The quantity of exhaust air was 6000 cfm (170 m^3/minute) and was moved through a 20-inch (0.5 m) diameter duct.

Abrasive and dust escaped from the small-bridge containment only rarely. The workers donned a continuous-flow, loose-fitting hood respirator prior to entering the containment. Within the small containment, personal lead concentration for three blaster workers ranged from 6,300 to 58,000 mg/m^3 with a geometric mean of 20,000 mg/m^3. The paint samples from the bridge contained approximately 58 (range 57-60) percent lead.

Finally, higher airborne lead concentrations may result from using steel grit that was not adequately cleaned prior to reblasting. Concentrations of lead in the abrasive (based on one sample each) were: 3700 ppm in the dirty grit, 1700 ppm in the cleaned (recycled) grit, and 100 ppm in the new grit. An improved abrasive cleaning system may help reduce airborne lead and dust exposures during abrasive blasting. The amount of exposure attributed to the contaminated abrasive was not determined.

Conclusions and Recommendations

Results from all three ventilation evaluations: the oil refinery containment, the large-bridge containment, and small-bridge containment, demonstrate that general ventilation alone is not an effective means for controlling the high concentrations of airborne lead generated during abrasive blasting of lead-coated steel structures. Abrasive blasting systems currently being used require the operator to work close to the lead and dust generation source. For significant reduction of worker exposure, lead particulate must be controlled before it reaches the blast operator.

Properly designed and functioning general ventilation systems provided for rapid decay of respirable dust levels when blasting ceases. Rapid dust decay may help reduce exposure during re-entry activities such as cleanup; however, it is insufficient to protect the worker from lead exposures during abrasive blasting.

General ventilation may not reduce concentrations of airborne lead and particulate below OSHA standards during abrasive blasting inside containment structures. Therefore, respiratory protection is needed to reduce worker exposure to hazardous airborne substances such as lead. The selection of respiratory protection should be based on workplace exposure data. Respirators should provide enough protection to reduce airborne exposures to acceptable levels. The use of respirators should supplement the continued use of engineering controls and good work practices, and they should not be used as the only means of exposure reduction.

Alternative methods for steel structures maintenance include overcoating, vacuum blasting, vacuum power tools, wet blasting, automated blasting, and chemical stripping. These methods may help to reduce worker lead exposures. Each removal method has particular strengths and weakness. When implementing new workplace procedures or controls, worker exposure monitoring should be conducted to determine the resulting change in exposure.

Table 1: Summary of airborne lead data during dry abrasive blasting

Location	Average sampling time (min)	Mean exposure during sampling and number of samples (mg/m^3)	Exposure range (mg/m^3)
Oil Refinery			
Personal, blaster	215	22,000 (1)	22,000
Area, in containment	370	10,000 (1)	10,000
Area, outside	385	1 (5)	0.1 - 4
Bridge Site			
Large containment			
Personal, blaster	260	6,200 (4)	2,700 -24,000
Area, in containment	450	15,000 (1)	15,000
Area, outside	500	210 (1)	210
Small containment			
Personal, blaster	380	20,000 (3)	6,300 - 58,000
Area, in containment	540	10,000 (1)	10,000
Area, outside	540	18 (2)	17 -20

FIGURE CAPTION LIST

Figure 1. Oil refinery process tank and surrounding scaffolding. Nylon-reinforced polyethylene was placed around this scaffolding to form the containment.

Figure 2. Inside view of the large containment at the bridge site. Ventilation exhaust ducts were suspended from a street light pole.

Figure 3. Dust decay curves for large and small containment systems.

Figure 4. Outside view of the small containment at the bridge site. Fresh air entered at one end of the containment and was exhausted at the other end.

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APPENDIX O

Attendees: Lead/Bridge Workshop

Mike Andrews Health & Safety Rep	International Brotherhood of Painter Allied Trades United Unions Building 1750 New York Avenue, N.W. Washington, D.C. 20006 (202) 637-0744 **FAX** (202) 637-0771
Bernie Appleman* Executive Director	Steel Structures Painting Council 4516 Henry Street, Suite 407 Pittsburgh, PA 15213-3728 (412) 687-1113 Ext. 134 **FAX** (412) 687-1153
James Brownlee Director Environmental Health Services	New Jersey Dept. of Health CN 360 Trenton, NJ 08625-0360 (609) 984-2193 (609) 633-2043 **FAX** (609) 984-2192
John Chisholm* Managing Director Traffic Safety Industry Division	American Road & Transportation Builders Association 1010 Massachusetts Ave., N.W. Washington, D.C. 20001 (202) 289-4434 **FAX** (202) 289-4436
Chuck Downie Loss Control Manager	The George Tomasso Const. Corp. 30 Bank Street New Britain, CT 06051 (203) 224-7686 **FAX** (203) 255-2206
Jeff Ghindea Industrial Hygienist Division of Safety & Hygiene	Bureau of Workers Compensation Columbus Regional Office 6829 Americana Parkway Columbus, OH 43068 (614) 575- 1190 (800) 862-7464 **FAX** (614) 575-1198
Norma Gilbert Specifications Engineer	Virginia Dept. of Transportation 1401 East Broad Street Richmond, VA 23219 (804) 786-2356 **FAX** (804) 225-3118
Brenda Gordon Area Director	Federal OSHA 639 Granite Street, 4th Floor Braintree, MA 02184 (617) 565-6924

	FAX (617) 565-6923
Terry Halkyard Highway Engineer	Federal Highway Administration Office of Technology Application 400 7th Street, S.W. Room 6319, HTA-22 Washington, D.C. 20690 (202) 366-6765 **FAX** (202) 366-7909
William Howe	State of New York Dept. of Transportation Construction Division 1220 Washington Ave. Albany, NY 12232-0410 (518) 457-6475 **FAX** (518) 485-8948
Bob Kogler* Coatings Engineer	Federal Highway Administration 6300 Georgetown Pike, HNR-20 McLean, VA 22101 (703) 285-2018 **FAX** (703) 285-2950
William Kojola* Director Occupational Safety & Health	Laborers' Health & Safety Fund of North America 1225 Eye Street., N.W. Suite 900 Washington, D.C. 20005 (202) 628-5465 **FAX** (202) 628-2613
Ken Lanford Vice President	Lanford Brothers Co., Inc. P.O. Box 7330 Roanoke, VA. 24019 (703) 992-2140 **FAX** (703) 992-213
Greg Laugeni Field Operations Coordinator	A. Laugeni and Son, Inc. 370 Ardale Street P.O. Box 26034 West Haven, CT 06516-6034 (203) 934-5302 **FAX** (203) 934-0562
George Macaluso Senior Industrial Hygienist	Laborers' Health & Safety Fund of North America 1225 Eye Street, N.W. Suite 900 Washington, D.C. 20005 (202) 628-5465 **FAX** (202) 628-2613
Frank Marsh Coordinator of Apprenticeship & Training	International Association of Bridge, Structural and Ornamental Iron Workers Local 401 11602 Norcom Rd. Philadelphia, PA 19154

(215) 676-3474

Kathy Maurer*	CRISP 150 Washington Street Hartford, CT 06106 (203) 566-1454 **FAX** (203) 566-3048
R. Leroy Mickelson Industrial Hygiene Engineer	U.S. Dept. of Health & Human Services Division of Physical Sciences and Engineering 4676 Columbia Parkway Cincinnati, OH 45226 (513) 841-4221
Michael Montopoli Assistant Director	U.S. Dept. of Labor Occupational Safety & Health Administration Office of Occupational Medicine Room N-3653 200 Constitution Ave,. N.W. Washington, D.C. 20210 (202) 219-5003 **FAX** (202) 219-9053
Tom Nunziata, Jr. Program Specialist	Laborers/AGC 37 Deerfield Road P.O. Box 37 Pomfret, CT 06259 (203) 974-0800 **FAX** (203) 974-1459
Ellen Roznowski Industrial Hygienist	U.S. Dept of Labor Occupational Safety & Health Administration Room N-3457 200 Constitution Ave., N.W. Washington, D.C. 20210 (202) 219-8644 **FAX** (202) 219-6594
John Schlecht Deputy Director	Institute of the Ironworking Industry 1750 New York Ave., N.W. Washington, D.C. 20006 (202) 783-3998 **FAX** (202) 393-1507
Robert Smee Environmental Specialist	High Industries 1853 William Penn Way P.O. Box 10008 Lancaster, PA 17605-0008 (717) 293-4506 **FAX** (717) 293-4507
Kent Starwalt Director	American Road & Transportation Builders

Contractors Division & State Activities	Association 1010 Massachusetts Ave., N.W. Washington, D.C. 20001 (202) 289-4434 **FAX** (202) 289-4435
Tim St. Clair Industrial Safety Specialist	Bureau of Workers Compensation Division of Safety and Hygiene S. Central Region Office 6929 Americana Parkway Reynoldsberg, OH 43068 (614) 575-1190 (800) 852-7464 **FAX** (614) 575-1198
Pam Susi* Exposure Assessment Program Director	Center to Protect Workers Rights 111 Massachusetts Ave., N.W. Suite 509 Washington, D.C. 20001 (202) 962-8490 **FAX** (202) 962-8499
Michael Taylor Executive Director	National Association of Demolition Contractors 16 N. Franklin Street Doylestown, PA 18901 (215) 348-4949 (800) 541-2412 **FAX** (215) 348-8422
David Valiante Industrial Hygiene Supervisor	New Jersey Dept. of Health Occupational Health Service CN 360 Trenton, NJ 08625-0360 (609) 984-1863 **FAX** (609) 984-2218
Joe Ventura Labor Liaison	Blue Cross/Blue Shield of Ohio Rock Run North 5700 Lombaro Center, Suite 140 Seven Hills, OH 44131-2587 (216) 573-6615 (800) 245-5272 **FAX** (216) 642-3575
Camille Villanova Safety & Health Specialist	U.S. Dept of Labor Occupational Safety & Health Administration Office of Construction and Engineering 200 Constitution Ave., N.W. N3457 Washington, D.C. 20210

*Steering Committee

APPENDIX P

One tool useful in identifying and controlling hazards in the workplace is the JOB HAZARD ANALYSIS (JHA). In a JHA, the basic sequential steps of a job are listed in column A. In column B, the potential hazards associated with each step are noted. In Column C, recommended actions or procedures to prevent accidents due to the hazards are entered.

JOB HAZARD ANALYSIS FORM

Company:____________________ Date:_______________ Analysis By:____________________

Job Title:____________________ Location:_______________ Page ________ of ________

A.: Step-by-Step Sequence of the Job	*B.: Potential Hazards*	*C.: Preventive Actions*

APPENDIX Q

Subject	**Special Emphasis Program (SEP) for SILICOSIS.**
Information Date	**May 02, 1996**

Text

May 2, 1996

MEMORANDUM FOR: REGIONAL ADMINISTRATORS

FROM: JOSEPH A. DEAR
ASSISTANT SECRETARY

SUBJECT: Special Emphasis Program (SEP) for SILICOSIS

This memorandum provides inspection targeting guidance for implementing an OSHA-wide Special Emphasis Program (SEP) to reduce and eliminate the workplace incidence of silicosis from exposure to crystalline silica. The policy set forth in this memorandum is effective immediately. This SEP covers most SIC codes where an exposure to crystalline silica may exist. Inspections initiated under this SEP shall be scheduled and conducted in accordance with the provisions in the Field Information Reference Manual (FIRM) and the Revised Field Operations Manual (FOM).(1,2) Regional Administrators and Area Directors shall ensure that the procedures established in this memorandum are adhered to in the scheduling of programmed inspections. Regional Administrators shall also ensure thatthe State Consultation Program Managers and the State Plan State Designees in their Regions are appraised and aware of the contents of this SEP and its required Area Office outreach initiatives. In all Federal enforcement states, and state plan states which adopt this program policy, Regional Administrators are to encourage the Consultation Programs' full cooperation and assistance in this Agency-wide effort.

Background information on crystalline silica and silicosis can be found in Appendix A to this document.

Procedures

General Industry Targeting:

Inspections conducted under this special emphasis program shall be scheduled and conducted under the priorities listed below. Wherever possible (data permits) inspections shall be focused to particular establishments where overexposures to crystalline silica are most likely or there are known cases of silicosis. In looking at records mentioned below be advised that a diagnosis of silicosis may include such terminology as pneumoconiosis, fibrosis, respiratory disease, non-malignant respiratory disease, or even congenital heart failure.

The following are suggestions for obtaining information to target inspections at particular establishments or SIC Codes. Area Offices shall determine if any of these suggestions are applicable to their areas and shall attempt to obtain and use such data. The data sources have been prioritized based upon what is considered most beneficial.

Note: In some cases the use of the data may involve lengthy discussions and preparation of Memorandums of Understanding with the respective agency.

- For Area and Regional Offices that have workers compensation data, it shall be evaluated for trigger entries such as silicosis, pulmonary fibrosis, fibrosis, nonmalignant respiratory disease, pulmonary edema, congenital heart failure, and/or scarring of the lungs. Data obtained from this source shall be examined and compared with likely SIC Codes for a determination of whetherthere is a potential for exposure to silica.

- Cross referencing of Agency-collected OSHA 200 data with SIC data may produce inspection sites for the SEP. The Office of Statistics can be contacted to determine the status of the data and the potential for matching certain SIC codes with specific employers. Bear in mind that, this is in the early development phase and will not likely be a good source during the early implementation of this SEP.

- SENSOR Data (Sentinel Event Notification Systems for Occupational Risks) is a NIOSH program of cooperative agreements with state health departments to develop models for state-based occupational disease surveillance programs. There are 11 current cooperative agreements for FY 1995. The program is collecting silicosis data in Illinois, Michigan, North Carolina, New Jersey, Ohio, Texas, and Wisconsin. The Office of Health Compliance can provide the names and phone number/address of state contact persons.

- State Surveillance Systems. Many states have such programs in place. As these become more popular they could represent our best source of data.

- Contacts with local trade unions, especially those involved with painting may provide information useful to developing a targeting system
.

- Hospital Discharge Data. This source may represent a valuable source of data as hospitals sometimes obtain patient work histories. Rosenman (1988), has considerate work on this and can be referred to for more specific information.(3)

- Registry of Occupational Safety and Health (ROSH) data. The Bureau of Labor Statistics (BLS) has been collecting data and has set up special coding for crystalline silica. The BLS can be contacted to obtain this data which cross references with SIC Codes

- Review of local or area morbidity statistics.

- Other possible sources include contacting pulmonary specialists and discussing silica and silicosis with them. Occupational health clinics, can be contacted as well as occupational physicians. One can also contact the Association of Occupational and Environmental Clinics (AOEC) at (202) 347-4976 for clinics in jurisdictional areas.

- The reference list for this memorandum also contains a variety of articles that show different sources of data that can be used in establishing inspection lists.

- Chemical Use Inventories- This is under development by the EPA. Potentially, the database will contain chemical, site specific information which can be used for targeting. Some states (New Jersey) may already have some form of this in place.

Construction Targeting (including maritime where applicable):

In construction, activities such as jack hammering, rock drilling, abrasive blasting, concrete mixing, concrete drilling, brick and concrete block or slab cutting, and guniting are associated with potential exposure to crystalline silica dust.(4) The following points are suggested sources to obtain construction targeting information.

- Data sources found under general industry targeting may be utilized where feasible
- Visual observations of potential crystalline silica generating processes such as rock drilling or abrasive blasting
- Targeting with known high silica hazard operations such as abrasive blasting or rock/well drilling. The local telephone books can be utilized to develop source lists.
- Dodge reports
- Construction activity reports from the University of Tennessee
- Appendix B, contains a list of construction SIC codes where OSHA sampling has found overexposures.
- Review of the "Construction Safety and Health State of the Art Reviews" (1995)(5)

Where CSHOs utilize visual observations for targeting of construction related inspections the following shall be followed:

A. Whenever a CSHO observes or receives information, the CSHO shall:

B.

1. Document the status and condition of the work operation as far as it is known, noting any serious hazards.
2. Note the name and address and location of the worksite or facility and, in construction, the name of the contractor(s) performing the work.
3. Provide the Area Office Supervisor or Area Director with the information. Based upon the information provided, all potential crystalline silica dust exposures brought to the attention of the Area Office shall be inspected as follows:
    - If the worksite has been inspected within the last 30 days, the results of the inspection shall be considered along with the current worksite observations in determining whether or not an inspection is to be conducted.
    - If the crystalline silica dust generating work was notin progress during the previous visit to the site but is currently in progress the inspection shall be authorized and opened.
    - If the crystalline silica dust generating work was in progress and evaluated during the previous inspection, the inspection will be opened only if apparent serious violations are present or can reasonably be expected at the site.
    - If the worksite has not been inspected within the previous 30 days, an inspection shall be conducted unless it is apparent that workers are not exposed to crystalline silica dust.

2. Documentation of the events leading up to the observation shall be maintained by the Area Office in case of a denial of entry.

3. For Area Offices that cannot develop a site specific inspection list from the examples in No. 1, a list of industries under their jurisdiction likely to be involved in crystalline silica-related activities and exposures shall be developed. The tables presented in Appendix B include SIC codes prepared from OSHA's IMIS data. The two tables represent lists of SIC codes where sampling was conducted and where over exposures to crystalline silica were documented. These lists can be used as a starting point for Area Offices to develop a list of SIC Codes and facilities under their jurisdiction where there is the most likely potential for worker silica exposure.

4. Inspection sites using any of the previously discussed methods shall be randomly selected for inspection using a random numbers table. This selection process sets forth administratively neutral criteria to identify establishments for inspection. Area Offices and Regions may first want to cull the list to remove sites recently evaluated or not likely to have hazards associated with crystalline silica. Some lists generated using 4 digit SIC codes will produce sites clearly not likely to have the hazard present.

5. **Focused Inspections**: As with focused inspections in construction(6), those sites targeted for inspection that have implemented an effective and ongoing silicosis prevention program can be exited after the program review. The silicosis prevention program may appear as or be part of the establishment's overall safety and health program. If the facility appears to qualify for a focused inspection based upon management interviews and company documentation the CSHO will verify the program through a brief walkthrough and employee interviews. The CSHO, prior to leaving the facility, shall document that his or her initial review of the site's safety and health program or the site's crystalline silica control program found that the program elements were appropriate and fully effective in providing protection to the affected workers.

   The following is a list of elements which may be included in an effective program [Note: In a facility where exposures are below the permissible exposure limit, CSHOs, for education and information purposes, should make the employer aware of elements that should be included in an effective crystalline silica control program in order toprovide employees at the establishment protection from possiblecrystalline silica over exposure(s).]:

   - ongoing personal air monitoring program*
   - ongoing medical surveillance program
   - training and information to workers on crystalline silica*
   - availability of air and medical surveillance data to workers*
   - an effective respiratory protection program*
   - hygiene facilities and clothing change areas
   - appropriate recordkeeping*
   - personal exposures below the PEL or the facility has an abatement program that also provides for interim worker protection
   - housekeeping program*
   - in construction- a safety and health program*
   - regulated areas

   * Required by specific OSHA standards if an overexposure to crystalline silica exists.

6. This SEP is a nationwide initiative with participation by all Regions and Area Offices. In the case of locally developed Cooperative Compliance Programs such as the Maine 200, the Wisconsin 200, the New Hampshire 50, or other programs developed by redesigned Area Offices, the offices shall work this SEP into their programs.

7. Regions are to begin conducting inspections under this SEP immediately following 60 days of outreach activities. (See Full Service Program Support beginning on page 11.)

8. In construction and maritime, where resources permit, a joint safety and health inspection should be conducted. Referrals to safety compliance officers where appropriate shall be submitted.

9. If CSHOs find a product that contains crystalline silica and downstream exposure is reasonably anticipated (sawing or cutting of brick, tiles, and concrete blocks), they should investigate the adequacy of the material safety data sheets (MSDS) and product labeling. For example, concrete blocks have been found with labels stating "caution, irritant dust", and the MSDS did not address accurately the chronic health hazard.

Application

1. Inspections under this SEP shall address areas of potential crystalline silica dust-related overexposures where there is an increased risk of silicosis. Inspections will include a review of written documentation (i.e. recordkeeping, air monitoring, medical examinations or evaluations, respirator protection, engineering and/or work practice controls, hazard communication, MSD sheets, and training). The CSHO may expand the inspection scope beyond the crystalline silica-related activities if hazards or violations are observed (FIRM CH. II-1).(1)

Note: If the CSHO, based upon professional judgment or sufficient employer monitoring data, determines that employees are not overexposed to crystalline silica the CSHO can close and move to another job site. Prior to exiting, the CSHO should discuss the employer's silica program and provide suggestions and information where appropriate.

2. CSHOs shall question employers to determine whether the employer has conducted personal or area sampling for dust containing crystalline silica. Where such data has been collected copies of the data shall be obtained. CSHO's will also interview the employer to determine whether the employer has conducted any medical surveillance of exposed employees. If such surveillance records exist, copies of the records shall be obtained where necessary to support a violation (medical access orders shall be used where necessary).

   Medical records should be reviewed in consultation with the Office of Occupational Medicine. Appendix C contains recommendations for medical evaluations related to crystalline silica exposure as well as suggestions for a medical monitoring program. Regardless of the level of exposure to crystalline silica, CSHOs should make Appendix C available to the employer.

3. CSHOs shall conduct personal employee monitoring and collect appropriate bulk samples where appropriate to document exposures unless the inspection focused or the employer has documented that no overexposure exists.

4. While evaluating worker exposures to dust containing crystalline silica during abrasive blasting, CSHOs shall also be aware of and evaluate potential exposures to **noise and metals**. Metal exposures often associated with abrasive blasting include but are not limited to: **lead, arsenic, manganese, chromium, cadmium, copper, and magnesium**. Worker clothing contaminated with crystalline silica dust can be carried home and potentially expose family members. Worksites where this potential is observed by the CSHO should be evaluated (including automobiles) and the employer and employee representatives made aware of the hazard of such activity.

5. Citations and classification of violations for overexposures to crystalline silica dust, for respiratory protection, and for work practice and/or engineering controls shall be issued in accordance with the procedures and requirements of the FIRM.(1)

6. For examples of standards that contribute in controlling potential exposures to crystalline silica please refer to Appendix D.

Sampling and Laboratory Submission of Samples

The exposure monitoring shall consist of personal respirable dust samples collected from the worker's breathing zone. Exposure monitoring shall be conducted in accordance with The OSHA Technical manual TED 1.15 and with OSHA Instruction CPL. 2-2.43A, the Chemical Information file (noted as Chemical Sampling Information on the OSHA CD).(6)

As a reminder, all collected samples shall be pre- and post-weighed by the CSHO in accordance with standard agency procedures. The SLTC is now providing filter weighing services to the field. To use the pre-weighed filters supplied by the SLTC with the 10-mm nylon cyclone sampling device assembly, the field must obtain a plastic coupler [contact the SLTC or the Cincinnati Technical Center (CTC) for further information]. The pre-weighed filters can be ordered either from the SLTC or the CTC. If the CSHOs do not use the SLTC pre-weighed filters, they should pre- and post-weigh all collected samples according to the standard agency procedures. Samples shall be desiccated before conducting pre- and post-weighings. Filter cassettes with the 10 mm nylon sampling device will be placed in the workers breathing zone. Full shift samples shall be collected where possible. Sample air volumes of 408 to 816 liters are recommended. A sampling flow rate of 1.7 liters per minute +/- 0.2 liters per minute) should be used with the 10 mm nylon cyclone sampling device. CSHOs should refer to the OSHA Technical manual TED 1.15 for pump calibration information with cyclones.(6) Care needs to be taken to assure that the cyclones are not inadvertently inverted. CSHOs are to check pumps on at least an hourly basis, if possible, and note the flow rates, and document what the worker was doing at the time of the check. If filter overloading is suspected or workers change to another job or procedure, the CSHO shall replace the sampling filter with a new filter and document the time of the changes. Blank filters shall be obtained in accordance with standard procedures. For jobs that are of short duration such as in construction, CSHOs should request that the samples be expedited.(8)

Note: The SLTC will honor a request from a CSHO to have sample analyses "rushed" because of "a short term operation", "severe health problems", "union or media concern", or even if a limited number of samples need to be rushed for a "fast track screening".

Occasionally CSHOs will encounter a work situation where there is mixed exposure to quartz, cristobalite, and/or tridymite. In these situations, CSHOs, in addition to looking at the individual exposures, shall also apply the mixture formula found in Appendix E to the samples.

Sampling for Bulks: For crystalline silica analysis, if available, bulk samples should be submitted to the laboratory under separate cover. Bulk samples can be collected through a variety of means. A bulk, high volume, respirable sample may be the most ideal of the bulk samples. However, this type of bulk sample may not be as practical to collect as a settled dust sample or a sample of the raw materials. The following bulk sample methods are listed in the ideal order of preference:(8)

1. High volume respirable filter sample (preferably > 1.0 grams). Contact the SLTC for information on this.

2. High volume filter sample- nonrespirable (preferably > 1.0 grams)

3. Representative of settled dust [i.e. rafter sample (preferably > 1.0 grams)].

4. Sample of the bulk material in the workplace- preferably 10-20 grams.

Interferences: Interferences can affect the laboratory analyses. However in the vast majority of cases, interferants do not prevent analyses. The SLTC uses X-ray diffraction to analyze for quartz and uses the three most sensitive peaks to minimize interferences and provide conclusive identification. To assist the laboratory, list any potential interferences on the OSHA 91A Form submitted with the samples. In addition, the CSHO should include a copy of the material safety data sheet for the silica containing material if available. Potential interferences on one or more peaks for crystalline silica analyses include but are not limited to the following:(8)

aluminum phosphate
biotite (mica)
clinoferrosilite
feldspar (some)
graphite
high albite
iron carbide
lead chromate
lead sulfate
leucite
microcline
muscovite (mica)
orthoclase
potassium hydroxide
sanidine
sillimanite
wollastonite
zircon

Special Procedures for Construction and Maritime

The crystalline silica exposure limit for the construction and maritime trades in 29 CFR Parts 1926 and 1915 are expressed in terms of millions of particles (of dust) per cubic foot (MPPCF), which is measured using an impinger sampling method. The impinger method of counting dust particles is obsolete, and comparative sampling has established that the formula of 250/[(% quartz) + 5] which sets the mppcf exposure limit described in the maritime and construction standards is equivalent to the general industry PEL of:

$$\frac{10 \text{ mg/m(3)}}{(\text{\% Quartz}) + 2}$$

Therefore the same gravimetric sampling method and the general industry PEL formula should be used in all industries. This evidence is discussed more fully in Appendix F.

Recording in the IMIS

Current instructions for completing enforcement forms OSHA-1, OSHA-7, OSHA-36, and OSHA-90 and Consultation Request Form-20 and Visit Form-30 shall be applied when recording inspections conducted under this SEP as follows:

1. The OSHA-1 Form for any programmed inspection covered under this special emphasis program for crystalline silica in all industries shall be marked "PLANNED" (Item 24h) and "SPECIAL EMPHASIS PROGRAM" (Item 25d) Record **SILICA** in the space in item 25d.

2. The OSHA-1 Form for any unprogrammed inspection shall be marked as unprogrammed (Item 24a. through g. as appropriate). In addition, it shall be marked "SPECIAL EMPHASIS PROGRAM" (Item 25d). Record **SILICA** in the space in Item 25d.

3. For focused inspections covered under this SEP, Item 42 (Optional Information) of the OSHA 1 Form shall be completed according to the guidelines outlined in the memorandum of March 10, 1995, detailing the proper coding for focused inspections (see Appendix G).

4. Whenever an OSHA-7 is completed by a Federal office and the applicable complaint alleges the presence of crystalline silica or related silicates, complete the OSHA-7 in the normal manner, but include the code for silica in "Optional Information" Item No. 46. The following format should be used:

TYPE	ID	VALUE
N	16	SILICA

5. Whenever an OSHA-36 is completed by a Federal office and the inspecting compliance officer(s) is/are able to identify at the site of the fatality/catastrophe the presence of crystalline silica or related silicates, complete the OSHA-36 in the normal manner, but include the code for silica in "Optional Information" Item No. 35. The following format should be used:

TYPE	ID	VALUE
N	16	SILICA

6. Complete the OSHA-90 in the normal manner and enter the code "SILICA" in "Optional Information" Item No. 26, when an OSHA-90 is completed by a Federal office and the applicable referral case has crystalline silica as one of the subject of the file. The following format should be used:

TYPE	ID	VALUE
N	16	SILICA

Consultation

Whenever a visit is made in response to this SEP, Consultation Request, and/or Visit forms are to be completed as follows:

1. Complete the Request Form-20 in the normal manner and enter the code "SILICA" in "Optional Information", Item No. 26, when a visit has been made in response to the SEP. The following Information should be used:

TYPE	ID	VALUE
N	16	SILICA

2. Complete the Visit Form-30 in the normal manner and enter the code "SILICA" in "Optional Information", Item No. 34, when a visit has been made in response to the SEP. The following Information should be used:

TYPE	ID	VALUE
N	16	SILICA

Full Service Program Support

Each Area Office/Region is encouraged to develop outreach programs that will support the enforcement effort. Such program could include letters to employers, professional associations, the Associated General Contractors (AGC), local unions, Associated Builders and Contractors, local safety councils, apprenticeship programs, local hospitals and occupational health clinics, and/or other industry employer organizations that work with or potentially generate crystalline silica dust. Speeches, training sessions, and/or news releases through the local news papers, safety councils and/or industrial hygiene organizations can provide another avenue for dissemination of information. A generalized crystalline silica/SEP news release will be prepared by the National Office and made available to each Region. All OSHA Consultation Program offices will be provided with a copy of the SEP memorandum. In those states which are participating in the program, Regional Administrators shall ensure the coordination between Area Directors and the State Consultation Program manager to encourage their assistance in outreach efforts in support of this program. Existing local silica/silicosis expertise within state Consultation program office may provide valuable assistance to the Area Office staff in their various outreach efforts. Consultation projects may also have already developed or have available to them written, audio visual, or materials in other formats on working safely with silica and/or worker safety and health training materials that may be helpful to the Area Office. State Consultation projects are provided specific instruction in this document for coding consultative visits made for requests for assistance in response to this SEP. Requests for Consultative visits from employers as a result of OSHAs Silicosis SEP are to be given priority over other visit requests, as appropriate.

The Office of Health Compliance Assistance in conjunction with the OSHA Training Institute will develop crystalline silica related information and training materials. This information will be made available to the Regional Offices for distribution to their respective field offices.

Area Offices are encouraged to develop a list of industries and contractors involved in crystalline silica related work and potential exposures. Once the list has been generated, each entry can be contacted (if resources permit) in writing and provided with a copy of this memorandum and general information available about crystalline silica.

To assist the Agency in outreach, Area and Regional Offices through the Silica SEP Coordinator should be compiling a list of frequently asked questions (FAQs) that are received a long with their full responses. These FAQs would then be periodically forwarded to the Office of Health Compliance Assistance. The FAQs could include questions like the following:

1. How does the OSHA PEL of 10/(% Quartz + 2) compare to the ACGIH TLV of 0.1 mg/m(3) or the NIOSH REL of 0.05 mg/m(3)?
2. How do I perform a mixture calculation if the sample contains both quartz and cristobalite?
3. How are we able to use a PVC filter with a 5 um pore size to capture down to submicron size dust?
4. Can I sample using low ash 0.4 um pore size AA (MCEF) filters instead of low ash PVC filters?
5. Why do we use nylon cyclones rather than metal cyclones?
6. How do I perform a leak test of the cyclone?

Measuring Acency Impact

Each Region shall designate an individual as the silica SEP Coordinator. The identified individual shall coordinate crystalline silica inspection activities and work with the Office of Health Compliance Assistance to collect and evaluate the effect and success of this program. Measuring Agency impact can be broken down into an interim component and a finalcomponent. In the interim, the Office of Health Compliance Assistance will collect and evaluate IMIS data through coding on the OSHA-1 for this SEP. In the long-term, the Regional Silica Coordinator in conjunction with the Office of Health Compliance Assistance will collect information on the development of new and feasible engineering and work practice control techniques, controls through substitution with other materials (for example some nonferrous foundries have found that with equipment modification they can use olivine sand), in place of silica sand, medical programs implemented, airborne personal monitoring programs in place, examples of silica control plans or exemplary workplace safety and health programs with effective silica control program elements, numbers of inspections that were focused, and the like.

Area Offices or the Regions, under this SEP, will need to maintain a file containing abatement information from their inspections and a summary of any medical programs related to silica exposure in effect. The data shall include both recommended and implemented abatement information for the specific type of operation that was evaluated. Such information shall also include a reference to the inspection number.

This program will run through Fiscal Year 1997. At the end of Fiscal Year 1997 the program will be regionally evaluated by each Regional Silica Coordinator. A written evaluation will be submitted to the Director of the Office of Health Compliance Assistance discussing the program operation in their respective Regions, the effectiveness, problems encountered, any recommendations for changes or additions to the program, and finally a recommendation on whether or not to continue the program. The Office of Health Compliance Assistance will evaluate these Regional Report and will make a recommendation to the Director of Compliance Programs on whether or not to continue the program. A final report on the program will be prepared by the Office of Health Compliance Assistance evaluating the effectiveness of this SEP.

Federal Program Change

This is a federal program change that impacts state programs. The Regional Administrator (RA) shall ensure that this change is promptly forwarded to each state designee using a format consistent with the Plan Change Two-way Memorandum in Appendix A, OSHA Instruction STP 2.22A, State Plan Policies and Procedures Manual (SPM). The RA shall explain the content of this change to the state designees. States are encouraged, but not required, to adopt an identical or alternative policy. States shall be asked to provide preliminary notification to the RA within 30 days from the date of this instruction of their intent to adopt or not to adopt the SEP established by this memorandum. The state shall formally respond to this change with an indication of its final determination within 70 days in accordance with paragraph I.1.a.(2).(a). and (b), Chapter III of Part I of the SPM. If the state adopts identical compliance procedures, the Plan Change Two-way Memorandum plus a copy of the state's cover memo or directive transmitting these procedures to its field staff will suffice as the plan supplement. If the state adopts different compliance procedures, a copy of the procedures shall be provided to the RA within six (6) months from the date of this memorandum.

In those state plan states where the PEL in construction or maritime is the same as OSHAs (units in MPPCF) the states are urged to follow the procedures spelled out in Appendix F. States are also strongly encouraged to use all the sampling and analytical methods in this memorandum when they evaluate crystalline silica, regardless of whether they adopt the SEP. These procedures are the same as those in the OSHA Technical Manual. As with any complex sampling procedures, states not having the necessary laboratory equipment for the analyses may contact the Salt Lake City Laboratory for assistance.

The RA shall review policy, procedures, and instructions issued by the state and monitor their implementation as provided in a performance agreement or through routine monitoring focusing on impact and results.

Distribution: National, Regional, and Area Offices
All Compliance Officers
State Designees
State Consultation Project Managers
NIOSH regional Program Directors
MSHA

Appendix A

Background: Crystalline Silica and Silicosis

Crystalline silica is a ubiquitous substance which is the basic component of sand, quartz and granite rock.(9) Airborne crystalline silica occurs commonly in both the work and non-work environments. Occupational exposure to crystalline silica dust has long been known to produce silicosis, a pneumoconiosis or dust disease of the lung. Activities such as sandblasting, rock drilling, roof bolting, foundry work, stonecutting, drilling, quarrying, brick/block/concrete cutting, gunite operations, lead-based paint encapsulant applications, and tunneling through the earth's crust can create an airborne silica exposure hazard. In addition some recently noted exposures to crystalline silica include the following:

- Calcined diatomaceous earth can contain anywhere from <1% to 75% cristobalite. In addition to use as a filtering media, calcined diatomaceous earth is often used in industries such as food and beverage preparation where only food grade products and equipment can come in contact with foods or beverages being made.

- Asphalt paving manufacturing may also be a source of crystalline silica exposure, due to the mechanical formation of crystalline silica dust when sand and aggregate passes through rotary dryers. The fine dust can have significant amounts of crystalline silica, depending upon the source of the aggregate. For example, rotary drying of gravel from the Willamette river in Oregon was found to generate dust containing approximately 7 to 12% quartz. The waste dust was transferred periodically by front loader, resulting in clouds of visible dust drifting to the operator.

- The repair or replacement of linings of rotary kilns found in pulp and paper mills and in other manufacturing locations as well as the linings in cupola furnaces are potential sources of crystalline silica exposure. This work may not be commonly seen due to the infrequency and less visible nature of the work location. Turnarounds and yearly shutdowns are the time when this work commonly occurs.

- In food processing operations where crops such as potatoes and beans are readied for market, silica overexposures have been documented in the sorting, grading and washing areas.

Geologically, quartz is the second most common mineral in the earth's crust. Quartz is readily found in both sedimentary and igneous rocks. Quartz content can vary greatly among different rock types, for example: granite can contain anywhere from 10 to 40 percent quartz; shales have been found to average approximately 22 percent quartz; and sandstones can average almost 70 percent quartz. Silica is a general term for the compound silicon dioxide (SiO(2)). Silica can be crystalline or amorphous. Different crystalline silica structures exist as polymorphs of silica and include quartz and less common forms such as cristobalite and tridymite. The latter two are less stable than quartz which accounts for the dominance of the quartz form. Quartz can exist as two sub-polymorphs, a-quartz or low quartz, and B-quartz or high quartz. Of these two forms, a-quartz is more common as the B-quartz is apparently only stable at temperatures above approximately 570 degrees centigrade. Upon cooling, B-quartz quickly converts to a-quartz. In the literature, crystalline silica is commonly referred to as silica sand, free-silica, quartz, cristobalite, and tripoli. When diatomaceous earth is subjected to pressure or is processed (calcined) at temperatures above 1000 degrees C some of the amorphous silica is converted to crystalline silica in the form of cristobalite.(11) Recent articles have documented the creation of cristobalite in "after-service" refractive ceramic fiber insulation.(12-14) Amorphous silica has been found to exist in nature as opal flint, siliceous glass, diatomaceous earth and vitreous silica.(15)

Silicosis is one of the world's oldest known occupational diseases with reports dating back to ancient Greece. Since the 1800's, the silicotic health problems associated with crystalline silica dust exposure have been referred to under a variety of common names including: consumption, ganister disease, grinders' asthma, grinders' dust consumption, grinders' rot, grit consumption, masons' disease, miner's asthma, miner's phthisis, potters' rot, sewer disease, stonemason's disease, chalicosis, and shistosis. Silicosis was considered the most serious occupational hazard during the 1930's, and was the focus of major federal, state, and professional attention during this time.(10) The hazard is still present 60+ years later.

Crystalline silica is commonly found and used in the following industries:

- electronics industry
- foundry industries
- ceramics, clay and pottery, stone, and glass industries
- construction
- agriculture
- maritime
- railroad industry (setting and laying track)
- slate and flint quarrying and flint crushing
- use and manufacture of abrasives
- manufacture of soaps and detergents
- mining industries.

Perhaps the most familiar use of quartz sand is as an abrasive blasting agent to remove surface coatings prior to repainting or treating. A recent alert published by the National Institute for Occupational Safety and Health (NIOSH) estimates that there are more than one million American workers that are at risk of developing silicosis. Of these workers, NIOSH further estimates that more than 100,000 are employed as sandblasters.(16)

In the United States, from 1968 through 1990 the total number of deaths where silicosis was reported anywhere on the death certificate was 13,744. Of these, approximately 6,322 listed silicosis as the underlying cause of the death.(17) In this study, deaths in the United States due to silicosis was primarily concentrated in 12 states (California, Colorado, Florida, Illinois, Michigan, New Jersey, New York, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin.) The silica-related deaths in these 12 states accounted for 68% of the total silica related deaths in the United States. By industry, construction accounted for 10% of the total silicosis-related deaths.(17)

Based upon the wide spread occurrence and use of crystalline silica across the major industrial groups (maritime, agriculture, construction, and general industry), and in consideration of the number of silicosis related deaths, the NIOSH estimates for the number of exposed workers, and the health effects of crystalline silica dust exposure (e.g., pulmonary fibrosis, lung and stomach cancer), the Agency is implementing a nationwide special emphasis program to assure worker protection from over exposure to crystalline silica dust.

Health Effects of Silica Exposure

Inhalation of crystalline silica-containing dusts has been associated with silicosis, chronic obstructive pulmonary disease, bronchitis, collagen vascular diseases, chronic granulomatous infections such as tuberculosis, and lung cancer. In general, aerosols of particulates can be deposited in the lungs. This can produce rapid or slow local tissue damage, eventual disease or physical plugging. Dust containing crystalline silica can cause formation of fibrosis (scar tissue) in the lungs.(9)

The inhalation of free crystalline silicon dioxide (SiO(2)) can produce a fibrotic lung disease known as silicosis. Particle size, dust concentration and duration of dust exposure are important factors in determining the attack rate, latency period, incidence, rate of progression and outcome of disease. A higher attack rate and severity of silicosis is seen with heating crystalline silica-containing materials to greater than 800 degrees C to transform SiO(2) into tridymite and cristobalite (both of which occur naturally and are also found in synthetic silica preparations). High cristobalite concentration also result from direct conversion of diatomaceous earth following heat and/or pressure and can be found in the superficial layers of refractory brick which have been repeatedly subjected to contact with molten metal.(9)

NIOSH has classified three types of silicosis, these include acute, accelerated, and chronic.

Acute Health Effects: Intense crystalline silica exposure has resulted in outbreaks of acute silicosis referred to medically as silico-proteinosis or alveolar lipoproteinosis-like silicosis. Initially, crystalline silica particles produce an alveolitis (inflammation in the gas exchange area of the lung) which is characterized by sustained increases in the total number of alveolar cells, including macrophages, lymphocytes and neutrophils. The alveolitis has been found to progress to the characteristic nodular fibrosis of simple silicosis.

A rapid increase in the rate of synthesis and deposition of lung collagen has also been seen with the inhalation of crystalline silica particles. The collagen formed is unique to silicainduced luna disease and biochemically different from normal lung collagen.(18)

Accelerated Health Effects: Accelerated silicosis may occur with more intense exposure over 5 to 15 years. Fibrotic nodules are generally smaller and the massive fibrosis often occurs in the mid-zones in the lungs.

Acute and accelerated silicosis have been associated with abrasive blasters.

Chronic Health Effects: Chronic silicosis usually takes 20 to 45 years to develop as a result of prolonged exposure to free crystalline silica. Nodular lesions tend to form in the upper lobes. In the simple stage of silicosis, symptoms and impairment of pulmonary function are uncommon. If progressive massive fibrosis (PMF) forms from the coalescence of fibrotic nodules the disease usually progresses, even following removal from exposure. Symptoms of silicosis may not develop for many years. Shortness of breath with exertion is the most common symptom of established silicosis. Cough and expectoration may develop with disease progression, especially in cigarette smokers. Wheezing typically only occurs when conditions such as chronic obstructive bronchitis or asthma are also present. Significant abnormality on a chest x-ray may not be seen until 15 to 20 years of exposure have occurred.

When advanced disease and progressive massive fibrosis are present there is distortion of the normal architecture of the lung. Airway obstruction may occur from contraction of the upper lobes of the lung. Emphysematous changes may develop in the lower lobes of the lung.(19)

Cancer: The issue of crystalline silica exposure and cancer is a complicated one with disagreement in the literature.(20) In worst case, exposure to respirable crystalline silica dust has been associated with lung cancer.(20-26) There also has been the suggestion of stomach cancer associated with ingestion of crystalline silica.(7) The International Agency for Research on crystalline line silica and Cancer (IARC) in examining the carcinogenesis of silica has published monographs regarding crystalline some silicates. IARC determined that there is sufficient evidence for carcinogenicity in experimental animals with limited evidence for carcinogenicity in humans and has classified silica as a 2B carcinogen.(21) IARC is in the prcess of revisiting the crystalline silica carcinogen issue based upon recent epidemiological studies.

Studies have demonstrated a statistically significant, doserelated increase in lung cancer in several occupationally exposed groups. Winter (1990) observed that the lung cancer risk for pottery workers increased with estimated cumulative exposure to low levels of silica found in potteries. Another study also found that the risk of lung cancer among pottery workers was related to exposure to silica, although the dose-response gradient was not significant (McLaughlin, et al., 1992). An adjustment for possibly confounding exposure to polycyclic aromatic hydrocarbons slightly raised the odds ratios for exposure to silica. This study also analyzed lung cancer risk in tin miners in China and found a significant trend of increasing risk of lung cancer with increasing cumulative respirable silica exposure. A significant dose-response relationship between death from lung cancer and silica dust particle-years has also been demonstrated for South African gold miners (Hnizdo and Sluis-Cremer, 1991). In this study a synergistic effect on lung cancer risk was found for silica exposure and smoking. Lung cancer risk among workers in the diatomaceous earth industry has been studied by Checkoway, et al. (1993). Results showed increasing risk gradients for lung cancer with cumulative exposure to crystalline silica. The authors felt that this finding indicated a causal relation. Several studies have demonstrated a relationship between the degree of silicosis disability and risk for lung cancer (Goldsmith, 1994). Since severity of silicosis reflects silica exposure, this may also indicate a dose-response relationship for silica exposure and lung cancer (Checkoway, 1993).

For additional information please refer to references No. 22-26.

Note: Due to the potential association between exposure to dust containing crystalline silica and the development of lung and stomach cancer, one may find facilities where the employer is evaluating or has evaluated this exposure using thoracic samplers. Thoracic dust is defined as that portion of inhaled dust that penetrates the larynx and is available for deposition within the airways of the thorax. Thoracic dust includes the respirable fraction. The collection of thoracic dust samples currently is not a method used by the Agency. Area Offices need to be aware that thoracic sampling devices are currently available and one may run across the use of these samplers during inspections, For more information one can consult with the OSHA Salt Lake Technical Center (SLTC) or the Office of Health Compliance Assistance.

Appendix B

SIC Codes where overexposures to crystalline silica dust have been documented(22)

SIC CODE	Industry Type
0723	Crop preparation services for market
1542	Nonresidential construction
1622	Bridge, tunnel, and elevated highway construction
1629	Heavy construction
1721	Painting and paper hanging
1741	Masonry and other stone work
1799	Special trades contractors
3255	Clay refractories
3321-2	Foundries
3325	Foundries
3365	Foundries
3441	Fabricated structural metal
3443	Fabricated plate work
3479	Metal coating and engraving and allied services.
3543	Industrial patterns
3731	Shipbuilding and repair

SIC Codes where sampling has been conducted for crystalline silica dust during the previous three years and overexposures were not found.

SIC CODE	Industry Type
1389	Oil and gas field services not elsewhere classified
1611	Highway and street construction
1771	Concrete work
1793	Glass and glazing work
1794	Excavation work
1795	Wrecking and demolition
2851	Paints, varnishes, lacquers, enamels, and allied products
2951	Asphalt paving mixtures and blocks
3088	Plastics plumbing fixtures
3089	Plastics products not elsewhere classified
3251	Brick and structural clay and tile
3281	Cut stone and stone products
3264	Porcelain electrical supplies
3272	Concrete products except brick and block
3297	Nonclay refractories
3324	Steel investment foundries
3363	Aluminum die castings
3364	Non-ferrous die castings
3366	Copper foundries
3369	Nonferrous foundries
3431	Enameled iron and metal sanitary ware
3444	Sheet metal works
3492	Fluid power valves and hose fittings

3498	Fabricated pipe and pipe fittings
3523	Farm machinery and equipment
3533	Oil and gas field machinery and equipment
3561	Pumps and pumping equipment
3569	General industrial machinery and equipment
3599	Industrial and commercial machinery and equipment not elsewhere classified
3648	Lighting equipment, not elsewhere classified
3715	Truck trailers
3823	Industrial instruments for measurement
4789	Transportation services
5199	Nondurable goods
7261	Funeral services and crematories
7363	Help supply services
7538/9	General automobile repair shops
7699	Repair shops and related services

Appendix C

Medical protocol recommendations for exposure to crystalline silica: (28-48)

A. MEDICAL EXAMINATIONS

The following are the recommended medical procedures for individuals chronically exposed to crystalline silica or for individuals who have received one or more severe acute exposures to crystalline silica.

1. A baseline examination which includes a medical and occupational history to elicit data on signs and symptoms of respiratory disease prior to exposure to crystalline silica. The medical examination emphasizing the respiratory system, should be repeated every five (5) years if under 20 years of exposure and every two (2) years if over 20 years of exposure. The medical examination should be repeated more frequently if respiratory symptoms develop or upon the recommendation of the examining physician.

2. A baseline chest x-ray should be obtained prior to employment with a follow-up every 5 years if under 20 years of exposure and every 2 years if over 20 years of exposure. A chest x-ray may be required more frequently if determined by the examining physician.

3. Pulmonary Function Tests (PFT): Should include FEV1 (forced expiratory volume in 1 second), FVC (forced vital capacity) and DLCO (diffusion lung capacity). PFTs should be obtained for a baseline examination with PFTs repeated every 5 years if under 20 years of exposure and every 2 years if over 20 years of exposure. PFTs may be required more frequently is respirable symptoms develop or if recommended by the examining physician.

4. A chest x-ray should be obtained on employment termination.

B. MEDICAL MANAGEMENT

The chest x-ray should be a chest roentgenogram (posteroanterior 14" x 17" or 14" x 14") classified according to the 1970 ILO International Classification of radiographs of Pneumoconiosis by a certified class "B" reader. The medical follow-up should include the following procedures:

1. With a positive chest x-ray (1/0 or greater) the worker should be placed in mandatory respiratory protection, or if already wearing a respirator, the program should be reevaluated to assure proper fit and that the elements of 29 CFR 1910.134 are being met.

2. The worker should be referred to a physician specializing in lung diseases for a medical evaluation and medical monitoring as warranted by the examining physician. A written opinion from the examining physician as to whether the employee has any detected condition that would place the worker at an increased risk should be provided to the employer and employee, while specific medical findings remain confidential.

3. All medical test results should be discussed with the worker by the physician.

4. In accordance with 29 CFR 1910.20, medical records shall be maintained for at least 30 years following the employee's termination of employment, unless the employee is employed for less than one year and the records are provided to the employee upon termination.

Appendix D

The following list of standards includes those standards, that may, under appropriate inspection conditions be cited for crystalline silica overexposure under this SEP. The standards listed below are for general industry, maritime, and construction standards.

OSHA Requirement	Gen. Ind. Std.	Const. Std.	Maritime Std.
Respiratory protection	1910.134	1926.103	1915.152
Permissible Exposure limit and controls	1910.1000	1926.55 & .57	1915.1000
Accident prevenetion & warning signs	1910.145	1926.200	--
Access to employee exposure and medical records	1910.20	1926.33	1915.1120
Osha 200 forms	1904	1904, 1926.22	1904
Abrasive blasting breathing air, enclosures, controls	1910.94	1926.28, 55, 95, 100, 101, 102, 103, and 300	1915.131, 133, 151, 152, 153, and 1000
Hygiene	1910.141	1926.27 and 51	1915.97
General PPE	1910.132	1926.28, 95, 100-105	1915.151-154
Hazard Communication	1910.1200	1926.59	1915.1200

Safety and Health program	--	1926.20	--
General training	--	1926.21	--

Appendix E

Sample Calculation for a mixture of crystalline silica:(8)

Two consecutive samples from the same employee taken from a combined exposure to crystalline silica dusts have the following results:

	Sampling	Total	Respirable	Respirable	Laboratory
Sample	Period	volume	weight	concentration	results
	(Min.)	(Liters)	(mg)	Mg/m(3)	(%)
A	238	405	0.855	2.1	5.2 quartz 2.3 cristobalite ND tridymite
B	192	326	0.619	1.9	4.8 quartz 1.7 cristoblite ND tridymite
TOTAL	430	731	1,474		

ND = Non Detected

Calculation of the TWA from the sampling and analytical data:

Step No. 1: Calculate the percentage of quartz, cristobalite, and tridymite in the respirable particulate collected

a. Quartz:

Percentage =
(weight of quartz in Sample A) + (weight of quam in sample B) x (100)

Total weight of respirable particulate collected

= 0.52(0.855 mg) + 0.048(0.619 mg) x (100)

(0.855 mg + 0.619 mg)

= 0.044 mg + 0.03 mg x (100) = 0.074 mg x (100) = 0.05(100) = 5%

1.474 mg   1.474 mg

b. Cristobalite:

Percentage =

$$\frac{(\text{wt. of cristobalite in sample A})+(\text{wt. of Cristobalite in sample b}) \times (100)}{\text{Total weight (wt.) of respirable particulate collected}}$$

$$= \frac{0.023(0.855\text{ mg}) + 0.017(0.619\text{ mg}) \times (100)}{1.474\text{ mg}}$$

$$= \frac{0.02\text{ mg} + 0.011\text{ mg}}{1.474\text{ mg}} \times (100)$$

$$= \frac{0.031\text{ mg}}{1.474\text{ mg}} \times (100) = 0.021(100) = 2.1\% = 2\%$$

c. Tridymite: None Detected = 0%

Step No. 2 Calculate the PEL for the mixture (use the formula in the OSHA Technical manual Appendix I-1.5)

$$\text{PEL(mixture)} = \frac{10\text{ mg/m(3)}}{[\ \%\text{ quartz} + 2(\%\text{ cristobalite}] + 2(\%\text{ tridymite}) + 2]}$$

$$= \frac{10\text{ mg/m(3)}}{[5.0 + 2(2.0) + 2(0) + 2]}$$

$$= \frac{10}{11} = 0.91\text{ mg/m(3)}$$

Step No. 3 Calculate the employee's exposure to respirable dust

$$\text{Exposure} = \frac{(\text{sample weight A} + \text{Sample weight B})}{\text{Total volume of air sampled}}$$

$$= \frac{(0.855\text{ mg} + 0.619\text{ mg})}{731\text{ liters (1 m(3)/1000 liters)}}$$

$$= 2.0\text{ mg/m(3)}$$

Step No. 4 Adjust (where necessary) for sampling period less than 8-hours. Assume a zero exposure time for the sampling period remaining.

$$\text{Adjusted Exposure} = \frac{(2.0\ \text{mg/m(3)})(430\ \text{minutes}) + 0(50\ \text{minutes})}{480\ \text{minutes}}$$

$$= \frac{2.0\ \text{mg/m(3)}\ (430\ \text{minutes}) = 1.8\ \text{mg/m(3)}}{480\ \text{minutes}}$$

Step No. 5 Calculate the Severity of the exposure:

$$\text{Severity} = \frac{\text{Adjusted Exposure}}{\text{PEL(mixture)}}$$

$$= \frac{(1.8\ \text{mg/m(3)})}{(0.91\ \text{mg/m(3)})} = 2.0$$

If the result from Step 5 is greater than 1.0 than an overexposure to the mixture of crystalline silica exists.

Appendix F

Permissible Exposure Limits for Construction and Maritime:

OSHA's silica standards, promulgated pursuant to section 6(a) of the OSHAct, adopted the identical 1968 (General Industry) and 1970 (construction and maritime) ACGIH TLVs, which were expressed in terms of mppcf, but contained a notification that ACGIH intended to begin to express the silica TLV in gravimetric (mg/m(3)) terms.(49-51) The 1968 and 1970 TLV tables therefore included two formulas.

Formula No. 1: $$\text{PEL} = \frac{250}{(\%\ \text{quartz}) + 5}\ \text{mppcf}$$

or

Formula No. 2: $$\text{PEL} = \frac{10}{\%\ \text{quartz} + 2}\ \text{mg/m(3)}$$

The 1968 and 1970 TLV documentation described the advantages of the newer gravimetric sampling method, which yields results expressed mg/m(3), over the impinger sampling method, which yields results expressed in mppcf.(49-51) These advantages include the gravimetric sampling method's ability to account for the particle size and respirability of collected dust, and the facts that only a single sample need be collected to determine both the quartz content and the concentration of the dust and that the samples do not need to be analyzed within 24 hours. Moreover, the results are likely to be more accurate because, unlike impinger samples, they will not be affected by the possible agglomeration of collected dust during processing. The documentation also explained that the two formulas provided equivalent limits, and stated ACGIH's intent to drop the mppcf formula entirely from future TLV editions.(49-51) Beginning in 1972, silica TLVs have been expressed exclusively in gravimetric terms.(51) ACGIH made clear that the purpose of this change was to take account of improved sampling and analytical procedures, and not to change the TLV in any way:

"The impinger method requiring a counting procedure for evaluating relative dustiness, although extremely valuable in judging dust reduction, falls short of the ideal in relevance to health hazard, in simplicity, in reproducibility, and in unit cost. By the use of size-selective (cyclones) sampling devices, a fraction of dust may be collected which is capable of penetrating to the gas-exchange portion of the lung, where long-term retention occurs. The concentration of airborne quartz in this size fraction should relate more closely to the degree of health hazard. Mass methods also have advantages in reproducibility, lower cost, and simplicity.

Data on long-term quartz exposures and their effects, using respirable mass measurements of dust, are not yet available. However, comparisons of impinger-count concentration and respirable-mass concentration show that the 9-10 MPPCF of granite dust suggested by Russell contains 0.1 mg/m(3) of respirable quartz.(52) The formula, TLV = 10/(% respirable quartz) mg/m(3) generalizes this relationship to all percentages of quartz in respirable dust. If the TLV were used only for dust containing at least 5% quartz, the above TLV formula would be satisfactory, but to prevent excessively high respirabledust concentrations when the fraction of quartz in the dust is less than 5%, a constant has been added in the denominator, as with the counting TLV, giving the formula, TLV = 10/(% respirable quartz + 2) mg/m(3). The additive constant "2" limits the concentration of respirable dust with <1% quartz to 5 mg/m(3). The above TLV has been demonstrated to give evaluations comparable to the impinger method in foundry dust exposures (emphasis added).(53) Where agglomerates are a factor, the results by the respirable mass method are more closely related to the hazard."(51)

OSHA's general industry standard, 29 C.F.R. 1910.1000, adopted in 1971, included both formulas as equivalent exposure limits. The construction and maritime standards, adopted in 1974, however, included only the mppcf formula. No reason was given for this distinction. In fact, OSHA's 1971 adoption of both formulas in its general industry standard makes clear the agency's agreement with ACGIH's position that the two formulas are substantively equivalent.

Since the PELs were adopted, the impinger sampling method has been rendered obsolete by gravimetric sampling. OSHA is not aware of any government agencies or employers in this country that are currently using impinger sampling to assess worker exposure to dust containing crystalline silica, and impinger samples are generally recognized as being less reliable than gravimetric samples. OSHA has determined that sampling procedures in the construction and maritime industries should the same as in general industry, and that the mppcf PELs in 29 C.F.R. 1915.1000 and 1926.55(a) are equivalent to the mg/m(3) PEL in 29 C.F.R. 1910.1000.

Appendix G:

March 10, 1995

MEMORANDUM FOR:	REGIONAL ADMINISTRATORS AREA DIRECTORS
FROM:	JOHN B. MILES, JR., DIRECTOR DIRECTORATE OF COMPLIANCE PROGRAMS
SUBJECT:	CORRECTING CODING OF FOCUSED INSPECTIONS IN CONSTRUCTION

On February 21, 1995 a memorandum was sent to Regional Administrators amending paragraph B.12 of the Focused Inspections in Construction Instructional Materials detailing changes in how focused inspections are to be recorded in the IMIS. Due to the strict edit procedures that will be implemented on

March 15 (see start of day message on February 27), Area Offices are requested to update all previous focused inspections in construction entered in the IMIS since October 1, 1994 according to the new instructions. These records must be updated to provide proper reporting of focused inspection data on micro-to-host, ad-hoc and standard reports and to allow modifications to existing records. An inspection scan report can be run for FY 95 inspections selecting an Optional Information N-14 to identify existing records. Please make sure you identify the controlling contractor and the subcontractors when multiple inspections occurred on a site.

Please follow exactly the instructions listed below for coding and updating focused inspections in construction. If you have any questions, please contact John Franklin at (202)219-4470.

B. SPECIFIC GUIDELINES

12. For coding purposes on the OSHA-1, a Focused Inspection will be considered a partial inspection. The IMIS code for Focused Inspections shall include the identification of the controlling contractor (record **Focus, C** for the controlling contractor) and shall include a notation of the total number of contractors effected (i.e., controlling contractor plus subcontractors on the site). For example, if there is a controlling contractor and three subcontractors, the inspection of the controlling contractor shall be recorded as follows

Type	ID	Value
N	14	Focus, C, 4

For each subcontractor issued a citation on a focused inspection the subcontractor's inspection (record **Focus, S** for the subcontractor) shall be recorded as follows:

Type	ID	Value
N	14	Focus, S

Appendix H: SEP References

References Related to the SEP

1. OSHA Instruction CPL 2.103, September 26, 1994, Field Inspection Reference Manual (FIRM).

2.
3. OSHA Instruction CPL 2.45B, March 3, 1995, The Revised Field Operations Manual (FOM).

4. Rosenman, K.: Use of Hospital Discharge Data in the Surveillance of Occupational Disease. Am. J. Ind. Med. Vol. 13: 281-289 (1988).

5. Lofgren, D.J.: Case Study: Silica Exposure for Concrete Workers and Masons. Appl. Occup. And Environ. Hyg. J. Vol. 8(10): 832- 835 (1993).

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APPENDIX R

Directive Number	**CPL 2.105**
Subject	**Special Emphasis Program: Lead in Construction**
Information Date	**March 11, 1996**

Text

OSHA Instruction CPL 2.105
March 11, 1996
Office of Health Compliance Assistance

SUBJECT: Special Emphasis Program: Lead in Construction

A. Purpose.

This instruction establishes a nationally directed Special Emphasis Program (SEP) for programmed health inspections of lead in construction operations in accordance with the provisions of the Field Information Reference Manual (FIRM).

B. Scope.

This instruction applies OSHA - wide.

C. Action.

Regional Administrators and Area Directors shall ensure that the procedures established in this instruction are adhered to in the scheduling of programmed inspections.

D. References.

1. OSHA Instruction CPL 2.103, September 26, 1994, Field Inspection Reference Manual (FIRM).
2. OSHA Instruction CPL 2.45B, March 3, 1995, The Revised Field Operations Manual (FOM).
3. Occupational Safety and Health Administration Technical Manual: OSHA Instruction TED 1.15 Section I, Chapter 1, part C; Section I, Chapter 2; Section IV, Chapter 3, Parts A, B, and C; Section VII.
4. OSHA Instruction CPL 2-2.58, December 13, 1993, 29 CFR 1926.62, Lead Exposure in Construction: Inspection and Compliance Procedures.

5. OSHA Instruction STD 3-8.1, October 30, 1978, Welding, Cutting, or Heating of Metals Coated with Lead-bearing Paint.

6. OSHA Instruction CPL 2-2.38C, October 22, 1990, Inspection Procedures for the Hazard Communication Standard.

7. OSHA Memorandum date August 22, 1994 (Revision September 20, 1995) "Guidance to Compliance Officers for Focused Inspections in the Construction Industry."

E Federal Program Change.

This is a federal program change that impacts state programs.

1. The Regional Administrator (RA) shall ensure that this change is promptly forwarded to each state designee using a format consistent with the Plan Change Two-way Memorandum in Appendix A, OSHA Instruction STP 2.22A, State Plan Policies and Procedures Manual (SPM).

2. The RA shall explain the content of this change to the State designees.

3. States are encouraged, but not required, to adopt an identical or alternative policy. States shall be asked to provide preliminary notification to the RA within 30 days from the date of this instruction of their intent to adopt or not to adopt the procedure in this directive. The state shall formally respond to this change with an indication of their intent within 70 days in accordance with paragraph I.1.a.(2).(a). and (b), Chapter III of Part I of the SPM. If the state adopts different compliance procedures, a copy of the procedures shall be provided to the RA within six (6) months from the date of this directive.

4. State designees also wish to include alternative procedures in a pilot Performance Agreement to be negotiated between the state and the RA and approved by the Assistant Secretary. Such agreements shall define interim indicators of effectiveness and the results anticipated from a successful policy.

5. The RA shall review policy, procedures, and instructions issued by the state and monitor their implementation as provided in a performance agreement or through routine monitoring focusing on impact and results.

F. Background.

Over the past several years OSHA inspections have documented elevated blood lead levels in construction workers. The source of the exposure is from the cutting, welding, grinding, and/or abrasive blasting on steel surfaces such as bridges and tanks that are coated with lead-bearing paints. In response, several state plan states, area offices, and regions have developed their own local emphasis programs to address this hazard in the construction industry.

The agency therefore, has determined that an increased uniform OSHA enforcement presence is warranted at work sites where such exposures occur.

1. In 1990, NIOSH set as a national goal the elimination of lead exposures that result in workers having blood lead concentrations greater than 26 µg/100 grams of whole blood.

2. In 1991, OSHA announced it would begin to develop a standard regulating lead exposure in construction.

3. In October, 1992, Congress passed Sections 1031 and 1032 of Title X of the Housing and Community Development Act of 1992 (Public Law 102-550). The Act specifically required the Secretary of Labor to issue an interim final lead standard covering the construction industry.

4. In May 1993, OSHA issued the Interim Final Rule for Lead in Construction.

5. The construction scheduling procedure outlined in the FIRM cannot directly be used in scheduling health inspections for lead exposure in construction. Consequently, the following procedures are prescribed in scheduling these inspections.

G. Procedures.

Inspections under this special emphasis program shall be scheduled and conducted under the following priority:

1. Referrals:

For states that have enacted mandatory reporting of blood lead, the Area or Regional Office shall attempt to obtain the blood lead data where possible. Employers with worker blood lead levels above 40 µg/100 grams of whole blood shall be targeted for inspection provided the worker can be identified with an employer. Any means to determine when construction activities involve worker exposure to hazards associated with lead during abrasive blasting, sanding, cutting, burning, welding, painting, etc. of steel structures coated with lead contaminated paints, or during any other disturbance of lead containing materials shall be used. All compliance personnel shall be instructed to be on the lookout for construction activities where there is a potential for exposure to lead. Such activities can include, but are not limited to:

residential remodeling,
petroleum tank repainting,
indoor and outdoor industrial maintenance* and renovation,
commercial and institutional remodeling,
highway and railroad bridge repainting and rehabilitation,
lead joint work on cast iron soil pipes,
repair and removal of water lines,
water tank repainting and demolition,
highway and railroad bridge demolition,
housing lead abatement projects,
electric transmission and communication tower maintenance,*
electrical cable splicing and resplicing,
installation of terne roofing,
elevator cable babbitting,*
underground storage tank demolition,
stained glass window removal and repair, and
mineral wool insulation with lead contamination.*

*__Note__: Construction work means any construction, alteration, and/or repair, including painting and decorating. The highlighted activities, may under some circumstances, fall under the General Industry lead standard 29 CFR 1910.1025. CSHOs should refer to page A-1 of CPL 2-2.58 for a discussion of such instances where 29 CFR 1910.1025 prevails. For inspections of these activities conducted under this SEP, CSHOs must document that the work is a construction activity as defined by CPL 2-2.58 and 29 CFR 1926.62.

Every observation of any operation where there exists the potential for lead exposure shall be handled as follows:

a. Whenever a CSHO observes or receives information, regardless of whether or not a violation is observed, through nonformal complaints, referrals, reports from members of the general public, and so forth, the CSHO shall:

    1. Document the status and condition of the work operation as far as it is known, noting any serious hazards.

    2. Note the name and address and location of the worksite and the contractor(s) performing the operation.

    3. Provide the Area office Supervisor or Area Director with the information. Based upon the information provided, all potential lead in construction work sites brought to the attention of the Area Office shall be investigated/inspected as follows:

        a. If the worksite has been inspected within the last 30 days, the results of the inspection shall be considered along with the current worksite observations in determining whether or not an inspection is to be conducted.

            1. If the lead-related work was not in progress during the previous visit to the site but is currently in progress the inspection shall be authorized and opened.

            2. If the lead-related work was in progress and evaluated during the previous inspection, the inspection will be opened only if apparent serious violations are present or can reasonably be expected at the site.

        b. If the worksite has not been inspected within the previous 30 days, an investigation/inspection shall be conducted unless it is apparent that workers are not exposed to lead.

b. Reports of imminent danger, fatality/catastrophe reports, formal/nonformal complaints, safety and health referrals from other federal, state, county, and city agencies, media reports, reports for physicians, hospitals, or medical clinics, and reports from the general public shall be investigated/inspected by the Area Office.

c. The discovery of these work sites may be the result of a specific search to find this type of operation, at the discretion of the Regional Administrator. Although sightings will be those normally that occur during the course of routine travel during duty or non-duty hours, Regional policy may provide that the Area Director saturate areas of high construction activity to identify potential lead in construction work sites. Documentation of the events leading up to the observation shall be maintained by the Area Office in case of a denial of entry.

2. Area Offices are encouraged to develop a list of construction contractors under their jurisdiction likely to be involved in lead related activities. SIC Codes most likely to be included in the list involve 1622 (bridge tunnel, and elevated highway construction), 1629 (heavy construction), 1721

(painting and paperhanging), 1791 (structural steel erection), 1795 (wrecking and demolition work, and 1799 (special trade contractors not elsewhere classified). Sources for contractors involved in lead related work can include, but are not limited to: federal or state Department of Transportation (DOT) contacts (bridge contracts), Dodge reports, and state and local building permits.

Inspection sites will be randomly selected for inspection from the list compiled from the above sources using a random numbers table. (This selection process sets forth administratively neutral criteria to identify establishments for inspection.) As new sites are added they should be randomized for inspection.

If a contractors' list is used for randomly selected inspections, the list of selected contractors should be checked with local state agencies such as the DOT to determine whether or not the selected contractor are involved in an active site.

Note: If a contractor does not have an active site, the Area Office may elect to review the records at the company's office or headquarters (bid specifications, contracts, respirator program, medical surveillance records, air monitoring records, lead training, compliance program, and hazard communication). Citable deficiencies will be documented and violations issued provided exposure to lead within the previous six months can be substantiated.

3. Industrial hygienists conducting these inspections should consult with safety CSHO's on fall protection hazards and hazards associated with working over water. Where resources permit, a joint safety and health inspection should be conducted. Referrals to safety compliance officers where appropriate shall be submitted.

4. The "Memorandum dated August 22, 1994 (Revision (2) September 20, 1995) Guidance to Compliance Officers for Focused Inspections in the Construction Industry" will be followed.

H. Application.

1. Inspections under this SEP shall address all aspects of any potential lead work or exposure and include a review of all related written documentation (i.e., record keeping, monitoring, medical, respirator fit testing and procedures, hazard communication, and training materials). The CSHO may expand the inspection scope beyond the lead related activities if hazards or violations are observed (FIRM CH. II-1).

2. When the company headquarters are located in another Region, every attempt shall be made to obtain the above information. A referral to another Region should be considered for violation of 1926.33, if access to employee exposure and medical records is denied.

3. If a site turns out to be located within the jurisdiction of another Area Office, a referral will be made to the appropriate Area Office according to current procedures. Information obtained from the contractors' headquarters will be shared with any other Area Office having an active site.

4. The number of inspections conducted under this SEP shall be determined independently by each Region. The inspections planned under this SEP shall be deducted from the number of total planned inspections.

5. CSHO's shall conduct personal monitoring and collect wipe samples as appropriate to document exposures. See OSHA Instruction TED 1.15.

6. While evaluating worker exposures to lead, CSHOs will also need to be aware of and evaluate potential exposures to other metals including but not limited to: **arsenic, manganese, chromium, cadmium, copper, and magnesium.** CSHOs should not request an ICP (inductively coupled

plasma) analysis for abrasive blasting operations or when an arsenic analysis is needed without first contacting the inorganic lab of the Salt Lake City Technical Center. Atomic Absorption (AA) Spectroscopy can be requested for arsenic and any of the other specific metals. With AA spectroscopy a total of four metals can be requested per sampling filter.

II. Recording in IMIS.

Current instructions for completing the appropriate inspection classification boxes (Items 24 and 25), as found in the IMIS Manual for the OSHA 1 Form shall be applied when recording inspections conducted under this SEP as follows:

1. The OSHA-1 Form for any programmed inspection covered under this special emphasis program for lead in construction shall be marked "PLANNED" (Item 24h), "CONSTRUCTION" (Item 25a) and "SPECIAL EMPHASIS PROGRAM" (Item 25d). Record "LEAD" in the space in item 25d.

2. The OSHA-1 Form for any unprogrammed inspection shall be marked as unprogrammed (Item 24a. through g. as appropriate). In addition, it shall be marked "SPECIAL EMPHASIS PROGRAM" (Item 25d). Record "LEAD" in the space in Item 25d.

J. Full Service Program Support.

Each Area Office/Region is encouraged to develop outreach programs that will support the enforcement effort. Such programs could include letters to employers, the Associated General Contractors (AGC), local unions, Associated Builders and Contractors, local safety councils, apprenticeship programs, local hospitals and occupational health clinics, and/or other construction employer organizations that engage in lead in construction activities. Speeches through the local safety councils or industrial hygiene organizations can provide another avenue for dissemination of information as can press releases to the local media. Region I has had a special emphasis program for lead in construction since 1989. The lead coordinator for Region I can be contacted for guidance and information on the outreach program ((617) 565-7164).

Area Offices are encouraged to develop a list of contractors involved with lead in construction work. Once the list has been generated, every contractor can be contacted (if resources permit) in writing and provided with a copy of the lead in construction standard and general information available about lead.

For additional outreach information and guidance please contact the Office of Health Compliance Assistance at 200 Constitution Ave., NW, Room N-3467, Washington, D.C. 20210; (202) 219-8036.

Joseph A. Dear
Assistant Secretary

Distribution: National, Regional, and Area Offices

All Compliance Officers
State Designees
NIOSH Regional Program Directors
7(c)(1) Consultation Project Managers

APPENDIX S

Standard Number: 1910.134
Standard Title: Respiratory Protection
SubPart Number: I
SubPart Title: Personal Protective Equipment

This section applies to General Industry (part 1910), Shipyards (part 1915), Marine Terminals (part 1917), Longshoring (part 1918), and Construction (part 1926).

Respiratory Protection

1910.134(a) Permissible practice.

(a)(1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section.

(a)(2) Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program which shall include the requirements outlined in paragraph (c) of this section.

1910.134(b) Definitions.

The following definitions are important terms used in the respiratory protection standard in this section.

Air-purifying respirator means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Assigned protection factor (APF) [Reserved]

Atmosphere-supplying respirator means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

Canister or cartridge means a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

Demand respirator means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Emergency situation means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

Employee exposure means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

End-of-service-life indicator (ESLI) means a system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

Escape-only respirator means a respirator intended to be used only for emergency exit.

Filter or air purifying element means a component used in respirators to remove solid or liquid aerosols from the inspired air.

Filtering facepiece (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Fit factor means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit test means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

Helmet means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

High efficiency particulate air (HEPA) filter means a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

Hood means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

Immediately dangerous to life or health (IDLH) means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Interior structural firefighting means the physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage. (See 29 CFR 1910.155)

Loose-fitting facepiece means a respiratory inlet covering that is designed to form a partial seal with the face.

Maximum use concentration (MUC) [Reserved].

Negative pressure respirator (tight fitting) means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen deficient atmosphere means an atmosphere with an oxygen content below 19.5% by volume.

Physician or other licensed health care professional (PLHCP) means an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by paragraph (e) of this section.

Positive pressure respirator means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered air-purifying respirator (PAPR) means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Pressure demand respirator means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Qualitative fit test (QLFT) means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

Quantitative fit test (QNFT) means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respiratory inlet covering means that portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

Self-contained breathing apparatus (SCBA) means an atmosphere- supplying respirator for which the breathing air source is designed to be carried by the user.

Service life means the period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

Supplied-air respirator (SAR) or airline respirator means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

This section means this respiratory protection standard.

Tight-fitting facepiece means a respiratory inlet covering that forms a complete seal with the face.

User seal check means an action conducted by the respirator user to determine if the respirator is properly seated to the face.

1910.134(c)

Respiratory protection program. This paragraph requires the employer to develop and implement a written respiratory protection program with required worksite-specific procedures and elements for required respirator use. The program must be administered by a suitably trained program administrator. In addition, certain program elements may be required for voluntary use to prevent potential hazards associated with the use of the respirator. The Small Entity Compliance Guide contains criteria for the selection of a program administrator and a sample program that meets the requirements of this paragraph. Copies of the Small Entity Compliance Guide will be available on or about April 8, 1998 from the Occupational Safety and Health Administration's Office of Publications, Room N 3101, 200 Constitution Avenue, NW, Washington, DC, 20210 (202-219-4667).

(c)(1) In any workplace where respirators are necessary to protect the health of the employee or whenever respirators are required by the employer, the employer shall establish and implement a written respiratory protection program with worksite-specific procedures. The program shall be updated as necessary to reflect those changes in workplace conditions that affect respirator use. The employer shall include in the program the following provisions of this section, as applicable:

(c)(1)(i) Procedures for selecting respirators for use in the workplace;

(c)(1)(ii) Medical evaluations of employees required to use respirators;

(c)(1)(iii) Fit testing procedures for tight-fitting respirators;

(c)(1)(iv) Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;

(c)(1)(v) Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;

(c)(1)(vi) Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;

(c)(1)(vii) Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;

(c)(1)(viii) Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and

(c)(1)(ix) Procedures for regularly evaluating the effectiveness of the program.

(c)(2) Where respirator use is not required:

(c)(1)(i) An employer may provide respirators at the request of employees or permit employees to use their own respirators, if the employer determines that such respirator use will not in itself create a hazard. If the employer determines that any voluntary respirator use is permissible, the employer shall provide the respirator users with the information contained in Appendix D to this section ("Information for Employees Using Respirators When Not Required Under the Standard"); and

(c)(2)(ii) In addition, the employer must establish and implement those elements of a written respiratory protection program necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator, and that the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the user. Exception: Employers are not required to include in a written respiratory protection program those employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks).

(c)(3) The employer shall designate a program administrator who is qualified by appropriate training or experience that is commensurate with the complexity of the program to administer or oversee the respiratory protection program and conduct the required evaluations of program effectiveness.

(c)(4) The employer shall provide respirators, training, and medical evaluations at no cost to the employee.

1910.134(d)

Selection of respirators. This paragraph requires the employer to evaluate respiratory hazard(s) in the workplace, identify relevant workplace and user factors, and base respirator selection on these factors. The paragraph also specifies appropriately protective respirators for use in IDLH atmospheres, and limits the selection and use of air-purifying respirators.

(d)(1) General requirements.

(d)(1)(i) The employer shall select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.

(d)(1)(ii) The employer shall select a NIOSH-certified respirator. The respirator shall be used in compliance with the conditions of its certification.

(d)(1)(iii) The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH.

(d)(1)(iv) The employer shall select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

(d)(2) Respirators for IDLH atmospheres.

(d)(2)(i) The employer shall provide the following respirators for employee use in IDLH atmospheres:

(d)(2)(i)(A) A full facepiece pressure demand SCBA certified by NIOSH for a minimum service life of thirty minutes, or

(d)(2)(i)(B) A combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.

(d)(2)(ii) Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

(d)(2)(iii) All oxygen-deficient atmospheres shall be considered IDLH. Exception: If the employer demonstrates that, under all foreseeable conditions, the oxygen concentration can be maintained within the ranges specified in Table II of this section (i.e., for the altitudes set out in the table), then any atmosphere-supplying respirator may be used.

(d)(3) Respirators for atmospheres that are not IDLH.

(d)(3)(i) The employer shall provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.

(d)(3)(i)(A) Assigned Protection Factors (APFs) [Reserved]

(d)(3)(i)(B) Maximum Use Concentration (MUC) [Reserved] (d)(3)(ii) The respirator selected shall be appropriate for the chemical state and physical form of the contaminant.

(d)(3)(iii) For protection against gases and vapors, the employer shall provide:

(d)(3)(iii)(A) An atmosphere-supplying respirator, or

(d)(3)(iii)(B) An air-purifying respirator, provided that:

(d)(3)(iii)(B)(1) The respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or

(d)(3)(iii)(B)(2) If there is no ESLI appropriate for conditions in the employer's workplace, the employer implements a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. The employer shall describe in the respirator program the information and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

(d)(3)(iv) For protection against particulates, the employer shall provide:

(d)(3)(iv)(A) An atmosphere-supplying respirator; or

(d)(3)(iv)(B) An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR part 84; or

(d)(3)(iv)(C) For contaminants consisting primarily of particles with mass median aerodynamic diameters (MMAD) of at least 2 micrometers, an air- purifying respirator equipped with any filter certified for particulates by NIOSH.

TABLE I. -- Assigned Protection Factors [Reserved]

TABLE II

Altitude	Oxygen Deficient Atmospheres (% O2) for which the employer may rely on atmosphere-supplying respirators
Less than 3,001	16.0-19.5
3,001-4,000	16.4-19.5
4,001-5,000	17.1-19.5
5,001-6000	17.8-19.5
6,001-7,000	18.5-19.5
7,001-8,000[1]	19.3-19.5

[1]Above 8,000 feet the exception does not apply. Oxygen-enriched breathing air must be supplied above 14,000 feet.

1910.134(e)

Medical evaluation. Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the employee. Accordingly, this paragraph specifies the minimum requirements for medical evaluation that employers must implement to determine the employee's ability to use a respirator.

(e)(1) General. The employer shall provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or required to use the respirator in the workplace. The employer may discontinue an employee's medical evaluations when the employee is no longer required to use a respirator.

(e)(2) Medical evaluation procedures.

(e)(2)(i) The employer shall identify a physician or other licensed health care professional (PLHCP) to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire.

(e)(2)(ii) The medical evaluation shall obtain the information requested by the questionnaire in Sections 1 and 2, Part A of Appendix C of this section.

(e)(3) Follow-up medical examination.

(e)(3)(i) The employer shall ensure that a follow-up medical examination is provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix C or whose initial medical examination demonstrates the need for a follow-up medical examination.

(e)(3)(ii) The follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination.

(e)(4) Administration of the medical questionnaire and examinations.

(e)(4)(i) The medical questionnaire and examinations shall be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee. The medical questionnaire shall be administered in a manner that ensures that the employee understands its content.

(e)(4)(ii) The employer shall provide the employee with an opportunity to discuss the questionnaire and examination results with the PLHCP.

(e)(5) Supplemental information for the PLHCP.

(e)(5)(i) The following information must be provided to the PLHCP before the PLHCP makes a recommendation concerning an employee's ability to use a respirator:

(e)(5)(i)(A) The type and weight of the respirator to be used by the employee;

(e)(5)(i)(B) The duration and frequency of respirator use (including use for rescue and escape);

(e)(5)(i)(C) The expected physical work effort;

(e)(5)(i)(D) Additional protective clothing and equipment to be worn; and (e)(5)(i)(E) Temperature and humidity extremes that may be encountered.

(e)(5)(ii) Any supplemental information provided previously to the PLHCP regarding an employee need not be provided for a subsequent medical evaluation if the information and the PLHCP remain the same.

(e)(5)(iii) The employer shall provide the PLHCP with a copy of the written respiratory protection program and a copy of this section.

Note to Paragraph (e)(5)(iii): When the employer replaces a PLHCP, the employer must ensure that the new PLHCP obtains this information, either by providing the documents directly to the PLHCP or having the documents transferred from the former PLHCP to the new PLHCP. However, OSHA does not expect employers to have employees medically reevaluated solely because a new PLHCP has been selected.

(e)(6) Medical determination. In determining the employee's ability to use a respirator, the employer shall:

(e)(6)(i) Obtain a written recommendation regarding the employee's ability to use the respirator from the PLHCP. The recommendation shall provide only the following information:

(e)(6)(i)(A) Any limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used, including whether or not the employee is medically able to use the respirator;

(e)(6)(i)(B) The need, if any, for follow-up medical evaluations; and

(e)(6)(i)(C) A statement that the PLHCP has provided the employee with a copy of the PLHCP's written recommendation.

(e)(6)(ii) If the respirator is a negative pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if the respirator is used, the employer shall provide a PAPR if the PLHCP's medical evaluation finds that the employee can use such a respirator; if a subsequent medical evaluation finds that the employee is medically able to use a negative pressure respirator, then the employer is no longer required to provide a PAPR.

(e)(7) Additional medical evaluations. At a minimum, the employer shall provide additional medical evaluations that comply with the requirements of this section if:

(e)(7)(i) An employee reports medical signs or symptoms that are related to ability to use a respirator;

(e)(7)(ii) A PLHCP, supervisor, or the respirator program administrator informs the employer that an employee needs to be reevaluated;

(e)(7)(iii) Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or

(e)(7)(iv) A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

1910.134(f)

Fit testing. This paragraph requires that, before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. This paragraph specifies the kinds of fit tests allowed, the procedures for conducting them, and how the results of the fit tests must be used.

(f)(1) The employer shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT) as stated in this paragraph.

(f)(2) The employer shall ensure that an employee using a tight- fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually thereafter.

(f)(3) The employer shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator makes visual observations of, changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

(f)(4) If after passing a QLFT or QNFT, the employee subsequently notifies the employer, program administrator, supervisor, or PLHCP that the fit of the respirator is unacceptable, the employee shall be given a reasonable opportunity to select a different respirator facepiece and to be retested.

(f)(5) The fit test shall be administered using an OSHA-accepted QLFT or QNFT protocol. The OSHA-accepted QLFT and QNFT protocols and procedures are contained in Appendix A of this section.

(f)(6) QLFT may only be used to fit test negative pressure air- purifying respirators that must achieve a fit factor of 100 or less.

(f)(7) If the fit factor, as determined through an OSHA-accepted QNFT protocol, is equal to or greater than 100 for tight-fitting half facepieces, or equal to or greater than 500 for tight-fitting full facepieces, the QNFT has been passed with that respirator.

(f)(8) Fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators shall be accomplished by performing quantitative or qualitative fit testing in the negative pressure mode, regardless of the mode of operation (negative or positive pressure) that is used for respiratory protection.

(f)(1)(8)(i) Qualitative fit testing of these respirators shall be accomplished by temporarily converting the respirator user's actual facepiece into a negative pressure respirator with appropriate filters, or by using an identical negative pressure air-purifying respirator facepiece with the same sealing surfaces as a surrogate for the atmosphere-supplying or powered air-purifying respirator facepiece.

(f)(1)(8)(ii) Quantitative fit testing of these respirators shall be accomplished by modifying the facepiece to allow sampling inside the facepiece in the breathing zone of the user, midway between the nose and mouth. This requirement shall be accomplished by installing a permanent sampling probe onto a surrogate facepiece, or by using a sampling adapter designed to temporarily provide a means of sampling air from inside the facepiece.

(f)(1)(8)(iii) Any modifications to the respirator facepiece for fit testing shall be completely removed, and the facepiece restored to NIOSH- approved configuration, before that facepiece can be used in the workplace.

1910.134(g)

Use of respirators. This paragraph requires employers to establish and implement procedures for the proper use of respirators. These requirements include prohibiting conditions that may result in facepiece seal leakage, preventing employees from removing respirators in hazardous environments, taking actions to ensure continued effective respirator operation throughout the work shift, and establishing procedures for the use of respirators in IDLH atmospheres or in interior structural firefighting situations.

(g)(1) Facepiece seal protection.

(g)(1)(i) The employer shall not permit respirators with tight-fitting facepieces to be worn by employees who have:

(g)(1)(i)(A) Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or

(g)(1)(i)(B) Any condition that interferes with the face-to-facepiece seal or valve function.

(g)(1)(ii) If an employee wears corrective glasses or goggles or other personal protective equipment, the employer shall ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user.

(g)(1)(iii) For all tight-fitting respirators, the employer shall ensure that employees perform a user seal check each time they put on the respirator using the procedures in Appendix B-1 or procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as those in Appendix B-1 of this section.

(g)(2) Continuing respirator effectiveness.

(g)(2)(i) Appropriate surveillance shall be maintained of work area conditions and degree of employee exposure or stress. When there is a change in work area conditions or degree of employee exposure or stress that may affect respirator effectiveness, the employer shall reevaluate the continued effectiveness of the respirator.

(g)(2)(ii) The employer shall ensure that employees leave the respirator use area:

(g)(2)(ii)(A) To wash their faces and respirator facepieces as necessary to prevent eye or skin irritation associated with respirator use; or

(g)(2)(ii)(B) If they detect vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece; or

(g)(2)(ii)(C) To replace the respirator or the filter, cartridge, or canister elements.

(g)(2)(iii) If the employee detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, the employer must replace or repair the respirator before allowing the employee to return to the work area.

(g)(3) Procedures for IDLH atmospheres. For all IDLH atmospheres, the employer shall ensure that:

(g)(3)(i) One employee or, when needed, more than one employee is located outside the IDLH atmosphere;

(g)(3)(ii) Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere;

(g)(3)(iii) The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue;

(g)(3)(iv) The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue;

(g)(3)(v) The employer or designee authorized to do so by the employer, once notified, provides necessary assistance appropriate to the situation;

(g)(3)(vi) Employee(s) located outside the IDLH atmospheres are equipped with:

(g)(3)(vi)(A) Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either

(g)(3)(vi)(B) Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or

(g)(3)(vi)(C) Equivalent means for rescue where retrieval equipment is not required under paragraph (g)(3)(vi)(B).

(g)(4) Procedures for interior structural firefighting. In addition to the requirements set forth under paragraph (g)(3), in interior structural fires, the employer shall ensure that:

(g)(4)(i) At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

(g)(4)(ii) At least two employees are located outside the IDLH atmosphere; and

(g)(4)(iii) All employees engaged in interior structural firefighting use SCBAs.

Note 1 to paragraph (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

Note 2 to paragraph (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.

1910.134(h)

Maintenance and care of respirators. This paragraph requires the employer to provide for the cleaning and disinfecting, storage, inspection, and repair of respirators used by employees.

(h)(1) Cleaning and disinfecting. The employer shall provide each respirator user with a respirator that is clean, sanitary, and in good working order. The employer shall ensure that respirators are cleaned and disinfected using the procedures in Appendix B-2 of this section, or procedures recommended by the respirator manufacturer, provided that such procedures are of equivalent effectiveness. The respirators shall be cleaned and disinfected at the following intervals:

(h)(1)(i) Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition;

(h)(1)(ii) Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals;

(h)(1)(iii) Respirators maintained for emergency use shall be cleaned and disinfected after each use; and

(h)(1)(iv) Respirators used in fit testing and training shall be cleaned and disinfected after each use.

(h)(2) Storage. The employer shall ensure that respirators are stored as follows:

(h)(2)(i) All respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they shall be packed or stored to prevent deformation of the facepiece and exhalation valve.

(h)(2)(ii) In addition to the requirements of paragraph (h)(2)(i) of this section, emergency respirators shall be:

(h)(2)(ii)(A) Kept accessible to the work area;

(h)(2)(ii)(B) Stored in compartments or in covers that are clearly marked as containing emergency respirators; and

(h)(2)(ii)(C) Stored in accordance with any applicable manufacturer instructions.

(h)(3) Inspection.

(h)(3)(i) The employer shall ensure that respirators are inspected as follows:

(h)(3)(i)(A) All respirators used in routine situations shall be inspected before each use and during cleaning;

(h)(3)(i)(B) All respirators maintained for use in emergency situations shall be inspected at least monthly and in accordance with the manufacturer's recommendations, and shall be checked for proper function before and after each use; and

(h)(3)(i)(C) Emergency escape-only respirators shall be inspected before being carried into the workplace for use.

(h)(3)(ii) The employer shall ensure that respirator inspections include the following:

(h)(3)(ii)(A) A check of respirator function, tightness of connections, and the condition of the various parts including, but not limited to, the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters; and (h)(3)(ii)(B) A check of elastomeric parts for pliability and signs of deterioration.

(h)(3)(iii) In addition to the requirements of paragraphs (h)(3)(i) and (ii) of this section, self-contained breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be maintained in a fully charged state and shall be recharged when the pressure falls to 90% of the manufacturer's recommended pressure level. The employer shall determine that the regulator and warning devices function properly.

(h)(3)(iv) For respirators maintained for emergency use, the employer shall:

(h)(3)(iv)(A) Certify the respirator by documenting the date the inspection was performed, the name (or signature) of the person who made the inspection, the findings, required remedial action, and a serial number or other means of identifying the inspected respirator; and

(h)(3)(iv)(B) Provide this information on a tag or label that is attached to the storage compartment for the respirator, is kept with the respirator, or is included in inspection reports stored as paper or electronic files. This information shall be maintained until replaced following a subsequent certification.

(h)(4) Repairs. The employer shall ensure that respirators that fail an inspection or are otherwise found to be defective are removed from service, and are discarded or repaired or adjusted in accordance with the following procedures:

(h)(4)(i) Repairs or adjustments to respirators are to be made only by persons appropriately trained to perform such operations and shall use only the respirator manufacturer's NIOSH-approved parts designed for the respirator;

(h)(4)(ii) Repairs shall be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed; and

(h)(4)(iii) Reducing and admission valves, regulators, and alarms shall be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

1910.134(i)

Breathing air quality and use. This paragraph requires the employer to provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity.

(i)(1) The employer shall ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accords with the following specifications:

(i)(1)(i) Compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and

(i)(1)(ii) Compressed breathing air shall meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

(i)(1)(ii)(A) Oxygen content (v/v) of 19.5-23.5%;

(i)(1)(ii)(B) Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

(i)(1)(ii)(C) Carbon monoxide (CO) content of 10 ppm or less;

(i)(1)(ii)(D) Carbon dioxide content of 1,000 ppm or less; and

(i)(1)(ii)(E) Lack of noticeable odor.

(i)(2) The employer shall ensure that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air.

(i)(3) The employer shall ensure that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

(i)(4) The employer shall ensure that cylinders used to supply breathing air to respirators meet the following requirements:

(i)(4)(i) Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 173 and part 178);

(i)(4)(ii) Cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air; and

(i)(4)(iii) The moisture content in the cylinder does not exceed a dew point of -50 deg.F (-45.6 deg.C) at 1 atmosphere pressure.

(i)(5) The employer shall ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

(i)(5)(i) Prevent entry of contaminated air into the air-supply system;

(i)(5)(ii) Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 deg.C) below the ambient temperature;

(i)(5)(iii) Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.

(i)(5)(iv) Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.

(i)(6) For compressors that are not oil-lubricated, the employer shall ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

(i)(7) For oil-lubricated compressors, the employer shall use a high- temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

(i)(8) The employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. No asphyxiating substance shall be introduced into breathing air lines.

(i)(9) The employer shall use breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR part 84.

1910.134(j)

Identification of filters, cartridges, and canisters. The employer shall ensure that all filters, cartridges and canisters used in the workplace are labeled and color coded with the NIOSH approval label and that the label is not removed and remains legible.

1910.134(k)

Training and information. This paragraph requires the employer to provide effective training to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary. This paragraph also requires the employer to provide the basic information on respirators in Appendix D of this section to employees who wear respirators when not required by this section or by the employer to do so.

(k)(1) The employer shall ensure that each employee can demonstrate knowledge of at least the following:

(k)(1)(i) Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;

(k)(1)(ii) What the limitations and capabilities of the respirator are;

(k)(1)(iii) How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;

(k)(1)(iv) How to inspect, put on and remove, use, and check the seals of the respirator;

(k)(1)(v) What the procedures are for maintenance and storage of the respirator;

(k)(1)(vi) How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators; and

(k)(1)(vii) The general requirements of this section.

(k)(2) The training shall be conducted in a manner that is understandable to the employee.

(k)(3) The employer shall provide the training prior to requiring the employee to use a respirator in the workplace.

(k)(4) An employer who is able to demonstrate that a new employee has received training within the last 12 months that addresses the elements specified in paragraph (k)(1)(i) through (vii) is not required to repeat such training provided that, as required by paragraph (k)(1), the employee can demonstrate knowledge of those element(s). Previous training not repeated initially by the employer must be provided no later than 12 months from the date of the previous training.

(k)(5) Retraining shall be administered annually, and when the following situations occur:

(k)(5)(i) Changes in the workplace or the type of respirator render previous training obsolete;

(k)(5)(ii) Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or

(k)(5)(iii) Any other situation arises in which retraining appears necessary to ensure safe respirator use.

(k)(6) The basic advisory information on respirators, as presented in Appendix D of this section, shall be provided by the employer in any written or oral format, to employees who wear respirators when such use is not required by this section or by the employer.

1910.134(l)

Program evaluation. This section requires the employer to conduct evaluations of the workplace to ensure that the written respiratory protection program is being properly implemented, and to consult employees to ensure that they are using the respirators properly.

(l)(1) The employer shall conduct evaluations of the workplace as necessary to ensure that the provisions of the current written program are being effectively implemented and that it continues to be effective.

(l)(2) The employer shall regularly consult employees required to use respirators to assess the employees' views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include, but are not limited to:

(l)(2)(i) Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);

(l)(2)(ii) Appropriate respirator selection for the hazards to which the employee is exposed;

(l)(2)(iii) Proper respirator use under the workplace conditions the employee encounters; and

(l)(2)(iv) Proper respirator maintenance.

1910.134(m)

Recordkeeping. This section requires the employer to establish and retain written information regarding medical evaluations, fit testing, and the respirator program. This information will facilitate employee involvement in the respirator program, assist the employer in auditing the adequacy of the program, and provide a record for compliance determinations by OSHA.

(m)(1) Medical evaluation. Records of medical evaluations required by this section must be retained and made available in accordance with 29 CFR 1910.1020.

(m)(2) Fit testing.

(m)(2)(i) The employer shall establish a record of the qualitative and quantitative fit tests administered to an employee including:

(m)(2)(i)(A) The name or identification of the employee tested;

(m)(2)(i)(B) Type of fit test performed;

(m)(2)(i)(C) Specific make, model, style, and size of respirator tested;

(m)(2)(i)(D) Date of test; and

(m)(2)(i)(E) The pass/fail results for QLFTs or the fit factor and strip chart recording or other recording of the test results for QNFTs.

(m)(2)(ii) Fit test records shall be retained for respirator users until the next fit test is administered.

(m)(3) A written copy of the current respirator program shall be retained by the employer.

(m)(4) Written materials required to be retained under this paragraph shall be made available upon request to affected employees and to the Assistant Secretary or designee for examination and copying.

1910.134(n)

Dates.

(n)(1) Effective date. This section is effective April 8, 1998. The obligations imposed by this section commence on the effective date unless otherwise noted in this paragraph. Compliance with obligations that do not commence on the effective date shall occur no later than the applicable start-up date.

(n)(2) Compliance dates. All obligations of this section commence on the effective date except as follows:

(2)(i) The determination that respirator use is required (paragraph (a)) shall be completed no later than September 8, 1998.

(n)(2)(ii) Compliance with provisions of this section for all other provisions shall be completed no later than October 5, 1998.

(n)(3) The provisions of 29 CFR 1910.134 and 29 CFR 1926.103, contained in the 29 CFR parts 1900 to 1910.99 and the 29 CFR part 1926 editions, revised as of July 1, 1997, are in effect and enforceable until October 5, 1998, or during any administrative or judicial stay of the provisions of this section.

(n)(4) Existing Respiratory Protection Programs. If, in the 12 month period preceding April 8, 1998, the employer has conducted annual respirator training, fit testing, respirator program evaluation, or medical evaluations, the employer may use the results of those activities to comply with the corresponding provisions of this section, providing that these activities were conducted in a manner that meets the requirements of this section.

1910.134(o)
Appendices.

(o)(1) Compliance with Appendix A, Appendix B-1, Appendix B-2, and Appendix C of this section is mandatory.

(o)(2) Appendix D of this section is non-mandatory and is not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

Appendix A to § 1910.134: Fit Testing Procedures (Mandatory)

Part I. OSHA-Accepted Fit Test Protocols

Fit Testing Procedures--General Requirements.

The employer shall conduct fit testing using the following procedures. The requirements in this appendix apply to all OSHA- accepted fit test methods, both QLFT and QNFT.

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.

3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.

5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

(a) Position of the mask on the nose
(b) Room for eye protection
(c) Room to talk
(d) Position of mask on face and cheeks

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

(a) Chin properly placed;
(b) Adequate strap tension, not overly tightened;
(c) Fit across nose bridge;
(d) Respirator of proper size to span distance from nose to chin;
(e) Tendency of respirator to slip;
(f) Self-observation in mirror to evaluate fit and respirator position.

8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in Appendix B-1 of this section or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in Appendix B-1. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.

14. Test Exercises.

(a) The following test exercises are to be performed for all fit testing methods prescribed in this appendix, except for the CNP method. A separate fit testing exercise regimen is contained in the CNP protocol. The test subject shall perform exercises, in the test environment, in the following manner:

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily

so the subject can inhale at each side.

(4) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(6) Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT)

(7) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

(8) Normal breathing. Same as exercise (1).

(b) Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

B. Qualitative Fit Test (QLFT) Protocols

1. General

(a) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

(b) The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Isoamyl Acetate Protocol

Note: This protocol is not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator must be equipped with an organic vapor filter.

(a) Odor Threshold Screening

Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.

(1) Three 1 liter glass jars with metal lids are required.

(2) Odor-free water (e.g., distilled or spring water) at approximately 25 deg. C (77 deg. F) shall be used for the solutions.

(3) The isoamyl acetate (IAA) (also known at isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1 liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.

(4) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.

(5) The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

(6) A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.

(7) The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.

(8) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(9) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(10) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

(11) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(b) Isoamyl Acetate Fit Test

(1) The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.

(2) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.

(3) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(4) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

(5) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.

(6) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.

(7) If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(8) If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (b) (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

(9) If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.

(10) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.

3. Saccharin Solution Aerosol Protocol

The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Taste threshold screening. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a 3/4-inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a sweet taste.

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The threshold check solution is prepared by dissolving 0.83 gram of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting 1 ml of the fit test solution (see (b)(5) below) in 100 ml of distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.

(7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted. If the test subject reports tasting the sweet taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.

(9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject is unable to taste saccharin and may not perform the saccharin fit test.

Note to paragraph 3. (a): If the test subject eats or drinks something sweet before the screening test, he/she may be unable to taste the weak saccharin solution.

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
(14) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.
(b) Saccharin solution aerosol fit test procedure.
(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure described in 3. (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected in section I. A. of this appendix. The respirator shall be properly adjusted and equipped with a particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.

(6) As before, the test subject shall breathe through the slightly open mouth with tongue extended, and report if he/she tastes the sweet taste of saccharin.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of

saccharin fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test. A minimum of 10 squeezes is required.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the original number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected. If the test subject does not report tasting the saccharin, the test is passed.

(11) If the taste of saccharin is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

(12) Since the nebulizer has a tendency to clog during use, the test operator must make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.

4. BitrexTM (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test Protocol

The BitrexTM (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Taste Threshold Screening.

The Bitrex taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of Bitrex.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a \3/4\ inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the Threshold Check Solution into the enclosure. This Nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex to 100 ml of 5% salt (NaCl) solution in distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.

(7) An initial ten squeezes are repeated rapidly and then the test subject is asked whether the Bitrex can be tasted. If the test subject reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.

(9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the Bitrex is not tasted after 30 squeezes (step 10), the test subject is unable to taste Bitrex and may not perform the Bitrex fit test.

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.

(14) The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Bitrex Solution Aerosol Fit Test Procedure.

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure as that described in 4. (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected according to section I. A. of this appendix. The respirator shall be properly adjusted and equipped with any type particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 337.5 mg of Bitrex to 200 ml of a 5% salt (NaCl) solution in warm water.

(6) As before, the test subject shall breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the

screening test.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex is detected. If the test subject does not report tasting the Bitrex, the test is passed.

(11) If the taste of Bitrex is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

5. Irritant Smoke (Stannic Chloride) Protocol

This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

(a) General Requirements and Precautions

(1) The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).

(2) Only stannic chloride smoke tubes shall be used for this protocol.

(3) No form of test enclosure or hood for the test subject shall be used.

(4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

(5) The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

(b) Sensitivity Screening Check

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

(1) The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

(2) The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

(3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

(c) Irritant Smoke Fit Test Procedure

(1) The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).

(2) The test subject shall be instructed to keep his/her eyes closed.

(3) The test operator shall direct the stream of irritant smoke from the smoke tube toward the faceseal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

(4) If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

(5) The exercises identified in section I.A. 14. of this appendix shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

(6) If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.

(7) Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

(8) If a response is produced during this second sensitivity check, then the fit test is passed.

C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable: Quantitative fit testing using a non- hazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; Quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; Quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

1. General

(a) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and ensure that test equipment is in proper working order.

(b) The employer shall ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Generated Aerosol Quantitative Fit Testing Protocol

(a) Apparatus.

(1) Instrumentation. Aerosol generation, dilution, and measurement systems using particulates (corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS] or sodium chloride) as test aerosols shall be used for quantitative fit testing.

(2) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the test agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the test agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(3) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high efficiency particulate air (HEPA) or P100 series filter supplied by the same manufacturer.

(4) The sampling instrument shall be selected so that a computer record or strip chart record may be made of the test showing the rise and fall of the test agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(5) The combination of substitute air-purifying elements, test agent and test agent concentration shall be such that the test subject is not exposed in excess of an established exposure limit for the test agent at any time during the testing process, based upon the length of the exposure and the exposure limit duration.

(6) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free air flow is allowed into the sampling line at all times, and there is no interference with the fit or performance of the respirator. The in-mask sampling device (probe) shall be designed and used so that the air sample is drawn from the breathing zone of the test subject, midway between the nose and mouth and with the probe extending into the facepiece cavity at least 1/4 inch.

(7) The test setup shall permit the person administering the test to observe the test subject inside the chamber during the test.

(8) The equipment generating the test atmosphere shall maintain the concentration of test agent constant to within a 10 percent variation for the duration of the test.

(9) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event and its being recorded.

(10) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(11) The exhaust flow from the test chamber shall pass through an appropriate filter (i.e., high efficiency particulate filter) before release.

(12) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

(13) The limitations of instrument detection shall be taken into account when determining the fit factor.

(14) Test respirators shall be maintained in proper working order and be inspected regularly for deficiencies such as cracks or missing valves and gaskets.

(b) Procedural Requirements.

(1) When performing the initial user seal check using a positive or negative pressure check, the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these pressure checks.

(2) The use of an abbreviated screening QLFT test is optional. Such a test may be utilized in order to quickly identify poor fitting respirators that passed the positive and/or negative pressure test and reduce the amount of QNFT time. The use of the CNC QNFT instrument in the count mode is another optional method to obtain a quick estimate of fit and eliminate poor fitting respirators before going on to perform a full QNFT.

(3) A reasonably stable test agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain types of test units, the determination of the test agent's stability may be established after the test subject has entered the test environment.

(4) Immediately after the subject enters the test chamber, the test agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full facepiece respirator.

(5) A stable test agent concentration shall be obtained prior to the actual start of testing.

(6) Respirator restraining straps shall not be over-tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use. The respirator shall not be adjusted once the fit test exercises begin.

(7) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject shall be refitted and retested.

(8) Calculation of fit factors.

(i) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration measured inside the respirator for each test exercise except the grimace exercise.

(ii) The average test chamber concentration shall be calculated as the arithmetic average of the concentration measured before and after each test (i.e., 7 exercises) or the arithmetic average of the concentration measured before and after each exercise or the true average measured continuously during the respirator sample.

(iii) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

A. Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers that calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.
B. Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.
C. Integration by calculation of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.
D. The calculation of the overall fit factor using individual exercise fit factors involves first converting the exercise fit factors to penetration values, determining the average, and then converting that result back to a fit factor. This procedure is described in the following equation:

$$\text{Overall Fit Factor} = \frac{\text{Number of exercises}}{1/ff_1 + 1/ff_2 + 1/ff_3 + 1/ff_4 + 1/ff_5 + 1/ff_6 + 1/ff_7 + 1/ff_8}$$

Where ff1, ff2, ff3, etc. are the fit factors for exercises 1, 2, 3, etc.

(9) The test subject shall not be permitted to wear a half mask or quarter facepiece respirator unless a minimum fit factor of 100 is obtained, or a full facepiece respirator unless a minimum fit factor of 500 is obtained.

(10) Filters used for quantitative fit testing shall be replaced whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.

3. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol.

The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount TM) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Portacount Fit Test Requirements.

(1) Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) per manufacturer's instruction.

(2) Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.

(3) Check the following conditions for the adequacy of the respirator fit: Chin properly placed; Adequate strap tension, not overly tightened; Fit across nose bridge; Respirator of proper size to span distance from nose to chin; Tendency of the respirator to slip; Self-observation in a mirror to evaluate fit and respirator position.

(4) Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.

(5) Follow the manufacturer's instructions for operating the Portacount and proceed with the test.

(6) The test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(7) After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

(b) Portacount Test Instrument.

(1) The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

(2) Since the pass or fail criterion of the Portacount is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this Appendix.

(3) A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

4. Controlled negative pressure (CNP) quantitative fit testing protocol.

The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer Dynatech Nevada also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his or her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) CNP Fit Test Requirements.

(1) The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.

(2) The CNP system defaults selected for test pressure shall be set at -- 15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate shall be 53.8 liters per minute for performing fit tests.

(Note: CNP systems have built-in capability to conduct fit testing that is specific to unique work rate, mask, and gender situations that might apply in a specific workplace. Use of system default values, which were selected to represent respirator wear with medium cartridge resistance at a low-moderate work rate, will allow inter- test comparison of the respirator fit.)

(3) The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test.

(4) The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.

(5) The test subject shall be trained to hold his or her breath for at least 20 seconds.

(6) The test subject shall don the test respirator without any assistance from the individual who conducts

the CNP fit test.

(7) The QNFT protocol shall be followed according to section I. C. 1. of this appendix with an exception for the CNP test exercises.

(b) CNP Test Exercises.

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during test measurement.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the turning head side to side exercise, the subject needs to hold head full left and hold his or her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his or her breath for 10 seconds during test measurement.

(4) Moving head up and down. Standing in place, the subject shall slowly move his or her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his or her head full up and hold his or her breath for 10 seconds during test measurement. Next, the subject shall hold his or her head full down and hold his or her breath for 10 seconds during test measurement.

(5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute. After the talking exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(6) Grimace. The test subject shall grimace by smiling or frowning for 15 seconds.

(7) Bending Over. The test subject shall bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(8) Normal Breathing. The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of a respirator shall be tried.

(c) CNP Test Instrument.

(1) The test instrument shall have an effective audio warning device when the test subject fails to hold his or her breath during the test. The test shall be terminated whenever the test subject failed to hold his or her breath. The test subject may be refitted and retested.

(2) A record of the test shall be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style and size of respirator used; and date tested.

Part II. New Fit Test Protocols

A. Any person may submit to OSHA an application for approval of a new fit test protocol. If the application meets the following criteria, OSHA will initiate a rulemaking proceeding under section 6(b)(7) of the OSH Act to determine whether to list the new protocol as an approved protocol in this Appendix A.

B. The application must include a detailed description of the proposed new fit test protocol. This application must be supported by either:

1. A test report prepared by an independent government research laboratory (e.g., Lawrence Livermore National Laboratory, Los Alamos National Laboratory, the National Institute for Standards and Technology) stating that the laboratory has tested the protocol and had found it to be accurate and reliable; or

2. An article that has been published in a peer-reviewed industrial hygiene journal describing the protocol and explaining how test data support the protocol's accuracy and reliability.

C. If OSHA determines that additional information is required before the Agency commences a rulemaking proceeding under this section, OSHA will so notify the applicant and afford the applicant the opportunity to submit the supplemental information. Initiation of a rulemaking proceeding will be deferred until OSHA has received and evaluated the supplemental information.

[63 FR 20098, April 23, 1998]

Appendix B-1 to § 1910.134: User Seal Check Procedures (Mandatory)

The individual who uses a tight-fitting respirator is to perform a user seal check to ensure that an adequate seal is achieved each time the respirator is put on. Either the positive and negative pressure checks listed in this appendix, or the respirator manufacturer's recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

I. Facepiece Positive and/or Negative Pressure Checks

A. Positive pressure check. Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

B. Negative pressure check. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

II. Manufacturer's Recommended User Seal Check Procedures

The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally effective.

[63 FR 1152, Jan. 8, 1998]

Appendix B-2 to § 1910.134: Respirator Cleaning Procedures (Mandatory)

These procedures are provided for employer use when cleaning respirators. They are general in nature, and the employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here in Appendix B- 2. Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth in Appendix B-2, i.e., must ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.

I. Procedures for Cleaning Respirators

A. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure- demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

B. Wash components in warm (43 deg. C [110 deg. F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

C. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain.

D. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43 deg. C (110 deg. F); or,

2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43 deg. C (110 deg. F); or,

3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

E. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

F. Components should be hand-dried with a clean lint-free cloth or air-dried.

G. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.

H. Test the respirator to ensure that all components work properly.

Appendix C to Sec. 1910.134: OSHA Respirator Medical Evaluation Questionnaire (Mandatory)

To the employer: Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination.

To the employee:

Can you read (circle one): Yes/No

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the health care professional who will review it.

Part A. Section 1. (Mandatory)

The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's date:_________________
2. Your name:______________________________________
3. Your age (to nearest year):________________
4. Sex (circle one): Male/Female
5. Your height: __________ ft. __________ in.
6. Your weight: ____________ lbs.
7. Your job title:_____________________________________
8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): _____________________

9. The best time to phone you at this number: ________________

10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes/No

11. Check the type of respirator you will use (you can check more than one category):
    a. ______ N, R, or P disposable respirator (filter-mask, non- cartridge type only).
    b. ______ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).

12. Have you worn a respirator (circle one): Yes/No

    If "yes," what type(s):_____________________________
    ____

Part A. Section 2. (Mandatory)

Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").

1. Do you currently smoke tobacco, or have you smoked tobacco in the last month: Yes/No

1. Have you ever had any of the following conditions?
    a. Seizures (fits): Yes/No
    b. Diabetes (sugar disease): Yes/No
    c. Allergic reactions that interfere with your breathing: Yes/No
    d. Claustrophobia (fear of closed-in places): Yes/No
    e. Trouble smelling odors: Yes/No

2. Have you ever had any of the following pulmonary or lung problems?
    a. Asbestosis: Yes/No
    b. Asthma: Yes/No
    c. Chronic bronchitis: Yes/No
    d. Emphysema: Yes/No
    e. Pneumonia: Yes/No
    f. Tuberculosis: Yes/No
    g. Silicosis: Yes/No
    h. Pneumothorax (collapsed lung): Yes/No
    i. Lung cancer: Yes/No
    j. Broken ribs: Yes/No
    k. Any chest injuries or surgeries: Yes/No
    l. Any other lung problem that you've been told about: Yes/No

4. Do you currently have any of the following symptoms of pulmonary or lung illness?
    a. Shortness of breath: Yes/No
    b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No
    c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No
    d. Have to stop for breath when walking at your own pace on level ground: Yes/No
    e. Shortness of breath when washing or dressing yourself: Yes/No

    f. Shortness of breath that interferes with your job: Yes/No
    g. Coughing that produces phlegm (thick sputum): Yes/No
    h. Coughing that wakes you early in the morning: Yes/No
    i. Coughing that occurs mostly when you are lying down: Yes/No
    j. Coughing up blood in the last month: Yes/No
    k. Wheezing: Yes/No
    l. Wheezing that interferes with your job: Yes/No
    m. Chest pain when you breathe deeply: Yes/No
    n. Any other symptoms that you think may be related to lung problems: Yes/No

5. Have you ever had any of the following cardiovascular or heart problems?
    a. Heart attack: Yes/No
    b. Stroke: Yes/No
    c. Angina: Yes/No
    d. Heart failure: Yes/No
    e. Swelling in your legs or feet (not caused by walking): Yes/No
    f. Heart arrhythmia (heart beating irregularly): Yes/No
    g. High blood pressure: Yes/No
    h. Any other heart problem that you've been told about: Yes/No

6. Have you ever had any of the following cardiovascular or heart symptoms?
    a. Frequent pain or tightness in your chest: Yes/No
    b. Pain or tightness in your chest during physical activity: Yes/No
    c. Pain or tightness in your chest that interferes with your job: Yes/No
    d. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No
    e. Heartburn or indigestion that is not related to eating: Yes/ No
    f. Any other symptoms that you think may be related to heart or circulation problems: Yes/No

7. Do you currently take medication for any of the following problems?
    a. Breathing or lung problems: Yes/No
    b. Heart trouble: Yes/No
    c. Blood pressure: Yes/No
    d. Seizures (fits): Yes/No

8. If you've used a respirator, have you ever had any of the following problems? (If you've never used a respirator, check the following space and go to question 9:)
    a. Eye irritation: Yes/No
    b. Skin allergies or rashes: Yes/No
    c. Anxiety: Yes/No
    d. General weakness or fatigue: Yes/No
    e. Any other problem that interferes with your use of a respirator: Yes/No
    f. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: Yes/No

Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-facepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

10. Have you ever lost vision in either eye (temporarily or permanently): Yes/No

11. Do you currently have any of the following vision problems?
    a. Wear contact lenses: Yes/No
    b. Wear glasses: Yes/No
    c. Color blind: Yes/No

    d. Any other eye or vision problem: Yes/No

12. Have you ever had an injury to your ears, including a broken ear drum: Yes/No

13. Do you currently have any of the following hearing problems?
    a. Difficulty hearing: Yes/No
    b. Wear a hearing aid: Yes/No
    c. Any other hearing or ear problem: Yes/No

14. Have you ever had a back injury: Yes/No

15. Do you currently have any of the following musculoskeletal problems?
    a. Weakness in any of your arms, hands, legs, or feet: Yes/No
    b. Back pain: Yes/No
    c. Difficulty fully moving your arms and legs: Yes/No
    d. Pain or stiffness when you lean forward or backward at the waist: Yes/No
    e. Difficulty fully moving your head up or down: Yes/No
    f. Difficulty fully moving your head side to side: Yes/No
    g. Difficulty bending at your knees: Yes/No
    h. Difficulty squatting to the ground: Yes/No
    i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No
    j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

Part B

Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire.

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No

   If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No

2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No

   If "yes," name the chemicals if you know them:__________
   ____
   ____
   ____

3. Have you ever worked with any of the materials, or under any of the conditions, listed below:
    a. Asbestos: Yes/No
    b. Silica (e.g., in sandblasting): Yes/No
    c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No
    d. Beryllium: Yes/No
    e. Aluminum: Yes/No
    f. Coal (for example, mining): Yes/No
    g. Iron: Yes/No
    h. Tin: Yes/No

i. Dusty environments: Yes/No
j. Any other hazardous exposures: Yes/No

If "yes," describe these exposures:____________________
____
____
____

4. List any second jobs or side businesses you have:_________
____
____

5. List your previous occupations:_______________________
____
____

6. List your current and previous hobbies:_________________
____
____

7. Have you been in the military services? Yes/No

   If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No

8. Have you ever worked on a HAZMAT team? Yes/No

9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No

   If "yes," name the medications if you know them:_________
____

10. Will you be using any of the following items with your respirator(s)?
    a. HEPA Filters: Yes/No
    b. Canisters (for example, gas masks): Yes/No
    c. Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?:
    a. Escape only (no rescue): Yes/No
    b. Emergency rescue only: Yes/No
    c. Less than 5 hours per week: Yes/No
    d. Less than 2 hours per day: Yes/No
    e. 2 to 4 hours per day: Yes/No
    f. Over 4 hours per day: Yes/No

12. During the period you are using the respirator(s), is your work effort:
    a. Light (less than 200 kcal per hour): Yes/No

       If "yes," how long does this period last during the average shift: ____________ hrs. ____________ mins.

Examples of a light work effort are sitting while writing, typing, drafting, or performing light assembly work; or standing while operating a drill press (1-3 lbs.) or controlling machines.

b. Moderate (200 to 350 kcal per hour): Yes/No
If "yes," how long does this period last during the average shift: ____________ hrs. ____________ mins

Examples of moderate work effort are sitting while nailing or filing; driving a truck or bus in urban traffic; standing while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; walking on a level surface about 2 mph or down a 5-degree grade about 3 mph; or pushing a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.

c. Heavy (above 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: ____________ hrs ____________mins.

Examples of heavy work are lifting a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock; shoveling; standing while bricklaying or chipping castings; walking up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lbs.).

13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No

    If "yes," describe this protective clothing and/or equipment:
    ____
    ____

14. Will you be working under hot conditions (temperature exceeding 77 degrees. F): Yes/No

15. Will you be working under humid conditions: Yes/No

16. Describe the work you'll be doing while you're using your respirator(s):
    ____
    ____
    ____

17. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):
    ____
    ____
    ____

18. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):

Name of the first toxic substance:________________________
Estimated maximum exposure level per shift:________________
Duration of exposure per shift:___________________________
Name of the second toxic substance:______________________
Estimated maximum exposure level per shift:________________
Duration of exposure per shift:___________________________
Name of the third toxic substance:________________________
Estimated maximum exposure level per shift:________________

Duration of exposure per shift:____________________________
The name of any other toxic substances that you'll be exposed to while using your respirator:

____
____
____
____
____

19. Describe any special responsibilities you'll have while using your respirator(s) that may affect the safety and well-being of others (for example, rescue, security):
    ____
    ____

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, of if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.

2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.

3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.

4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

APPENDIX T

List of Project Contractor Reviewers

Tim Tangeman District Safety Manager	Kiewit Construction Company 16 Trotter Drive Medway, MA 02053 (508) 533-1400 (x201)
John A. Reyhan President	Sangamo Construction Company 2100 East Moffat Ave. P.O. Box 38 Springfield, IL 62075 (217) 544-9871
Gerry Anderson District Safety Supervisor	Kiewit Construction Company 6797 Dorsey Road, Suite 5 Baltimore, MD 21227 (410) 796-8311
Dave Maloney, Jr. Safety Coordinator	Joseph B. Fay Co. P.O. Box 11351 Pittsburgh, PA 15238 (412) 963-1870
Jim Wathen Southwest Safety Engineer	General Construction Company 34 Executive Park, Suite 100 Irvine, CA 92614-6721 (714) 553-8800
Kenneth Straney Project Manager	ET&L Construction Corporation Rt. 117 & Delaney Street Stow, MA 01775 (508) 897-4353
Vic Gremillion Corporate Safety Director	Boh Bros. Constuction, Co., LLC 730 S. Tonti Street PO Drawer 53266 New Orleans, LA 70153 (504) 821-2400

APPENDIX U

CAPSTONE CONSTRUCTION COMPANY
RESPIRATOR PROGRAM

GENERAL

This is a mandatory program for each project where respiratory hazards are present. The program is designed to allow each project to identify their hazards and to provide the appropriate protection. Each project where respiratory protection is needed shall have a Respirator Program Administrator (RPA). This individual must be knowledgeable of respiratory protection equipment, including the manufacturer recommendations and instructions for the proper use, inspection and maintenance. The RPA must be capable of identifying existing and potential respiratory hazards and has the authority to take prompt corrective action to protect workers from those hazards.

The Respirator Program Administrator for this project is:

____
(PRINT)

The intent of this written program is to define the company rules now in effect regarding the use of respirators for personal protection against airborne contaminants. The requirements contained herein are not optional for the employee. Capstone Construction considers this policy mandatory and a condition of employment for each individual.

To ensure the availability of this respirator program at all times, copies of this written program shall be distributed as follows:

1. ____
2. ____
3. ____

WORK AREA SURVEILLANCE

It is essential to follow the Hazard Communication Program of this company in order to identify all chemical hazards prior to the commencement of work. A review of all Material Safety Data Sheets for the project will be necessary to complete the following list of potential air contaminants where respiratory protection may be required. Air sampling may be conducted to define personal exposures associated with potentially hazardous operations and follow-up air sampling shall be conducted when conditions change. Documentation of all air sampling shall be maintained at the project using the following table.

For this project the following is a list of all known Air Contaminants (i. e. Welding, Organic Solvents, Fiberglass), exposure levels, and project locations where these contaminants are likely to be found.

AIR CONTAMINANTS	KNOWN OR ANTICIPATED EXPOSURE LEVEL	LOCATION

AVAILABILITY OF RESPIRATORS

Each employee that requires a respirator will be provided one by the RPA with replacement parts, cartridges and filters available upon request. The following types of respirators are available:

TYPE OF RESPIRATOR & CARTRIDGE	CONTAMINANT(S) PROTECTED AGAINST
1. ____________________	____________________
2. ____________________	____________________
3. ____________________	____________________
4. ____________________	____________________
5. ____________________	____________________
6. ____________________	____________________
7. ____________________	____________________
8. ____________________	____________________
9. ____________________	____________________
10. ____________________	____________________

USE OF RESPIRATORS

Each employee whose job assignment requires a respirator shall wear a NIOSH approved respirator, properly fitted, at all times during the course of that job assignment. Additionally, any employee in the immediate area of a hazardous operation and at risk of an exposure must follow the requirements of this program. No alterations of the respirators are permitted. The following operations at this project are considered potentially hazardous and require the use of a respirator:

1. ____________________	11. ____________________
2. ____________________	12. ____________________
3. ____________________	13. ____________________
4. ____________________	14. ____________________
5. ____________________	15. ____________________
6. ____________________	16. ____________________
7. ____________________	17. ____________________
8. ____________________	18. ____________________
9. ____________________	19. ____________________
10. ____________________	20. ____________________

SELECTION OF RESPIRATORS

Only NIOSH approved respirators have been chosen for use in this program. The choice between these respirators is dependent upon the airborne contaminant present, the operation performed, and on the basis of comfort and ease in obtaining a proper individual fit. Negative pressure respirators may only be used for slightly to moderately toxic dusts, fumes and mists, or vapors with good odor warning properties (10% less concentration of the allowable limit). Half face respirators may only be used for up to 10 times the permissible exposure limits (PEL); full face respirators for up to 50 times the PELs. They are not allowed for use in unknown concentrations, emergency or rescue, immediately dangerous to life and health situations or oxygen deficient atmospheres.

The company will provide these respirators, maintaining a supply at the project site. The useful life of each respirator will depend mainly on the employee's job duties and the actual time the unit is in use. A respirator cartridge or canister change schedule will be provided to each userand must strictly followed. Notify RPA if any contaminants are sensed through breathing becomes difficult using cartridge/canister schedule.

FITTING OF RESPIRATORS

Proper fitting of respirators is essential if employees are to receive the designed protection. Air that passes around the edges of the respirator, rather than through it, is not filtered air. In order to ensure a good face seal, the following rules must be observed.

1. The respirator and straps must be in place and work in the appropriate position. To adjust head bands, pull the free ends tight until a comfortable fit is obtained. All straps shall be secure.

2. To adjust the facepiece properly, simply position your chin firmly in the chin cup and manually shift the rubber mask until the most comfortable position is located. Make final adjustments in the head band and do not break the nasal seal. Modifications to the respirator or straps shall not be made.

3. Proper fit must be checked each time the respirator is worn. Fit checking procedures found in Appendix B-1 of 1910. 134 will be followed each time a respirator is put on. The Respirator Program Administrator will assure during the training period, that each employee can demonstrate the use of fit-checking procedures. Respirators shall not be worn when projections under the facepiece prevent a good face seal. Note: Such conditions may be a growth of beard, sideburns, temple pieces on glasses or a skullcap that projects under the facepiece.

4. Prior to issuing a respirator to an individual, the respirator must be tested using the appropriate qualitative or quantitative fit test procedures found in Appendix A of 1910. 134. For example, qualitative fit tests determine if the wearer can detect the "banana oil" odor. Irritant smoke tests can also be used with respirators to insure proper fit. An advantage of the irritant smoke method is that subjective employee responses are eliminated since a poor fit results in an involuntary coughing response. Quantitative and semi-quantitative fit tests involve the use of a booth or other means for measuring the concentration of the test atmosphere inside the respirator versus the concentration which exists outside the respirator.

5. The fit test exercises for testing a respirator equipped with a facepiece include the following for at least two minutes each:
    a. Normal breathing
    b. Deep breathing
    c. Turning head from side to side
    d. Nodding head up and down
    e. Talking
    f. Normal breathing

   In the event an employee is unable to obtain a satisfactory fit with the type of respirator furnished, the RPA will make efforts to correct the problem (i. e. provide a different size of respirator or a different brand of respirator).

6. Fit testing will be conducted prior to wearing a respirator, and will be repeated annually. Fit testing will also be conducted whenever a different respirator facepiece is used, or when there is a change in an employee's physical condition that could affect a fit (such as dental work or surgery, that affects the facial contours.)

CLEANING, INSPECTION, STORAGE AND MAINTENANCE OF RESPIRATORS

Respirator cleaning, inspection, storage and maintenance are part of the user's responsibility. Procedures for cleaning and disinfecting respirators found in 1910. 134, Appendix B-2 will be followed.

Respirators must be cleaned after each day's use and placed in a plastic bag and properly stored.

At the end of each week (or more often, if needed) respirators should be completely cleaned and disinfected by carrying out the following procedures:

1. Remove the air purifying elements from the respirator. Air purifying elements must never be washed and disinfected.

2. Immerse the respirator in a warm (140-160 degrees F) aqueous solution of a germicidal detergent. The respirator facepiece and parts may be scrubbed gently with a soft brush. Make sure that all foreign matter is removed from all surfaces of the rubber exhalation valve flap and plastic exhalation valve seats.

3. After washing and disinfecting the respirator, rinse the same with clean, warm (140160 degrees F) water and then allow the respirator to dry.

4. After the respirator is dry, attach the air purifying elements.

5. Store the respirator in the container provided for the purpose.

Any malfunction on the respirator shall be reported to Respirator Program Administrator. Necessary replacement parts will be made available.

After inspection, cleaning and necessary repair, or after each day's use, the respirator shall be stored in a bag and in the location provided for the purpose of protecting the respirator and keeping it clean and sanitary. In storing the respirator, the facepiece and exhalation valve must be in normal position, so as to prevent the abnormal set of elastomeric parts during storage.

Each worker assigned to use a respirator shall maintain and routinely inspect it before and after each use. Respirators will be inspected monthly by the Respirator Program Administrator to assure that they are kept clean and in satisfactory working condition.

MEDICAL SURVEILLANCE

A blank Respirator Medical Evaluation Questionnaire (identical to that found in 1910. 134, Appendix C) will be provided to each employee required to use a respirator prior to fit testing. This questionnaire must be completed and sent, in the postage-paid envelope, to the designated examining licensed health care provider (LHCP). Information provided by the employee in this questionnaire will not be disclosed to this company or the Respirator Program Administrator. The Respirator Program Administrator will give the LHCP information regarding the type of respirator each employee will be using, how and when the respirator will be used, the employee's work duties, and other factors which may affect the employee's ability to use a respirator such as the use of additional personal protective equipment, and the presence of high heat and humidity working conditions. A copy of this written respiratory protection program and a copy of 1910. 134 will also be provided to the LHCP.

The Licensed Health Care Provider for this Project is:

____

Based on information about the types and conditions of respirator use, and a review of the questionnaire, the examining physician may request that an employee visit for a follow-up medical examination to determine the ability to wear a respirator. A recommendation regarding a prospective respirator user's ability to wear a respirator will be provided to the company by the LHCP. A copy of this recommendation will be provided to the prospective user as well.

Employees who have been approved to wear a type or types of respirators by a LHCP, will be provided additional medical evaluations at a later date if any of the following conditions exist:

- The employee reports medical signs or symptoms that are related to the ability to use a respirator;
- An LHCP, supervisor, or the Respirator Program Administrator request a reevaluation;
- Any information such as observations during fit testing or inspections of the respirator program indicates the need for employee reevaluation; or
- A change in workplace conditions (such as physical work effort, protective clothing, increased temperature or humidity) occurs that may result in an increase in the physiological burden placed on an employee.

TRAINING AND INFORMATION

Before initially using a respirator, and at least annually, each employee will receive training regarding the need for, care and use of their respirator. Following the training, each employee will be asked to explain and/or demonstrate:

- Why they need to wear the respirator;
- How the proper functioning of the respirator can be effected by improper fit, usage, or maintenance;
- In what hazards and work conditions the respirator will and will not provide proper protection;
- How to recognize when the respirator malfunctions, and what to do about it;
- How to inspect, put on, take off, use and fit check the respirator;
- How to properly maintain and store the respirator;
- How to recognize personal health problems which may make wearing a respirator hazardous to your health;
- The contents of this company's respirator program and the general requirements of OSHA's respirator standard;
- The purpose of this company's medical surveillance program for respirator use and how it works.

Upon successful demonstration that the employee understands the information above, a respirator training card will be presented to each employee. This card will contain the employee's name, date of training, specific respirators the employee may use, and the date for the next training. Training may be repeated more often than annually as necessary.

Respirator Training Record

Employee Name	Date of Training	Allowable Respirators	Trainer

RESPIRATOR PROGRAM EVALUATION

The company shall monitor the effectiveness of this program by:

1. Frequent unscheduled observation of employee activities throughout the project to confirm proper respirator use and continual supervisory enforcement to ensure that employees are wearing proper respirators and maintaining them properly.

2. Observation of, and discussion with, new and relocated employees to confirm proper training has been carried out.

3. Periodic discussion with supervisors and general personnel during appropriate scheduled meetings to reinforce previous training.

RECORDKEEPING

Records shall be kept at the job site to document that each respirator wearer has been subject to training, fit testing, medical surveillance. Written records of air sampling information, workplace surveillance information, respirator types available on site, respirator inspections and program evaluations will also be kept at the site. Following the conclusion of the job, all written records related to respiratory protection will be forwarded to the company administrative offices. The LHCP will maintain any confidential medical information, including the employee's initial Respirator Medical Evaluation Questionnaire. Any employee may review safety and health records related to this or any prior job by contacting their supervisor or the company's records administrator.