The HUD Lead-Based Paint Abatement Demonstration (FHA)

August 1991

Prepared for the
U.S. Department of Housing and Urban Development
Office of Policy Development and Research
Washington, D.C.
By
Dewberry & Davis
HC-5831

NOTE TO THE READER: In order to avoid duplication of effort, only the first two sections of the Instruction to Bidders, (General Information and Description/Definition of Work) are included here. The extensive Federal regulations regarding Worker Protection during abatement that were originally included in the Instructions to Bidders have been omitted for the purposes of this report, and are listed below:

- NIBS Guidelines, Chapter II, Worker Protection
- OSHA Regulation 29 CFR 1910.1025
- OSHA Respirator Standard 29 CFR 1910.134
- OSHA Regulation 29 CFR 1910.1200
- EPA, Office of Solid Waste and Emergency Response, Understanding the Small Quantity Generator Hazardous Waste Rules: A Handbook for Small Business, September 1986.
- 40 CFR Parts 260, 261, 262, 264, 265, 268, 270, and 271.

CONTRACT DOCUMENTS

9/8/89

AGREEMENT

THIS AGREEMENT, entered into as of this ___ day of ____________, 19__, by and between ____________________________ hereinafter called the Contractor and Dewberry & Davis hereinafter called the Engineer.

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The Contractor will commence and complete the abatement of lead-based hazard paint at:

   ____

   ____

2. The Contractor will furnish all of the materials, supplies, tools, equipment, labor and other services necessary for the construction and completion of the **PROJECT** described herein.

3. The Contractor will commence the **WORK** required by the **CONTRACT DOCUMENTS** on or before a date to be specified in a written **"NOTICE TO PROCEED"** issued by the Engineer and to complete the same within _____ consecutive calendar days thereafter unless the period for completion is extended otherwise by the **CONTRACT DOCUMENTS**. The Contractor further agrees to pay, as liquidated damages, the sum of _______ for each consecutive calendar days thereafter until the completion and acceptance of the **WORK** by _______ as hereinafter provided in Paragraph 20 of the General Conditions.

4. The Contractor agrees to perform all of the **WORK** described in the **CONTRACT DOCUMENTS** and comply with the terms therein for the sum of $__________.

5. The term **"CONTRACT DOCUMENTS"** means and includes the following:

   (a) Agreement
   (b) General Conditions for all the work.
   (c) Specifications as shown in Bid Schedule and Sections I through IV of the Specifications

   (d) Bid and Bid Quantity List
   (e) Instructions for Bidders
   (f) Special Conditions (if submitted)
   (g) Payment Bond
   (h) Performance Bond
   (i) Notice to Proceed
   (j) Change Orders

(k) ADDENDA:

No._____, dated ______________, 19__.

No._____, dated ______________, 19__.

No._____, dated ______________, 19__.

No._____, dated ______________, 19__.

No._____, dated ______________, 19__.

6. The Engineer will pay to the Contractor in the manner and at such times as set forth in the General Conditions, such amounts as required by the **CONTRACT DOCUMENTS**.

7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors and assigns.

IN WITNESS WHEREOF: The parties hereto have executed or caused to be executed by their duly authorized official, this agreement in (______) copies each of which shall be deemed an original on the date first above written.

ENGINEER:

____

BY:__________________________

NAME:________________________

TITLE:_______________________

ATTEST:

____

NAME:________________________

TITLE:_______________________

CONTRACTOR:

____

BY: ___________________________

NAME: _________________________

TITLE: ________________________

ATTEST:

____

NAME: _________________________

TITLE: ________________________

PART B

Item 1B. Capital Costs: $________________

Note: Capital costs includes the cost of any equipment or materials purchase or leased to perform the actual abatement. This cost will include items such as HEPA vacuums, abrasive removal equipment, heat gun, etc.

Item 1C. Overhead Costs: $________________
Item 1D. Cleanup Costs: $________________

Note: Cleanup consists of completely vacuuming the housing unit where abatement occurred with a HEPA vacuum, cleaning with a Trisodium Phosphate wash (5% to 10%) and a final vacuuming with HEPA vacuum.

Item 1E. Waste Disposal Costs: $ N/A

Note: This will only apply if contractor is requested to bid on hauling and disposing of hazardous waste material. The contractor is responsible for the collecting, bagging and storing of this material. Contractor is also responsible for collecting and disposing of all non-hazardous waste according to the Contract Documents.

Item 1F. Set-Up Costs: $________________

Note: This will apply to the costs associated with preparing the unit for abatement including removal of debris, pre-cleaning, plastic, installation of plastic, set-up of decontamination area, lockable dumpster, i.e rental, etc.

PART C

ITEM	SPECIFICATION	QTY	DESCRIPTION	UNIT PRICE	TOTAL

Specification A
Encapsulation ---- Interior and Exterior Coatings

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this section includes the furnishing of all labor, materials, and equipment required to encapsulate lead-based paint by application of a coating sealer system.

Part 2. Encapsulation Coating Systems

2.1 Elastic acrylic coatings shall be warranted by the manufacturer to be heavy-bodied and compatible with the substrate they are applied to. Elastic acrylic coatings shall be long-lasting and resist cracking, peeling, algae and fungus. Elastic formula should allow for some movement in walls without cracking. Coatings shall contain no hazardous ingredients by OSHA definition and be non-flammable.

Part 3. Execution

3.1 Encapsulation coatings shall be applied in accordance with the manufacturer's recommendations.

3.2 Remove surface dust and debris by scrubbing with detergent (trisodium phosphate 5%-10% solution) and rinsing. Remove loose paint until a sound, intact edge is achieved. Loose plaster shall be removed and replaced prior to the coating application.

3.3 Encapsulation coatings shall be applied to the substrate in a continuous system as to seal the surface being coated. The number of coats required and coverage rates shall be accordance with the manfacturers' recommendations.

3.4 Areas that are lifting and peeling after the application of the coating shall be repaired by scraping until sound adhesive is obtained, feathering the edges and repainting.

3.5 Obstacles in the surface to be coated such as electric receptacles, switches, exhaust fans, hardware etc. are to be removed or covered so to prevent them from being coated.

Part 4. Damages Care shall be taken to protect adjacent surfaces and surface obstacles from damage from coating systems. Damages to non-protected adjacent surfaces and surface obstacles shall be repaired at the Contractor's expense.

Specification B
Abrasive Removers -- Machine Sander

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this section includes the furnishing of all labor, materials, and equipment required to remove lead-based paint by machine sanding using a high efficiency dust Particulate Accumulator (HEPA) vacuum system, as called out in these specifications.

Part 2. Machine Sanding Equipment

2.1 Sanders shall be of the dual action, rotary action, orbital or straight line system type, capable of being fitted with a high efficiency particulate accumulator (HEPA) dust pick-up system.

2.2 Air compressors utilized to operate this equipment shall be designed to continuously provide 90 to 110 p.s.i. or as recommended by the manufacturer.

Part 3. Execution

3.1 Sanding shall only be done on flat surfaces which allow the HEPA dust collection system to come into tight contact with the surface being sanded. Surfaces to be sanded shall be wide enough to allow maximum efficiency of the HEPA dust collection system.

3.2 All lead-based paint shall be removed down to the bare substrate surface. In cases that some pigment may remain embedded in wood grain and similar porus substrate, care shall be taken to avoid damage to the substrate with the sanding machine. If the pigment can not be removed without damaging the substrate, Contractor shall notify the Engineer for further instructions.

Part 4. Damages Care shall be taken to protect adjacent surfaces such as drywall, paneling, plaster, glass, etc. from damage from machine sanding. Damages to non-protected adjacent surfaces shall be repaired at the Contractor's expense.

Specification C
Heat Blower Gun Removers

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this section includes the furnishing of all labor, materials, and equipment required to remove lead-based paint by heat, using a heat blower gun followed by scrapping, as called out in these specifications.

Part 2. Heat Blower Gun Equipment

Electrically-operated, heat-blower gun shall be a flameless electrical paint softener type. Heat-blower shall have electronically controlled temperature settings to allow usage below a temperature of 700 degrees Fahrenheit. Heat-blower shall be DI type (non-grounded) 120V, AC application. Heat-blower shall be equipped with various nozzles to cover all common applications (cone, fan, glass protector, spoon reflector, etc.).

Part 3. Execution

3.1 The hot air stream from the heat-blower gun shall be directed at the painted surface and the paint allowed to blister and soften. Considerable lead is volatilized from lead-based paint and lead fumes are released at approximately 700 degrees Fahrenheit. Heat-blower shall not be operated above 700 degrees Fahrenheit and respirator protection is required for all persons in the work area.

3.2 Softened paint shall be removed down to the substrate surface as completely as possible by scraping and/or brushing. In cases that some pigment may remain embedded in wood grain and similar porus substrate, care shall be taken to avoid damage to the substrate with the scraping or brushing. If the pigment can not be removed without damaging the substrate, Contractor shall notify the Engineer for further instructions.

Part 4. Damages

Care shall be taken to protect glass in windows and doors, and adjacent areas from damage from thermal stresses induced by the concentrated heat of the heat-blower gun. Damages to non-protected glass and adjacent areas from thermal stresses shall be repaired at the Contractor's expense.

Specification D
On-Site Chemical Removers

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this section includes the furnishing of all labor, materials, and equipment required to remove lead-based paint by scraping and/or brushing after the paint has been softened by the application of a chemical stripping agent, as called out in these specifications. Exterior applications may be removed by water jet washing method on masonry substrates only.

Part 2. Chemical Stripping Removers

2.1 Chemical removers shall contain no methylene chloride products. Chemical removers shall be compatible with, and not harmful to the substrate that they are applied to. Chemical removers used on masonry surfaces shall contain anti-stain formulation that inhibits discoloration of stone, granite, brick and other masonry construction. Chemical removers used on interior surfaces shall not raise or discolor the surface being abated.

2.2 Chemical Stripping Agent Neutralizer

Chemical stripping agent neutralizers may be used on exterior surfaces only. Neutralizers shall be compatible with and not harmful to the substrate that they are applied to. Neutralizers shall be compatible with the stripping agent that has been applied to the surface substrate.

Part 3. Execution Chemical stripping agents and neutralizers shall be applied in accordance with the recommendations of the manufacturer. Care must be taken to adhere to all health/safety code and other specification section requirements. Stripping agents shall not be allowed to penetrate wood or other fibrous substrates. The softened paint shall be removed by scrapping or wire brush.

Part 4. Damages The Contractor shall protect adjacent areas from damage from stripping agent during the course of work. Damages to non-protected adjacent areas from stripping agent shall be repaired at the Contractor's expense.

Specification E
Vacuum Blasting Removers (Full Containment)

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this section includes the furnishing of all labor, materials, and equipment required to remove lead-based paint by machine blasting using a vacuum blaster with full containment capability, as called out in these specifications. Blasting shall not be considered for use on wood surface.

Part 2. Vacuum Blasting Equipment and Abrasive Media

2.1 Blaster shall be of full containment vacuum type, designed in full compliance with ASME, OSHA and all codes that govern the removal and handling of hazardous materials. The machine shall automatically clean dust and contaminates from the used abrasive by a dust separator before reuse of abrasive. All machine air filters shall be automatically cleaned during operations. The machine shall automatically load the dust and contaminates into approved disposable bags during operations. The machine shall be equipped with brush type blast heads for a wide range of flat, curved and other shaped surfaces.

2.2 Blasting media shall be non-toxic and conform to the recommendations and specifications of the vacuum blasting machine manufacturer.

Part 3. Execution

3.1 Blasting shall be done on flat and shaped surfaces that are compatible with the available blast heads as provided by the equipment manufacturer. Blast heads shall come into contact with the surfaces being blasted as to provide maximum containment of dust and debris created by the blasting operation.

3.2 All lead-based paint shall be removed down to the bare substrate. In some cases that pigment may remain embedded in porous materials, care shall be taken not to damage the substrate with the blasting operation. If pigments cannot be removed without damaging the substrates, the Contractor shall notify the Engineer for further instructions.

3.3 Blasting operations shall be performed by workers who are properly trained in the use of the blasting equipment being utilized.

3.4 All work shall be in compliance with this Section, and all other applicable specification sections and all health and safety codes.

Part 4. Damages The Contractor shall protect adjacent surfaces such as drywall, paneling, plaster, glass, etc. from damage from blasting work. Damages to non-protected adjacent surfaces shall be repaired at the Contractor's expense.

Specification F
Enclosure ---- Paneling

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section

1.2.0 Work included under this Section includes the furnishing of all labor, materials, and equipment required to enclose lead-based painted surfaces with prefinished plywood paneling complete as called out in these specifications.

1.2.1 Prior to the start of work, the Contractor shall submit to the Engineer for approval, manufacturer's descriptive literature, two (2) 12"x 12" samples of paneling and two (2) 6" long samples of molding of each color chosen for submittal. Submittal of samples shall be in compliance with Specification K.

Part 2. Prefinished Plywood Panel

2.1 Prefinished plywood paneling shall be 5/32 inch thick, good (1) grade, lauan backing grade veneer, with type II bonding glue. Surface flame spread shall not exceed a 200 rating in accordance with ASTM E84 or in accordance with building code whichever is most restrictive.

2.2 Panel Finish-Nails, Putty Stick, Molding

The panel finish shall be as selected by the Engineer from samples submitted. Nails shall be finish type. Color of nails, putty stick and molding shall be matched to the paneling. Molding shall be as recommended by the manufacturer.

2.3 Adhesive Adhesive for bonding paneling to framing or existing surfaces shall be as recommended by the paneling manufacturer.

2.4 Furring Strips If furring strips are used, a system that is enclosed at the top, bottom and sides of the walls in addition to the placement of the strips for enclosure installation shall be used. Adhesive shall be applied to the top, side and bottom furring strips prior to attaching the paneling.

Part 3. Execution

3.1 Surface Preparation

3.1.0 Remove foreign material by wash-down with a 5% to 10% trisodium phosphate solution. Remove loose plaster, loose paint and loose wallpaper.

3.1.1 Repair damaged areas flush with existing wall surface prior to installation of paneling.

3.1.2 Warning labels stating surface contains **"LEAD-BASED PAINT"** shall be affixed to the surface prior to being enclosed. Labels shall be 3"x5" and placed every 4' across the wall being enclosed.

3.2 Test for Soundness

3.2.1 Test for soundness of paint bond where the condition is questionable by application of 3/8" x 3" long bead of adhesive to the face of an 8" square of gypsum wallboard and press wallboard square on to wall surface to be tested. Allow setting time recommended by adhesive manufacturer. Pull square away from wall. Paint bond is acceptable if the paper surface is separated from the wallboard square.

3.2.2 Repeat test procedure wherever wall surface is questionable. If test fails, Contractor will notify the Engineer for further instructions.

3.3 Paneling Installation

3.3.0 Panel shall fit as tight as possible to adjacent surfaces (zero clearance). Each panel shall be fitted before applying adhesive.

3.3.1 The adhesive shall be applied in a 3/8 inch diameter bead at 16 inch o.c or on all framing and continuous 1/2 inch from edges. One bead shall be installed at each abutting edge.

3.3.2 Press panel firmly into contact with adhesive. Nail top, bottom and side edges at 6 inch o.c Caulk or seal around perimeter of each panel with an approved caulk or sealant.

3.3.3 Nails used to install paneling over existing wall surfacing shall be sized to penetrate a minimum of 7/8 inch into the existing wall surfacing.

3.3.4 Molding shall be installed with mitered, tight, smooth corners.

3.3.5 Penetrations made in paneling to accommodate electrical receptacles, switches, light fixtures, etc. shall be sealed continuous with a non-hardening caulk or sealer. Penetrations shall be slightly larger then the existing opening to allow for a tight seal to the existing wall surfacing.

Specification G1
Enclosure of Exterior Substrate

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this Section includes the furnishing of all labor, materials and equipment required to enclose lead-based painted exterior surfaces complete, as called out in these specifications.

Part 2. Enclosure Systems

2.1 Composite Enclosure Systems shall be long lasting and demonstrate resistance to moisture, mildew, abrasion, chemicals, absorption-freeze and impact. Composite enclosure systems shall be of reinforcing mesh type that allow for thermal expansion and contraction without cracking, peeling or spalling. Composite systems shall have a mechanically fastened reinforcing mesh set in a adhesive base coat with final application of a finish coat. Composite systems that include insulation board are acceptable. Composite enclosures shall be installed to the substrate in a continuous system as to completely enclose the lead-based painted substrate that they are applied to. Composite systems shall be fire resistant to produce a flame spread of no more then 10 and smoke development of no more the 5 in accordance with the modified ASTM E-108 Fire Test or local code, whichever is most restrictive.

2.2 Fabricated Enclosure Systems shall be of aluminum, vinyl or wood enclosure systems. Fabricated systems shall be long lasting and demonstrate resistance to moisture, mildew, abrasion, chemicals, absorption-freeze and impact. Fabricated systems shall allow for thermal expansion and contraction without cracking, peeling or buckling. Fabricated systems shall be installed on a furring system that is enclosed at top, bottom and sides as to form a tight enclosure to contain lead-based paint flakes and dust completely. Fabricated systems shall consist of furring with mechanically attached sheeting. Sheeting joints are to be sealed by tapping. The sheeting system shall provide a vapor barrier to prevent a dewpoint condition behind the sheeting. Finally the system shall be sided with aluminum, vinyl or wood. Exterior trim such as soffits, fascia window and door trim shall be completely enclosed with mechanically fastened aluminum, vinyl or wood and sealed with an approved caulk or sealer to completely contain lead-based paint flakes or dust.

2.3 Enclosure systems shall be submitted to the Engineer for approval in accordance with Specification K.

2.4 Warning labels stating surface contains"**LEAD-BASED PAINT**" shall be affixed to the surface prior to being enclosed. Labels shall be 3"x5" and placed every 4' across the wall and at the bottom and top of the wall being enclosed.

Part 3. Execution

3.1 Enclosure systems shall be installed in compliance with the manufacturer's recommendations.

3.2 Composite enclosure systems shall be installed only to flat substrate of good structural integrity such as masonry, concrete, stucco etc.

3.3 Fabricated enclosure systems may be installed to irregular as well as flat substrate. Irregular substrates are shingle, lap joint, formstone etc.

3.4 Care shall be taken to comply with the General Conditions, Part 8 20,21 and Section I - Set Up Procedures, Section II - Worker Protection, Section III - Cleanup Procedures and Section IV - Disposal of Waste Materials.

Part 4. Damages The Contractor shall exercise care as to protect adjacent areas or elements from damage caused by this work. Damages to non-protected areas or elements or from lack of care shall be repaired or replaced at the Contractor's expense.

1.0 Set-Up Procedures for Abatement

1.1 Safety Guidelines: Shut down or alter all electrical power sources and mechanical ventilation systems to affected areas prior to containment. Institute controls to avoid electric shock to workers in the control area. The Contractor shall abide by OSHA regulations contained in 29 CFR 1910.1025 which are included in the instruction to bidders.

1.2 Isolation of Work Area: Prior to the preparation of a dwelling for abatement, the contracts shall place warning signs immediately outside all entering and exits to the dwelling. Signage shall be labeled **"CAUTION LEAD HAZARD, KEEP OUT"** and be in bold letters at least 2 inches high. Signage shall also state the address of the dwelling being abated and date the abatement will commence. Signage shall be posted at least three (3) days prior to the commencement of abatement and shall remain until the work has been accepted by the Engineer. Signs stating that no smoking, eating or drinking in the work area shall also be posted.

1.3 Access to Units: The Contractor will not allow anyone access to the dwelling unless they have successfully passed the Lead Paint and Health and Safety Training Course (See Section 2.1) and have been fitted and wearing a properly fitted respirator unless stated otherwise by the Engineer.

1.4 Protective Clothing: Furnish personnel exposed to airborne concentrations of lead dust with disposable protective whole body clothing, head coverings, gloves and foot coverings. Furnish disposable plastic or rubber gloves to protect hands for use during abatement methods requiring such. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Use tape to secure sleeves at the wrists and to secure foot coverings at the ankles.

1.5 Work Clothing: Cloth work clothes may be work under the disposable protective coveralls. Cool vest for workers are recommended for use in temperatures above 100 degrees.

1.6 Pre-Cleaning of Housing Unit: The Contractor shall pre-clean all surfaces with a HEPA vacuum and remove any furniture, curtains, carpet or other moveable objects. All debris gathered during this cleanup shall be disposed of in accordance with sections 3.6 and 3.7 of the contract documents.

SECTION I

SET UP PROCEDURES FOR ABATEMENT

1.7 Preparation of Interior Work Area: The contractor shall seal off all critical barriers including doors, vents, HVAC units, windows, drains and plumbing to the house with 2 layers of 6 mil plastic. One layer of 6 mil plastic shall be applied to the floor and any walls not being abated. Tread guards on plasticized stairways should be added to prevent slipping. Plastic shall be installed with 2" duct tape, spray adhesive and industrial size staples. All joints must be taped. Any remaining immovable objects such as cabinets, appliances, etc. shall be covered with one layer of plastic and have joints taped.

1.8 Preparation of Exterior Work Area: The contractor shall place 6 mil plastic on the ground extending out from the foundation at least 5 feet and an additional 3 feet per story to a maximum of 20 feet. The plastic shall be secured at the foundation by placing weights on the plastic. The edge of the plastic shall be elevated at both ends to trap all water and debris. All exterior doors and windows on any exterior wall that is being abated shall be covered with plastic. All shrubs and bushes shall be covered to prevent damages from liquid waste or dust.

1.9 Airlock Preparation: All entrances or doorways leading to and from the work area shall be controlled with a three (3) stage airlock. The airlock shall be comprised of one sheet of plastic taped and stapled on all four sides of the opening. This sheet shall then be split to allow passage through the entrance. Two sheets of plastic, one on each side of the split plastic sheet, shall be taped and stapled to the top of the opening and will hang down and fully cover the opening on both sides. The airlock shall be braced by wood or PVC. Airlocks shall also be constructed inside the building between rooms that are being abated and rooms that are not being abated.

1.10 Change Rooms: A decontamination area that is adjacent and connected to the abatement area for the decontamination of workers contaminated with lead shall be constructed. The decontamination shall consist of an equipment room, shower area, and clean room in series. Ensure that employees enter and exit the regulated area through the three (3) stage airlock decontamination area. A temporary unit shall provide for a separate decontamination locker room and a clean locker room for personnel required to wear whole body protective clothing. Provide two separate lockers for each lead worker, one in each locker room. Street clothing and street shoes are to be stored in the clean locker. While still wearing respirators at the boundary of the lead work area HEPA vacuum and remove disposal protective clothing seal in impermeable bags or containers for disposal. Do not remove disposable protective clothing in the decontamination locker room. Remove cloth work clothing and respirators in the decontamination room. Tag and bag cloth work clothes for laundering and keep work shoes in the decontamination locker. Do not wear work clothing between home and work. Locate showers if required or wash facilities between the decontamination locker room and the clean locker room and require that all employees shower before changing into street clothes. Shower waste water shall be handled and disposed of as lead-contaminated material or shall be filtered through a final filter of at least 0.5 micron particle size collection capability before disposal into the sanitary sewer system. Handle and dispose of filters as lead-contaminated material. Clean lead contaminated work clothing in accordance with 29 CFR 1910.1025. Change rooms shall be physically attached to the lead control area. (See Section 2.5 through 2.6 of the contract documents for filter information)

1.11 <u>Eye Protection:</u> Furnish goggles to personnel engaged in lead operations when the use of a full face respirator is not required.

Specification G
Enclosure ---- Gypsum Wallboard

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this Section includes the furnishing of all labor, materials and equipment required to enclose lead-based painted surfaces with gypsum wallboard complete, as called out in these specifications.

Part 2. Materials

2.1 Gypsum Wallboard Gypsum wallboard shall be in accordance with ASTM C36-70 or Federal Specification SS-L-30C, Type III, Grade R, Class I and shall be 1/2 inch thick.

2.2 Molding-Beading

2.2.0 Corner bead shall be U.S. Gypsum No. 101 dura-bead or equal.

2.2.1 Casing bead shall be U.S. Gypsum No. 200A metal trim or equal.

2.2.2 Molding shall be installed with formed, mitered, tight and smooth corners and splices.

2.3 Adhesive Adhesive for bonding wallboards to framing or to existing surfaces shall be as recommended by the wallboard manufacturer.

2.4 Nails Nails shall not be used.

2.5 Screws Screws shall be self-tapping, bugle-head for use with power driven screwdrivers. Type S, 1" long, shall be used to fasten wallboard to sheet metal. Type W, 1 1/4" long shall be used to fasten wallboard to wood. Type G, 1 1/2" long shall be used to fasten wallboard to wallboard. Type G, 1 1/2" long shall be used to fasten wallboard to an existing plaster wall and shall be penetrated into framing a minimum of 5/8 inch.

2.6 Furring Strips If furring strips are used, a system that is enclosed at the top, bottom and sides of the walls in addition to the placement of the strips for enclosure installation shall be used. Adhesive shall be applied to the top, side and bottom furring strips prior to attaching the paneling.

2.7 Joint Materials

2.7.0 Joint tape shall be perforated type or in accordance with ASTM C475-70 or FS SS-J-570A, Type II.

2.7.1 Joint compound shall be in accordance with ASTM C475 or FS SS-J-570, Type I, or equal.

2.8 Laminating Adhesive Laminating adhesive shall be in accordance with wallboard manufacturer's recommendation or ASTM C557-67.

Part 3. Execution

3.1 Surface Preparation

3.1.0 Remove foreign material by wash-down with a 5% to 10% high phosphate solution. Remove loose plaster, loose paint and loose wallpaper.

3.1.1 Repair damaged areas larger 3"x3" flush with existing wall surface prior to installation of gypsum wallboard.

3.1.2 Wallboard shall be conditioned prior to application by storing in the room in which wallboard is to be applied no less than 24 hours before wallboard is installed.

3.1.3 Warning labels stating surface contains **"LEAD-BASED PAINT"** shall be affixed to the surface prior to being enclosed. Labels shall be 3"x5" and placed every 4' across the wall being enclosed.

3.2 Test for Soundness

3.2.1 Test for soundness of paint bond where the condition is questionable by application of 3/8" x 3" long bead of adhesive to the face of an 8" square of gypsum wallboard and press wallboard square on to wall surface to be tested. Allow setting time recommended by adhesive manufacturer. Pull square away from wall. Paint bond is acceptable if the paper surface is separated from the wallboard square.

3.2.2 Repeat test procedure wherever wall surface is questionable.

3.2.3 If the test fails, Contractor shall notify the Engineer for further instruction.

3.3 Wallboard Installation

3.3.0 Wallboards shall be used in maximum lengths to minimize end joints. End joints shall be staggered and located as far as possible from wall and ceiling centers. Each sheet of wallboard shall be fitted before applying adhesive.

3.3.1 Adhesive bead shall be applied as a 3/8" diameter bead and installed at 16" o.c or on all framing. Secure all ends and abutting edges by application of a 3/8" diameter bead, continuous 1/2" in from ends and abutting edges.

3.3.2 Press wallboard firmly into contact with adhesive. Screw top, bottom and side edges at 8 inch o.c.

3.3.3 Penetrations made in wallboard to accommodate electrical receptacles, switches, light fixtures, etc. shall be sealed continuous with a non-hardening caulk or sealer. Penetrations shall not be smaller than those in existing wall surfacing to allow a tight seal to the existing surfacing.

3.4 Joint Treatment

3.4.0 V-grooves formed by abutting rounded edges of wallboard shall be filled with prefill joint compound. Permit prefill joint compound to harden prior to application of tape.

3.4.1 A thin uniform layer of joint compound shall be applied to all joints and angles that are to be reinforced and reinforcing tape applied immediately. Apply a skim coat immediately following tape embedment.

3.4.2 Fastener depressions shall be filled level with the wallboard surface by three separate applications of joint compound.

3.4.3 Two finish fill coats shall be applied and adequate time shall be allowed for drying between coats. Light sanding shall be done between coats to provide a smooth surface before application of second coat.

3.4.4 All joint compound surfaces shall be sanded to provide a flat smooth surface ready for decorative painting.

PART IV. Disposal of Waste Material:

4.1 The Contractor shall contact the regional EPA, state, and local authorities to determine lead-based paint debris disposal requirements. The requirements of Resource Conservation and Recovery Act (RCRA) shall be complied with as well as applicable state solid waste plan requirements. The Engineer will supply the Contractor with the addresses of the appropriate regulatory agencies. This does not relive the Contractor of the responsibility of contacting an appropriate regulatory agent. During the actual abatement, the Contractor shall not leave debris in the yard or nearby property, incinerate debris, dump waste by the road or in an unauthorized dumpster, or introduce lead-contaminated water into storm (will not be flushed down yard inlet or street drain) or sanitary sewers (will not be flushed down toilet or other household drain).

4.2 Testing on lead-based paint abatement waste materials by use of the EPA toxicity test will be completed by the Engineer and results supplied to the Contractor.

4.3 The following materials will be tested to determine whether or not they are hazardous:

1. paint chips (having a lead concentration more than 1% is considered hazard.)
2. waste water
3. dust from HEPA filters and from damp sweeping
4. woodwork, plaster, windows, doors, and other components removed from building
5. plastic sheets, duct tape, or tape used to cover floors and other services during the lead-based paint removal
6. solvents and caustics used during the stripping process
7. liquid waste, such as wash water used to decontaminate wood after solvents have been used, and liquid waste from exterior water blasting
8. rags, sponges, mops, HEPA filters, respirator cartridges, scrapers, and other materials using for testing, abatement, and clean up
9. disposable work clothes and respirator filters
10. any other items contaminated with lead-based paint

4.4 Non-Hazardous Solid Waste (as determined by testing) The Contractor shall place lead-based paint chips, debris, and lead dust in double (4-mil) or single (6-mil) polyethylene bags that are air-tight and puncture-resistant. Pieces of wood or other types of substrates

SECTION IV
DISPOSAL OF WASTE MATERIALS

Specification H
Chemical Removers ---- Off-Site Stripping

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this Section includes the furnishing of all labor, materials and equipment required to remove and transport lead-based painted elements to a off-site location, remove lead-based paint by chemical stripping, return elements to the job site and reinstall complete as called out in these specifications. All substrate shall be marked in order to insure proper reinstallation.

Part 2. Chemical Stripping Removers Chemical removers shall contain no methylene chloride products. Chemical removers shall be compatible with and not harmful to the substrate that they are applied to. Chemical removers used on wood substrate shall be of a product that will not raise or discolor wood grain.

Part 3. Execution

3.1 Extreme care shall be taken to remove elements to be taken off-site as not to damage or cause harm to those elements. Elements must be marked and identified using an inconspicuous engraving. Hardware associated with an element shall be bagged and marked as to which element the hardware is associated with. If needed, hardware shall be chemically stripped, cleaned or reconditioned as required.

3.2 Chemical stripping agents shall be applied and the lead-based paint removed in accordance with the recommendations of the manufacturer. Stripping agents shall not be allow to penetrate wood or other fibrous substrates.

3.3 Care must be taken to adhere to all health/safety code and other specification section requirement that apply to the job site area.

Part 4. Damages The Contractor shall protect the elements that are removed and adjacent areas from damage from removal and reinstallation of those elements. Damages due to non-protection or lack of care shall be repaired or replaced at the Contractor's expense.

Specification I
Removal and Replacement of Lead-Based Painted Substrates

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this Section includes the furnishing of all labor, materials and equipment required to remove and replace lead-based painted substrates complete, as called out in these specifications.

Part 2. Materials All substrates that are removed for replacement shall be replaced with material of the same or better quality. Substrates shall include but not be limited to doors, windows, moldings, casements, mantles, trims, baseboards and associated hardware and fasteners.

Part 3. Execution

3.1 Care shall be taken to avoid damage to adjacent areas during the removal of substrates to be replaced.

3.2 Substrates that are removed for replacement shall be wrapped and stored for disposal, or disposed of in accordance with the applicable codes and sections of this specification.

Part 4. Damages The Contractor shall protect areas adjacent to substrates that are removed for replacement from damage caused by this work. Damages to non-protected areas or from lack of care shall be repaired or replaced at the Contractor's expense.

Specification J
Encapsulation ---- Flexible Wall Covering

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section

1.2.0 Work included under this Section includes the furnishing of all labor, materials and equipment required to encapsulate lead-based painted surfaces with a flexible wall covering system complete, as called out in these specifications.

1.2.1 Prior to the start of work, the Contractor shall submit to the Engineer for his approval, manufacturer's descriptive literature, two (2) 5 1/2" x 8" samples of wall covering system and two (2) samples showing neutral colors. Submittal of samples shall be in compliance with Specification Section K.

Part 2. Materials

2.1 The wall covering shall be a reinforced fiber type. The wallcovering system shall form a secure bond with the substrate and be resistant to joint peeling and the formation of mold. The wallcovering system shall form a seal over the substrate to which it is applied and not allow the passage of substrate dust into the living environment.

Part 3. Execution

3.1 Surface Preparation

3.1.0 Remove foreign material by wash-down with a 5% to 10% trisodium phosphate solution. Remove loose plaster, loose paint and loose wallpaper.

3.1.1 Repair damaged areas larger flush with existing wall surface prior to installation of wallcovering systems.

3.2 Test for Soundness

3.2.1 Test for soundness of paint bond where the condition is questionable by application of 3/8" x 3" long bead of adhesive to the face of an 8" square of gypsum wallboard and press wallboard square on to wall surface to be tested. Allow setting time recommended by adhesive manufacturer. Pull square away from wall. Paint bond is acceptable if the paper surface is separated from the wallboard square.

3.2.2 Repeat test procedure wherever wall surface is questionable.

3.3 Wallcovering Installation The wall covering shall be installed in accordance with the manufacturer's recommendations.

Specification K
Submittal Approval by Engineer

Part 1. General

1.1 Work Covered Under Other Sections The scope of work for providing temporary utilities, security, safety, worker protection, cleanup and disposal of waste materials are covered under Sections 1 through 4 of these contract specifications.

1.2 Work Included Under This Section Work included under this Section includes the submission of product data and samples that require the approval of the Engineer before being incorporated into the project.

Part 2. Description

2.1 Submit to the Engineer product data and samples required by the specification sections.

2.2 Product data shall be manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, material safety data sheets (MSDS) and other standard descriptive data. Submittal data shall be clearly marked to identify pertinent materials, products or models and show performance characteristics and capacities.

2.3 Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product or material with integrally related parts and attachment devices.

Part 3. Contractor's Responsibilities

3.1 Review product data and samples prior to submission to the Engineer. Submitted material must bear a statement of Contractor's review.

> Example: This submission has been reviewed and submitted in accordance with the General Conditions and Section K of the Contract Specifications.
>
> Signed__________________________Date____________
> (Contractor's name, address, etc.)

3.2 Coordinate each submittal with requirements of work and of Contract Documents.

3.3 Contractor's responsibility for errors and omissions in submittals is not relieved by the Engineer's review of submittals.

3.4 Contractor's responsibility for deviations in submittals from requirements of contract documents is not relieved by the Engineer's review of submittals, unless the Engineer gives written acceptance of specific deviations.

3.5 Notify the Engineer in writing at the time of submission of deviations in submittals from requirements of the contract documents.

3.6 Begin no work which requires submittal for approval until the Engineer has "approved" or "approved as noted" the submittal.

Part 4. <u>Submission Requirements</u>

4.1 Schedule submissions at least 10 days before dates reviewed submittals will be needed by the Contractor.

4.2 Unless otherwise specified in product specification sections, submit four (4) copies of manufacturer's descriptive data for materials, equipment, etc., showing information as required until final approval is obtained from the Engineer.

4.3 Samples shall be marked, tagged or otherwise properly identified with the name of the Contractor, the name of the project, the purpose for which the samples are submitted, and the date.

4.4 Samples shall be accompanied by a letter of transmittal containing information similar to part 4.3 together with the specification paragraph number for identification of each item.

4.5 Submittals shall provide a blank space 4 inch by 4 inch for the Engineer's review comments.

Part 5. <u>Resubmission Requirements</u> Resubmission of "rejected" or "revise and resubmit" submittals shall be accomplished within 10 days of such comment by the Engineer.

Specification L

Operating Procedures for the Uses of Negative Pressure Systems for Lead-Based Paint Abatement

L.1 Introduction

This specification provides guidelines for the use of negative pressure systems in removing lead containing materials from buildings. A negative pressure system is one in which static pressure in an enclosed work area is lower than that of the environment outside the containment barriers.

The pressure gradient is maintained by moving air from the work area to the environment outside the area via powered exhaust equipment at a rate that will support the desired air flow and pressure differential. Thus, the air moves into the work area through designated access spaces and any other barrier openings. Exhaust air is filtered by a high-efficiency particulate air (HEPA) filter to remove lead particles.

The use of negative pressure lead removal protects against large-scale release of particles to the surrounding area in case of a breach in the containment barrier. A negative pressure system also can reduce the concentration of airborne lead in the work area by increasing the dilution ventilation rate (i.e., diluting contaminated air in the work area with uncontaminated air from outside) and exhausting contaminated air through HEPA filters. The circulation of fresh air through the work area reportedly also improves worker comfort, which may aid the removal process by increasing job productivity.

L.2 Materials and Equipment

L.2.1 The Portable, HEPA-Filtered, Powered Exhaust Unit

The exhaust unit establishes lower pressure inside than outside the enclosed work area during lead abatement. Basically, a unit (see Figure L-1) consists of a cabinet with an opening at each end, one for air intake and one for exhaust. A fan and a series of filters are arranged inside the cabinet between the openings. The fan draws contaminated air through the intake and filters and discharges clean air through the exhaust.

Portable exhaust units used for negative pressure systems in lead abatement projects should meet the following specifications.

L.2.1.1 Structural Specifications

The cabinet should be ruggedly constructed and made of durable materials to withstand damage from rough handling and

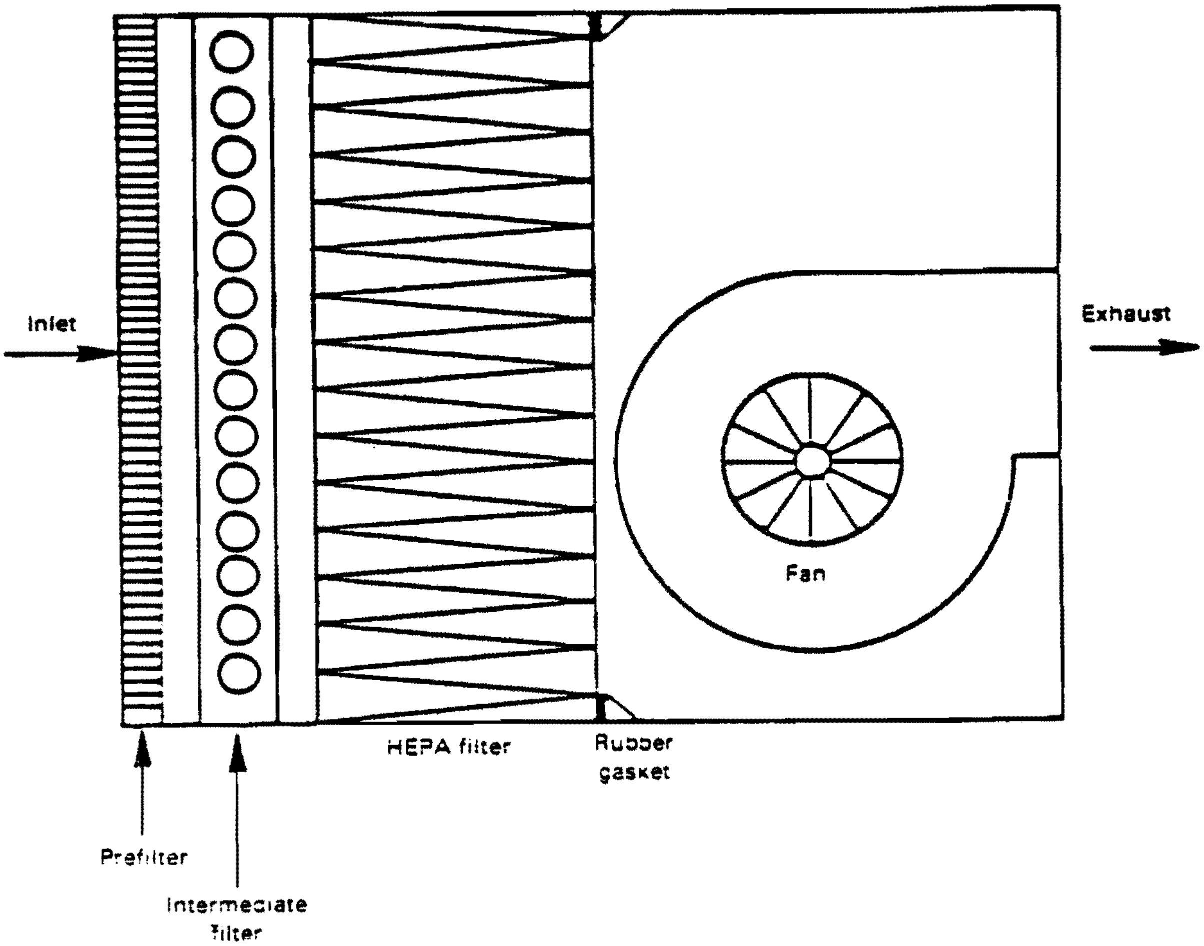

Figure L-1 An example of a HEPA-filtered exhaust unit. This scheme is one of several possible designs.

transportation. The width of the cabinet should be less than 30 inches to fit through standard-size doorways. The cabinet must be appropriately sealed to prevent lead containing dust from being emitted during use, transport, or maintenance. There should be easy access to all air filters from the intake end, and the filters must be easy to replace. The unit should be mounted on casters or wheels so it can be easily moved. It should be accessible for easy cleaning.

L.2.1.2 Mechanical Specifications

L.2.1.2.1 Fans

The fan for each unit should be sized to draw a desired air flow through the filters in the unit at a specified static pressure drop. The unit should have an air-handling capacity of 1,000 to 2,000 ft^3/min (under "clean" filter conditions). The fan should be of the centrifugal type.

For large-scale abatement projects, where the use of a larger capacity, specially designed exhaust system may be more practical than several smaller units, the fan should be appropriately sized according to the proper load capacity established for the application, i.e.,

$$\text{Total ft}^3\text{/min (load)} = \frac{\underline{\text{Volume of air in ft}^3 \text{ x air changes/hour}}}{\text{60 min/hour}}$$

Smaller-capacity units (e.g., 1,000 ft^3/min) equipped with appropriately sized fans and filters may be used to ventilate smaller work areas. The desired air flow could be achieved with several units.

L.2.1.2.2 Filters

The final filter must be the HEPA type. Each filter should have a standard nominal rating of at least 1,100 ft^3/min with a maximum pressure drop of 1 inch H_2O clean resistance. The filter media (folded into closely pleated panels) must be completely sealed on all edges with a structurally rigid frame and cross-braced as required. The exact dimensions of the filter should correspond with the dimensions of the filter housing inside the cabinet or the dimensions of the filter-holding frame. The recommended standard size HEPA filter is 24 inches high with 24 inches wide x 11-1/2 inches deep. The overall dimensions and squareness should be within 1/8 inch.

A continuous rubber gasket must be located between the filter and the filter housing to form a tight seal. The gasket material should be 1/4 inch thick and 3/4 inch wide.

Each filter should be individually tested and certified by the manufacturer to have an efficiency of not less than 99.97 percent when challenged with 0.3-um dioctylphthalate (DOP) particles. Testing should be in accordance Military Standard Number 282 and Army Instruction Manual 136-300-175A. Each filter should bear a UL586 label to indicate ability to perform under specified conditions.

Each filter should be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

Prefilters, which protect the final filter by removing the larger particles, are recommended to prolong the operating life of the HEPA filter. Prefilters prevent the premature loading of the HEPA filter. They can also save energy and cost. One (minimum) or two (preferred) stages of prefiltration may be used. The first-stage prefilter should be a low-efficiency type (e.g., for particles 10 um and larger). The second-stage (or intermediate) filter should have a medium efficiency (e.g., effective for particles down to 5 um). Various types of filters and filter media for prefiltration applications are available from many manufacturers. Prefilters and intermediate filters should be installed either on or in the intake grid of the unit and held in place with special housings or clamps.

L.2.1.2.3 Instrumentation

Each unit should be equipped with a Magnehelic gauge or manometer to measure the pressure drop across the filters and indicate when filters have become loaded and need to be changed. The static pressure across the filters (resistance) increases as they become loaded with dust, affecting the ability of the unit to move air at its rated capacity.

L.2.1.3 Electrical

L.2.1.3.1 General

The electrical system should have a remote fuse disconnect. The fan motor should be totally enclosed, fan-cooled, and the nonoverloading type. The unit must use a standard 115-V, single-phase, 60-cycle service. All electrical components must be approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL).

L.2.1.3.2 Fans

The motor, fan, fan housing, and cabinet should be grounded. The unit should have an electrical (or mechanical) lockout to prevent the fan from operating without a HEPA filter.

L.2.1.3.3 Instrumentation

An automatic shutdown system that would stop the fan in the event of a major rupture in the HEPA filter or blocked air discharge is recommended. Optional warning lights are recommended to indicate normal operation, too high of a pressure drop across the filters (i.e., filter overloading), and too low of a pressure drop (i.e., major rupture in HEPA filter or obstructed discharge). Other optional instruments include a timer and automatic shut-off and an elapsed time meter to show the total accumulated hours of operation.

L.3 Setup and Use of a Negative Pressure System

L.3.1 Preparation of the Work Area

L.3.1.1 Determining the Ventilation Requirements for a Work Area

Experience with negative pressure systems on lead abatement projects indicates a recommended rate of one air change every 15 minutes. The volume (in ft^3) of the work area is (in ft^3/min) for the work area is determined by dividing this volume by the recommended air change rate (i.e., one air change every 15 minutes).*

$$\text{Total ft}^3/\text{min} = \text{Volume of work area (in ft}^3)/15 \text{ min}$$

The number of units needed for the application is determined by dividing the total ft^3/min by the rated capacity of the exhaust unit.

$$\text{Number of units needed} = [\text{Total ft}^3/\text{min}]/[\text{Capacity of unit (in ft}^3]$$

L.3.1.2 Location of Exhaust Units

The exhaust unit(s) should be located so that makeup air enters the work area primarily through the decontamination facility and traverses the work area as much as possible. This may be accomplished by positioning the exhaust unit(s) at a maximum distance from the worker access opening or other makeup air sources.

Wherever practical, work area exhaust units can be located on the floor in or near unused doorways or windows. The end of the unit or its exhaust duct should be placed through an opening in the plastic barrier or wall covering. The plastic around the unit or duct should then be sealed with tape.

Each unit must have temporary electrical power (115V AC). If necessary, three-wire extension cords can supply power to a unit. The cords must be in continuous lengths (without splice), in good condition, and should not be more than 100 feet long. They must not be fastened with staples, hung from nails, or suspended by wire. Extension cords should be suspended off the floor and out of workers' way to protect the cords from damage from traffic, sharp objects, and pinching.

Whenever possible, exhaust units should be vented to the outside of the building. This may involve the use of additional lengths of flexible or rigid duct connected to the air outlet and routed to the nearest outside opening. Windowpanes may have to be removed temporarily.

If exhaust air cannot be vented to the outside of the building or if cold temperatures necessitate measures to conserve heat and minimize cold air infiltration, filtered air that has been exhausted through the barrier may be recirculated into an adjacent area. However, this is not recommended.

Additional makeup air may be necessary to avoid creating too high of a pressure differential, which could cause the plastic coverings and temporary barriers to "blow in." Additional makeup air also may be needed to move air most effectively through the work area. Supplemental makeup air inlets may be made by making openings in the plastic sheeting that allow air from outside the building into the work area. Auxiliary makeup air inlets should be as far as possible from the exhaust unit(s) (e.g., on an opposite wall), off the floor (preferably near the ceiling), and away from barriers that separate the work area from occupied clean areas. They should be resealed whenever the negative pressure system is turned off after removal has started. Because the pressure differential (and ultimately the effectiveness of the system) is affected by the adequacy of makeup air, the number of auxiliary air inlets should be kept to a minimum to maintain negative pressure. Figure L-2 presents examples of negative pressure systems denoting the location of HEPA-filtered exhaust units and the direction of air flow.

L.3.2 Use of the Negative Pressure System

L.3.2.1 Testing the System

The negative pressure system should be tested before any lead containing substrate is wetted, removed, or abated. After the work area has been prepared, the decontamination facility set up, and the exhaust unit(s) installed, the unit(s) should be started (one at a time). Observe the barriers and plastic sheeting. The plastic curtains of the decontamination facility should move slightly in toward the work area. The use of ventilation smoke tubes and a rubber bulb is another easy and inexpensive way to visually check system performance and direction of air flow through openings in the barrier. Another test is to use a Magnehelic gauge (or other instrument) to measure the static pressure differential across the barrier. The measuring device must be sensitive enough to detect a relatively low pressure drop. A Magnehelic gauge with a scale of 0 to 0.25 or 0.50 inch of H_2O and 0.005 or 0.01 inch graduations is generally adequate. The pressure drop across the barrier is measured from the outside by punching a small hole in the plastic barrier and inserting one end of a piece of rubber or Tygon tubing. The other end of the tubing is connected to the "low pressure" top of the instrument. The "high pressure" tap must be open to the atmosphere. The pressure is read directly from the scale. After the test is completed, the hole in the barrier must be patched.

The HEPA filter should be replaced if prefilter and/or intermediate filter replacement does not restore the pressure drop across the filters to its original clean resistance reading or if the HEPA filter becomes damaged. The exhaust unit is shut off to replace the HEPA filter, which requires removing the prefilter first, then opening the intake grill of filter access, and finally removing the HEPA filter from the unit. Used HEPA filters should be placed in a sellable plastic bag (appropriately labeled) and disposed of as lead waste. A new HEPA filter (structurally identical to the original filter) should then be installed. The intake grill and intermediate filter should be put back in place, the unit turned on, and the prefilter positioned on the intake grill. Whenever the HEPA filter is replaced, the prefilter and intermediate filter should also be replaced.

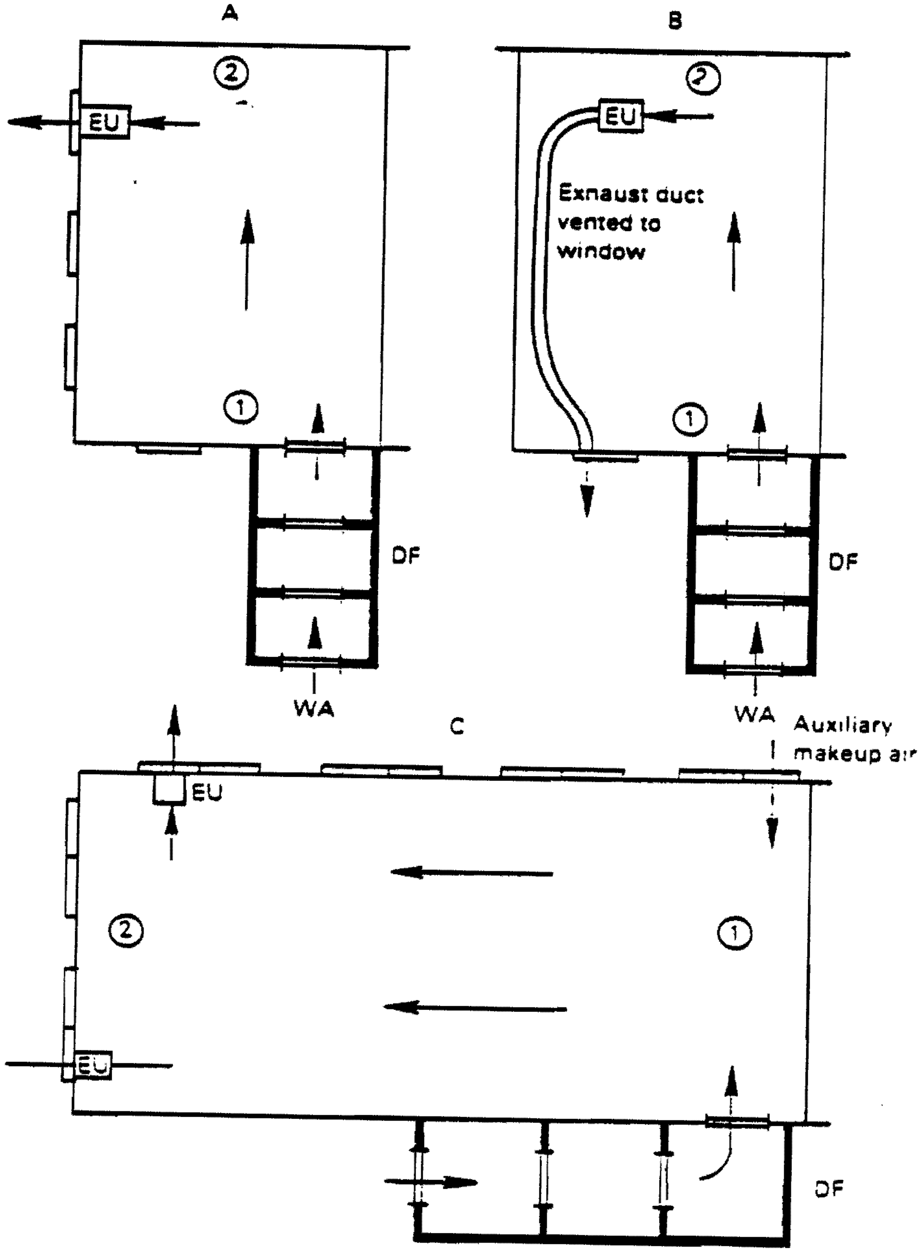

Figure L-2. Examples of negative pressure systems. DF, Decontamination Facility; EU, Exhaust Unit; WA, Worker Access; A, Single-room area with multiple windows; B, Single-room work area with single window near entrance; C, Large single-room work area with windows and auxiliary makeup air source (dotted arrow). Arrows denote direction of air flow. Circled numbers indicate progression of removal sequence.

When several exhaust units are used to ventilate a work area, any air movement through an inactive unit during the HEPA filter replacement will be into the work area. Thus, the risk of lead dust released to the outside environment is controlled.

Any filters used in the system may be replaced more frequently than the pressure drop across the filters indicates is necessary. Prefilters, for example, may be replaced two to four times a day or when accumulations of particulate matter become visible. Intermediate filters must be replaced once every day or so, and the HEPA filter may be replaced at the beginning of each new project. (Used HEPA filters must be disposed of as lead containing waste.) Conditions in the work area dictate the frequency of filter changes. In a work area where fiber release is effectively controlled by thorough wetting and good work practices, fewer filter changes may be required than in work areas where the removal process is not well controlled. It should also be noted that the collection efficiency of a filter generally improves as particulate accumulates on it. Thus, filters can be used effectively until resistance (as a result of excessive particulate loading) diminishes the exhaust capacity of the unit.

L.3.2.3 Dismantling the System

When a final inspection and the results of final air tests indicate that the area has been decontaminated, all filters of the exhaust units should be removed and disposed of properly and the units shut off. The remaining barriers between contaminated and clean areas and all seals on openings into the work area and fixtures may be removed and disposed of as contaminated waste. A final check should be made to be sure that no dust or debris remain on surfaces as a result of dismantling operations.

GENERAL CONDITIONS FOR ALL WORK

1. Scope of Services: The Engineer employs the Contractor to make renovation improvements for lead-based paint abatement upon premises known as ______________________________. The Contractor shall perform all of the services and furnish all the material and equipment necessary to make and/or construct the improvements set forth in the Plans and Specifications, which are attached and made a part by this reference.

2. Indemnification: Contractor agrees to indemnify, defend, and hold Engineer harmless from any and all claims, liabilities, obligations, governmental penalties, fines, and causes of action of whatsoever nature, including injury to or death of any person or damage to or destruction of any property, or court costs or attorney's fees resulting from any and all negligent acts or omissions of Contractor or any Subcontractor to this Agreement or any of their respective Directors, Officers, Partners, Principals, Employees or Agents. Neither this Agreement nor any Subcontract will create any contractual relationship between any Subcontractor and Engineer, nor any liability of Engineer to any Subcontractor.

3. Time for Bid and Time for Completion: The bid must be received by the Engineer no later than _____P.M. on ________________, 19__. The bid will be delivered to ____________________________. The bid shall bear the address of the structure to be renovated. The Contractor will be notified by the Engineer of the acceptance or rejection of the bid within 10 days from the date of receipt. If the Contractor is not so notified, the bid can be withdrawn. If accepted, the Contractor shall not commence any work until receipt of final approval of the bid, a Written Notice To Proceed and the completion of a medical examination, blood test and successful completion of the worker protection training course for all employees working on the project. The Contractor will then commence work within 5 days after issuance of the Notice to Proceed. The Contractor shall satisfactorily complete all work under this contract within 30 days after the issuance of the Notice to Proceed by the Engineer. If the work is not completed by the specified completion date, the Contractor will be assessed $300.00 per day per dwelling unit in liquidated damages.

4. Equal Employment and Federal Labor Standards: The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color or national origin. The Contractor shall abide by Federal, State and local regulations pertaining to Equal Employment as set forth in Executive Order 11246 and by the rules, regulations, and orders of the Secretary of Labor and the Secretary of Housing & Urban Development. In addition, the Contractor certifies that he will abide by the terms and conditions of Title VI of the Civil Rights Act of 1964, Title VIII of the Civil Rights Act of 1968, and all other applicable non-discrimination rules for legislation.

5. Insurance: The Contractor shall furnish evidence of comprehensive public liability insurance coverage protecting the Engineer for not less than $500,000.00 per person/$500,000.00 per accident, and property damage insurance coverage for not less than $500,000.00 for any one accident arising from work performed by the Contractor, any of his subcontractors, or any direct or indirect employee of either of them. Contractor shall also provide automobile liability in the amount of $500,000 per occurance. Evidence of insurance or other coverage required by local laws governing Workmen's Compensation will also be provided by the Contractor.

6. Assignment of Contract: The Contractor shall not assign the Contract without written consent of the Engineer.

7. Permits, Fees, Engineering Studies and Registered Surveys: The Contractor shall obtain and pay for all necessary permits, inspection charges (not conducted by the Engineer), and licenses for the authorization and execution of the work and labor performed. The Engineer shall furnish all engineering studies as required and specified.

8. Compliance with Code: The Contractor shall perform all work under the Contract in conformance with applicable codes, ordinances, regulations, and requirements per Federal, State and local regulations.

9. Cooperation: The Engineer shall cooperate with the Contractor to provide access to the dwelling units for the performance of the work.

10. Occupancy of Premises: Unless otherwise stated, it shall be assumed that the premises will be unoccupied during the course of the renovation.

11. Inspection by Contractors: The Contractor shall visit the dwelling units and familiarize himself with all existing conditions so that his bid will be complete in every detail. A pre-bid walk through of the housing units will be conducted by the Engineer.

12. Inspection: The Contractor shall permit authorized persons access to the unit to inspect and examine the work during all working hours. These persons include agents of the U.S. Government, its designee, and the Engineer or his designees. If any work is covered up without approval or consent of the Engineer, it must, if required, be exposed for inspection at the Contractor's expense. All defects caused by the Contractor, or his subcontractors, shall be corrected at the Contractor's expense.

13. Guarantee: The Contractor shall guarantee the work performed and materials and equipment for a period of one year from the date of final acceptance of all work required by the contract documents. Further, the Contractor shall furnish the Engineer with all manufacturers' and suppliers' written guarantees and warranties covering materials and equipment furnished under the requirements of the contract documents. All defects appearing within the one year period, which are the fault of the Contractor or are the result of defective material, shall be corrected at his expense.

14. Bid and Proposal Contract: The contract consists of the general conditions, instruction to bidders, the specifications and lead-based paint renovation bid schedule, abatement set-up, worker protection and safety work, cleanup waste disposal and any drawings and sketches, if applicable.

15. Default: In case of default by the Contractor, the Owner and Engineer may procure articles or services from other sources and hold the Contractor responsible for any excess cost incurred.

16. Notice: Notices to the Contractor shall be considered delivered for the purpose of the Contract, if mailed by regular mail or hand delivered to the Contractor at the address he has given on the Bid.

17. Changes: It is agreed that there shall be no changes to the Contract and the work covered unless, for essential work which causes a change in cost and/or performance time, a mutually-agreed-to change has been put in writing and signed by the Engineer and Contractor.

18. Time for Performance: The Contractor shall, within 5 days after issuance of the Notice To Proceed, begin performance. Work to be performed by the Contractor shall be completed within the period of time stated in the Contract. However, the Contractor, on written notification to and approval of the Engineer, will be excused from delay charges and a performance time extension granted if, at any time in the progress of the work, delays are caused by:

    a. Any act or neglect of the Engineer
    b. Changes ordered in the work

c. Strikes
d. Lockouts
e. Fire (if not caused by the Contractor)
f. Delay in transportation
g. Unavoidable casualties
h. Or any other causes beyond the Contractor's control.

19. Disputes: The Engineer shall, within a reasonable time, make decisions on all claims of the Contractor submitted to the Engineer in writing.

20. Workmanship: The work provided the Contractor shall be executed pursuant to the plans, specifications, and other contract documents in a sound, workman-like, and substantial manner. Materials used in the construction, rehabilitation, renovating, remodeling, and improving shall be new, unless otherwise expressly set forth in the specifications.

21. Supervision: The Contractor shall provide a competent supervisor who is capable of understanding the plans and specifications. All supervisors shall have successfully completed the worker protection and safety course. The Contractor shall keep a complete set of approved plans and specifications on the job site.

22. Termination: This Contract may be terminated if:

a. If at any time the Contractor fails to furnish materials or execute work in accordance with the provisions of the contract documents, fails to proceed with or complete the work within the time limit specified in the contract documents, or otherwise violates any provision of the Agreement, then upon (10) days written notice to the Contractor, the Engineer shall have the right to terminate the Agreement. In this event the Engineer will proceed to have the work completed and apply the cost to any money due under the Contract. The Contractor shall be responsible for any damages or added cost resulting by reason of this default.

b. If at any time the Owner and/or Engineer fails to cooperate with the Contractor by denying access to the property, refusing to furnish necessary services, or otherwise prohibiting completion of work as specified in the Agreement, the Engineer shall have ten (10) days from notice to cure such deficiencies. Notice to Engineer shall contain the reason for the Contractor's intention to terminate. Unless the deficiency ceases or a satisfactory arrangement has been made for its correction, the Contractor shall have the right to terminate the Agreement at the end of the ten (10) day notice period.

After termination, Contractor will be reimbursed for services rendered to the termination date upon submission to Engineer of detailed supporting documentation. Contractor will not be entitled to profit or other compensation on services not performed.

23. Payments: The amount of 10% will be retained until the Contractor submits a request for final payment. Final payment for this Contract shall be made only after final inspection, final clearance, acceptance of all work specified, and the Contractor furnishing the Engineer satisfactory releases of liens or claims against the property by his subcontractors, laborers, and material suppliers. The amount of 10% of the final payment may be retained in escrow for a period of up to thirty (30) days to cover contract compliance, or until completion of all work.

24. Non-Collusive Affidavit: Each person submitting a bid for any portion of the work contemplated by the bidding documents shall execute an affidavit, in the form provided by the Engineer, to the effect that he has not colluded with any other person, form or corporation in regard to any bid submitted. Such affidavit shall be attached to the bid.

25. Equal Employment Opportunity: A Certification of Nonsegregated Facilities must be submitted prior to the award of a federally assisted construction contract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. Such a certification is printed on the bid form and is deemed executed by submission of the bid.

    Contractors receiving subcontract awards exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause will be required to provide for the forwarding of this notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed $10,000 and are not exempt from the provisions of the Equal Opportunity clause.

26. Limitations on Indemnification: In any and all claims against the Engineer or any of its agents or employees by any employee of the Contractor, anyone directly or indirectly employed by it or anyone for whose acts it may be liable, the indemnification obligation under Paragraph 2 of these General Conditions shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor under workmen's compensation acts, disability benefit acts, or other employee benefit acts.

27. Captions: The Captions in these General Conditions are for purposes of convenience only and form no part of the General Conditions. In no event shall they be deemed to limit or modify the text of the General Conditions.

28. Severability: The invalidity or unenforceability of any portion(s) or provision(s) of this Agreement shall in no way affect the validity or enforceability of any other portion(s) or provision(s) hereof. Any invalid or unenforceable provision(s) shall be severed from the Agreement and the balance of the Agreement shall be construed and enforced as if the Agreement did not contain the particular portion(s) or provision(s) held to be invalid and/or unenforceable.

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AIA Document A312

Performance Bond

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Construction Contract Date):
Amount:
Modifications to this Bond: ☐ None ☐ See Page 3

CONTRACTOR AS PRINCIPAL	SURETY
Company: (Corporate Seal)	Company: (Corporate Seal)
Signature: ______________________	Signature: ______________________
Name and Title:	Name and Title:

(Any additional signatures appear on page 3)

(FOR INFORMATION ONLY—Name, Address and Telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

1 The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except to participate in conferences as provided in Subparagraph 3.1.

3 If there is no Owner Default, the Surety's obligation under this Bond shall arise after:

3.1 The Owner has notified the Contractor and the Surety at its address described in Paragraph 10 below that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Construction Contract. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default; and

3.2 The Owner has declared a Contractor Default and formally terminated the Contractor's right to complete the contract. Such Contractor Default shall not be declared earlier than twenty days after the Contractor and the Surety have received notice as provided in Subparagraph 3.1; and

3.3 The Owner has agreed to pay the Balance of the Contract Price to the Surety in accordance with the terms of the Construction Contract or to a contractor selected to perform the Construction Contract in accordance with the terms of the contract with the Owner.

4 When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

4.1 Arrange for the Contractor, with consent of the Owner, to perform and complete the Construction Contract; or

4.2 Undertake to perform and complete the Construction Contract itself, through its agents or through independent contractors; or

4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and the contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor's default; or

4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, tender payment therefor to the Owner; or

.2 Deny liability in whole or in part and notify the Owner citing reasons therefor.

5 If the Surety does not proceed as provided in Paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Subparagraph 4.4, and the Owner refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

6 After the Owner has terminated the Contractor's right to complete the Construction Contract, and if the Surety elects to act under Subparagraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. To the limit of the amount of this Bond, but subject to commitment by the Owner of the Balance of the Contract Price to mitigation of costs and damages on the Construction Contract, the Surety is obligated without duplication for:

6.1 The responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

6.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 4; and

6.3 Liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

7 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators or successors.

8 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

9 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation avail-

able to sureties as a defense in the jurisdiction of the suit shall be applicable.

10 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page.

11 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12 DEFINITIONS

12.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

12.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.

12.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)

Signature: ______________________
Name and Title:
Address:

SURETY
Company: (Corporate Seal)

Signature: ______________________
Name and Title:
Address:

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AIA Document A312

Payment Bond

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT
  Date:
  Amount:
  Description (Name and Location):

BOND
  Date (Not earlier than Construction Contract Date):
  Amount:
  Modifications to this Bond: ☐ None ☐ See Page 6

CONTRACTOR AS PRINCIPAL	SURETY
Company: (Corporate Seal)	Company: (Corporate Seal)
Signature: ______________________	Signature: ______________________
Name and Title:	Name and Title:

(Any additional signatures appear on page 6)

(FOR INFORMATION ONLY—Name, Address and Telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

1 The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference.

2 With respect to the Owner, this obligation shall be null and void if the Contractor:

2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2 Defends, indemnifies and holds harmless the Owner from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Construction Contract, provided the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety, and provided there is no Owner Default.

3 With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

4 The Surety shall have no obligation to Claimants under this Bond until:

4.1 Claimants who are employed by or have a direct contract with the Contractor have given notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2 Claimants who do not have a direct contract with the Contractor:

.1 Have furnished written notice to the Contractor and sent a copy, or notice thereof, to the Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and

.2 Have either received a rejection in whole or in part from the Contractor, or not received within 30 days of furnishing the above notice any communication from the Contractor by which the Contractor has indicated the claim will be paid directly or indirectly; and

.3 Not having been paid within the above 30 days, have sent a written notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the Contractor.

5 If a notice required by Paragraph 4 is given by the Owner to the Contractor or to the Surety, that is sufficient compliance.

6 When the Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

6.1 Send an answer to the Claimant, with a copy to the Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2 Pay or arrange for payment of any undisputed amounts.

7 The Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

8 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any Construction Performance Bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

9 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

11 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the work or part of the work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Subparagraph 4.1 or Clause 4.2 (iii), or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, the Owner or the Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this

Bond shall be construed as a statutory bond and not as a common law bond.

14 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15 DEFINITIONS

15.1 Claimant: An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

15.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)

Signature: ____________________
Name and Title:
Address:

SURETY
Company: (Corporate Seal)

Signature: ____________________
Name and Title:
Address:

CHANGE ORDER

OWNER
ENGINEER
CONTRACTOR
FIELD
OTHER

PROJECT:
(name, address)

TO CONTRACTOR:
(name, address)

CHANGE ORDER NUMBER:

DATE:
ENGINEER'S PROJECT NO:

CONTRACT DATE:
CONTRACT FOR:

The Contract is changed as follows:

Not valid until signed by the Engineer and Contractor

The original (Contract Sum)(Guaranteed Maximum Price) was ....$__________

Net change by previously authorized Change Orders ....$__________

The (Contract Sum)(Guaranteed Maximum Price) prior to this Change Order was ....$__________

The (Contract Sum)(Guaranteed Maximum Price) will be (increased)(decreased) (unchanged by this Change Order in the amount of ....$__________

The Contract Time will be (increased)(decreased) (unchanged by

( ) days

The date of Substantial Completion as of the date of this Change Order therefore is

NOTE: This summary does not reflect changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive.

ENGINEER	CONTRACTOR
Address	Address
Date	Date
By	By

NOTICE TO PROCEED

TO: ____________________

____

____

____

____

____

DATE: ____________________

PROJECT: ____________________

____

____

____

____

You are hereby notified to commenc WORK in accordance with the Agreement dated ____________, 19__, on or before ___________, 19__, and you are to complete the WORK within ___ consecutive calendar days ____________, 19__.

____

OWNER

BY: ____________________

TITLE: ____________________

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED

is hereby acknowledged by _____________

____.

this the ______________________, 19______

____

By______________________________________

Title___________________________________

NOTICE OF AWARD

TO: ____________________ DATE: ________________________

____________________ PROJECT: ____________________

____________________ ____________________________

This is to inform you that ________________________________,
Name of Company

at ____.
Address

__________________, has been awarded to

contract ______________ to perform lead-based paint abatement

at ____

____.

The contract is for _____________ and construction is
$ Amount

estimated to begin _____________.
Date

____
Name

____
Title

____
Date

Form of Non-Collusive Affidavit

Affidavit

(Prime Bidder)

STATE OF ________________________

COUNTY OF__________________________

____, being first duly sworn deposes and says:

That he is____ the party making the foregoing proposal or bid that such proposal or bid is genuine and not collusive or sham; that said bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any person to fix the bid price or affiant or of any other bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any other bidder, or to secure any advantage against the Engineer or any person interested in the proposed contract; and that all statements in said proposal or bid are true.

Signature of:

____

Bidder, if the bidder is an individual;
Partner, if the bidder is a partnership;
Officer, if the bidder is a corporation.

Subscribed and sworn to before me

this____day of___________, 19__.

____

My commission expires _____________,19__.

2.0 Worker Protection

2.1 Training: Any worker entering a dwelling unit known to contain lead-based paint for the purpose of removing or disturbing lead-based paint must have successfully completed training in Lead Paint Abatement Health and Safety Training. The Engineer will provide a six (6) hour training course to all of the Contractor's employees who will work on the job. The employees must pass the course in order to work on the job site. Contractor will adhere to OSHA regulation CFR 1910.1200 and 1910.1025.

2.2 Biological Monitoring: All workers must have baseline and post abatement blood lead level screenings determined by the whole blood lead method, utilizing Vena-Puncture technique. In addition, the Contractor shall have physical performed on each employee and the Engineer will recommend laboratories and/or clinics to be used for obtaining blood level tests. The blood tests will also be required at the end of each 30 day period, if the employee is working on the job. This test must be performed before workers enter a lead contaminated work area. A worker will be removed from the job if his blood lead level is 30 ug/dl or greater. The Contractor shall be responsible for medical surveillance and record keeping.

2.3 Air Monitoring to Determine Respiratory Protection:

2.3.1 The Contractor will provide all workers, foremen, and superintendents with properly fitted half-faced respirators approved by NIOSH and MSHA. Authorized visitors (i.e. Federal, State, and Local inspectors) must provide a current health and medical report certifying them as approved to wear half-face respirators. When respirators and disposable filters are employed, sufficient replacement filters will be provided by the Contractor for the workers and any visitors.

2.3.2 The minimum respiratory protection required for this project is as follows:

a. Negative pressure, half mask, air purifying respirators, equipped with HEPA filters for airborne lead dust levels not in excess of 0.5mg/m^3 (10XPEL). Contractors will base their bids on this type of respirator.

b. Full face piece, air purifying respirator, with HEPA filters for airborne dust levels not in excess of 2.5mg/m^3 (50XPEL).

c. Pressure demand, full face, supplied air respirators for airborne lead dust concentrations

SECTION II

WORKER PROTECTION

3.5 <u>Surfaces to be Cleaned:</u> Surfaces to be cleaned include ceilings, walls, floors, windows (sash, jamb, sill), doors, fixtures (lights, bathroom, kitchen) of any kind, built-in cabinets, and appliances. All surfaces must be cleaned except, those in rooms which were found free of lead, were not abated, were properly sealed, or were never entered during the abatement of the unit.

3.6 <u>Removal of Large Debris:</u> Large debris from demolition (i.e. doors, windows, baseboards) shall be wrapped in plastic sheets at least 6 mil thick, sealed with heavy duct tape, and stored in the designated area. This debris will be removed according to specifications outlined in Section IV of the contract documents.

3.7 <u>Removal of Small Debris:</u> Prior to picking-up or collecting small debris, the surface to be cleaned will be sprayed with a fine mist of water. The debris will be picked up, collected, and placed into a single plastic bag, at least 6 mil thick, or double bags of 4 mil thick plastic. The bags shall not be overloaded, shall be securely tied, and shall be stored in the designated area until disposal.

3.8 <u>Removal of Plastic Sheeting:</u> The plastic sheeting covering the floors, or any other plastic sheeting, shall be sprayed, picked up, and HEPA vacuumed prior to removal. The plastic sheeting shall be carefully folded from the corners and ends toward the middle and placed into a double 4 mil or single 6 mil plastic bag and sealed. Bags shall be stored in the designated area and disposed according to Part V of the contract documents.

3.9 <u>Pre-Clearance Clean Up:</u> The Contractor shall remove all plastic sheeting, except critical barrier, according to the above section. The entire area shall be HEPA vacuumed, washed, and HEPA vacuumed again, according to Section III, Sections 3.3, 3.4 and 3.5. After this final cleaning, the Contractor shall await wipe testing results (performed by the Engineer) results. If the area does not pass testing, the procedures outlined in Section 3.2, 3.3, 3.4, 3.5, and 3.8 shall be followed until the surfaces pass final clearance.

3.10 <u>Final Clearance:</u> Finished coatings, including but not limited to stains, primer, sealers and polyurethane shall be applied only after final clearance. Any surface requiring painting shall be primed with an approved primer. Window sills and wells shall be finished coated with an approved high gloss white enamel. All primers or finish coating materials shall have labeling stating, in equal or appropriate wording, "does not contain lead-based paint greater than 600 parts per million", as per C.P.S.C. regulations. All floors in the abated area shall be sealed with an approved clear polyurethane or a polyurethane-based paint. Tile or similar floors shall be sealed with an approved high quality wax and concrete floors shall be sealed with an approved concrete sealer.

3.11 Final Clean Up and Inspection: The Contractor shall begin final clean up no less than 24 hours (unless notified otherwise) after final clearance and all materials, equipment, debris, and plastic sheeting have been removed. The entire dwelling unit shall be HEPA vacuumed, washed with a high phosphate detergent, and HEPA vacuumed again. The Engineer will then visually inspect the entire dwelling unit to ensure all abated surfaces and floors have been primed, painted or sealed. All disposable supplies used during clean up, such as mop heads, sponges, etc., shall be disposed of according to Section IV of the contract documents.

BID

Proposal of ______________________________ (hereinafter called "BIDDER"), organized and existing under the laws of the State of ______________ doing business as ______________*. *Insert "a corporation", "a partnership", or "an individual" as applicable.

In compliance with your Notice for Bids, Bidder hereby proposes to perform all WORK for the ______________________ in the strict accordance with the CONTRACT DOCUMENTS dated _________, at the price stated below.

By submìssions of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to his own organization, that this BID has been derived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other BIDDER or with any competitor.

The undersigned bidder gives as his estimated time for completion _____ consecutive calendar days and agrees to complete the work within that time after receiving a Notice to Proceed.

Bidder further agrees to pay as liquidated damages, the sum of $300.00 for each consecutive calendar day thereafter as provided in Paragraph 20 of the General Conditions.

BIDDER acknowledges receipt of the following ADDENDUM:

____

____.

The undersigned hereby proposes and agrees to furnish all necessary labor materials, equipment, tools, and services for the construction required for this project in accordance with the plans, specifications and other contract documents prepared by Dewberry & Davis, for the following amount:

Base Bid

Total sum of ____

____ Dollars ($__________)

SUBMITTED BY:

Licensed Contractor No. ______________________.

Valid until ______________________.
(Date)

ATTEST: __________ NAME: _______________ TITLE: ___________

BID SCHEDULE

The undersigned hereby proposes and agrees to furnish all the necessary labor, materials, equipment, tools, and services for the lead-based paint abatement and renovation required for this project in accordance with the plans, specifications, and other contract prices are to cover all expenses, including sales tax and all other taxes and fees which are a part of this proposal. Total contract amounts shall be stated in both words and figures. In case of a discrepancy, words shall govern. The undersigned agrees that the prices below are the balanced figures used in preparing the bid, and further agrees that if awarded the contract, will furnish an itemized breakdown of costs for any bid item.

PART A

Item 1A. Mobilization:

This item shall include the out of pocket expenses necessary to start work. It shall include but not be limited to the cost for bonds, general permits, equipment movement and the establishment of an office. The amount shall not exceed 5% of the total bid and have accompanying documentation. **LUMP SUM** ________________
____________________ and ____/**100 Dollars ($**___________**).**

dispose of work suit, wash and dry face and hands, and vacuum clothes.

2.5.3 Disposable clothing, such as TYVEK suits, and other personal protective equipment (PPE) must be donned prior to entering work area. A clean room will be provided for workers to put on suits and other personal protective equipment and to store their street clothes. Disposable suits shall be used once, then properly discarded.

2.5.4 A lavatory facility must be provided and located in the work area. The eating and drinking area, clean room, and the lavatory facility must be maintained in a clean and orderly fashion at all times. The Contractor will provide portable lavatories when needed and disinfect them daily.

2.5.5 If air monitoring data, gathering by the Engineer shows that employee exposure to airborne lead exceeds 50 ug/m^3, the following conditions apply:

1. Street clothes cannot be worn into containment. Workers must wear nylon shorts, TYVEK shorts, or nothing under disposable suit.

2. Showers must be provided. Shower water must pass through at least a 5.0 micron filter before returning to the public waste system.

3. All workers must shower upon leaving work area.

4. Three stage decontamination unit must be established consisting of Dirty Room, Airlock, Shower, Airlock, and Clean Room.

are expected to meet or exceed 50 mg/m^3 (1000XPEL).

2.3.3 All workers inside the work area will wear the proper respirator for the lead dust level generated.

2.3.4 Workers must be properly trained in the care, use, and maintenance of respirators. The Engineer will require that these workers have been fit tested and see that a fit test is performed and passed a day before entering the work area. A formal respiratory protection program must be implemented in accordance with 29 CFR 1910.134.

2.3.5 Respirators will not be removed until the worker enters the washing area of the decontamination chamber.

2.4 Personal Protective Equipment:

2.4.1 Workers will wear full body disposable suits with hoods and booties. A TYVEK or similar type of suit may be worn. Suits will be worn inside the work area after the area passes pre-abatement inspection and shall remain in use until the area passes final clearance inspection. Light-weight nylon clothes may be worn under the suit but these clothes must be changed before leaving the work area and should be laundered separately.

2.4.2 Goggles with side shields will be worn when working with a material that may splash or fragment, or if protective eye wear is specified on the Material Safety Data Sheet (MSDS) for that product.

2.4.3 Additional respiratory protection by supplemental filters, such as organic vapor cartridges, may be needed when handling some coating products. Consult the (Material Safety Data Sheets) MSDS and obtain the proper filters as necessary.

2.5 Personal Hygiene Practices: The abatement Contractor shall enforce and follow good personal hygiene practices during abatement. These practices will include but not be limited to the following:

2.5.1 No eating, drinking, smoking, or applying of cosmetics in work area. The abatement Contractor will provide a clean space, separated from the work area, for these activities.

2.5.2 All workers must wash upon leaving the work area. Wash facilities will be provided by the abatement Contractor. This wash facility will consist of, at least, running potable water, towels, and a HEPA vacuum. Upon leaving the work area, each worker will remove and

Part III. Clean Up Procedures for Abatement

3.1 General: The work site when abatement is taking place shall be cleaned at end of each day's abatement activities. Prior to beginning abatement, all furnishings, equipment, and carpet shall be removed. A separate, secured area within the dwelling unit shall be designated for storage of debris until it can be properly disposed of according to Section IV of the contract documents. The unit shall be secured to prevent entry, by any person, after termination of work day. Disposable supplies, such as mop heads, sponges, and rags shall be replaced regularly and disposed of according to Section IV of the contract documents. Durable equipment, such as power and hand tools, generators, and vehicles shall be cleaned monthly. All equipment shall be cleaned by HEPA vacuuming and high-phosphate washing.

3.2 Clean Up Methods and Equipment: Dwelling unit rooms, in which abatement operations have been completed, shall be cleaned, starting at the ceilings and working down to the floors, by vacuum cleaning using a High Efficiency Particulate Air Accumulator (HEPA) vacuum, followed by a wet cleaning with high-phosphate (trisodium phosphate) wash. The Contractor may use a garden sprayer or similar type to wet all surface with a 5% to 10% trisodium phosphate cleaning solution. After spraying the surface, a wet and dry HEPA vacuum shall be used to vacuum the water from the surface.

3.3 High Efficiency Particulate Air Accumulator (HEPA) Vacuum: The Contractor will obtain training in the use of the HEPA vacuum from the manufacturer prior to use. The Contractor shall obtain HEPA vacuum attachments, such as various size brushes, crevice tools, and angular tools to be used for varied applications and service the HEPA vacuum routinely to assure proper operation. Caution shall be used any time the HEPA is opened for filter replacement or debris removal. Operators shall wear a full set of protective clothing and equipment, including respirators, when using the HEPA vacuuming equipment.

3.4 Wet Cleaning with High-Phosphate (Trisodium Phosphate) Wash: The Contractor shall prepare and use detergents containing at least 5% to 10% trisodium phosphate, according to the manufacturers' instructions. The manufacturer's recommended coverage will be followed. Detergent solutions should be replaced after each individual room has been washed unless the contractor has used a garden spray application and vacuumed the surface. The waste water from clean up shall be contained and disposed of according to Section IV of the contract documents.

SECTION III
CLEAN-UP PROCEDURES

TABLE OF CONTENTS
INSTRUCTIONS TO BIDDERS

removing the waste material adequately covers all loads so as to assure that no dust or debris is released.

4.15 Disposal of Hazardous Waste (as determined by testing) The Contractor will be required to comply with the Resource Conservation and Recovery Act (RCRA) and with the provisions of Section 6.1.

4.16 The Contractor shall apply for an EPA identification number from the appropriate Regional EPA office; if more than 100 kg of hazardous waste will be generated from the abatement process during any calendar month. If less than 100 kg, the Contractor shall obtain provincial EPA generator number from the each property address. The Engineer will assist the Contractor in contacting the appropriate EPA office to secure the identification.

4.17 Waste Containers: The Contractor will comply with EPA and DOT regulations for containers. The Contractor shall contact the state and local authorities to determine their criteria for containers. The more stringent regulation shall apply.

4.18 Waste Transportation: If the Contractor is not a certified hazardous waste transporter, a contract shall be entered into with a certified transporter to move the waste. The Contractor shall require the certified hazardous waste transport to follow RCRA regulation.

that do not fit into plastic bags will be wrapped and labeled **"DANGER, LEAD DUST"**.

4.5 The Contractor will place all disposable cleaning materials, such as sponges, mop heads, filters, disposable clothing, and brooms in double (4-mil) or single (6-mil) plastic bags and sealed.

4.6 The Contractor shall clean surfaces and equipment and bag large debris. The Contractor shall than remove plastic sheeting and tape from covered surfaces. Prior to removing the plastic sheeting, the Contractor shall lightly mist the sheeting in order to keep dust down and fold inward to form tight bundles to bag for disposal. The Contractor shall place all plastic sheeting shall be placed in double (4-mil) or single (6-mil) thick plastic bags and seal.

4.7 The Contractor shall bag and seal vacuum bags and filters in double (4-mil) or single (6-mil) thick plastic bags.

4.8 The Contractor shall place all contaminated clothing or clothing covers used during abatement and clean up in plastic bags for disposal prior to leaving equipment room.

4.9 The Contractor shall place solvent residues and residues from strippers in drums made out of materials that cannot be dissolved or corroded by chemicals. Solvents will be tested by the Engineer to determined if they are hazardous. Solvents, caustic and acid waste must be segregated and not stored in the same containers.

4.10 The Contractor shall contain and properly dispose of all liquid waste, including lead-dust contaminated wash water.

4.11 The Contractor shall HEPA vacuum the exterior of all liquid waste containers. Prior to removing the waste containers from the work area, and shall wet wipe the containers to ensure that there is no residual contamination. Containers should then be moved out of the work area into the designated storage area.

4.12 The Contractor shall carefully place the containers into the truck or dumpster used for disposal.

4.13 The Contractor shall ensure that all waste is transported in covered vehicles to a landfill, or lined landfill, if available.

4.14 If the Contractor subcontracts the removing of the lead-based paint waste, he shall insure that the company nature; who is not in a position to perform the contract, or who has habitually and without just cause neglected the payment of bills or otherwise disregarded his obligations to subcontractors, materialmen, or employees.

d. The ability of a bidder to obtain a performance bond shall not be regarded as the sole test of such bidder's competency or responsibility.

5. PERFORMANCE AND PAYMENT BOND, EXECUTION OF CONTRACT

a. Subsequent to the award and within ___ days after the prescribed forms are presented for signature, the successful bidder shall execute and deliver to the Engineer a contract in the form furnished in such number of counterparts as the Engineer may require.

b. Having satisfied all conditions of award as set forth elsewhere in these documents, the successful bidder shall, within the period specified above,furnish bond(s) in a penal sum of at least the full amount of the contract as awarded, in the form included in the specifications, which secures the faithful performances of the contract, and for the payment of all persons, firms or corporations to whom the Contractor may become legally indebted for labor, materials, tools, equipment, or services, of any nature, employed or used by him in performing the work. Such bond(s) shall bear the same date as or a date subsequent to, the date of the contract.

c. On each such bond the rate of premium shall be stated, together with the total amount of the premium charged. The current power of attorney for the person who signs for any surety company shall be attached to such bond.

d. The failure of the successful bidder to execute such contract and to supply the required bonds within ____ days after the prescribed forms are presented for signature or within such extended period as the Engineer may grant based upon reasons determined adequate by the Engineer, shall constitute a default, and the Engineer may either award the contract to the next responsible bidder or readvertise for bids, and may charge against the bidder the difference between the amount of the bid and the amount for which a contract for the work is subsequently executed, irrespective of whether the amount thus due exceeds the amount of the bid guaranty.

SECTION A

(GENERAL INFORMATION)

1. BID

a. All bids must be submitted on forms furnished by the Engineer and shall be subject to all requirements of the Specifications and Drawings. Bid Forms will be furnished in triplicate, two to be submitted with the bid and one to be retained by the bidder for his records. Only one of the two copies of the bid shall be signed. The other shall be conformed.

b. Bid Documents shall be sealed in an envelope which shall be clearly labeled with the words "Bid Documents," and show the project number, name of bidder, and date and time of opening.

2. INTERPRETATIONS

Interpretations of the contract document will be made by the Engineer. Upon receipt of a request for interpretation, the Engineer will review each of the contractors bidding on the project.

3. TIME FOR RECEIVING BIDS

Bids will be submitted by the contractor on the date and time specified by the Engineer.

4. AWARD OF CONTRACT: REJECTION OF BIDS

a. The contract will be awarded to the responsible bidder submitting the lowest proposal complying with the conditions of the Advertisement for Bids, provided his bid is reasonable and it is to the interest of the Engineer to accept it. The bidder to whom the award is made will be notified as the earliest practicable date. The Engineer, however, reserves the right to reject any and all bids and to waive any informally in bids received whenever such rejection or waiver is in the interest of the Engineer.

b. The Engineer is prohibited from making any awards to contractors or accepting as subcontractors any individuals or firms which are on lists of contractors ineligible to receive awards from the United States, as furnished from time to time by HUD.

c. The Engineer also reserves the right to reject the bid of any bidder who has previously filed to perform properly, or to complete on time, contracts of a similar

6. Preconstruction Conference

Either before or soon after the actual award of the Contract (but in any event prior to the start of construction), the Contractor of his representative shall attend a Preconstruction Conference with representatives of the Engineer. The Conference will serve to acquaint the participants with the general plan of contract administration and requirements under which the construction operation is to proceed, and will inform the contractor, in detail, of the obligations imposed on him and his subcontractors by the Executive Orders concerning Equal Employment Opportunity. Labor provisions will also be covered.

The date, time, and place of the Conference will be furnished to the contractor by the Engineer.

Part II. Definitions of Work

2.1 Overview of the Work

The Contractor will be required to use specified abatement methodologies during the course of the work. It will be the responsibility of the Contractor to abide by all of the worker protection and safety specifications as outlined in Section II of the contract documents. The Contractor will be required to provide electrical service sufficient for the equipment to be used during abatement. Plumbing shall also be provided so that adequate services are available for washing down the areas after abatement and for personal hygiene. The Contractor will be required to have an on-site supervisor during all phases of abatement and will be required to have all employees trained that will be the actual work. The Contractor will be provided 6 hours of training free of cost prior to commencing work by the engineering team. The Contractor will be required to pay the labor cost of his employees for the training session.

2.2 Definitions of Abatement Methodologies

2.2.1 ENCLOSURE: This methodology will be used by the Subcontractor to cover existing substrates by materials specified in the contract. Prior to enclosure, surfaces that are peeling or flaking shall be removed by wet scraping. Trisodium phosphate detergent (5% to 10%) may be added to the water to facilitate the scraping. Materials used for enclosure shall be glued and mechanically fastened to the existing substrates. When furring strips are used, glue shall be applied to the surface of each and the enclosing material mechanically secured to the strips. All seams must be sealed or caulked and warning labels stating **"SURFACE CONTAINS LEAD-BASED PAINT"** shall be affixed to the surfaces prior being enclosed. Labels shall be 3" x 5" and placed every 4' across the wall being enclosed.

2.2.2 ENCAPSULATION: The Contractor will use this methodology to cover existing substrates by applying materials that will permanently form a bond to the existing substrates. Prior to encapsulation of a surface; all peeling or chalking paint shall be wet scraped and the surfaces being encapsulated shall be cleaned, in order to ensure proper application.

2.2.3 REPLACEMENT: The Contractor shall use this methodology to remove existing substrates and replacing them as specified in the contract documents. When removing old materials, dust shall be controlled by misting or wet spraying the material and areas surrounding the materials prior to removal. New materials used for replacement shall be installed

SECTION B

DESCRIPTION/DEFINITION OF WORK

2.2.8 CLEAN UP: The process used to clean a substrate after the lead-based paint has been removed and prior to testing. A cleanup process includes: (1) A complete HEPA vacuuming of the entire room; (2) A complete wash using a trisodium phosphate solution of the entire room and; (3) another complete HEPA vacuuming of the entire room.

2.2.9 DISPOSAL: The process used to package, store and dispose of the waste material generated as a result of the abatement.

according to the specification and in some cases be sealed and caulked.

2.2.4 HAND AND/OR MECHANICAL REMOVAL: The Contractor, in using this methodology, shall pay particular attention to worker protection, since the methodology involves dry scraping alone; or with the aide of solvent, hand sanding, wire brushing, machine sanding (with a disk and a dust containment shield not be wider than surface being sanded) equipped with a high efficiency particle accumulator (HEPA) vacuum, controlled low-level heating element (use restricted to small areas) which produces a temperature not exceeding 700 degrees fahrenheit, or abrasive blasting using a wet misting technique and simultaneous vacuuming system.

2.2.5 CHEMICAL REMOVAL--ON-SITE: The Contractor will use chemical stripping agents (methylene chloride agents are not to be used) which may require multiple applications, depending on the number of layers of paint being abated. When this type of method is used, care should be taken to avoid drying of the agent. Also, residue from this method shall not be allowed to dry. Surfaces that come in contact with the stripping agents used in this methodology during washing or neutralizing shall be completely cleaned before the waste drys.

2.2.6 CHEMICAL REMOVAL--OFF-SITE: When using this methodology, all substrates should be carefully removed and identified (i.e. by stamping or engraving) in order for proper replacement to be accomplished. Prior to using this method, the abatement Contractor should determine the size limitations of off-site stripping tanks, arrange for same-day stripping of the components, and ascertain from the stripping service provider the procedures to be used for washing components to remove lead residue left behind on stripped surfaces. Components must be cleaned so that no lead residue/dust remains. After stripping, precautions shall be taken in handling and reinstalling the substrate to protect the worker from the exposure to lead dust. The Contractor shall secure certification from the off-site stripping Contractor that stripping solutions are changed often enough to eliminate the possible absorption of additional lead into porous substrates. Additional certification shall also be obtained to assure that the stripping service facility disposes of liquid waste in compliance with applicable waste disposal regulations.

2.2.7 SUBSTRATE: For the purposes of this contract, a substrate is defined as any surface upon which paint has been or may be applied such as drywall, baseboards, plaster, metal, etc.

SECTION C
FEDERAL REGULATIONS

Chapter II Worker Protection

2.1 Introduction

As discussed in Chapter 1, significant lead exposures can and do occur during abatement.[1-6] Any lead paint abatement project, regardless of the method(s) used can potentially expose workers and homeowners doing the work themselves, to lead and other hazards. The most effective way to achieve worker protection is to minimize exposure through the use of engineering and work practice controls and not to rely solely on a respirator protection (RP) program. Contractors should be aware that, as of the time these guideline were prepared, the exposures associated with various methods and phases of abatement are not well documented. Until such documentation is available, respiratory protection programs should normally be implemented.

Through toxic and disease registries and case reports, lead poisoning in workers resulting from lead paint abatement have been well documented.[4,7,8] Most of these cases are the result of inadequate education and training in lead paint abatement and protection of workers and homeowners, poor work practices, and the use of traditional methods of abatement which produce high dust levels of exposure (see Sections 1.3 and 4.1.3). Worker protection programs can work[9], however, they have not always prevented increases in worker blood lead levels.[9-11] Depending on the extent of the increase in worker blood lead levels, additional testing, medical referral, and remedial action (to either reduce exposure, change worker behavior, or both) may be necessary.

Any employer of abatement workers is responsible for preparing and implementing a worker protection plan to ensure that lead exposures are minimized. Abatement projects will vary in terms of exposure and scope of activity. A common sense approach is needed, particulary for one-time projects which may only involve limited abatement. An example is the removal of a few interior doors. However, since worker protection planning requires technical skills and knowledge, and special testing equipment, as well as a common sense approach, employers may want to consider consulting with an industrial hygienist in developing and implementing the abatement worker protection plan (see section 2.2.7). Since repair and maintenance activities may break lead painted surfaces (e.g.,plumbing repairs), PHAs should also consider consulting with an industrial hygienist to develop a protection plan for workers involved in repair and maintenance.

Due to possible exposure to radiation from the radioisotopes used in the portable x-ray fluorescence analyzers for lead-paint detection, operators require special training in health and safety (see section 3.7.1). This training is usually conducted by the manufacturer or by a health physicist consultant.

At least two states have modified the federal lead standard specifically for workers in the construction trades.[12,13] Unless stated otherwise, regulatory standards that appear in this chapter come from Maryland or Massachusetts regulations.

In light of recent research on the health effects of lead in adults and fetuses mentioned in chapter 1, these regulations may not provide adequate safeguards, particularly for women in their childbearing years whose future children are at risk for developmental deficits.

The following is a list of employer actions and responsibilities for worker protection:

Tasks to be done before abatement:

- o Educate and train workers
- o Determination of potential or actual worker exposures to lead
- o Contact OSHA for copies of:
  - The OSHA occupational safety and health standard, occupational
  - Exposure to lead (29 CFR 1910.1025) including appendix "C" and qualitative respirator fit test protocols
  - Respiratory protection practice protocols
- o Forward copies of OSHA lead standard Appendix "C" and Appendix 2.2, Medical Surveillance of Lead Exposed Workers, to physician performing medical surveillance
- o Initiate a program of respiratory protection, including respirator selection and fit testing
- o Perform initial medical surveillance
  - medical examination
  - baseline blood lead levels
  - pulmonary function tests
- o Provide protective clothing and equipment
- o At least three days before the start of the job, post appropriate warning signs at entrances and exits of work areas and leave in place until clearance testing indicates that the unit is safe for reoccupancy.

The signs should include at least the phrase:

"CAUTION LEAD HAZARD - KEEP OUT" in bold lettering at least two inches high.

Post bilingual signs when the proportion of non-English speaking persons indicates the need.

Tasks be done during abatement:

- o Exposure monitoring
- o Implement engineering and work practice controls
- o Periodic medical surveillance and blood lead monitoring
- o Provide daily changes of protective clothing and shoe covers
- o Implement and enforce respiratory protection program
- o Maintain and care for protective equipment

Tasks to be done after abatement:

- Maintain medical and exposure records
- Maintain records of company studies concerning the employees' working conditions or environment

These measures, taken together can reduce both worker exposure and employer liability. This chapter assumes that the workers and contractors are familiar with and implement usual safety and health precautions for construction work.

2.2 How to Develop a Worker Protection Plan

Basic elements common to all worker protection plans and the need to tailor worker protection measures to the specific abatement methods are described in this section. It also familiarizes the reader with both employer and employee responsibilities for worker protection.

The basic elements of all worker protection plans are as follows:

- Mandatory worker education and training
- Exposure monitoring
- Engineering and work practice controls
- Respiratory protection program
- Medical surveillance and medical removal
- Protective clothing and equipment
- Record keeping

2.2.1 Mandatory Worker Education and Training

Employers are responsible for worker education and training. Sections 2.2.7 and 4.11.3 provide information on sources of training for PHAs and other entities. It will not provide the actual content of a training program; instead, the aim is to enable the reader to evaluate the completeness of a training program.

The basic elements of a worker education and training program are as follows:

- Worker right-to-know requirements
- Health effects of lead
- Personal hygiene and other worker responsibilities
- Routes of exposure and potential exposure levels
- Use and maintenance of protective clothing and equipment
- Training in use of specific methods of abatement
- The use of engineering and work practice controls
- Other health and safety considerations

Employers may choose to provide training in an array of abatement methods (see Chart 4.3 in Section 4.4.1) or only for the methods specified in a particular abatement plan. Employers should provide hands on training as a part of training on containment and abatement methods.

2.2.1.1 Worker Right-to-Know

Under the U.S. Occupational Safety and Health (OSHA) Hazard Communication Standard (29 CFR 1910.1200), employees have the right to know what hazards they will be exposed to, what precautions to take, and what sources of information they can access. It also requires employers to have a written hazard communication program and an information and training program (see Appendix 2.1). All worker education programs should discuss and make available this standard and the federal OSHA Lead Standard. Employers should check local requirements as some states have adopted their own right-to-know regulations.

The OSHA right-to know standard also requires that the worker is assured access to three types of records:

- Medical Records
- Exposure Records
- Company Studies

The worker has the option to request a copy of his/her medical records with an explanation of what they mean. The worker also has the right to examine industrial hygiene sampling information, results of biological monitoring, exposure records and material safety data sheets.

2.2.1.2 Health effects

Lead serves no known useful function in the human body - all known effects of lead are adverse $_{14}$. All worker education programs should cover the following areas with regard to health effects:

- The types and meanings of tests to determine lead exposure
- Routes of exposure for fetuses, children and adults
- Health effects in fetuses, children and adults
- Blood lead levels at which various health effects occur
- Signs and symptoms of lead poisoning
- Medical treatments and diet
- Conditions for medical removal from the job
- Conditions for medical referrals

This portion of worker training is important in motivating worker compliance with worker protection and abatement plans. A worker who understands the toxic potential of lead even at low levels of exposure will appreciate the need for precautions and attention to work quality. Workers should report any signs or symptoms of lead poisoning to their employers.

2.2.1.3 Personal hygiene

A few simple personal hygiene practices can contribute greatly to the control of worker exposure to lead. All training programs should include discussion of the following personal hygiene practices:

- Prohibition of smoking, eating, drinking, chewing gum or tobacco, and the application of cosmetics in work areas
- Use of designated changing and shower areas to avoid cross contamination of street and work clothes
- Washing of hands and face at appropriate times
- HEPA vacuuming of protective clothing before leaving the work area
- Other measures to prevent the transfer of lead to the worker's home, car, or environment

2.2.1.4 Routes of Exposure and Potential Levels

The primary routes of worker exposure are inhalation and ingestion. Workers should be made aware of (a) the potential exposure levels associated with at least those abatement methods used in any given abatement project and (b) the importance of matching protection measures with anticipated or actual exposure levels. For example, heat guns require full worker protection, including at least half-mask air purifying respirators equipped with HEPA filters.[3,6] protective clothing and shoe covers.

Additionally, workers need to understand the potential for exposing family members to lead brought home on clothing, shoes, hair, and tools from the work site.

2.2.1.5 Training in Specific Methods of Abatement

Prior to abatement, workers should receive training in abatement methods, including their advantages and disadvantages, appropriate and inappropriate applications (see Charts 4.2 and 4.3 in Chapter IV) and the use of special tools and equipment.

2.2.1.6 Use of protective clothing and equipment

Workers must be taught the need for protective clothing and how to select, wear, and maintain appropriate protective clothing and equipment. This training includes procedures for dressing and undressing and the use of gloves, facial protection, eye protection, and shoe coverings. Respiratory protection programs (see section 2.2.5.1) and fit testing should be explained in detail during training. This training always includes individual fit testing of respirators and procedures to maintain and clean respirators. Prior to fit testing, employees must be referred for a medical examination (see Section 2.2.4.1). The employer has the ultimate responsibility for proper use and maintenance of protective clothing and equipment by workers.

2.2.1.7 Engineering and work practice controls

Workers need to understand and know how to implement the following types of engineering and work practice controls:

- Measures for control of debris and lead dust
- Measures for containment of debris and lead dust

- Housekeeping measures

See Section 4.7.2 for information on control and containment of lead dust and Sections 5.2.2.1 and 5.3.2.1 (a) for information on housekeeping measures.

Training should include information on measures for the control of lead dust exposure through HEPA filtered vacuums, and prohibition of dry sweeping (see Section 5.3.2.2.a (2)). Maintenance of HEPA vacuums and filters must be explained (see section 5.3.1.1). Containment measures, such as the use of polyethylene sheeting for interior and exterior use and containment of dry and liquid waste, should be reviewed (see Section 4.7.3). Hands on training should be provided for the implementation of containment measures.

2.2.1.8 Other Health and Safety Considerations

a. General Construction Safety

General construction precautions should be reviewed, particularly those relating to plastic sheeting and potential slips, trips, and falls and the use of hazardous chemicals. The need for special precautions when working in buildings with housing code violations and structural problems (e.g. damaged stairs, missing floor boards) should be reviewed. Particular attention should be paid to:

- Safe use of ladders and scaffolding
- Potential fire hazards
- Electrical safety
- Avoidance of heat stress and heat exhaustion while wearing protective gear
- Potential for exposure to carbon monoxide, solvents and caustic chemicals.

b. Pregnant Women and Women of Child-Bearing Age

No training program is complete without providing workers with the information from recent research studies which indicate that (1) lead is transferred from mother to fetus during pregnancy and (2) exposure of the fetus to even low levels of lead is associated with developmental delay during the first two years of life and possibly longer (see Section 2.2.4.1) [14].

2.2.2 Exposure Monitoring

Exposure monitoring is accomplished by measuring the concentration of lead in the breathing zones of workers. The purpose of exposure monitoring is to characterize exposure levels during different phases of an abatement project so that the abatement contractor can take appropriate measures to reduce exposure to the greatest extent possible.

Exposure monitoring allows the abatement contractor (and his/her industrial hygienist or health and safety technician consultant) to maximize protection of workers from exposure and himself from liability by:

- Determining the level of worker protection needed during different phases of an abatement project
- Evaluating, modifying and improving engineering and work practice controls
- Evaluating, modifying and improving methods of abatement, application techniques, and specific work practices
- Evaluating work quality and need for additional worker training

Exposure monitoring allows the contractor to avoid sole dependence on biological monitoring as the indicator of adequacy of worker protection and abatement methods. This is important because workers can attain exposures which put them at risk for health effects prior to biological testing.

Moreover, information on worker blood lead levels in the absence of exposure monitoring data does not indicate which abatement methods, processes or controls can be modified to reduce exposure. This is the case even if no worker blood lead increases are detected.

2.2.2.1 When Should Exposure Monitoring Be Done?

Current monitoring practices have come from industrial, and not construction settings. These practices do not reflect the research of the last ten years, which indicates detrimental health effects at lower levels of exposure.[14,15] This suggests that current practices do not adequately protect workers, in particular, female workers and their future children. Furthermore, air lead monitoring practices developed for an industrial setting are not necessarily adequate for, or applicable to all abatement work. Abatement may be of short or long duration and create widely varying lead exposures depending upon the tasks performed. Contractors performing one-time abatement work of short duration (e.g., less than two weeks) may chose to implement full worker protection in lieu of exposure monitoring.

Under current practice,[12,13] exposure levels of at least 30 micrograms per cubic meter per 8-hour time weighted average (TWA), trigger further exposure monitoring requirements and respirator protection.

However, due to concerns about health effects mentioned in Chapter I, employers should consider full worker protection combined with continued exposure monitoring (of air lead levels) and the institution of engineering and work practice controls to reduce exposure levels even if these levels are found to be less than 30 micrograms per cubic meter (TWA).

An initial determination should be made by the employer to determine potential exposure to lead of any employee at or above 30 micrograms per cubic meter (as an 8-hour time weighted average [TWA]).

For abatement work, this initial determination should be done, if possible, as part of planning prior to abatement. This monitoring may be done as a pilot project in the first unit of a series of units to be abated. Initial determinations will most likely include air lead monitoring due to the current lack of well documented exposure information for various methods, phases and processes of abatement and cleanup. When this information becomes available, an initial determination can also be based on any information, observations, calculations, or anticipated operations which would indicate employee exposure to lead, or any previous measurements of airborne lead.

Under current practice,[12,13] exposure monitoring should also be performed:

- Whenever there is a production, job site, material, process, control or personnel change which may result in new or additional exposure.
- Whenever the employer has any other reason to suspect a change which may result in new or additional exposures.
- Whenever an employee complains of any signs or symptoms which may be attributed to lead exposure.
- Whenever an initial determination or subsequent monitoring reveals the airborne exposure to be at or above 30 micrograms per cubic meter (TWA) then exposure monitoring shall be done at least every six months and until at least two consecutive measurements taken at least seven days apart, are below the 30 micrograms level. For abatement projects of duration less than six months, employers should advance the monitoring schedule to accommodate the abatement work schedule.
- Whenever initial determination or subsequent monitoring reveals that airborne exposure is above 50 micrograms per cubic meter (TWA), repeat monitoring quarterly until at least two consecutive measurements taken at least seven days apart, are below 30 micrograms per cubic meter (TWA). For abatement projects of short duration, employers should advance the monitoring schedule to accommodate the abatement work schedule.

Employers should consider additional exposure monitoring anytime a worker has an increased blood lead level warranting medical referral and not solely when medical removal occurs (see section 2.2.4). Any increase in worker blood lead levels suggests the possibility that overexposure may be occurring and that actions may be needed to prevent overexposure of other workers. Additional exposure monitoring can help identify sources of overexposure and needed modifications to abatement practices to reduce exposure.

2.2.2.2 When Is Exposure Monitoring Optional?

Despite the advantages and utility of exposure monitoring outlined above, there are circumstances under which the employer may want to forego exposure monitoring and institute a full program of worker protection, including a respirator protection program. These circumstances are as follows:

- When abatement of limited duration is to be performed one time only (e.g., abatement of a single unit which is expected to last less than two weeks). Exposure monitoring should be done when the contractor or owner plans on doing a series of single unit abatements over time even if full worker protection is used.
- When exposure has already been well documented for specific methods of abatement and for experienced workers using these previously documented methods.

2.2.3. Engineering and Work Practice Controls

The most effective way to achieve worker protection is to minimize exposure through the use of engineering and work practice controls and not to rely solely on a respirator protection (RP) program. In addition to helping protect workers from overexposure, engineering and work practice controls protect the environment and occupants of adjacent units and make cleanup an easier task. (see Section 4.3.2).

Engineering and work practice controls that have a direct bearing on worker protection are described in other sections of these guidelines as follows:

- o Prohibition of unacceptable methods of abatement such as open-flame burning and sanding (see Section to 4.1.3).
- o Limited use of certain methods of abatement such as on-site paint removal by heat gun, caustic and solvent-based chemicals and wet scraping (see Chart 4.3 in Chapter IV).
- o Provision of "clean rooms" on-site for changing clothes and provision of washing facilities (see Section 2.2.5.2).
- o Shutting down forced air systems and sealing all intake and exhaust points in the work area (see Section 4.7.4.2) and provide alternative sources of heat if necessary.
- o Daily cleanup procedures (see Section 5.3.2.2)
- o Spray misting of dry debris prior to clean-up and prohibition of dry sweeping (see Section 5.3.2.2.a.(2))

2.2.4 Medical Surveillance and Medical Removal

Medical surveillance, which consists of biological monitoring of worker blood lead levels and medical examinations and consultations, must be implemented prior to employment. One purpose of biological monitoring is to establish a baseline blood lead level and to detect early changes in worker blood lead levels. Medical examinations and procedures, including blood lead collection, should be performed by, or under the supervision of, a licensed physician and preferably, one with board certification in occupational medicine. Appendix 2.2 contains information for physicians on medical surveillance of lead-exposed workers. Employers should become familiar with the information in Appendix 2.2 and provide a copy to all physicians caring for their workers.

Blood lead testing should only be performed by laboratories accredited by the College of American Pathologists or the federal Occupational Safety and Health Administration (OSHA). Appendix 2.3 lists blood lead testing laboratories approved by federal OSHA. All results must be provided to workers along with an explanation.

The current practices for medical surveillance and medical removal are provided below.[12,13] However, more recent research indicates health effects at lower levels of exposure. Therefore, recent research suggests that the current standards do not adequately protect workers, in particular, female workers and their future children. Each of the following sections provides information for employers on additional measures to protect workers from exposure and themselves from liability.

2.2.4.1 Referring Workers for Medical Exams/Consultations

Under current practices it is necessary to refer the workers for medical examinations and consultations as indicated below.[13] If a medical referral is made, then careful investigation and remedial action should be taken to reduce exposure or change worker behavior or both. Medical referrals should be made:

- o Prior to their starting abatement work and prior to respirator fit testing, workers must be referred to a physician for a medical examination which includes the following elements:
    - A detailed work and medical history, with particular attention to past lead exposure, personal habits and past gastrointestinal, hematologic, renal, cardiovascular, reproductive and neurological problems.
    - 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.
    - A blood pressure measurement
    - A blood sample and analysis which determines: blood lead levels; hemoglobin and hematocrit determinations; red cell indices; and examination of peripheral smear morphology; blood urea nitrogen; and serum creatinine.
    - A routine urinalysis with microscopic examination
    - Any laboratory or other test which the examining physician deems necessary
    - A discussion of the adverse effects of lead, particularly the effects on fetuses (see Section 1.2, Chapter I, for a summary of blood lead levels associated with adverse health effects in children, fetuses, and adults).
- o Immediately, whenever blood lead levels exceed 30 micrograms per deciliter (whole blood).[16]
- o As soon as possible after a worker notifies the employer that he/she has signs or symptoms associated with lead toxicity.
- o Whenever the employee desires medical advice concerning the effects of current or past exposure to lead.
- o Immediately, upon notification that an employee is pregnant.[16]
- o Whenever the employee desires medical advice on lead's effects on the employee's ability to procreate a healthy child.
- o Prior to restarting work following medical removal.

2.2.4.2 Blood Lead Monitoring

Under current practices, worker blood lead monitoring should be done as follows:[13]

- o Before assignment, for each employee.
- o At least every two months during the first six months and after that every six months.
- o At least every two months for each employee whose last blood lead analysis indicated a level at or above 25 micrograms per deciliter. Continue testing at least every two months until two consecutive blood lead levels are below 25 micrograms per deciliter.
- o At least monthly during medical removal (see Section 2.2.4.3)
- o At termination of employment.

For reasons of worker safety and employer liability additional biological (blood lead) monitoring should be done for all new workers regardless of prior blood lead levels and exposure levels in the work area as follows:[16]

- o 30 days after beginning employment
- o Thereafter at least once every two months for 6 months and after that every six months until termination of employment or termination of the employee's involvement with lead paint abatement work for reasons other than medical removal

2.2.4.3 Implementing Medical Removal

Medical removal is the temporary removal of workers due to elevated blood lead levels. A current practice for medical removal is as follows:[17]

- o Whenever worker blood lead level is 30 micrograms per deciliter or higher
- o Whenever the average of the last three blood tests is above 25 micrograms per deciliter (whole blood)
- o Whenever indicated by a physician's judgment based upon medical determination
- o Workers can return to former job status when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 25 micrograms per deciliter. If removal was due to a medical determination, a physician must approve the return to work.

2.2.5 Protective Clothing and Equipment

Protective clothing and equipment should be provided to all workers in order to help assure that lead dust is not transferred from the abatement work area to the homes, vehicles, and environment of workers. Protective clothing and equipment also serve to prevent skin and hair contact with hazardous chemicals (solvents and caustics) or contact with skin or eye irritants that may be used on a limited basis during abatement.

The employer is responsible for:

- o Providing clean protective clothing and shoe covers of appropriate sizes on a daily basis
- o Providing a clean changing area
- o Having water available for washing of hands and face and shower facilities if possible
- o Enforcing the removal of protective clothing at the end of each work day and before eating, drinking, and smoking
- o Enforcing the removal of shoe covers upon leaving the work area
- o Appropriate disposal or laundering of work clothes
- o Providing protective clothing and equipment when the possibility of skin or eye irritation exists
- o Informing the worker how to maintain clothing and equipment

2.2.5.1 Types of Protective Clothing and Equipment

The following protective items may be required during abatement, cleanup and disposal:

- Gloves
- Hair protection
- Eye goggles and face shields
- Respirators and Respirator cartridges
- Protective coverall
- Shoe covers

Protective coveralls and shoe covers constitute basic worker protection gear and must be worn at all times by all workers. Disposable coveralls and shoe covers are preferred to avoid the need for laundering of gear.

Disposable items can either be breathable or non-breathable. Non-breathable coveralls should not be used when the possibility of heat stress and exhaustion exists. The possibility of heat stress and exhaustion should be discussed with the abatement project's health and safety consultant/expert.

Glove material should be appropriate for the specific chemical exposure (e.g. caustic or solvent). Cotton gloves provide some protection against contamination of hands and cuticles with lead dust. Paper suits and shoe covers are not appropriate for wet abatement processes. Employers have the responsibility of providing the appropriate respirator cartridges. The HEPA cartridge provides protection against dusts, mists and fumes and is always necessary when using a respirator on a lead abatement project. Additionally, an organic vapor cartridge needs to be added to the HEPA filtering cartridge when organic solvents are used on the work site. If the chemical stripper contains methylene chloride, then a supplied air respirator should be used.[16]

a. Respiratory Protection (RP) Programs

A limitation of RP programs is their reliance on strict worker compliance to attain necessary worker protection. Failure to wear or maintain the respirator at all times, and in accordance with manufacturer recommendations, can result in significant exposures to lead and/or other toxins. For this reason, contractors should conduct frequent random inspections to help ensure that respirators are properly selected, used, and maintained. For example, random inspections may need to be done daily or even periodically throughout the day, particularly to ensure that new employees develop safe work practices.

(1) When are RP Programs Necessary?

Respiratory protection programs are always necessary in the absence of exposure monitoring information that indicates, without a doubt, that respiratory protection is not needed. Contractors should be aware that, as of the time these guideline were prepared, the exposures associated with various methods and phases of abatement are not well documented. Until such time as exposure monitoring and research on effects of lead at lower levels indicates that respiratory protection is not needed, use RP as a measure to supplement engineering and work practice controls. When effective engineering controls are not available or feasible, then strict reliance on implementation of RP programs and an awareness of their limitations are necessary. Respirators should be furnished any time an employee makes a request.

The Maryland OSHA Lead in Construction Standard specifies that respiratory protection is needed when initial determination (see Section 2.2.2) indicates an airborne lead concentration above 50 micrograms per cubic meter^3 (TWA).

Employees concerned about exposure at or below 50 micrograms per cubic meter should request respirator protection. Female employees, in particular, may want added respirator protection.

(2) Respiratory Protection Program Requirements

The U.S. Occupational Safety and Health Administration (OSHA) has regulations that outline requirements for a minimal acceptable program of respiratory protection (29 CFR 1910.134). More stringent state and local requirements may apply. Therefore, the abatement contractor should check if there are any additional local and state requirements for respiratory protection programs.

When respirators are provided, a respiratory protection program must be established in accordance with these OSHA regulations and respirator fit testing must be conducted. A medical examination must be performed by a physician prior to fit testing and any time an employee exhibits difficulty breathing during respirator fit testing or use. Certain pre-existing health conditions may preclude a worker from safely using a respirator.

The requirements for a minimal acceptable respiratory protection program are as follows:

- Establishment of 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.

- Training of workers on the limitations and use of respirators, including fit testing.
- Assignment of respirators to individual workers for their exclusive use.
- Daily cleaning and disinfecting of respirators.
- Storage of respirators in a convenient and sanitary location.
- Inspection of respirators for worn and deteriorated parts during cleaning.
- Surveillance of work area conditions and degree of employee exposure or stress.
- Evaluation of program effectiveness.
- Medical examination of workers by a physician prior to fit testing and annually thereafter.
- Use of approved respirators only.

2.2.5.2 How to Use Protective Clothing and Equipment

Procedures prior to the start of work:

- Change into work clothing and booties in the clean section of the designated changing areas.
- Don appropriate size work garments and use duct tape to reinforce seams (e.g., underarm, crotch, and back).
- Any clothing not worn under protective clothing needs to be stored in the designated changing area.
- Select and wear appropriate protective gear, including respirators if needed, before entering the work area.

Clothing that is appropriate for weather and temperature conditions should be worn under protective clothing.

Procedures upon leaving the work area:

- Heavily contaminated work clothing should be HEPA vacuumed while still being worn.
- Remove shoe covers and leave them in the work area.
- Remove protective clothing and gear in the dirty area of the designated changing area prior to eating, drinking and smoking outside the work area and prior to leaving the work site. Protective coveralls should be removed carefully by rolling down the garment to reduce exposure to dust. Respirators should be the last item of gear removed.
- Wash hands and face.
- Clean respirators and change cartridges as needed when breathing becomes difficult.

Procedures upon finishing work for the day (in addition to procedures described above):

- Place disposable coveralls and shoe covers with abatement waste.
- Place clothes for laundering in a closed container.
- Wash hands and face again.
- If showers are available, take shower and wash hair.

- Clean protective gear, including respirators according to standard procedures.
- If shower facilities are not available at the work site, workers should shower immediately at home and wash hair.

2.2.5.3 Care and Maintenance of Protective Gear

a. Respirators

- Inspect daily for defects and perform a leak check
- Clean and disinfect daily
- Repair as needed
- Store in plastic bag at end of work day

b. Goggles, gloves, and rubber boots

- Wash and air dry daily
- Store in plastic bag at end of each work day

See Section 5.3.2.4, Chapter V, for procedures for cleaning tools, equipment, and vehicles.

2.2.6 Record Keeping

The purpose of record keeping is to be in compliance with any local, state and federal regulations, and for insurance and liability purposes.

The abatement contractor is responsible for maintaining written records of:

- Exposure monitoring
- Medical surveillance
- Medical removal

2.2.6.1 Exposure Monitoring Records

The following information should be contained in exposure monitoring records:

- Dates, number, duration, location and results of each of the samples taken.
- A description of the sampling procedure(s).
- A description of the sampling and analytical methods used and evidence of their accuracy.
- The type of respirator worn, if any.
- Employee name, social security number, and monitored job classification.
- Environmental variables that could affect the measurement of employee exposure.

Exposure monitoring records should be maintained for 40 years or for the duration of employment plus 20 years, whichever is longer.

2.2.6.2 Medical Surveillance Records

Medical surveillance records shall include: [12,13]

- o Employee name, social security number, and description of duties.
- o A copy of the physician's written opinions.
- o Results of any airborne exposure monitoring done for that employee and the representative exposure levels supplied to the physician.
- o Any employee medical complaints related to lead exposure. The employer or the examining physician keeps:
  - A copy of the medical exam results, including medical and work history and the description of laboratory procedures. The employer may only receive a summary of medical exam results for his records.
  - A copy of any standards/guidelines used to interpret the test results.
  - A copy of the results of any biological monitoring.

Medical surveillance records should be maintained for 40 years or for the duration of employment plus 20 years, whichever is longer.

2.2.6.3 Medical Removal Records

Medical removal records should include the name and social security number of the employee, the date on each occasion that the employee was removed from current exposure to lead, as well as the date on which the employee was returned to his or her former job status. A brief explanation of now each removal was or is being accomplished and a statement with respect to each removal indicating whether or not the reason for the removal was an elevated blood lead level. These records should be maintained for at least the duration of an employee's employment.

2.2.7 Finding Qualified Trainers, Industrial Hygienists, Health and Safety Technicians

The following are sources of information to identify qualified trainers and industrial hygienists or health and safety technicians. It is important to inquire about the person's knowledge and direct prior experience with lead hazard abatement.

- o Federal, state, and local government occupational safety and health or industrial hygiene units (see Appendix 2.4 for list of regional offices of OSHA)
- o State or local departments of health or environment
- o American Academy of Industrial Hygiene or one of its local chapters.
- o American Industrial Hygiene Association.
- o American Society of Safety Engineers.
- o Academic or university-based environmental centers.

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III. SPUTUM CYTOLOGY

Sputum can be collected by aerosol inhalation during the medical exam or by spontaneous early morning cough at home. Sputum is induced by transoral inhalation of an aerosolized solution of eight per cent (8 percent) sodium chloride in water. After inhaling as few as three to five breaths the subject usually yields an adequate sputum. All sputum should be collected directly into sixty percent (60 percent) alcohol.

Scientific evidence suggests that chest X-rays and sputum cytology should be used together as screening tests for lung tests for lung cancer in high risk populations such as workers exposed to inorganic arsenic. The tests are to be performed every six months on workers who are 45 years of age or older or have worked in the regulated area for 10 or more years. Since the tests seem to be complementary, it may be advantageous to alternate the test procedures. For instance, chest X-rays could be obtained in June and December and sputum cytologies could be obtained in March and September. Facilities for providing necessary diagnostic investigation should be readily available as well as chest physicians, surgeons, radiologists, pathologists and immunotherapists to provide any necessary treatment services.

[43 FR 19624, May 5, 1978; 43 FR 28472, June 30, 1978, as amended at 45 FR 35282, May 23, 1980]

§ 1910.1025 Lead.

(a) *Scope and application.* (1) This section applies to all occupational exposure to lead, except as provided in paragraph (a)(2).

(2) This section does not apply to the construction industry or to agricultural operations covered by 29 CFR Part 1928.

(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 $\mu g/m^3$) averaged over an 8-hour period.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Director" means the Director, National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health, Education, and Welfare, or designee.

"Lead" means metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.

(c) *Permissible exposure limit (PEL).* (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 permissible exposure limit, as a time weighted average (TWA) for that day, shall be reduced according to the following formula:

Maximum permissible limit (in $\mu g/m^3$) = 400 ÷ hours worked in the day.

(3) When respirators are used to supplement engineering and work practice controls to comply with the PEL and all the requirements of paragraph (f) have been met, employee exposure, for the purpose of determining whether the employer has complied with the PEL, 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 exposure.

(d) *Exposure monitoring*—(1) *General.* (i) For the purposes of paragraph (d), employee exposure is that exposure which would occur if the employee were not using a respirator.

(ii) With the exception of monitoring under paragraph (d)(3), the employer shall collect full shift (for at least 7 continuous hours) personal samples including at least one sample for each shift for each job classification in each work area.

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(iii) Full shift personal samples shall be representative of the monitored employee's regular, daily exposure to lead.

(2) *Initial determination.* Each employer who has a workplace or work operation covered by this standard shall determine if any exployee may be exposed to lead at or above the action level.

(3) *Basis of initial determination.* (i) 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 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) Measurements of airborne lead made in the preceding 12 months may be used to satisfy the requirement to monitor under paragraph (d)(3)(i) if the sampling and analytical methods used meet the accuracy and confidence levels of paragraph (d)(9) of this section.

(4) *Positive initial determination and initial monitoring.* (i) Where a determination conducted under paragraphs (d) (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) Measurements of airborne lead made in the preceding 12 months may be used to satisfy this requirement if the sampling and analytical methods used meet the accuracy and confidence levels of paragraph (d)(9) of this section.

(5) *Negative initial determination.* Where a determination, conducted under paragraphs (d) (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) 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 monitoring reveals employee exposure to be below the action level the measurements need not be repeated except as otherwise provided in paragraph (d)(7) of this section.

(ii) If the initial determination or subsequent monitoring reveals employee exposure to be at or above the action level but below the permissible exposure limit the employer shall repeat 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 monitoring reveals that employee exposure is above the permissible exposure limit the employer shall repeat monitoring quarterly. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least 7 days apart, are 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), except as otherwise provided in paragraph (d)(7) of this section.

(7) *Additional monitoring.* Whenever there has been a production, process, control or personnel change which may result in new or additional exposure to lead, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to lead, additional monitoring in accordance with this paragraph shall be conducted.

(8) *Employee notification.* (i) Within 5 working days after the receipt of monitoring results, 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, exceeds the permissible exposure limit, the employer shall incude in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken or to be taken to reduce exposure to or below the permissible exposure limit.

(9) *Accuracy of measurement.* The employer shall use a method of monitoring and analysis which has an accuracy (to a confidence level of 95%) of not less than plus or minus 20 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.* (i) Where any employee is exposed to lead above the permissible exposure limit for more than 30 days per year, the employer shall implement engineering and work practice controls (including administrative controls) to reduce and maintain employee exposure to lead in accordance with the implementation schedule in Table I below, except to the extent that the employer can demonstrate that such controls are not feasible. Wherever the engineering and work practice controls which can be instituted are not sufficient to reduce employee exposure to or below the permissible exposure limit, the employer shall nonetheless use them to reduce exposures to the lowest feasible level and shall supplement them by the use of respiratory protection which complies with the requirements of paragraph (f) of this section.

(ii) Where any employee is exposed to lead above the permissible exposure limit, but for 30 days or less per year, the employer shall implement engineering controls to reduce exposures to 200 $\mu g/m^3$, but thereafter may implement any combination of engineering, work practice (including administrative controls), and respiratory controls to reduce and maintain employee exposure to lead to or below 50 $\mu g/m^3$.

TABLE I—IMPLEMENTATION SCHEDULE

Industry [1]	Compliance dates [2]		
	200 $\mu g/m^3$	100 $\mu g/m^3$	50 $\mu g/m^3$
Primary lead production	(3)	3	10
Secondary lead production	(3)	3	5
Lead acid battery manufacture	(3)	2	5
Automobile manufacture/solder grinding	(3)	N/A	7
Electronics, gray iron foundries, ink manufacture, paints and coatings manufacture, wall paper manufacture, can manufacture, and printing	(3)	N/A	1
Lead pigment manufacture, nonferrous foundries, leaded steel manufacture, lead chemical manufacture, shipbuilding and ship repair, battery breaking in the collection and processing of scrap (excluding collection and processing of scrap which is part of a secondary smelting operation), secondary lead smelting of copper, and lead casting	(3)	N/A	N/A
All other industries	(3)	N/A	2½

[1] Includes ancillary activities located on the same worksite.

[2] Expressed as the number of years from the effective date by which compliance with the given airborne exposure level, as an 8-hour TWA must be achieved.

(2) *Respiratory protection.* Where engineering and work practice controls do not reduce employee exposure to or below the 50 $\mu g/m^3$ permissible exposure limit, the employer shall supplement these controls with respirators in accordance with paragraph (f).

(3) *Compliance program.* (i) Each employer shall establish and implement a written compliance program to reduce exposures to or below the permissible exposure limit, and interim levels if applicable, solely by means of engineering and work practice controls in accordance with the implementation schedule in paragraph (e)(1).

(ii) Written plans for these compliance programs shall include at least the following:

(A) A description of each operation in which lead is emitted; e.g. machinery used, material processed, 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, including engineering plans and studies used to determine methods selected for controlling exposure to lead;

(C) A report of the technology considered in meeting the permissible exposure limit;

(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 regulation;

(G) An administrative control schedule required by paragraph (e)(6), if applicable;

(H) Other relevant information.

(iii) Written programs shall be submitted upon request to the Assistant Secretary and the Director, and shall be available at the worksite for examination and copying by the Assistant Secretary, Director, any affected employee or authorized employee representatives.

(iv) Written programs shall be revised and updated at least every 6 months to reflect the current status of the program.

(4) *Bypass of interim level.* Where an employer's compliance plan provides for a reduction of employee exposures to or below the PEL solely by means of engineering and work practice controls in accordance with the implementation schedule in table I, and the employer has determined that compliance with the 100 $\mu g/m^3$ interim level would divert resources to the extent that it clearly precludes compliance, otherwise attainable, with the PEL by the required time, the employer may proceed with the plan to comply with the PEL in lieu of compliance with the interim level if:

(i) The compliance plan clearly documents the basis of the determination;

(ii) The employer takes all feasible steps to provide maximum protection for employees until the PEL is met; and

(iii) The employer notifies the OSHA Area Director nearest the affected workplace in writing within 10 working days of the completion or revision of the compliance plan reflecting the determination.

(5) *Mechanical ventilation.* (i) When ventilation is used to control exposure, measurements which demonstrate the effectiveness of the system in controlling exposure, such as capture velocity, duct velocity, or static pressure shall be made at least every 3 months. Measurements of the system's effectiveness in controlling exposure shall be made within 5 days of any change in production, process, or control which might result in a change in employee exposure to lead.

(ii) *Recirculation of air.* If air from exhaust ventilation is recirculated into the workplace, the employer shall assure that (A) the system has a high efficiency filter with reliable back-up filter; and (B) controls to monitor the concentration of lead in the return air and to bypass the recirculation system automatically if it fails are installed, operating, and maintained.

(6) *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.

(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) During the time period necessary to install or implement engineering or work practice controls, except that after the dates for compliance with the interim levels in table I, no employer shall require an employee to wear a negative pressure respirator longer than 4.4 hours per day;

(ii) In work situations in which engineering and work practice controls are not sufficient to reduce exposures to or below the permissible exposure limit; and

(iii) Whenever an employee requests a respirator.

(2) *Respirator selection.* (i) Where respirators are required under this section the employer shall select the appropriate respirator or combination of respirators from table II below.

TABLE II—RESPIRATORY PROTECTION FOR LEAD AEROSOLS

Airborne concentration of lead or condition of use	Required respirator[1]
Not in excess of 0.5 mg/m^3(10X PEL).	Half-mask, air-purifying respirator equipped with high efficiency filters.[2] [3]
Not in excess of 2.5 mg/m^3(50X PEL).	Full facepiece, air-purifying respirator with high efficiency filters.[3]
Not in excess of 50 mg/m^3(1000X PEL).	(1) Any powered, air-purifying respirator with high efficiency filters;[3] or (2) Half-mask supplied-air respirator operated in positive-pressure mode.[2]
Not in excess of 100 mg/m^3(2000XPEL).	Supplied-air respirators with full facepiece, hood, helmet, or suit, operated in positive pressure mode.
Greater than 100 mg/m^3, unknown concentration or fire fighting.	Full facepiece, self-contained breathing apparatus operated in positive-pressure mode.

[1] Respirators specified for high 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 high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

(ii) The employer shall provide a powered, air-purifying respirator in lieu of the respirator specified in Table II 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.

(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 II.

(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)(C) 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.* If an employee is exposed to lead above the PEL, without regard to the use of respirators or where the possibility of skin or eye irritation exists, the employer shall provide at no cost to the employee and assure that the employee uses appropriate protective work clothing and equipment 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 Part.

(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 μg/m³ of lead as an 8-hour TWA.

(ii) The employer shall provide for the cleaning, laundering, or 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 rooms 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-room 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) are labelled 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) *Surfaces.* All surfaces shall be maintained as free as practicable of accumulations of lead.

(2) *Cleaning floors.* (i) Floors and other surfaces where lead accumulates may not be cleaned by the use of compressed air.

(ii) 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.

(3) *Vacuuming.* Where vacuuming methods are selected, the vacuums shall be used and emptied in a manner which minimizes the reentry of lead into the workplace.

(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, except in change rooms, lunchrooms, and showers required under paragraphs (i)(2) through (i)(4) of this section.

(2) *Change rooms.* (i) The employer shall provide clean change rooms for employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators.

(ii) The employer shall assure that change rooms are equipped with separate storage facilities for protective work clothing and equipment and for street clothes which prevent cross-contamination.

(3) *Showers.* (i) The employer shall assure that employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators, shower at the end of the work shift.

(ii) The employer shall provide shower facilities in accordance with § 1910.141 (d)(3) of this part.

(iii) The employer shall assure that employees who are required to shower pursuant to paragraph (i)(3)(i) do not leave the workplace wearing any clothing or equipment worn during the work shift.

(4) *Lunchrooms.* (i) The employer shall provide lunchroom facilities for employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators.

(ii) The employer shall assure that lunchroom facilities have a temperature controlled, positive pressure, filtered air supply, and are readily accessible to employees.

(iii) The employer shall assure that employees who work in areas where their 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 with protective work clothing or equipment unless surface lead dust has been removed by vacuuming, downdraft booth, or other cleaning method.

(5) *Lavatories.* The employer shall provide an adequate number of lavatory facilities which comply with § 1910.141(d) (1) and (2) of this part.

(j) *Medical surveillance*—(1) *General.* (i) The employer shall institute a medical surveillance program for all employees who are or may be exposed above the action level for more than 30 days per year.

(ii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician.

(iii) The employer shall provide 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 paragraph (j)(1)(i) of this section on the following schedule:

(A) At least every 6 months to each employee covered under paragraph (j)(1)(i) of this section;

(B) At least every two months for each employee whose last blood sampling and analysis indicated a blood lead level at or above 40 μg/100 g of whole blood. This frequency shall continue until two consecutive blood samples and analyses indicate a blood lead level below 40 μg/100 g of whole blood; and

(C) At least monthly during the removal period of each employee removed from exposure to lead due to an elevated blood lead level.

(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), 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/100ml, whichever is greater, and shall be conducted by a laboratory licensed by the Center for Disease Control, United States Department of Health, Education and Welfare (CDC) or which has received a satisfactory grade in blood lead proficiency testing from CDC in the prior twelve months.

(iv) *Employee notification.* Within five working days after the receipt of biological monitoring results, the employer shall notify in writing each employee whose blood lead level exceeds 40 μg/100 g: (A) of that employee's blood lead level and (B) 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)(i) 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 μg/100 g;

(B) Prior to assignment for each employee being assigned for the first time to an area in which airborne concentrations of lead are at or above the action level;

(C) 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, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during use; and

(D) 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.* Medical examinations made available pursuant to paragraph (j)(3)(i) (A) through (B) 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 which the examining physician deems necessary by sound medical practice.

The content of medical examinations made available pursuant to paragraph (j)(3)(i) (C) through (D) 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.

(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 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 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 expeditious alternate physician determination mechanism in lieu of the multiple physician review mechanism provided by this paragraph so long as the alternate mechanism otherwise satisfies 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), 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 levels*—(A) *First year of the standard.* During the first year following the effective date of the standard, the employer shall remove an employee from work having a daily eight hour TWA exposure to lead at or above $100\ \mu g/m^3$ 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 80 µg/100 g of whole blood;

(B) *Second year of the standard.* During the second year following the effective date of the standard, the employer shall remove an employee from work having a daily 8-hour TWA exposure to lead at or above 50 µg/m^3 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 70 µg/100 g of whole blood;

(C) *Third year of the standard, and thereafter.* Beginning with the third year following the effective date of the standard, 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 60 µg/100 g of whole blood; and,

(D) *Fifth year of the standard, and thereafter.* Beginning with the fifth year following the effective date of the standard, the employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that the average of the last three blood sampling tests conducted pursuant to this section (or the average of all blood sampling tests conducted over the previous six (6) months, whichever is longer) indicates that the employee's blood lead level is at or above 50 µg/100 g of whole blood; provided, however, that an employee need not be removed if the last blood sampling test indicates a blood lead level at or below 40 µg/100 g of whole blood.

(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" shall mean 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 80 µg/100 g, when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 60 µg/100 g of whole blood;

(*2*) For an employee removed due to a blood lead level at or above 70 µg/100 g, when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 50 µg/100 g of whole blood;

(*3*) For an employee removed due to a blood lead level at or above 60 µg/100 g, or due to an average blood lead level at or above 50 µg/100 g, when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 40 µg/100 g of whole blood;

(*4*) 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. If (*1*) 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*) 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 to 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 the employer shall maintain the earnings, seniority and other employment rights and benefits of an employee as though the employee had not been removed from normal exposure to lead or otherwise limited.

(iii) *Follow-up medical surveillance during the period of employee removal or limitation.* During the period of time that an employee is removed from normal exposure to lead or otherwise 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) *Employees whose blood lead levels do not adequately decline within 18 months of removal.* The employer shall take the following measures with respect to any employee removed from exposure to lead due to an elevated blood lead level whose blood lead level has not declined within the past eighteen (18) months of removal so that the employee has been returned to his or her former job status:

(A) The employer shall make available to the employee a medical examination pursuant to this section to obtain a final medical determination with respect to the employee;

(B) The employer shall assure that the final medical determination obtained indicates whether or not the employee may be returned to his or her former job status, and if not, what steps should be taken to protect the employee's health;

(C) Where the final medical determination has not yet been obtained, or once obtained indicates that the employee may not yet be returned to his or her former job status, the employer shall continue to provide medical removal protection benefits to the employee until either the employee is returned to former job status, or a final medical determination is made that the employee is incapable of ever safely returning to his or her former job status.

(D) Where the employer acts pursuant to a final medical determination which permits the return of the employee to his or her former job status despite what would otherwise be an unacceptable blood lead level, later questions concerning removing the employee again shall be decided by a final medical determination. The employer need not automatically remove such an employee pursuant to the blood lead level removal criteria provided by this section.

(vii) *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) of this section.

(l) *Employee information and training*—(1) *Training program.* (i) Each employer who has a workplace in which there is a potential exposure to airborne lead at any level shall inform employees of the content of Appendices A and B of this regulation.

(ii) The employer shall institute a training program for and assure the participation of all employees who are subject to exposure to lead at or above the action level or for whom the possibility of skin or eye irritation exists.

(iii) The employer shall provide initial training by 180 days from the effective date for those employees covered by paragraph (l)(1) (ii) on the standard's effective date and prior to the time of initial job assignment for those employees subsequently covered by this paragraph.

(iv) The training program shall be repeated at least annually for each employee.

(v) The employer shall assure that each employee is informed of the following:

(A) The content of this standard and its appendices;

(B) The specific nature of the operations which could result in exposure to lead above the action level;

(C) The purpose, proper selection, fitting, use, and limitations of respirators;

(D) 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);

(E) The engineering controls and work practices associated with the employee's job assignment;

(F) The contents of any compliance plan in effect; and

(G) 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;

(2) *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 the Assistant Secretary and the Director.

(iii) In addition to the information required by paragraph (l)(1)(v), the employer shall include as part of the training program, and shall distribute to employees, any materials pertaining to the Occupational Safety and Health Act, the regulations issued pursuant to that Act, and this lead standard, which are made available to the employer by the Assistant Secretary.

(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 the PEL is exceeded:

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 monitoring.* (i) The employer shall establish and maintain an accurate record of all monitoring required in paragraph (d) of this section.

(ii) This record shall include:

(A) The date(s), number, duration, location and results of each of the samples taken, 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 these monitoring records for at least 40 years or for the duration of employment plus 20 years, whichever is longer.

(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 for that employee and the representative exposure levels supplied 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 those medical records for at least 40 years, or for the duration of employment plus 20 years, whichever is longer.

(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 on 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) *Availability.* (i) The employer shall make available upon request all records required to be maintained by paragraph (n) of this section to the Assistant Secretary and the Director for examination and copying.

(ii) Environmental monitoring, medical removal, and medical records required by this paragraph shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.20 (a)-(e) and (2)-(i). Medical removal records shall be provided in the same manner as environmental monitoring records.

(5) *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 such 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 shall become effective March 1, 1979.

(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) *Sta. up dates.* All obligations of this standard commence on the effective date except as follows:

(1) The initial determination under paragraph (d)(2) shall be made as soon as possible but no later than 30 days from the effective date.

(2) Initial monitoring under paragraph (d)(4) shall be completed as soon as possible but no later than 90 days from the effective date.

(3) Initial biological monitoring and medical examinations under paragraph (j) shall be completed as soon as possible but no later than 180 days from the effective date. Priority for biological monitoring and medical examinations shall be given to employees whom the employer believes to be at greatest risk from continued exposure.

(4) Initial training and education shall be completed as soon as possible but no later than 180 days from the effective date.

(5) Hygiene and lunchroom facilities under paragraph (i) shall be in operation as soon as possible but no later than 1 year from the effective year.

(6)(i) Respiratory protection required by paragraph (f) shall be provided as soon as possible but no later than the following schedule:

(A) Employees whose 8-hour TWA exposure exceeds 200 $\mu g/m^3$—on the effective date.

(B) Employees whose 8-hour TWA exposure exceeds the PEL but is less than 200 $\mu g/m^3$—150 days from the effective date.

(C) Powered, air-purifying respirators provided under (f)(2)(ii)—210 days from the effective date.

(D) Quantitative fit testing required under (f)(3)(ii)—one year from effective date. Qualitative fit testing is required in the interim.

(7)(i) Written compliance plans required by paragraph (e)(3) shall be completed and available for inspection and copying as soon as possible but no later than the following schedule:

(A) Employers for whom compliance with the PEL or interim level is required within 1 year from the effective date—6 months from the effective date.

(B) Employers in secondary smelting and refining, lead storage battery manufacturing lead pigment manfacturing and nonferrous foundry industries—1 year from the effective date.

(C) Employers in primary smelting and refining industry—1 year from the effective date for the interim level; 5 years from the effective date for PEL.

(D) Plans for construction of hygiene facilities, if required—6 months from the effective date.

(8) The permissible exposure limit in paragraph (c) shall become effective 150 days from the effective date.

Appendix A to Section 1910.1025—Substance Data Sheet for Occupational Exposure to Lead

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 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 at least 120 different occupations, including primary and secondary lead smelting, lead storage battery manufacturing, lead pigment manufacturing and use, solder manufacturing and use, shipbuilding and ship repairing, auto manufacturing, and printing.

D. *Permissible Exposure:* The Permissible Exposure Limit (PEL) set by the standard is 50 micrograms of lead per cubic meter of air (50 $\mu g/m^3$), averaged over an 8-hour workday.

E. *Action Level:* The standard establishes an action level of 30 micrograms per cubic meter of air (30 $\mu g/m^3$), time weighted average, based on an 8-hour work-day. The action level initiates several requirements of the standard, such as exposure monitoring, medical surveillance, and training and education.

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 worker blood lead (PbB) levels be maintained at or below forty micrograms per one hundred grams of whole blood (40 μg/100g). The blood lead levels of workers (both male and female workers) who intend to have children should be maintained below 30 μg/100g to minimize adverse reproductive health effects to the parents and to the developing fetus.

The measurement of your blood lead level is the most useful indicator of the amount of lead being absorbed by your body. Blood lead levels (PbB) are most often reported in units of milligrams (mg) or micrograms (μg) of lead (1 mg=1000 μg) per 100 grams (100g), 100 milliters (100 ml) or deciliter (dl) of blood. These three units are essentially the same. Sometime PbB's are expressed in the form of mg% or μg%. This is a shorthand notation for 100g, 100 ml, or dl.

PbB 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. PbB 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 PbBs and various diseases. As a result, your PbB 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/100g, your risk of disease increases. There is a wide variability of individual response to lead, thus it is difficult to say that a particular PbB in a given person will cause a particular effect. Studies have associated fatal encephalopathy with PbBs as low as

150 μg/100g. Other studies have shown other forms of diseases in some workers with PbBs well below 80 μg/100g. Your PbB 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 PbBs. The longer you have an elevated PbB, 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 PbB below 40 μg/100g. 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 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 on 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 the employer selected the initial physician. This procedure, however, was delayed by the Court of Appeals in March of 1979, and will not go into effect until after the Court's decision on the overall validity of the standard.

APPENDIX B TO SECTION 1910.1025—EMPLOYEE STANDARD SUMMARY

This appendix summarizes key provisions of the standard that you as a worker should become familiar with.

The appendix discuses the entire standard, but some portions of the standard were temporarily postponed (stayed) by federal court on March 1, 1979. This litigation concerns the validity of the entire lead standard, and a final decision is expected in 1980. Most of the lead standard is currently legally in effect, however. The following discussion in the Appendix notes those few provisions of the standard which have been temporarily stayed.

I. PERMISSIBLE EXPOSURE LIMIT (PEL)—PARAGRAPH (C)

The standards sets a permissible exposure limit (PEL) of fifty micrograms of lead per cubic meter of air (50 μg/m^{3}), averaged over an 8-hour work-day. This is the highest level of lead in air to which you may be permissibly exposed over an 8-hour workday. Since it is an 8-hour average it permits short exposures above the PEL so long as for each 8-hour work day your average exposure does not exceed the PEL.

This standard recognizes 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, 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 μg/m^{3}.

II. EXPOSURE MONITORING—PARAGRAPH (D)

If lead is present in the workplace where you work in any quantity, your employer is required to make an initial determination of whether the action level is exceeded for any employee. This initial determination must include instrument monitoring of the air for the presence of lead and must cover the exposure of a representative number of employees who are reasonably believed to have the highest exposure levels. If your employer has conducted appropriate air sampling for lead in the past year he may use these results. 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. This initial determination must have been completed by March 31, 1979. If this initial determination shows that a reasonable possibility exists that *any* employee may be exposed, without regard to respirators, over the action level (30 μg/m^{3}) your employer must set up an air monitoring program to determine the exposure level of every 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 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 represented by at least one full shift (at least 7 hours) air sample. In addition, these air samples must be taken under conditions which represent each employee's *regular*, daily exposure to lead. All initial exposure monitoring must have been completed by May 30, 1979.

If you are exposed to lead and air sampling is performed, your employer is required to quickly notify you in writing of air monitoring results which represent your exposure. If the results indicate your exposure exceeds the PEL (without regard to your use of respirators), then your employer must also notify you of this in writing, and provide you with a description of the corrective action that will be taken to reduce your exposure.

Your exposure must be rechecked by monitoring every six months if your exposure is over the action level but below the PEL. Air monitoring must be repeated every 3 months if you are exposed over the PEL. Your employer may discontinue monitoring for you if 2 consecutive measurements, taken at least two weeks apart, are below the action level. However, whenever there is a production, process, control, or personnel change at your workplace which may result in new or additional exposure to lead, or whenever there is any other reason to suspect a change 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. The standard establishes a priority of methods to be used to meet the PEL. Due to the temporary ruling by the United States Circuit Court of Appeals, your employer will not be legally required to use the preferred engineering and work practice controls. Until the litigation is completed, your employer may meet the PEL by requiring you to wear respirators. Alternatively, the employer may choose to implement engineering and work practice controls even though they are not legally required. Also, OSHA's previous lead standard is still in effect. This does require your employer to use feasible engineering and administrative controls to reduce employee exposure levels, but only to a level of 200 micrograms of lead per cubic meter of air (200 $\mu g/m^3$).

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 does not exceed 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 seven types listed in Table II 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, but this requirement has been stayed as a part of the pending litigation.

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, beginning on November 12, 1982, your employer must give you either a qualitative fit test in accordance with Appendix D of the standard or a quantitative fit test if you use a negative pressure respirator. 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.

Until March 1, 1980, 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, 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 μg/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. He is responsible for providing repairs and replacement as necessary, and also is responsible for the cleaning, laundering or disposal of protective clothing and equipment. Contaminated work clothing or equipment must be removed in change rooms and not worn home or you will extend your exposure and expose your family since lead from your clothing can accumulate in your house, car, etc. Contaminated clothing which is to be cleaned, laundered or disposed of must be placed in closed containers in the change room. At no time may lead be removed from protective clothing or equipment by any means which disperses lead into the workroom air.

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 absolutely prohibited. Dry or wet sweeping, shoveling, or brushing may not be used except where vaccuming or other equally effective methods have been tried and do not work. Vacuums must be used 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 change rooms, showers, and filtered air lunchrooms be constructed and made available to workers exposed to lead above the PEL. These requirements have temporarily been delayed by the court of appeals in situations where new facilities must be constructed, or where substantial renovations must be made to existing facilities. When the PEL is exceeded and these facilities are available, however, the employer must assure that food and beverage is not present or consumed, tobacco products are not present or used, and cosmetics are not applied, except in these facilities. Change rooms, showers, and lunchrooms, if available, must be used by workers exposed in excess of the PEL. After showering, *no* clothing or equipment worn during the shift may be worn home, and this includes shoes and underwear. Your own clothing worn during the shift should be carried home and cleaned carefully so that it does not contaminate your home. Lunchrooms 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 affectively 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 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. Medical surveillance must be made available to all employees who are exposed in excess of the action level for more than 30 days a year. The initial phase of the medical surveillance program, which includes blood lead level tests and medical examinations, must be completed for all covered employees no later than August 28, 1979. Priority within this first round of medical surveillance must be given to employees whom the employer believes to be at greatest risk from continued exposure (for example, those with the longest prior exposure to lead, or those with the highest current exposure). Thereafter, the employer must periodically make medical surveillance—both biological monitoring and medical examinations—available to all covered employees.

Biological monitoring under the standard consists of blood lead level (PbB) and zinc protoporphyrin tests at least every 6 months after the initial PbB test. A zinc protoporphyrin (ZPP) test is a very useful blood test which measures an effect of lead on your body, but this test has been temporarily stayed by the Court. Thus biological monitoring under the standard is currently limited to PbB testing. If a worker's PbB exceeds 40 μg/100g the monitoring frequency must be increased from every 6 months to at least every 2 months and not reduced until two consecutive PbBs indicate a blood lead level below 40 μg/100g. Each time your PbB is determined to be over 40 μg/100g, your employer must notify you of this in writing within five working days of his receipt of the test results. The employer must also inform you that the standard requires temporary medical removal with economic protection when your PbB exceeds certain criteria. (See Discussion of Medical Removal Protection—Paragraph (k).) During the first year of the standard, this removal criterion is 80 μg/100g. Anytime your PbB exceeds 80 μg/100g your employer must make available to you a prompt follow-up PbB test to ascertain your PbB. If the two tests both exceed 80 μg/100g and you are temporarily removed, then your employer must make successive PbB 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/100g at any time during the preceding year. The initial examination will provide information to establish a baseline to which subsequent data can be compared. An initial medical examination 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. 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, and (3) 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 would give you a chance to have a physician of your choice directly participate in the medical surveillance program. If you were dissatisfied with an examination by a physician chosen by your employer, you could 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. This multiple physician review mechanism, however, has been temporarily delayed by the Court of Appeals. As a result, 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 lead exposure, (3) your exposure level, (4) a description of 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 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 Na_2 EDTA), Calcium Disodium Versenate (Versenate), and d-penicillamine (pencillamine 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 temprorary 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. Up to 18 months of 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. The standard contains special provisions to deal with the extraordinary but possible case where a longterm worker's blood lead level does not adequately decline during eighteen months of removal.

During the first year of the standard, if your blood lead level is 80 $\mu g/100g$ or above you must be removed from any exposure where your air lead level without a respirator would be 100 $\mu g/m^3$ or above. If you are removed from your normal job you may not be returned until your blood lead level declines to at least 60 $\mu g/100g$. These criteria for removal and return will change according to the following schedule:

	Removal blood lead ($\mu g/100$ g)	Air lead ($\mu g/m^3$)	Return blood lead ($\mu g/100$ g)
After Mar. 1, 1980	70 and above	50 and above	At or below 50.
After Mar. 1, 1981	60 and above	30 and above	At or below 40.
After Mar. 1, 1983	50 and above averaged over six months.	30 and above	Do.

You may also be removed from exposure even if your blood lead levels are below these criteria 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 (1)

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. This program must inform these employees of the specific hazards associated with their work environment, protective measures which can be taken, the danger of lead to their bodies (including their reproductive systems), and their rights under the standard. In addition your employer must make readily available to all employees, including those exposed below the action level, a copy of the standard and its appendices and must distribute to all employees any materials provided to the employer by the Occupational Safety and Health Administration (OSHA).

Your employer is required to complete this training program for all employees by August 28, 1979. After this date, all new 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.

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

NO SMOKING OR EATING

This requirement, however, has been stayed by the Court of Appeals.

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 analytic techniques, the results of this sampling, and the type of respiratory protection being worn by the person sampled. Your employer is also required to keep all records of biological monitoring and medical examination results. These must include the names of the employees, the physician's written opinion, and a copy of the results of the examination. All of the above kinds of records must be kept for 40 years, or for at least 20 years after your termination of employment, whichever is longer.

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 PbB'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. OBSERVATIONS 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 March 1, 1979, and employer obligations under the standard begin to come into effect as of that date.

XV. FOR ADDITIONAL INFORMATION

A. Copies of the Standard and explanatory materials can be obtained free of charge by calling or writing the OSHA Office of Publications, Room S-1212, United States Department of Labor, Washington, D.C. 20210: Telephone (202) 523-6138. The following publications are available:

1. The standard and summary of the statement of reasons (preamble), FEDERAL REGISTER, Volume 43, pp. 52952-53014, November 14, 1978.
2. The full statement of reasons (preamble) FEDERAL REGISTER, vol. 43, pp. 54354-54509, November 21, 1978.
3. Partial Administrative Stay and Corrections to the standard, (44 FR 5446-5448) January 26, 1979.
4. Notice of the Partial Judicial Stay (44 FR 14554-14555) March 13, 1979.
5. Corrections to the preamble, FEDERAL REGISTER, vol. 44, pp. 20680-20681, April 6, 1979.
6. Additional correction to the preamble concerning the construction industry, FEDERAL REGISTER, vol. 44, p. 50338, August 28, 1979.
7. Appendices to the standard (Appendices A, B, C), FEDERAL REGISTER, Vol. 44, pp. 60980-60995, October 23, 1979.
8. Corrections to appendices, FEDERAL REGISTER, Vol. 44, 68828, November 30, 1979.
9. Revision to the standard and additional appendices (Appendices D and E), FEDERAL REGISTER, Vol. 47, pp. 51117-51119, November 12, 1982.

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.

APPENDIX C TO SECTION 1910.1025—MEDICAL SURVEILLANCE GUIDELINES

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 occupational health standard for inorganic lead[1] was promulgated to protect workers exposed to inorganic lead including metallic lead, all inorganic lead compounds and organic lead soaps.

Under this final standard in effect as of March 1, 1979, occupational exposure to inorganic lead is to be limited to 50 $\mu g/m^3$ (micrograms per cubic meter) based on an 8 hour time-weighted average (TWA). This level of exposure eventually must be achieved through a combination of engineering, work practice and other administrative controls. Periods of time ranging from 1 to 10 years are provided for different industries to implement these controls. The schedule which is based on individual industry considerations is given in Table 1. Until these controls are in place, respirators must be used to meet the 50 $\mu g/m^3$ exposure limit.

The standard also provides for a program of biological monitoring and medical surveillance for all employees exposed to levels of inorganic lead above the action level of 30 $\mu g/m^3$ (TWA) for more than 30 days per year.

The purpose of this document is to outline the medical surveillance provisions of the standard for inorganic lead, 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

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[1] The term inorganic lead used throughout the medical surveillance appendices is meant to be synonymous with the definition of lead set forth in the standard.

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.

TABLE 1

Permissible airborne lead levels by industry ($\mu g/m^3$)[1]	Effective date					
	Mar. 1, 1979	Mar. 1, 1980	Mar. 1, 1981	Mar. 1, 1982	Mar. 1, 1984	Mar. 1, 1989 (final)
1. Primary lead production	200	200	200	100	100	50
2. Secondary lead production	200	200	200	100	50	50
3. Lead-acid battery manufacturing	200	200	100	100	50	50
4. Nonferrous foundries	200	100	100	100	50	50
5. Lead pigment manufacturing	200	200	200	100	50	50
6. All other industries	200	50	50	50	50	50

[1] Airborne levels to be achieved without reliance or respirator protection through a combination of engineering, work practice and other administrative controls. While these controls are being implemented respirators must be used to meet the 50 $\mu g/m^3$ exposure limit.

I. MEDICAL SURVEILLANCE AND MONITORING REQUIREMENTS FOR WORKERS EXPOSED TO INORGANIC LEAD

Under the occupational health standard for inorganic lead, a program of biological monitoring and medical surveillance is to be made available to all employees exposed to lead above the action level of 30 $\mu g/m^3$ TWA for more than 30 days each year. 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 of all employees who are exposed to lead above the action level of 30 $\mu g/m^3$ is to be determined at least every six months. The frequency is increased to every two months for employees whose last blood lead level was between 40 $\mu g/100$ g whole blood and the level requiring employee medical removal to be discussed below. 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. ZPP monitoring is one of several requirements of the standard that has been temporarily stayed by pending litigation over the lead standard. Unless otherwise noted in this document, all provisions of the standard pertaining to medical surveillance and medical removal protection are currently in effect.

An annual medical examination and consultation performed under the guidelines discussed in Section 3 is to be made available to each employee for whom a blood test conducted at any time during the preceding 12 months indicated a blood lead level at or above 40 $\mu g/100$ g. 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 action level. 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. The following guidelines which are summarized in Table 2 were created under the standard for the temporary removal of an exposed employee and his or her subsequent return to work in an exposure area.

TABLE 2

	Effective date				
	Mar. 1, 1979	Mar. 1, 1980	Mar. 1, 1981	Mar. 1, 1982	Mar. 1, 1983 (final)
A. Blood lead level requiring employee medical removal. (Level must be confirmed with second follow-up blood lead level within two weeks of first report.).	$\geq$80 μg/100 g	$\geq$70μg/100 g	$\geq$60 μg/100 g	$\geq$60 μg/100 g	$\geq$60μg/100 g or average of last three blood samples or all blood samples over previous 6 months (whichever is over a longer time period) is 50 μg/100 g or greater unless last blood sample is 40 μg/100 g or less
B. Frequency which employees exposed to action level of lead (30 μg/m^3 TWA) must have blood lead level checked (ZPP is also strongly recommended in each occasion that a blood lead is obtained.):					
1. Last blood lead level less than 40 μg/100 g	Every 6 months	Every 6 months	Every 6 months	Every 6 months	Every 6 months
2. Last blood lead level between 40 μg/100 g and level requiring medical removal (see A above).	Every 2 months	Every 2 months	Every 2 months	Every 2 months	Every 2 months
3. Employees removed from exposure to lead because of an elevated blood lead level.	Every 1 month	Every 1 month	Every 1 month	Every 1 month	Every 1 month
C. Permissible airborne exposure limit for workers removed from work due to an elevated blood lead level (without regard to respirator protection).	100 μg/m^3 8 hr TWA.	50 μg/m^3 8 hr TWA.	30 μg/m^3 8 hr TWA.	30 μg/m^3 8 hr TWA.	30 μg/m^3 8 hr TWA.
D. Blood lead level confirmed with a second blood analysis, at which employee may return to work. Permissible exposure without regard to respirator protection is listed by industry in Table I.	$\leq$60 μg/100 g	$\leq$50 μg/100 g	$\leq$40 μg/100 g	$\leq$40 μg/100 g	$\leq$40 μg/100 g.

NOTE: When medical opinion indicates that an employee is at risk of material impairment from exposure to lead, the physician can remove an employee from exposures exceeding the action level (or less) or recommend special protective measures as deemed appropriate and necessary. Medical monitoring during the medical removal period can be more stringent than noted in the table above if the physician so specifies. Return to work or removal of limitations and special protections is permitted when the physician indicates that the worker is no longer at risk of material impairment.

Under the standard's ultimate worker removal criteria, a worker is to be removed from any work having any eight hour TWA exposure to lead of 30 μg/m³ or more whenever either of the following circumstances apply: (1) a blood lead level of 60 μg/100 g or greater is obtained and 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, or (2) the average of the previous three blood lead determinations or the average of all blood lead determinations conducted during the previous six months, whichever encompasses the longest time period, equals or exceeds 50 μg/100 g, unless the last blood sample indicates a blood lead level at or below 40 μg/100 g in which case the employee need not be removed. Medical removal is to continue until two consecutive blood lead levels are 40 μg/100 g or less.

During the first two years that the ultimate removal criteria are being phased in, the return criteria have been set to assure that a worker's blood lead level has substantially declined during the period of removal. From March 1, 1979 to March 1, 1980, the blood lead level requiring employee medical removal is 80 μg/100 g. Workers found to have a confirmed blood lead at this level or greater need only be removed from work having a daily 8 hour TWA exposure to lead at or above 100 μg/m³. Workers so removed are to be returned to work when their blood lead levels are at or below 60 μg/100 g of whole blood. From March 1, 1980 to March 1, 1981, the blood lead level requiring medical removal is 70 μg/100 g. During this period workers need only be removed from jobs having a daily 8 hour TWA exposure to lead at or above 50 μg/m³ and are to be returned to work when a level of 50 μg/100 g is achieved. Beginning March 1, 1981, return depends on a worker's blood lead level declining to 40 μg/100 g of whole blood.

As part of the standard, the employer is required to notify in writing each employee whose blood lead level exceeds 40 μg/100 g. 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 limits.

In addition to the above blood lead level criteria, 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 the action level. 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. 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.

On rare occasions, an employee's blood lead level may not acceptably decline within 18 months of removal. This situation will arise only in unusual circumstances, thus the standard relies on an individual medical examination to determine how to protect such an employee. This medical determination is to be based on both laboratory values, including lead levels, zinc protoporphyrin levels, blood counts, and other tests felt to be warranted, as well as the physician's judgment that any symptoms or findings on physical examination are a result of lead toxicity. The medical determination may be that the employee is incapable of ever safely returning to his or her former job status. The medical determination may provide additional removal time past 18 months for some employees or specify special protective measures to be implemented.

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. This multiple physician review mechanism has been temporarily stayed during the pending litigation, but OSHA recommends that it be used if disputes arise over medical determinations.

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 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 physicians'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 have not been fully implemented. 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 final standard on occupational exposure to inorganic lead, 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 monitoring, medical surveillance, and medical removal for each employee. Exposure monitoring and medical surveillance records must be kept for 40 years or the duration of employment plus 20 years, whichever is longer, while medical removal records 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 the action level 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/100 g 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/100 g 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/100 g whole blood. At a blood lead level of 40 ug/100 g, more than 20% of the population would have 70% inhibition of ALA-D. There is an exponential increase in ALA excretion at blood lead levels greater than 40 μg/100 g.

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/100 g or greater, nearly 100% of the population will have an increase in FEP. There is also an exponential relationship between blood lead levels greater than 40 μg/100 g 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/100 g 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/100 g. 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, delerium, 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/100 g whole blood and therefore recommend a 40 μg/100 g 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/100 g 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/100 g 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/100 g 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/100 g.

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/100 g and hypospermia and asthenospermia at 41 μg/100 g. 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/100 g in children can cause significant neurobehavioral impairments and there is evidence of hyperactivity at blood levels as low as 25 μg/100 g. 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/100 g with a population mean of 15 μg/100 g. Blood lead levels in the fetus and newborn likewise should not exceed 30 μg/100 g.

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/100 g 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 electrocardiogarphic 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 at least 120 occupations, including lead smelting, the manufacture of lead storage batteries, the manufacture of lead pigments and products containing pigments, solder manufacture, shipbuilding and ship repair, auto manufacturing, construction, and painting.

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 work processes, exposure to fumes or dust, known exposures to lead or other toxic substances, respiratory protection 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:

General—weight loss, fatigue, decreased appetite.

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.

Cardio-pulmonary—shortness of breath, cough, chest pains, palpitations, or orthopnea.

Gastrointestinal—nausea, vomiting, heartburn, abdominal pain, constipation or diarrhea.

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.

Hematologic—pallor, easy fatigability, abnormal blood loss, melena.

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.

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 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 (This requirement is currently not in effect due to the pending litigation, but is recommended nonetheless).

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 which has several advantages over the blood lead level is, due to the pending litigation, not required under the standard. 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% 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 the Center for Disease Control (CDC) or which have received satisfactory grades in proficiency testing by the CDC in the previous year. 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/100 g in some workers. Once the blood lead level has reached 40 μg/100 g there is more marked rise in the ZPP value from its normal range of less than 100 μg/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 a CDC 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/l 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 standard for inorganic lead places significant emphasis on the medical surveillance of all workers exposed to levels of inorganic lead above the action level of 30 μg/m³ 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.

APPENDIX D TO § 1910.1025—QUALITATIVE FIT TEST PROTOCOLS

This appendix specifies the only allowable qualitative fit test protocols permissible for compliance with paragraph (f)(3)(ii).

I. ISOAMYL ACETATE PROTOCOL

A. Odor threshold screening.

1. Three 1-liter glass jars with metal lids (e.g. Mason or Bell jars) are required.

2. Odor-free water (e.g. distilled or spring water) at approximately 25°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. This solution shall be prepared new 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 may not be connected to the same recirculating ventilation system.

5. The odor test solution is prepared in a second jar by placing. .4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

6. A test blank is prepared in a third jar by adding 500 cc of odor free water.

7. The odor test and test blank jars shall be labelled 1 and 2 for jar identification. If the labels are put on the lids they can be periodically *dried off* and switched to avoid people thinking the same jar always has the IAA.

8. The following instructions 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 QLFT may not be used.

11. If the test subject correctly identifies the jar containing the odor test solution he may proceed to respirator selection and fit testing.

B. Respirator selection.

1. The test subject shall be allowed to select the most comfortable respirator from a large array of various sizes and manufacturers that includes at least three sizes of elastomeric half facepieces and units of at least two manufacturers.

2. The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. 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 assess an "comfortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This may not constitute his formal training on respirator use, only a review.

3. The test subject should understand that he is being asked to select the respirator which provides the most comfortable fit for him. Each respirator represents a different size and shape and, if fit properly, will provide adequate protection.

4. The test subject holds each facepiece up to his face and eliminates those which are obviously not giving a comfortable fit. Normally, selection will begin with a half-mask and if a fit cannot be found here, the subject will be asked to go to the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

5. The more comfortable facepieces are recorded; 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 #8 below. If the test subject is not familiar with using a particular respirator, he shall be directed to don the mask several times and to adjust the straps each time, so that he becomes adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject:

- Chin properly placed.
- Positioning of mask on nose.
- Strap tension.
- Fit across nose bridge.
- Room for safety glasses.
- Distance from nose to chin.
- Room to talk.
- Tendency to slip.
- Cheeks filled out.
- Self-observation in mirror.
- Adequate time for assessment.

7. The test subject shall conduct the conventional negative and positive-pressure fit checks (e.g. see ANSI Z88.2-1980). Before conducting the negative- or positive-pressure checks, the subject shall be told to "seat" his mask by rapidly moving the head side-to-side and up and down, taking a few deep breaths.

8. The test subject is now ready for fit testing.

9. After passing the fit test, the test subject shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

10. The employee shall be given the opportunity to select a different facepiece and be retested if during the first two weeks of on-the-job wear the chosen facepiece becomes unacceptably uncomfortable.

C. Fit test.

1. The fit test chamber shall be substantially similar to a clear 55 gallon drum liner suspended inverted over a 2 foot diameter frame, so that the top of 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 himself, 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 hook, to prevent general room contamination.

4. A copy of the following test exercises and rainbow (or equally effective) passage shall be taped to the inside of the test chamber:

Test Exercises

i. Normal breathing.

ii. Deep breathing. Be certain breaths are *deep* and *regular*.

iii. Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have the test subject inhale when his head is at either side.

iv. Nodding head up-and-down. Be certain motions are complete and made about every second. Alert the test subject not bump the respirator on the chest. Have the test subject inhale when his head is in the fully up position.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

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.

vi. Normal breathing.

5. Each test subject shall wear his respirator for at least 10 minutes before starting the fit test.

6. 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 three-quarters of one cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

7. Allow two minutes for the IAA test concentration to be reached 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 cooperation, the purpose for the head exercises, or to demonstrate some of the exercises.

8. Each exercise described in No. 4 above shall be performed for at least one minute.

9. If at any time during the test, the subject detects the banana-like odor of IAA, he shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

10. Upon returning to the selection room, the subject shall remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, etc. 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.

11. If a person cannot be fitted with the selection of half-mask respirators, include full facepiece models in the selection process. When a respirator is found that passes the test, its efficiency shall be demonstrated for the subject by having him break the face seal and take a breath before exiting the chamber.

12. When the test subject leaves the chamber he shall remove the saturated towel, returning it to the test conductor. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag. There is no significant IAA concentration buildup in the test chamber from subsequent tests.

13. Persons who have successfully passed this fit test may be assigned the use of the tested respirator in atmospheres with up to 10 times the PEL of airborne lead. In other words this IAA protocol may be used to assign a protection factor no higher than 10.

II. SACCHARIN SOLUTION AEROSOL PROTOCOL

A. Taste threshold screening.

1. Threshold screening as well as fit testing employees shall use 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 movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly of part # FT 14 and FT 15 combined is adequate.

2. The test enclosure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

3. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

4. The test subject shall don the test enclosure. For the threshold screening test, he shall breath through his open mouth with tongue extended.

5. 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.

6. The threshold check solution consists of 0.83 grams of sodium saccharin, USP in water. It can be prepared by putting 1 cc of the test solution (see C6 below) in 100 cc of water.

7. To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely then released and allowed to fully expand.

8. Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

9. If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

10. If the second response is negative ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

11. The test conductor will take note of the number of squeezes required to elicit a taste response.

12. If the saccharin is not tasted after 30 squeezes (Step 9), the test subject may not perform the saccharin fit test.

13. If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

14. Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

15. 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. Respirator selection.

Respirators shall be selected as described in section IB above, except that each respirator shall be equipped with a particulate filter cartridge.

C. Fit test.

1. The fit test uses the same enclosure described in B1 and B2 above

2. Each test subject shall wear his respirator for at least 10 minutes before starting the fit test.

3. The test subject shall don the enclosure while wearing the respirator selected in section A above. This respirator shall be properly adjusted and equipped with a particulate filter cartridge.

4. The test subject may not eat, drink (except plain water), or chew gum for 15 minutes before the test.

5. 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.

6. The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.

7. As before, the test subject shall breathe through the open mouth with tongue extended.

8. The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure and the fit test solution is sprayed into the enclosure using the same technique as for the taste threshold screening and the same number of squeezes required to elicit a taste response in the screening. (See B 10 above).

9. After generation of the aerosol the test subject shall be instructed to perform the following exercises for one minute each.

i. Normal breathing.

ii. Deep breathing. Be certain breaths are *deep* and *regular.*

iii. Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have the test subject inhale when his head is at either side.

iv. Nodding head up-and-down. Be certain motions are complete. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his head in the fully up position.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

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 his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

10. Every 30 seconds, the aerosol concentration shall be replenished using one-half the number of squeeze as initially (C8).

11. The test subject shall so indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

12. If the saccharin is detected the fit is deemed unsatisfactory and a different respirator shall be tried.

13. 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 used assign protection factors no higher than ten.

III. IRRITANT FUME PROTOCOL

A. Respirator selection.

Respirators shall be selected as described in section IB above, except that each respirator shall be equipped with high efficiency cartridges.

B. Fit test.

1. The test subject shall be allowed to smell a weak concentration of the irritant smoke to familiarize him with the characteristic odor of each.

2. The test subject shall properly don the respirator selected as above, and wear it for at least 10 minutes before starting the fit test.

3. The test conductor shall review this protocol with the test subject before testing.

4. The test subject shall perform the conventional positive pressure and negative pressure fit checks. Failure of either check shall be cause to select an alternate respirator.

5. Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part No. 5645, or equivalent. Attach a short length of tubing to one end of the smoke tube. Attach the other end of the smoke tube to a low pressure air pump set to deliver 200 milliliters per minute.

6. Advise the test subject that the smoke can be irritating to the eyes and instruct him to keep his eyes closed while the test is performed.

7. The test conductor shall direct the stream of irritant smoke from the tube towards the faceseal area of the test subject. He shall begin at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

8. The following exercises shall be performed while the respirator seal is being challenged by the smoke. Each shall be performed for one minute.

i. Normal breathing.

ii. Deep breathing. Be certain breaths are *deep* and *regular.*

iii. Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have test subject inhale when his head is at either side.

iv. Nodding head up-and-down. Be certain motions are complete. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his head is in the fully up position.

v. Talking—slowly and distinctly, count backwards from 100.

vi. Normal breathing.

9. If the irritant smoke produces an involuntary reaction (cough) by the test subject, the test conductor shall stop the test. In this case the tested respirator is rejected and another respirator shall be selected.

10. 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 to determine whether he reacts to the smoke. Failure to evoke a response shall void the fit test.

11. Steps B4, B7, B8 of this protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the irritant smoke.

12. Respirators successfully tested by the protocol may be used in contaminated atmospheres up to ten times the PEL. In other words this protocol may be used to assign protection factors not exceeding ten.

(Approved by the Office of Management and Budget under control number 1218-0092)

[43 FR 53007, Nov. 14, 1978, as amended at 44 FR 5447, Jan. 26, 1979; 44 FR 14554, Mar. 13, 1979; 45 FR 50338, Aug. 28, 1979; 44 FR 60981, Oct. 23, 1979; 44 FR 68828, Nov. 30, 1979; 45 FR 35283, May 23, 1980; 46 FR 60775, Dec. 11, 1981; 47 FR 51117, Nov. 12, 1982; 48 FR 9641, Mar. 6, 1983; 49 FR 18295, Apr. 30, 1984]

EDITORIAL NOTE: At 49 FR 23175, June 5, 1984, the administrative stay of § 1910.1025(e)(3)(ii)(B) and (E), partially stayed at 47 FR 54433, Dec. 3, 1982, was vacated, effective June 1, 1984. For compliance provisions, see 49 FR 23175, June 5, 1984.

OSHA Respirator Standard
29 CFR 1910.134

Appendix A3. Occupational Safety and Health Administration (OSHA) Respiratory Protection (29 CFR 1910.134)

1910.134 RESPIRATORY PROTECTION

(a) PERMISSIBLE PRACTICE

(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 the following requirements.

(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 protective program which shall include the requirements outlined in paragraph (b) of this section.

(3) The employee shall use the provided respiratory protection in accordance with instructions and training received.

(b) REQUIREMENTS FOR A MINIMAL ACCEPTABLE PROGRAM

(1) Written standard operating procedures governing the selection and use of respirators shall be established.

(2) Respirators shall be selected on the basis of hazards to which the worker is exposed.

(3) The user shall be instructed and trained in the proper use of respirators and their limitations.

(4) Where practicable, the respirators should be assigned to individual workers for their exclusive use.

(5) Respirators shall be regularly cleaned and disinfected. Those issued for the exclusive use of one worker should be cleaned after each day's use, or more often if necessary. Those used by more than one worker shall be thoroughly cleaned and disinfected after each use.

(6) Respirators shall be stored in a convenient, clean, and sanitary location.

(7) Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use such as self-contained devices shall be thoroughly inspected at least once a month and after each use.

(8) Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained.

(9) There shall be regular inspection and evaluation to determine the continued effectiveness of the program.

(10) Persons should not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. The local physician shall determine what health and physical conditions are pertinent. The respirator user's medical status should be reviewed periodically (for instance, annually).

(11) Approved or accepted respirators shall be used when they are available. The respirator furnished shall provide adequate respiratory protection against the particular hazard for which it is designed in accordance with standards established by competent authorities. The U.S. Department of Interior, Bureau of Mines, and the U.S. Department of Agriculture are recognized as such authorities. Although respirators listed by the U.S. Department of Agriculture continue to be acceptable for protection against specified pesticides, the U.S. Department of the Interior, Bureau of Mines, is the agency now responsible for testing and approving pesticide respirators.

(c) SELECTION OF RESPIRATORS

Proper selection of respirators shall be made according to the guidance of American National Standard Practices for Respiratory Protection Z88.2-1969.

(d) AIR QUALITY

(1) Compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity. Oxygen shall meet the requirements of the United States Pharmacopoeia for medical or breathing oxygen. Breathing air shall meet at least the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Commodity Specification G-7.1-1966. Compressed oxygen shall not be used in supplied-air respirators or in open circuit self-contained breathing apparatus that have previously used compressed air. Oxygen must never be used with air line respirators.

(2) Breathing air may be supplied to respirators from cylinders or air compressors.

(i) Cylinders shall be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR Part 178).

(ii) The compressor for supplying air shall be equipped with necessary safety and standby devices. A breathing air-type compressor shall be used. Compressors shall be constructed and situated so as to avoid entry of contaminated air into the system and suitable in-line air-purifying sorbent beds and filters installed to further assure breathing air quality. A receiver of sufficient capacity to enable the respirator wearer to escape from a contaminated atmosphere in event of compressor failure, and alarms to indicate compressor failure and overheating shall be installed in the system. If an oil-lubricated compressor is used, it shall have a high-temperature or carbon monoxide alarm, or both. If only a high-temperature alarm is used, the air from the compressor shall be frequently tested for carbon monoxide to insure that it meets the specifications in paragraph (d)(1) of this section.

(3) Air line couplings shall be incompatible with outlets for other gas systems to prevent inadvertant servicing of air line respirators with nonrespirable gases or oxygen.

(4) Breathing gas containers shall be marked in accordance with American National Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained, Z48.1-1954; Federal Specification BB-A-1034a, June 21, 1968, Air, Compressed for Breathing Purposes; or Interim Federal Specification GG-B-00675b, April 27, 1965, Breathing Apparatus, Self-Contained.

(e) USE OF RESPIRATORS

(1) Standard procedures shall be developed for respirator use. These should include all information and guidance necessary for their proper selection, use, and care. Possible emergency and routine uses of respirators should be anticipated and planned for.

(2) The correct respirator shall be specified for each job. The respirator type is usually specified in the work procedures by a qualified individual supervising the respiratory protective program. The individual issuing them shall be adequately instructed to insure that the correct respirator is issued. Each respirator permanently assigned to an individual should be durably marked to indicate to whom it was assigned. This mark shall not affect the respirator performance in any way. The date of issuance should be recorded.

(3) Written procedures shall be prepared covering safe use of respirators in dangerous atmospheres that might be encountered in normal operations or in emergencies. Personnel shall be familiar with these procedures and the available respirators.

(i) In areas where the wearer, with failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional man shall be present. Communications (visual, voice, or signal line) shall be maintained between both or all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and have

the proper rescue equipment to be able to assist the other(s) in case of emergency.

(ii) When self-contained breathing apparatus or hose masks with blowers are used in atmospheres immediately dangerous to life or health, standby men must be present with suitable rescue equipment.

(iii) Persons using air line respirators in atmospheres immediately hazardous to life or health shall be equipped with safety harnesses and safety lines for lifting or removing persons from hazardous atmospheres or other and equivalent provisions for the rescue of persons from hazardous atmospheres shall be used. A standby man or men with suitable self-contained breathing apparatus shall be at the nearest fresh air base for emergency rescue.

(4) Respiratory protection is no better than the respirator in use, even though it is worn conscientiously. Frequent random inspections shall be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained.

(5) For safe use of any respirator, it is essential that the user be properly instructed in its selection, use, and maintenance. Both supervisors and workers shall be so instructed by competent persons. Training shall provide the men an opportunity to handle the respirator, have it fitted properly, test its face-piece-to-face seal, wear it in normal air for a long familiarity period, and, finally, to wear it in a test atmosphere.

(i) Every respirator wearer shall receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators shall not be worn when conditions prevent a good face seal. Such conditions may be a growth of beard, sideburns, a skull cap that projects under the facepiece, or temple pieces on glasses. Also, the absence of one or both dentures can seriously affect the fit of a facepiece. The worker's diligence in observing these factors shall be evaluated by periodic check. To assure proper protection, the facepiece fit shall be checked by the wearer each time he puts on the respirator. This may be done by following the manufacturer's facepiece fitting instructions.

(ii) Providing respiratory protection for individuals wearing corrective glasses is a serious problem. A proper seal cannot be established if the temple bars of eye glasses extend through the sealing edge of the full facepiece. As a temporary measure, glasses with short temple bars or without temple bars may be taped to the wearer's head. Wearing of contact lenses in contaminated atmospheres with a respirator shall not be allowed. Systems have have been developed for mounting corrective lenses inside full facepieces. When a workman must wear corrective lenses as part of the facepiece, the facepiece and lenses shall be fitted by qualified individuals to provide good vision, comfort, and a gas-tight seal.

(iii) If corrective spectacles or goggles are required, they shall be worn so as not to affect the fit of the facepiece. Proper selection of equipment will minimize or avoid this problem.

(f) MAINTENANCE AND CARE OF RESPIRATORS

(1) A program for maintenance and care of respirators shall be adjusted to the type of plant, working conditions, and hazards involved, and shall include the following basic services:

(i) Inspection for defects (including a leak check),

(ii) Cleaning and disinfecting,

(iii) Repair,

(iv) Storage

Equipment shall be properly maintained to retain its original effectiveness.

(2) *(i)* All respirators shall be inspected routinely before and after each use. A respirator that is not routinely used but is kept ready for emergency use shall be inspected after each use and at least monthly to assure that it is in satisfactory working condition.

(ii) Self-containing breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be fully charged according to the manufacturer's instructions. It shall be determined that the regulator and warning devices function properly.

(iii) Respirator inspection shall include a check of the tighmess of connections and the condition of the facepiece, headbands, valves, connecting tube, and canisters. Rubber or elastomer parts shall be inspected for pliability and signs of deterioration. Stretching and manipulating rubber or elastomer parts with a massaging action will keep them pliable and flexible and prevent them from taking a set during storage.

(iv) A record shall be kept of inspection dates and findings for respirators maintained for emergency use.

(3) Routinely used respirators shall be collected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided for the wearer. Each worker should be briefed on the cleaning procedure and be assured that he will always receive a clean and disinfected respirator. Such assurances are of greatest significance when respirators are not individually assigned to workers. Respirators maintained for emergency use shall be cleaned and disinfected after each use.

(4) Replacement or repairs shall be done only by experienced persons with parts designed for the respirator. No attempt shall be made to replace components or to make adjustment or repairs beyond the manufacturer's recommendations. Reducing or admission valves or regulators shall be returned to the manufacturer or to a trained technician for adjustment or repair.

(5) *(i)* After inspection, cleaning, and necessary repair, respirators shall be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators placed at stations and work areas for emergency use should be quickly accessible at all times and should be stored in compartments built for the purpose. The compartments should be clearly marked. Routinely used respirators, such as dust respirators, may be placed in plastic bags. Respirators should not be stored in such places as lockers or tool boxes unless they are in carrying cases or cartons.

(ii) Respirators should be packed or stored so that the facepiece and exhalation valve will rest in a normal position and function will not be impaired by the elastomer setting in an abnormal position.

(iii) Instructions for proper storage of emergency respirators, such as gas masks and self-contained breathing apparatus, are found in "use and care" instructions usually mounted inside the carrying case lid.

(g) IDENTIFICATION OF GAS MASK CANISTERS

(1) The primary means of identifying a gas mask canister shall be by means of properly worded labels. The secondary means of identifying a gas mask canister shall be by a color code.

(2) All who issue or use gas masks falling within the scope of this section shall see that all gas masks canisters purchased or used by them are properly lableled and colored in accordance with these requirements before they are placed in service and that the labels and colors are properly maintained at all times thereafter until the canisters have completely served their purpose.

(3) On each canister shall appear in bold letters the following:

(i) Canister for ______________________
(Name for atmospheric contaminant)
or
Type N Gas Mask Canister

(ii) In addition, essentially the following wording shall appear beneath the appropriate phrase on the canister label: "For respiratory protection in atmosphere containing not more than __________ percent by volume of ______________________
(Name of atmospheric contaminant)

(4) Canisters having a special high-efficiency filter for protection against radionuclides and other highly toxic particulates shall be labeled with a statement of the type and degree of protection afforded by the filter. The label shall be affixed to the neck end of, or to the gray stripe which is around and near the top of, the canister. The degree of protection shall be marked as the percent of penetration of the canister by a 0.3-micron-diameter dioctyl phthalate (DOP) smoke at a flow rate of 85 liters per minute.

(5) Each canister shall have a label warning that gas masks should be used only in atmospheres containing sufficient oxygen to support life (at least 16 percent by volume), since gas mask canisters are only designed to neutralize or remove contaminants from the air.

(6) Each gas mask canister shall be painted a distinctive color or combination of colors indicated in Table I-1. All colors used shall be such that they are clearly identifiable by the user and clearly distinguishable from one another. The color coating used shall offer a high degree of resistance to chipping, scaling, peeling, blistering, fading, and the effects of the ordinary atmospheres to which they may be exposed under normal conditions of storage and use. Appropriately colored pressure sensitive tape may be used for the stripes.

Table I-1.

ATMOSPHERIC CONTAMINANTS TO BE PROTECTED AGAINST	COLORS ASSIGNED*
Acid gases	White
Hydrocyanic acid gas	White with 1/2 inch green stripe completely around the canister near the bottom
Chlorine gas	White with 1/2 inch yellow stripe completely around the canister near the bottom
Organic vapors	Black
Ammonia Gas	Green
Acid gases and ammonia gas	Green with 1/2 inch white stripe completely around the canister near the bottom
Carbon monoxide	Blue
Acid gases and organic vapors	Yellow
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2 inch blue stripe completely around the canister near the bottom
Acid gases, organic vapors, and ammonia gases	Brown
Radioactive materials, excepting tritium and noble gases	Purple (Magenta)
Particulates (dusts, fumes, mists, fogs, or smokes) in combination with any of the above gases or vapors	Canister color for contaminant, as designated above, with 1/2 inch gray strip completely around the canister near the top.
All of the above atmospheric contaminants	Red with 1/2 inch gray stripe completely around the canister near the top.

* Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.

NOTE: Orange shall be used as a complete body, or stripe color to represent gases not included in this table. The user will need to refer to the canister label to determine the degree of protection the canister will afford.

(Secs. 4(b)(2), 6(b) and 8(c), 84 Stat. 1592, 1593, 1596, 29 U.S.C. 653, 655, 657; Secretary of Labor's Order No. 8-76 (41 FR 25059); 29 CFR Part 1911)

(39 FR 23502, June 27, 1974, as amended at 43 FR 49748, Oct. 24, 1978)

OSHA REGULATION

1910.1200

§ 1910.1200 Hazard communication.

NOTE: The Office of Management and Budget has disapproved, under the Paperwork Reduction Act, three applications of the Hazard Communication Standard:

(1) The requirement that material safety data sheets be provided on multi-employer worksites;

(2) Coverage of any consumer product excluded from the definition of "hazardous chemical" under section 311(e)(3) of the Superfund Amendments and Reauthorization Act of 1986; and

(3) Coverage of any drugs regulated by the U.S. Food and Drug Administration in the non-manufacturing sector.

(a) *Purpose.* (1) The purpose of this section is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets and employee training.

(2) This occupational safety and health standard is intended to address comprehensively the issue of evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, and to preempt any legal requirements of a state, or political subdivision of a state, pertaining to the subject. Evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, may include, for example, but is not limited to, provisions for: developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present; labeling of containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces; preparation and distribution of material safety data sheets to employees and downstream employers; and development and implementation of employee training programs regarding hazards of chemicals and protective measures. Under section 18 of the Act, no state or political subdivision of a state may adopt or enforce, through any court or agency, any requirement relating to the issue addressed by this Federal standard, except pursuant to a Federally-approved state plan.

(b) *Scope and application.* (1) This section requires chemical manufacturers or importers to assess the hazards of chemicals which they produce or import, and all employers to provide information to their employees about the hazardous chemicals to which they are exposed, by means of a hazard communication program, labels and other forms of warning, material safety data sheets, and information and training. In addition, this section requires distributors to transmit the required information to employers.

(2) This section applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

(3) This section applies to laboratories only as follows:

(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(ii) Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees; and,

(iii) Employers shall ensure that laboratory employees are apprised of the hazards of the chemicals in their workplaces in accordance with paragraph (h) of this section.

(4) In work operations where employees only handle chemicals in sealed containers which are not opened under normal conditions of use (such as are found in marine cargo handling, warehousing, or retail sales), this section applies to these operations only as follows:

(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(ii) Employers shall maintain copies of any material safety data sheets that are received with incoming shipments of the sealed containers of hazardous chemicals, shall obtain a material safety data sheet for sealed containers of hazardous chemicals received without a material safety data sheet if an employee requests the material safety data sheet, and shall ensure that the material safety data sheets are readily accessible during each work shift to employees when they are in their work area(s); and,

(iii) Employers shall ensure that employees are provided with information and training in accordance with paragraph (h) of this section (except for the location and availability of the written hazard communication program under paragraph (h)(1)(iii)), to the extent necessary to protect them in the event of a spill or leak of a hazardous chemical from a sealed container.

(5) This section does not require labeling of the following chemicals:

(i) Any pesticide as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 et seq.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

(ii) Any food, food additive, color additive, drug, cosmetic, or medical or veterinary device, including materials intended for use as ingredients in such products (e.g. flavors and fragrances), as such terms are defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et seq.*) and regulations issued under that Act, when they are subject to the labeling requirements under that Act by the Food and Drug Administration;

(iii) Any distilled spirits (beverage alcohols), wine, or malt beverage intended for nonindustrial use, as such terms are defined in the Federal Alcohol Administration Act (27 U.S.C. 201 *et seq.*) and regulations issued under that Act, when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Bureau of Alcohol Tobacco, and Firearms; and,

(iv) Any consumer product or hazardous substance as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, when subject to a consumer product safety standard or labeling requirement of those Acts, or regulations issued under those Acts by the Consumer Product Safety Commission.

(6) This section does not apply to:

(i) Any hazardous waste as such term is defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 et seq.), when subject to regulations issued under that Act by the Environmental Protection Agency;

(ii) Tobacco or tobacco products;

(iii) Wood or wood products;

(iv) Articles;

(v) Food, drugs, cosmetics, or alcoholic beverages in a retail establishment which are packaged for sale to consumers;

(vi) Foods, drugs, or cosmetics intended for personal consumption by employees while in the workplace;

(vii) Any consumer product or hazardous substance, as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 *et seq.*) and Federal Hazardous Substances Act (15 U.S.C. 1261 *et seq.*) respectively, where the employer can demonstrate it is used in the workplace in the same manner as normal consumer use, and which use results in a duration and frequency of exposure which is not greater than exposures experienced by consumers; and,

(viii) Any drug, as that term is defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et seq.*), when it is in solid, final form for direct administration to the patient (i.e. tablets or pills).

(c) *Definitions.*

"Article" means a manufactured item: (i) Which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and

(iii) which does not release, or otherwise result in exposure to, a hazardous chemical, under normal conditions of use.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Chemical" means any element, chemical compound or mixture of elements and/or compounds.

"Chemical manufacturer" means an employer with a workplace where chemical(s) are produced for use or distribution.

"Chemical name" means the scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which will clearly identify the chemical for the purpose of conducting a hazard evaluation.

"Combustible liquid" means any liquid having a flashpoint at or above 100 °F (37.8 °C), but below 200 ° F (93.3 ° C), except any mixture having components with flashpoints of 200 °F (93.3 °C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

"Common name" means any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name.

"Compressed gas" means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 °F (21.1 °C); or

(ii) a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 °F (54.4 °C) regardless of the pressure at 70 °F (21.1 °C); or

(iii) A liquid having a vapor pressure exceeding 40 psi at 100 °F (37.8 °C) as determined by ASTM D-323-72.

"Container" means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

"Designated representative" means any individual or organization to whom an employee gives written authorization to exercise such employee's rights under this section. A recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Distributor" means a business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

"Employee" means a worker who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies. Workers such as office workers or bank tellers who encounter hazardous chemicals only in non-routine, isolated instances are not covered.

"Employer" means a person engaged in a business where chemicals are either used, distributed, or are produced for use or distribution, including a contractor or subcontractor.

"Explosive" means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

"Exposure" or "exposed" means that an employee is subjected to a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.), and includes potential (e.g. accidental or possible) exposure.

"Flammable" means a chemical that falls into one of the following categories:

(i) "Aerosol, flammable" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(ii) "Gas, flammable" means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve (12) percent by volume, regardless of the lower limit;

(iii) "Liquid, flammable" means any liquid having a flashpoint below 100 °F (37.8 °C), except any mixture having components with flashpoints of 100 °F (37.8 °C) or higher, the total of which make up 99 percent or more of the total volume of the mixture;

(iv) "Solid, flammable" means a solid, other than a blasting agent or explosive as defined in § 190.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

"Flashpoint" means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24-1979 (ASTM D 56-79)) for liquids with a viscosity of less than 45 Saybolt University Seconds (SUS) at 100 °F (37.8 °C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7-1979 (ASTM D 93-79)) for liquids with a viscosity equal to or greater than 45 SUS at 100 °F (37.8 °C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (See American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTMD 3278-78))

Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

"Foreseeable emergency" means any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

"Hazardous chemical" means any chemical which is a physical hazard or a health hazard.

"Hazard warning" means any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the hazard(s) of the chemical(s) in the container(s).

"Health hazard" means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. Appendix A provides further definitions and explanations of the scope of health hazards covered by this section, and Appendix B describes the criteria to be used to determine whether or not a chemical is to be considered hazardous for purposes of this standard.

"Identity" means any chemical or common name which is indicated on the material safety data sheet (MSDS) for the chemical. The identity used shall permit cross-references to be made among the required list of hazardous chemicals, the label and the MSDS.

"Immediate use" means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

"Importer" means the first business with employees within the Customs Territory of the United States which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within the United States.

"Label" means any written, printed, or graphic material, displayed on or affixed to containers of hazardous chemicals.

"Material safety data sheet (MSDS)" means written or printed material concerning a hazardous chemical which is prepared in accordance with paragraph (g) of this section.

"Mixture" means any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction.

"Organic peroxide" means an organic compound that contains the bivalent -O-O-structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

"Oxidizer" means a chemical other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

"Physical hazard" means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

"Produce" means to manufacture, process, formulate, or repackage.

"Pyrophoric" means a chemical that will ignite spontaneously in air at a temperature of 130 °F (54.4 °C) or below.

"Responsible party" means someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

"Specific chemical identity" means the chemical name, Chemical Abstracts Service (CAS) Registry Number, or any other information that reveals the precise chemical designation of the substance.

"Trade secret" means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix D sets out the criteria to be used in evaluating trade secrets.

"Unstable (reactive)" means a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

"Use" means to package, handle, react, or transfer.

"Water-reactive" means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

"Work area" means a room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

"Workplace" means an establishment, job site, or project, at one geographical location containing one or more work areas.

(d) *Hazard determination.* (1) Chemical manufacturers and importers shall evaluate chemicals produced in their workplaces or imported by them to determine if they are hazardous. Employers are not required to evaluate chemicals unless they choose not to rely on the evaluation performed by the chemical manufacturer or importer for the chemical to satisfy this requirement.

(2) Chemical manufacturers, importers or employers evaluating chemicals shall identify and consider the available scientific evidence concerning such hazards. For health hazards, evidence which is statistically significant and which is based on at least one positive study conducted in accordance with established scientific principles is considered to be sufficient to establish a hazardous effect if the results of the study meet the definitions of health hazards in this section. Appendix A

shall be consulted for the scope of health hazards covered, and Appendix B shall be consulted for the criteria to be followed with respect to the completeness of the evaluation, and the data to be reported.

(3) The chemical manufacturer, importer or employer evaluating chemicals shall treat the following sources as establishing that the chemicals listed in them are hazardous:

(i) 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA); or,

(ii) *Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment,* American Conference of Governmental Industrial Hygienists (ACGIH) (latest edition).

The chemical manufacturer, importer, or employer is still responsible for evaluating the hazards associated with the chemicals in these source lists in accordance with the requirements of this standard.

(4) Chemical manufacturers, importers and employers evaluating chemicals shall treat the following sources as establishing that a chemical is a carcinogen or potential carcinogen for hazard communication purposes:

(i) National Toxicology Program (NTP), *Annual Report on Carcinogens* (latest edition);

(ii) International Agency for Research on Cancer (IARC) *Monographs* (latest editions); or

(iii) 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration.

NOTE: The *Registry of Toxic Effects of Chemical Substances* published by the National Institute for Occupational Safety and Health indicates whether a chemical has been found by NTP or IARC to be a potential carcinogen.

(5) The chemical manufacturer, importer or employer shall determine the hazards of mixtures of chemicals as follows:

(i) If a mixture has been tested as a whole to determine its hazards, the results of such testing shall be used to determine whether the mixture is hazardous;

(ii) If a mixture has not been tested as a whole to determine whether the mixture is a health hazard, the mixture shall be assumed to present the same health hazards as do the components which comprise one percent (by weight or volume) or greater of the mixture, except that the mixture shall be assumed to present a carcinogenic hazard if it contains a component in concentrations of 0.1 percent or greater which is considered to be a carcinogen under paragraph (d)(4) of this section;

(iii) If a mixture has not been tested as a whole to determine whether the mixture is a physical hazard, the chemical manufacturer, importer, or employer may use whatever scientifically valid data is available to evaluate the physical hazard potential of the mixture; and,

(iv) If the chemical manufacturer, importer, or employer has evidence to indicate that a component present in the mixture in concentrations of less than one percent (or in the case of carcinogens, less than 0.1 percent) could be released in concentrations which would exceed an established OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health hazard to employees in those concentrations, the mixture shall be assumed to present the same hazard.

(6) Chemical manufacturers, importers, or employers evaluating chemicals shall describe in writing the procedures they use to determine the hazards of the chemical they evaluate. The written procedures are to be made available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director The written description may be incorporated into the written hazard communication program required under paragraph (e) of this section.

(e) *Written hazard communication program.* (1) Employers shall develop, implement, and maintain at the workplace, a written hazard communication program for their workplaces which at least describes how the criteria specified in paragraphs (f), (g), and (h) of this section for labels and other forms of warning, material safety data sheets, and employee information and training will be met, and which also includes the following:

(i) A list of the hazardous chemicals known to be present using an identity that is referenced on the appropriate material safety data sheet (the list may be compiled for the workplace as a whole or for individual work areas); and,

(ii) The methods the employer will use to inform employees of the hazards of non-routine tasks (for example, the cleaning of reactor vessels), and the hazards associated with chemicals contained in unlabeled pipes in their work areas.

(2) *Multi-employer workplaces.* Employers who produce, use, or store hazardous chemicals at a workplace in such a way that the employees of other employer(s) may be exposed (for example, employees of a construction contractor working on-site) shall additionally ensure that the hazard communication programs developed and implemented under this paragraph (e) include the following:

(i) The methods the employer will use to provide the other employer(s) with a copy of the material safety data sheet, or to make it available at a central location in the workplace, for each hazardous chemical the other employer(s)' employees may be exposed to while working;

(ii) The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplace's normal operating conditions and in foreseeable emergencies; and,

(iii) The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace.

(3) The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this paragraph (e).

(4) The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director, in accordance with the requirements of 29 CFR 1910.20(e).

(f) *Labels and other forms of warning.* (1) The chemical manufacturer, importer, or distributor shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged or marked with the following information:

(i) Identity of the hazardous chemical(s);

(ii) Appropriate hazard warnings; and

(iii) Name and address of the chemical manufacturer, importer, or other responsible party.

(2) For solid metal (such as a steel beam or a metal casting) that is not exempted as an article due to its downstream use, the required label may be transmitted to the customer at the time of the intial shipment, and need not be included with subsequent shipments to the same employer unless the information on the label changes. The label may be transmitted with the initial shipment itself, or with the material safety data sheet that is to be provided prior to or at the time of the first shipment. This exception to requiring labels on every container of hazardous chemicals is only for the solid metal itself and does not apply to hazardous chemicals used in conjunction with, or known to be present with, the metal and to which employees handling the metal may be exposed (for example, cutting fluids or lubricants).

(3) Chemical manufacturers, importers, or distributors shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked in accordance with this section in a manner which does not conflict with the requirements of the Hazardous Materials Transportation Act (49 U.S.C. 1801 *et seq.*) and regulations issued under that Act by the Department of Transportation.

(4) If the hazardous chemical is regulated by OSHA in a substance-specific health standard, the chemical manufacturer, importer, distributor or employer shall ensure that the labels or other forms of warning used are in accordance with the requirements of that standard.

(5) Except as provided in paragraphs (f)(6) and (f)(7) the employer shall ensure that each container of hazard-

ous chemicals in the workplace is labeled, tagged or marked with the following information:

(i) Identity of the hazardous chemical(s) contained therein; and

(ii) Appropriate hazard warnings.

(6) The employer may use signs, placards, process sheets, batch tickets, operating procedures, or other such written materials in lieu of affixing labels to individual stationary process containers, as long as the alternative method identifies the containers to which it is applicable and conveys the information required by paragraph (f)(5) of this section to be on a label. The written materials shall be readily accessible to the employees in their work area throughout each work shift.

(7) The employer is not required to label portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer.

(8) The employer shall not remove or deface existing labels on incoming containers of hazardous chemicals, unless the container is immediately marked with the required information.

(9) The employer shall ensure that labels or other forms of warning are legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift. Employers having employees who speak other languages may add the information in their language to the material presented, as long as the information is presented in English as well.

(10) The chemical manufacturer, importer, distributor or employer need not affix new labels to comply with this section if existing labels already convey the required information.

(g) *Material safety data sheets.* (1) Chemical manufacturers and importers shall obtain or develop a material safety data sheet for each hazardous chemical they produce or import. Employers shall have a material safety data sheet for each hazardous chemical which they use.

(2) Each material safety data sheet shall be in English and shall contain at least the following information:

(i) The identity used on the label, and, except as provided for in paragraph (i) of this section on trade secrets:

(A) If the hazardous chemical is a single substance, its chemical and common name(s);

(B) If the hazardous chemical is a mixture which has been tested as a whole to determine its hazards, the chemical and common name(s) of the ingredients which contribute to these known hazards, and the common name(s) of the mixture itself; or,

(C) If the hazardous chemical is a mixture which has not been tested as a whole:

(*1*) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise 1% or greater of the composition, except that chemicals identified as carcinogens under paragraph (d)(4) of this section shall be listed if the concentrations are 0.1% or greater; and,

(*2*) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise less than 1% (0.1% for carcinogens) of the mixture, if there is evidence that the ingredient(s) could be released from the mixture in concentrations which would exceed an established OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health hazard to employees; and,

(*3*) The chemical and common name(s) of all ingredients which have been determined to present a physical hazard when present in the mixture;

(ii) Physical and chemical characteristics of the hazardous chemical (such as vapor pressure, flash point);

(iii) The physical hazards of the hazardous chemical, including the potential for fire, explosion, and reactivity;

(iv) The health hazards of the hazardous chemical, including signs and symptoms of exposure, and any medical conditions which are generally recognized as being aggravated by exposure to the chemical;

(v) The primary route(s) of entry;

(vi) The OSHA permissible exposure limit, ACGIH Threshold Limit Value, and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the material safety data sheet, where available;

(vii) Whether the hazardous chemical is listed in the National Toxicology Program (NTP) *Annual Report on Carcinogens* (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) *Monographs* (latest editions), or by OSHA;

(viii) Any generally applicable precautions for safe handling and use which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, including appropriate hygienic practices, protective measures during repair and maintenance of contaminated equipment, and procedures for clean-up of spills and leaks;

(ix) Any generally applicable control measures which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, such as appropriate engineering controls, work practices, or personal protective equipment;

(x) Emergency and first aid procedures;

(xi) The date of preparation of the material safety data sheet or the last change to it; and,

(xii) The name, address and telephone number of the chemical manufacturer, importer, employer or other responsible party preparing or distributing the material safety data sheet, who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

(3) If no relevant information is found for any given category on the material safety data sheet, the chemical manufacturer, importer or employer preparing the material safety data sheet shall mark it to indicate that no applicable information was found.

(4) Where complex mixtures have similar hazards and contents (i.e. the chemical ingredients are essentially the same, but the specific composition varies from mixture to mixture), the chemical manufacturer, importer or employer may prepare one material safety data sheet to apply to all of these similar mixtures.

(5) The chemical manufacturer, importer or employer preparing the material safety data sheet shall ensure that the information recorded accurately reflects the scientific evidence used in making the hazard determination. If the chemical manufacturer, importer or employer preparing the material safety data sheet becomes newly aware of any significant information regarding the hazards of a chemical, or ways to protect against the hazards, this new information shall be added to the material safety data sheet within three months. If the chemical is not currently being produced or imported the chemical manufacturer or importer shall add the information to the material safety data sheet before the chemical is introduced into the workplace again.

(6) Chemical manufacturers or importers shall ensure that distributors and employers are provided an appropriate material safety data sheet with their intitial shipment, and with the first shipment after a material safety data sheet is updated. The chemical manufacturer or importer shall either provide material safety data sheets with the shipped containers or send them to the employer prior to or at the time of the shipment. If the material safety data sheet is not provided with a shipment that has been labeled as a hazardous chemical, the employer shall obtain one from the chemical manufacturer, importer, or distributor as soon as possible.

(7) Distributors shall ensure that material safety data sheets, and updated information, are provided to other distributors and employers. Retail distributors which sell hazardous chemicals to commercial customers shall provide a material safety data sheet to such employers upon request, and shall post a sign or otherwise inform them that a material safety data sheet is available. Chemical manufacturers, importers, and distributors need not provide material safety data sheets to retail distributors which have informed them that the retail distributor does not sell the product to commercial customers or open the sealed container to use it in their own workplaces.

(8) The employer shall maintain copies of the required material safety data sheets for each hazardous chemical in the workplace, and shall ensure that they are readily accessible during each work shift to employees when they are in their work area(s).

(9) Where employees must travel between workplaces during a workshift, *i.e.*, their work is carried out at more than one geographical location, the material safety data sheets may be kept at a central location at the primary workplace facility. In this situation, the employer shall ensure that employees can immediately obtain the required information in an emergency.

(10) Material safety data sheets may be kept in any form, including operating procedures, and may be designed to cover groups of hazardous chemicals in a work area where it may be more appropriate to address the hazards of a process rather than individual hazardous chemicals. However, the employer shall ensure that in all cases the required information is provided for each hazardous chemical, and is readily accessible during each work shift to employees when they are in in their work areas(s).

(11) Material safety data sheets shall also be made readily available, upon request, to designated representatives and to the Assistant Secretary, in accordance with the requirements of 29 CFR 1910.20 (e). The Director shall also be given access to material safety data sheets in the same manner.

(h) *Employee information and training.* Employers shall provide employees with information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new hazard is introduced into their work area.

(1) *Information.* Employees shall be informed of:

(i) The requirements of this section;

(ii) Any operations in their work area where hazardous chemicals are present; and,

(iii) The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and material safety data sheets required by this section.

(2) *Training.* Employee training shall include at least:

(i) Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

(ii) The physical and health hazards of the chemicals in the work area;

(iii) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and,

(iv) The details of the hazard communication program developed by the employer, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

(i) *Trade secrets.* (1) The chemical manufacturer, importer, or employer may withhold the specific chemical identity, including the chemical name and other specific identification of a hazardous chemical, from the material safety data sheet, provided that:

(i) The claim that the information withheld is a trade secret can be supported;

(ii) Information contained in the material safety data sheet concerning the properties and effects of the hazardous chemical is disclosed;

(iii) The material safety data sheet indicates that the specific chemical identity is being withheld as a trade secret; and,

(iv) The specific chemical identity is made available to health professionals, employees, and designated representatives in accordance with the applicable provisions of this paragraph.

(2) Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity of a hazardous chemical is necessary for emergency or first-aid treatment, the chemical manufacturer, importer, or employer shall immediately disclose the specific chemical

identity of a trade secret chemical to that treating physician or nurse, regardless of the existence of a written statement of need of a confidentiality agreement. The chemical manufacturer, importer, or employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of paragraphs (i)(3) and (4) of this section, as soon as circumstances permit.

(3) In non-emergency situations, a chemical manufacturer, importer, or employer shall, upon request, disclose a specific chemical identity, otherwise permitted to be withheld under paragraph (i)(1) of this section, to a health professional (i.e. physician, industrial hygienist, toxicologist, epidemiologist, or occupational health nurse) providing medical or other occupational health services to exposed employee(s), and to employees or designated representatives, if:

(i) The request is in writing;

(ii) The request describes with reasonable detail one or more of the following occupational health needs for the information:

(A) To assess the hazards of the chemicals to which employees will be exposed;

(B) To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels;

(C) To conduct pre-assignment or periodic medical surveillance of exposed employees;

(D) To provide medical treatment to exposed employees;

(E) To select or assess appropriate personal protective equipment for exposed employees;

(F) To design or assess engineering controls or other protective measures for exposed employees; and,

(G) To conduct studies to determine the health effects of exposure.

(iii) The request explains in detail why the disclosure of the specific chemical identity is essential and that, in lieu thereof, the disclosure of the following information to the health professional, employee, or designated representative, would not satisfy the purposes described in paragraph (i)(3)(ii) of this section:

(A) The properties and effects of the chemical;

(B) Measures for controlling workers' exposure to the chemical;

(C) Methods of monitoring and analyzing worker exposure to the chemical; and,

(D) Methods of diagnosing and treating harmful exposures to the chemical;

(iv) The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and,

(v) The health professional, and the employer or contractor of the services of the health professional (i.e. downstream employer, labor organization, or individual employee), employee, or designated representative, agree in a written confidentiality agreement that the health professional, employee, or designated representative, will not use the trade secret information for any purpose other than the health need(s) asserted and agree not to release the information under any circumstances other than to OSHA, as provided in paragraph (i)(6) of this section, except as authorized by the terms of the agreement or by the chemical manufacturer, importer, or employer.

(4) The confidentiality agreement authorized by paragraph (i)(3)(iv) of this section:

(i) May restrict the use of the information to the health purposes indicated in the written statement of need;

(ii) May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable pre-estimate of likely damages; and,

(iii) May not include requirements for the posting of a penalty bond.

(5) Nothing in this standard is meant to preclude the parties from pursuing non-contractual remedies to the extent permitted by law.

(6) If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to OSHA, the chemical manufacturer, importer, or employer who provided the information shall be informed by the health professional, employee, or designated representative prior to, or at the same time as, such disclosure.

(7) If the chemical manufacturer, importer, or employer denies a written request for disclosure of a specific chemical identity, the denial must:

(i) Be provided to the health professional, employee, or designated representative, within thirty days of the request;

(ii) Be in writing;

(iii) Include evidence to support the claim that the specific chemical identity is a trade secret;

(iv) State the specific reasons why the request is being denied; and,

(v) Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the specific chemical identity.

(8) The health professional, employee, or designated representative whose request for information is denied under paragraph (i)(3) of this section may refer the request and the written denial of the request to OSHA for consideration.

(9) When a health professional, employee, or designated representative refers the denial to OSHA under paragraph (i)(8) of this section, OSHA shall consider the evidence to determine if:

(i) The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity is a trade secret;

(ii) The health professional, employee, or designated representative has supported the claim that there is a medical or occupational health need for the information; and,

(iii) The health professional, employee, or designated representative has demonstrated adequate means to protect the confidentiality.

(10)(i) If OSHA determines that the specific chemical identity requested under paragraph (i)(3) of this section is not a *bona fide* trade secret, or that it is a trade secret, but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means to protect the confidentiality of the information, the chemical manufacturer, importer, or employer will be subject to citation by OSHA.

(ii) If a chemical manufacturer, importer, or employer demonstrates to OSHA that the execution of a confidentiality agreement would not provide sufficient protection against the potential harm from the unauthorized disclosure of a trade secret specific chemical identity, the Assistant Secretary may issue such orders or impose such additional limitations or conditions upon the disclosure of the requested chemical information as may be appropriate to assure that the occupational health services are provided without an undue risk of harm to the chemical manufacturer, importer, or employer.

(11) If a citation for a failure to release specific chemical identity information is contested by the chemical manufacturer, importer, or employer, the matter will be adjudicated before the Occupational Safety and Health Review Commission in accordance with the Act's enforcement scheme and the applicable Commission rules of procedure. In accordance with the Commission rules, when a chemical manufacturer, importer, or employer continues to withhold the information during the contest, the Administrative Law Judge may review the citation and supporting documentation *in camera* or issue appropriate orders to protect the confidentiality or such matters.

(12) Notwithstanding the existence of a trade secret claim, a chemical manufacturer, importer, or employer shall, upon request, disclose to the Assistant Secretary any information which this section requires the chemical manufacturer, importer, or employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the Assistant Secretary so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.

(13) Nothing in this paragraph shall be construed as requiring the disclosure under any circumstances of process or percentage of mixture information which is a trade secret.

(j) *Effective dates.* (1) Chemical manufacturers, importers, and distributors shall ensure that material safety data sheets are provided with the next shipment of hazardous chemicals to employers after September 23, 1987.

(2) Employers in the non-manufacturing sector shall be in compliance with all provisions of this section by May 23, 1988. (Note: Employers in the manufacturing sector (SIC Codes 20 through 39) are already required to be in compliance with this section.)

APPENDIX A TO § 1900.1200 HEALTH HAZARD DEFINITIONS (*Mandatory*)

Although safety hazards related to the physical characteristics of a chemical can be objectively defined in terms of testing requirements (e.g. flammability), health hazard definitions are less precise and more subjective. Health hazards may cause measurable changes in the body—such as decreased pulmonary function. These changes are generally indicated by the occurrence of signs and symptoms in the exposed employees—such as shortness of breath, a non-measurable, subjective feeling. Employees exposed to such hazards must be apprised of both the change in body function and the signs and symptoms that may occur to signal that change.

The determination of occupational health hazards is complicated by the fact that many of the effects or signs and symptoms occur commonly in non-occupationally exposed populations, so that effects of exposure are difficult to separate from normally occurring illnesses. Occasionally, a substance causes an effect that is rarely seen in the population at large, such as angiosarcomas caused by vinyl chloride exposure, thus making it easier to ascertain that the occupational exposure was the primary causative factor. More often, however, the effects are common, such as lung cancer. The situation is further complicated by the fact that most chemicals have not been adequately tested to determine their health hazard potential, and data do not exist to substantiate these effects.

There have been many attempts to categorize effects and to define them in various ways. Generally, the terms "acute" and "chronic" are used to delineate between effects on the basis of severity or duration. "Acute" effects usually occur rapidly as a result of short-term exposures, and are of short duration. "Chronic" effects generally occur as a result of long-term exposure, and are of long duration.

The acute effects referred to most frequently are those defined by the American National Standards Institute (ANSI) standard for Precautionary Labeling of Hazardous Industrial Chemicals (Z129.1-1982)—irritation, corrosivity, sensitization and lethal dose. Although these are important health effects, they do not adequately cover the considerable range of acute effects which may occur as a result of occupational exposure, such as, for example, narcosis.

Similarly, the term chronic effect is often used to cover only carcinogenicity, teratogenicity, and mutagenicity. These effects are obviously a concern in the workplace, but again, do not adequately cover the area of chronic effects, excluding, for example, blood dyscrasias (such as anemia), chronic bronchitis and liver atrophy.

The goal of defining precisely, in measurable terms, every possible health effect that may occur in the workplace as a result of chemical exposures cannot realistically be accomplished. This does not negate the need for employees to be informed of such effects and protected from them. Appendix B, which is also mandatory, outlines the principles and procedures of hazardous assessment.

For purposes of this section, any chemicals which meet any of the following definitions, as determined by the criteria set forth in Appendix B are health hazards:

1. *Carcinogen:* A chemical is considered to be a carcinogen if:

(a) It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or

(b) It is listed as a carcinogen or potential carcinogen in the *Annual Report on Carcinogens* published by the National Toxicology Program (NTP) (latest edition); or,

(c) It is regulated by OSHA as a carcinogen.

2. *Corrosive:* A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. Department of Transportation in Appendix A to 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term shall not refer to action on inanimate surfaces.

3. *Highly toxic:* A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose (LD_{50}) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal does (LD_{50}) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration (LC_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

4. *Irritant:* A chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of 16 CFR 1500.41 for four hours exposure or by other appropriate techniques, it results in an empirical score of five or more. A chemical is an eye irritant if so determined under the procedure listed in 16 CFR 1500.42 or other appropriate techniques.

5. *Sensitizer:* A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

6. *Toxic.* A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose (LD_{50}) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal dose (LD_{50}) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration (LC_{50}) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

7. *Target organ effects.* The following is a target organ categorization of effects which may occur, including examples of signs and symptoms and chemicals which have been found to cause such effects. These examples are presented to illustrate the range and diversity of effects and hazards found in the workplace, and the broad scope employers must consider in this area, but are not intended to be all-inclusive.

a. Hepatotoxins: Chemicals which produce liver damage
  Signs & Symptoms: Jaundice; liver enlargement
  Chemicals: Carbon tetrachloride; nitrosamines

b. Nephrotoxins: Chemicals which produce kidney damage
  Signs & Symptoms: Edema; proteinuria
  Chemicals: Halogenated hydrocarbons; uranium

c. Neurotoxins: Chemicals which produce their primary toxic effects on the nervous system
  Signs & Symptoms: Narcosis; behavioral changes; decrease in motor functions
  Chemicals: Mercury; carbon disulfide

d. Agents which act on the blood or hematopoietic system: Decrease hemoglobin function; deprive the body tissues of oxygen
  Signs & Symptoms: Cyanosis; loss of consciousness
  Chemicals: Carbon monoxide; cyanides

e. Agents which damage the lung: Chemicals which irritate or damage the pulmonary tissue
  Signs & Symptoms: Cough; tightness in chest; shortness of breath
  Chemicals: Silica; asbestos

f. Reproductive toxins: Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis)
  Signs & Symptoms: Birth defects; sterility
  Chemicals: Lead; DBCP

g. Cutaneous hazards: Chemicals which affect the dermal layer of the body
  Signs & Symptoms: Defatting of the skin; rashes; irritation
  Chemicals: Ketones; chlorinated compounds

h. Eye hazards: Chemicals which affect the eye or visual capacity
  Signs & Symptoms: Conjunctivitis; corneal damage
  Chemicals: Organic solvents; acids

APPENDIX B TO § 1910.1200 HAZARD DETERMINATION (MANDATORY)

The quality of a hazard communication program is largely dependent upon the adequacy and accuracy of the hazard determination. The hazard determination requirement of this standard is performance-oriented. Chemical manufacturers, importers, and employers evaluating chemicals are not required to follow any specific methods for determining hazards, but they must be able to demonstrate that they have adequately ascertained the hazards of the chemicals produced or imported in accordance with the criteria set forth in this Appendix.

Hazard evaluation is a process which relies heavily on the professional judgment of the evaluator, particularly in the area of chronic hazards. The performance-orientation of the hazard determination does not diminish the duty of the chemical manufacturer, importer or employer to conduct a thorough evaluation, examining all relevant data and producing a scientifically defensible evaluation. For purposes of this standard, the following criteria shall be used in making hazard determinations that meet the requirements of this standard.

1. *Carcinogenicity*: As described in paragraph (d)(4) and Appendix A of this section, a determination by the National Toxicology Program, the International Agency for Research on Cancer, or OSHA that a chemical is a carcinogen or potential carcinogen will be considered conclusive evidence for purposes of this section.

2. *Human data*: Where available, epidemiological studies and case reports of adverse health effects shall be considered in the evaluation.

3. *Animal data*: Human evidence of health effects in exposed populations is generally not available for the majority of chemicals produced or used in the workplace. Therefore, the available results of toxicological testing in animal populations shall be used to predict the health effects that may be experienced by exposed workers. In particular, the definitions of certain acute hazards refer to specific animal testing results (see Appendix A).

4. *Adequacy and reporting of data.* The results of any studies which are designed and conducted according to established scientific principles, and which report statistically significant conclusions regarding the health effects of a chemical, shall be a sufficient basis for a hazard determination and reported on any material safety data sheet. The chemical manufacturer, importer, or employer may also report the results of other scientifically valid studies which tend to refute the findings of hazard.

APPENDIX C TO § 1910.1200 INFORMATION SOURCES (ADVISORY)

The following is a list of available data sources which the chemical manufacturer, importer, distributor, or employer may wish to consult to evaluate the hazards of chemicals they produce or import:

—Any information in their own company files, such as toxicity testing results or illness experience of company employees.

—Any information obtained from the supplier of the chemical, such as material safety data sheets or product safety bulletins.

—Any pertinent information obtained from the following source list (latest editions should be used):

Condensed Chemical Dictionary
Van Nostrand Reinhold Co., 135 West 50th Street, New York, NY 10020.

The Merck Index: An Encyclopedia of Chemicals and Drugs
Merck and Company, Inc., 126 E. Lincoln Ave., Rahway, NJ 07065.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man
Geneva: World Health Organization, International Agency for Research on Cancer, 1972-Present. (Multivolume work). Summaries are available in supplement volumes. 49 Sheridan Street, Albany, NY 12210.

Industrial Hygiene and Toxicology, by F.A. Patty
John Wiley & Sons, Inc., New York, NY (Multivolume work).

Clinical Toxicology of Commercial Products
Gleason, Gosselin, and Hodge

Casarett and Doull's Toxicology; The Basic Science of Poisons
Doull, Klaassen, and Amdur, Macmillan Publishing Co., Inc., New York, NY.

Industrial Toxicology, by Alice Hamilton and Harriet L. Hardy
Publishing Sciences Group, Inc., Acton, MA.

Toxicology of the Eye, by W. Morton Grant
Charles C. Thomas, 301-327 East Lawrence Avenue, Springfield, IL.

Recognition of Health Hazards in Industry
William A. Burgess, John Wiley and Sons, 605 Third Avenue, New York, NY 10158.

Chemical Hazards of the Workplace
Nick H. Proctor and James P. Hughes, J.P. Lipincott Company, 6 Winchester Terrace, New York, NY 10022.

Handbook of Chemistry and Physics
Chemical Rubber Company, 18901 Cranwood Parkway, Cleveland, OH 44128.

Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment and Biological Exposure Indices with Intended Changes
American Conference of Governmental Industrial Hygienists (ACGIH), 6500 Glenway Avenue, Bldg. D-5, Cincinnati, OH 45211.

Information on the physical hazards of chemicals may be found in publications of the National Fire Protection Association, Boston, MA.

NOTE.—The following documents may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Occupational Health Guidelines
NIOSH/OSHA (NIOSH Pub. No. 81-123)

NIOSH Pocket Guide to Chemical Hazards
NIOSH Pub. No. 85-114

Registry of Toxic Effects of Chemical Substances
NIOSH Pub. No. 80-102
Miscellaneous Documents published by the National Institute for Occupational Safety and Health:
Criteria documents.
Special Hazard Reviews.
Occupational Hazard Assessments.
Current Intelligence Bulletins.
OSHA's General Industry Standards (29 CFR Part 1910)
NTP Annual Report on Carcinogens and *Summary of the Annual Report on Carcinogens.*
National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161; (703) 487-4650.

BIBLIOGRAPHIC DATA BASES

Service provider	File name
Bibliographic Retrieval Services (BRS), 1200 Route 7, Latham, NY 12110.	Biosis Previews CA Search Medlars NTIS Hazardline American Chemical Society Journal Excerpta Medica IRCS Medical Science Journal Pre-Med Intl Pharmaceutical Abstracts Paper Chem
Lockheed—DIALOG Information Service, Inc., 3460 Hillview Avenue, Palo Alto, CA 94304.	Biosis Prev. Files CA Search Files CAB Abstracts Chemical Exposure Chemname Chemsis Files Chemzero Embase Files Environmental Bibliographies Enviroline Federal Research in Progress IRL Life Science Collection NTIS Occupational Safety and Health (NIOSH) Paper Chem
SDC—Orbit, SDC Information Service, 2500 Colorado Avenue, Santa Monica, CA 90406.	CAS Files Chemdex, 2, 3 NTIS
National Library of Medicine, Department of Health and Human Services, Public Health Service, National Institutes of Health, Bethesda, MD 20209.	Hazardous Substances Data Bank (NSDB) Medline files Toxline Files Cancerlit RTECS Chemline
Pergamon International Information Corp., 1340 Old Chain Bridge Rd., McLean, VA 22101.	Laboratory Hazard Bulletin
Questel, Inc., 1625 Eye Street, NW., Suite 818, Washington, DC 20006.	CIS/ILO Cancernet

BIBLIOGRAPHIC DATA BASES—Continued

Service provider	File name
Chemical Information System ICI (ICIS), Bureau of National Affairs, 1133 15th Street, NW., Suite 300, Washington, DC 20005.	Structure and Nomenclature Search System (SANSS) Acute Toxicity (RTECS) Clinical Toxicology of Commercial Products Oil and Hazardous Materials Technical Assistance Data System CCRIS CESARS
Occupational Health Services, 400 Plaza Drive, Secaucus, NJ 07094.	MSDS Hazardline

APPENDIX D TO § 1910.1200 DEFINITION OF "TRADE SECRET" (MANDATORY)

The following is a reprint of the *Restatement of Torts* section 757, comment *b* (1939):

b. Definition of trade secret. A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacturing, treating or preserving materials, a pattern for a machine or other device, or a list of customers. It differs from other secret information in a business (see § 759 of the *Restatement of Torts* which is not included in this Appendix) in that it is not simply information as to single or ephemeral events in the conduct of the business, as, for example, the amount or other terms of a secret bid for a contract or the salary of certain employees, or the security investments made or contemplated, or the date fixed for the announcement of a new policy or for bringing out a new model or the like. A trade secret is a process or device for continuous use in the operations of the business. Generally it relates to the production of goods, as, for example, a machine or formula for the production of an article. It may, however, relate to the sale of goods or to other operations in the business, such as a code for determining discounts, rebates or other concessions in a price list or catalogue, or a list of specialized customers, or a method of bookkeeping or other office management.

Secrecy. The subject matter of a trade secret must be secret. Matters of public knowledge or of general knowledge in an industry cannot be appropriated by one as his secret. Matters which are completely disclosed by the goods which one markets cannot be his secret. Substantially, a trade secret is known only in the particular business in which it is used. It is not requisite that only the proprietor of the business know it. He may, without losing his protection, communicate it to employees involved in its use. He may likewise communicate it to others pledged to secrecy. Others may also know of it independently, as, for example, when they have discovered the process or formula by independent invention and are keeping it secret. Nevertheless, a substantial element of secrecy must exist, so that, except by the use of improper means, there would be difficulty in acquiring the information. An exact definition of a trade secret is not possible. Some factors to be considered in determining whether given information is one's trade secret are: (1) The extent to which the information is known outside of his business; (2) the extent to which it is known by employees and others involved in his business; (3) the extent of measures taken by him to guard the secrecy of the information; (4) the value of the information to him and his competitors; (5) the amount of effort or money expended by him in developing the information; (6) the ease or difficulty with which the information could be properly acquired or duplicated by others.

Novelty and prior art. A trade secret may be a device or process which is patentable; but it need not be that. It may be a device or process which is clearly anticipated in the prior art or one which is merely a mechanical improvement that a good mechanic can make. Novelty and invention are not requisite for a trade secret as they are for patentability. These requirements are essential to patentability because a patent protects against unlicensed use of the patented device or process even by one who discovers it properly through independent research. The patent monopoly is a reward to the inventor. But such is not the case with a trade secret. Its protection is not based on a policy of rewarding or otherwise encouraging the development of secret processes or devices. The protection is merely against breach of faith and reprehensible means of learning another's secret. For this limited protection it is not appropriate to require also the kind of novelty and invention which is a requisite of patentability. The nature of the secret is, however, an important factor in determining the kind of relief that is appropriate against one who is subject to liability under the rule stated in this section. Thus, if the secret consists of a device or process which is a novel invention, one who acquires the secret wrongfully is ordinarily enjoined from further use of it and is required to account for the profits derived from his past use. If, on the other hand, the secret consists of mechanical improvements that a good mechanic can make without resort to the secret, the wrongdoer's liability may be limited to damages, and an injunction against future use of the improvements made with the aid of the secret may be inappropriate.

(Approved by the Office of Management and Budget under control number 1218-0072)

(Approved by the Office of Management and Budget under control number 1218-0072, except for: (1) The requirement that material safety data sheets be provided on multi-employer worksites; (2) coverage of any consumer product excluded from the definition of "hazardous chemical" under section 311(e)(3) of the Superfund Amendments and Reauthorization Act of 1986; and (3) coverage of any drugs regulated by the Food and Drug Administration in the non-manufacturing sector.)

[52 FR 31877, Aug. 24, 1987, as amended at 52 FR 46080, Dec. 4, 1987; 53 FR 15035, Apr. 27, 1988]

§ 1910.1499 Source of standards.

Section 1910.1000	41 CFR 50-204.50, except for Table Z-2, the source of which is American National Standards Institute, Z37 series.

[40 FR 23073, May 28, 1975]

§ 1910.1500 Standards organizations.

Specific standards of the following organizations have been referred to in this subpart. Copies of the standards may be obtained from the issuing organization.

American Conference of Governmental
Industrial Hygienists
1014 Broadway
Cincinnati, Ohio 45202

American National Standards Institute
1430 Broadway
New York, New York 10018

[40 FR 23073, May 28, 1975, as amended at 43 FR 57603, Dec. 8, 1978]

Understanding the Small Quantity Generator <u>Hazardous Waste Rules:</u>

A Handbook for Small Business

This document was prepared by the United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. 20460.

EPA/530-SW-86-019
September 1986

Modifications to this document were made to address the special needs of lead-based paint abatement contractors. The modifications appear on the "Notification of Hazardous Waste Activity" form and on the "Uniform Hazardous Waste Manifest".

In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA), which directed the U.S. Environmental Protection Agency (EPA) to develop and implement a program to protect human health and the environment from improper hazardous waste management practices. The program is designed to control the management of hazardous waste from its generation to its ultimate disposal—from "cradle-to-grave."

EPA first focused on large companies, which generate the greatest portion of hazardous waste. Business establishments producing less than 1000 kilograms (2,200 pounds) of hazardous waste in a calendar month (known as small quantity generators) were exempted from most of the hazardous waste management regulations published by EPA in May 1980.

In recent years, however, public attention has been focused on the potential for environmental and health problems that may result from mismanaging even small quantities of hazardous waste. For example, small amounts of hazardous waste dumped on the land may seep into the earth and contaminate underground water that supplies drinking water wells.

In November 1984, the Hazardous and Solid Waste Amendments to RCRA were signed into law. With these amendments, Congress directed EPA to establish new requirements that would bring small quantity generators who generate between 100 and 1000 kilograms (kg) of hazardous waste in a calendar month into the hazardous waste regulatory system. EPA issued final regulations for these 100 to 1000 kg/mo generators on March 24, 1986. Most of the requirements are effective September 22, 1986.

PAY ATTENTION TO THESE DATES!

September 22, 1986

Most of the new rules for small quantity generators of hazardous waste become effective. Noncompliance may lead to fines and legal action.

March 24, 1987

Small quantity generators that decide to store hazardous waste for longer than six months, perform certain kinds of waste treatment, or dispose of hazardous waste on their property must apply for a RCRA permit and comply with additional rules. (See Chapter 4)

ABOUT THIS HANDBOOK

This handbook was prepared by the U.S. Environmental Protection Agency (EPA) to help small business owners and managers understand how the federal hazardous waste management laws may affect their businesses.

The information in this handbook will help you determine whether your business is a regulated small quantity generator of hazardous waste. Specific information is provided to help you understand how to:

- ▶ Obtain a U.S. EPA Identification Number.
- ▶ Use the Uniform Hazardous Waste Manifest system when shipping hazardous waste off-site.
- ▶ Select hazardous waste transporters who have U.S. EPA Identification Numbers.
- ▶ Accumulate hazardous waste on-site for no more than 180 days, or 270 days if the waste is to be shipped more than 200 miles, without obtaining a hazardous waste storage permit.
- ▶ Ensure that hazardous waste is managed at a hazardous waste facility with interim status or a permit under RCRA.

The chapters in this handbook describe these new requirements, and provide some step-by-step instructions to help you meet your responsibilities as a small quantity generator of hazardous wastes.

This handbook presents a description of the federal regulations only. You should be sure to contact your state hazardous waste management agency for additional help and information on state requirements. Telephone numbers for state hazardous waste management agencies are listed in Appendix A.

TABLE OF CONTENTS

CHAPTER

DOES YOUR BUSINESS GENERATE HAZARDOUS WASTE?

What is a Hazardous Waste?

A waste is any solid, liquid, or contained gaseous material that you no longer use, and either recycle, throw away, or store until you have enough to treat or dispose of.

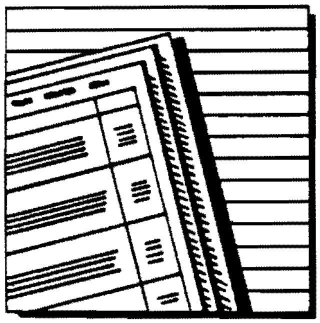
As a result of doing business, a company may generate wastes that can cause serious problems if not handled and disposed of carefully. Such wastes could:

- cause injury or death; or
- damage or pollute land, air, or water.

These wastes are considered *hazardous*, and they are currently regulated by federal and state public health and environmental safety laws.

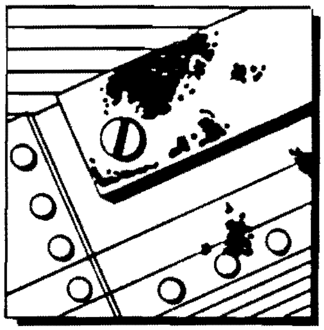
There are two ways a waste may be brought into the hazardous waste regulatory system: *listing*, and identification through *characteristics*.

- *Listed wastes.* Your waste is considered hazardous if it appears on any one of the four lists of hazardous wastes contained in the RCRA regulations. These wastes have been listed because they either exhibit one of the characteristics described below or contain any number of toxic constituents that have been shown to be harmful to health and the environment. The regulations list over 400 hazardous wastes, including wastes derived from manufacturing processes and discarded commercial chemical products. Many of the listed hazardous wastes that you are likely to generate are included in Appendix B of this handbook.



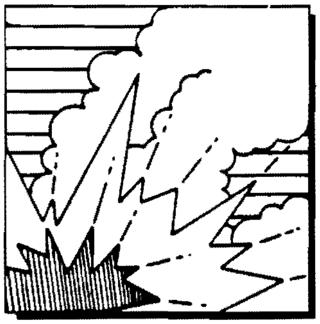
- *Characteristic wastes.* Even if a waste does not appear on one of the EPA lists, it is considered hazardous if it has one or more of the following characteristics:

It is easily combustible or flammable. This is called an ***ignitable*** waste. Examples are paint wastes, certain degreasers, or other solvents.

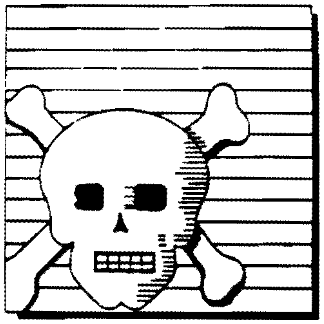


It dissolves metals, other materials, or burns the skin. This is called a ***corrosive*** waste. Examples are waste rust removers, waste acid or alkaline cleaning fluids, and waste battery acid.

It is unstable or undergoes rapid or violent chemical reaction with water or other materials. This is called a ***reactive*** waste. Examples are cyanide plating wastes, waste bleaches, and other waste oxidizers.



A waste sample is tested and shows EP (extraction procedure) toxicity. Wastes are *EP toxic* if an extract from the waste is tested and found to contain high concentrations of heavy metals (such as mercury, cadmium, or lead) or specific pesticides that could be released into the ground water.



Your industry may generate other hazardous wastes beyond the examples mentioned above. It is your **responsibility** to determine whether your wastes are hazardous. If you need assistance, call one of the sources of information listed below in Table 1. A list of the typical hazardous wastes for your industry is also provided in Table 2.

See Appendix A for a complete list of EPA regional offices and state hazardous waste management agencies.

TABLE 1

While the rules and regulations for managing hazardous waste are complex, help is available.

For more information, call:

- ▶ Your state hazardous waste management agency (See Appendix A)
- ▶ Your EPA regional office (See Appendix A)
- ▶ The RCRA/Superfund Hotline – 1-800-424-9346 (In Washington, D.C.: 382-3000)
- ▶ EPA's Small Business Ombudsman Hotline – 1-800-368-5888 (In Washington, D.C.: 557-1938)
- ▶ Your national trade association or its local chapter

Acutely Hazardous Wastes

Some wastes are considered to be "acutely hazardous." These are wastes that EPA has determined to be so dangerous in small amounts that they are regulated the same way as are large amounts of other hazardous wastes. Acutely hazardous wastes, for example, may be generated using certain pesticides. They also include dioxin-containing wastes.

Wastes that appear in Appendix B with an asterisk (*) have been designated acutely hazardous. If your business generates more than 1 kg (approximately 2.2 pounds) of acutely hazardous wastes in a calendar month or stores more than that amount for any period of time, you are subject to all of the regulations that apply to generators that generate more than 1000 kilograms of hazardous waste per calendar month. Contact one of the sources of information listed in Appendix A for more information about acutely hazardous wastes.

TABLE 2

TYPICAL WASTE STREAMS GENERATED BY SMALL QUANTITY GENERATORS*

Type of Business	Types of Hazardous Wastes Generated
Building Cleaning and Maintenance	Acids/Bases Solvents
Chemical Manufacturers	Acids/Bases Cyanide Wastes Heavy Metals/Inorganics Ignitable Wastes Reactives Solvents
Cleaning Agents and Cosmetics	Acids/Bases Heavy Metals/Inorganics Ignitable Wastes Pesticides Solvents
Construction	Acids/Bases Ignitable Wastes Solvents
Educational and Vocational Shops	Acids/Bases Ignitable Wastes Pesticides Reactives Solvents
Equipment Repair	Acids/Bases Ignitable Wastes Solvents
Formulators	Acids/Bases Cyanide Wastes Heavy Metals/Inorganics Ignitable Wastes Pesticides Reactives Solvents
Funeral Services	Solvents Formaldehyde
Furniture/Wood Manufacturing and Refinishing	Ignitable Wastes Solvents

**Additional information on typical waste streams is found in Appendix B of this handbook.*

TYPICAL WASTE STREAMS GENERATED BY SMALL QUANTITY GENERATORS*

(continued)

Type of Business	Types of Hazardous Wastes Generated
Laboratories	Acids/Bases Heavy Metals/Inorganics Ignitable Wastes Reactives Solvents
Laundries and Dry Cleaners	Dry Cleaning Filtration Residues Solvents
Metal Manufacturing	Acids/Bases Cyanide Wastes Heavy Metals/Inorganics Ignitable Wastes Reactives Solvents Spent Plating Wastes
Motor Freight Terminals and Railroad Transportation	Acids/Bases Heavy Metals/Inorganics Ignitable Wastes Lead-Acid Batteries Solvents
Other Manufacturing: 1) Textiles 2) Plastics 3) Leather	Heavy Metals/Inorganics Solvents
Pesticide End Users and Application Services	Heavy Metals/Inorganics Pesticides Solvents
Printing and Allied Industries	Acids/Bases Heavy Metals/Inorganics Ink Sludges Spent Plating Wastes Solvents
Vehicle Maintenance	Acids/Bases Heavy Metals/Inorganics Ignitable Wastes Lead-Acid Batteries Solvents
Wood Preserving	Preserving Agents

******Additional information on typical waste streams is found in Appendix B of this handbook.***

DETERMINING YOUR GENERATOR STATUS

Categories of Hazardous Waste Generators

In March 1986, the federal rules for hazardous waste management were modified to bring businesses that generate small amounts of hazardous waste into the regulatory system. Previously, these small quantity generators that generate less than 1000 kilograms (or about 2,200 pounds) of hazardous waste in a calendar month had been exempt from most hazardous waste regulations.

The 1986 rules set new requirements specifically for those generators that generate between 100 and 1000 kilograms of hazardous waste in a calendar month. Consequently, there are three categories of hazardous waste generators, shown in Table 3: (1) generators of no more than 100 kilograms/month (also known as conditionally-exempt small quantity generators); (2) 100 to 1000 kilograms/month (kg/mo) small quantity generators; and (3) generators of 1000 kilograms or more in a month.

Determining Your Generator Category

To determine which category of hazardous waste generator your business falls into—and what requirements you must meet—you must measure or "count" the hazardous wastes your business generates in a calendar month. In general, you must add up the weight of all the hazardous wastes your business generates during a month; the total weight will determine your generator category. Table 4 summarizes the kinds of wastes you must count and wastes you do not count when you determine your generator status.

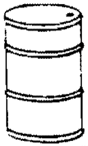
When you begin to count your hazardous wastes each month, it may be confusing at first to determine what kinds of hazardous wastes you generate and how much. If you have questions, call the EPA RCRA/Superfund Hotline or your state hazardous waste management agency listed in Appendix A.

If you decide to accumulate hazardous waste until you have collected enough to make transport to a licensed hazardous waste management facility more economical, make sure that:

- You accumulate no more than 6000 kg of hazardous waste **in any 180 day period** (270 days are allowed if you must transport your waste over 200 miles to a licensed hazardous waste facility) if you are a 100-1000 kg/mo generator. Otherwise, you will need to obtain a special storage permit.
- You accumulate no more than 1000 kg of hazardous waste **at any time** if you are a generator of no more than 100 kg/mo.

TABLE [illegible]

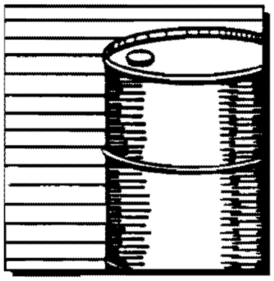
CATEGORIES OF HAZARDOUS WASTE GENERATORS

KEY:  *= 1 barrel = about 200 kilograms of hazardous waste which is about 55 gallons*

Generators of No More Than 100 kg/mo

If you generate no more than 100 kilograms (about 220 pounds or 25 gallons) of hazardous waste and no more than 1 kg (about 2 pounds) of acutely hazardous waste in any calendar month, you are a conditionally-exempt small quantity generator and the federal hazardous waste laws require you to:

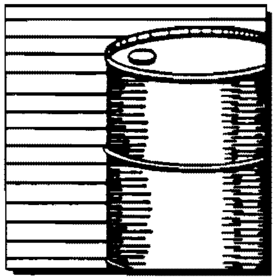
- Identify all hazardous waste you generate.
- Send this waste to a hazardous waste facility, or a landfill or other facility approved by the state for industrial or municipal wastes.
- Never accumulate more than 1000 kg of hazardous waste on your property. (If you do, you become subject to all the requirements applicable to 100-1000 kg/mo generators explained in this handbook.)

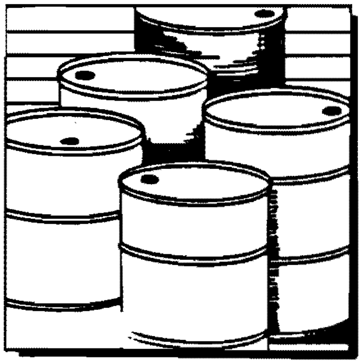


100-1000 kg/mo Generators

If you generate more than 100 and less than 1000 kg (between 220 and 2,200 pounds or about 25 to under 300 gallons) of hazardous waste and no more than 1 kg of acutely hazardous waste in any month, you are a 100-1000 kg/mo generator and the federal hazardous waste laws require you to:

- Comply with the 1986 rules for managing hazardous waste, including the accumulation, treatment, storage, and disposal requirements described in this handbook.

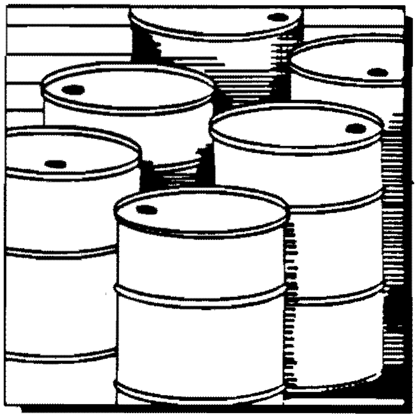




Generators of 1000 kg/mo or More

If you generate 1000 kg (about 2,200 pounds or 300 gallons) or more of hazardous waste, or more than 1 kg of acutely hazardous waste in any month, you are a generator of 1000 kg/mo or more and the federal hazardous waste laws require you to:

- Comply with *all* applicable hazardous waste management rules.



Do Count

You do count all quantities of "Listed" and "Characteristic" hazardous wastes as defined on page 2 that you:

- Accumulate on-site for any period of time prior to subsequent management.
- Package and transport off-site.
- Place directly in a regulated on-site treatment or disposal unit.
- Generate as still bottoms or sludges and remove from product storage tanks.

Don't Count

You do not have to count wastes that:

- Are specifically exempted from counting. Examples of these exempted wastes are:
  - spent lead-acid batteries that will be sent off-site for reclamation.
  - used oil that has not been mixed with hazardous waste.
- May be left in the bottom of containers that have been completely emptied through conventional means, for example, by pouring or pumping. Containers that held an acute hazardous waste must be more thoroughly cleaned.
- Are left as residue in the bottom of product storage tanks, if the residue is not removed from the product tank.
- You reclaim continuously on-site without storing the waste prior to reclamation, such as dry cleaning solvents. (You *do* have to count any residue removed from the machine as well as spent cartridge filters.)
- You manage in an elementary neutralization unit, a totally enclosed treatment unit, or a wastewater treatment unit. An elementary neutralization unit is a regulated tank, container, or transport vehicle (including ships) which is designed to contain and neutralize corrosive wastes.
- Are discharged directly to a publicly-owned treatment works (POTW) without being stored or accumulated first. This discharge to a POTW must comply with the Clean Water Act. POTWs are public utilities, usually owned by the city, county, or state, that treat industrial and domestic sewage for disposal.
- You have already counted once during the calendar month, and treated on-site or reclaimed in some manner, and used again.

CHAPTER [illegible]

OBTAINING A U.S. EPA IDENTIFICATION NUMBER

THE THREE MOST IMPORTANT THINGS YOU SHOULD KNOW ABOUT OBTAINING YOUR EPA ID NUMBER

1. *Call your state agency or EPA regional office to get a notification form.*
2. *Fill out the form and sign it.*
3. *Send the form to the hazardous waste contact listed for your state.*

If your business generates more than 100 kg of hazardous waste in any calendar month, you will need to obtain a U.S. EPA Identification Number. Transporters and facilities that store, treat, or dispose of regulated quantities of hazardous waste must also have U.S. EPA Identification Numbers. These twelve-character identification numbers used by EPA and states are part of a national data base on hazardous waste activities.

To obtain your U.S. EPA Identification Number:

▶ Call or write your state hazardous waste management agency or EPA regional office (see Appendix A) and ask for a copy of EPA Form 8700-12, "Notification of Hazardous Waste Activity." You will be sent a booklet containing the two-page form and instructions for filling it out. Figure 1 provides a sample copy of a completed notification form to show you the kind of information required. (Note: A few states use a form that is different from the form shown in Figure 1. Your state will send you the appropriate form to complete.)

▶ Fill in the form with the same kinds of information shown in the sample form in Figure 1. This information covers your "installation" (your business site) and your hazardous wastes. To complete Item X of the form, you need to identify your hazardous waste by the EPA hazardous waste number. **Appendix B** contains some common waste types generated by small quantity generators, along with their EPA hazardous waste numbers. If you do not understand the information in Appendix B, or if you cannot match your wastes with those listed, seek help from one of the sources listed in Appendix A.

▶ Complete one copy of the form for each of your plant sites or business locations where you generate or handle hazardous wastes. Each site or location will receive its own U.S. EPA Identification Number.

▶ Make sure your form is filled out completely and correctly and sign the certification in Item XI. Send the form to your state hazardous waste contact. This address is listed in the information booklet you received with the form.

This information will be recorded by EPA and the state, and you will be assigned a U.S. EPA Identification Number. This number will be unique to the site identified on your form. Use this number on all hazardous waste shipping papers.

The U.S. EPA Identification Number will stay with the business site or location. If you move your business to another location, you must notify EPA or the state of your new location and submit a new form. If hazardous waste was previously handled at the new location, and it already has a U.S. EPA Identification Number, you will be assigned that number for the site after you have notified EPA.

Changing Generator Categories

Under the federal hazardous waste management system, you may be regulated under different rules at different times, depending on the amount of hazardous waste you generate in a given month. For example, if in June, you generate 100 kg or less of hazardous waste, you would be a conditionally-exempt small quantity generator for June. If, in July, your waste totals more than 100 kg but less than 1000 kg, your status changes and your July wastes would be subject to the requirements for 100-1000 kg/mo generators. If in September you generate 1000 kg or more of hazardous waste, your September waste would be subject to all applicable hazardous waste management regulations, as would all other hazardous waste you generated in previous months and mixed with your September wastes.

If, after counting your wastes, you have determined that you never generate more than 100 kg/mo of hazardous waste, you need not read the following chapters. As a conditionally-exempt small quantity generator, you must:

- Identify your wastes as hazardous.
- Dispose of them in a hazardous waste facility, or a landfill or other facility approved by the State for industrial or municipal wastes.
- Never accumulate more than 1000 kg of hazardous waste at your facility, or you become subject to all of the requirements for 100-1000 kg/mo generators.

If, however, you do generate between 100 and 1000 kg of hazardous waste in a month, the remainder of this handbook will explain what you must do to handle your hazardous wastes safely and legally.

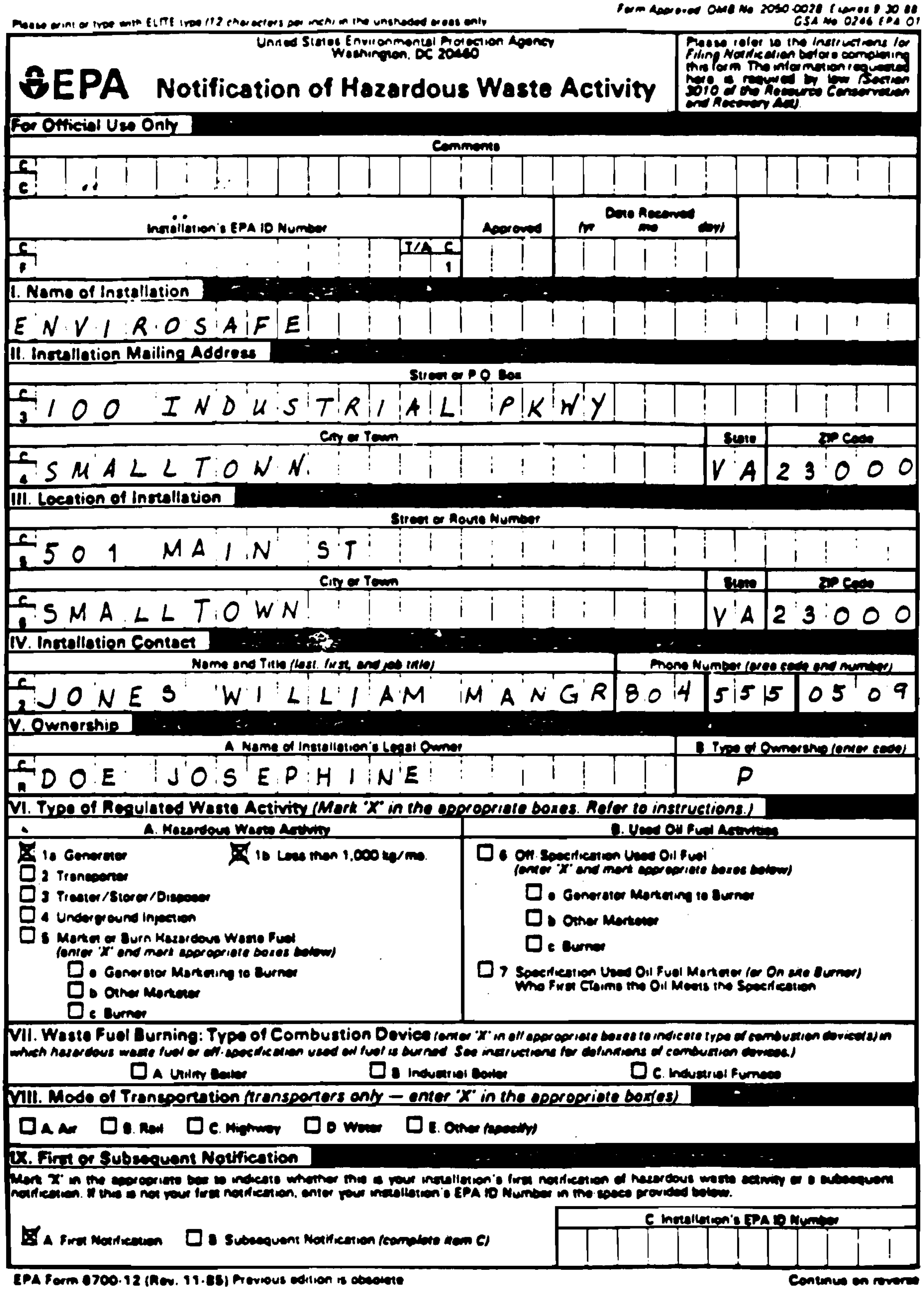
Remember, many states have different generator categories and requirements. If you have any questions about your generator status, call your state agency (See Appendix A) for assistance.

FIGURE 1

EXAMPLE 1

SAMPLE "NOTIFICATION OF HAZARDOUS WASTE ACTIVITY" FORM*

PHYSICAL STRIPPING



Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved OMB No. 2050-0028 Expires 9-30-88
GSA No. 0246-EPA-OT

United States Environmental Protection Agency
Washington, DC 20460

EPA Notification of Hazardous Waste Activity

Please refer to the Instructions for Filing Notification before completing this form. The information requested here is required by law (Section 3010 of the Resource Conservation and Recovery Act).

For Official Use Only

Comments

C

C

Installation's EPA ID Number | Approved | Date Received (yr. mo. day)

C F | T/A C 1

I. Name of Installation

ENVIROSAFE

II. Installation Mailing Address

Street or P.O. Box: 3 100 INDUSTRIAL PKWY

City or Town: 4 SMALLTOWN | State: VA | ZIP Code: 23000

YOUR COMPANY ADDRESS

III. Location of Installation

Street or Route Number: 5 501 MAIN ST

City or Town: 6 SMALLTOWN | State: VA | ZIP Code: 23000

ABATEMENT SITE ADDRESS

IV. Installation Contact

Name and Title (last, first, and job title): 2 JONES WILLIAM MANGR | Phone Number (area code and number): 804 555 0509

V. Ownership

A. Name of Installation's Legal Owner: R DOE JOSEPHINE | B. Type of Ownership (enter code): P

VI. Type of Regulated Waste Activity *(Mark 'X' in the appropriate boxes. Refer to instructions.)*

A. Hazardous Waste Activity

☒ 1a Generator ☒ 1b Less than 1,000 kg/mo.
☐ 2 Transporter
☐ 3 Treater/Storer/Disposer
☐ 4 Underground Injection
☐ 5 Market or Burn Hazardous Waste Fuel *(enter 'X' and mark appropriate boxes below)*
  - ☐ a Generator Marketing to Burner
  - ☐ b Other Marketer
  - ☐ c Burner

B. Used Oil Fuel Activities

☐ 6 Off-Specification Used Oil Fuel *(enter 'X' and mark appropriate boxes below)*
  - ☐ a Generator Marketing to Burner
  - ☐ b Other Marketer
  - ☐ c Burner

☐ 7 Specification Used Oil Fuel Marketer *(or On-site Burner)* Who First Claims the Oil Meets the Specification

VII. Waste Fuel Burning: Type of Combustion Device *(enter 'X' in all appropriate boxes to indicate type of combustion device(s) in which hazardous waste fuel or off-specification used oil fuel is burned. See instructions for definitions of combustion devices.)*

☐ A. Utility Boiler ☐ B. Industrial Boiler ☐ C. Industrial Furnace

VIII. Mode of Transportation *(transporters only — enter 'X' in the appropriate box(es))*

☐ A. Air ☐ B. Rail ☐ C. Highway ☐ D. Water ☐ E. Other *(specify)*

IX. First or Subsequent Notification

Mark 'X' in the appropriate box to indicate whether this is your installation's first notification of hazardous waste activity or a subsequent notification. If this is not your first notification, enter your installation's EPA ID Number in the space provided below.

☒ A. First Notification ☐ B. Subsequent Notification *(complete item C)*

C. Installation's EPA ID Number

EPA Form 8700-12 (Rev. 11-85) Previous edition is obsolete

Continue on reverse

**Instructions for filling out this form are provided, along with the form, by EPA. Additional information is found in Appendix B of this handbook.*

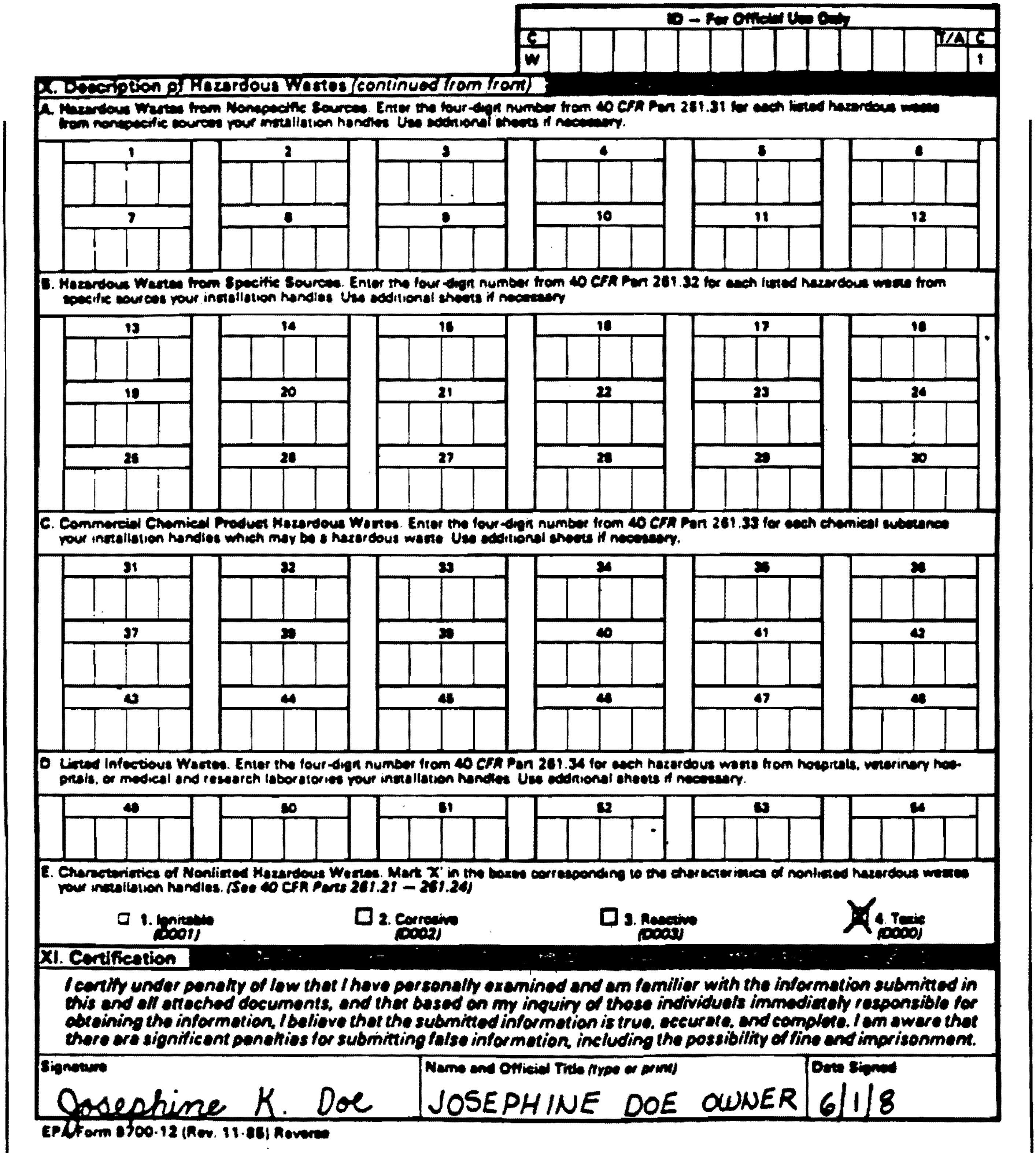
FIGURE 1

EXAMPLE 1

SAMPLE NOTIFICATION OF HAZARDOUS "WASTE ACTIVITY" FORM*

(Continued)

PHYSICAL STRIPPING



ID — For Official Use Only

C													T/A	C
W														1

X. Description of Hazardous Wastes *(continued from front)*

A. Hazardous Wastes from Nonspecific Sources. Enter the four-digit number from 40 *CFR* Part 261.31 for each listed hazardous waste from nonspecific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
7	8	9	10	11	12

B. Hazardous Wastes from Specific Sources. Enter the four-digit number from 40 *CFR* Part 261.32 for each listed hazardous waste from specific sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

C. Commercial Chemical Product Hazardous Wastes. Enter the four-digit number from 40 *CFR* Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48

D. Listed Infectious Wastes. Enter the four-digit number from 40 *CFR* Part 261.34 for each hazardous waste from hospitals, veterinary hospitals, or medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. Characteristics of Nonlisted Hazardous Wastes. Mark 'X' in the boxes corresponding to the characteristics of nonlisted hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 — 261.24)*

☐ 1. Ignitable *(D001)*   ☐ 2. Corrosive *(D002)*   ☐ 3. Reactive *(D003)*   ☒ 4. Toxic *(D000)*

XI. Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signature	Name and Official Title *(type or print)*	Date Signed
Josephine K. Doe	JOSEPHINE DOE OWNER	6/1/8

EPA Form 8700-12 (Rev. 11-85) Reverse

Instructions for filling out this form are provided, along with the form, by EPA. Additional information is found in Appendix B of this handbook.

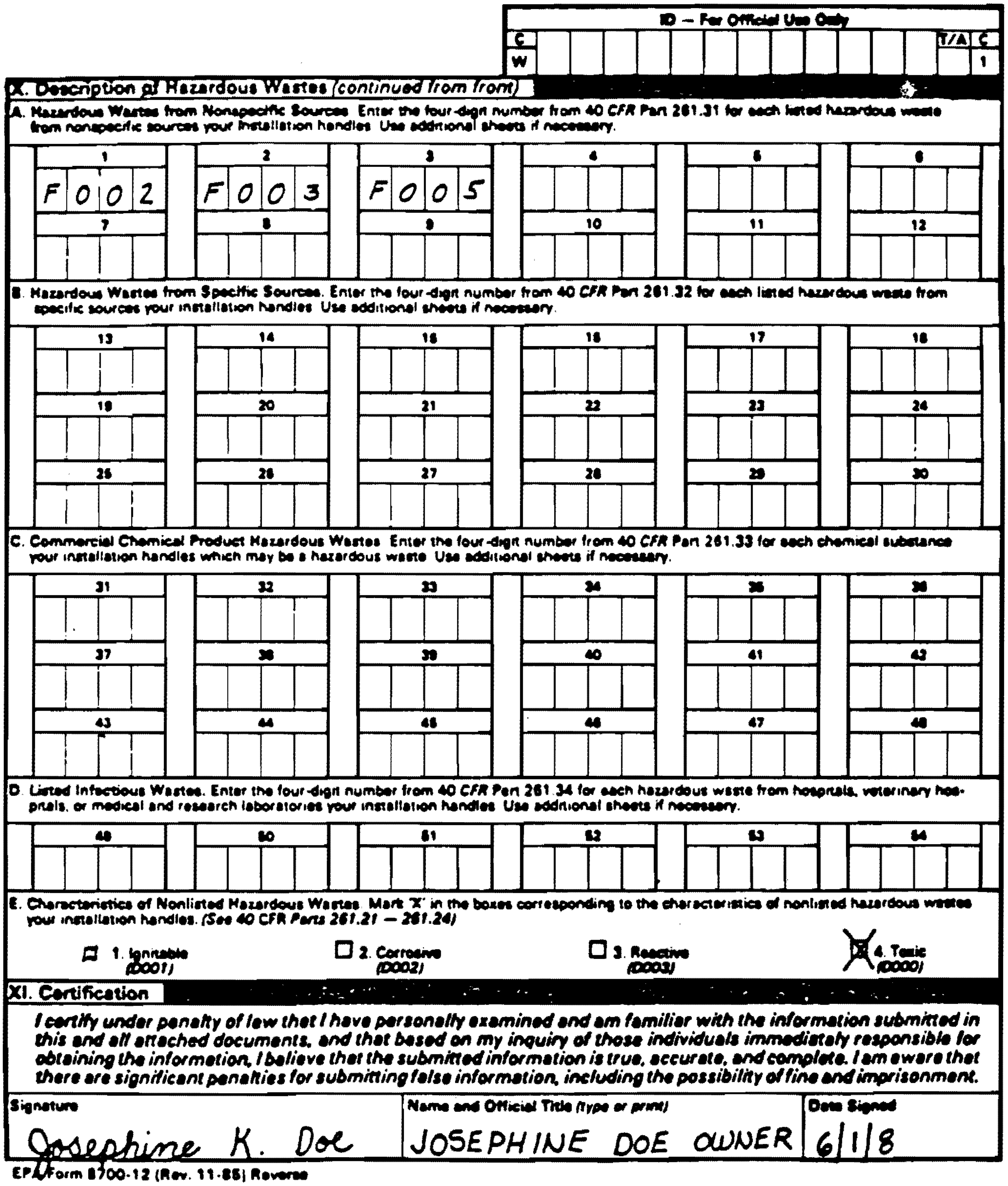
EXAMPLE 2

FIGURE 1

SAMPLE "NOTIFICATION OF HAZARDOUS WASTE ACTIVITY" FORM*

(Continued)

CHEMICAL STRIPPING –
METHYLENE CHLORIDE



ID – For Official Use Only

C W | | T/A C 1

X. Description of Hazardous Wastes *(continued from front)*

A. Hazardous Wastes from Nonspecific Sources. Enter the four-digit number from 40 *CFR* Part 261.31 for each listed hazardous waste from nonspecific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
F002	F003	F005			
7	8	9	10	11	12

B. Hazardous Wastes from Specific Sources. Enter the four-digit number from 40 *CFR* Part 261.32 for each listed hazardous waste from specific sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

C. Commercial Chemical Product Hazardous Wastes. Enter the four-digit number from 40 *CFR* Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48

D. Listed Infectious Wastes. Enter the four-digit number from 40 *CFR* Part 261.34 for each hazardous waste from hospitals, veterinary hospitals, or medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. Characteristics of Nonlisted Hazardous Wastes. Mark "X" in the boxes corresponding to the characteristics of nonlisted hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 — 261.24)*

☐ 1. Ignitable *(D001)* ☐ 2. Corrosive *(D002)* ☐ 3. Reactive *(D003)* ☒ 4. Toxic *(D000)*

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Signature	**Name and Official Title** *(type or print)*	**Date Signed**
Josephine K. Doe	JOSEPHINE DOE OWNER	6/1/8

EPA Form 8700-12 (Rev. 11-85) Reverse

**Instructions for filling out this form are provided, along with the form, by EPA. Additional information is found in Appendix B of this handbook.*

EXAMPLE 3

FIGURE 1

SAMPLE "NOTIFICATION OF HAZARDOUS WASTE ACTIVITY" FORM*

(Continued)

CHEMICAL STRIPPING - CAUSTIC

ID — For Official Use Only														
C													T/A	C
W														1

X. Description of Hazardous Wastes *(continued from front)*

A. Hazardous Wastes from Nonspecific Sources. Enter the four-digit number from 40 *CFR* Part 261.31 for each listed hazardous waste from nonspecific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
7	8	9	10	11	12

B. Hazardous Wastes from Specific Sources. Enter the four-digit number from 40 *CFR* Part 261.32 for each listed hazardous waste from specific sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

C. Commercial Chemical Product Hazardous Wastes. Enter the four-digit number from 40 *CFR* Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48

D. Listed Infectious Wastes. Enter the four-digit number from 40 *CFR* Part 261.34 for each hazardous waste from hospitals, veterinary hospitals, or medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. Characteristics of Nonlisted Hazardous Wastes. Mark 'X' in the boxes corresponding to the characteristics of nonlisted hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 — 261.24)*

☐ 1. Ignitable *(D001)*
☒ 2. Corrosive *(D002)*
☐ 3. Reactive *(D003)*
☒ 4. Toxic *(D000)*

XI. Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signature	**Name and Official Title** *(type or print)*	**Date Signed**
Josephine K. Doe	JOSEPHINE DOE OWNER	6/1/8

EPA Form 8700-12 (Rev. 11-85) Reverse

******Instructions for filling out this form are provided, along with the form, by EPA. Additional information is found in Appendix B of this handbook.*

THE THREE MOST IMPORTANT THINGS YOU SHOULD KNOW ABOUT MANAGING YOUR HAZARDOUS WASTES ON-SITE

1. Comply with storage time, quantity, and handling requirements for containers and tanks.

2. Obtain a storage, treatment, or disposal permit if you store, treat, or dispose of your hazardous waste on-site in a manner requiring a permit.

3. Take adequate precautions to prevent accidents, and be prepared to handle them properly in the event that they do occur.

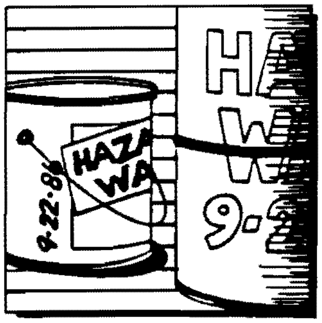
Storing Hazardous Waste On-Site

You may store no more than 6000 kg of hazardous waste on your site for up to 180 days, or for up to 270 days if the waste must be shipped to a treatment, storage, or disposal facility that is located over 200 miles away. If you exceed these time or quantity limits, you will be considered a storage facility and you must obtain a storage permit (see below) and meet all of the RCRA storage requirements. These time limits on storage are longer than the 90 days allowed generators of 1000 kg/mo or more. You are allowed to store your waste for as long as 180 or 270 days so that you will have time to accumulate enough hazardous waste to ship it off-site for treatment or disposal economically.

You can store hazardous waste in 55-gallon drums, tanks, or other containers suitable for the type of waste generated if you follow certain common sense rules that are meant to protect human health and the environment, and reduce the likelihood of damages or injuries caused by leaks or spills of hazardous wastes.

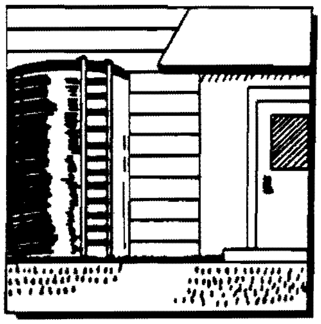
If you store your hazardous waste in ***containers***, you must:

- Clearly mark each container with the words "HAZARDOUS WASTE," and with the date you began to collect waste in that container.
- Keep containers in good condition, handle them carefully, and replace any leaking ones.
- Not store hazardous waste in a container if it may cause rupture, leaks, corrosion, or other failure.
- Keep containers closed except when you fill or empty them.
- Inspect the container for leaks or corrosion every week.
- Make sure that if you are storing ignitable or reactive wastes, containers are placed as far as possible from your facility property line to create a buffer zone.
- NEVER store wastes in the same container that could react together to cause fires, leaks, or other releases.
- Make sure that the stored waste is taken off-site or treated on-site within 180 (or 270) days.



If you store your waste in ***tanks***, you must follow similar common sense rules:

- Do not store hazardous waste in a tank if it may cause rupture, leaks, corrosion, or otherwise cause the tank to fail.



- Keep a tank covered or provide at least two feet of freeboard (space at the top of the tank) in uncovered tanks.
- If your tanks have equipment that allow the waste to flow into them continuously, provide waste feed cutoff or bypass systems to stop the flow in case of problems.
- Inspect any monitoring or gauging systems on each operating day and inspect the tanks themselves for leaks or corrosion every week.
- Use the National Fire Protection Association's (NFPA) buffer zone requirements for tanks containing ignitable or reactive wastes. These requirements specify distances considered as safe buffer zones for various liquids based on the characteristics of all combustible and flammable liquids. Call your local fire department or EPA regional office (see Appendix A) if you need help.
- Make sure that the stored waste is taken off-site or treated on-site within 180 (or 270) days.

Treating Hazardous Waste On-Site

You may treat your hazardous wastes on your site without a special permit providing:

- You treat the accumulated hazardous waste within 180 (or 270) days.
- You comply with the container and tank regulations described above.
- You take steps to prepare for and prevent accidents as described below.

If you do not meet each of these requirements and you treat your hazardous wastes on your site, you must obtain a hazardous waste treatment permit as described below.

Disposing of Hazardous Waste On-Site

You may not dispose of your hazardous waste on your site unless you have obtained a disposal permit as described below. Under certain circumstances, it may be legal to dispose of certain types of hazardous waste on your site without a permit: Farmers may dispose of their own waste pesticide provided they triple rinse the empty pesticide container and dispose of the pesticide residue on their own farm in a manner consistent with the instructions on the pesticide label. Even if you are not a farmer, you may be allowed to dispose of certain hazardous wastes by discharging them directly into your sewer drain. However, this is not considered good management practice and in many communities it may be illegal. For more information concerning wastes which may be disposed of in this manner, contact your local wastewater or sewage treatment office or your state hazardous waste management agency (see Appendix A).

Obtaining a Permit to Store, Treat, or Dispose of Hazardous Waste On-Site

If you store, treat, or dispose of your hazardous waste on-site in any manner other than those permissible ones described above, you must obtain a permit. Obtaining a permit to store, treat, or dispose of your hazardous wastes on your site can be a costly and time consuming process. The process is described in Title 40 of the Code of Federal Regulations (40 CFR) Part 270. To obtain such a permit you must:

- Notify EPA or your state of your hazardous waste activity.
- Complete Part A of the permit application.
- Comply with the interim status standards as described in 40 CFR Part 265.
- Complete Part B of the permit application.
- Comply with the standards described in 40 CFR Parts 264 and 266.

If you are not sure whether you need such a permit, or if you are interested in finding out more about it, call your state hazardous waste management agency or EPA regional office (see Appendix A) for help.

Preparing for and Preventing Accidents

Whenever you generate hazardous waste and store it on-site, you must take the precautions and steps necessary to prevent any sudden or accidental release to the environment. This means that you must carefully operate and maintain your facility to reduce the possibility of fire, explosion, or release of hazardous waste.

Your facility must have appropriate types of emergency communication and fire equipment for the kinds of waste handled at your site. You must also attempt to make arrangements with local fire, police, or hospital officials as needed to ensure that they will be able to respond to any potential emergencies that could arise. Some of the steps you may need to take to prepare for emergencies at your facility include:

- Installing and maintaining emergency equipment such as an alarm, a telephone or a two-way portable radio, fire extinguishers (using water, foam, inert gas, or dry chemicals as appropriate to your waste type), hoses, automatic sprinklers, or spray equipment in your plant so that it is immediately available to your employees if there is an emergency.
- Providing enough room for emergency equipment and response teams to get into any area in your facility in the event of an emergency.
- Writing to local fire, police, and hospital officials or state or local emergency response teams explaining the types of wastes you handle and asking for their cooperation and assistance in handling emergency situations.

Planning for Emergencies

A contingency plan is a plan that attempts to look ahead and prepare for any accidents that could possibly occur. It can be thought of as a set of answers to a series of "what if" questions. For example: "*What if* there is a fire in the area where hazardous waste is stored?" or "*What if* I have a spill of hazardous waste or one of my containers leaks?" Emergency procedures are the steps you should follow if you have an emergency, that is, if one of the "contingencies" or "what ifs" occurs. While a specific written contingency plan is not required, it may be a good idea to make a list of these questions and answer them on paper. This also may be helpful in informing your employees about their responsibilities in the event of an emergency.

If you have an emergency in your plant:

1. In the event of a **fire**, call the fire department or attempt to extinguish it using the appropriate type of fire extinguisher.
2. In the event of a **spill**, contain the flow of hazardous waste to the extent possible and notify the National Response Center. The Center operates a 24-hour toll free number: 800-424-8802, or in Washington, D.C.: 426-2675. As soon as possible, clean up the hazardous waste and any contaminated materials or soil.
3. In the event of a **fire, explosion, or other release**, immediately notify the National Response Center as required by Superfund regulations. (Superfund is the law that deals with the cleanup of spills and leaks of hazardous waste at abandoned hazardous waste sites.)

Emergency phone numbers and locations of emergency equipment must be posted near telephones and all employees must know proper waste handling and emergency procedures. You must appoint an employee to act as **emergency coordinator** to ensure that emergency procedures are carried out in the event an emergency arises. The responsibilities of the emergency coordinator are generally that he/she be available 24 hours a day (at the facility or by phone) and know whom to contact and what steps to follow in an emergency. For most small businesses, the owner or operator may already perform these functions. Thus, it is not intended nor is it likely that you will need to hire a new employee to fill this role.

It is important to avoid potential risks in this area. If you have a serious emergency and you have to call your local fire department or you have a spill that extends outside your plant or that could reach surface waters, **IMMEDIATELY CALL THE NATIONAL RESPONSE CENTER (800-424-8802) AND GIVE THEM THE INFORMATION THEY ASK FOR.** If you didn't need to call, they will tell you so. **BUT ANYONE WHO WAS SUPPOSED TO CALL AND DOES NOT IS SUBJECT TO A $10,000 FINE, A YEAR IN JAIL, OR BOTH.** An owner or manager of a business who fails to report a release also may have to pay for the entire cost of repairing any damage, even if the facility was not the single or the main cause of the damage.

CHAPTER [illegible]

SHIPPING HAZARDOUS WASTE OFF-SITE

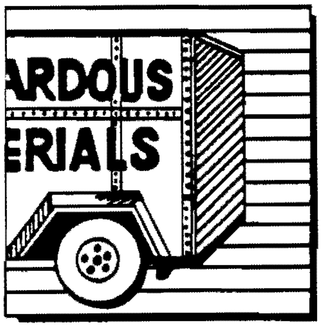
THE THREE MOST IMPORTANT THINGS YOU SHOULD REMEMBER ABOUT SHIPPING YOUR HAZARDOUS WASTE OFF-SITE

1. *Choose a hauler and facility which have EPA identification numbers.*
2. *Package and label your wastes for shipping.*
3. *Prepare a hazardous waste manifest.*

Under federal regulations, if you are a 100-1000 kg/mo generator, you are allowed to accumulate your hazardous wastes on your premises without a permit for up to 180 days (or 270 days if you must ship it more than 200 miles) as long as you never accumulate more than 6000 kilograms. These limits are set so that a small business can accumulate enough waste to make shipping and disposal more economical.

Choosing a Hazardous Waste Hauler and Designated Waste Management Facility

Carefully choosing a hauler and designating a waste management facility is important. The hauler will be handling your wastes beyond your control while you are still responsible for their proper management. Similarly, the waste management facility will be the final destination of your hazardous waste for treatment, storage, or disposal. Before choosing a hauler or designating a facility, check with the following sources:



- Your friends and colleagues in business who may have used a specific hazardous waste hauler or designated facility in the past.
- Your trade association(s) which may keep a file on companies that handle hazardous wastes.
- Your Better Business Bureau or Chamber of Commerce to find out if any complaints have been registered against a hauler or facility.
- Your state hazardous waste management agency or EPA regional office, which will be able to tell you whether or not a company has a U.S. EPA Identification Number, and may know whether or not the company has had any problems.

After checking these sources, contact the hauler and designated hazardous waste management facility directly to verify that they have U.S. EPA Identification Numbers, and that they can and will handle your waste. Also make sure that they have the necessary permits and insurance, and that the hauler's vehicles are in good condition. Checking sources and choosing a hauler and designated facility may take some time—try to begin checking well ahead of the time you will need to ship your waste. Careful selection is very important.

Preparing Your Hazardous Wastes for Shipment

When you prepare hazardous wastes for shipment, you must put the wastes in containers acceptable for transportation and make sure the containers are properly labeled. Your hauler should be able to assist you. If you need additional information, you may wish to consult the requirements for packaging and labeling hazardous wastes found in the Department of Transportation (DOT) regulations (49 CFR Part 172). To find out what these requirements are for your wastes, you should contact your state hazardous waste management agency for the name and telephone number of your state transportation agency. Your state transportation agency, your hauler, or your designated facility can help you understand the DOT requirements.

The Uniform Hazardous Waste Manifest

A hazardous waste manifest is a multicopy shipping document that you must fill out and use to accompany your hazardous waste shipments.[1]

The manifest form is designed so that shipments of hazardous waste can be tracked from their point of generation to their final destination—the so-called "cradle-to-grave" system. The hazardous waste generator, the hauler, and the designated facility must each sign this document and keep a copy. The designated facility operator also must send a copy back to you, so that you can be sure that your shipment arrived. You must keep this copy, which will be signed by the hauler and designated facility, on file for three years.

If you do not receive a signed copy from the designated hazardous waste management facility within 30 days, it is a good idea for you to find out why and, if necessary, let the state or EPA know. **REMEMBER:** Just because you have shipped the hazardous waste off your site and it is no longer in your possession, your liability has not ended. You are potentially liable under Superfund for any mismanagement of your hazardous waste. The manifest will help you to track your waste during shipment and make sure it arrives at the proper destination.

You can obtain blank copies of the manifest from several sources. To determine which source you should use, use this system:

1. If the state to which you are shipping your waste has its own manifest, use that manifest form. Contact the hazardous waste management agency of that state (see Appendix A), your hauler, or the designated facility you intend to use for manifest forms.
2. If the state to which you are shipping your waste does not have its own manifest, use the manifest of the state in which your waste was generated. Contact your hauler or your state hazardous waste agency for blank forms.
3. If neither state requires a state-specific manifest, you may use the "general" Uniform Hazardous Waste Manifest—EPA Form 8700-22. Copies are available from some haulers and designated hazardous waste management facilities, or may be purchased from some commercial printers.

A sample copy of a hazardous waste manifest has been filled out for you in Figure 2. When you sign the certification in ITEM 16 you are personally confirming that:

- The manifest is complete and accurately describes the shipment.
- The shipment is ready for transport.
- You have considered whether, given your budget, your waste management arrangements are the best to reduce the amount and hazardous nature of your wastes.

States, haulers, recyclers, and designated facilities may require additional information; check with them before you prepare a hazardous waste shipment. Your hazardous waste hauler often will be the best source for packaging and shipping information and will help in completing the manifest. EPA has also prepared some industry-specific information to help you in completing the manifest. This industry-specific information is available from EPA Regional Offices and a number of trade associations. If you have any trouble obtaining, filling out, or using the manifest, ask your hauler, your designated facility operator, or one of the contacts listed in Appendix A for help.

Federal regulations allow you to haul your hazardous waste to a designated facility yourself. You must, however, obtain an EPA transporter identification number and comply with applicable DOT requirements for packaging, labeling, mark-

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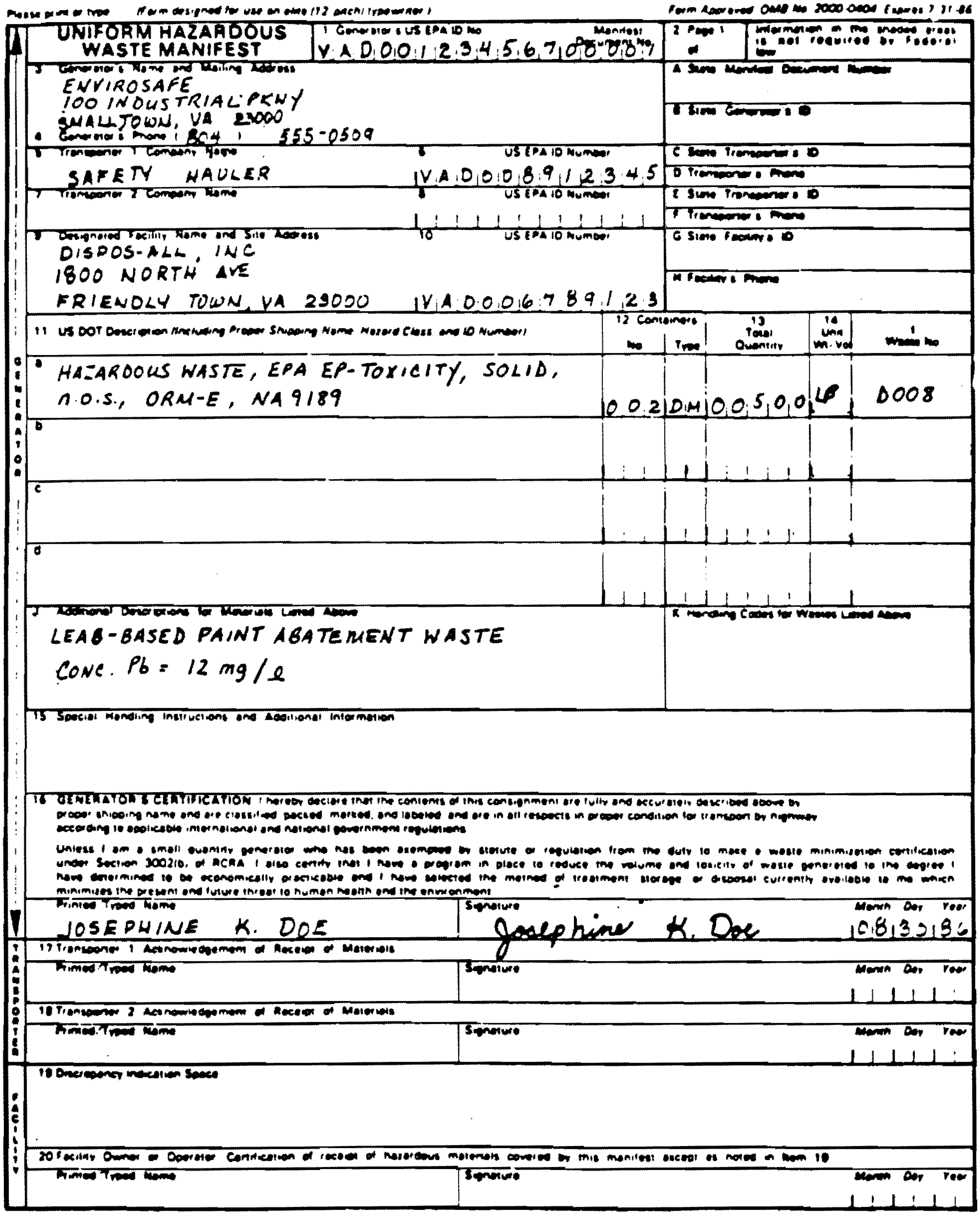
[1] There is an exception to this requirement. You may be able to use a contract recycling agreement instead of a manifest. For more information about this, contact one of the information sources identified in Appendix A.

EXAMPLE 1

FIGURE 2

SAMPLE "UNIFORM HAZARDOUS WASTE MANIFEST" FORM*

PHYSICAL STRIPPING
PAINT CHIPS, DUST



Please print or type (Form designed for use on elite (12 pitch) typewriter.)

Form Approved OMB No. 2000-0404 Expires 7-31-86

UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No. VAD001234567 Manifest Document No. 00007

2 Page 1 of

Information in the shaded areas is not required by Federal law.

3 Generator's Name and Mailing Address
ENVIROSAFE
100 INDUSTRIAL PKWY
SMALLTOWN, VA 23000

4 Generator's Phone (804) 555-0509

A State Manifest Document Number

B State Generator's ID

5 Transporter 1 Company Name SAFETY HAULER

6 US EPA ID Number VAD000891234 5

C State Transporter's ID

D Transporter's Phone

7 Transporter 2 Company Name

8 US EPA ID Number

E State Transporter's ID

F Transporter's Phone

9 Designated Facility Name and Site Address
DISPOS-ALL, INC
1800 NORTH AVE
FRIENDLY TOWN, VA 23000

10 US EPA ID Number VAD000678912 3

G State Facility's ID

H Facility's Phone

11 US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12 Containers No.	12 Containers Type	13 Total Quantity	14 Unit Wt/Vol	I Waste No.
a HAZARDOUS WASTE, EPA EP-TOXICITY, SOLID, n.o.s., ORM-E, NA9189	002	DM	00500	LB	D008
b					
c					
d					

J Additional Descriptions for Materials Listed Above
LEAB-BASED PAINT ABATEMENT WASTE
Conc. Pb = 12 mg/l

K Handling Codes for Wastes Listed Above

15 Special Handling Instructions and Additional Information

16 **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

Unless I am a small quantity generator who has been exempted by statute or regulation from the duty to make a waste minimization certification under Section 3002(b) of RCRA, I also certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and I have selected the method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment.

Printed/Typed Name	Signature	Month Day Year
JOSEPHINE K. DOE	Josephine K. Doe	08 30 86

17 Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
		←

18 Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

19 Discrepancy Indication Space

20 Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month Day Year
		←

GENERATOR
TRANSPORTER
FACILITY

EPA Form 8700-22 (Rev. 4-85) Previous edition is obsolete.

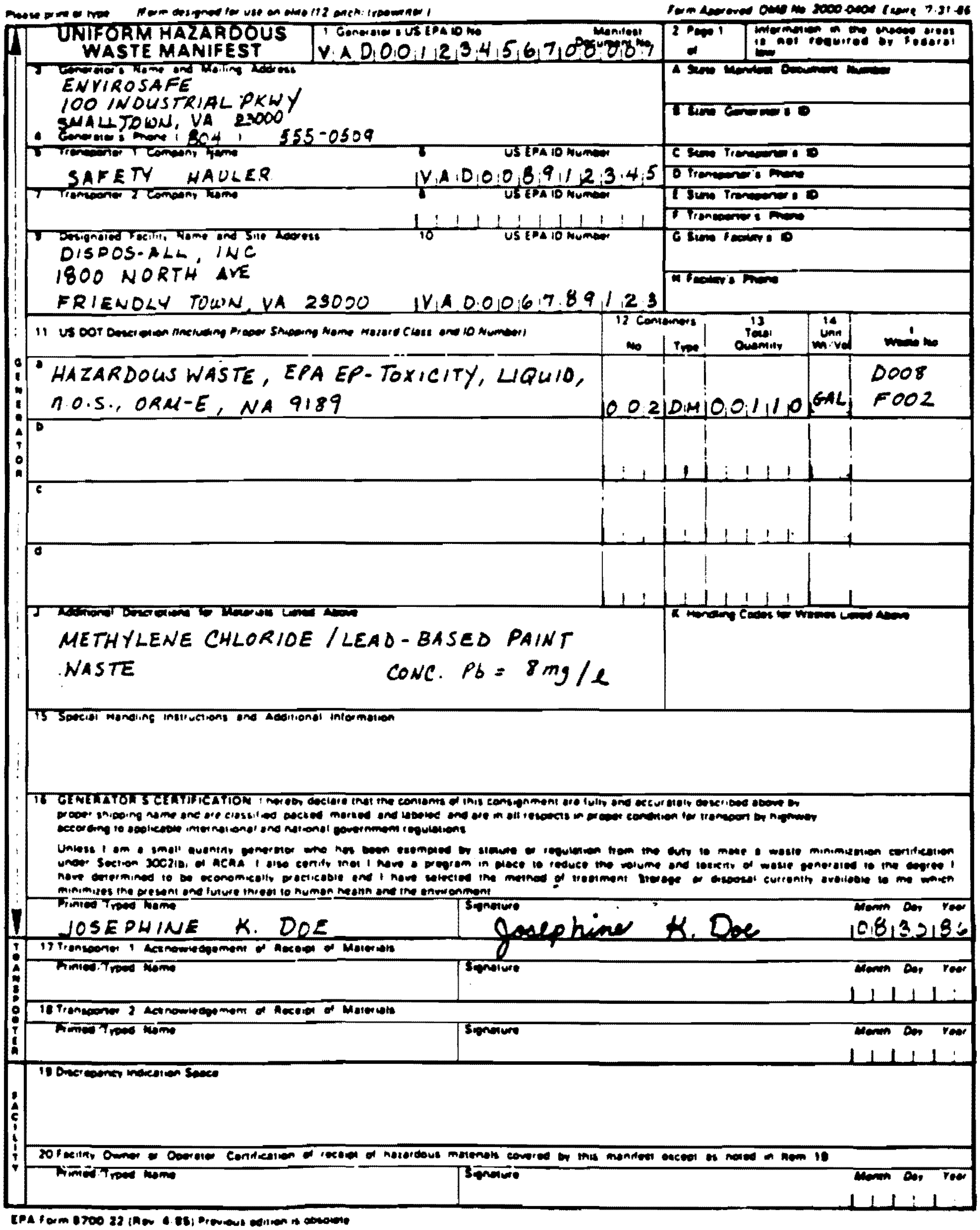
Information in the shaded areas is not required by Federal law, but this or other additional information may be required by your state.

EXAMPLE 2

FIGURE 2

SAMPLE "UNIFORM HAZARDOUS WASTE MANIFEST" FORM*

CHEMICAL STRIPPING
METHYLENE CHLORIDE



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UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No: V A D 0 0 1 2 3 4 5 6 7
Manifest Document No: 0 0 0 0 7
2 Page 1 of
Information in the shaded areas is not required by Federal law

3 Generator's Name and Mailing Address:
ENVIROSAFE
100 INDUSTRIAL PKWY
SMALLTOWN, VA 23000

4 Generator's Phone (804) 555-0509

5 Transporter 1 Company Name: SAFETY HAULER
6 US EPA ID Number: V A D 0 0 8 9 1 2 3 4 5

7 Transporter 2 Company Name:
8 US EPA ID Number:

9 Designated Facility Name and Site Address:
DISPOS-ALL, INC
1800 NORTH AVE
FRIENDLY TOWN, VA 23000

10 US EPA ID Number: V A D 0 0 0 6 7 8 9 1 2 3

A State Manifest Document Number
B State Generator's ID
C State Transporter's ID
D Transporter's Phone
E State Transporter's ID
F Transporter's Phone
G State Facility's ID
H Facility's Phone

11 US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12 Containers No	12 Containers Type	13 Total Quantity	14 Unit Wt/Vol	I Waste No
a HAZARDOUS WASTE, EPA EP-TOXICITY, LIQUID, n.o.s., ORM-E, NA 9189	002	DM	00110	GAL	D008 F002
b					
c					
d					

J Additional Descriptions for Materials Listed Above:
METHYLENE CHLORIDE / LEAD-BASED PAINT WASTE
CONC. Pb = 8 mg/l

K Handling Codes for Wastes Listed Above

15 Special Handling Instructions and Additional Information

16 GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

Unless I am a small quantity generator who has been exempted by statute or regulation from the duty to make a waste minimization certification under Section 3002(b) of RCRA, I also certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and I have selected the method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment.

Printed/Typed Name: JOSEPHINE K. DOE
Signature: Josephine K. Doe
Month Day Year: 08 32 86

17 Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year: ←

18 Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year:

19 Discrepancy Indication Space

20 Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19
Printed/Typed Name:
Signature:
Month Day Year: ←

GENERATOR
TRANSPORTER
FACILITY

EPA Form 8700-22 (Rev. 4-85) Previous edition is obsolete

*Information in the shaded areas is not required by Federal law, but this or other additional information may be required by your state.

EXAMPLE 3

FIGURE 2

SAMPLE "UNIFORM HAZARDOUS WASTE MANIFEST" FORM*

CHEMICAL STRIPPING
CAUSTIC

Please print or type (Form designed for use on elite (12 pitch) typewriter.)

Form Approved OMB No 2000-0404 Expires 7-31-86

UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No: VAD001234567

Manifest Document No: 00001

2 Page 1 of

Information in the shaded areas is not required by Federal law

3 Generator's Name and Mailing Address
ENVIROSAFE
100 INDUSTRIAL PKWY
SMALLTOWN, VA 23000

4 Generator's Phone (804) 555-0509

A State Manifest Document Number

B State Generator's ID

5 Transporter 1 Company Name: SAFETY HAULER

6 US EPA ID Number: VAD008912345

C State Transporter's ID

D Transporter's Phone

7 Transporter 2 Company Name

8 US EPA ID Number

E State Transporter's ID

F Transporter's Phone

9 Designated Facility Name and Site Address
DISPOS-ALL, INC
1800 NORTH AVE
FRIENDLY TOWN, VA 23000

10 US EPA ID Number: VAD006789123

G State Facility's ID

H Facility's Phone

11 US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12 Containers No	12 Containers Type	13 Total Quantity	14 Unit Wt/Vol	I Waste No
a HAZARDOUS WASTE, EPA CORROSIVITY, LIQUID, n.o.s., ORM-E, NA 9189	002	DM	00110	GAL	D002 D008
b					
c					
d					

J Additional Descriptions for Materials Listed Above
SODIUM HYDROXIDE / LEAD-BASED PAINT WASTE
pH = 13.0 CONC. Pb = 8 mg/l

K Handling Codes for Wastes Listed Above

15 Special Handling Instructions and Additional Information

16 **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

Unless I am a small quantity generator who has been exempted by statute or regulation from the duty to make a waste minimization certification under Section 3002(b) of RCRA, I also certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and I have selected the method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment.

Printed/Typed Name	Signature	Month Day Year
JOSEPHINE K. DOE	Josephine K. Doe	08 30 86

17 Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

18 Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

19 Discrepancy Indication Space

20 Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name	Signature	Month Day Year

EPA Form 8700-22 (Rev. 4-85) Previous edition is obsolete.

Information in the shaded areas is not required by Federal law, but this or other additional information may be required by your state.

ing, and placarding your shipment. There are also financial responsibility and liability requirements under the Federal Motor Carrier Act, but you may be exempt from these if you:

1. Use a vehicle with a Gross Vehicle Weight Rating of less than 10,000 pounds (van or pick-up truck).
2. Transport your wastes for commerce within your state in non-bulk shipments (i.e. containers with capacities of less than 3,500 gallons).
3. Transport hazardous wastes which meet the "limited quantity exclusion" requirements of Section 172.101 of the DOT regulations.

If you decide to transport your own hazardous wastes, call your state hazardous waste management agency (See Appendix A) to find out what state regulations apply to you. Not all states will allow you to transport your own hazardous wastes. You should also note that if you have an accident during transport, you are responsible for the clean-up.

"GOOD HOUSEKEEPING" AND A SAFE ENVIRONMENT

THE FOUR MOST IMPORTANT THINGS YOU SHOULD REMEMBER ABOUT MANAGING YOUR WASTES PROPERLY

1. *Reduce the amount of your hazardous waste.*
2. *Conduct your own self-inspection.*
3. *Cooperate with state and local inspectors.*
4. *Call your state hazardous waste management agency or the U.S. EPA with your questions.*

Good hazardous waste management can be thought of simply as using "good housekeeping" practices such as: using and reusing materials as much as possible; recycling or reclaiming waste; treating waste to reduce its hazards; or reducing the amount of waste you generate. To reduce the amount of waste you generate:

- ▶ Do not mix nonhazardous wastes with hazardous ones. For example, do not put nonhazardous cleaning agents or rags in the same container as a hazardous solvent or the entire contents becomes subject to the hazardous waste regulations.
- ▶ Avoid mixing several different hazardous wastes. Doing so may make recycling very difficult, if not impossible, or make disposal more expensive.
- ▶ Avoid spills or leaks of hazardous products. (The materials used to clean up such spills or leaks also will become hazardous.)
- ▶ Make sure the original containers of hazardous products are completely empty before you throw them away. Use **ALL** the product.
- ▶ Avoid using more of a hazardous product than you need. For example, use no more degreasing solvent or pesticide than you need to do the job. Also, do not throw away a container with unused solvent or pesticide in it.

Reducing your hazardous waste means saving money on raw materials and reducing the costs to your business for managing and disposing of your hazardous wastes.

Another aspect of "good housekeeping" is cooperating with inspection agencies and using a visit by an inspector as an opportunity to identify and correct problems. Accompanying state or local inspectors on a tour of your facility will enable you to ask any questions you may have and receive advice on more effective ways of handling your hazardous products and wastes. In addition, guiding the inspectors through your property and explaining your operations may help them to be more sensitive to the particular problems or needs of your business. Inspectors can also serve as a valuable source of information on recordkeeping, manifests, and safety requirements specific to your facility.

The best way to prepare for a visit from an inspector is to conduct your own self-inspection. This handbook can serve as a basic guide to developing a self-inspection checklist. Make sure you can answer correctly the following questions, and make sure you have met the requirements described in the handbook:

- ☑ Do you have some documentation on the AMOUNTS and KINDS of hazardous waste you generate and on how you determined that they are hazardous?
- ☑ Do you have a U.S. EPA IDENTIFICATION NUMBER?
- ☑ Do you SHIP waste OFF-SITE? If so, by which HAULER and to which DESIGNATED HAZARDOUS WASTE MANAGEMENT FACILITY?
- ☑ Do you have copies of MANIFESTS used to ship your hazardous waste off-site? Are they filled out correctly? Have they been signed by the designated facility?

☑ Is your hazardous waste stored in the PROPER CONTAINERS?

☑ Are the containers properly DATED and MARKED?

☑ Have you designated an EMERGENCY COORDINATOR?

☑ Have you posted EMERGENCY TELEPHONE NUMBERS and the location of EMERGENCY EQUIPMENT?

☑ Are your EMPLOYEES thoroughly FAMILIAR with proper waste handling and emergency procedures?

☑ Do you understand when you may need to contact the NATIONAL RESPONSE CENTER?

Remember: If you are still uncertain about how to handle your hazardous waste, or have any questions concerning the rules for 100-1000 kg/mo generators, there are several sources listed in Appendix A that you can contact for answers. Taking responsibility for proper handling of hazardous waste will not only ensure a safer environment and workplace for everyone, but will save your business money. So write or call your state hazardous waste management agency or the U.S. EPA with your questions today.

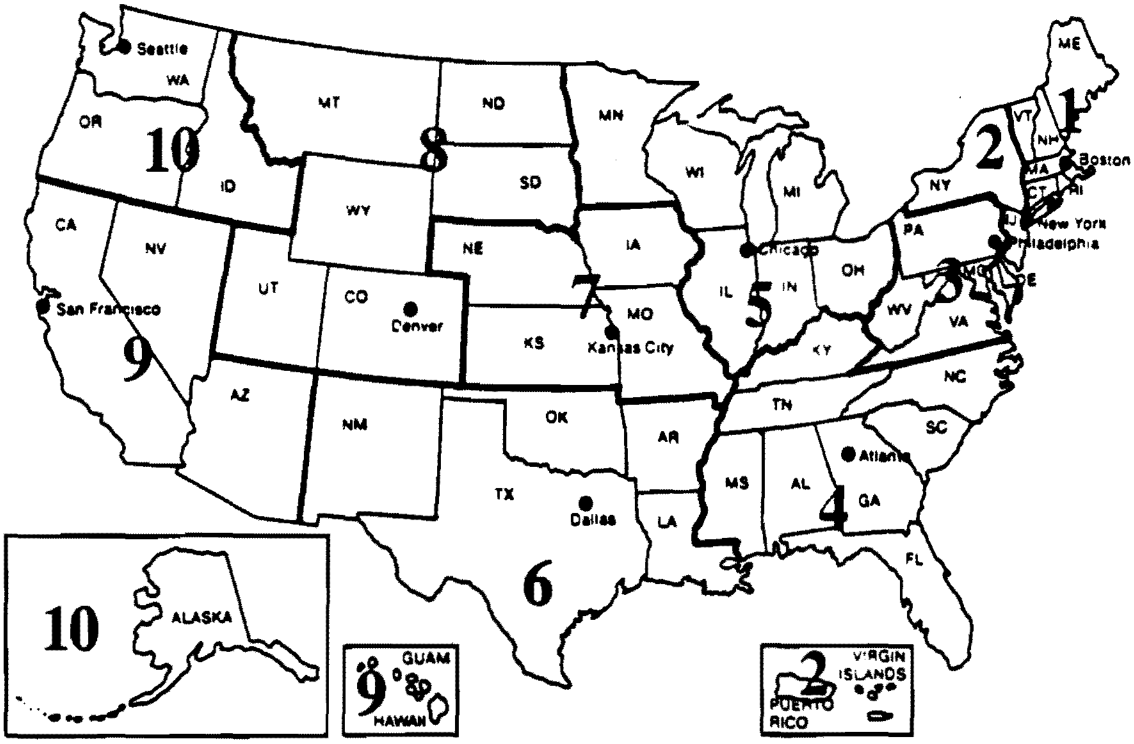
APPENDIX A

EPA AND STATE HAZARDOUS WASTE CONTACTS FOR ASSISTANCE

RCRA/Superfund Hotline
1-800-424-9346
(In Washington, D.C.: 382-3000)

EPA Small Business Ombudsman
Hotline 1-800-368-5888
(In Washington, D.C.: 557-1938)

National Response Center
1-800-424-8802
(In Washington, D.C.: 426-2675)



Regions

4 — Alabama
10 — Alaska
9 — Arizona
6 — Arkansas
9 — California
8 — Colorado
1 — Connecticut
3 — Delaware
3 — D.C.
4 — Florida
4 — Georgia
9 — Hawaii
10 — Idaho
5 — Illinois

Regions

5 — Indiana
7 — Iowa
7 — Kansas
4 — Kentucky
6 — Louisiana
1 — Maine
3 — Maryland
1 — Massachusetts
5 — Michigan
5 — Minnesota
4 — Mississippi
7 — Missouri
8 — Montana
7 — Nebraska

Regions

9 — Nevada
1 — New Hampshire
2 — New Jersey
6 — New Mexico
2 — New York
4 — North Carolina
8 — North Dakota
5 — Ohio
6 — Oklahoma
10 — Oregon
3 — Pennsylvania
1 — Rhode Island
4 — South Carolina
8 — South Dakota

Regions

4 — Tennessee
6 — Texas
8 — Utah
1 — Vermont
3 — Virginia
10 — Washington
3 — West Virginia
5 — Wisconsin
8 — Wyoming
9 — American Samoa
9 — Guam
2 — Puerto Rico
2 — Virgin Islands

APPENDIX A

U.S. EPA REGIONAL OFFICES

EPA Region I
State Waste Programs Branch
JFK Federal Building
Boston, Massachusetts 02203
(617) 223-3468

Connecticut, Massachusetts, Maine,
New Hampshire, Rhode Island, Vermont

EPA Region II
Air and Waste Management Division
26 Federal Plaza
New York, New York 10278
(212) 264-5175

New Jersey, New York, Puerto Rico,
Virgin Islands

EPA Region III
Waste Management Branch
841 Chestnut Street
Philadelphia, Pennsylvania 19107
(215) 597-9336

Delaware, Maryland, Pennsylvania,
Virginia, West Virginia,
District of Columbia

EPA Region IV
Hazardous Waste Management Division
345 Courtland Street, N.E.
Atlanta, Georgia 30365
(404) 347-3016

Alabama, Florida, Georgia,
Kentucky, Mississippi, North
Carolina, South Carolina, Tennessee

EPA Region V
RCRA Activities
230 South Dearborn Street
Chicago, Illinois 60604
(312) 353-2000

Illinois, Indiana, Michigan,
Minnesota, Ohio; Wisconsin

EPA Region VI
Air and Hazardous Materials Division
1201 Elm Street
Dallas, Texas 75270
(214) 767-2600

Arkansas, Louisiana, New Mexico,
Oklahoma, Texas

EPA Region VII
RCRA Branch
726 Minnesota Avenue
Kansas City, Kansas 66101
(913) 236-2800

Iowa, Kansas, Missouri, Nebraska

EPA Region VIII
Waste Management Division (8HWM-ON)
One Denver Place
999 18th Street, Suite 1300
Denver, Colorado 80202-2413
(303) 293-1502

Colorado, Montana, North Dakota,
South Dakota, Utah, Wyoming

EPA Region IX
Toxics and Waste Management Division
215 Fremont Street
San Francisco, California 94105
(415) 974-7472

Arizona, California, Hawaii,
Nevada, American Samoa, Guam,
Trust Territories of the Pacific

EPA Region X
Waste Management Branch—MS-530
1200 Sixth Avenue
Seattle, Washington 98101
(206) 442-2777

Alaska, Idaho, Oregon, Washington

APPENDIX A

STATE HAZARDOUS WASTE MANAGEMENT AGENCIES

ALABAMA
Alabama Department of Environmental Management
Land Division
1751 Federal Drive
Montgomery, Alabama 36130
(205) 271-7730

ALASKA
Department of Environmental Conservation
P.O. Box 0
Juneau, Alaska 99811
Program Manager: (907) 465-2666
Northern Regional Office (Fairbanks): (907) 452-1714
South-Central Regional Office (Anchorage): (907) 274-2533
Southeast Regional Office (Juneau): (907) 789-3151

AMERICAN SAMOA
Environmental Quality Commission
Government of American Samoa
Pago Pago, American Samoa 96799
Overseas Operator
(Commercial Call (684) 663-4116)

ARIZONA
Arizona Department of Health Services
Office of Waste and Water Quality
2005 North Central Avenue
Room 304
Phoenix, Arizona 85004
Hazardous Waste Management: (602) 255-2211

ARKANSAS
Department of Pollution Control and Ecology
Hazardous Waste Division
P.O. Box 9583
8001 National Drive
Little Rock, Arkansas 72219
(501) 562-7444

CALIFORNIA
Department of Health Services
Toxic Substances Control Division
714 P Street, Room 1253
Sacramento, California 95814
(916) 324-1826

State Water Resources Control Board
Division of Water Quality
P.O. Box 100
Sacramento, California 95801
(916) 322-2867

COLORADO
Colorado Department of Health
Waste Management Division
4210 E. 11th Avenue
Denver, Colorado 80220
(303) 320-8333 Ext. 4364

CONNECTICUT
Department of Environmental Protection
Hazardous Waste Management Section
State Office Building
165 Capitol Avenue
Hartford, Connecticut 06106
(203) 566-8843, 8844

Connecticut Resource Recovery Authority
179 Allyn Street, Suite 603
Professional Building
Hartford, Connecticut 06103
(203) 549-6390

DELAWARE
Department of Natural Resources and Environmental Control
Waste Management Section
P.O. Box 1401
Dover, Delaware 19903
(302) 736-4781

DISTRICT OF COLUMBIA
Department of Consumer and Regulatory Affairs
Pesticides and Hazardous Waste Materials Division
Room 114
5010 Overlook Avenue, S.W.
Washington, D.C. 20032
(202) 767-8414

FLORIDA
Department of Environmental Regulation
Solid and Hazardous Waste Section
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301
RE: SQG's
(904) 488-0300

GEORGIA
Georgia Environmental Protection Division
Hazardous Waste Management Program
Land Protection Branch
Floyd Towers East, Suite 1154
205 Butler Street, S.E.
Atlanta, Georgia 30334
(404) 656-2833
Toll Free: (800) 334-2373

GUAM
Guam Environmental Protection Agency
P.O. Box 2999
Agana, Guam 96910
Overseas Operator
(Commercial Call (671) 646-7579)

HAWAII
Department of Health
Environmental Health Division
P.O. Box 3378
Honolulu, Hawaii 96801
(808) 548-4383

IDAHO
Department of Health and Welfare
Bureau of Hazardous Materials
450 West State Street
Boise, Idaho 83720
(208) 334-5879

ILLINOIS
Environmental Protection Agency
Division of Land Pollution Control
2200 Churchill Road, #24
Springfield, Illinois 62706
(217) 782-6761

INDIANA
Department of Environmental Management
Office of Solid and Hazardous Waste
105 South Meridian
Indianapolis, Indiana 46225
(317) 232-4535

IOWA
U.S. EPA Region VII
Hazardous Materials Branch
726 Minnesota Avenue
Kansas City, Kansas 66101
(913) 236-2888
Iowa RCRA Toll Free:
(800) 223-0425

KANSAS
Department of Health and Environment
Bureau of Waste Management
Forbes Field, Building 321
Topeka, Kansas 66620
(913) 862-9360 Ext. 292

KENTUCKY
Natural Resources and Environmental Protection Cabinet
Division of Waste Management
18 Reilly Road
Frankfort, Kentucky 40601
(502) 564-6716

LOUISIANA
Department of Environmental Quality
Hazardous Waste Division
P.O. Box 44307
Baton Rouge, Louisiana 70804
(504) 342-1227

MAINE
Department of Environmental Protection
Bureau of Oil and Hazardous Materials Control
State House Station #17
Augusta, Maine 04333
(207) 289-2651

MARYLAND
Department of Health and Mental Hygiene
Maryland Waste Management Administration
Office of Environmental Programs
201 West Preston Street, Room A3
Baltimore, Maryland 21201
(301) 225-5709

MASSACHUSETTS
Department of Environmental Quality Engineering
Division of Solid and Hazardous Waste
One Winter Street, 5th Floor
Boston, Massachusetts 02108
(617) 292-5589
(617) 292-5851

MICHIGAN
Michigan Department of Natural Resources
Hazardous Waste Division
Waste Evaluation Unit
Box 30028
Lansing, Michigan 48909
(517) 373-2730

MINNESOTA
Pollution Control Agency
Solid and Hazardous Waste Division
1935 West County Road, B-2
Roseville, Minnesota 55113
(612) 296-7282

MISSISSIPPI
Department of Natural Resources
Division of Solid and Hazardous Waste Management
P.O. Box 10385
Jackson, Mississippi 39209
(601) 961-5062

MISSOURI
Department of Natural Resources
Waste Management Program
P.O. Box 176
Jefferson City, Missouri 65102
(314) 751-3176
Missouri Hotline:
(800) 334-6946

MONTANA
Department of Health and Environmental Sciences
Solid and Hazardous Waste Bureau
Cogswell Building, Room B-201
Helena, Montana 59620
(406) 444-2821

NEBRASKA
Department of Environmental Control
Hazardous Waste Management Section
P.O. Box 94877
State House Station
Lincoln, Nebraska 68509
(402) 471-2186

NEVADA
Division of Environmental Protection
Waste Management Program
Capitol Complex
Carson City, Nevada 89710
(702) 885-4670

NEW HAMPSHIRE
Department of Health and Human Services
Division of Public Health Services
Office of Waste Management
Health and Welfare Building
Hazen Drive
Concord, New Hampshire 03301-6527
(603) 271-4608

NEW JERSEY
Department of Environmental Protection
Division of Waste Management
32 East Hanover Street, CN-028
Trenton, New Jersey 08625
Hazardous Waste Advisement Program: (609) 292-8341

NEW MEXICO
Environmental Improvement Division
Ground Water and Hazardous Waste Bureau
Hazardous Waste Section
P.O. Box 968
Santa Fe, New Mexico 87504-0968
(505) 827-2922

NEW YORK
Department of Environmental Conservation
Bureau of Hazardous Waste Operations
50 Wolf Road, Room 209
Albany, New York 12233
(518) 457-0530
SQG Hotline: (800) 631-0666

NORTH CAROLINA
Department of Human Resources
Solid and Hazardous Waste Management Branch
P.O. Box 2091
Raleigh, North Carolina 27602
(919) 733-2178

NORTH DAKOTA
Department of Health
Division of Hazardous Waste Management and Special Studies
1200 Missouri Avenue
Bismarck, North Dakota 58502-5520
(701) 224-2366

NORTHERN MARIANA ISLANDS, COMMONWEALTH OF
Department of Environmental and Health Services
Division of Environmental Quality
P.O. Box 1304
Saipan, Commonwealth of Mariana Islands 96950
Overseas call (670) 234-6984

OHIO
Ohio EPA
Division of Solid and Hazardous Waste Management
361 East Broad Street
Columbus, Ohio 43266-0558
(614) 466-7220

OKLAHOMA
Waste Management Service
Oklahoma State Department of Health
P.O. Box 53551
Oklahoma City, Oklahoma 73152
(405) 271-5338

OREGON
Hazardous and Solid Waste Division
P.O. Box 1760
Portland, Oregon 97207
(503) 229-6534
Toll Free: (800) 452-4011

PENNSYLVANIA
Bureau of Waste Management
Division of Compliance Monitoring
P.O. Box 2063
Harrisburg, Pennsylvania 17120
(717) 787-6239

PUERTO RICO
Environmental Quality Board
P.O. Box 11488
Santurce, Puerto Rico 00910-1488
(809) 723-8184

– or –

EPA Region II
Air and Waste Management Division
26 Federal Plaza
New York, New York 10278
(212) 264-5175

RHODE ISLAND
Department of Environmental Management
Division of Air and Hazardous Materials
Room 204, Cannon Building
75 Davis Street
Providence, Rhode Island 02908
(401) 277-2797

SOUTH CAROLINA
Department of Health and Environmental Control
Bureau of Solid and Hazardous Waste Management
2600 Bull Street
Columbia, South Carolina 29201
(803) 734-5200

SOUTH DAKOTA
Department of Water and Natural Resources
Office of Air Quality and Solid Waste
Foss Building, Room 217
Pierre, South Dakota 57501
(605) 773-3153

TENNESSEE
Division of Solid Waste Management
Tennessee Department of Public Health
701 Broadway
Nashville, Tennessee 37219-5403
(615) 741-3424

TEXAS
Texas Water Commission
Hazardous and Solid Waste Division
Attn: Program Support Section
1700 North Congress
Austin, Texas 78711
(512) 463-7761

UTAH
Department of Health
Bureau of Solid and Hazardous Waste Management
P.O. Box 16700
Salt Lake City, Utah 84116-0700
(801) 538-6170

VERMONT
Agency of Environmental
Conservation
103 South Main Street
Waterbury, Vermont 05676
(802) 244-8702

VIRGIN ISLANDS
Department of Conservation and
Cultural Affairs
P.O. Box 4399
Charlotte Amalie, St. Thomas
Virgin Islands 00801
(809) 774-3320
– or –
EPA Region II
Air and Waste Management Division
26 Federal Plaza
New York, New York 10278
(212) 264-5175

VIRGINIA
Department of Health
Division of Solid and Hazardous
Waste Management
Monroe Building, 11th Floor
101 North 14th Street
Richmond, Virginia 23219
(804) 225-2667
Hazardous Waste Hotline:
(800) 552-2075

WASHINGTON
Department of Ecology
Solid and Hazardous Waste Program
Mail Stop PV-11
Olympia, Washington 98504-8711
(206) 459-6322
In-State: 1-800-633-7585

WEST VIRGINIA
Division of Water Resources
Solid and Hazardous Waste/
Ground Water Branch
1201 Greenbrier Street
Charleston, West Virginia 25311

WISCONSIN
Department of Natural Resources
Bureau of Solid Waste Management
P.O. Box 7921
Madison, Wisconsin 53707
(608) 266-1327

WYOMING
Department of Environmental Quality
Solid Waste Management Program
122 West 25th Street
Cheyenne, Wyoming 82002
(307) 777-7752
– or –
EPA Region VIII
Waste Management Division
(8HWM-ON)
One Denver Place
999 18th Street
Suite 1300
Denver, Colorado 80202-2413
(303) 293-1502

description of ignitable wastes, see 40 CFR 261.21, Characteristic of ignitability). Examples are spent solvents (see also solvents), solvent still bottoms, ignitable paint wastes (paint removers, brush cleaners and stripping agents), epoxy resins and adhesives (epoxies, rubber cements and marine glues), and waste inks containing flammable solvents. Unless otherwise specified, all ignitable wastes have the EPA Hazardous Waste Number of D001.

Some commonly used ignitable compounds are:

Acetone	F003
Benzene	F005
n-Butyl Alcohol	F003
Chlorobenzene	F002[1]
Cyclohexanone	F003
Ethyl Acetate	F003
Ethylbenzene	F003
Ethyl Ether	F003
Ethylene Dichloride	D001
Methanol	F003
Methyl Isobutyl Ketone	F003
Petroleum Distillates	D001
Xylene	F003

Ink Sludges Containing Chromium and Lead:

This includes solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead. All ink sludges have the EPA Hazardous Waste Number K086.

Lead-Acid Batteries:

Used lead-acid batteries should be reported on the notification form *only* if they are not recycled. Used lead-acid batteries that *are* recycled do not need to be counted in determining the quantity of waste that you generate per month, nor do they require a hazardous waste manifest when shipped off your premises. (Note: Special requirements do apply if you recycle your batteries on your own premises—see 40 CFR Part 266.)

Lead Dross	D008
Spent Acids	D002
Lead-Acid Batteries	D008

Pesticides:

The pesticides listed below are hazardous. Wastes marked with an asterisk (*) have been designated acutely hazardous. For a more complete listing, see 40 CFR 261.32 and 261.33 for specific listed pesticides, and other wastes, wastewaters, sludges, and by-products from pesticide formulators. (Note that while many of these pesticides are no longer in common use, they are included here for those cases where they may be found in storage.)

*Aldicarb	P070
*Aldrin	P004
Amitrole	U011
*Arsenic Pentoxide	P011
*Arsenic Trioxide	P012
Cacodylic Acid	U136
Carbamic Acid, Methylnitroso-, Ethyl Ester	U178
Chlordane	U036
*Copper Cyanides	P029
1,2-Dibromo-3-chloropropane	U066
1,2-Dichloropropane	U083
1,3-Dichloropropene	U084
2,4-Dichlorophenoxy Acetic Acid	U240
DDT	U061
*Dieldrin	P037
Dimethylcarbamoyl Chloride	U097

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[1] Chlorobenzene is listed by EPA as a hazardous waste due to its toxicity and has been assigned EPA Hazardous Waste Number F002. It has a flashpoint, however, of less than 140°F and is therefore included here as an ignitable waste.

Pesticides *(Continued)*:

•Dinitrocresol	P047
•Dinoseb	P020
Disodium Monomethanearsenate	D004
•Disulfoton	P039
•Endosulfan	P050
•Endrin	P051
Ethylmercuric Chloride	D009
•Famphur	P097
•Heptachlor	P059
Hexachlorobenzene	U127
Kepone	U142
Lindane	U129
2-Methoxy Mercuric Chloride	D009
Methoxychlor	D014
•Methyl Parathion	P071
Monosodium Methanearsenate	D004
•Nicotine	P075
•Parathion	P089
Pentachloronitrobenzene	U185
Pentachlorophenol	U242
Phenylmercuric Acetate	D009
•Phorate	P094
•Strychnine	P108
2,4,5-Trichlorophenoxy Acetic Acid	U232
2-(2,4,5-Trichlorophenoxy)-Propionic Acid	U233
•Thallium Sulfate	P115
Thiram	U244
•Toxaphene	P123
Warfarin	U248

Reactives:

Reactive wastes include reactive materials or mixtures which are unstable, react violently with or form explosive mixtures with water, generate toxic gases or vapors when mixed with water (or when exposed to pH conditions between 2 and 12.5 in the case of cyanide or sulfide bearing wastes), or are capable of detonation or explosive reaction when heated or subjected to shock (for a complete description of reactive wastes, see 40 CFR 261.23, Characteristic of reactivity). Unless otherwise specified, all reactive wastes have the EPA Hazardous Waste Number D003. The following materials are commonly considered to be reactive:

Acetyl Chloride
Chromic Acid
Cyanides
Hypochlorites
Organic Peroxides
Perchlorates
Permanganates
Sulfides

Spent Plating and Cyanide Wastes:

Spent plating wastes contain cleaning solutions and plating solutions with caustics, solvents, heavy metals, and cyanides. Cyanide wastes may also be generated from heat treatment operations, pigment production, and manufacturing of anti-caking agents. Plating wastes are generally Hazardous Waste Numbers F006-F009, with F007-F009 containing cyanide. Cyanide heat treating wastes are generally Hazardous Waste Numbers F010-F012. See 40 CFR 261.32 for a more complete description of plating wastes.

Wood Preserving Agents:

The wastewater treatment sludges from wastewater treatment operations are considered hazardous (EPA Hazardous Waste Number K001—bottom sediment sludges from the treatment of wastewater processes that use creosote and pentachlorophenol). In addition, unless otherwise indicated, specific wood preserving compounds are:

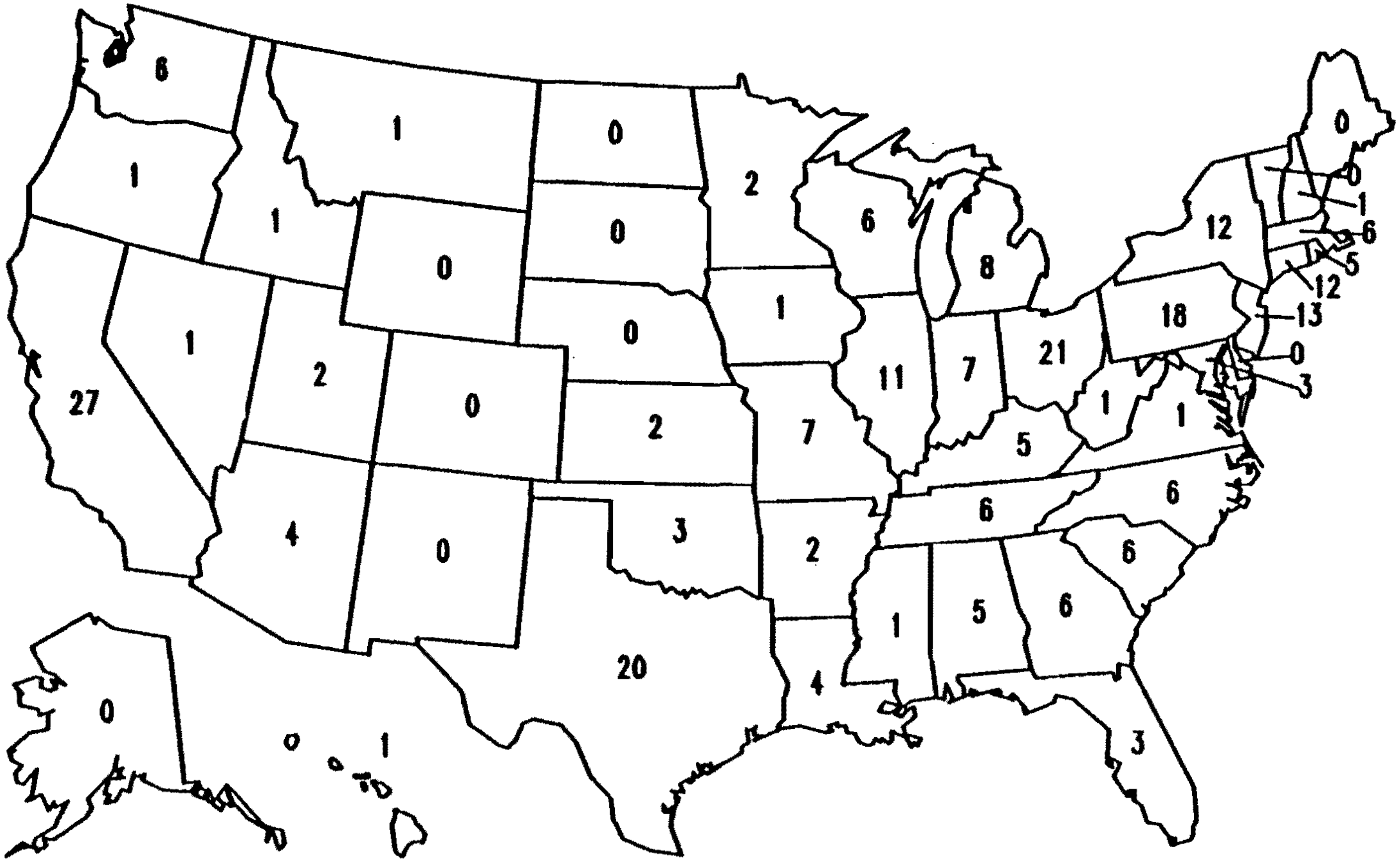
Chromated Copper Arsenate	D004
Creosote	U051
Pentachlorophenol	F027

NOTE: This handbook was intended to avoid the need for you to obtain, read, and understand the actual regulatory requirements for small quantity generators contained in the *Code of Federal Regulations* (CFR). However, if you wish to obtain a copy of the actual regulations, you may do so by requesting a copy of the March 24, 1986 ***Federal Register*** from one of the sources in Appendix A. The requirements for small quantity generators are contained in Parts 261 and 262 of the hazardous waste regulations.

Facilities Managing Metal Wastes

Appendix 2

Number of Facilities Managing Metals Wastes by State



Puerto Rico - 2
Total number of facilities: 250

The following pages list directory identification numbers for each of these facilities

Facilities Managing Metal Wastes

ALABAMA

Northern Alabama

AL002 Ashland Chemical Co	Birmingham
AL003 CWM-Emelle	Emelle
AL005 ILCO Inc	Leeds
AL006 M & M Chemical & Equipment Co., Inc.	Reece City

Southern and Eastern Alabama

AL011 Sanders Lead Company Inc	Troy

ARIZONA

Southern Arizona

AZ001 Buds Oil Serv Inc	Phoenix
AZ002 CWM-Phoenix	Phoenix
AZ003 Environmental Waste Entpr Inc	Eloy
AZ005 World Resources Company	Phoenix

ARKANSAS

Southern Arkansas

AR003 Lion Oil Company	El Dorado

Northern and Central Arkansas

AR004 National Bumper Exchange	West Memphis

CALIFORNIA

Los Angeles Region

CA009 Crosby & Overton, Inc.	Long Beach
CA014 GNB, Inc.	Los Angeles
CA027 IT Transportation Corp Wilmington	Wilmington
CA029 Norris Industries Inc	Los Angeles
CA031 Omega Chemical Corp	Whittier
CA032 Orange County Chemical Corp.	Santa Ana
CA035 Quemetco, Inc.	City of Industry
CA045 Southern California Chemical Co Inc	Santa Fe Springs
CA047 Turco Products, Inc.	Carson

Southern California

CA001 Appropriate Technologies II	Chula Vista
CA021 IT Corp Imperial Facil	Westmorland
CA033 Pacific Treatment Corp	San Diego

South Central California

CA006 Casmalia Resources	Casmalia
CA010 CWM-Kettleman City	Kettleman City
CA013 General Portland Inc Systech Corp	Lebec
CA026 IT Transportation Corp Taft Facility	Taft

San Francisco Region

CA004 Bay Area Environmental Inc	Richmond
CA017 Imperial West Chemical Company	Antioch
CA018 IT Corp Amorco Facility	Martinez
CA019 IT Corp Baker Facility	Martinez
CA020 IT Corp Benicia Fac	Benicia
CA022 IT Corp No Ca. Services	Martinez

CA023 IT Corp Oil Reprocess Facility	Martinez
CA025 IT Corp Vine Hill	Martinez

North Central and Northeast California

CA008 Chemwest Industries Inc	Cloverdale
CA024 IT Corp San Jose Transfer Facility	San Jose
CA044 Solvent Service Inc	San Jose

CONNECTICUT

Statewide

CT001 American Chemical & Refining Company	Waterbury
CT002 Cecos International Inc	Bristol
CT003 City of Danbury	Danbury
CT004 Connecticut Trmt Corp	Bristol
CT005 East Coast Environmental Serv Corp	New Haven
CT006 Envirite Corporation	Thomaston
CT007 Environmental Waste Resources, Inc.	Waterbury
CT008 Handy & Harman Fairfield Plt	Fairfield
CT010 MacDermid Inc.	Waterbury
CT011 MacDermid Inc.	Waterbury
CT012 Porters Grove Metal Recovery Co	Bridgeport
CT013 Printing Developments Inc	East Granby

FLORIDA

Southern Florida

FL001 Ashland Chemical Co	Tampa
FL003 CWM Inc	Pompano Beach
FL007 Porters Grove Metal Recovery S. E.	Lakeland

GEORGIA

Northern Georgia

GA003 Ashland Chemical Co	Doraville
GA004 Chemical Products Corp	Cartersville
GA005 IMC	Augusta
GA015 Solidtek Inc. Systems Inc	Morrow
GA016 Trichem Company	Atlanta

Southern Georgia

GA006 International Minerals & Chemical Corp	Americus

HAWAII

Statewide

HI001 Unitek Environmental Services Inc	Ewa Beach

IDAHO

Statewide

ID001 Envirosafe Services of Idaho Inc	Grand View

Facilities Managing Metal Wastes

ILLINOIS

Northeast Illinois

IL002 American Waste Processing Ltd	Maywood
IL007 Cecos International Inc/BFI Ind of Ill	Zion
IL008 Chem-Clear Inc	Chicago
IL010 CWM-CID	Calumet City
IL012 CWM-SCA Chicago-Chemical Services Inc.	Chicago
IL013 Envirite Corporation	Harvey
IL023 Northrop Corp Defense Systems Div	Rolling Meadows
IL025 Petrochem Services, Inc.	Lemont

Northwest and East Central Illinois

IL024 Peoria Disposal Co	Peoria

West Central and Southern Illinois

IL011 CWM-Sauget	Sauget
IL035 United Ind Syndicate Air Tex Prod Dv	Fairfield

INDIANA

Northern Indiana

IN003 Ashland Chemical Co	Indianapolis
IN005 CWM-Adams Center Landfill	Fort Wayne
IN008 Four County Ldfl	Rochester
IN009 I J Recycling	Fort Wayne
IN010 ILWD Inc	Indianapolis
IN013 Quemetco, Inc.	Indianapolis
IN020 Stauffer Chemical Co	Hammond

IOWA

Central Iowa

IA004 Salsbury Laboratories	Charles City

KANSAS

Eastern Kansas

KS004 Deffenbaugh Disposal Service	Shawnee

Western and Southern Kansas

KS002 Conservation Services, Inc.	Wichita

KENTUCKY

North Central Kentucky

KY003 Custom Industrial Services Inc	Shelbyville
KY005 Kyana Oil, Inc	Louisville

Eastern Kentucky

KY002 Ashland Chemical Co - I C & S Division	Catlettsburg
KY008 M & T Chemicals, Inc.	Carrollton

Western and South Central Kentucky

KY012 Pennwalt Corp	Calvert City

LOUISIANA

Southern Louisiana

LA001 Cecos International Inc	Westlake
LA003 CWM-Carlyss	Carlyss
LA004 Rollins Environmental Services Inc	Baton Rouge
LA005 Rollins Environmental Services of LA Inc	Plaquemine

MARYLAND

DC and Maryland Metro Area

MD003 GSX Services Inc	Laurel

Near District of Colombia

MD001 Capital Assay Labs Ltd.	Baltimore
MD002 Chem-Clear Inc of Baltimore	Baltimore

MASSACHUSETTS

Western and Northeast Massachusetts

MA002 Clean Harbors of Natick Inc.	Natick
MA005 Geochem D/B/A Jet-Line of Lowell	Lowell
MA007 Matheson Gas Products Inc	Gloucester
MA008 North East Solvents Corp	Lawrence

Southeast Massachusetts

MA001 Clean Harbors of Braintree, Inc	Braintree
MA004 General Metal Finishing Co Inc	Attleboro

MICHIGAN

Eastern Michigan

MI002 Chem-Met Services Inc	Wyandotte
MI006 Environmental Waste Control Inc	Inkster
MI011 Michigan Disposal Inc (WPF)	Belleville
MI012 Nelson Industrial Services	Detroit
MI014 Petro-Chem Processing Inc	Detroit
MI020 Waste Acid Service Inc	Detroit
MI021 Wayne Disposal, Inc. Site #2	Belleville

Northern and Western Michigan

MI018 Tricil Environmental Services, Inc.	Muskegon Heights

MINNESOTA

Eastern Minnesota

MN002 Federal-Hoffman, Inc.	Anoka
MN006 North Star Steel Co	St Paul

MISSISSIPPI

Southern Mississippi

MS001 Ashland Chemical Co	Jackson

Facilities Managing Metal Wastes

MISSOURI

Eastern Missouri

MO001 Ashland Chemical Co	St Louis
MO002 B. H. S., Inc.	Wright City
MO003 Conservation Chemical Co	St Louis

Western Missouri

MO008 Reclamare Enterprises	Kansas City
MO009 Reclamare Enterprises Plant #2	Kansas City
MO014 Solvent Recovery Corporation	Kansas City

Central Missouri

MO010 Resource Recovery Center	Columbia

MONTANA

Statewide

MT001 Burlington Northern Somers Tie Plant	Somers

NEVADA

Statewide

NV001 US Ecology Inc Chem Site	Beatty

NEW HAMPSHIRE

Statewide

NH001 Coating Systems Inc	Nashua

NEW JERSEY

Northern New Jersey

NJ001 Advanced Env Tech Corp	Flanders
NJ004 CWM-SCA Newark-Chemical Services Inc.	Newark
NJ007 Emergency Technical Services Corp	Vernon
NJ010 Givaudan Corporation	Alifton
NJ014 OMI International Corp	Nutley
NJ015 Pass Recovery Systems Inc	Clifton
NJ016 Perk Chemical Company, Inc	Elizabeth
NJ017 Pittsburg Metal & Equipment Co.	Jersey City
NJ018 Plasti-Clad Metal Products Inc.	Wall
NJ021 S & W Waste, Inc.	South Kearny
NJ024 Spectrasery Inc.	Kearny
NJ026 Vanguard Research Associates Inc	South Plainfield

Southern New Jersey

NJ006 Dupont E I De Nemours, Chambers Works	Deepwater

NEW YORK

New York City Region

NY016 Revere Smelting and Refining Corp	Middletown

Long Island Region

NY003 Chemical Management	Farmingdale
NY004 Chemical Pollution Control	Bay Shore
NY005 Chemical Waste Disposal	Astoria
NY008 General Waste Oil Co. Inc	Wyandanch
NY014 Radiac Research	Brooklyn

Eastern New York

NY011 Lehigh Portland Cement Co	Cementon

Central New York

NY009 Haz-O-Waste Corporation	Wampsville

Western New York

NY001 BDT, Inc.	Clarence
NY002 Cecos International Inc	Niagara Falls
NY007 Frontier Chemical Waste Process, Inc.	Niagara Falls
NY017 SCA Chemical	Model City

NORTH CAROLINA

Northcentral and Northeast N. Carolina

NC001 Ashland Chemical Co	Greensboro
NC003 Ashland Chemical Co	Raleigh
NC006 GSX Services Inc	Reidsville

Western and Southern North Carolina

NC002 Ashland Chemical Co	Charlotte
NC004 Caldwell Systems Inc	Lenoir
NC007 Lithium Corp of America Chemical Plt	Bessemer City

OHIO

Northwest and East Central Ohio

OH005 Ashland Chemical Co	Columbus
OH016 CWM-Vickery	Vickery
OH023 F E I Landfarming Site 2	Oregon
OH024 Fondessy Enterprises Inc	Oregon
OH027 General Tire & Rubber Co	Toledo
OH042 Tricil Environmental Services, Inc.	Hillard

Northeast Ohio

OH001 Alchem-Tron Inc	Cleveland
OH002 Alchem-Tron Inc	Cleveland
OH003 Ashland Chemical Co	Akron
OH010 Chem-Clear Inc	Cleveland
OH017 Delhi Industrial Products	Mc Donald
OH018 Dupont E I De Nemours & Co	Cleveland
OH019 Envirite Corporation	Canton
OH022 Erieway Pollution Control Inc	Bedford
OH032 Master Metals Inc	Cleveland
OH041 Samsel Service Co	Cleveland

Southern and West Central Ohio

OH006 Ashland Chemical Co	Evendale
OH008 Cecos International Inc	Cincinnati
OH009 Cecos International Inc	Williamsburg
OH020 Environmental Enterprises Incorp	Cincinnati
OH026 General Portland Inc Paulding Plant	Paulding

Facilities Managing Metal Wastes

OKLAHOMA

Western Oklahoma

OK001 Ashland Chemical Co	Mklahoma City
OK005 USPCI	Waynoka

Eastern Oklahoma

OK003 Eagle Picher Industries Inc EOM Dept	Quapaw

OREGON

Statewide

OR002 CWM-Chem-Security Systems Inc	Arlington

PENNSYLVANIA

Southwest Pennsylvania

PA001 A M O Pollution Svces Inc	Canonsburg
PA002 Ashland Chemical Co	Freedom
PA019 Mill Service Inc	Buiger
PA020 Mill Service Inc Yukon Plt	Yukon

Northwest Pennsylvania

PA013 International Metals Reclamation Co, Inc.	Ellwood City

Central Pennsylvania

PA009 Envirite Corporation	York
PA010 Harley-Davidson Motor Co. Inc.	York
PA011 Industrial Solvents and Chemical Co.	York Haven
PA012 Industrial Waste Removal Inc	Lewisberry
PA015 Keystone Chemical Co.	Giradville
PA028 WRC Processing Company	Pottsville

Northeast Pennsylvania

PA022 New Jersey Zinc Company	Palmerton

Southeast Pennsylvania

PA004 C & D Power Systems, Inc	Aonshohocken
PA005 Chem-Clear Inc	Chester
PA007 Delaware Container Co Inc	Coatsville
PA008 East Penn Manufacturing Co Inc	Lyon Station
PA017 Marcus Hook Processing Inc	Marcus Hook
PA027 Waste Conversion Inc.	Hatfield

PUERTO RICO

All

PR002 Proteco	Penuelas
PR004 Thermo King Caribbean Inc.	Ciales

RHODE ISLAND

Statewide

RI001 Boliden Metech Inc	Mapleville
RI003 Fort Barton Holdings Inc	Warwick
RI004 International Depository Inc.	North Kingstown

RI005 Narragansett Improvement Company	Providence
RI006 Northland Chemical Company	Providence

SOUTH CAROLINA

Statewide

SC001 Ashland Chemical Co	Greenville
SC002 CP Chemicals Inc	Sumter
SC003 Groce Laboratories	Greer
SC004 GSX Services of South Carolina, Inc.	Pinewood 452-5003
SC005 GSX Thermal Oxidation Corp (ABCO Ind)	Roebuck
SC008 Stablex South Carolina Inc	Rock Hill

TENNESSEE

Eastern Tennessee and Nashville Area

TN002 Diversified Sys., Inc. Storage Fac.	Athens
TN005 GSX Services Inc	Greenbrier
TN008 Tricil Environmental Services, Inc.	Antioch
TN009 Yale Security Inc. (Scovill)	Lenoir City

Western Tennessee

TN003 Earth Industrial Waste Management	Millington
TN006 Industrial Liquids Recycling Inc	Mt Pleasant

TEXAS

Northeast Texas

TX002 Ashland Chemical Co	Garland
TX012 Gibraltar Chemical Resources	Winona
TX013 GNB Batteries, Inc.	Frisco

Eastcentral Texas

TX001 Ashland Chemical Co	Houston
TX006 CWM-Port Arthur	Port Arthur
TX008 Diamond Shamrock Chemicals Company	Deer Park
TX009 Disposal Systems Inc-Deer Park Facil	Deer Park
TX010 Eltex Chemical & Supply Company	Houston
TX011 Empak Inc Deer Park	Deer Park
TX014 Gulf Coast Waste Disposal Authority	Texas City
TX018 Malone Service Company	Texas City
TX020 Olin Corporation	Beaumont
TX021 Paktank Gulf Coast Inc Deer Park	Deer Park
TX023 Petro Processors, Inc.	San Leon
TX024 Rollins Environmental Services of TX Inc	Deer Park
TX028 Torque Petroleum Products	San Leon

Southern Texas

TX005 CWM-Corpus Christi	Corpus Christi
TX026 Standard Industries	San Antonio
TX027 Texas Ecologists Inc	Robstown

Western Texas

TX003 Cecos International Inc	Odessa

UTAH

Statewide

UT001 Ekotek Inc	Salt Lake City
UT003 USPCI Grassy Mt. Facility	Knowles

VIRGINIA

Southwest Virginia

VA001 Ashland Chemical Co	Roanoke

WASHINGTON

Western and Central Washington

WA001 Chemical Processors Inc	Seattle
WA002 Chemical Processors Inc	Seattle
WA003 Chemical Processors Inc	Tacoma
WA004 Crosby & Overton, Inc. Plant 2	Kent
WA005 Mc Clary Columbia Corp	Washougal
WA006 Northwest Enviroservice Inc.	Seattle

WEST VIRGINIA

North W. Virgina

WV002 Weirton Steel Corp	Weirton

WISCONSIN

Southern Wisconsin

WI001 Aqua-Tech, Inc.	Port Washington
WI006 CWM-Menomonee Falls	Menomonee Falls
WI009 Milwaukee Solvents & Chemicals Corp	Menomonee Falls
WI011 Printing Developments Inc	Racine

Northern and Central Wisconsin

WI002 Ashland Chemical Co	Menasha
WI013 Zimpro Inc	Rothschild

DISPOSAL OF LEAD-BASED PAINT AS HAZARDOUS WASTE

RCRA - Resource Conservation and Recovery Act

RCRA, AS AMENDED BY:

- Solid Waste Disposal Act Amendments of 1980
- Hazardous and Solid Waste Amendments of 1984

RELATED, BUT NOT RCRA:

- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or "Superfund")

HAZARDOUS WASTE REGULATION REFERENCES

- 40 CFR Parts 261-265
- Georgia Rules for Hazardous Waste, Chapter 391-3-11

GENERATOR PROCESS SUMMARY

1) Characterize waste streams
2) Hazardous or non-hazardous?
3) Determine generator status
4) Generator Identification Number (GIN), if necessary
5) Manifest, pre-transport requirements
6) Recordkeeping and reporting
7) Planning
8) Legalities and liabilities

WHAT IS A HAZARDOUS WASTE?

Waste must first be a *SOLID WASTE*

If a Solid Waste, is it *SPECIFICALLY EXCLUDED* from regulation?

If a Solid Waste and *NOT EXCLUDED* is it a Characteristic Waste or a Listed Waste?

CHARACTERISTIC OR LISTED WASTE?

CHARACTERISTIC WASTES:

- Ignitability, D001
- Corrosivity, D002
- Reactivity, D003
- EP-Toxicity, D004-D017

- Special Waste, D000

LISTED WASTES:

- Non-specific, "F"
- Specific, "K"
- Acutely Hazardous, "P"
- Hazardous, "U"

HAZARDOUS WASTE DETERMINATION:

- Determine if Excluded (261.4)
- Is it Listed?
- Is it a Characteristic Waste?
- Known properties

CHARACTERISTIC WASTES

IGNITABILITY, D001

- Liquid, other than aqueous solution of <24% alcohol
- Flashpoint <140°F
- Not a liquid, but under STP capable of causing fire through friction, moisture absorption, or spontaneous chemical changes; when ignited burns so vigorously and persistently that it creates a hazard
- Ignitable compressed gas per 49 CFR 173.300
- Oxidizer per 49 CFR 173.151

CORROSIVITY, D002

- Aqueous solution with pH ≤ 2.0 or ≥ 12.5
- Liquid and corrodes steel at a rate greater than 6.35 mm per year at 130°F

REACTIVITY, D003

- Normally unstable and readily undergoes violent change without detonation
- Water-reactive
- When mixed with water generates toxic gases, vapors, or fumes in sufficient quantities to endanger Human Health or the Environment
- Cyanide- or sulfide-bearing waste which when exposed to extreme pH can generate hydrogen cyanide or hydrogen sulfide gas

EP-TOXICITY, D004-D017

- Only hazardous wastes with concentration limits
- Concentrations are for analytically-derived leachate
- Eight heavy metals
- Six pesticides

EP-TOXICITY LIMITS

HW #	CONTAMINANT	CONCENTRATION (mg/l)
D004	Arsenic	5.0
D005	Barium	100.0
D006	Cadmium	1.0
D007	Chromium	5.0
D008	Lead	5.0
D009	Mercury	0.2
D010	Selenium	1.0
D011	Silver	5.0
D012	Endrin	0.02
D013	Lindane	0.4
D014	Methoxychlor	10.0
D015	Toxaphene	0.5
D016	2,4-D	10.0
D017	2,4,5-TP Silvex	1.0

- EP-Tox concentrations are 100x primary drinking water standards
- More substances are being proposed for regulation

LISTED WASTES

NON-SPECIFIC SOURCES, F001-F128

- Halogenated solvents used in degreasing and still bottoms from recovery
- Halogenated solvents and still bottoms
- Non-halogenated solvents and still bottoms
- Cyanide plating baths
- Aluminum chemical conversion coating baths
- Quenching baths
- Chlorinated aliphatic hydrocarbon production wastes
- Certain mixtures of "F" wastes F001, F002, F004, and F005

SPECIFIC WASTES, K001-K136

- Wood preservation
- Inorganic pigments
- Organic chemicals
- Inorganic chemicals
- Explosives
- Petroleum refining
- Iron and steel
- Secondary lead smelting
- Veterinary pharmaceuticals
- Ink formulation
- Coking
- Pesticides

DISCARDED COMMERCIAL CHEMICAL PRODUCTS, OFF-SPEC SPECIES, CONTAINER RESIDUES, AND SPILL RESIDUES, P001-P123

- Acutely hazardous wastes
- Special generation amounts apply for all generators

DISCARDED COMMERCIAL CHEMICAL PRODUCTS, OFF-SPEC SPECIES, CONTAINER RESIDUES, AND SPILL RESIDUES, U001-U359

- Hazardous wastes

RCRA GENERATOR PROVISIONS

GENERATOR REQUIREMENTS - GENERAL

1) Determination of waste's nature
2) Generator status
3) Manifest
4) Pre-transport requirements
    - Packaging
    - Labeling
    - Marking
    - Placarding
    - Accumulation time
5) Recordkeeping and reporting
6) Waste minimization

GENERATOR STATUS

- Large-quantity generator (LQG)
- 100 to 1,000 kg/month generator
- Small-quantity generator (SQG)

LQG REQUIREMENTS

- >1,000 kg/month of hazardous waste
- 90-day on-site storage
- Notification
- Manifest
- Recordkeeping
    - Contingency plan
    - Hazard prevention plan
    - Personnel training plan
    - Annual or biennial report
    - Waste minimization

100 to 1,000 kg/month GENERATOR REQUIREMENTS (SQG)

- 100 to 1,000 kg/month of hazardous waste
- 180 or 270-day on-site storage
- Notification
- Manifest
- Recordkeeping
    - Contingency plan (modified)
    - Hazard prevention plan (modified)
    - Personnel training plan (modified)
    - Annual or biennial report (modified)
    - Waste minimization (modified)

SQG REQUIREMENTS (CONDITIONALLY-EXEMPT SQG, CESQG)

- No specific requirements than to dispose of wastes in an environmentally-sound manner

The size of a company is not always a true indicator of its generator status.

MANIFEST

LQG AND 100 to 1,000 kg/month MANIFEST REQUIREMENTS

- Must complete entire manifest
- Used as a round trip tracking document

- Recommend completion of Item I - EPA Waste Number

PRE-TRANSPORT REQUIREMENTS

- Packaging
- Labeling
- Marking
- Placarding
- Accumulation time

PACKAGING

Use approved container

LABELING

- Approved and correct label

MARKING

49 CFR 172, Subpart D & 173

- Proper shipping name
- Consignee (consignor) name and address
- ORM
- This End Up
- Other specifics

PLACARDING

- Generator must supply placards

49 CFR 173.101 (Hazmat Tables)

Specifics and exemptions found in other DOT regulations

ACCUMULATION TIME

- Must be plainly marked on container - OK on HW label

RECORDKEEPING AND REPORTING

- Annual or biennial report
- Exception report
- Manifest retention for 3 years
- Contingency plan
- Hazard prevention plan
- Personnel training plan

Please print or type (Form designed for use on elite (12-pitch) typewriter) Form Approved OMB No 2050 0039 Expires 9 30 88

UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No GAD123456789 Manifest Document No. 00001
2 Page 1 of 1
Information in the shaded areas is not required by Federal law

3 Generator's Name and Mailing Address
Lead Busters, Inc.
1372 Big Industry Blvd. Stinkytown, GA 00000
4 Generator's Phone (404) 123-4567

A. State Manifest Document Number
B. State Generator's ID

5. Transporter 1 Company Name Skip & Scam Trucking
6. US EPA ID Number GAD234567890
C. State Transporter's ID
D. Transporter's Phone

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID
F. Transporter's Phone

9 Designated Facility Name and Site Address
Hump 'n Dump, Ltd.
1 Landfill Rd.
Outasight, GA 00010
10 US EPA ID Number GAD345678901
G. State Facility's ID
H. Facility's Phone

GENERATOR

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No	12. Containers Type	13 Total Quantity	14 Unit Wt/Vol	I Waste No
a. Hazardous waste, solid, n.o.s. ORM-E, NA9189	20	DM	8852	LB	D008
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
Lead-based paint abatement waste

K. Handling Codes for Wastes Listed Above

15 Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION**. I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment, OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford

Printed/Typed Name John Doe Signature John Doe Month Day Year 10 13 88

TRANSPORTER

17 Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name James Smith Signature James Smith Month Day Year 10 13 88

18 Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name Signature Month Day Year

FACILITY

19 Discrepancy Indication Space

20 Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19
Printed/Typed Name Steve Jones Signature Month Day Year 10 14 88

EPA Form 8700-22 (Rev. 9-86) Previous editions are obsolete

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 260, 261, 262, 264, 265, 268, 270, and 271

[SWH-FRL-3219-1]

Land Disposal Restrictions for Certain "California List" Hazardous Wastes and Modifications to the Framework

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency is today promulgating regulations restricting land disposal of certain "California list" wastes: liquid hazardous wastes containing polychlorinated biphenyls (PCBs) above specified concentrations; and hazardous wastes containing halogenated organic compounds (HOCs) above specified concentrations. In addition, today's final rule codifies the statutory land disposal prohibitions on certain California list corrosive wastes. This action also establishes methods for determining compliance with the prohibitions and modifies portions of the land disposal restrictions framework which was promulgated on November 7, 1986 (51 FR 40572).

EPA is taking this action in response to the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA), which requires EPA to restrict the land disposal of hazardous wastes containing the California list constituents above specified concentrations. Today's rule does not establish regulations for the California list wastes containing metals or free cyanides beyond requirements set forth in the statute. EPA may establish more stringent requirements for these wastes in a separate rulemaking.

Today's rule, however, does address the Agency's approach to determining compliance with the statutory prohibitions on the metal-bearing and free cyanide containing wastes.

EFFECTIVE DATE: This final rule is effective July 8, 1987.

ADDRESSES: The official record for this rulemaking is identified as Docket Number LDR-4 and is located in the EPA RCRA Docket Room (sub-basement) 401 M Street, SW., Washington, DC 20460. The docket is open from 9:00 to 4:00 Monday through Friday, except for public holidays. To review docket materials, the public must make an appointment by calling (202) 475-9327. The public may copy a maximum of 50 pages from any regulatory docket at no cost. Additional copies cost $.20 per page.

FOR FURTHER INFORMATION CONTACT: For general information contact the RCRA Hotline, Office of Solid Waste (WH-562), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460, (800) 424-9346 (toll-free) or (202) 382-3000 locally.

For information on specific aspects of this final rule contact: Gary A. Jonesi or Jacqueline W. Sales, Office of Solid Waste (WH-562B), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460, (202) 382-4770.

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I. Background

A. Summary of Hazardous and Solid Waste Amendments of 1984

The Hazardous and Solid Waste Amendments of 1984 (HSWA), enacted on November 8, 1984, prohibit the continued land disposal of hazardous wastes beyond specified dates unless the Administrator determines, based on a case-specific petition, that there will be "no migration" of hazardous constituents from the disposal unit or injection zone for as long as the wastes remain hazardous. Wastes treated in accordance with the treatment standards set by EPA pursuant to RCRA section 3004(m) are not subject to the prohibitions and may be land disposed. The land disposal prohibitions are effective immediately upon promulgation unless the Agency sets another effective date based on the earliest date that adequate alternative treatment, recovery, or disposal capacity which is protective of human health and the environment will be available. The relevant statutory deadlines are as follows:

1. Scheduled Wastes and Newly Listed Wastes

On May 28, 1986 (51 FR 19300), EPA promulgated a schedule for making land disposal restrictions decisions for all hazardous wastes listed or identified by characteristic as of November 8, 1984, excluding solvent and dioxin wastes and the California list wastes which are subject to a statutory schedule. If EPA fails to set treatment standards or grant a "no migration" petition for any of the scheduled wastes by May 8, 1990, all such wastes will be prohibited from land disposal. (Hazardous wastes containing California List constituents are prohibited from land disposal at concentrations which exceed the statutory levels.)

For any hazardous waste identified or listed after November 8, 1984, EPA is required to make a land disposal restriction determination within 6 months of the date of identification or listing. However, there is no automatic prohibition on land disposal if EPA misses a deadline for any newly listed or identified waste.

2. Solvents and Dioxins

On November 7, 1986, EPA promulgated a final rule that established a framework for implementing the congressionally mandated land disposal prohibitions (51 FR 40572). The rule established procedures for establishing treatment standards, for granting nationwide variances from statutory effective dates, for granting extensions of effective dates on a case-by-case basis, for evaluating petitions allowing variances from the treatment standard, and for evaluating petitions demonstrating that continued land disposal is protective of human health and the environment. In addition, the November 7, 1986 final rule established treatment standards and effective dates for wastes included in the first phase of the land disposal prohibitions: certain solvent-containing and dioxin-containing hazardous wastes.

3. California List

Today's rule addresses the second phase of the land disposal restrictions i.e., the California list wastes. The California list consists of liquid hazardous wastes containing certain metals, free cyanides, polychlorinated biphenyls (PCBs), corrosives with a pH of less than or equal to two (2.0), and liquid and nonliquid hazardous wastes containing halogenated organic compounds (HOCs) as described below:

(A) Liquid hazardous wastes, including free liquids associated with any solid or sludge, containing free cyanides at concentrations greater than or equal to 1,000 mg/1.

(B) Liquid hazardous wastes, including free liquids associated with any solid or sludge, containing the following metals (or elements) or compounds of these metals (or elements) at concentrations greater than or equal to those specified below:

(i) Arsenic and/or compounds (as As) 500 mg/1;

(ii) Cadmium and/or compounds (as Cd) 100 mg/1;

(iii) Chromium (VI and/or compounds (as Cr VI)) 500 mg/1;

(iv) Lead and/or compounds (as Pb) 500 mg/1;

(v) Mercury and/or compounds (as Hg) 20 mg/1;

(vi) Nickel and/or compounds (as Ni) 134 mg/1;

(vii) Selenium and/or compounds (as Se) 100 mg/1; and

(viii) Thallium and/or compounds (as T1) 130 mg/1;

(C) Liquid hazardous waste having a pH less than or equal to two (2.0).

(D) Liquid hazardous wastes containing polychlorinated biphenyls at concentrations greater than or equal to 50 ppm.

(E) Hazardous wastes containing halogenated organic compounds in total concentration greater than or equal to 1,000 mg/kg.

Collectively, these hazardous wastes are referred to as the California list because the State of California developed regulations to restrict the land disposal of hazardous wastes containing these constituents, and Congress subsequently incorporated these prohibitions into the 1984 Amendments to RCRA. (RCRA sections 3004(d) (1) and (2), 42 U.S.C. 6924(d) (1), and (2)). Congress intended the California list prohibitions as a starting point in carrying out the congressional mandate to minimize land disposal of hazardous waste. Congress' intent in specifying threshold levels for the land disposal of California list wastes was to avoid time-consuming litigation over the selection of appropriate levels. However, section 3004(d)(2) of RCRA directs the Agency to substitute more stringent concentration levels where necessary to protect human health and the environment.

B. Summary of Proposed Rule

1. Prohibition Levels

On December 11, 1986 (51 FR 44714), the Agency proposed to codify the statutory levels for all of the California list as set forth in RCRA section 3004(d). The Agency requested comments on an alternative approach that would substitute more stringent concentration levels for those California list metals for which Extraction Procedure (EP) toxicity characteristic levels exist. The Agency also requested comment on whether the prohibition levels should be lowered for the remaining metals for which EP levels have not been established.

2. Applicability

The Agency proposed to require use of the Paint Filter Liquids Test (PFLT) in determining whether a waste is considered to be a liquid or a nonliquid for purposes of the California list prohibitions. For purposes of determining whether a liquid waste exceeds the applicable prohibition levels, EPA proposed to require that the regulated community analyze both the free liquid portion of the waste and the residual solids remaining in the paint filter using the Toxicity Characteristic Leaching Procedure (TCLP). The Agency also proposed to define the universe of prohibited HOCs as those constituents listed as a hazardous constituent under Appendix VIII to Part 261. Finally, the Agency also proposed to apply the statutory level for cyanides (1,000 mg/1) to total cyanide rather than free cyanide because of the lack of a precise definition of free cyanide and because complexed cyanide may convert to free cyanide under certain conditions that may exist in the environment.

3. Treatment Standards and Effective Dates

In the proposed rule, the Agency established treatment standards expressed as specified technologies for the prohibited liquid hazardous wastes containing PCBs and for the prohibited liquid and nonliquid hazardous wastes containing HOCs (except for dilute HOC wastewaters). The proposed treatment standard for the PCB containing wastes was thermal destruction in accordance with the technical standards required by regulations promulgated pursuant to the

Toxic Substances Control Act (TSCA). The Agency proposed to establish a two-year nationwide variance for these wastes. Incineration in accordance with existing RCRA regulations was proposed as the treatment standard for most HOCs. However, based on a lack of incineration capacity, the Agency proposed a two-year nationwide variance from the prohibition effective date for these HOC wastes. The Agency also proposed a performance based treatment standard for corrosives wastes having a pH less than or equal to two (2.0). The Agency did not propose required treatment standards for the remaining California list wastes; however, applicable technologies generally capable of meeting the statutory prohibition levels were discussed in the proposal.

4. Modifications to the Land Disposal Restrictions Regulatory Framework

EPA also proposed to modify portions of the land disposal restrictions framework established in the November 7, 1986 final rule. These proposed changes would apply to all wastes subject to the land disposal restrictions. Among them was a proposal to strengthen the dilution prohibition by amending § 268.3 to prohibit dilution as a means of achieving the prohibition levels or as a means of circumventing the effective date of a land disposal prohibition. The Agency also proposed a prohibition on evaporation of hazardous constituents for purposes of obtaining an exemption under § 268.4 which provision allows otherwise prohibited wastes to be treated in surface impoundments without the wastes first being treated to the section 3004(m) standards.

The Agency also proposed to amend Part 270 to provide more flexibility in handling restricted wastes by allowing permitted facilities to use the minor modification process to change their operations and treat or store restricted wastes in tanks or containers, subject to certain enumerated conditions. The Agency further proposed that the so-called reconstruction ban in § 270.72(e) not apply to interim status facilities adding treatment or storage capacity (also in tanks or containers) to comply with the land disposal restrictions.

C. Summary of Today's Final Rule

1. Applicability

Today the Agency is promulgating land disposal prohibitions and effective dates for liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm (California list PCBs) and other liquid and nonliquid hazardous wastes containing HOCs in total concentration greater than or equal to 1,000 mg/kg (California list HOCs). In addition, EPA is establishing treatment standards expressed as specified technologies for these PCB and HOC wastes (except for dilute HOC wastewaters). EPA is also codifying the statutory prohibition on land disposal of liquid hazardous wastes with a pH less than or equal to two (2.0) (California list corrosives).

Today's final rule does not establish prohibition levels, treatment standards, or effective dates for the California list liquid hazardous wastes containing metals or free cyanides. Rather, EPA is publishing a notice of data availability and request for comment which outlines the Agency's findings with respect to establishing more stringent prohibition levels. Since a final decision as to more stringent land disposal prohibitions for these wastes will be contained in a separate notice, most comments on metals and free cyanide issues received in response to the December 11, 1986 proposal will be addressed in that final rule. The California list metals and free cyanides are only addressed in today's final rule for purposes of explaining the Agency's approach to demonstrating compliance with the statutory prohibitions which automatically become effective on July 8, 1987, and for purposes of determining if the statutory prohibition date shall be immediately effective or whether national capacity variances shall be granted.

The California list PCB and HOC wastes that are not subject to a national-capacity variance are prohibited from land disposal unless the wastes comply with the applicable treatment standards (including potential alternative standards granted pursuant to § 268.42(b)), a "no migration" petition has been granted by the Administrator pursuant to § 268.6, a case-by-case capacity variance has been granted pursuant to § 268.5, or the wastes are treated in an impoundment which is exempt from land disposal prohibitions under § 268.4.

The California list corrosives, metal-bearing wastes, and free cyanide wastes are prohibited from land disposal on July 8, 1987, unless a "no migration" petition has been granted by the Administrator under § 268.6, or the Administrator grants a case-by-case capacity variance under § 268.5. In complying with these prohibitions, the regulatory framework promulgated on November 7, 1986 (51 FR 40572) is applicable. Unless otherwise specified in today's rule, the Part 268 (e.g., § 268.7 tracking, notification and certification) and related RCRA Subtitle C requirements (e.g., § 264.13 and § 265.13 waste analysis requirements) are applicable to all of the California list wastes, including the metal and free cyanide containing wastes.

Where treatment standards and prohibitions effective dates are promulgated for California list waste constituents that are also covered under the November 7, 1986 solvents and dioxins final rule, the constituent-specific treatment standards and effective dates promulgated on November 7, 1986 apply. For example, HOC-containing wastes that are also covered by the F001 or F002 spent solvent listings are prohibited from land disposal according to the effective date specified on November 7, 1986 and must be treated to the levels specified in that final rule (or meet those levels as generated). They need not be incinerated in order to reach such levels. (This example assumes that the waste does not exceed the California list prohibitions levels for any constituent but HOCs. See section III. G. below.)

2. Testing Requirements

Today's rule requires that the Paint Filter Liquids Test (PFLT) be used to determine whether a waste, including a free cyanide or metal-bearing waste, is considered to be a liquid or nonliquid waste for purposes of the California list land disposal restrictions. The procedure is method 9095 in EPA Publication No. SW-846, "Test Methods for Evaluating Solid Waste."

The Agency proposed to determine whether a waste is a liquid, and thus potentially subject to the California list land disposal restrictions, at the point of disposal. However, today's final rule departs from the proposal and clarifies EPA's position that wastes (both California list wastes and other wastes restricted under RCRA section 3004) are considered to be prohibited at the point of generation, as described in more detail in the "Scope and Applicability" section of today's preamble.

To determine whether a waste meets the specified prohibition levels, the Agency is departing from the proposed rule which stated that an extract generated using the Toxicity Characteristic Leaching Procedure (TCLP) would be tested. Today's final rule requires a total constituent analysis when testing liquid wastes containing PCBs or liquid or nonliquid wastes containing other HOCs. This approach requires that the entire waste sample be analyzed for the constituents of concern. Today's rule also states that when testing liquid hazardous wastes to evaluate whether they have a pH less than or equal to two (2.0), the existing method for determining the characteristic of corrosivity in § 261.22(a)(1) is required.

In determining compliance with the statutory prohibition levels for metals and free cyanides, EPA will be evaluating whether the filtrate generated from the Paint Filter Liquids Test contains the prohibited constituents in concentrations exceeding the specified levels. The literal sense of the statutory language "liquid hazardous waste, including free liquids associated with any solid or sludge" is that the free cyanide and metal containing waste bans applies when the true aqueous portions of the wastes contain concentrations exceeding the statutory levels. Further, the HOC wastes are prohibited when "total concentration(s)" exceed the statutory levels. The absence of any reference to total concentrations in the metal and cyanide waste provisions strongly suggests a difference in regulatory approach. EPA thus disagrees with those commenters who claimed that a total constituent analysis of the metal and cyanide wastes is mandated.

Consistent with the framework established on November 7, 1986, generators may determine whether their wastes are restricted based on knowledge of the waste pursuant to § 268.7.

3. Halogenated Organic Compounds (HOCs)

The Agency is promulgating the definition of HOCs as proposed (i.e., as a compound containing a carbon-halogen bond), but is modifying the proposed limitation on those HOCs subject to the California list restrictions. Only those HOCs that are listed on a new Appendix III to Part 268 are included within the regulatory definition. In limiting the universe of HOCs subject to today's final rule, the Agency is clarifying that polymeric materials such as polyvinyl chlorides (PVCs) are not HOCs within the scope of the HOC land disposal restrictions because they are not listed on Appendix III.

4. Treatment Standards and Effective Dates

a. *HOCs.* Pursuant to today's final rule, all liquid and nonliquid hazardous wastes containing HOCs in total concentration greater than or equal to 1,000 mg/kg except dilute HOC wastewaters (i.e., HOC-water mixtures containing primarily water and which contain less than 10,000 mg/l HOCs) must be incinerated in accordance with existing RCRA regulations. However, EPA has determined that there is a nationwide lack of such incineration capacity and, therefore, is promulgating a 2-year variance from these treatment standards. HOC wastewaters need not be incinerated but they must be treated to the 1,000 mg/l prohibition level. Because the Agency is unable to determine that there is insufficient treatment capacity for these wastewaters, they are not subject to the 2-year variance. Such wastewaters are prohibited as of July 8, 1987, unless those wastewaters are also F001–F005 spent solvent wastewaters granted a 2-year variance in the November 7, 1986 final rule. HOC wastewaters regulated as hazardous because they contain such listed solvent hazardous wastes remain exempt from the treatment requirements until November 8, 1988.

b. *PCBs.* Liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm must be treated in accordance with existing TSCA thermal treatment regulations at 40 CFR Part 761. EPA proposed to grant a 2-year variance from the July 8, 1987 prohibition effective date for these wastes due to a perceived lack of incineration capacity. However, today's final rule does not grant such a variance.

Although the treatment standards applicable to the California list PCB and HOC wastes are expressed as specified technologies which must be used, alternative treatment methods (e.g., chemical dechlorination of PCBs) may also be utilized provided the Administrator finds that a petitioner's method can achieve a measure of performance equivalent to the method specified by EPA and certain other requirements under § 268.42 are met.

5. Prohibition on Dilution and Evaporation

As proposed, today's rule strengthens the existing prohibition on dilution of restricted wastes by amending § 268.3 to include a prohibition on dilution as a means of avoiding the land disposal restrictions. Thus, dilution of wastes to concentrations below the applicable levels is prohibited, as is dilution to circumvent the effective date of a prohibition on land disposal. Today's final rule also prohibits evaporation of hazardous constituents as the principal means of treatment for purposes of obtaining an exemption under § 268.4, which provision allows treatment of otherwise prohibited wastes in surface impoundments.

6. Permit Modifications and Changes During Interim Status

As proposed, today's final rule allows permitted facilities to use the minor modification process, under certain conditions, to obtain approval to change their facilities to treat or store restricted wastes in tanks or containers as necessary to comply with the land disposal restrictions. Also, today's final rule allows interim status facilities to expand their operations by more than 50 percent, in terms of capital expenditures, to treat or store restricted wastes in tanks or containers as necessary to comply with the land disposal restrictions.

D. Rationale for Immediate Effective Date

Today's rule is effective on July 8, 1987. Absent any regulatory action by EPA, the California list land disposal restrictions in section 3004(d) take effect automatically on July 8, 1987; thus, this is the latest date for EPA to promulgate regulations that will prevent the "hammer" in section 3004(d) from falling. Section 3004(h) of RCRA provides that regulations promulgated under sections 3004(d), (e), (f), or (g) take effect immediately. Moreover, section 3004(m) provides that regulations setting treatment standards must have the same effective date as the applicable regulation promulgated under sections 3004(d), (e), (f), or (g). Therefore, since the statute clearly provides that the regulations implementing section 3004(d) go into effect on July 8, 1987, EPA finds that good cause exists under RCRA section 3010(b)(3) to provide for an immediate effective date. For the same reasons, EPA finds that good cause exists under 5 U.S.C. section 553(d)(3) to waive the requirement that regulations be published at least 30 days before they become effective.

In addition, EPA is promulgating rules establishing an administrative framework for implementing the prohibitions and interpreting certain statutory terms (such as "liquid", "halogenated organic compound", etc.). These rules are a necessary adjunct to the prohibitions which take effect immediately by operation of law, and so it would be impractical for the Agency to delay their effectiveness. Good cause thus exists to make them effective immediately. In the alternative, many of these provisions could be viewed as interpretive rules, and so may take effect immediately.

II. Scope and Applicability

A. RCRA Section 3004(d) Requirements

The RCRA section 3004(d) provisions prohibit the land disposal of hazardous wastes containing California list constituents above specified concentrations. With the exception of HOCs, the restricted wastes must be liquids. In order to be subject to the section 3004(d) provisions, a given waste must meet each of the four criteria discussed in this section: (1) The waste must contain a constituent specified in the California list provisions or have a pH less than or equal to two (2.0) (see section 3004(d)); (2) the physical form of the waste must be a liquid (except for HOCs); (3) the waste containing the California list constituent must be listed or identified as hazardous under RCRA section 3001 (as implemented in 40 CFR Part 261); and (4) the waste must contain a concentration of one or more California list constituents at or above the levels specified in section 3004(d).

1. Definition of California List Constituents

The Agency proposed to define cyanides as any substance that can be shown as having a resonance structure containing a carbon-nitrogen triple bond. There were numerous comments as to the proposed definition of prohibited cyanides and EPA has modified its approach as a result to apply more clearly to the free cyanides in the waste.

The California list metals are easily defined with reference to the periodic table of elements. This requirement applies both to individual constituents and to the relevant metal portion of any compounds containing California list metals.

The Agency proposed that wastes having a pH less than or equal to two (2.0) are to be determined using the method specified for determining the characteristic of corrosivity at 40 CFR 261.22(a)(1). No commenters addressed this issue; therefore, EPA is promulgating this definition as proposed in order to maintain consistency with the existing definition.

The proposed definition of PCBs is consistent with the existing definition in the PCB regulations promulgated under the Toxic Substances Control Act (TSCA). Although one commenter suggested an alternative definition, the Agency does not believe that it is consistent with congressional intent. Therefore, the proposed definition is being promulgated in today's final rule.

EPA proposed to define the universe of prohibited HOCs as any compound that contains a carbon-halogen bond and is listed as a hazardous constituent in 40 CFR Part 261, Appendix VIII. The comments generally supported this approach; however, concern was expressed over the open-ended nature of Appendix VIII and the availability of test methods for all constituents on Appendix VIII. In response to these comments, the Agency has slightly modified its definition of HOCs for purposes of today's final rule.

More detailed definitions of corrosive wastes, and wastes containing cyanides, PCBs, or HOCs are provided later in the preamble sections addressing those constituents.

2. Physical Form Requirement

Except for HOCs (which are prohibited from land disposal in both liquid and nonliquid form), RCRA section 3004(d) prohibits the land disposal of California list wastes only if such wastes exist in liquid form.[1] For purposes of determining whether a given waste is a liquid, the Agency proposed to require use of the Paint Filter Liquids Test (Method 9095 in EPA Publication SW-846). On April 30, 1985 (50 FR 18370), EPA promulgated a final rule requiring use of the Paint Filter Liquids Test in determining whether a waste sample contains free liquids. The Paint Filter Liquids Test is described in detail in both the April 30, 1985 **Federal Register** notice and in the background document for the December 11, 1986 proposed rule. Basically, the method consists of placing a predetermined amount of the waste in a paint filter. If any portion of the waste passes through the filter within five minutes, the waste is deemed to contain free liquids. For purposes of the California list proposal, it would also be considered a liquid waste.

Commenters unanimously supported use of the test; therefore, today's final rule requires use of the Paint Filter Liquids Test to determine whether wastes, including the metal-bearing and cyanide wastes subject to the automatic statutory prohibitions, are liquids for purposes of the California list prohibitions. EPA is clarifying that once a waste is determined to be a liquid, the entire waste is prohibited (provided the concentration of California list constituents in the filtrate, or, for PCBs and HOCs, the entire waste, exceeds the applicable levels), not just the liquid portion. The Paint Filter Liquids Test thus determines whether wastes are liquids for purposes of the California list prohibitions, but not what portion of the waste is prohibited.

3. Hazardous Waste Requirement

RCRA section 3004(d)(2) states that the California list land disposal prohibition "applies to the following hazardous wastes listed or identified under section 3001." This section covers any wastes which are either listed as hazardous under 40 CFR Part 261 or exhibit one or more of the characteristics of hazardous waste identified in Part 261 (i.e. ignitability, corrosivity, reactivity, or EP toxicity), and which also contain a California list constituent. Since PCBs are not currently regulated as hazardous under RCRA, they would have to be mixed with or contained in a RCRA hazardous waste or otherwise be contained in a waste that exhibits a characteristic in order to be subject to the California list prohibitions.

4. Concentration Levels Prohibited From Land Disposal

The California list prohibitions in RCRA section 3004(d) establish certain concentration levels above which there is a strong statutory presumption against land disposal. After the effective date of the prohibitions, the only circumstances in which such wastes may be land disposed in concentrations above the levels specified in section 3004(d) are those cases: (a) For the California list metal and free cyanide containing wastes and corrosive wastes, where the waste has been treated and rendered nonliquid; (b) for the California list PCB wastes, where the waste has been treated by the specified technologies or is subject to a variance from the treatment requirements of § 268.42(b); or (c) for any of these wastes where a petition has been granted pursuant to the § 268.6 "no migration" standards adopted on November 7, 1986 (51 FR 40640).

a. *Codifying the statutory prohibition levels.* HSWA specifies allowable concentration levels for each of the California list constituents; however, the statute and legislative history give EPA both the authority and flexibility to establish more stringent concentration levels. Although EPA is codifying the statutory prohibition levels for the California list corrosives and the California list wastes containing HOCs and PCBs, hazardous wastes that are corrosive or contain these constituents

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[1] EPA will address the solid phase of many of the California list wastes at later dates in accordance with the schedule finalized on May 28, 1986 (51 FR 19300). Listed wastes containing metals in a solid matrix will be addressed pursuant to the various time frames in the final schedule and nonliquid wastes identified by characteristic will be addressed no later than May 8, 1990, in accordance with the provisions in RCRA section 3004(g)(4) and the final schedule.

(except for PCBs, which are not currently regulated as hazardous wastes under RCRA unless they are otherwise contained in hazardous wastes) will be reevaluated according to the Agency's final schedule for promulgating land disposal restrictions (51 FR 19300).

The California list metal and cyanide wastes are being addressed in a separate final rule because the Agency currently is compiling and evaluating data which may indicate that more stringent prohibition levels are necessary to protect human health and the environment. A separate notice of data availability and request for comments will outline EPA's basis for lowering the prohibition levels and establishing treatment standards. As will be discussed more fully in that notice, the Agency is considering promulgating prohibitions on the California list metal and cyanide wastes at levels 100 times existing drinking water standards. Similarly, treatment standards that would be promulgated in the next several months (concurrent with such lower levels) will serve as an interim measure until EPA reevaluates these wastes according to the May 28, 1986 final schedule.

b. *Determination of whether wastes exceed the concentration levels.* Having codified the PCB, HOC, and corrosives statutory prohibition levels, EPA must specify a method for determining whether a waste as generated equals or exceeds these levels. Using the Paint Filter Liquids Test to determine whether or not a waste is a liquid results in a filtrate (the liquid that comes through the filter) and, in many cases, a residue that is left behind. The California list constituents may be contained in the filtrate, entrained in the matrix of the solid residue left on the filter, or may be partitioned between the two phases. Because of this possible partitioning, the Agency considered several approaches as to which part or parts of the wastes should be analyzed in order to determine if the concentration of California list constituents is greater than or equal to the statutory prohibition levels.

The Agency received numerous comments on this issue, many of which were critical of requiring use of the Toxicity Characteristic Leaching Procedure (TCLP) in determining the applicable concentration level. Among the criticisms were comments that the TCLP was inappropriate for use on HOCs in light of statutory language prohibiting HOCs in "total concentration", and comments that the PCB regulations under TSCA require what is in effect a total constituent analysis. For these and other reasons discussed later in today's preamble, EPA is requiring that a total constituent analysis be performed on the liquid hazardous wastes containing PCBs as well as the nonliquid hazardous wastes containing HOCs.

For the liquid hazardous wastes containing free cyanides or the specified metals, EPA is requiring that only the filtrate generated from the Paint Filter Liquids Test be tested in order to determine the applicable statutory concentration levels. Thus, the Agency reads section 3004(d) as applying only when the liquid portion of a waste (which includes the free liquids which partition in the Paint Filter Liquids Test) contains concentrations of the specified metals and free cyanides in excess of the statutory levels. When testing the relevant portions of these wastes, EPA is recommending use of the applicable methods in "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods", EPA Publication No. SW-846, 3d ed., November, 1986.

As in the November 7, 1986, final rule, generators may also determine whether their wastes are restricted using knowledge of the waste. However, a correction notice published in the June 4, 1987, Federal Register (52 FR 21010) clarifies that in such cases the generator must maintain all supporting data used to make such a determination on-site in the generator's files.

B. Determination of When California List Wastes Are Restricted

1. Rationale for Changing from Proposed Point of Disposal Approach

In the proposed rule, EPA stated that California list wastes are determined to be liquids at the point of disposal. While noting that this approach deviates from the November 7, 1986 solvents and dioxins rule (51 FR 40620) which requires that wastes are determined to be restricted at the point of generation, EPA stated that the proposed approach is consistent with congressional concerns about the land disposal of the California list constituents in their liquid or mobile form. Except for the HOC wastes, which are prohibited in both liquid and nonliquid form, the statutory prohibitions apply only to liquid hazardous wastes. Therefore, EPA proposed to allow liquid California list wastes to be treated (e.g., by solidification) at any point, so as to render the waste a nonliquid, and subsequently eligible for land disposal.

EPA continues to believe that Congress' primary goal in enacting the California list prohibitions was to eliminate the land disposal of highly toxic liquid hazardous wastes as a starting point; however, as the Agency noted in a recent notice of data availability and request for comment (52 FR 22356, June 11, 1987), the Agency agrees with the commenter who stated that determining whether these wastes are restricted at the point of disposal is not what Congress intended. The legislative history regarding dilution indicates that Congress intended hazardous wastes, including the California list wastes, to be restricted at the point of generation. (*See e.g.*, H.R. Rep. No. 198, Part I, 98th Cong., 1st Sess. 34–35 (1983).)

Furthermore, a point of disposal approach is inconsistent with the Agency's stated concerns regarding the dilution of California list wastes because the amended dilution language in § 268.3 only applies to restricted wastes. If a waste is not considered to be restricted until the point of disposal, then, by definition, it is not subject to any of the land disposal restriction regulations prior to that time, including the dilution prohibition. This is clearly not what Congress or EPA intended. A point of disposal approach likewise undermines the congressional directive that where the Agency specifies section 3004(m) pretreatment standards, wastes may be land disposed only after being pretreated in accord with those standards (i.e., by a specified method or to a specified level).

The Agency recognizes that it can be argued that the California list statutory language is jurisdictional, i.e., that hazardous wastes which do not fall within the scope of the California list language in section 3004(d) are not prohibited. One commenter made a similar argument that because wastes are only prohibited by statute when land disposed, any determination of their regulatory status must be made at the point of disposal. EPA does not view the section 3004(d) language as jurisdictional (past the point of generation) because such a reading renders the section 3004(m) standards mandated for such wastes, as well as the dilution prohibition, virtually meaningless.

However, the question of whether the section 3004(d) language is jurisdictional is essentially an academic one since the Agency possesses independent authority under RCRA section 3004(g) to require that these wastes be pretreated by specified methods or to specified levels. In essence, EPA could simply prohibit land disposal of certain of the section 3004(g) wastes on an accelerated timetable. This reduces the debate to a matter of semantics (i.e., characterizing the rule as a section 3004(d) or a section 3004(g) rule), and in such circumstances the Agency has great latitude in choosing the means by which to proceed. *See e.g., CMA v. NRDC*, 105 S. Ct. 1102, 1111 (1985). For these reasons, therefore, EPA finds unpersuasive the notion that the California list statutory language is a jurisdictional bar requiring prohibition determinations to be made only at the point of disposal.

2. Final Approach

Having determined not to use a point of disposal approach, EPA is clarifying in today's rule when wastes are considered "prohibited," both for purposes of the California list restrictions and within the remainder of the land disposal restrictions framework.

Today's final rule indicates that "initial generators" of hazardous wastes must determine whether their wastes are prohibited. In interpreting this language to determine at what particular point generators are to make this determination, the Agency has considered two principal options. These are: (1) At the point of generation (see 51 FR at 40620 (Nov. 7, 1986), 51 FR 44727 (Dec. 11, 1986) (raising the issue)); or (2) at the point of common aggregation preceding centralized treatment (52 FR 22356 (June 11, 1987)). In this last-mentioned notice, EPA advanced as reasons for interpreting the rules to use a point of aggregation approach the feasibility of sampling wastes in enclosed systems such as pipes or process vessels, plus the fact that aggregation in many cases is a legitimate and necessary step in centralized treatment processes.

Commenters to the June 11, 1987 notice pointed out, however, the severe practical difficulties of determining a precise point of legitimate aggregation. Commenters also raised the issue that a point of aggregation approach could result in less treatment of concentrated waste streams, or could in some cases lead to impermissible dilution.

Upon reconsideration, EPA has decided to adhere to the interpretation from the November 7, 1986 rules that initial generators are to determine if their hazardous wastes are prohibited at the point of generation. 51 FR 44620. In the first place, the implementation difficulties with a point of aggregation approach are considerable, and could only be solved on a case-by-case basis, raising the possibility of uncertainty and inconsistent determinations. The point of generation is easier to demarcate, and, indeed, EPA's rules on when a waste is hazardous already use this test. *See* § 261.3 (b)(1) and (b)(3). The Agency sees no compelling reason to deviate from this long-standing regulatory requirement.

Perhaps more important is the need to avoid the possibility of compromising applicable treatment standards. For example, if a generator generates four solvent-bearing wastestreams, one an organic liquid containing greater than 10,000 ppm prohibited solvent, and the other three containing less than 10,000 ppm solvents, it was the Agency's intention (and existing rules require) that the concentrated stream has to meet the treatment standard based on incineration (*see* § 268.41(a) and Appendix II to Part 268), and that, if these streams are aggregated, the aggregated streams must meet the treatment standards based on incineration as well (*see* § 268.41(b); *see also* 51 FR at 40623, both of which state that where wastes are combined for treatment, treatment residues must meet the treatment standard for the common constituents). These settled principles could be confused by a point of aggregation approach.

The practical difficulties the Agency saw with a point of generation approach appear to be manageable. As far as the difficulties of sampling enclosed systems, EPA believes that in most cases waste stream pipes are easily entered by installing sample taps. This should not interfere with on-going treatment processes. No claims of difficulty installing such taps have been made since implementation of the solvent ban rule, which adopted a point of generation approach. Generators also can determine if wastes are prohibited based on knowledge of their waste. (§ 268.7(a)). In extreme cases where these means would severely disrupt process or treatment operations, wastes could be sampled when they exit closed systems.

The Agency also wished to ensure that any determination scheme not interfere with, or discourage legitimate centralized treatment. A point of generation approach would not do so. EPA reiterates that aggregation of waste streams for centralized treatment is not considered to be a form of impermissible dilution (51 FR 40592, 52 FR 22356); it is a form of mixing that facilitates treatment. Artificial aggregation points designed to avoid a prohibition certainly would not be considered legitimate, however. (The Agency would also distinguish the case where a waste not requiring treatment or not aiding in treatment is mixed. This would be impermissible dilution, as it would merely dilute hazardous constituents into a larger volume of wastes to lower constituent concentrations. (51 FR 40592).)

EPA also repeats that California list wastes for which there are no treatment standards may be aggregated for treatment (assuming no impermissible dilution) and would no longer be considered prohibited if they no longer exceed the specified prohibition levels or are rendered nonliquid. For example, if a generator generated liquid lead-bearing wastestreams of 1,000, 300, 40, and 50 mg/l lead and aggregated them for centralized treatment and the waste streams before or after treatment contained less than 500 mg/l lead, the waste currently would not be prohibited. Hazardous sludges generated from wastewater treatment likewise would not be prohibited if they do not contain free liquids; nor would such sludges currently be prohibited if they contained free liquids whose filtrate contained less than 500 mg/l lead. (Should EPA promulgate treatment standards for California-list lead-bearing wastes, then the combined lead-bearing wastes in this example would have to meet that treatment standard. (§ 268.41(b).)

Thus, should EPA ultimately adopt treatment standards for California list metal and free cyanide wastes, these wastes would have to meet or be treated to meet these standards and not simply be treated to reduce concentrations below the prohibition levels or be rendered nonliquid. Where treatment standards are expressed as specified technologies, the Agency has stated in the November 7, 1986 final rule that such specified technologies must be employed. *See e.g.*, 51 FR 40628. For example, in today's final rule, the California list wastes containing PCBs must be treated in accordance with the standards specified in § 268.42 (i.e., thermal destruction in incinerators or high efficiency boilers) and may not be rendered nonliquid in order to avoid the Part 268 requirements. EPA believes that this approach reflects the intent of RCRA section 3004(m) to require treatment to a level or "by a method specified in regulations." Allowing solidification of such wastes in lieu of the specified method(s) would undermine the congressional directive in section 3004(m) to require pretreatment and would make EPA's establishment of treatment standards meaningless.

Under these circumstances, EPA does not see that a point of generation approach would require alteration of legitimate centralized treatment practices, or force unwarranted batch treatment. The Agency consequently sees no reason to alter its existing approach.

3. Ramifications of the Final Approach

Determinations as to whether a waste is both a liquid and exceeds the applicable concentrations of hazardous constituents thus would be made at the point of generation. The generator notification and certification requirements in § 268.7(a) likewise would apply at this point.

This point of generation principle also has several ramifications in determining how to treat prohibited wastes, and to what levels such wastes must be treated. With respect to those wastes for which the treatment standard is specified as a method, the wastes would be considered prohibited at the point of generation, with the further consequence that they would require treatment using such methods. Likewise, where EPA has established performance levels as the treatment standard, wastes would have to be treated until they meet that standard. (See also the correction notice published in the June 4, 1987 Federal Register.) Thus, prohibited solvent and dioxin-containing wastes (i.e. solvent and dioxin-containing wastes prohibited at the point described above) would have to be treated to the levels specified in § 268.41. Prohibited solvent or dioxin-containing wastes treated to the one percent level specified in the § 268.30(a)(3) national capacity variance would continue to require treatment to the specified levels. For example, if a prohibited solvent still bottom is incinerated and the incinerator ash residue does not meet the treatment standard but contains less than one percent total F001–F005 solvent constituents, further treatment would be required.

As explained in the June 11, 1987 notice, however, there is one exception to the principle that treatment residues from prohibited wastes must continue to be treated until they meet the treatment standard. This is where treatment results in a residue that belongs to a different treatability group than the initial waste and the Agency has already determined that there is inadequate nationwide capacity to treat the wastes belonging to that group.

For example, if an incinerator was to burn an F001–F005 spent solvent containing greater than or equal to one percent total F001–F005 solvent constituents and generate a scrubber water, this resulting scrubber water belongs to a different treatability group, i.e. the wastewater treatability group. If the scrubber water contains F001–F005 solvent constituents in concentrations less than one percent but greater than the applicable treatment standards, further treatment of the scrubber water would not be required until November 8, 1988 because the Agency has already determined that there is inadequate nationwide capacity to treat liquids containing less than one percent total F001–F005 solvent constituents.

As stated in the June 11, 1987 notice, this distinction comes directly from the Agency's own estimates of available treatment capacity. These estimates included capacity for further treatment of solid (or slurry) solvent treatment residues which did not meet the treatment standards. No capacity was allocated for wastewaters resulting from treatment of these wastes.

The discussion above covers situations where wastes are determined by their initial generator to be presently prohibited at the point of generation (i.e., not subject to any variance). The Agency is clarifying that where the waste initially generated is subject to a national capacity or other variance, any residue from treating the waste remains subject to the variance. This point follows directly from the principle reiterated most recently in the Agency's correction notice (52 FR 21010, June 4, 1987) that the initial generator of hazardous waste determines whether his waste is presently prohibited from land disposal (see § 268.30(a)(3), as amended).

Thus, using F001–F005 solvent wastes as examples, residues from treating small quantity generator wastes (either 1–100 kg/month, or 100–1,000 kg/month), CERCLA response action or RCRA corrective action wastes, or an initial generator's solvent waste containing less than one percent total F001–F005 solvent constituents, would remain exempt regardless of solvent concentration in the residue (or regardless of whether the residues met the treatment standards) since the waste's status has already been determined by the initial generator. The policy rationale for this is that any other result creates a disincentive for treatment. 52 FR 22357. (This discussion assumes that the treatment residues derive solely from treating exempted wastes. If both exempt and regulated wastes are commingled and treated, residues would not automatically be exempt.)

EPA adds several caveats. First, although wastes are considered to be prohibited as early as the point of generation, the California list prohibitions also must necessarily apply at the point of disposal in cases where the waste is not subject to any of the above stated variances. See RCRA sections 3004(d)–(q), 51 FR 40597 (November 7,1986), and 40 CFR 268.7(c) (land disposal facilities are ultimately responsible for ensuring that wastes not meeting the treatment standards or prohibition levels, or not otherwise exempt, are not land disposed). For example, if a waste is initially a nonliquid, but changes its physical form and becomes a liquid (for instance, in transit), the waste would still be prohibited if it exceeds the specified California list concentration levels at the point of disposal. (In this last example, standards could apply to treatment facilities as well. *See e.g.*, § 268.7(b).)

Second, if a non-hazardous waste is treated and the resulting treatment residue is a hazardous waste, the new hazardous waste would be subject to any applicable prohibitions from that point of generation. This is the initial point at which a waste could become subject to RCRA Subtitle C regulation, and therefore to any of the prohibitions. (Furthermore, there is no inconsistency with the regulatory provisions discussed above referring to initial generators, because these provisions apply to initial generators of *hazardous* wastes.)

Finally, as noted in the November 7, 1986, final rule, where a waste generated before a land disposal prohibition effective date is later removed from storage or disposal, it becomes subject to the land disposal prohibitions at that point (assuming that at the time of removal the waste is ineligible for one of several variances and does not already meet the applicable treatment standards). 51 FR 40577. Similarly, residues generated from such wastes, such as leachate or contaminated groundwater containing F001–F005 solvent wastes disposed prior to November 8, 1986, would be viewed as newly generated wastes. Their eligibility for the national capacity variance (or the statutory variance for certain CERCLA response action and RCRA corrective action wastes) would consequently be determined *de novo* upon removal, and not by reference to the composition of the waste prior to the prohibition effective date.

III. Detailed Discussion of Today's Final Rule

A. Free Cyanides and Metals

Today's final rule does not establish prohibition levels or treatment standards for the California list wastes containing free cyanides or metals. These determinations will be made in a separate rulemaking. Today's rule, however, does address the Agency's approach to determining compliance with the statutory prohibitions on the

metal-bearing and cyanide wastes which are automatically effective prior to the separate rulemaking.

1. Definition of Free Cyanides and California List Metals

The Agency proposed to define the universe of prohibited cyanide wastes as any substance that can be shown as having a resonance structure containing a carbon-nitrogen triple bond. The proposed definition would have prohibited the land disposal of wastes containing "total" cyanides above the statutory concentration levels and would have required the use of the Toxicity Characteristic Leaching Procedure (TCLP) to develop a waste extract, which would have then been tested for cyanide concentration levels. The Agency recommended using Method 9010 for Total Cyanide in *Test Methods for Evaluating Solid Wastes, Physical Chemical Methods* (EPA Publication SW-846). This approach was criticized by many commenters as being contrary to the statutory language prohibiting "free" cyanides. Many of these commenters suggested that Method 9010-Cyanides Amenable to Chlorination would be more appropriate. Other commenters suggested that EPA adopt the weak acidic dissociable test from *Standard Methods for the Evaluation of Water and Wastewater* (16th Edition, 1985) (Ref. 4 in Proposal). Commenters in general did not agree with the proposed use of the TCLP to develop a waste extract for further testing.

After evaluating the comments, EPA agrees that the filtrate from the Paint Filter Liquids Test is the portion of the sample that should be analyzed for free cyanides. The Agency is not requiring the use of a particular test, but agrees with commenters that the statutory restriction in section 3004(d) is on "free" cyanides. For analytical purposes, EPA is recommending the use of the Cyanides Amenable to Chlorination test in Method 9010 (EPA Publication SW-846) for determining "free" cyanide concentrations. The Agency believes this is among the more accurate existing methods for measuring free cyanides, it is widely used, and it was recommended by most of the commenters to the proposed rule.

For purposes of the RCRA section 3004(d) prohibition, the California list metals are defined with reference to the periodic table of elements. As discussed in the "Scope and Applicability" section of today's final rule, this requirement applies both to individual constituents and to the relevant metal portion of any compounds containing such metals.

2. Physical Form Requirement

As discussed in the "Scope and Applicability" section of today's final rule, RCRA section 3004(d) prohibits land disposal of the free cyanide and metal wastes only in a liquid form. In determining whether hazardous wastes containing these prohibited constituents are liquids, EPA is requiring use of the Paint Filter Liquids Test. EPA believes that the statutory language referring to "liquid hazardous wastes, including free liquids associated with any solid or sludge" prohibits only the true aqueous portion of the waste plus the filtrate. Not only is this the literal sense of the section 3004(d) language, but the section 3004(c) liquids in landfill provision uses almost identical language (prohibiting disposal in landfills of certain "liquid hazardous or free liquids contained in hazardous waste"), and legislative history to that provision states that this language applies to "liquid in the conventional sense * * * and the free flowing or liquid portion * * * that readily separates." The legislative history further states that the liquid determination can permissibly be made using the Paint Filter Liquids Test. S. Rep. No. 284, 98th Cong., 1st Sess. 22 (1983).

3. Hazardous Waste Requirement

As with the other California list wastes, the free cyanide and metal wastes must be regulated as hazardous under RCRA in order to be subject to the section 3004(d) prohibitions. This provision covers any wastes that are either listed as hazardous under 40 CFR Part 261 or exhibit one or more characteristics of hazardous waste identified in Part 261 (i.e., ignitability, corrosivity, reactivity, or EP toxicity), and which also contain the specified metals or cyanides.

4. Concentration Levels Prohibited From Land Disposal

The Agency proposed to codify the statutory prohibition levels for the California list cyanide and metal wastes; however EPA is not finalizing these proposed levels in today's rule. Instead, EPA is publishing a separate notice of data availability and request for comment requesting comment and data on appropriate prohibition levels and establishing treatment standards for these wastes. Subject to the comments received in response to that notice, EPA will promulgate a final rule addressing these issues.

Prior to promulgation of this separate rule, statutory prohibitions in RCRA section 3004(d) become automatically effective. These concentrations are those described in the section entitled "Summary of Hazardous and Solid Amendments of 1984" at the beginning of today's preamble. As discussed above, EPA interprets the statutory prohibitions as applying when free cyanide or metal concentrations in the filtrate developed using the Paint Filter Liquids Test exceed the statutory concentration levels.

B. Corrosives

1. Final Approach

A *Definition of wastes with pH less than or equal to 2.0.* The Agency proposed to adopt the statutory definition for the liquid hazardous wastes as wastes having a pH less than or equal to two (2.0). No alternative definitions were suggested by commenters. The Agency is therefore finalizing the definition as proposed. The definition is the one currently used in the existing corrosivity characteristic at 40 CFR 261.22(a)(1).

B. *Hazardous waste and physical form requirements.* By definition, acidic wastes are hazardous based on the characteristic of corrosivity found in 40 CFR 261.11(a)(1) when the pH is less or equal to 2.0. If these wastes are treated to a pH greater than two (2.0), they are no longer characteristic hazardous wastes and may be land disposed in a Subtitle D facility. Additionally, section 3004(d)(2) specifies that the California list land disposal restrictions apply only to liquid wastes (with the exception of HOCs). Therefore, since the Agency is not specifiying a technolohgy-based treatment standard, corrosive wastes may be neutralized to a pH greater than 2.0 or rendered nonliquid by chemical fixation or other treatment methods and be eligible for land disposal. If a wastes is hazardous solely because of the characteristic of corrosibity (pH > 2.0), rendering it nonliquid also renders it nonhazardous because the characteristic of corrosivity based on low *pH only applies to aqueous wastes.*

c. *pH levels prohibited.* The Agency proposed to codify the statutory prohibition levels for these acidic wastes. To determine if the wastes exceed the prohibitionl level, the Agency proposed to require testing using the test method specified in 40 CFR 261.22(a)(1). Inadvertantly, EPA also proposed (as part of the general proposal to use the TCLP) that this test method was to be applied to a leachate generated by the TCLP. Use of the TCLP is inappropriate for the corrosive wastes, since it involves a pH adjustment step and use of an acidic extractant. EPA had intended that the pH of a waste be determined by testing the waste sample—not a leachate—to see if it has the properties in § 261.22(a)(1). Thus, today's rule requires that the waste sample be tested using the method specified in § 261.22(a)(1) to determine whether its pH is less than or equal to two (2.0).

2. Determination Not to promulgate Treatment Standards

The Agency proposed that treatment that neutralizes acidic wastes to above two (2.0) are BDAT treatment, and requested comment on whether this type of treatment should be codified as a specified method or performance-based standard. The majority of commenters supported the proposed approach and recommened that treatment be cofified as a performance-based standard. They preferred the performance-based standard because it is consistent with the hazardouw characteristic, it simplifies demonstration of compliance, and it places no limitation on technological developments.

One commenter suggested an alternative treatment standard for corrosive wastes, recommending that the pH levels be raised to a level above four (4.0). The commenter argued that this approach was more consistent with operational recommendations of synthetic liner manufacturers to prevent liner damage caused by acidic wastes. The Agency recognizes the need to fully evaluate treatment performance data and information before promulgating a treatment standard for acidic wastes. The Agency is codifying the statutory prohibition level in today's final rule, but is not promulgating a treatment standard for wastes with pH less than or equal to two (2.0). This approach will not result in any differences for the generator of TSDF, since they still must comply with the prohibition on wasted with a pH less than or equal to two (2.0) specified in 40 CFR 268.32 before the waste is land disposed. The Agency will address the issue of the appropriate treatment standard for corrosive wastes when ti considers the scheluded wastes (51 FR 19300).

Another commenter argued that the Agency should establish an alternative treatment standard for its corrosive wastewater because portions of the wastewater are utilized in a gypsum recovery process that requires the water to be at a pH less than two (2.0). This request does not take into account the statutory language in RCRA section 3004(m) which requires that treatment methods or levels be those "which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents * * *." The commenter's argument regarding its process simply does not address these statutorily mandated requirements. The process in fact is designed to *maintain* the very property which makes the waste hazardous. Thus, even if EPA were to take action to establish treatment standards for these corrosive wastes, the Agency could not grant the commenter's request.

C. Polychlorinated Biphenyls (PCBs)

1. Final Approach

a. *Definition of polychlorinated biphenyls (PCBs).* For the California list restrictions, the Agency is defining PCBs consistent with the definition of 40 CFR 761.3. That provision defines PCBs for purposes of regulation under the Toxic Substances Control Act (TSCA) as "any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such substance." In addition, inadvertently generated non-Aroclor PCBs are defined as "the total PCBs calculated following division of the quantity of monochlorinated biphenyls by 50 and dichlorinated biphenyls by 5." This was inserted in the TSCA regulations in recognition that monochlorinated biphenyls are less toxic and less persistent than dichlorinated biphenyls, which are themselves less toxic and less persistent than polychlorinated biphenyls with greater than two chlorines.

Although an alternative definition of PCBs was suggested by a commenter, EPA believes that in the absence of an alternative definition of PCBs specified in HSWA, it is reasonable to adopt the existing definition found in the TSCA regulations. The statutory reference to 50 ppm is drawn directly from the Agency's regulations, evincing an intent to use the existing regulatory framework. Furthermore, the regulatory definition accounts for differing degrees of hazard associated with different compounds. Such a definition appears to be consistent with congressional intent, as expressed in section 3004(d), to concentrate on wastes that are known to create substantial risk. Moreover, the Agency believes that an alternative definition would add confusion to an already complex and overlapping framework for regulating PCBs. An alternative definition considered by EPA would not have employed the use of division factors for inadvertently generated PCBs. Under this definition, PCBs would have been defined as "the biphenyl molecule that has been chlorinated to any degree." EPA does not believe that this approach is consistent with congressional intent, therefore, the Agency is adopting the TSCA regulatory definition as discussed above.

b. *Hazardous waste requirement.* Since PCBs are not listed as hazardous wastes under RCRA, PCB-containing wastes are only subject to the California list prohibitions if they are mixed with or otherwise contained in wastes which are listed as hazardous under 40 CFR Part 261, or if the mixture exhibits one or more of the characteristics of hazardous waste identified in Part 261 (i.e., ignitability, corrosivity, reactivity, and EP toxicity).

Transformers often contain both PCBs and hazardous constituents listed in 40 CFR Part 261, Appendix VIII. However, if the waste containing these constituents is not a listed or characteristic hazardous waste, the California list prohibition does not apply. For example, some transformers contain isomers of tetrachlorobenzene and trichlorobenzene. Although several of these isomers (e.g. 1,2,4,5-tetrachlorobenzene and 1,2,4-trichlorobenzene) are listed as Appendix VIII hazardous constituents, EPA has not listed wastes containing these isomers as hazardous where the source of the waste is a spent dielectric fluid. Consequently, these PCB-containing spent dielectric fluids will be subject to the California list land disposal prohibitions only if they are mixed with a listed hazardous waste or if they exhibit a characteristic indentified in Part 261.

c. *Prohibition levels.* EPA is codifying the 50 ppm prohibition level specified in section 3004(d)(2)(D) of RCRA. This level is consistent with the comprehensive PCB regulations existing under the Toxic Substances Control Act (TSCA) and, at this time, the Agency does not have data suggesting that a different level is necessary. Under today's final rule, liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm are prohibited from land disposal unless they are treated in accordance with § 268.42, are the subject of a successful "no migration" petition under § 268.6, or are granted a case-by-case extension or national capacity variance.

In determining whether a liquid hazardous waste contains PCBs in concentrations greater than or equal to 50 ppm, EPA proposed requiring testing of a leach extract generated using the TCLP. Because the Agency believes that Congress adopted the 50 ppm prohibition level to be consistent with existing regulations under TSCA, EPA also believes that the test methods required under TSCA are appropriate for use in determining compliance with the land disposal restrictions. The methods specified in the TSCA regulations at 40 CFR 761 do not test leach extracts. Those methods require testing of the total waste. In addition, the statutory prohibition on PCB-containing wastes is expressed in "ppm" rather than "mg/l" as used for the other California list liquid wastes, suggesting that consideration of the solid fraction in the PCB-containing waste is appropriate. Therefore, today's final rule requires that once a hazardous waste containing PCBs is determined to be a liquid, then the total waste (not an extract or filtrate) must be analyzed for purposes of determining compliance with the California list land disposal restrictions.

2. Existing Regulations of PCBs

Regulations promulgated pursuant to TSCA currently address the land disposal of PCB wastes which are not mixed with RCRA hazardous wastes. The TSCA requirements at 40 CFR Part 761 vary depending on the concentration of PCBs in the waste and the physical form in which the waste is disposed, i.e., in bulk liquid form, as a containerized liquid, or as a nonliquid. Disposal of PCBs at concentrations below 50 ppm is not regulated under TSCA unless such concentrations were created by diluting a higher concentration of PCB or unless they are used in specified ways, i.e., as a sealant, coating, dust control agent, pesticide carrier, or as a rust prevention agent on pipes. Liquid PCBs at concentrations greater than or equal to 50 ppm, but less than 500 ppm, may be incinerated or burned in a high efficiency boiler. They may also be land disposed pursuant to the TSCA regulations, but with certain limitations, some of which are summarized in the December 11, 1986 proposed rule (51 FR 44723). Liquid wastes containing PCBs at concentrations greater than or equal to 500 ppm must be incinerated according to TSCA regulations or disposed of by any other approved alternate methods (40 CFR 761.60(e)) that can achieve a level of performance equivalent to the technical standards set in 40 CFR 761.70. Such liquid wastes containing PCBs at concentrations greater than or equal to 500 ppm cannot be land disposed.

3. Relationship Between HSWA and Existing Regulations

Several provisions in HSWA impose restrictions on the land disposal of PCB wastes which are not contained in the existing TSCA or RCRA regulations. The TSCA regulations at 40 CFR 761.1(e) clearly state that where there is an inconsistency between TSCA and RCRA standards, the more stringent regulations govern. In addition, the HSWA legislative history (H.R. Rep. No. 198, Part I, 98th Cong., 1st Sess. 56 (1983)) suggests that allowing the more stringent provisions to govern is also consistent with Congress' understanding of the regulatory scheme. Today's final rule integrates a number of the TSCA requirements into the RCRA framework in order to ensure that where there is an inconsistency between TSCA and RCRA standards the more stringent regulations govern (see § 268.5, § 268.6, § 268.42, and § 268.50 in today's final rule and the accompanying preamble discussions in the section entitled "Modifications to the Land Disposal Restrictions Framework"). For a further discussion of the PCB land disposal requirements in light of the RCRA section 3004(c) liquids in landfill prohibitions and the RCRA section 3004(d) requirements, see the December 11, 1986 proposed rule (51 FR 44723).

4. Treatment Standards

EPA is establishing treatment standards for liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm. The Agency proposed to require thermal destruction (i.e., treatment in incinerators or high efficiency boilers) of such wastes pursuant to the operating standards set forth in 40 CFR 761.60 and 761.70. None of the commenters challenged the appropriateness of these proposed standards, and EPA is promulgating the treatment standards as proposed. Alternative treatment methods (e.g., chemical dechlorination) may be used where the Administrator has determined that such methods achieve a measure of performance equivalent to that achievable by methods EPA has specified, and where certain other enumerated conditions are satisfied. See § 268.42(b). See the section in today's final rule entitled "Treatment Standards" for a further discussion of the treatment standards applicable to the California list PCB-containing wastes.

5. Prohibition Effective Date

The Agency proposed to grant a 2-year nationwide variance from the July 8, 1987 statutory effective date based on a perceived lack of adequate thermal treatment capacity for the California list PCB wastes. Several commenters stated that there is sufficient treatment capacity for liquid halogenated wastes. Although the commenters did not provide quantitative data to support these assertions, EPA has revised its capacity estimates and determined that there does not appear to be a nationwide lack of adequate capacity to treat liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm. Thus, the proposed 2-year variance is not being promulgated in today's final rule. Rather, the statutory effective date of July 8, 1987 is applicable to the California list PCB wastes. To the extent that isolated shortages of capacity occur, applicants may apply for case-by-case extensions pursuant to § 268.5. See the section in today's final rule entitled "Capacity Determinations and Effective Dates" for a further discussion of the Agency's basis for the approach.

D. Halogenated Organic Compounds (HOCs)

1. Final Approach

a. *Definition of halogenated organic compounds (HOCs).* HOCs are compounds containing a carbon and a halogen in the molecular formula. Halogens include the five nonmetallic elements in Group VIIA of the periodic table: fluorine (F), chlorine (Cl), bromine (Br), iodine (I), and astatine (At). For purposes of the California list land disposal prohibitions, the Agency proposed a definition for HOCs that would require a carbon-halogen bond. The rationale for this proposed definition was that compounds that lack such a bond, but that have a halogen attached to an atom such as nitrogen (e.g., aniline hydrochloride), are not true HOCs. All the commenters who addressed this issue agreed that a carbon-halogen bond should be required; therefore, today's final rule promulgates the HOC definition as proposed.

b. *Hazardous waste requirement.* Wastes containing HOCs are only subject to the California list prohibitions if the waste is listed as hazardous under 40 CFR Part 261 or exhibits one or more of the characteristics of hazardous waste identified in Part 261. However, the waste listing or characteristic need not be related to the HOC content of the hazardous waste for it to be covered.

c. *Concentration levels prohibited.* The RCRA section 3004(d)(2)(E) prohibition codified today applies only to hazardous wastes containing HOCs in total concentration greater than or equal to 1,000 mg/kg. Although EPA is codifying the statutory prohibition level as proposed, the Agency will be evaluating each hazardous waste containing HOCs in accordance with the final schedule for implementing the land disposal restrictions (51 FR 19300)). At that time, prohibitions on land disposal and treatment standards will be established to the extent necessary for individual HOCs or groups of related HOCs.

In determining the concentration of HOCs in a hazardous waste, the Agency recognized that the proposed carbon-halogen definition presents a potential problem because it would include a number of polymerized and other halogenated compounds that are generally considered nonhazardous due to their relative immobility and lack of toxicity. EPA stated in the proposal that Congress did not indicate an intent to include within the California list prohibitions every possible HOC such as polymers that comprise solid plastics and vinyls. Instead, EPA stated that Congress was concerned with constituents that are mobile and/or potentially hazardous to human health and the environment. Therefore, the Agency proposed to limit the HOCs included under the California list prohibition to those HOCs which are regulated as hazardous under 40 CFR Part 261 or listed in Appendix VIII to Part 261.

Many commenters agreed with the Agency's proposed rationale for limiting the HOC prohibition; however, several suggested that the Agency clarify that polyvinyl chlorides (PVCs) are not subject to the California list prohibitions. Although some commenters supported the reference to Appendix VIII as a means of limiting the HOC prohibition, other commenters stated that testing for Appendix VIII constituents is difficult due to, among other things, the lack of appropriate test methods and the undefined boundaries inherent in the list (e.g., because of the "not otherwise specified" (N.O.S.) categories). The commenters suggested that EPA substitute Part 264, Appendix IX in place of Part 261, Appendix VIII as a limitation on the HOC prohibition.

EPA agrees with the concerns of commenters regarding testing and is requiring in today's final rule that, in determining whether a hazardous waste contains HOCs in concentrations above the California list prohibition level, only those HOCs which are listed in Part 268 Appendix III must be included in the calculation. Appendix III is being added to Part 268 in today's final rule. It consists of all HOCs which EPA currently analyzes in establishing section 3004(m) treatment standards expressed as performance levels. (See the "BDAT Pollutant List" in *Generic Quality Assurance Project Plan for Land Disposal Restrictions Program (BDAT)*, U.S. EPA, Office of Solid Waste; March 12, 1987.) The Agency has also added PCBs not otherwise specified to this Appendix because the "BDAT Pollutant List" that formed the basis for Appendix III only lists certain Aroclor PCBs (whereas the existing TSCA regulations apply to non-Aroclor PCBs as well).

Appendix III is a finite list of constituents for which test methods exist, thereby addressing the commenters' concerns. It includes only HOCs found in Appendix VIII of Part 261, and so is limited to toxic HOCs, satisfying the concerns of commenters and the Agency that innocuous HOCs not be included. EPA is not adopting the Part 264 Appendix IX limitation suggested by several commenters because it has not been finalized as yet and because Appendix IX only addresses those HOCs that are water soluble, and so would not be appropriate when HOCs are found in solid matrices. (When finalized, Appendix IX will serve as the new list of constituents for which ground water monitoring is required.) The list adopted in Appendix III to Part 268 also contains HOCs that are not water soluble and, therefore, EPA believes it addresses congressional concerns and better represents a comprehensive yet enforceable list of HOCs to be regulated.

In finalizing the HOC prohibition, EPA is reiterating that compounds such as PVCs, even if contained in hazardous wastes, are not within the scope of the California list prohibitions because PVCs are not included on Appendix III to Part 268. However, monomeric vinyl chloride is subject to the restrictions because it is listed in Part 268 Appendix III.

In testing for the HOCs discussed above, EPA proposed to require use of the TCLP. Several commenters were critical of this approach because they stated that the statutory prohibition on HOCs "in total concentration" indicated that EPA should require total constituent analysis.

The Agency agrees with the comments that a total constituent analysis better reflects congressional intent (as well as the literal statutory language) regarding the HOC prohibition and, therefore, today's final rule departs from the proposed approach in this respect. As a result, the entire waste (not an extract) must be tested in order to determine the concentrations of the HOCs discussed above. However, as in the November 7, 1986 final rule, generators need not test their wastes if they can make a determination as to whether or not they are restricted using knowledge of the waste. In doing so, generators must maintain all supporting data used to make such a determination on-site in the generator's files.

2. Relationship to California List Prohibition on PCBs

As discussed earlier in the preamble, today's final rule codifies the RCRA section 3004(d)(2)(D) prohibition on the land disposal of liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm. Because PCBs are also halogenated organic compounds, EPA reads the PCB prohibition as placing an upper limit of 50 ppm on the concentration of PCBs that may be contained in a hazardous waste containing HOCs which is land disposed. (As discussed more fully later in today's preamble, the treatment standards and prohibition effective dates for the PCB-containing wastes, as the more waste-specific determinations, would control and the HOC treatment standards and effective dates are superceded).

The limitation of 50 ppm, however, is only applicable to *liquid* hazardous wastes containing PCBs. Therefore, a nonliquid hazardous waste containing PCBs at concentrations greater than or equal to 50 ppm may be land disposed without violating the California list PCB prohibition on HOCs as long as the total concentration of HOCs does not exceed 1,000 mg/kg. For example, a nonliquid hazardous waste containing 200 mg/kg (ppm) PCBs and 700 mg/kg (ppm) other HOCs may be land disposed because the 50 ppm prohibition does not apply to nonliquids and because the 900 mg/kg total HOC concentration does not exceed the 1,000 mg/kg threshold promulgated in today's final rule.

If the total concentration of HOCs in either a liquid or nonliquid hazardous waste is greater than or equal to 1,000 mg/kg, the waste is prohibited from land disposal even if the concentration of PCBs is below 50 ppm. For example, a liquid hazardous waste containing 25 mg/kg (ppm) PCBs and 980 mg/kg HOCs other than PCBs is prohibited from land disposal under the California list HOC prohibition despite the fact that the California list prohibition on PCBs would allow up to 50 ppm PCBs in a liquid hazardous waste to be land disposed. Also, a nonliquid hazardous waste containing 400 mg/kg (ppm) PCBs and 700 mg/kg HOCs other than PCBs is prohibited from land disposal despite the fact that existing regulations promulgated under TSCA would allow such nonliquid PCB wastes to be disposed in an approved landfill.

3. Treatment Standards

EPA is establishing incineration as the treatment standard for all hazardous wastes containing HOCs in total concentration greater than or equal to 1,000 mg/1 except dilute HOC wastewaters (i.e., liquid hazardous wastes that are primarily water and contain HOCs in total concentration less than 10,000 mg/1). As explained more fully below, however, if an HOC-containing waste already is subject to a treatment standard for a specific HOC (e.g., and F001 or F002 spent solvent, or a prohibited dioxin- or PCB-containing waste), the treatment standard applicable to the more specific HOC waste would control. Thus, when all of the treatment standards become effective, the wastes need not be incinerated to meet the solvent, dioxin, and PCB treatment standards. (See the section of today's final entitled "Treatment Standards" for a further discussion of the treatment requirements applicable to the California list HOC-containing wastes).

4. Prohibition Effective Dates

Due to a lack of incineration capacity, the Agency proposed to grant a 2-year nationwide variance from the July 8, 1987 statutory effective date for the California list wastes requiring incineration. EPA did not propose to grant a nationwide variance for the dilute HOC wastewaters. As a result, these wastes would be prohibited from land disposal as of July 8, 1987. EPA received mixed comments regarding available treatment capacity for the California list HOC wastes; however, no quantitative data were submitted suggesting that incineration capacity was adequate. Therefore, the Agency is promulgating the 2-year variances as proposed. To the extent that new data are developed by the Agency, revised capacity determinations will be made, some of which could result in the revocation of existing nationwide variances. (For a further discussion of these issues, see the section in today's final rule entitled "Capacity Determinations and Effective Dates.")

E. Treatment Standards

Today's final rule promulgates treatment standards for several of the California list wastes. Unlike the concentration-based treatment standards established for the solvent- and dioxin-containing wastes on November 7, 1986 (51 FR 40572), today's treatment standards are expressed as specified technologies. These specified technologies are applicable to the California list wastes containing HOCs (except for dilute HOC wastewaters) and the California list wastes containing PCBs. Today's final rule does not establish treatment standards for the California list wastes that contain metals or free cyanides. Treatment standards for these wastes are being addressed in a separate final rulemaking. Today's final rule also does not establish treatment standards for the California list corrosive wastes. As a result, the statutory prohibitions on liquid hazardous wastes containing cyanides, metals, and those having a pH less than or equal to two (2.0) govern the degree to which such wastes must be treated prior to land disposal.

1. HOC Containing Wastes

As discussed in the proposed rule (51 FR 44725), the treatment technologies applicable to hazardous wastes containing HOCs in total concentration greater than or equal to the 1,000 mg/kg statutory prohibition level are similar to those technologies identified as the basis for establishing BDAT for the F001–F005 solvent wastes. (F001 and F002 spent solvents are halogenated organic compounds.) These technologies include incineration, batch distillation, thin film evaporation, fractionation, biological degradation, activated carbon adsorption, and steam stripping.

a. *Dilute HOC wastewaters.* Among these technologies, EPA determined in the November 7, 1986 final rule that wastewater treatment technolgies such as biological treatment, activated carbon adsorption, and steam stripping should form the basis for concentration-based treatment standards applicable to the F001–F005 solvent wastewaters. However, the Agency did not propose to establish treatment standards for HOCs not covered by the November 7, 1986 final rule. The rationale for this approach was that the wide variety of contituents included within the term "halogenated organic compounds", even as limited in this rulemaking, makes it impractical at this time for EPA to develop wastewater treatment standards expressed either as concentration levels or as specified technologies. Application of technologies such as biological treatment, activated carbon adsorption, or steam stripping may be effective for many HOC wastes; however, a generalization that one or all of them constitutes BDAT for such a wide variety of compounds is not possible at this time.

In the absence of data submitted by the commenters, EPA is promulgating the dilute HOC wastewater prohibition as proposed. As a result, dilute HOC wastewaters (i.e., wastes that are primarily water and contain less than 10,000 mg/l HOCs) must be treated to concentrations below the 1,000 mg/l statutory prohibition level prior to land disposal. However, no particular methods for achieving this level are specified in today's final rule. As stated in the proposal, EPA will reevaluate each of the HOCs covered under the California list prohibitions (except for the solvent and dioxin-containing wastes for which the Agency has already established treatment standards on November 7, 1986) in accordance with the schedule published in the **Federal Register** on May 28, 1986 (51 FR 19300).

b. *Other HOC wastes.* For the California list HOC wastes that are not dilute wastewaters as defined above, EPA proposed to establish treatment standards expressed as a specified technology. The required method specified in the proposal was incineration in accordance with the existing requirements of 40 CFR Part 264 Subpart O or 40 CFR Part 265 Subpart O.

One commenter stated that the administrative record does not support the Agency's selection of incineration as BDAT for these non-wastewater hazardous wastes containing HOCs in total concentration greater than or equal to 1,000 mg/kg. The same commenter also stated that in establishing incineration as BDAT the Agency must demonstrate at least the same level of treatment performance as that required for permitting under 40 CFR Part 264 Subpart O. For example, the commenter asserted that since EPA is promulgating a generic rulemaking, it must demonstrate 99.99% destruction and removal efficiency (four 9s DRE) for all HOCs the Agency includes within the scope of the HOC treatment standard.

The Agency disagrees with the commenter that the administrative record does not support EPA's selection of incineration as BDAT for the non-wastewater HOC wastes subject to today's final rule. In the preamble to the proposed rule (51 FR 44725), the Agency cited the November 7, 1986 final rule as support for a determination that incineration represents BDAT for most organic liquids as well as organic and inorganic sludges and solids. Further support for incineration as the basis for BDAT is the fact that incineration is presently a demonstrated and currently used treatment method for most PCB compounds. These halogenated organic PCB compounds are very stable and difficult to destroy. The background documents for the November 7, 1986 final rule contain data regarding the incineration of hazardous wastes containing HOCs (chlorinated solvents). The data summarize the performance of 10 incinerators at nine facilities. Of the nine facilities, seven facilities incinerated HOC wastes and all seven showed a reduction in the concentration of HOCs in incinerator ash sufficient to satisfy the RCRA section 3004(m) requirement that any treatment levels or methods specified by EPA substantially diminish the toxicity of the waste so that short-term and long-term threats to human health and the environment are minimized.

The requirement that hazardous waste incinerators achieve 99.99% DRE is codified in the existing RCRA regulations under Part 264 Subpart O. The requirement is also mandated by statute. RCRA section 3004(o)(1)(B). The California list final rule does not reopen consideration of the permit standards. If a facility demonstrates that a restricted waste cannot be incinerated in compliance with Subpart O requirements, the facility may petition the Agency for a treatment variance pursuant to § 268.44 or the facility may petition EPA for approval to use an alternative equivalent treatment method pursuant to § 268.42(b).

The Agency recently proposed that burning HOC wastes in boilers industrial furnaces in compliance with proposed Part 266 standards would be equally effective as Subpart O incineration and suggested that such methods could form the basis for a revised determination of BDAT. 52 FR 16982 (May 6, 1987). These standards could provide for use of these alternatives to incineration in treating prohibited HOC wastes without requiring a case-specific demonstration as to equivalency pursuant to § 268.42(b).

c. *Applicability of today's treatment standards.* Although EPA has determined that incineration is an appropriate treatment standard for the broad category of wastes referred to as HOCs, the Agency recognizes that the California list was intended as a starting point in the land disposal restrictions and so where the Agency has developed waste-specific data it is desirable to refine the treatment requirements accordingly. Such waste-specific requirements are likely to be more reliable, as the wastes themselves are better characterized. Furthermore, as discussed in the November 7, 1986 final rule, the Agency prefers to establish concentration-based treatment standards rather than treatment standards expressed as specified technologies because EPA believes that this will provide the regulated community with greater flexibility in meeting treatment standards and will encourage the development of more efficient and innovative technologies.

Consistent with these principles, and in response to a commenter's concern over which treatment standards apply where a waste contains several constituents, the HOC treatment standards promulgated in today's final rule are only applicable to those HOCs that are not covered by other Agency rulemakings under § 268.41, § 268.42, or § 268.43. The Agency has provided in § 268.42 that treatment standards established for wastes containing individual California list constituents will supersede today's treatment standards. With respect to the prohibition effective date, the waste-specific determination that adequate treatment capacity does or does not exist for the more specific type of HOC waste would also be controlling. Therefore, § 268.32 states that the prohibition effective date established for the more specific HOC waste would apply, not the prohibition effective date established today for the generic HOC wastes.

For example, a restricted waste (i.e., a waste to which no variances apply) containing an F001 or F002 halogenated spent solvent constituent (such as trichloroethylene—F001) is subject to a concentration-based treatment standard. See Table CCWE, 51 FR 40642, November 7, 1986). Thus, such a waste need only be treated to meet the applicable levels in Table CCWE. The Agency is not requiring that incineration be used to achieve this level. However, the waste must be treated to these levels effective November 8, 1986 and is not entitled to the 2-year nationwide capacity variance applicable to non-solvent HOCs.

The Agency cautions, however, that these principles stating that waste-specific determinations as to treatment standards and effective dates are controlling over more generic determinations only applies where the wastes are a subset of HOCs for which treatment standards and prohibition effective dates exist. (The wastes currently affected by this overlap are the prohibited solvent, dioxin, and PCB wastes. Several additional examples of the Agency's approach in such cases are provided following the section entitled "Capacity Determinations and Effective Dates" in today's preamble.) Where a hazardous waste contains both HOCs and non-HOC constituents (e.g., prohibited levels of a California list metal in liquid form), the waste would be prohibited from land disposal until it is in compliance with the treatment standard for both HOC and non/HOC constituents (or, until treatment standards are promulgated for the California list metals, the waste also meets the statutory prohibition levels or has been treated and rendered nonliquid). In this case, unlike the case of the HOC/more-specific-HOC overlap, there is no necessary relation between treatment of the non-HOC constituent and the HOCs, so that HOCs could go untreated if the treatment standards for only the non-HOC constituents applied. The general principle here is that where different constituents are present in the same waste (as opposed to one constituent appearing on two lists, e.g., an F001–F002 solvent which is also an HOC), all of the constituents in the waste must be in compliance with, or be treated to comply with, all specified treatment standards (or prohibition levels where no treatment standards have been established). The same principle would apply in determining prohibition effective dates for wastes containing HOCs and non-HOC constituents. Unless the Agency had specifically addressed this type of waste matrix in its capacity determinations, the prohibition effective date for each constitutent would be applicable.[2]

For example, where a liquid hazardous waste contains both California list metals above the statutory prohibition levels and HOCs in total concentration greater than or equal to 10,000 mg/l, the applicable prohibition effective dates are July 8, 1987 for the metal portion of the waste and July 8, 1989 for the HOC portion. This reading is not only consistent with the Agency's analysis of available treatment capacity (EPA is finding that there presently does not exist a nationwide shortage of treatment capacity for such metals), but it is also necessary to avoid situations where the Agency would be granting a national capacity variance for a period longer than two years. This could happen, for instance, in the case of an F001–F005 solvent waste which is entitled to the 2-year variance from the November 8, 1986 prohibition effective date but which also contains prohibited concentrations of California list constituents (e.g., metals) for which EPA

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[2] Even if the Agency had addressed this type of waste matrix, EPA is not precluded from revising its determinations as to treatment standards and corresponding prohibition effective dates (within certain statutory constraints regarding the length of variances to the effective dates). However, the Agency's subsequent determination would have to evince a clear intent to supersede an earlier determination; otherwise each prohibition effective date would apply.

established an effective date later than November 8, 1988 (assuming only for purposes of this example that such a variance was granted for the metal-bearing wastes). Since national capacity variances cannot exceed two years (RCRA section 3004(h)(2)), the variance on the solvent portion of the waste could not extend beyond November 8, 1988. For these reasons, today's final rule states in § 268.32 that constituents in a waste may become subject to prohibitions different times.

2. PCB-Containing Wastes

The Agency proposed to establish treatment standards expressed as specified technologies for liquid hazardous wastes containing PCBs in concentrations greater than or equal to 50 ppms. The proposed methods were thermal treatment pursuant to the technical requirements in the TSCA regulations at 40 CFR 761.60 (burning in high efficiency boilers) or 40 CFR 761.70 (incineration). Commenters did not challenge the appropriateness of the well established TSCA treatment specifications, therefore, EPA is finalizing the treatment standards as proposed.

The treatment standards promulgated today in § 268.42(a) are consistent with the TSCA regulations which require the incineration of liquid wastes containing PCBS at concentrations greater than or equal to 500 ppm. Liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm and less than 500 ppm may be burned in either high efficiency boilers or in incinerators. As with the prohibited HOC weastes or any other wastes subject to treatment standards expressed as specified technologies, alternative equivalent methods may be used provided they are approved by the Administrator according to the standards and procedures specified in § 268.42(B).

Applications for approval of alternative equivalent methods should be submitted to the EPA Administrator; however, where such applications involve PCB-containing wastes copies should also be sent to the Director, Exposure Evaluation Division, Office of Toxic Substances, and to the Chief, Waste Treatment Branch, Office of Solid Waste.

Regardless of whether the specified methods in § 268.42(a) or alternative equivalent methods approved under § 268.42(b) are employed, EPA is clarifying that, since the PCB wastes subject to today's prohibitions are contained in RCRA hazardous wastes, compliance with the applicable provisions in 40 CFR Parts 264, 265, and 266 is also required. The more stringent technical operating requirements for incineration in the TSCA regulations are applicable; however, facilities treating these liquid hazardous wastes containing PCBs must also be in compliance with existing RCRA interim status or permit standards specified in Part 264 and 265. In addition, any Part 266 regulations that may be promulgated with respect to the burning of hazardous wastes in boilers and industrial furnaces will also apply. (See 52 FR 16982, May 6, 1987.)

Liquid hazardous wastes may contain both PCBs and other hazardous constituents for which EPA has established different treatment standards or prohibition effective dates. An example would be solvent wastes and PCB wastes mixed in a single matrix. In this circumstance, both sets of treatment standards and effective dates would apply. This is consistent with the principle outlined above that where different constituents are present in a waste, all applicable treatment standards and prohibition effective dates must be complied with.

F. Capacity Determinations and Effective Dates

1. HOC-Containing Wastes

On December 11, 1986, EPA proposed that liquid hazardous wastes containing halogenated organic compounds (HOCs) in total concentrations greater than or equal to 1,000 mg/l and less than 10,000 mg/l HOCs ("dilute HOC wastewaters") be prohibited effective July 8, 1987. EPA did not consider proposing a 2-year nationwide variance for the dilute HOC wastewaters, in part, because the Agency believed it was legally precluded from granting capacity variances where treatment standards are not specified. For all other California list HOC wastes, EPA proposed incineration as the required treatment method and proposed to grant a 2-year nationwide variance from the July 8, 1987 prohibition effective date due to a lack of incineration capacity. For these wastes, EPA stated that incineration capacity was already exhausted as a result of the land disposal prohibitions for solvent-containing hazardous wastes.

Several commenters suggested that there was available thermal treatment capacity for liquid HOC wastes. Other commenters questioned whether the Agency was in fact legally precluded from granting capacity variances where it did not establish treatment standards. Additional commenters noted that the Agency had already found that there is inadequate capacity to treat dilute solvent wastewaters, which are a subset of dilute HOC wastewaters, and noted the incongruity of not granting a corresponding variance for the dilute HOC wastewaters. The Agency has reexamined these issues in light of the comments received and in light of new information. EPA's findings are set out below.

a. *Legal constraints on granting national capacity variances.* As stated in the Agency's recent notice of data availability and request for comment (52 FR 22356, June 11, 1987), the threshold issue here is whether the Agency is barred as a matter of law from granting capacity variances where it does not specify treatment standards. Upon reexamination, EPA believes there is no absolute legal constraint. No commenter to the June 11, 1987 notice challenged this conclusion. The statute itself contemplates that such variances can be granted. Section 3004(h)(2) indicates that the Agency may grant a national capacity variance in either of two cases: (1) With respect to wastes prohibited when the Agency promulgates regulations pursuant to section 3004(d)-(g); or (2) with respect to hazardous wastes "subject to a prohibition" under those same subsections. In this latter case, the prohibition would take effect by operation of law (i.e., the so-called statutory hammer would fall), and no treatment standards would be established. Yet the statute states that EPA remains authorized to grant national capacity variances. The Agency could grant case-by-case extensions of the effective date under section 3004(h)(3) as well, since (h)(3) authorizes extensions to an "effective date which would otherwise apply" under subsections (d)-(g) or subsection (h)(2). These effective dates, as just explained, can take effect whether or not the Agency promulgates treatment standards.

In addition, the statutory standard that authorizes EPA to grant capacity variances is not identical to the language in section 3004(m) authorizing EPA to establish waste treatment standards. The Agency construes this to mean that it need not consider precisely identical factors. Section 3004(h)(2) requires the Agency's determination to be based on availability of "adequate alternative treatment, recovery, or disposal capacity which protects human health and the environment * * *". This can either be broader or narrower, under different circumstances, than treatment satisfying the section 3004(m) standards. 51 FR at 40600. The key point here, however, is that the existence of the different statutory standards for granting capacity variances and establishing treatment standards confirms that the two determinations are not inextricably linked.

b. *Determination not to grant national capacity variance for dilute HOC wastewaters.* Although the Agency's rationale at proposal for not granting national capacity variances for dilute nonsolvent HOC wastewaters would no longer apply, the Agency does not believe such a variance is warranted. The Agency's estimates are that these wastes are generated in low volumes, and most of these wastes are believed to contain less than the statutory HOC prohibition level. 52 FR 22358. No commenter challenged this conclusion. In addition, there is some available commercial capacity to treat these wastes. 51 FR 40614.

Commenters to the December 11, 1986 proposed rule and the June 11, 1987 notice did not document any shortage of available treatment capacity; however, several suggested that the Agency's determination in the November 7, 1986 rule that there is inadequate treatment capacity for certain dilute solvent wastewaters (which are also HOCs) is inconsistent with the proposed approach not to grant a nationwide variance for the dilute HOC wastewaters. The two rules are consistent. The dilute solvent wastewaters granted a national capacity variance in the November 7, 1986 rule are not limited to wastes containing 1,000 mg/l solvent HOCs. Rather, many of those wastes contain less than 1,000 mg/l solvent HOCs and, therefore, are not subject to the capacity demands imposed by the California list prohibitions.

The Agency notes, however, that the national capacity variance for F001–F005 solvent-containing wastewaters would continue to apply even if the solvent wastes also contain over 1,000 mg/l HOCs as long as the wastewater is regulated as hazardous because of the F001–F005 solvent constituents. This is because EPA has already addressed these specific types of HOC wastes on November 7, 1986 and has indicated in the California list proposal (51 FR 44725) and earlier in today's preamble that such waste-specific determinations supersede the California list determinations. However, if the solvent-HOC hazardous wastewater is not regulated as hazardous by virtue of being an F001–F005 solvent, it does not meet the definition of those wastes addressed in the November 7, 1986 rule and, therefore, it is subject to the prohibition effective date promulgated for the dilute HOC wastewaters. As a result, the hazardous waste would be prohibited effective July 8, 1987 despite the fact it might contain constituents identical to those specified in the F001–F005 listings.

C. *Determination to grant national capacity variance for HOC liquids containing greater than 10,000 mg/l HOCs and HOC solids.* As stated earlier in this section to today's final rule, EPA has specified incineration as the required treatment for all California list HOC wastes except dilute HOC wastewaters and determined that, due in large part to the additional demand placed on incinerators as a result of the November 7, 1986 solvent restrictions, there is a nationwide lack of incineration capacity. Several commenters suggested that incineration capacity exists for the liquid HOC wastes; however, quantitative data were not submitted to support these assertions. Other commenters agreed with the Agency's capacity analysis as discussed in the proposed rule (51 FR 44732). Based on EPA's data and public comments, the Agency is granting the proposed 2-year nationwide variances from the July 8, 1987 prohibition effective date for these categories of California list HOC wastes.

As noted in the previous section entitled "Treatment Standards," the Agency prefers to establish concentration-based treatment standards rather than treatment standards expressed as specified technologies because concentration-based standards provide the regulated community with flexibility and are believed to encourage the development of innovative new treatment processes or more efficient operation of existing technologies. In addition, EPA intends to revise treatment standards as new technologies emerge or the Agency obtains new data. For example, the Agency's recent proposal (52 FR 16982, May 6, 1987) to regulate the burning of hazardous wastes (including HOCs) in boilers and industrial furnaces and to specify numerous operating requirements could form the basis for a revision of the HOC treatment standard. In the absence of regulatory standards specifying operation of these devices, the Agency is not yet comfortable including them as treatment methods, and intends to first analyze comments to the May 6, 1987 proposal before instituting any such action. Should EPA revise the treatment standards as mentioned above, or in other ways, a revised capacity determination will be required in order to justify the continuance to today's national capacity variances.

2. PCB-Containing Wastes

On December 11, 1986, EPA proposed treatment standards for the California list liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm. In proposing these treatment standards (i.e., thermal treatment in accordance with existing technical requirements set forth in the TSCA regulations at 40 CFR Part 761), EPA also proposed to grant a 2-year nationwide variance based on a perceived lack of such thermal treatment capacity.

A reevaluation of existing data and new volume and incineration capacity data indicate that there is not a nationwide shortage of capacity to manage the small volumes of these PCB wastes that are currently land disposed.

For the liquid wastes containing PCBs at concentrations greater than or equal to 500 ppm, the TSCA regulations in 40 CFR Part 761 already require incineration. Since none of these wastes can permissably be land disposed currently, the California list prohibitions do not add any incremental demand to a capacity analysis. Therefore, the Agency is not granting the proposed 2-year nationwide capacity variance. As with the HOC wastes discussed above, any individual demonstrations of capacity shortfalls may warrant a case-by-case extension provided the requirements of § 268.5 are met.

The primary impact of the California list prohibitions on PCB-containing wastes is on liquid wastes containing PCBs at concentrations greater than or equal to 50 ppm and less than 500 ppm. Such wastes could previously be land disposed under the TSCA regulations provided absorbents are added and other requirements are met. Today's final rule prohibits the land disposal of such concentrations if contained in hazardous waste; however, Agency data indicate that very low volumes are currently being land disposed. In addition, treatment capacity in high efficiency boilers and alternative technologies (e.g., chemical dechlorination) appear to be adequate. Therefore, additional demand for treatment as a result of the California list prohibitions appears minimal and existing estimates of capacity supply do not warrant granting a nationwide variance for these wastes. This conclusion was not disputed by any commenter to the June 11, notice.

3. Metals, Free Cyanides, and Corrosives

The Agency stated in the November 7, 1986 final rule (51 FR 44732) and the June

11, 1987 notice (52 FR 22359) that it does not believe it is necessary to grant a national capacity variance for the California list metal, cyanide, and corrosive wastes, given the relative ease with which treatment can be conducted and unregulated tank capacity can be installed. Several commenters challenged this conclusion. EPA is currently reevaluating its assumption that tank capacity and associated treatment devices can be rapidly installed; however, the Agency does not believe it can currently justify granting of national capacity variances given its uncertainties about volumes of wastes generated, existence of commercial treatment capacity, plus the ability to treat these California lists wastes to render them nonliquid (ordinarily a relatively unsophisticated treatment process) and, therefore, no longer prohibited. In addition, the fact that EPA has only received two petitions to date requesting case-by-case extensions for California list wastes suggests that no national shortages exist. To the extent that there are isolated shortages in capacity, case-by-case extensions may be granted pursuant to the requirements of § 268.5. Although today's final rule does not grant a nationwide variance for these wastes, the Agency is concerned that certain large volume flows might pose a capacity problem, and is compiling and evaluating data relevant to future capacity determinations.

G. Examples Illustrating Integration of Today's Final Rule With Other Land Disposal Restrictions Rules

The following examples are the Agency's interpretation of the operation of today's final rule. (These examples assume that none of the exemptions in §§ 268.4, 268.5, and 268.6 apply.)

1. *Generator A generates a liquid hazardous waste containing 2,000 ppm HOCs, some of which are F001 hazardous waste solvents.* The waste must meet the treatment standard for the F001 solvent by November 8, 1988. The treatment standards and prohibition effective dates for spent solvent wastes control here because these solvents are a subset of HOCs already addressed in the November 7, 1986 final rule. (See § 268.30(a)(3) which states that solvent wastes containing less than 1% total F001–F005 constituents as initially generated are prohibited effective November 8, 1988, 51 FR 40641, 52 FR 21012, 21017.)

2. *Generator B generates a nonliquid hazardous waste containing 12,000 ppm HOCs, over 10,000 ppm of which are F001 solvents.* For the same reasons as the previous example, the waste must meet the treatment standard for F001 solvents, but it need not be incinerated to do so. The land disposal prohibition for F001 wastes containing greater than or equal to 1% total F001–F005 solvent constituents is already in effect (since November 8, 1986). (This answer assumes that the waste is not generated by a small quantity generator, a CERCLA response action, or RCRA corrective action.)

3. *Generator C, a small quantity generator (SQG) of 100–1,000 kg per month of hazardous waste, generates a spent solvent waste containing 20,000 ppm of F001 solvents and 25,000 ppm of other HOCs.* The treatment standard for F001 solvents will apply as of November 8, 1988 because the Agency has determined that there is currently insufficient nationwide treatment capacity for such spent solvent wastes generated by SQGs. (See §268.30(a)(1) at 51 FR 40641.) As these SQG F001 solvents are a subset of HOCs already addressed in the November 7, 1986 final rule, their treatment standards and prohibition effective data will control.

4. *Generator D, a large quantity generator, generates a non-CERCLA liquid hazardous waste containing 600 ppm PCBs and 11,000 ppm hazardous waste spent chlorinated solvents.* The waste must meet the treatment standard for both solvents and PCBs, and must do so by incineration. These prohibitions are effective immediately. Solvents and PCBs are considered to be different constituents and, therefore, both sets of treatment standards and prohibition effective dates (November 8, 1986 and July 8, 1987, respectively) apply. While the earlier examples illustrate that the HOC prohibitions are superseded by prohibitions on more specific types of HOCs, this is not the case here because solvents are not a subset of PCBs or vice versa.

5a. *Generator E, a small quantity generator (100–1,000 kg/mo), generates the same waste as Generator D in the previous example.* Because EPA has not found any shortage in nationwide PCB treatment capacity, this waste would have to be incinerated as of July 8, 1987.

5b. *Same facts as the previous example, except the waste is not a liquid.* Only the treatment standards and November 8, 1986 prohibition effective date for the solvent applies because nonliquid PCB wastes are not prohibited in today's final rule.

6. *Generator F generates a liquid hazardous waste containing 11,000 mg/l HOCs and 600 mg/l lead.* The HOC portion of the waste is not prohibited until July 8, 1988. The metal portion of the waste is prohibited immediately. Once the HOC prohibition becomes effective, the waste cannot be land disposed until it has been incinerated. The residue from incineration may be land disposed if it is a nonliquid (e.g., an ash) or, if still a liquid (e.g., a scrubber water), it contains less than 500 ppm lead (or more stringent levels that may be specified). The general principle here is that where a waste contains different constituents that are not subsets, the waste must meet the treatment standards and prohibition effective dates for each such constituent.

H. Comparative Risk and Available Treatment Alternatives

As EPA recognized in establishing a framework for implementing the statutorily mandated land disposal restrictions, Congress did not intend that risks to human health and the environment be increased as a result of such restrictions. To help prevent situations in which regulations restricting hazardous wastes from the land disposal would encourage treatment technologies posing greater risks than those posed by direct land disposal, EPA is conducting comparative risk analyses. In the November 7, 1986 final rule (51 FR 40572), the Agency conducted comparative risk assessments for the first category of wastes subject to the land disposal restrictions, i.e., certain dioxin-containing the solvent-containing hazardous wastes.

The Agency has conducted comparative risk assessments in conjunction with establishing section 3004(m) treatment standards for several of the California list wastes. The methodology employed is similar but not identical to that utilized in the November 7, 1986 solvents and dioxins final rule. The RCRA Risk-Cost Analysis (WET) Model continues to be the primary tool for assessing comparative risks; however, the WET Model has been revised on the basis of detailed case studies performed for the November 7, 1986 final rule and public comments responding to the Agency's approach in that rulemaking.

Results of the comparative risk analysis are not being used to allow continued land disposal of untreated hazardous waste. Instead, treatment technologies that are determined to pose greater total risks than land disposal of untreated wastes are excluded (i.e., considered "unavailable") as a basis for establishing the section 3004(m) treatment standards. If the best or most efficient treatment technology for a waste is determined to be riskier than land disposal, the decision to classify it as unavailable will have a direct impact on the level or method established as the section 3004(m) treatment standard. The treatment standard, which must be based on the capabilities of the best demonstrated available treatment technologies for a waste, is then based upon the capabilities of the best demonstrated treatment technology that does not pose greater risks than land disposal. To the extent that the next best treatment technology performs less efficiently than the best technology (in terms of the fate of its residuals in the environment), the resulting section 3004(m) treatment standard will be less stringent.

As noted in the November 7, 1986 final rule, treatment technologies identified as riskier than land disposal, and therefore, classified as unavailable for purposes of establishing standards, may still be used by facilities in complying with treatment standards expressed as performance levels. Accordingly, EPA is committed to developing sufficient regulatory controls or prohibitions over the design and operation of these technologies to ensure that their use in complying with the treatment standards does not result in increased risks to human health and the environment. The analyses conducted in support of these comparative risk assessments will provide a basis for developing such controls or prohibitions, however, additional supporting data will be necessary. Where, as in today's final rule, the section 3004(m) treatment standards are expressed as specific methods which must be utilized, a determination to classify a treatment alternative as unavailable will prohibit the use of that technology in complying with the applicable treatment standards.

The comparative risk analysis conducted for selected California list wastes estimated the human health risks of land disposal practices and treatment alternatives for California list PCB and HOC wastes. These assessments produced estimates of two measures of risk: the probability of harm to the maximum exposed individual (MEI risk); and the total number of cases of health effects (population risk). For a treatment to be considered unavailable with respect to a certain waste stream: (1) It had to be more risky than land disposal along all points of the risk distribution; (2) the treatment and land disposal risks had to share the same medium and constitutent of concern; and (3) the first two conditions had to be met for both the population and MEI risk distributions for that waste stream.

Results of the comparative risk assessments indicate that the best demonstrated treatment methods for the PCB and HOC wastes are not clearly riskier than land disposal. Whenever treatment is less risky or it is uncertain that a given treatment technology or treatment train is clearly riskier than land disposal, as in today's final rule concerning California list wastes, the Agency will consider the treatment available for determining treatment standards and will develop data to support additional regulatory controls that may be appropriate. All alternate treatment technologies modeled in this analysis were determined to be available alternatives to the land disposal of HOC-containing California list wastes. For all PCB-containing California list wastes, incineration to 99.9999 percent (six 9s) destruction and removal efficiency (DRE) was determined to be an available alternative to disposal in a landfill.

IV. Modifications to the Land Disposal Restrictions Framework

Today's final rule does two things. First, it addresses the land disposal of the second category of wastes scheduled for prohibition under RCRA section 3004, i.e., the "California list" wastes. Second, it modifies portions of the land disposal restrictions framework promulgated on November 7, 1986 (51 FR 40572). Unless otherwise specified (e.g. the unique waste analysis requirements codified in § 268.32), the modified framework applies to both California list wastes and all other restricted wastes. This section in today's final rule describes the substantive changes made in the framework and briefly discusses any unique requirements with respect to the California list wastes.

A. General Waste Analysis (§ 264.13 and § 265.13)

In the November 7, 1986 final rule (51 FR 40637–38), the Agency amended the general waste analysis provisions by requiring owners or operators to specify in their written waste analysis plans certain procedures and schedules for meeting the requirements of the § 268.4 treatment in surface impoundments exemption. In particular, § 264.13(b)(7)(iii) and § 265.13(b)(7)(iii) require the waste analysis plan to specify the procedures and schedules for complying with the RCRA section 3005(j)(11)(B) requirement to annually remove hazardous residues for subsequent management. In implementing the hazardous residue removal requirement, the Agency stated that such residues need not be delisted. Rather, EPA provided in § 268.4(a)(2) that the removal requirement could be satisfied if the residues which do not meet the Subpart D treatment standards are removed. The rationale for this approach is that since wastes meeting the treatment standards may be land disposed, such wastes should not be subject to the removal requirement.

Today's rule does not change the basic thrust of this approach. However, many of the California list wastes are subject to prohibition levels which are not expressed (at least as yet) as treatment standards. Similar to wastes that are treated to meet corresponding treatment standards, California list wastes treated to below the prohibition levels may be land disposed. Today's final rule revises § 268.4(a)(2) to provide that where no treatment standards have been established (e.g., for several of the California list wastes), residues not meeting the applicable prohibition levels are subject to the annual removal requirement. As a result, the waste analysis requirements are also revised accordingly. (Incidentally, such a residue could not be rendered nonliquid and then be placed back in an impoundment unless it also meets the specified prohibition level because it would become liquid again immediately upon placement in the impoundment.)

B. Purpose, Scope and Applicability of Part 268 (§ 268.1)

In § 268.1 of the November 7, 1986, final rule (51 FR 40638), the Agency stated that the Part 268 land disposal restrictions apply to generators, transporters, and owners or operators of treatment, storage, or disposal facilities. EPA also noted (51 FR 40577) that the land disposal restrictions apply to both interim status and permitted facilities.

Section 268.1 also contains certain exemptions from the land disposal prohibitions. Among these are exemptions for: (1) Wastes that are subject to successful case-by-case extensions pursuant to § 268.5; (2) wastes that are the subject of a successful "no migration" petition pursuant to § 268.6; (3) contaminated soil and debris resulting from a response action taken under section 104 or section 106 of CERCLA or resulting from a corrective action required under RCRA; and (4) wastes generated by small quantity generators of less than 100 kilograms of non-acute hazardous wastes per month or less than 1 kilogram of acute hazardous waste per month. These exemptions continue to apply.

The Agency notes that it omitted to cross-reference an existing regulatory exemption in proposing the California list rules. This is the exemption in 40 CFR 262.51 for a farmer disposing of waste pesticides from his own use on his own farm in accordance with the disposal instructions on the pesticide label. There is no suggestion in RCRA or the legislative history that this practice, which can be similar to lawful application of a pesticide product, was intended to be subject to the land disposal prohibitions. The Agency discussed this omission in the June 11, 1987 notice of data availability and received no adverse comment. Therefore, today's final rule codifies this exemption in § 268.1(d) and revise § 262.51 accordingly.

EPA is not amending § 268.1 to exempt lab packs, as requested by some commenters. As the Agency stated in the November 7, 1986 final rule (51 FR 40584), lab packs remain subject to the land disposal restrictions because neither the legislative history nor the statute indicate that lab packs can be excluded from the land disposal restrictions if they contain restricted wastes in concentrations exceeding the applicable treatment standards or prohibition levels. In addition, liquid wastes contained in lab packs must comply with the Part 264 and Part 265 requirements regarding the placement of containerized liquids in landfills.

C. Definitions Applicable to this Part (§ 268.2)

As stated earlier in today's preamble, EPA is defining the California list constituents subject to the RCRA section 3004(d) prohibitions on land disposal. To avoid confusion in the regulated community over which wastes are subject to the section 3004(d) prohibitions, the Agency has codified several of these definitions in § 268.2. A more detailed discussion of the basis for these definitions appears in the earlier preamble sections addressing each constituent.

The Agency also notes that today's rule slightly revises the language defining the term "land disposal" to correct an ambiguity in the November 7, 1986 version of the definition. As revised, the definition clearly states that "land disposal" is "placement in or on the land" and that such placement need only be "for disposal purposes" when placement occurs in the concrete vault or bunker. See RCRA section 3004(k).

D. Dilution Prohibition (§ 268.3)

EPA proposed to amend the § 268.3 dilution prohibition promulgated on November 7, 1986 (51 FR 40639) to include dilution to avoid a prohibition in Subpart C of Part 268 (e.g., dilution to below the restrictions levels for the California list wastes) and dilution to circumvent the effective date of a Subpart C prohibition on land disposal. As proposed, these amendments to § 268.3 would apply to the entire land disposal restrictions program, and not just to the California list wastes. For example, a waste prohibited from land disposal as of November 8, 1986 because it contains greater than or equal to 1% total F001–F005 solvents could not be diluted to create a solvent waste containing less than 1% total F001–F005 solvent constituents in order to take advantage of the November 8, 1988 prohibition effective date applicable to the latter group of solvent wastes.

Most of the commenters supported the proposed amendments to the dilution prohibition; however, several expressed concern that solidification not be eliminated as a means of treating restricted hazardous wastes. They stated that solidification is treatment, not dilution, and should be allowed.

EPA is promulgating the amendments to the dilution prohibition as proposed; however, the Agency is clarifying that it agrees with the commenters that solidification—i.e., treatment that renders the waste nonliquid—is appropriate treatment in many cases. Therefore, legitimate solidification technologies are appropriate for use on the California list metal-bearing wastes, at least until treatment standards have been established for such wastes.

In the November 7, 1986 final rule (51 FR 40592), EPA noted that many treatment methods require the addition of reagents, but do not thereby constitute dilution. Addition of these reagents produces physical or chemical changes and does not merely dilute the hazardous constituents into a larger volume of waste so as to lower the constituent concentration. Where such physical or chemical changes do not occur, or where the hazardous constituents (e.g., metals) are not otherwise immobilized, "solidification" techniques may possibly be considered dilution as a substitute for adequate treatment within the meaning of the § 268.3 prohibition.

As a practical matter, even where solidification techniques are not considered dilution, the liquids in landfills prohibitions set forth in § 264.314 and § 265.314 remain applicable. These provisions place certain prohibitions on the use of absorbents. (See, for example, "Statutory Interpretative Guidance on the Placement of Bulk Liquid Hazardous Waste in Landfills," OSWER Policy Directive #9487.00–2A, June 11, 1986.)

EPA notes that once treatment standards are promulgated for the liquid metal-bearing wastes, solidification in and of itself will no longer be a permissible means of treatment to avoid a prohibition. Solidification will either have to achieve the treatment levels or, where treatment standards have been expressed as specified technologies, those technologies must be utilized. Where particular technologies have been specified, any treatment methods not specified in § 268.42 or approved under § 268.42(b) are not allowed. Thus, in today's final rule, the California list wastes containing PCBs must be treated using the specified thermal destruction technologies (i.e., incineration or burning in high efficiency boilers).

The Agency also notes here that, as stated earlier in today's preamble, legitimate aggregation of waste streams (e.g., wastewaters) to facilitate centralized treatment is not considered impermissible dilution. However, artificial aggregation of wastes to avoid a land disposal prohibition standard, or mixing substances that do not either themselves need to be treated or which do not aid in treatment, would be considered impermissible.

E. Treatment Surface Impoundment Exemption: Evaporation Prohibition (§ 268.4)

In addition to modifying the treatment residue removal requirement as described in section A of this unit in today's preamble, EPA is also revising § 268.4 to prohibit, in certain circumstances, the evaporation of hazardous constituents for purposes of obtaining an exemption allowing treatment of prohibited in surface impoundments. The Agency proposed this limitation because of its belief that only impoundments used to treat restricted wastes to reduce their toxicity or mobility, and not just to transfer hazardous constituents and their associated risks to other media (e.g., from the land to the air), should be eligible for the § 268.4 exemption.

A majority of the commenters supported the proposed prohibition, but several suggested that *de minimis* or other releases incident to treatment should be allowed. One commenter stated that EPA should focus on the risks of evaporation in defining the appropriate scope of the prohibition. The Agency agrees with the comments that *de minimis* evaporation incident to properly operated and effective treatment methods should be allowed in the context of today's final rule. Today's final rule thus states that evaporation of hazardous constituents as the principal means of treatment is not considered permissible treatment for purposes of a § 268.4 exemption.

In finalizing the proposed prohibition, EPA emphasizes that it is defining what constitutes permissible "treatment" for purposes of section 268.4 and RCRA section 3005(j)(11). EPA agrees that evaporation risks should be evaluated but not in the context of today's final rule. The Agency is not determining in this final rule whether evaporation from such impoundments poses risks requiring control. This will be determined in the context of rules implementing RCRA section 3004(n). Rather, EPA is stating that impoundments which merely evaporate hazardous constituents are not engaging in an activity justifying receipt of prohibited wastes. This reading of the statute is a corollary to the prohibition on dilution: both evaporation as described above and dilution do nothing to remove, destroy, or immobilize contaminants as contemplated by RCRA. The thrust of the statutory provision in section 3005(j)(11) is to grant a limited exemption for impoundments engaged in treatment which to some extent meet the objectives of section 3004(m), namely which reduce levels of toxicity or reduce the potential for hazardous constituents to migrate from the waste. Practices which do nothing more than transfer hazardous constituents to other media fail to satisfy this objective. Put another way, since placement of restricted wastes in surface impoundments is considered land disposal under RCRA section 3004(k) and § 268.2, the Agency does not believe that Congress intended to allow this exemption where impoundments are essentially engaged in land disposal, i.e., placement on the land followed by the evaporation of hazardous constituents. Therefore, today's final rule prohibits such evaporation as the "principal" means of treatment for purposes of a § 268.4 exemption.

An example of impermissible evaporation of hazardous constituents as the "principal" means of treatment is where the sole activity occurring in the impoundment is the volatilization of organic compounds into the ambient air. However, EPA recognizes that certain treatment practices include evaporation as a consequence of treatment (e.g., aggressive biological treatment) or involve emissions of hazardous constituents incident to other treatment. These practices are nonetheless legitimate treatment under § 268.4 because they destroy or immobilize hazardous constituents. (This is not to say that "aggressive" treatment is necessarily required in order to comply with § 268.4.)

The Agency is also clarifying its intent that evaporation of water or other compounds not on the list of "hazardous constituents" (in 40 CFR Part 261, Appendix VIII) is not addressed by today's final rule. Therefore, a treatment process involving the evaporation of water as the principal means of treatment is currently eligible for a § 268.4 exemption. For example, dewatering liquid metal-bearing wastes to concentrate metals for recovery or further treatment is acceptable under today's final rule.

F. Case-by-Case Extensions (§ 268.5)

In § 268.5 of the November 7, 1986 final rule (51 FR 40639), EPA established procedures for obtaining case-by-case extensions to a prohibition effective date pursuant to the authority of RCRA section 3004(h)(3). One requirement in § 268.5 for obtaining such extensions is that the applicant demonstrate that he has entered into a binding contractual commitment to construct or otherwise provide treatment, recovery, or disposal capacity that meets the applicable treatment standards. The rationale for this requirement is that Congress intended to encourage the development of alternative capacity by accommodating those making a good faith effort to comply with the prohibitions by the effective date but who are unable to do so due to circumstances beyond their control. (See S. Rep. No. 284, 98th Cong., 1st Sess. 19 (1983).) The basic thrust of this approach is not changed by today's final rule; however, the Agency has recognized that applicants cannot demonstrate a binding contractual commitment to provide capacity meeting treatment standards where no treatment standards have been established (e.g., for several of the California list wastes). Therefore, EPA is revising § 268.5 to require that, where no treatment standards have been established, the capacity being provided must meet the underlying statutory standard of being protective of human health and the environment.

Two other modifications to § 268.5 are also being promulgated in today's final rule, both of which deal with how prohibited wastes subject to a case-by-case extension may be managed during the period of such an extension. On November 7, 1986, EPA stated that such wastes may be placed in landfills or surface impoundments provided certain minimum technological requirements are met. Section 268.5(h)(2) references the applicable minimum technological requirements specified in Part 264 and Part 265; however, § 265.221 does not contain a reference to the RCRA section 3005(j)(1) provision stating that existing interim status surface impoundments must be in compliance with the minimum technological requirements applicable to new impoundments by November 8, 1988. Although the Agency has not codified this statutory requirement, it remains applicable. In order to clarify the regulated community's obligations, however, today's final rule references the RCRA section 3005(j)(1) requirement in § 268.5(h)(2).

Another modification to § 268.5(h)(2) is made in today's final rule with respect to the disposal of California list PCB-containing wastes that are subject to a case-by-case extension. In order to integrate the TSCA and RCRA requirements, a new paragraph (h)(2)(v) is added which states that a landfill disposing of such PCB-containing wastes during the period of an extension must be in compliance with both the TSCA regulations for chemical waste landfills at 40 CFR 761.75 (PCB wastes at 50 ppm or greater may not be placed in surface impoundments under the TSCA regulations) and the Part 264 and 265 requirements. This modification has been made to ensure that the more stringent of the two sets of requirements apply.

G. "No Migration" Petitions to Allow Continued Land Disposal (§ 268.6)

In the November 7, 1986, final rule (51 FR 40640), EPA established procedures for granting petitions allowing prohibited wastes to be land disposed where applicants can demonstrate, to a reasonable degree of certainty, that there will be "no migration of hazardous constituents from the disposal unit or injection zone for as long as the wastes remain hazardous." RCRA sections 3004 (d), (e), and (g). Today's final rule does not change the procedures established in § 268.6; however, the exemption is being limited by excluding certain PCB-containing wastes from eligibility for such exemptions.

Current TSCA regulations require that liquid wastes containing PCBs at concentrations greater than or equal to 500 ppm be incinerated according to 40 CFR 761.70 standards. In order to avoid the possibility of circumventing this TSCA requirement, EPA is revising § 268.6 to provide that liquid hazardous wastes containing PCBs at concentrations greater than or equal to 500 ppm are not eligible for such "no migration" exemptions. Although this limitation was not specifically discussed in the December 11, 1986 proposal, the Agency did state (51 FR 44723) that where there is an inconsistency between TSCA and RCRA standards, the more stringent requirements govern. Today's modification to § 268.6 simply codifies an existing TSCA standard within the

RCRA regulations in order to facilitate compliance by the regulated community.

H. Waste Analysis and Recordkeeping (§ 268.7)

In the November 7, 1986, final rule (51 FR 40597), EPA acknowledged that the ultimate responsibility is on land disposal facilities to ensure that prohibited wastes are not illegally disposed. However, the Agency also recognized that a testing and tracking scheme is critical to implementation and, as a result, imposed certain waste analysis, notice and recordkeeping requirements on generators and treatment facilities, as well as land disposal facilities. These requirements, as specified in § 268.7 and set forth in the Agency's recent correction notice (52 FR 21010, June 4, 1987), are not substantially modified in today's final rule.

Generators remain responsible for determining whether their wastes are restricted from land disposal and may continue to make this determination based on knowledge of their waste, testing, or both. A unique aspect of today's final rule is that, when testing, the Toxicity Characteristic Leaching Procedure (TCLP) is not required for the California list wastes. Rather than testing an extract developed using the TCLP (as is required for the solvents and dioxins to determine if wastes meet the applicable treatment standards), § 268.32 specifies the relevant portion of the waste to test, i.e., the entire waste and not a leach extract for HOCs, PCBs, and corrosives. Other revisions to § 268.7 involve modifications and the notice and certification provisions to require reference to the applicable prohibition levels where no treatment standards are established. The remainder of § 268.7 is unchanged.

I. Waste Specific Prohibitions—California List Wastes (§ 268.32)

The primary focus of today's rule is on codifying statutory land disposal prohibitions, establishing effective dates, and, for certain California list wastes, promulgating treatment standards. Today's final rule adds a new § 268.32 which contains the prohibitions and effective dates. The unique waste analysis requirements for these wastes are also included in § 268.32.

Prohibitions and effective dates for the California list metal and free cyanide containing wastes are not included in today's final rule. These determinations will be made in a separate rulemaking. In the interim, the statutory prohibitions in RCRA section 3004(d)(2)(B) are applicable and today's preamble discusses the Agency's approach to determining compliance with the statutory prohibitions. In addition, § 268.32 (and § 268.42) are revised to state that the California list prohibitions, treatment standards, and effective dates for HOCs are superseded by more specific Agency determinations regarding treatment standards and prohibition effective dates (e.g., any determinations already made for solvent-containing and dioxin-containing wastes on November 7, 1986, or any determinations to be made according to the May 28, 1986 schedule. (51 FR 19300)).

The rationale for this approach is that EPA has recognized (51 FR 44725) that it is difficult to establish prohibitions and treatment standards for the broad and diverse categories of wastes specified on the California list. In both the December 11, 1986 proposal (51 FR 44715) and today's final rule, EPA has noted that Congress intended the California list prohibitions to serve as a starting point in carrying out the congressional mandate to minimize land disposal of hazardous waste. Therefore, as the Agency develops data on particular waste streams, it will promulgate prohibitions, treatment standards, and effective dates that will supersede those promulgated today.

J. Treatment Standards Expressed as Specified Technologies (§ 268.42)

Today's final rule establishes treatment standards expressed as specified technologies for the California list wastes containing HOCs (except dilute HOC wastewaters) and those containing PCBs. The technologies specified in § 268.42(a) are thermal treatment methods currently subject to existing regulations and are discussed in more detail in today's preamble section entitled "Treatment Standards." Because the PCB wastes subject to these treatment standards are mixed with RCRA hazardous wastes, the Agency is reiterating in § 268.42(a)(1) that compliance with both the TSCA and RCRA standards is required in treating such wastes. This will ensure that today's treatment standards do not result in reducing the stringency of existing treatment requirements for PCB wastes or RCRA hazardous wastes.

EPA is also clarifying two aspects of § 268.42(b). As promulgated on November 7, 1986 (51 FR 40642), this provision allows the Administrator to approve the use of alternative treatment methods provided an applicant can demonstrate that such alternatives can achieve a measure of performance equivalent to that achievable by methods EPA has specified. A further demonstration must be made that the alternative treatment method does not pose an unreasonable risk to human health or the environment.

One commenter suggested that such equivalency petitions may only be granted through rulemaking after notice and public comment. The Agency does not fully agree. Such a determination could be made in such a way as not to have general applicability and effect, and so amount only to an individualized variance. The Agency does not believe that in such instances rulemaking procedures necessarily are required. To the extent, however, that Agency action on an equivalency petition would have general applicability and effect (for example, indicating that a technology constituted an equivalent technology for classes of wastes and generators), then rulemaking procedures would be appropriate. The EPA would make this determination when evaluating each petition. The language in § 268.42(b) therefore should not be read to require use of rulemaking procedures in every case.

The Agency is removing the language in § 268.42(b) requiring petitioners to demonstrate that their treatment method does not pose an "unreasonable risk." This standard is drawn from the Toxic Substances Control Act (TSCA) and is inappropriate for a RCRA determination. EPA is substituting the RCRA standard which requires a demonstration that the alternative treatment method is "protective of human health and the environment." To the extent that the equivalency petition is made with respect to PCB-containing wastes also regulated under TSCA, the applicant would also have to satisfy the "unreasonable risk" standard contained in 40 CFR 761.60(e) as part of the demonstration required independently under the TSCA regulations. The remainder of the § 268.42(b) framework continues to apply.

K. Prohibitions on Storage of Restricted Wastes (§ 268.50)

Today's final rule does not modify the framework for prohibiting storage of restricted wastes; however, two revisions are being made that are unique to the California list wastes. First, the applicability provision in § 268.50(e) is being modified to account for wastes for which treatment standards are not specified (e.g., several of the California list wastes). As promulgated on November 7, 1986 (51 FR 40642), this provision exempted from the storage prohibitions any wastes meeting the applicable treatment standards, i.e., wastes that are not prohibited from land disposal. Today's revisions to § 268.50(e) simply extend this principle to wastes that are not prohibited from land disposal but for which treatment standards are not specified.

Section 268.50 is also being revised to incorporate an existing TSCA PCB storage prohibition into the RCRA regulations in order to integrate the two sets of requirements and facilitate compliance by the regulated community. Existing TSCA regulations at 40 CFR 761.65(a) require that wastes containing PCBs at concentrations greater than or equal to 50 ppm be removed from storage and disposed within one year from the date when they were first placed into storage. The RCRA regulations in § 268.50, however, allow storage of restricted wastes in tanks or containers where such storage is "solely for the purpose of the accumulation of such quantities of hazardous waste as necessary to facilitate proper recovery, treatment, or disposal." Despite some confusion in the regulated community, § 268.50 does not establish a firm time limit on allowable storage of restricted wastes. Section 268.50 merely shifts the burden of demonstrating compliance (or lack thereof) when restricted wastes are stored beyond one year. Storage violations may occur within one year, or storage may be allowable beyond one year, depending on the reasons for such storage. Absent a modification to § 268.50 for the California list PCB wastes, the open-ended RCRA storage prohibition could circumvent the flat one-year limit imposed by the TSCA regulations. Therefore, today's final rule revises § 268.50 to require that the California list PCB wastes may only be stored in accordance with the § 268.50 requirements, but that such storage is limited to one year. For the convenience of the regulated community, today's rule also revises § 268.50 to incorporate the § 761.65(b) provision requiring certain physical characteristics at such PCB storage facilities (e.g., adequate roofing, walls, and floors with curbing).

L. Minor Modifications of Permits and Changes During Interim Status (§ 270.42 and § 270.72)

On December 11, 1987, the Agency proposed two amendments to the requirements in Part 270 to give facilities the ability to change their operations to treat or store restricted wastes in tanks or containers as necessary to comply with the Part 268 land disposal restrictions. For permitted facilities it was proposed that such changes could be approved through the minor modification process under certain conditions. It was also proposed that these expansions at interim status facilities would not be subject to the reconstruction ban. The following two sections discuss the comments received on the proposed approach and a description of the provisions contained in today's final rule.

1. Minor Modifications of Permits (§ 270.42)

All comments received on the proposed amendment to the minor permit modification regulations supported the proposed approach. Commenters indicated that the use of minor modifications would be essential to allow facilities to respond promptly and effectively to the land disposal restrictions. The Agency agrees with the commenters and is promulgating § 270.42(p) essentially as proposed.

Specifically, this provision will allow permitted facilities to use the minor modification process in obtaining approval to make changes as needed to treat or store restricted wastes in tanks or containers in order to comply with Part 268 land disposal restrictions, provided the permittee complies with the following conditions: first, the owner or operator must submit a complete major permit modification application pursuant to §§ 124.5 and 270.41; second, the applicant must demonstrate that changes in a unit to treat or store restricted wastes in tanks or containers are necessary to comply with the land disposal restrictions of Part 268; and third, the applicant must ensure that such units comply with the applicable Part 265 standards until the major modification request is granted or until Part 265 closure and post-closure responsibilities are fulfilled. For example, any tanks used to treat or store restricted wastes would be subject to the tank system standards of Part 265, Subpart J, which include secondary containment requirements for new tanks (see 51 FR 25422, July 14, 1986). The authorization to continue in operation with the changes terminates upon final administrative disposition of the major modification request or the termination of the permit.

One commenter suggested that the minor modification provision should be expanded to include units other than tanks and containers. As stated in the preamble to the proposal, EPA believes that the addition of other treatment processes, such as incineration, is likely to raise issues that would be best addressed through the major modification process. However, the Agency is exploring these issues as part of an overall review of the permit modification regulations. EPA recently completed regulatory negotiations on permit modifications, and expects to issue a proposed rule in the next several months.

2. Changes During Interim Status: Removal of Reconstruction Limits (§ 270.72)

The Agency proposed to allow interim status facilities to modify their operations to treat or store restricted wastes in tanks or containers as necessary to comply with the land disposal restrictions without being required to obtain a permit even if such changes exceed the reconstruction limits. Current regulations at § 272.72(e) require owners or operators of interim status facilities that may need to expand the facility by more than 50 percent (in terms of capital investment) to defer such changes until a permit is issued.

Virtually all of the commenters supported the proposed approach to waive the 50 percent reconstruction limits for interim status facilities. They further commented that delaying such necessary changes to the facility until a permit is issued could present significant operational difficulties at the facility. The Agency, therefore, is amending §270.72(e) essentially as proposed to allow owners or operators to modify interim status facilities to handle wastes restricted from land disposal without being subject to the 50 percent capital expenditure limit. Pursuant to today's final rule, interim status facilities would be required to file a revised Part A application prior to such changes. Applicants must also demonstrate that the changes were necessary to comply with the land disposal restrictions of Part 268. Facilities allowed to expand their operations by more than 50 percent under today's final rule continue to be subject to the Part 265 standards.

V. Effects of the Land Disposal Restrictions Program on Other Environmental Programs

As an alternative to using BDAT treatment, the regulated community might dispose of restricted California list wastes using non-RCRA disposal options. Two options regulated under the Marine Protection, Research, and Sanctuaries Act (MPRSA) (33 U.S.C. 1401) are ocean dumping and ocean-based incineration. The Agency conducted an analysis of the potential shift in demand for these options resulting from the restrictions on land disposal of solvent, dioxin, and California list wastes. The results are described in "Assessment of Impacts of Land Disposal Restrictions on Ocean Dumping and Ocean Incineration of Solvents, Dioxins, and California List

Wastes." (U.S. EPA, 1986). This assessment was based on a methodology to score and rank waste streams for relative acceptability for ocean disposal, based on technical requirements, environmental criteria, and, to a limited extent, risk to human health and the environment. This analysis was supplemented with an analysis of cost factors and capacity constraints.

The scoring/ranking methodology was based on technical requirements (e.g., physical form and heating value) and MPRSA environmental criteria (e.g., constituent concentrations, toxicity, solubility, density, and persistence of the waste) associated with ocean disposal of hazardous waste. The capacity analysis assumed that those wastes least acceptable for ocean disposal will be treated or disposed of by land-based methods. The cost analysis assumed that additional land-based treatment capacity would be built to treat waste streams for which the costs of land-based treatment would be less than the costs of ocean disposal (including on-land transportation to a port located on the East Coast).

The results of the cost/capacity analysis indicated that, as a result of the land disposal restrictions, approximately 20.3 million gallons per year of hazardous waste containing HOCs, 15.1 million gallons per year of liquid hazardous wastes containing metals, and 8.2 million gallons per year of liquid hazardous wastes containing PCBs could create demands for ocean dumping and ocean-based incineration. Such demands result from capacity shortfalls of land-based treatment (e.g., incineration and chemical precipitation) and the relatively lower cost of ocean dumping and ocean-based incineration, taking into account the costs of transportation on land. The cost/capacity analysis did not take into account technical requirements or environmental criteria.

The Agency expanded the cost/capacity analysis to evaluate the wastes based on cost, capacity, technical requirements and MPRSA environmental criteria, and to a limited extent, risk to human health and the environment. The results of that analysis indicated that ocean disposal of some of these waste streams may incur risks to the marine environment. Clearly, potential risks will influence whether or not ocean dumping permits, for example, would be issued for the affected waste streams. However, under present statutory authorities, with the exception of certain specified wastes, EPA may not disapprove ocean dumping of a hazardous waste for failure to comply with one or more environmental criteria. EPA must consider all statutory factors under section 102(a) of the MPRSA in its decision-making on permit issuance, not just compliance with environmental criteria. Consequently, EPA will have to make case-by-case decisions on whether such permits will be issued for hazardous waste streams prohibited from land disposal.

VI. State Authority

A. Applicability of Rules in Authorized States

Under section 3006 of RCRA, EPA may authorize qualified States to administer and enforce the RCRA program within the State. Following authorization, EPA retains enforcement authority under sections 3008, 3013 and 7003, although authorized States have primary enforcement responsibility. The standards and requirements for authorization are found in 40 CFR Part 271.

Prior to the Hazardous and Solid Waste Amendments of 1984 (HSWA), a State with final authorization administered its hazardous waste program in lieu of EPA administering the Federal program in that State. The Federal requirements no longer applied in the authorized State, and EPA could not issue permits that the State was authorized to issue. When new, more stringent, Federal requirements were promulgated or enacted, the State was obligated to enact equivalent authority within specified time frames. New Federal requirements did not take effect in an authorized State until the State adopted the requirements as State law.

In contrast, under RCRA section 3006(g) (42 U.S.C. 6926(g)) new requirements and prohibitions imposed by HSWA take effect in authorized States at the same time that they take effect in non-authorized States. EPA is directed to carry out these requirements and prohibitions in authorized States, including the issuance of permits, until the State is granted authorization to do so. While States must still adopt HSWA-related provisions as State law to retain final authorization, HSWA applies in authorized States in the interim.

Today's rule is promulgated pursuant to sections 3004(d) through (k), and (m), of RCRA (42 U.S.C. 6924), provisions added by HSWA. Therefore, it is being added to Table 1 in 40 CFR 271.1(j) which identifies the Federal program requirements that are promulgated pursuant to HSWA and take effect in all States, regardless of their authorization status. States may apply for either interim or final authorization for the HSWA provisions in Table 1, as discussed in the following section. The Agency is modifying Table 2 in § 271(j) also to indicate that this rule pertains to the self-implementing statutory provision of the RCRA amendments.

B. Effect on State Authorizations

As noted above, EPA will implement these regulations in authorized States until States modify their programs to adopt the regulations and the modification is approved by EPA. Because these rules are promulgated pursuant to HSWA, a State submitting a program modification may apply to receive either interim or final authorization under RCRA section 3006(g)(2) or 3006(b), respectively, on the basis of requirements that are substantially equivalent or equivalent to EPA's. The procedures and schedule for State program modifications for either interim or final authorization are described in 40 CFR 271.21. It should be noted that all HSWA interim authorizations will expire January 1, 1993 (see § 271.24(c)).

Section 271.21(e)(2) requires States that have final authorization to modify their programs to reflect Federal program changes, and to subsequently submit the modifications to EPA for approval. The deadline by which the State must modify its program to adopt today's rule is July 1, 1991 (July 1, 1992, if a State statutory change is necessary). These deadlines can be extended in certain cases (see § 271.21(e)(3)). Once EPA approves the modification, the State requirements become Subtitle C RCRA requirements.

States with authorized RCRA programs may have requirements similar to those in today's rule. These State regulations have not been assessed against the Federal regulations being promulgated today to determine whether they meet the tests for authorization. Thus, a State is not authorized to implement these requirements in lieu of EPA until the State program modification is approved. Of course, States with existing standards may continue to administer and enforce their standards are a matter of State law. In implementing the Federal program EPA will work with States under cooperative agreements to minimize duplication of efforts. In many cases EPA will be able to defer to the States in their efforts to implement their programs, rather than take separate actions under Federal authority.

States that submit official applications for final authorization less than 12 months after the effective date of these standards are not required to include standards equivalent to these standards in their application. However, the State must modify its program by the deadlines set forth in § 271.21(e). States that submit official applications for final authorization 12 months after the effective date of these standards must include standards equivalent to these standards in their application. Section 271.3 sets forth the requirements a State must meet when submitting its final authorization application.

C. State Implementation

There are several unique aspects of today's rule which affect State implementation and impact State actions on the regulated community:

1. Under 40 CFR Part 268, Subpart C, EPA is promulgating nationwide land disposal restrictions for all generators and TSDFs of certain types of hazardous waste. In order to retain authorization, States must adopt the regulations under this Subpart, since State requirements cannot be less stringent than Federal requirements.

2. Under § 268.32, the Agency may grant a national capacity variance to the prohibition effective date for up to two years if it is found that there is insufficient alternative treatment capacity. Under § 268.5, case-by-case extensions to the effective date of up to one year (renewable for an additional year) may be granted for specific applicants lacking adequate capacity.

EPA Headquarters is solely responsible for granting such extensions. It is clear that RCRA section 3004(h)(3) intends for the Administrator to grant such extensions after consulting the affected States, on the basis of national concerns that only the Administrator can evaluate. Therefore, this aspect of the program cannot be delegated to the States.

3. Under § 268.42(b) and § 268.44, the Agency may grant a waste-specific variance from a treatment standard in cases where it can be demonstrated that the physical or chemical properties of the waste differs significantly from wastes analyzed in developing the treatment standard, and, the waste cannot be treated to specified levels or by specified methods.

The Agency is solely responsible for granting such variances since the result of such an action will be the establishment of a new waste treatability group. Wastes meeting the criteria of this newly established waste treatability group may also be eligible for the variance. Thus, granting such a variance could have national impacts. Therefore this aspect of the program cannot be delegated to the States.

4. Under § 268.6, EPA may grant petitions of specific duration to allow land disposal of certain hazardous waste where applicants can demonstrate that there will be no migration of hazardous constitutents from the disposal unit or injection zone for as long as the waste remains hazardous.

States that have the authority to impose land disposal prohibitions may be authorized under RCRA section 3006 to grant petitions for such exemptions. Decisions on site-specific petitions do not require the national perspective required to grant extensions or variances from the treatment standard. The Agency expects few "no migration" petitions, therefore, EPA is currently requiring that these be handled at EPA Headquarters, though the States may be authorized to grant these petitions in the future. Also, since the Agency has had few opportunities to implement the newly promulgated land disposal restrictions, the Agency expects to gain valuable experience and information from review of "no migration" petitions that may affect future land disposal restrictions rulemakings. In accordance with RCRA section 3004(i), EPA will publish its determination that the "no migration" demonstration has been made in the **Federal Register**.

States are free to impose their own land disposal prohibitions if they are more stringent or broader in scope than Federal programs (RCRA section 3009 and 40 CFR 271.1(i)). Where States impose such prohibitions, the broader or more stringent State ban governs and EPA's action is without meaning in the State.

VII. Regulatory Requirements

A. Regulatory Impact Analysis

Executive Order 12291 requires EPA to assess the effect of contemplated Agency actions during the development of regulations. Such an assessment consists of a quantification of the potential benefits and costs of the rule, as well as a description of any beneficial or adverse effects that cannot be quantified in monetary terms. In addition, Executive Order 12291 requires that regulatory agencies prepare an analysis of the regulatory impact of major rules. Major rules are defined as those likely to result in:

1. An annual cost to the economy of $100 million or more; or
2. A major increase in costs or prices for consumers or individual industries, or
3. Significant adverse effects on competition, employment, investment, innovation, or international trade.

The Agency has performed an analysis of today's regulation to assess the economic effect of associated compliance costs. Total costs of restrictions on affected wastes are expected to be $93.7 million per year. Although the rule does not constitute a major rule under Executive Order 12291, EPA has nonetheless prepared a formal regulatory impact analysis of today's regulatory action in recognition of the effect of the rule on a broad spectrum of American industry.

The remainder of this section describes the analyses performed by EPA in support of today's rule affecting all California list wastes identified in section 3004(d)(2) of the Resource Conservation and Recovery Act (RCRA).

1. Cost and Economic Impact Methodology

EPA has assessed the costs, benefits and potential economic effects of this rule and of major regulatory alternatives to it. In the final rule, EPA has specified treatment standards or concentration levels for each of the five waste groups identified as part of the California list. For the corrosive wastes, EPA is codifying the statutory prohibition specified in section 3004(d)(2) of RCRA. For the PCB and most HOC wastes, EPA has specified treatment standards as described earlier in today's preamble. Finally, for the liquid hazardous wastes containing the specified metals and free cyanides, EPA is deferring to the statutory levels at this time.

In addition to assessing the regulation itself, the Agency has examined major regulatory alternatives to it. This preamble presents results for the final rule only. Each of the alternatives is explored in detail in the Regulatory Impact Analysis (RIA) that is available for viewing in the docket.

EPA establishes the total costs and economic impacts of this rule in three steps. First, EPA estimates the population of wastes, facilities and waste management practices that will be affected. Next, it derives the total social costs of the regulation by adding costs for individual facilities. Finally, EPA assesses economic impacts on affected facilities by comparing total costs for individual facilities to standard measures of facility financial vitality.

a. *Affected population and practices.* The affected population is the total number of hazardous waste treatment, storage and disposal facilities (TSDFs) and generators land disposing of California list wastes either directly at the generation site or indirectly through the purchase of commercial land disposal capacity. This group's waste management practices are assessed to identify baseline costs of managing wastes and incremental cost increases attributable to today's rule.

The number of facilities that land dispose of affected wastes was determined using the EPA's 1981 Regulatory Impact Analysis Mail Survey.[3] Waste quantities and management costs for facilities responding to the Mail Survey are scaled up to represent the national population by means of weighting factors developed within the survey. EPA estimates that 339 facilities comprise the total national population of commercial and noncommercial facilities land disposing of California list wastes on-site, excluding RCRA wastes mixed with polychlorinated biphenyls (PCBs). This estimate is based on 1981 survey data adjusted for intervening regulatory requirements.

EPA estimates that an additional 2,182 plants generate more than 1,000 kilograms per month of wastes that are sent off-site for management. The waste is disposed of either by noncommercial TSDFs (e.g., those owned by the firm generating the waste but at a different location), or by a commercial TSDF.

Generators of less than 1,000 kilograms per month were not included in the 1981 survey because they were considered exempt at that time. However, the 1984 amendments to the Solid Waste Disposal Act directed EPA to lower the exemption for small quantity generators (SQGs) from 1,000 to 100 kilograms per month by March 31, 1986, so SQGs generating between 100 and 1,000 kilograms of waste per month for off-site disposal are also included in the affected population. The Agency estimates that these SQGs add 2,046 plants to the affected population. Plant- and waste-specific data on this group are derived from EPA's Small Quantity Generator Survey.[4]

Because PCBs are not themselves a listed RCRA hazardous waste, data on generators of PCBs mixed with hazardous wastes regulated under RCRA were not specifically gathered in the RIA Mail Survey. However, recently developed data on this group indicate that there are approximately 63 generators of mixed PCB/RCRA hazardous wastes.[5]

EPA's characterization of current management practices for these groups includes the cost of compliance with regulations that have taken effect since the 1981 survey was conducted. In particular, EPA has adjusted waste management practices reported to reflect compliance with the provisions of 40 CFR Part 264. In making this adjustment, the Agency assumes facilities elect the least costly methods of compliance. This adjustment defines not only baseline management practices and costs associated with them, but also the number of waste streams in the affected population. For example, for 16 facilities, the costs of land disposing certain wastes are driven so high by regulations predating this final rule that other management modes are less expensive. EPA assumes that these facilities no longer land dispose these wastes and that these wastes are therefore no longer part of the population of waste streams that may be affected by any restrictions on land disposal.

No aggregate models have been developed for the population of treatment, storage, and disposal facilities and small quantity generators examined in this analysis. Instead, individual observations in the data sources have been weighted to represent the national population of wastes and management practices. For generating plants disposing of large quantities of California list wastes off-site, model plants representing average, maximum, and minimum waste quantities were developed to assess the range of potential economic effects. For generators of mixtures of PCBs and RCRA hazardous wastes, economic effects were assessed using model plants representing typical waste quantity and plant size characteristics.

b. *Development of costs.* Once the waste quantity and the type and method of treatment are known for the affected population, EPA estimates the costs of compliance for individual facilities. The analysis detailed in this section is based on cost estimates for surveyed facilities representing the affected population. EPA estimates baseline and compliance waste management costs using engineering judgment. Wastes amenable to similar types of treatment are grouped to identify economies of scale available through co-treatment and disposal.

EPA developed baseline waste management costs by adjusting 1981 waste management practices to reflect compliance with regulatory requirements predating restrictions on land disposal. Costs for disposal in surface impoundments assume compliance with section 3005(j) of RCRA, which requires surface impoundments to fully retrofit with double liners and leachate collection systems between liners (subjects to certain exemptions). This assumption could lead to an overestimate of baseline disposal costs and, thus, to an underestimate of incremental costs for surface impoundments exempted from these requirements. Existing regulatory requirements are also considered in developing costs for disposal in landfills and waste piles.

Facilities face several possible options if they may no longer land dispose their wastes. EPA applies the same rationale in predicting facility choice among these options as it does in establishing the affected population: facilities are assumed to elect the least costly method of complying with the requirements of this rule. Costs of compliance are derived by predicting the minimum-cost method of compliance with land disposal restrictions for each facility and calculating the increment between that and baseline disposal costs. As in the analysis of baseline costs, economies of scale in waste management are considered.

Shipping costs for wastes sent off-site for management are also considered. In the development of baseline waste management costs, the transportation distance assumed for off-site waste treatment and/or disposal is 100 miles. Most plants now sending wastes off-site do so for disposal. Although the likely effect of restrictions will be to require treatment before and in addition to disposal, the Agency has not increased the assumed transportation distance. This implies that plants now sending wastes off-site for disposal only can also purchase treatment services from the same commercial facilities. Even if the assumption that average transportation distances will not increase does not accurately predict the effects of this rule, EPA's examination of the sensitivity of results to this assumption revealed that varying the assumption in travel distances, even by as much as a factor of eight, has a

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[3] EPA conducted the RIA Mail Survey of hazardous waste generators and TSDFs to determine waste management practices in 1981. Facilities that handled less than 1,000 kilograms of waste per month were not regulated in 1981 and thus are not included in the data. For more information see the "National Survey of Hazardous Waste Generators and Treatment, Storage and Disposal Facilities Regulated under RCRA in 1981." Because the 1981 survey was a statistical sample and not a census, updating it with more current information available to the Agency from other sources is difficult. Based on these sources, however, EPA believes that this estimate may overstate the actual number of TSDFs now land disposing of California list waste.

[4] Office of Solid Waste, "National Small Quantity Hazardous Waste Generator Survey," February 1985.

[5] Office of Solid Waste, "Characterization of Mixed PCB/RCRA Hazardous Wastes," February 1985.

minimal effect on results. This is because many plants that send wastes off-site send small amounts, and economies of scale, reflected in per-unit prices of waste disposal at large commercial facilities, outweigh even major increases in shipping costs.

EPA developed facility-specific compliance costs in two components, which are weighted and then summed to estimate total national costs of the rule. The first component of the total compliance cost is incurred annually for operation and maintenance of alternative modes of waste treatment and disposal. The second component of the compliance cost is a capital cost, which is an initial outlay incurred for construction and depreciable assets. Capital costs are restated as annual values by adjusting them into equivalent yearly payments using a capital recovery factor based on a real cost of capital of 7 percent. These annualized capital costs are then added to yearly O&M costs to derive an annual equivalent cost.

c. *Economic impact analysis*—i. *Noncommercial TSDFs and SQGs.* EPA assesses economic impacts on non-commercial TSDFs and SQGs in several steps. First, the Agency employs a general screening analysis to compare facility-specific incremental costs to financial information about firms, disaggregated by Standard Industrial Classification (SIC) and number of employees per facility. This comparison generates two ratios, which EPA uses to identify facilities likely to experience adverse economic effects. The first is a ratio of individual facility compliance costs to costs of production. This ratio represents the percent product price increase for facility output that occurs if the entire compliance cost—accompanied by facility profit—is passed through to customers in the form of higher prices. A change exceeding five percent is considered to imply a substantial adverse economic effect on a facility. The second is a coverage ratio relating cash from operations to costs of compliance. This ratio represents the number of times that facility gross margin covers the regulatory compliance cost if the facility fully absorbs the cost. For this ratio, a value of less than 20 is considered to represent a significant adverse effect. The coverage ratio is the more stringent of the two ratios, but exceeding the critical level in either one suggests that a facility is likely to be significantly affected. These ratios bound possible effects on individual firms. This analysis considers only pre-tax costs, because Census data are stated in before-tax terms.

Once facilities experiencing adverse economic effects are identified using the two screening ratios, more detailed financial analysis is performed to verify the results and to focus more closely on affected facilities. For this subset of facilities, the coverage ratio is adjusted to allow a portion of costs to be passed through. Economic effects on individual facilities are examined assuming that product price increases of one and five percent are possible. Those facilities for which the coverage ratio is less than two are considered likely to close.

ii. *Commercial TSDFs.* Commercial TSDFs are here defined as those facilities that accept fees in exchange for management of wastes generated elsewhere. For this group of facilities, there exists no Census SIC from which to draw financial information. Two SICs that EPA might use as proxies, 4953 and 4959, do not distinguish between financial data for hazardous waste treatment firms and for firms managing municipal and solid wastes. Consequently, the analysis of economic effects on commercial facilities is qualitative. This analysis includes an examination of the quantity of waste each facility receives from the waste group restricted by today's rule. EPA also examines the ability of each facility to provide the additional treatment required once these restrictions are promulgated, and thus to retain or expand that portion of its business generated by restricted wastes.

iii. *Generators of large quantities of wastes.* EPA's analysis of the economic effects of this rule on generating plants disposing of large quantities of affected wastes off-site assumes that commercial facilities can entirely pass on the costs of compliance with this regulation in the form of higher prices for waste management services. Because of data limitations in the RIA Mail Survey, EPA has not developed plant-specific characterizations of wastes, treatment methods, and compliance costs for generators, as it has for TSDFs. EPA's analysis of the economic effects of today's final rule on this group uses RIA Mail Survey data to develop model plants generating average, maximum, and minimum waste quantities. This allows EPA to assess the range of possible effects on generating plants.

2. Costs and Economic Impacts

Total costs of regulating California list wastes do not qualify this rule as a major rule under Executive Order 12291, since the total annualized costs of restricting land disposal of these wastes are estimated at $93.7 million per year. These costs are not adjusted for the effect of taxation, which is merely a transfer from one sector of the economy to another. Costs are stated in 1986 dollars.

Today's regulation will affect entities in a variety of four-digit SICs, including chemicals and allied products, petroleum products, and metals industries. Two SIC sectors, chemicals and allied products (SIC 28) and primary metals (SIC 33) together account for approximately three-fourths of the after-tax cost of complying with the land disposal restrictions.

Economic effects have been assessed for both noncommercial and commercial facilities. Noncommercial facilities are those that generate and manage their own wastes, as distinct from facilities that accept fees in exchange for managing and disposing of wastes generated by others. Of 308 (weighted) noncommercial facilities nationally, 39 (weighted) facilities may experience financial distress because of this rule, and six of these appear likely to close.

EPA estimates that 31 (weighted) commercial facilities will incur incremental costs as a result of the restriction on land disposal of California list wastes. Fifty-eight percent of these commercial facilities offer a range of hazardous waste management services, including land-based disposal, storage, and treatment. The increased demand this rule will create for highly priced treatment services may actually strengthen the financial position of these firms by allowing them to increase their market shares. On the other hand, for the 16 percent of commercial facilities that offer solely land-based management of restricted wastes, the increased emphasis on treatment prior to land disposal may prove economically disadvantageous. It was not possible to characterize the remaining 26 percent of commercial facilities based on services offered.

Turning to effects on generators, EPA found that based on average waste quantities, the SIC sectors generating California list wastes include 2,162 (weighted) plants. Of these, 34 (weighted) plants may experience significant financial distress based on costs imposed by restrictions on land disposal. This represents 1.6 percent of all waste-generating plants that may face increased waste management prices. Based on further analysis, none of the 34 distressed plants appear likely to close.

Total annualized national costs for the 2,046 (weighted) small quantity generators (SQGs) of California list wastes are $4.5 million. Based on engineering estimates of prices for off-site waste management services, costs for SQGs generating the maximum of 1,000 kilograms per month of nothing but hazardous wastes specified in the California list would incur not more than $13,200 annually in incremental compliance costs. Economic ratios for all plants in each 4-digit sector represented in the SQG survey were examined. In 102 (weighted) cases, plants seemed likely to experience some financial distress, and none of these plants appear likely to close. Thus, restricting land disposal of California list wastes may have substantial adverse economic effect on approximately 5 percent of all generators of small quantities of wastes.

Economic effects on generators of mixed PCB/RCRA wastes are also not expected to be significant; although, because of data limitations, no plant-specific analysis could be undertaken. Further information on economic effects on all groups mentioned above is available in the regulatory impact analysis (RIA) supporting this rule.

The following table summarizes the economic impact information presented above:

Type of firm	No. of firms	Significantly impacted
Noncommercial	308	39
Small Quantity Generators	2,046	102
PCB Generators	63	0
Large Quantity Generators	2,162	34
Commercial TSDFs [1]	31	—
Totals	4,610	175

[1] Because of the assumption of full cost pass-through by commercial TSDFs, no economic effects are identified for this group.

3. Methodology Used in Assessing Benefits and Cost-Effectiveness

The RIA performed by the Agency evaluated the benefits of three regulatory alternatives for restricting the land disposal of California list wastes. As with the discussion of cost and economic impacts, this preamble only presents results associated with the final rule.

The benefits of today's final rule were evaluated by considering the reduction in human health risk that results from treating California list wastes to below statutory levels prior to land disposal rather than managing by baseline land disposal practices. Human health risk is defined as the probability of injury, disease, or death over a given time due to responses to doses of disease causing agents. Predicting human health risk entails estimating quantitatively the consequences of human exposure to these agents. To estimate risks of baseline and alternative technologies, the analysis characterizes wastes, technologies, releases, environmental transport, and dose-response relationships based on a number of simplifying assumptions. These include:

—The steady-state management and release of wastes—in other words, the quantity of waste managed in the baseline continues to be managed—and subject to releases—ad infinitum;

—Exposure to contaminated media is steady-state;

—The dose results from daily consumption of surface and ground water, inhalation of air, and ingestion of contaminated fish over 70 years by a 65 kg person;

—The dose-response relationship for carcinogens is linear without a threshold; for noncarcinogens it is a modified linear response;

—Risks are based on exposures to all constituents in each waste stream; and

—Risks are not discounted.

The human health risk posed by a waste management practice is a function of complex interactions between the toxicity of the chemical constituents in the waste stream and the extent of human exposure to these chemicals (e.g., considering, among other things, the hydrogeologic settings at land disposal units and the fate and transport of chemical constituents of wastes).

EPA estimates human health risk in four steps. The first step is to estimate the concentrations of each of the hazardous constituents of the waste stream in each of the three media (air, surface water, ground water) into which they may be released in the course of waste management. These estimates depend on the steady-state release rates calculated for each technology, and on environmental fate and transport. The next step is to estimate the total human intake, or dose, of each of the chemicals through inhalation of air and ingestion of ground water, surface water, and contaminated fish. The Agency next calculates the risk to an individuals from the dose derived in the previous step. EPA estimates the relationship of dose to effect (using the "dose-response" curve developed based on toxicity data), and weights the effect according to severity. Finally, EPA estimates the population at risk by multiplying the average individual risk by the number of people in a given environment, which is derived by a Monte Carlo simulation involving 2,000 iterations.

In assessing the benefits of the rule, EPA limits the analysis to reductions in human health effects attributed to a reduction in exposure to the toxic constituents in the wastes. Other benefits, such as improvements in environmental quality, are not quantified. As a result, the benefits of the land disposal restrictions for California list wastes may be underestimated. Furthermore, the assessment may underestimate benefits since the effects of the comparative risk analysis were not included. Therefore, negative benefits resulting from a technology considered riskier than land disposal (which would be designated not available for purposes of establishing treatment standards) were included in the analysis. Although this assessment does not estimate potential increases in risk from increased transportation and handling of California list wastes, an initial analysis indicates that such increases are not likely to be significant.

4. Benefits and Cost-Effectiveness

Based on this benefits analysis, the final rule is estimated to result in a net reduction in health risk equal to 2,298 weighted cases (e.g., cancer, fatal toxicity, decreases in reproductive capacity) over seventy years, which represents a 71.1 percent reduction from baseline practices. Of the total reduction, 2,049 cases—or 89 percent of the benefit—comes from changes to land disposal technologies, such as disposal in landfills, land farms, wastes piles, and disposal impoundments. An additional 10 percent reduction in risk comes from changes to land-based storage practiced in surface impoundments. Finally, approximately 1 percent of the total reduction comes from changes in treatment practiced in surface impoundments.

The analysis is in no sense time-dependent. Benefits are expressed as steady-state annual values. No attempt has been made to compare the initial year at which steady-state risk values are reached across options or between an option and the baseline. However, it can be generally observed that the effect of restricting land disposal is to reduce risk in absolute terms while shifting it forward temporally. This is because ground water risks, the type likely to predominate in the baseline, tend to occur a long time after waste is land disposed of, because of the slowness of constituent movement in this medium. However, air and surface water risks—while lower as a whole—are likely to predominate in the post-regulation scenario. Migration of wastes in these media is relatively rapid, and thus risks are incurred sooner.

B. Regulatory Flexibility Analysis

Pursuant to the Regulatory Flexibility Act, 5 U.S.C. 601, whenever an agency is required to publish a notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a Regulatory Flexibility Analysis that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small governmental jurisdictions). This analysis is unnecessary if the agency's administrator certifies that the rule will not have a significant economic effect on a substantial number of small entities.

EPA evaluated the economic effect of the rule on small entities, here defined as concerns employing fewer than 50 people. Because of data limitations, this small business analysis excludes generators of large quantities of California list wastes. The small business population here examined therefore includes only two groups: all noncommercial treatment, storage, and disposal facilities employing fewer than 50 persons, and all small quantity generators which are also small businesses.

One hundred and fifty-four (weighted) TSDFs are small businesses. Of these, six (weighted) exceed threshold values on the cost of production ratio, a figure that represents four percent of this small business population. Of the total of 2,046 small quantity generators examined in this analysis, the vast majority are also small businesses. A total of five SQGs (or less than one percent of all small businesses) exceeded threshold values on the cost of production ratios.

According to EPA's guidelines for conducting Regulatory Flexibility Analyses, if over 20 percent of the population of small businesses is likely to experience financial distress based on the costs of a rule, then the Agency is required to consider that the rule will have a significant effect on a substantial number of small entities and to perform a formal Regulatory Flexibility Analysis.[6] EPA has examined the rule's potential effects on small businesses as required by the Regulatory Flexibility Act and has concluded that today's final rule will not have a significant economic effect on a substantial number of small entities. As a result of this finding, EPA has not prepared a formal Regulatory Flexibility Analysis document in support of this rule. More detailed information on small business impacts is available in technical background documents prepared in support of this rulemaking.

C. Review of Supporting Documents

The primary source of information on current land disposal practices and industries affected by this rule is EPA's National Survey of Hazardous Waste Generators and Treatment, Storage, and Disposal Facilities. Waste stream characterization data and engineering costs of waste management are based on the 1981 RIA Mail Survey and on reports by the Mitre Corporation, "Composition of Hazardous Waste Streams Currently Incinerated," (April 1983), and "The RCRA Risk-Cost Analysis Model," (U.S. EPA, March 1984). The survey of small quantity generators has been the major source of data on this group. Data used to characterize generators of mixed PCB/RCRA hazardous wastes were taken from an EPA study, "Characterization of Mixed PCB/RCRA Hazardous Wastes," (February 1986). For financial and value of shipment information for the general screening analysis, 1982 Census data were used, adjusted by 1983 Annual Survey of Manufactures data. Producer price indices were also used to restate 1983 dollars in 1986 terms.

List of Subjects in 40 CFR Parts 260, 261, 262, 264, 265, 268, 270, and 271

Administrative practice and procedure, Confidential business information, Environmental protection, Hazardous materials, Hazardous materials transportation, Hazardous waste, Imports, Indian lands, Insurance, Intergovernmental relations, Labeling, Packaging and container, Penalties, Recycling, Reporting and recordkeeping requirements, Security measures, Surety measures, Surety bonds, Waste treatment and disposal, Water pollution control, Water supply.

Dated: July 6, 1987.

Lee M. Thomas,

Administrator.

Therefore, for reasons set out in the preamble, Chapter I of Title 40 is amended as follows:

PART 262—STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE

I. In Part 262:

1. The authority citation for Part 262 continues to read as follows:

Authority: Secs. 1006, 2002, 3002, 3003, 3004, 3005, and 3017, of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6905, 6912, 6922, 6923, 6924, 6925, and 6937).

Subpart E—Special Conditions

2. Section 262.51 is revised to read as follows:

§ 262.51 Farmers

A farmer disposing of waste pesticides from his own use which are hazardous wastes is not required to comply with the standards in this part or other standards in 40 CFR Parts 264, 265, 268, or 270 for those wastes provided he triple rinses each emptied pesticide container in accordance with § 261.7(b)(3) and disposes of the pesticide residues on his own farm in a manner consistent with the disposal instructions on the pesticide label.

PART 264—STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

II. In Part 264:

1. The authority citation for Part 264 continues to read as follows:

Authority: Secs. 1006, 2002, 3004, and 3005 of the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6905, 6912, 6924, and 6925).

Subpart B—General Facility Standards

2. In § 264.13, paragraph (b)(7)(iii) is revised to read as follows:

§ 264.13 General waste analysis.

* * * * *

(b) * * *

(7) * * *

(iii) The annual removal of residues which are not delisted under § 260.22 of this chapter and do not exhibit a characteristic of hazardous waste, and which do not meet the treatment standards of Part 268 Subpart D of this chapter or, where no treatment standards have been established, the annual removal of residues which do not meet the applicable prohibition levels in Part 268 Subpart C or RCRA section 3004(d).

* * * * *

PART 265—INTERIM STATUS STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

III. In Part 265:

1. The authority citation for Part 265 continues to read as follows:

Authority: Secs. 1006, 2002(a), 3004, 3005, and 3015 of the Solid Waste Disposal Act, as amended by the Resource Conservation and

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[6] See U.S. EPA, "Guidelines for Compliance with the Regulatory Flexibility Act," February 1982.

Dewberry & Davis

Management and Work Plan (MWP) Narrative in Support of HUD 441.1 - Baseline Plan

INCLUDES:

- Research Design
- Quality Control/Quality Assurance Procedures
- NIBS Guidelines

Lead-Based Paint Abatement Demonstration
Office of Policy Development and Research
U.S. Department of Housing and Urban Development
Washington, D.C.

June 16, 1989

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MANAGEMENT AND WORK PLAN
LEAD-BASED PAINT ABATEMENT DEMONSTRATION

Management and Work Plan

INTRODUCTION

MANAGEMENT AND WORK PLAN

NARRATIVE IN SUPPORT OF HUD 441.1 - BASELINE PLAN

Dewberry & Davis (D&D) presents this Management and Work Plan (MWP) and HUD 441.1 Baseline Plan in partial completion of Contract HC-5831, entitled "Lead-Based Paint Demonstration" for the U.S. Department of Housing and Urban Development (HUD). It is based on the scope outlined in the Contract, the methodology outlined in our Technical Proposal, the guidelines set forth by the National Institute of Building Sciences (NIBS) (See Attachment C), and information received in various meetings with the Department of Housing and Urban Development (HUD) staff, beginning with the orientation meeting held on January 17, 1989.

The project start date was January 7, 1989. The targeted completion date is December 15, 1989. A draft of the final report will be submitted to HUD no later than November 15, 1989.

This project will address the following major questions:

1. What are the costs of various lead-based paint (LBP) abatement strategies? Which are most efficient and cost effective? (A strategy is a logical group of abatement methodologies.)

2. What special working skills are required to carry out the various abatement strategies?

3. What special equipment is required to carry out the various abatement strategies?

4. What precautions must be employed to ensure worker and occupant safety for abatement strategies?

5. What is the unit cost of abatement, by abatement strategy?

6. What levels of dust are generated by the different abatement strategies?

7. How long does it take to abate utilizing different abatement strategies?

8. What strategies, if any, allow abatement to take place in a housing unit without requiring removal of occupants from other units in a multi-family structure?

The scope of this project is to test for lead-based paint in up to 500 units of housing. After the results of the testing have been analyzed, approximately to 173 units will be selected for abatement. Utilizing subcontractors, we will abate the lead hazard, both interior and exterior, of each of the units that is selected. The National Institute of Building Sciences' Lead-Based Paint Testing, Abatement, Cleanup and Disposal Guidelines (NIBS Guidelines) serve as the overall guiding directives for testing, abatement protocols, worker safety, and clearance. Extensive data collection prior to, during, and after abatement will be undertaken. These abated units will be unoccupied and will be turned over to the appropriate HUD Regional Office after abatement is completed.

PROJECT TEAM & MAJOR ROLES

DEWBERRY & DAVIS - Dewberry & Davis is the project manager, responsible for coordinating and conducting supervision of each task, management of all abatement, and preparation of final reports. Dewberry & Davis personnel will also perform several operational functions, including field inspections of candidate units, development of abatement specifications, monitoring of abatement, and data collection.

KTA - TATOR, INC. - KTA will be responsible for all XRF testing, development of LBP detection protocols, testing of up to 500 units of housing in five cities, and conducting AAS and EP toxicity tests where necessary.

TRACOR TECHNOLOGY RESOURCES, INC. - TRACOR will develop worker protection and safety protocols, develop and conduct worker protection and safety training sessions for abatement contractors, and carry out environmental and personnel monitoring. They will perform AAS laboratory analysis of samples and monitor data collection and cleanup/waste disposal, and be responsible for final testing of all abated units. They will review specifications of abatement products and provide oversight of safety and environmental concerns during abatement.

THE MARCOR GROUP - MARCOR will provide LBP abatement for the ten (10) unit prototype abatements in Baltimore, Maryland. Marcor will also assist in the development of the abatement methodologies, substrate identification, abatement monitoring, and data collection. MARCOR will serve as back-up abatement contractor where sufficient numbers of contractors cannot be secured in any of the cities of the Demonstration.

SPEEDWELL, INC. - Speedwell will develop the research design, including preliminary unit selection plan, all field data collection instruments (forms), and the final unit selection plan. Speedwell will also compile, analyze, and report the results of all data received during this project.

MEDICAL COLLEGE OF VIRGINIA CONSULTANTS - The MCV consultants will be available to review contract documents relative to worker protection, safety, and legal issues.

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I. TASK 1 - ORIENTATION

DESCRIPTION: Key members from the D&D Team met on January 17, 1989 with the HUD Government Technical Representative (GTR), the Government Technical Monitor (GTM), and other HUD staff to discuss many outstanding substantive and operational matters associated with the project. Major discussion items included the cities to be visited, testing methodologies, the unit selection plan, abatement methodologies, substrates to be abated, worker protection and safety, abatement contracting, cleanup, and waste disposal.

Significant transfer of information has subsequently occurred. The D&D Team has reviewed the National Institute of Building Sciences' Lead-Based Paint Testing, Abatement, Cleanup and Disposal Guidelines (NIBS Guidelines), evaluated new LBP abatement methodology literature, and held several coordination and information meetings. These efforts have been, and will be, instrumental in the execution of the tasks of this Demonstration project.

DELIVERABLES: The D&D Team and HUD arrived at an understanding of the scope of work, developed a functional communications network, planned a work schedule, and initiated research on various factors of the Demonstration project. Detailed procedures were agreed upon for inclusion in this MWP.

II. TASK 2 - MANAGEMENT & WORK PLAN (MWP)

DESCRIPTION: As a result of the various meetings held during Task 1, this formal MWP and HUD 441.1 Baseline Plan has been prepared. The MWP describes the major tasks and subtasks of the LBP project, identifies levels of effort of key personnel, outlines a schedule for task completion, identifies project deliverables, and states the estimated cost for each task. Submitted with this MWP, as attachments hereto, are the Research Design and Quality Assurance Procedures descriptions which are products of other tasks.

DELIVERABLES: Completed MWP with HUD Form 441.1. The HUD Form 661.1 (Progress Report) will be submitted monthly beginning July 1, 1989.

III. TASK 3 - REVIEW OF PROTOCOLS, ABATEMENT METHODS, AND SUBSTRATES; AND DEVELOPMENT OF A UNIT SELECTION PLAN

DESCRIPTION: This task is divided into two distinct parts: (1) the review of protocols, abatement methods, and potential substrates for abatement; and (2) the development of a unit selection plan. During this effort we were directed to use the National Institute of Building Sciences' Lead-Based Paint Testing, Abatement, Cleanup and Disposal Guidelines (NIBS Guidelines) for testing, abatement, cleanup, worker protection and waste disposal. The unit selection plan is detailed in Attachment A (Research Design).

DELIVERABLES: The following will be the deliverables of this task:

- Identification of abatement methodologies
- Identification of substrates to be abated
- Quality assurance procedures for all testing
- Prototypes of data collection instruments and documentation procedures
- Acceptance of NIBS Guidelines for this Demonstration
- Description of Unit Selection Plan

IV. TASK 4 - DEVELOP A DETAILED DATA COLLECTION PLAN

DESCRIPTION: The D&D Team has divided this task into three distinct efforts. The first consists of developing the data collection plan which is part of the Research Design; the second effort is the Advance City Team (ACT) Initiative; and the third effort is the prototype abatement of ten (10) units.

1. **(TASK 4) DEVELOPMENT OF THE DATA COLLECTION PLAN:** (Please refer to Attachment A, Research Design, for our Data Collection Plan.) The Data Collection Plan identifies the data to be collected during unit abatement, the number of and scale of measurement, and the method of collection of all data required.

2. **(TASK 4a) THE ADVANCE CITY TEAM (ACT) INITIATIVE**: The ACT Initiative concept is an integral part of a project of this magnitude and nature. Upon preliminary approval of the protocols and data collection methodology, advance city teams were deployed. Their primary purpose was to reconnoiter each city and develop baseline data on the up to 500 candidate units on which the LBP tests were to be conducted. ACT responsibilities included:

   (a) acquiring locational data on candidate units;

   (b) developing an initial deployment strategy for testing and abatement teams, given location, parking, traffic, and other physical and geographic constraints of the sites where units are located;

   (c) establishing key points of contact in the communications network to expedite testing and abating units at a later date;

   (d) researching the local labor and construction markets to determine available abatement contractors and minority contractors; identifying codes, permits, and availability of construction material;

   (e) developing alternatives for a command post for operations within the city, and investigating logistics, administrative support, etc.;

   (f) establishing baseline test data on the suspect units;

   (g) developing sketches of floor plans for each unit as well as identifying types and condition of substrates;

   (h) discussing and coordinating details of our testing and inspection with the local HUD Property Disposition

Office; and

(i) determining if special access, security, utility provisions, or other arrangements must be made prior to the arrival of inspection teams.

The ACT Initiative was eventually merged with Task 5, which is the actual field testing phase of the Demonstration. With the combination of the results of the testing phase and the ACT Initiative, profiles can be developed on every unit; thus enabling us to make a statistical determination of which substrates are most common in each city, and which units are ideal for abatement.

3. **(TASK 4b) PILOT ABATEMENT OF TEN (10) UNITS**: We propose to abate ten (10) units in Baltimore as a pilot or preliminary review of the full scale abatement program. During the pilot abatement program, a review of the effectiveness of the Research Design testing procedures and data collection instruments will be made. This review will determine changes or refinements of our procedures for using particular abatement strategies, the methods utilized to gather data, the survey forms used to gather data, and our abatement contract documents.

The decision to carry out the pilot abatements in Baltimore was made because:

(a) HUD's Office of Policy Development & Research (PD&R) is close to Baltimore; PD&R staff can monitor the project most easily.

(b) D&D's project management is located close to Baltimore.

(c) The Team's pilot abatement subcontractor (MARCOR Group) is headquartered in the Baltimore/Washington Metropolitan area.

(d) The City of Baltimore and the State of Maryland have a substantial history of addressing the LBP issue, and their stringent guidelines will best test our approaches.

DELIVERABLES: The following will be deliverables of this task:

- Draft Data Collection Plan (as part of the Research Design)
- Products of the ACT Initiative
- Ten (10) abated units
- Refinement of procedures and data collection instruments for future abatement.

V. TASK 5 - TESTING OF 500 UNITS

DESCRIPTION: The objective of Task 5 is to determine all of the lead paint-containing substrates in the candidate 500 units, and to determine the level of lead content in each substrate. This effort will be accomplished through thorough testing of every unit using XRF machines at the first reading, and additional AAS testing where required. Additionally, pre-abatement AAS testing for lead content in soils for units to be abated will be performed.

Specific considerations regarding this task include:

(a) All substrates in units to be abated pursuant to the Unit Selection Plan which yield XRF readings of 0.2 to 1.8 mg/cm^2 will have back-up AAS tests to determine lead content.

(b) All testing (XRF and AAS) will be performed utilizing NIBS Guidelines and following rigorous quality assurance procedures described in the Quality Assurance Attachment (B) of this MWP.

(c) Once the testing and unit inspection have been completed, the data will be transmitted to the KTA offices in Pittsburgh for entry into the KTA computer. After the data has been entered, it will be transmitted to Speedwell for further analysis.

(d) Speedwell will compile and analyze the data collected and recommend the units to be abated based on the Unit Selection Plan.

(e) Units not selected will be reported to the HUD Property Disposition Office, and given no further consideration for the Demonstration.

As stated in Task 4, the field work to accomplish the testing effort of this task will be combined with Task 4A field work. This will minimize travel and manpower costs and improve coordination between the data collected for each task.

DELIVERABLES: The following will be deliverables of this task:

- XRF testing results of up to 500 units of housing
- AAS testing results on XRF readings in the 0.2 to 1.8 mg/cm^2 range for units selected for abatement
- Pre-abatement AAS soil testing on each side of the housing unit (where applicable)

VI. TASK 6 - PREPARE FINAL UNIT SELECTION PLAN & ABATEMENT SCHEDULE

DESCRIPTION: This task is divided into two efforts: 1) Preparation of the Final Unit Selection Plan, and 2) Development of the Abatement Schedule.

The Final Unit Selection Plan has been prepared as part of the Research Design which is Attachment A of this MWP. It is the product of our initial research approach to the Demonstration and the information gathered from Tasks 1, 4 and 5. Pricing considerations for development of the Unit Selection Plan included cost constraints, number of substrates, and data requirements to meet the objectives of the Demonstration.

Development of the Abatement Schedule is premised on the acceptance and approval of this MWP, and its attachments. The initial abatement schedule will be submitted fifteen (15) days from the date of the final submission of this MWP. The schedule will propose the dates of the pilot abatement program and the beginning and ending dates of the abatement efforts in each of the five (5) selected cities.

DELIVERABLES: The following will be deliverables of this task:

- Unit Selection Plan as detailed in the Research Design (Attachment A)
- Projected schedule for abatement of candidate units

VII. TASK 7 - ABATEMENT CONTRACTOR SELECTION/CONTRACTOR EVALUATION

DESCRIPTION: The preliminary investigation of potential abatement subcontractors commenced during the ACT Initiative in Task 4. HUD and City Fair Housing and Equal Opportunity Offices were visited to secure a listing of minority firms, Disadvantaged Business Concerns (DBC), Women Owned Business Concerns (WOBC), and small business firms. Advertisements for subcontractors and minority business concerns were placed in major newspapers in each city, and the D&D Team contacted the Small Business Administration office that represents each city for a list of local contractors. In addition, other contractors were located through each city's building inspection office.

Upon development of the list of potential contractors, a questionnaire was distributed to each contractor to further research each of their capabilities. This questionnaire addressed such issues as previous experience in housing renovation, experience in asbestos removal, experience in LBP removal, insurance capabilities, bonding capabilities, number of employees, and client references.

Upon receipt and review of this data, eight (8) to ten (10) contractors in each of the five (5) cities who show interest in the project and possess the necessary qualifications will be selected as potential bidders for abatement. We anticipate utilizing four (4) to five (5) of these contractors per city for the actual abatement. If no contractors are found, we will utilize our subcontractor, MARCOR, to abate the units.

Contract documents for the abatement effort will be developed under this task as well.

These documents will include a scope of work, general conditions, insurance and bonding requirements; a bid list identifying the substrate to be abated, the quantity of the substrate (in square feet, linear feet, or units); specifications for the abatement of each substrate, worker protection and safety, cleanup, and waste disposal.

DELIVERABLES: The following will be deliverables of this task:

- A list of potential abatement contractors per city
- A list of minority contractor concerns
- A list of selected contractors for abatement
- Contract documents for bidding purposes

VIII. TASK 8 - AWARD ABATEMENT CONTRACTS

DESCRIPTION: The efforts for this task will be those necessary to award abatement contracts to successful bidders for the unit abatements. These bidders will be those selected from the screening process of Task 7. Our goal is for there to be approximately four (4) or five (5) contractors in each city, each dealing with assignments of six (6) or eight (8) unit abatements per contract. Specific steps of the award process include:

1. develop unit specific quantities and specifications for abatement
2. hold a pre-bid conference to fully explain the contract documents to potential bidders (screened in Task 7);
3. provide a "walk-through" of each unit to be abated in order to completely familiarize the contractors with the scope of work prior to bid submittal;
4. receive and review bids on the unit(s);
5. award contract(s);
6. hold pre-construction conference;
7. give notice to proceed; and
8. monitor contractor.

It is estimated that the average cost of abatement per unit will be approximately $10,400. HUD will be consulted throughout this process, particularly with regard to cost.

DELIVERABLES: Approximately 25 abatement contracts in the five (5) cities of the Demonstration.

IX. TASK 9 - TRAINING PROGRAM FOR ABATEMENT STAFF

DESCRIPTION: The D&D team will develop and conduct a six-hour training course for abatement workers. Training presentations will be provided by an industrial hygienist experienced in lead abatement regulations and safety procedures on abatement sites. Before the course is offered to abatement contractors, a formal training session will be conducted for HUD officials and key project personnel. This session may be videotaped for future use. The six-hour course module will be based on the NIBS Guidelines and will address worker protection and safety. The following is a general listing of topics that will be included in the training session.

1. Health effects of lead exposure
2. Work area preparation
3. Decontamination procedures
4. Waste disposal
5. Regulations and standards regarding LBP abatement work (OSHA, EPA, HUD, RCRA and local.) (If a regulation or standard is more stringent, then it will take precedent over NIBS.)
6. Respiratory protection
7. Protective clothing
8. Safety equipment
9. Medical surveillance
10. Containment techniques
11. HEPA equipment operation and engineering controls
12. Record keeping
13. Any additional items covered in the NIBS manual
14. Written examination

Certification will be granted upon receiving a test score equal to or more than 70. (If an employee fails, he will be re-tested. If he fails again, he will not be eligible to work on the abatements.)

The initial training session will take place in each city prior to the beginning of the abatements and will then be repeated for new subcontractors and their work crews. At the conclusion of each training session, abatement workers will have the knowledge required to work safely in a lead-contaminated environment in accordance with all applicable regulations and project conditions. An identification card will be issued to all persons who successfully complete this course. This card must be available for inspection by the D&D Team members or regulatory agencies when the worker is on a job site.

DELIVERABLES:

- The development of a 6-hour Worker Safety Training Program meeting NIBS and local government guidelines.
- Approximately 12 training sessions, including 2 in each of the selected cities of the Demonstration.

X. TASK 10 - COMPREHENSIVE ABATEMENT OF SELECTED UNITS

DESCRIPTION: The comprehensive exterior and interior abatement of approximately 173 units will take place in Baltimore, Maryland; Washington, D.C.; Birmingham, Alabama; Indianapolis, Indiana; Denver, Colorado; and Seattle/Tacoma, Washington. During abatement of the units, the NIBS Guidelines for abatement, cleanup, worker protection and safety, and waste disposal will be followed.

Three conditions could result in the return of a unit to HUD without achieving acceptable clearance levels. They are:

(a) an approved abatement method fails to achieve clearance and costs and/or time prohibit further abatement measures;

(b) structural deficiencies or other considerations of the unit are found during abatement which make further work infeasible

(c) after three (3) cleanup iterations the unit fails clearance criteria and further abatement/cleanup is deemed infeasible by HUD.

During the abatement, the D&D Team will ensure that all units are being abated according to the contract specifications. It is anticipated that ten (10) to fifteen (15) units will be undergoing abatement concurrently in two cities at any given time until all the units are abated. D&D is projecting an average abatement cost per unit of $10,400. This does not include any testing costs.

DELIVERABLES: Comprehensive abatement of approximately 173 according to the contract documents.

XI. TASK 11 - MONITORING OF ABATEMENT CONTRACTS

DESCRIPTION: The monitoring described in this task is directed to ensure contractor compliance to the abatement contracts. The effort, combined with Task 12, also accomplishes the extensive data collection requirements of the Research Design. This task requires field personnel from Dewberry & Davis, MARCOR, and TRACOR to: oversee the contractor's procedures and adherence to safety and code requirements; perform ongoing contract administration; administer contractor closeout; and collect cost and time related data specifically directed at the abatement contractor's efforts.

It is proposed that there be a team representative on site, in conjunction with Task 12, approximately 60 to 70% of the time that the contractor has personnel on site.

Specific actions of this task include:

- Monitor contractor schedule, mobilization, work procedures, and general adherence to the construction specifications.
- Ensure contractor compliance with pre-construction requirements (blood tests, completion of training program, provision of required data)
- Collection of contractor specific costs - wages, fringe benefits, equipment, and the cost factors required by the Research Design
- Ensure contractor compliance to all LBP specific safety procedures -- contract and Federal, State and Local codes
- Documentation, via a daily inspection report, of abatement activities specifically noting any events or actions having impact on the abatement strategy, costs, or Research Design requirements
- Time and motion documentation of the abatement process.

Draft data collection and documentation instruments are included with the Research Design, Attachment A.

DELIVERABLES: Deliverables for this task include:

- documentation of contractor activities to confirm compliance to abatement contract requirements.
- documentation of all data collected

XII. TASK 12 - ADDITIONAL DATA COLLECTION PLAN AND DATA ANALYSIS

DESCRIPTION: The monitoring of the abatement process is for the purpose of collecting data and documentation required to meet the objectives of the Research Design. We have divided this effort into two parts. The first was described in Task 11, which is oriented toward contractor generated data. Task 12 data collection is oriented toward the impacts of lead dust generation and testing. This data collection effort consists of pre-abatement, ongoing, and post-abatement data collection and documentation.

Details of the data to be collected are described in the Research Design included as Attachment A of this MWP. In general, they include:

a) airborne lead dust generated during abatement

b) worker exposure to lead dust

c) pre- and post-abatement levels of surface dust

d) levels of lead in soils

e) post-abatement AAS tests

f) EP toxicity tests on waste materials

The on site monitoring effort will be a team approach as described in Task 11. For this task, TRACOR will perform wipe tests, air monitoring, and personal exposure tests. KTA will perform post abatement AAS testing, soil testing, and EP toxicity testing. Dewberry & Davis will respond to any problem encountered during abatement, maintain close communication with HUD, and perform general oversight and quality assurance functions.

The type, estimated number, and cost of the tests to be performed during the abatement process are listed below. Please refer to Attachment B which will detail the quality assurance procedure utilized during the testing and lab analysis.

			TESTING					
Test	Standard	Pre-Test	During/ Interim	Post	No. Tests	No. Units	Cost	Total
1. Personal Exposure	NIOSH 7082	4	21	0	25	173	$20.00	$ 86,500
2. Area	NIOSH 7082		6		6	173	20.00	20,760
3. Wipes	NIBS 3.6.2	8		8	16	153	20.00	48,960
4. Wipes (Maryland)	Maryland	41	5	44	90	20	20.00	36,000
5. Soil (AAS)	NIBS 3.4.3	3		3	6	173	20.00	20,760
6. Detection (AAS)	NIBS 3.4.1.2	20			20	173	20.00	69,200
7. EP Toxicity	RCRA			2	2	173	90.00	31,140
TOTAL								$313,320

Tests 1, 2, 3, and 4 address minimum required for worker safety
Tests 5, 6, and 7 obtain back-up data and hazardous waste monitoring

The final effort of this task will be the analysis by Speedwell of the data generated in all of the tasks of the Demonstration. As described in the Research Design, Attachment A, the data analysis will be oriented toward meeting the objectives of the Demonstration. Additionally, all data will be compiled, documented, and computerized as required by the specifications of the contract.

DELIVERABLES: Deliverables for this task include:

- Full documentation of all data collected during the abatement process according to the specifications of the contract.
- Analysis of all data in accordance with the Research Design for inclusion in the final report.

XIII. TASK 13 - PREPARATION OF DETAILED REPORT FOR HUD

DESCRIPTION: A detailed report on the Demonstration process and findings will be prepared. It will include:

- Descriptions of all procedures, processes, and pertinent actions of the Demonstration effort
- Descriptions of the Dewberry & Davis Team roles and responsibilities
- Presentation of all collected data and documentation
- Final presentations of the Research Design and Quality Assurance procedures
- Discussions of problems encountered during the Demonstration, and their resolution
- Sample abatement contracts and descriptions of the contracting effort
- The processes and findings of the statistical analyses
- The findings of the Demonstration, conclusions and recommendations
- An Executive Summary

In total, the Final Report will be a complete description of the efforts and results of the Demonstration. Much of it will be drafted during actual task operations. The preparation of the Final Report will require significant coordination with HUD. This will start with a presentation of a draft outline, and continue with interim reviews of all sections of the report.

DELIVERABLES:

- Draft Outline
- Partial Draft Submissions
- Final Draft
- Final Report

RESEARCH DESIGN

LEAD BASED PAINT ABATEMENT DEMONSTRATION

Prepared by:

SPEEDWELL, INC.

June 16, 1989

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1. RESEARCH OBJECTIVES

The LBP Abatement Demonstration has three major objectives and one minor objective:

Major Objectives

(1) To develop reliable estimates of the cost of LBP abatement. Estimates will include the costs of set-up and clean-up, as well as costs that vary with the number and quantities of the substrates to be abated within the unit. Cost estimates will be broken down into standard cost categories.

(2) To measure the extent of lead hazards to which workers are exposed during the course of abatement and to confirm the effectiveness of the protective measures that will be in effect during the demonstration. The relationship between lead hazards present during abatement (measured by air samples) and the methods of LBP abatement employed is to be carefully examined.

(3) To measure the extent of post-abatement lead hazards (measured by wipe tests) and to examine the relationship between post-abatement surface lead dust levels and the methods of LBP abatement employed. The way in which clean-up costs vary with post-abatement surface lead levels will be examined, and soil test data will also be reported.

Minor Objective

(1) To measure the efficacy of negative air as a means of controlling lead hazards during abatement and as a means of reducing post-abatement clean-up costs; this would only be done when high-dust-generating abatement methods are employed.

2. DEFINITIONS OF ABATEMENT STRATEGIES

The simplest design for the LBP Abatement Demonstration would inventory all the substrates requiring abatement in the units selected for abatement and then randomly assign each substrate to one of the abatement methods being tested. In this design, the method of abatement selected for a given wall would be statistically independent of the method selected for another wall in the same unit or for a baseboard in the same unit. Two problems with this design make it unsuitable in this application:

(1) The design would not accommodate research interest in the relationship between post-abatement lead surface levels and the abatement methods used. In the first place, random assignment of substrates to methods of abatement would produce only negligible differences in post-abatement lead dust levels between properties. In the second place, differences that did exist could not be explained statistically because the number of independent variables (# of substrate types x (# of abatement methods per substrate type -1)) will be iarger than the number of observations on post-abatement lead dust levels, treating all post-abatement measurements in a given unit as one observation.

(2) Random assignment of substrates to abatement methods is not a very 'real world' approach. In other words, the design would not likely yield generalized study results and would be expensive.

We have approached the problem of design by identifying 6 generic methods of LBP hazards abatement:

(1) Enclose
(2) Encapsulate
(3) Remove Paint On-Site by Mechanical Methods
(4) Remove Paint On-Site by Chemical Methods
(5) Remove Paint On-Site by Hand
(6) Replace

We then defined 6 'Unit Abatement Strategies' for each of these generic methods. The 'Unit Abatement Strategy' states how the generic method is to be applied to each type of substrate. The generic method defined by the selected Unit Abatement Strategy will be the first choice for all substrates in a unit. Thus if 'Replacement' is the strategy for a given unit, the rule would be to replace all substrates requiring abatement assuming, of course, that replacement is a feasible method for each substrate.

If the Unit Abatement Strategy defines a first-choice abatement method for a given substrate that is not feasible, the rule will be to substitute the abatement method that most resembles the first-choice method in terms of its anticipated environmental consequences. The 6 strategies can be grouped into 3 categories corresponding to anticipated dust-generation levels:

<u>Low Dust Generation</u>

- Enclose
- Encapsulate

<u>Medium Dust Generation</u>

- On-Site Paint Removal by Mechanical Methods (with HEPA Attachment)
- On-Site Paint Removal by Chemical Methods

<u>High Dust Generation</u>

- On-Site Paint Removal by Hand
- Removal/Replacement

Using this categorization of Unit Abatement Strategies, we can identify which abatement method to use if the preferred method is infeasible. For example,if Enclosure is the Unit Abatement Strategy, but enclosure is not feasible for a particular substrate (i.e., window trim), the rule would then be to encapsulate.

In the event that neither the first nor second choices are feasible for a given substrate, the order of substitution of abatement methods will be:

(1) On-site Paint Removal by Chemical Methods
(2) Enclosure
(3) Replacement

These abatement methods were chosen because they are feasible more frequently than the other abatement methods with which they are paired in terms of dust-generation levels. The 6 Unit Abatement Strategies can now be defined in terms of the rules described above:

UNIT ABATEMENT STRATEGIES

Preference Ordering for Abatement Methods	Enclose	Encapsulate	Mechanical Removal	Chemical Removal	Hand Removal	Replace
1st Choice	Enclose	Encapsulate	Mechanical	Chemical	Hand	Replace
2nd Choice	Encapsulate	Enclose	Chemical	Mechanical	Replace	Hand
3rd Choice	Chemical	Chemical	Enclose	Enclose	Chemical	Chemical
4th Choice	Replace	Replace	Replace	Replace	Enclose	Enclose

These rules have been applied to all substrate types that may require abatement in the course of the demonstration using a Schedule of Feasible Methods for each substrate type. The resulting Unit Abatement Strategies, together with the Schedule of Feasible Methods, are attached as Attachment A of this document.

In order for the Unit Abatement Strategies to define completely what is to be done in any given unit, additional rules must be observed:

(1) Replacement Unit Abatement Strategy

We have intentionally not specified whether a building component to be replaced should be replaced with a new component or with the same component from which the paint has been removed at some off-site location.

Other things being equal, this choice should be made on the basis of cost considerations - which may lead to different outcomes for different substrate types. If we mandate which of the two kinds of replacement component is to be re-installed in the research design, we will have built an upward bias into our cost estimates for the Replacement Unit Abatement Strategy. Therefore, it is preferable to leave the choice to the abatement contractor.

An exception to this rule may arise if the existing component cannot be replaced with a component of equivalent aesthetic value. In this case, off-site paint removal should be specified in the work write-up.

(2) <u>On-Site Mechanical Paint Removal Unit Abatement Strategy</u>

There are 3 substrategies for mechanical paint removal:

(1) Grinding
(2) Sanding
(3) Vacuum or Water Blasting

All of these methods will require the use of HEPA equipment.

The preference orderings for abatement methods within the substrategies will be:

MECHANICAL PAINT REMOVAL UNIT ABATEMENT SUBSTRATEGIES

Preference Ordering for Abatement Methods	Grinding	Sanding	Blasting
1st Choice	Grinding	Sanding	Blasting
2nd Choice	Sanding	Blasting	Grinding
3rd Choice	Blasting	Grinding	Sanding

(3) Abatement of Damaged Building Components

It may not be sensible to treat a damaged building component in any way other than through replacement, even though the Unit Abatement Strategy does not indicate that the component should be replaced. In such cases, the Unit Abatement Strategy should be overidden and replacement should be specified in the work write-up.

One further addition to the definition of Unit Abatement Strategies is motivated by the secondary research objective of assessing the efficacy of negative air when used in conjunction with high dust generating abatement methods. To support this research objective negative air will be used in conjunction with the Replacement and On-Site Hand Removal Unit Abatement Strategies during the abatement of some of the units.

3. EXPERIMENTAL DESIGN

There are two questions to be resolved in constructing the experimental design for the LBP Abatement Demonstration:

- Which units should be selected for the demonstration?
- How will Unit Abatement Strategies be assigned to units?

(1) Unit Selection

The plan is to select 173 units from 300-350 candidate units. The candidate units are all vacant, FHA foreclosed, predominantly single-family homes currently owned by HUD. They are located in 5 areas: Baltimore/Washington, Birmingham, Denver, Indianapolis and Seattle. The candidate units have been surveyed for the purpose of inventorying and identifying all substrates which may require abatement. All such substrates have been subjected to XRF testing and the results, with the exception of those from Denver, have been subjected to preliminary review.

The first step in the unit selection process will be a 2-way stratification of all candidate units by location (5 levels) and by the extent of lead hazard present in the unit, as measured by the number of substrates requiring abatement[1] (3 levels). Based on inspection of the data, we will determine the intervals needed to break down the candidate properties into terciles on the distribution of the number of substrates per property requiring abatement.

Units will then be selected for the demonstration such that the variance in cost estimates for abating a representative property are minimized. This procedure will incorporate a number of additional constraints to insure the representativeness of the sample in terms of locations and levels of lead hazard. It will also incorporate a constraint on the estimated total costs of abatement in the

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[1] Analysis of test data on 135 units in Baltimore/Washington, Birmingham, Indianapolis and Seattle show an average of 41.0 substrates per property requiring abatement. This was based on using 1.0 mg/cm^2 as the abatement standard and an average of 3 XRF readings per substrate. AAS testing will be done on all substrates with XRF average readings between 0.2 and 1.8 mg/cm^2 prior to abatement.

incorporate a constraint on the estimated total costs of abatement in the demonstration.[2]

(2) Assignment of Unit Abatement Strategies to Units

Proposed sample sizes for each Unit Abatement Strategy are presented in Exhibit 1. The only imbalance in the sampling design (apart from limiting negative air to high-dust methods) is in the lower sampling rates for the Enclosure, Encapsulation and On-Site Chemical Paint Removal Strategies. This reflects the absence of substrategies to be compared in these cases, unlike the other cases.

The assignment of Unit Abatement Strategies to Units will be carried out so as to minimize any confounding between unit abatement strategies and the stratifying variables (locations and extent of lead hazard). Thus, if we have 23 Enclosure Strategies to assign we would randomly select one property in each of the 15 cells for enclosure and then distribute the remaining Enclosure Strategies by assigning 2-3 per lead hazard level tercile in as many different cities as possible.

A nearly balanced design, can be achieved in that confounding will exist only with the interaction effects between locations and lead hazard levels.

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[2] Formally, we will minimize an expression of the form:

$$\sum_i \sum_j (w_i^2 d_j / n_{ij})$$

where w_i denotes the frequency with which the i^{th} substrate type needing abatement occurs where n_{ij} denotes the number of times the i^{th} substrate type needing abatement occurs in the j^{th} unit and where $d_j = 1$ (j^{th} unit selected) $d_j = 0$ (j^{th} unit not selected). The additional constraints will require that a minimum of 24 properties from each location be selected, that a minimum of 36 properties from each lead hazard tercile be selected and that average abatement costs do not exceed $11,000 per property. Some of these numbers may change.

Exhibit 1

PROPOSED SAMPLE SIZES BY UNIT ABATEMENT STRATEGY

	Low Dust Strategies		Medium Dust Strategies		High Dust Strategies	
	Enclosure	Encapsulation	On-Site Mechanical Paint Removal	On-Site Chemical Paint Removal	On-Site Hand Removal	Replacement
Without Negative Air	23	23	36*	23	17	17
With Negative Air					17	17
TOTAL	23	23	36	23	34	34

* To be divided equally between Grinding (12), Sanding (12) and Blasting (12) Substrategies.

4. DATA ACQUISITION PLAN

Ten kinds of data will be collected in each unit selected for the demonstration:

(1) XRF test readings on all coated substrates prior to unit selection.

(2) AAS test results on all substrates with XRF average readings between 0.2-1.8 mmg/cm^2 after unit selection but pre-abatemen.

(3) AAS test results on 10% of all substrates where paint was removed during abatement, including off-site stripping.

(4) Labor hours, materials, equipment use together with hourly wage rates, fringe benefit costs, unit costs of materials and hourly costs of equipment use for each substrate abated and for set-up and clean-up activities.

(5) Levels of surface lead dust before and after abatement of each unit.

(6) Levels of soil lead dust before and after abatement of each unit.

(7) Blood lead levels of abatement workers on entry and on exit from abatement work.

(8) Airborne lead dust in rooms/areas adjacent to rooms/areas where abatement is being conducted.

(9) Lead dust levels in air potentially inhaled by workers during abatement.

(10) Toxicity of waste materials generated during the course of abatement.

The timing and frequency with which these data are to be collected and the scales on which measurements will be based are presented in Exhibit 2. Draft data collection instruments are included as Attachment B.

Exhibit 2

LBP ABATEMENT DEMONSTRATION: DATA ACQUISITION PLAN

Type of Data	Number of Measurements	Scale of Measurement	Method Data Collection
1. Lead Content of Substrate	3 Readings per Substrate	milligrams/cm^2	XRF Readings
2. Lead Content of Substrate	All Substrates with XRF Averages between 0.2 and 1.8 mg/cm^2	% lead content	AAS Tests
3. Lead Content of Substrate	10% of all Components where LBP was removed by stripping	% of lead content	AAS Tests
4. Costs of Abatement	All Substrates Abated plus set-up and clean-up	Labor Hours Materials Used Equipment Hours	On-Site Observation
5. Surface Lead Dust	Pre-Abatement: 1 Window Sill/Room, Post-Clean-up: 1 Window Sill/Room 1 Window Well/Room 1 Floor/Room	milligrams/cm^2	Wipe tests
6. Soil Lead Dust	2 Soil Samples per side of unit both before and after abatement	parts per million	Soil Sample
7. Blood Lead Levels	Entry: 1 Sample/Worker Exit: 1 Sample/Worker	micrograms/ deciliter	Bloodsamples
8. Airborne Lead Dust	1 per day during Abatement in room/area adjacent to abatement activity	milligrams/ meters^3	Airsample
9. Potentially Inhaled Lead Dust	Continuously during each task	micrograms/ meters^3	Airsample (Personal Zone)
10. Waste Toxicity	2 sets of wastes per unit	parts per million	EP Toxicity

5. DATA ANALYSIS PLAN

5.1 Analysis of Cost Data

For each substrate abated, we will have data on labor hours, material quantities and equipment time in use. We will also have data for each worker on hourly wages and fringe benefit costs, on materials costs and on equipment costs. By combining these data we can estimate the variable cost associated with abating each substrate in the demonstration.

Cost data will be standardized (i.e., converted to per sq. ft., per linear ft., or per unit) and sample means and sample variances will be computed for each substrate type and each abatement method. We will then examine the relationship between mean costs and the stratifying variables (location and level of lead hazard) in the framework of the analysis of variance. Given the large sample sizes (we expect to have over 10,000 observations on all substrate types), the reliability of cost estimates for abating the most commonly encountered substrates should be very high.

The cost analysis will also include separate estimates for set-up and clean-up costs, with data collected in the same manner. Sample means and variances will be estimated for each unit by Unit Abatement Strategy. These will also be examined to determine the influence of location and level of lead hazard on set-up and clean-up costs.

The results of both sets of analysis will then be combined in a general linear model of LBP abatement costs. The model will have LBP abatement costs as the dependent variable and the amounts of each substrate to be abated, together with location and level of lead hazard, as the independent variables. The coefficients of the model will take on different values according to the methods of abatement to be employed. The reliability of predictions from the model, under different assumptions about the types and methods of abatement to be undertaken, will then be estimated using the sample variances of its coefficients.

5.2 Analysis of Surface Lead Dust Levels

We will have surface lead dust measurements before and after abatement in each room of all units abated. The post-abatement lead dust measurements will be taken after each clean-up, which consists of HEPA vacuum wash and a final HEPA vacuuming. If the unit fails to meet minimum standards, clean-up and post clean-up lead dust wipe samples will be repeated. After three clean-up intentions, if clearance has not been achieved, HUD will be notified and a decision will be made as to continuing clean-up or ceasing work.

We propose to subject the surface lead dust levels to several different types of analysis.

(1) Pre- and Post-Abatement Comparisons

We will compare lead dust levels before abatement and after clean-up on a room by room basis for all units in the demonstration. We will calculate percentage and absolute reductions or increases in measured lead dust and present their frequency distributions across the sample as a whole. We will estimate average pre- and post-abatement changes separately for each of the six Unit Abatement Strategies and separately for units where negative air was employed during abatement.

(2) Analysis of Pre-Abatement Surface Lead Dust Levels

The units in the sample will all have been vacant for some time prior to abatement. For this reason, they may not be representative units in which to examine the relationship between the presence of lead-based paint and the presence of lead dust on surfaces. We propose, however, to attempt such an analysis.

This analysis will be done both at the room level and at the unit level. At the room level, we will regress the measured surface lead dust levels from sill wipe tests on the lead contaminated substrates, on their levels of lead and on their surface areas. The independent variables will be, for each substrate, the product of its XRF reading and its area in square centimeters. We will also modify the independent variables to reflect the condition of the coating (i.e., intact, peeling, etc.).

A similar analysis will be done at the unit level using surface lead dust levels averaged across rooms as the dependent variable. We will then compare the predictions of the aggregate equation with the averaged predictions of the individual room equations to determine the extent to which disaggregation improves prediction and, implicitly, the extent to which dust is transported from room to room in vacant units.

(3) Analysis of Post-Abatement Surface Lead Dust Levels

The post-abatement surface lead dust levels will all be measured after each clean-up. We will attempt statistical explanation of observed differences in surface lead dust and clean-up costs between Unit Abatement Strategies (including the negative air substrategies). The influence of different levels of pre-existing lead-based paint should be effectively controlled for in the experimental design, but we will also control for it in the analysis.

This part of the analysis will involve contrasts between the 6 major Unit Abatement Strategies using observations in approximately 173 units (unit level analysis) and something approaching 1000 rooms (room level analysis). We anticipate achieving reasonably good power in tests of the null hypothesis that there are no differences in the surface lead dust residues of different Unit Abatement Strategies.

We will also attempt a more detailed analysis, which regresses surface lead dust levels on the amounts and types of substrates abated in each room. This will be done separately for each Unit Abatement Strategy. Because each Unit Abatement Strategy allows one, and only one, method of abatement to be used for each surface, the number of independent variables in the regression will be limited to a manageable number. A preliminary analysis of XRF readings from 135 candidate properties indicates that the 20 most common substrate types account for over 90% of all substrates requiring abatement. If we were to include only those rooms in which those substrate types appear, we could limit the number of independent variables to 20.

The independent variables in this analysis will be, for each substrate type, the products of the lead level determined and the area (cm^2) of the substrate. The interpretation of the estimated coefficients will be the contribution of the substrate to surface lead dust levels when the method of abatement prescribed by the Unit Abatement Strategy is used. Comparisons of coefficients across regression equations will then show the effects of different abatement methods on residual surface lead dust levels.

5.3 Analysis of Soil Lead Dust Measurements

Soil lead dust data will be used to support before/after abatement comparisons per unit. These will be presented in terms of the distributions of pre- and post-abatement differences on soil lead levels together with conventional summary statistics i.e., medians, sample means, sample variances, etc. Observed changes in soil lead dust levels will be compared for different Unit Abatement Strategies.

5.4 Analysis of Blood Lead Levels

Entry and Exit abatement blood lead levels of workers will be compared for each worker for each unit abated. Statistical explanation of changes in blood lead levels will be attempted using the workers' activities (hours by abatement method) and using data from personal monitoring of air inhaled by the workers.

5.5 Analysis of Airborne Lead Dust Levels Adjacent to Abatement Activity

Airborne lead dust levels in areas adjacent to abatement activity will be analyzed to determine the effectiveness of containment procedures during abatement. Comparisons will be made across Unit Abatement Strategies, including the negative air substrategy.

5.6 Analysis of Personal Air Monitoring Data

Personal air monitoring data will be statistically explained in terms of hours spent by abatement method.. Overall contrasts of these data between Unit Abatement Strategies will also be performed.

5.7 Analysis of Toxicity of Waste Materials

EP toxicity test data will be analyzed in terms of frequency distributions across units and waste types. Comparisons of EP tox test data across Unit Abatement Strategies will also be conducted.

ATTACHMENT A

UNIT ABATEMENT STRATEGIES AND SCHEDULE OF FEASIBLE METHODS

LBP UNIT ABATEMENT STRATEGIES

SUBSTRATE	ENCLOSE	ENCAPSULATE	MECHANICAL REMOVAL (1) GRINDING	MECHANICAL REMOVAL (2) SANDING	MECHANICAL REMOVAL (3) BLASTING	CHEMICAL REMOVAL	HAND REMOVAL	REPLACEMENT
WALLS, PLASTER	ENCLOSE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WALLS, GYPSUM	ENCLOSE	ENCAPSULATE	ENCLOSE	ENCLOSE	ENCLOSE	ENCLOSE	HAND REMOVAL	HAND REMOVAL
WALLS, CONC. BLOCK	ENCLOSE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WALLS, BRICK	ENCLOSE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WALLS, WOOD PANEL	ENCLOSE	ENCAPSULATE	SAND	SAND	SAND	CHEM. REMOVAL	HAND REMOVAL	HAND REMOVAL
WALLS, WOOD SMOOTH	ENCLOSE	ENCAPSULATE	SAND	SAND	SAND	CHEM. REMOVAL	HAND REMOVAL	HAND REMOVAL
WALLS, WOOD ROUGH	ENCLOSE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WALLS, WAINSCOT	ENCLOSE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WALLS, ALUMINUM SIDING	ENCLOSE	ENCAPSULATE	ENCLOSE	ENCLOSE	ENCLOSE	ENCLOSE	ENCLOSE	ENCLOSE
WALLS, WOOD SHINGLE	ENCLOSE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WALLS, STUCCO	ENCLOSE	ENCAPSULATE	ENCLOSE	ENCLOSE	ENCLOSE	ENCLOSE	ENCLOSE	ENCLOSE
CHAIR RAILS, WOOD SMOOTH	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
CHAIR RAILS, WOOD ORNATE	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
BASEBOARDS, WOOD SMOOTH	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
BASEBOARDS, WOOD ORNATE	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
BASEBOARDS, VINYL	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
CEILINGS, PLASTER SMOOTH	ENCLOSE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
CEILINGS GYPSUM SMOOTH	ENCLOSE	ENCAPSULATE	ENCLOSE	ENCLOSE	ENCLOSE	ENCLOSE	HAND REMOVAL	HAND REMOVAL
CEILINGS, WOOD SMOOTH	ENCLOSE	ENCAPSULATE	SAND	SAND	SAND	CHEM. REMOVAL	HAND REMOVAL	HAND REMOVAL
CEILINGS, WOOD ORNATE	ENCLOSE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
CEIL. MOLD., WOOD SMOOTH	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
CEIL. MOLD., WOOD ORNATE	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
FLOORS, WOOD	ENCLOSE	ENCAPSULATE	SAND	SAND	SAND	CHEM. REMOVAL	HAND REMOVAL	HAND REMOVAL
FLOORS, CONCRETE	ENCLOSE	ENCAPSULATE	GRIND	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL

LBP UNIT ABATEMENT STRATEGIES

SUBSTRATE	ENCLOSE	ENCAPSULATE	MECHANICAL REMOVAL (1) GRINDING	MECHANICAL REMOVAL (2) SANDING	MECHANICAL REMOVAL (3) BLASTING	CHEMICAL REMOVAL	HAND REMOVAL	REPLACEMENT
WINDOWS, WOOD ORNATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
WINDOWS, METAL SMOOTH	CHEM. REMOVAL	CHEM. REMOVAL	GRIND	SAND	BLAST	CHEM. REMOVAL	HAND REMOVAL	REPLACE
WINDOWS, METAL ORNATE	CHEM. REMOVAL	CHEM. REMOVAL	BLAST	BLAST	BLAST	CHEM. REMOVAL	REPLACE	REPLACE
WINDOW SILL, WOOD SMOOTH	ENCAPSULATE	ENCAPSULATE	SAND	SAND	SAND	CHEM. REMOVAL	HAND REMOVAL	REPLACE
WINDOW SILL, WOOD ORNATE	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
WINDOW SILL, METAL SMOOTH	ENCAPSULATE	ENCAPSULATE	GRIND	SAND	BLAST	CHEM. REMOVAL	HAND REMOVAL	REPLACE
WINDOW SILL, METAL ORNATE	ENCAPSULATE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	REPLACE	REPLACE
WINDOW SILL, BRICK SMOOTH	ENCAPSULATE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WINDOW SILL, BRICK ORNATE	ENCAPSULATE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WINDOW SILL, CONCRETE SMOOTH	ENCAPSULATE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WINDOW SILL, CONCRETE ORNATE	ENCAPSULATE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
WINDOW TRIM, WOOD SMOOTH	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
WINDOW TRIM, WOOD ORNATE	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
WINDOW TRIM, METAL SMOOTH	ENCAPSULATE	ENCAPSULATE	GRIND	SAND	BLAST	CHEM. REMOVAL	REPLACE	REPLACE
WINDOW TRIM, METAL ORNATE	ENCAPSULATE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	REPLACE	REPLACE
DOORS, WOOD SMOOTH	CHEM. REMOVAL	CHEM. REMOVAL	SAND	SAND	SAND	CHEM. REMOVAL	HAND REMOVAL	REPLACE
DOORS, WOOD ORNATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
DOORS, METAL SMOOTH	CHEM. REMOVAL	CHEM. REMOVAL	GRIND	SAND	BLAST	CHEM. REMOVAL	HAND REMOVAL	REPLACE
DOORS, ALUMINUM	REPLACE	REPLACE	REPLACE	REPLACE	REPLACE	REPLACE	REPLACE	REPLACE
DOOR FRAME, WOOD SMOOTH	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
DOOR FRAME, WOOD ORNATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
DOOR FRAME, METAL SMOOTH	CHEM. REMOVAL	CHEM. REMOVAL	GRIND	SAND	BLAST	CHEM. REMOVAL	HAND REMOVAL	REPLACE
DOOR FRAME, METAL ORNATE	CHEM. REMOVAL	CHEM. REMOVAL	GRIND	SAND	BLAST	CHEM. REMOVAL	HAND REMOVAL	REPLACE

LBP UNIT ABATEMENT STRATEGIES

SUBSTRATE	ENCLOSE	ENCAPSULATE	MECHANICAL REMOVAL (1) GRINDING	MECHANICAL REMOVAL (2) SANDING	MECHANICAL REMOVAL (3) BLASTING	CHEMICAL REMOVAL	HAND REMOVAL	REPLACEMENT
CABINET, METAL	ENCAPSULATE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	REPLACE	REPLACE
SHELVING, WOOD	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
STAIR SYS, WOOD STAIRTREADS	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
STAIR SYS, WOOD HANDRAIL	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
RADIAT/MECH ENC. METAL SMOOTH	CHEM. REMOVAL	CHEM. REMOVAL	BLAST	BLAST	BLAST	CHEM. REMOVAL	REPLACE	REPLACE
SOFFITS/FACIA, WOOD	ENCLOSE	ENCAPSULATE	SAND	SAND	SAND	CHEM. REMOVAL	HAND REMOVAL	REPLACE
PORCH/DECK/PATIO, WOOD	ENCLOSE	ENCAPSULATE	SAND	SAND	SAND	CHEM. REMOVAL	HAND REMOVAL	HAND REMOVAL
PORCH/DECK/PATIO, CONCRETE	ENCLOSE	ENCAPSULATE	GRIND	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
COLUMNS, WOOD	ENCLOSE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	REPLACE	REPLACE
COLUMNS, BRICK	ENCLOSE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
FOUNDATION, CONCRETE, SMOOTH	ENCLOSE	ENCAPSULATE	GRIND	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
FOUNDATION, BLOCK, UNEVEN	ENCLOSE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
GUTTERS/DOWNSPOUTS	REPLACE	REPLACE	REPLACE	REPLACE	REPLACE	REPLACE	REPLACE	REPLACE
FENCING, WOOD	ENCAPSULATE	ENCAPSULATE	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
FENCING, METAL	ENCAPSULATE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL
FENCING, CEMENTITIOUS	ENCAPSULATE	ENCAPSULATE	BLAST	BLAST	BLAST	CHEM. REMOVAL	CHEM. REMOVAL	CHEM. REMOVAL

LCM: LEAD COATED MATERIALS 5-Jun-89

						COVER		REPLACE	RESTORE					
									Hand Rem.	Mechanical Rem.			Chemical	
ID#	Location	Component	Quantity	Substrate	Texture	Enclosure	Encapsulate	Replacement	w/ or w/o Heat Gun	Grind	Sand	Blast	On Site	Off Site
1	Interior	Wall	Square feet	Wood	Smooth/flat	Y	Y	N	Y	N	Y	N	Y	N
2				Metal	Smooth/flat	Y	Y	N	Y	Y	Y	Y	Y	N
3				Cementitious	Smooth/flat	Y	Y	N	N	Y	N	Y	Y	N
4				Plaster	Smooth/flat	Y	Y	N	N	N	N	N	Y	N
5				Gypsum	Smooth/flat	Y	Y	N	Y	N	N	N	N	N
6				Veneer	Smooth/flat	Y	Y	N	Y	N	N	N	N	N
7				Stucco	Smooth/flat	Y	Y	N	N	N	N	N	N	N
8				Wood	Uneven/ornate	Y	Y	N	N	N	N	N	Y	N
9				Metal	Uneven/ornate	Y	Y	N	N	N	N	Y	Y	N
10				Cementitious	Uneven/ornate	Y	Y	N	N	N	N	Y	Y	N
11				Plaster	Uneven/ornate	Y	Y	N	N	N	N	N	Y	N
12				Gypsum	Uneven/ornate	Y	Y	N	N	N	N	N	N	N
13				Veneer	Uneven/ornate	Y	Y	N	N	N	N	N	N	N
14				Stucco	Uneven/ornate	Y	Y	N	N	N	N	N	N	N
15	Interior	Ceiling	Square feet	Wood	Smooth/flat	Y	Y	N	Y	N	Y	N	Y	N
16				Metal	Smooth/flat	Y	Y	N	Y	Y	Y	Y	Y	N
17				Cementitious	Smooth/flat	Y	Y	N	N	Y	Y	Y	Y	N
18				Plaster	Smooth/flat	Y	Y	N	N	N	N	N	Y	N
19				Gypsum	Smooth/flat	Y	Y	N	Y	N	N	N	N	N
20				Veneer	Smooth/flat	Y	Y	N	Y	N	N	N	N	N
21				Stucco	Smooth/flat	Y	Y	N	N	N	N	N	N	N
22				Wood	Uneven/ornate	Y	Y	N	N	N	N	N	Y	N
23				Metal	Uneven/ornate	Y	Y	N	N	N	N	Y	Y	N
24				Cementitious	Uneven/ornate	Y	Y	N	N	N	N	Y	Y	N
25				Plaster	Uneven/ornate	Y	Y	N	N	N	N	N	Y	N
26				Gypsum	Uneven/ornate	Y	Y	N	N	N	N	N	N	N
27				Veneer	Uneven/ornate	Y	Y	N	N	N	N	N	N	N
28				Stucco	Uneven/ornate	Y	Y	N	N	N	N	N	N	N
29	Interior	Floor	Square feet	Wood	Smooth/flat	Y	Y	N	Y	N	Y	N	Y	N
30				Metal	Smooth/flat	Y	Y	N	Y	Y	Y	Y	Y	N
31				Cementitious	Smooth/flat	Y	Y	N	N	Y	Y	Y	Y	N
32	Interior	Door	Unit	Wood	Smooth/flat	N	N	Y	Y	N	Y	N	Y	Y
33				Metal	Smooth/flat	N	N	Y	Y	Y	Y	Y	Y	Y
34				Veneer	Smooth/flat	N	N	Y	N	N	N	N	N	N
35				Wood	Uneven/ornate	N	N	Y	N	N	N	N	Y	Y
36				Veneer	Uneven/ornate	N	N	Y	N	N	N	N	N	N
37				Metal	Uneven/ornate	N	N	Y	N	N	N	Y	Y	Y
38	Interior	Door Frame	Linear feet	Wood	Smooth/flat	N	N	Y	Y	N	Y	N	Y	N
39				Metal	Smooth/flat	N	N	Y	Y	Y	Y	Y	Y	N
40				Veneer	Smooth/flat	N	N	Y	N	N	N	N	N	N
41				Wood	Uneven/ornate	N	N	Y	N	N	N	N	Y	N
42				Metal	Uneven/ornate	N	N	Y	N	N	N	Y	Y	N
43				Veneer	Uneven/ornate	N	N	Y	N	N	N	N	N	N
44	Interior	Window	Unit	Wood	Smooth/flat	N	N	Y	Y	N	Y	N	Y	N
45				Metal	Smooth/flat	N	N	Y	Y	Y	Y	Y	Y	N
46				Wood	Uneven/ornate	N	N	Y	N	N	N	N	Y	N
47				Metal	Uneven/ornate	N	N	Y	N	N	N	Y	Y	N
48	Interior	Window sill	Linear feet	Wood	Smooth/flat	Y	Y	Y	Y	N	Y	N	Y	N
49				Metal	Smooth/flat	Y	Y	Y	Y	Y	Y	Y	Y	N
50				Veneer	Smooth/flat	Y	Y	Y	N	N	N	N	N	N
51				Plaster	Smooth/flat	Y	Y	Y	N	N	N	N	Y	N
52				Gypsum	Smooth/flat	Y	Y	Y	Y	N	N	N	N	N
53				Cementitious	Smooth/flat	Y	Y	N	N	Y	Y	Y	Y	N

LCM: LEAD COATED MATERIALS 5-Jun-89

						COVER		REPLACE	RESTORE					
									Hand Rem. w/ or w/o Heat Gun	Mechnical		Rem.	Chemical	
										Grind	Sand	Blast	On Site	Off Site
ID#	Location	Component	Quantity	Substrate	Texture	Enclosure	Encapsulate	Replacement						
54				Wood	Uneven/ornate	N	Y	Y	N	N	N	N	Y	N
55				Metal	Uneven/ornate	N	Y	Y	N	N	N	Y	Y	N
56				Veneer	Uneven/ornate	N	Y	Y	N	N	N	N	N	N
57				Plaster	Uneven/ornate	N	Y	Y	N	N	N	N	Y	N
58				Gypsum	Uneven/ornate	N	Y	Y	N	N	N	N	N	N
59				Cementitious	Uneven/ornate	N	Y	N	N	N	N	Y	Y	N
60	Interior	Wall trim	Linear feet	Wood	Smooth/flat	Y	Y	Y	Y	N	Y	N	Y	Y
61				Metal	Smooth/flat	Y	Y	Y	Y	Y	Y	Y	Y	Y
62				Plaster	Smooth/flat	Y	Y	N	N	N	Y	N	Y	Y
63				Wood	Uneven/ornate	N	Y	Y	N	N	Y	N	Y	Y
64				Metal	Uneven/ornate	N	Y	Y	N	N	Y	Y	Y	Y
65				Plaster	Uneven/ornate	N	Y	Y	N	N	Y	N	Y	Y
66	Interior	Door/Window trim	Linear feet	Wood	Smooth/flat	N	Y	Y	Y	N	Y	N	Y	Y
67				Metal	Smooth/flat	N	Y	Y	Y	Y	Y	Y	Y	Y
68				Cementitious	Smooth/flat	N	Y	Y	N	N	N	Y	Y	N
69				Plaster	Smooth/flat	N	Y	Y	N	N	N	N	Y	N
70				Wood	Uneven/ornate	N	Y	Y	N	N	N	N	Y	Y
71				Metal	Uneven/ornate	N	Y	Y	N	N	N	Y	Y	Y
72				Cementitious	Uneven/ornate	N	Y	Y	N	N	N	Y	Y	N
73				Plaster	Uneven/ornate	N	Y	Y	N	N	N	N	Y	N
74	Interior	Stairwell trim	Linear feet	Wood	Uneven/ornate	N	Y	Y	N	N	N	N	Y	Y
75				Metal	Uneven/ornate	N	Y	Y	N	N	N	Y	Y	Y
76				Cementitious	Uneven/ornate	N	Y	Y	N	N	N	Y	Y	N
77	Interior	Stair system	Linear feet	Wood	Uneven/ornate	N	Y	N	N	N	N	N	Y	N
78				Metal	Uneven/ornate	N	Y	N	N	N	N	Y	Y	N
79				Cementitious	Uneven/ornate	N	Y	N	N	N	N	Y	Y	N
80	Interior	Storage unit Cabinet	Square feet	Wood	Uneven/ornate	N	N	Y	N	N	N	N	Y	Y
81				Metal	Uneven/ornate	N	N	Y	N	N	N	N	Y	Y
82	Interior	Radiator	Linear feet	Metal	Uneven/ornate	N	N	Y	N	N	N	Y	Y	Y
83	Interior	Radiator cover	Linear feet	Wood	Uneven/ornate	N	N	Y	N	N	N	N	Y	Y
84				Metal	Uneven/ornate	N	N	Y	N	N	N	Y	Y	Y
85	Interior	Grate	Unit	Wood	Uneven/ornate	N	N	Y	N	N	N	N	Y	Y
86				Metal	Uneven/ornate	N	N	Y	N	N	N	Y	Y	Y
87	Interior	Pipes	Linear feet	Metal	Uneven/ornate	Y	Y	Y	N	N	N	Y	Y	N
88	Porch	Ceiling	Square feet	Wood	Smooth/flat	Y	Y	N	Y	N	Y	N	Y	N
89				Metal	Smooth/flat	Y	Y	N	Y	Y	Y	Y	Y	N
90	Porch	Floor	Square feet	Wood	Smooth/flat	Y	Y	N	Y	N	Y	N	Y	N
91				Metal	Smooth/flat	Y	Y	N	Y	Y	Y	Y	Y	N
92				Cementitious	Smooth/flat	Y	Y	N	N	Y	N	Y	Y	N
93	Exterior	Column	Unit	Wood	Uneven/ornate	Y	Y	Y	N	N	N	N	Y	N
94				Metal	Uneven/ornate	Y	Y	Y	N	N	N	Y	Y	N
95				Cementitious	Uneven/ornate	Y	Y	N	N	N	N	Y	Y	N
96	Exterior	Railings & stairwell trim	Linear feet	Wood	Uneven/ornate	N	N	Y	N	N	N	N	Y	Y
97				Metal	Uneven/ornate	N	N	Y	N	N	N	Y	Y	Y
98				Cementitious	Uneven/ornate	N	N	Y	N	N	N	Y	Y	Y
99	Exterior	Wall	Square feet	Wood	Smooth/flat	Y	Y	N	Y	N	Y	N	Y	N
100				Metal	Smooth/flat	Y	Y	N	Y	Y	Y	Y	Y	N
101				Cementitious	Smooth/flat	Y	Y	N	N	Y	Y	Y	Y	N
102				Wood	Uneven/ornate	Y	Y	N	N	N	N	N	Y	N
103				Metal	Uneven/ornate	Y	Y	N	N	N	N	Y	Y	N
104				Cementitious	Uneven/ornate	Y	Y	N	N	N	N	Y	Y	N

LCM: LEAD COATED MATERIALS 5 Jun 89

						COVER		REPLACE	RESTORE					
									Hand Rem. w/ or w/o Heat Gun	Mechnical Rem.			Chemical	
ID#	Location	Component	Quantity	Substrate	Texture	Enclosure	Encapsulate	Replacement		Grind	Sand	Blast	On Site	Off Site
105	Exterior	Door	Unit	Wood	Smooth/flat	N	N	Y	Y	N	Y	N	Y	Y
106				Metal	Smooth/flat	N	N	Y	Y	Y	Y	Y	Y	Y
107				Veneer	Smooth/flat	N	N	Y	N	N	N	N	N	Y
108				Wood	Uneven/ornate	N	N	Y	N	N	N	N	Y	Y
109				Metal	Uneven/ornate	N	N	Y	N	N	N	Y	Y	Y
110				Veneer	Uneven/ornate	N	N	Y	N	N	N	N	N	N
111	Exterior	Window sill & trim	Unit	Wood	Uneven/ornate	N	Y	Y	N	N	N	N	Y	Y
112				Metal	Uneven/ornate	N	Y	Y	N	N	N	Y	Y	Y
113				Cementitious	Uneven/ornate	N	Y	N	N	N	N	Y	Y	N
114	Exterior	Trim	Linear feet	Wood	Uneven/ornate	Y	Y	Y	N	N	N	N	Y	Y
115				Metal	Uneven/ornate	Y	Y	Y	N	N	N	Y	Y	Y
116	Exterior	Stair system	Linear feet	Wood	Uneven/ornate	N	Y	Y	N	N	N	N	Y	Y
117				Metal	Uneven/ornate	N	Y	Y	N	N	N	Y	Y	Y
118				Cementitious	Uneven/ornate	N	Y	N	N	N	N	Y	Y	N
119	Exterior	Storage unit	Square feet	Wood	Smooth/flat	Y	Y	Y	Y	N	Y	N	Y	Y
120				Metal	Smooth/flat	Y	Y	Y	Y	Y	Y	Y	Y	Y
121				Cementitious	Smooth/flat	Y	Y	N	N	Y	Y	Y	Y	N
122				Wood	Uneven/ornate	Y	Y	Y	N	N	N	N	Y	Y
123				Metal	Uneven/ornate	Y	Y	Y	N	N	N	Y	Y	Y
124				Cementitious	Uneven/ornate	Y	Y	N	N	N	N	Y	Y	N
125	Exterior	Roof	Square feet	Metal	Smooth/flat	Y	Y	Y	Y	Y	Y	Y	Y	N
126	Exterior	Soffit/facia	Square feet	Wood	Smooth/flat	Y	Y	Y	Y	N	N	N	Y	N
127				Metal	Smooth/flat	Y	Y	Y	Y	Y	Y	Y	Y	N
128				Wood	Uneven/ornate	Y	Y	Y	N	N	N	N	Y	N
129				Metal	Uneven/ornate	Y	Y	Y	N	N	N	Y	Y	N
130	Exterior	Foundation	Square feet	Cementitious	Smooth/flat	Y	Y	N	N	Y	Y	Y	Y	N
131				Cementitious	Uneven/ornate	Y	Y	N	N	N	N	Y	Y	N
132	Exterior	Gutter-Flashing	Linear feet	Metal	Uneven/ornate	N	N	Y	N	N	N	N	Y	N
133														
134	Exterior	Fence	Linear feet	Wood	Uneven/ornate	N	Y	Y	N	N	N	N	Y	Y
135				Metal	Uneven/ornate	N	Y	Y	N	N	N	Y	Y	Y
136				Cementitious	Uneven/ornate	N	Y	Y	N	N	N	Y	Y	N

ATTACHMENT B

LBP ABATEMENT DEMONSTRATION PROPERTY DATA INSTRUMENTS

LBP ABATEMENT DEMONSTRATION PROPERTY DATA

Property ID:

Name of Contractor:

ID#	CREW MEMBERS	U/ NU	SKILL LEVEL	HOURLY WAGE RATE	BENEFITS (% OF WAGE)
1					
2					
3					
4					
5					
6					
7					

ID#	MATERIALS USED	UNIT COST	QTY USED
1			
2			
3			
4			
5			

ID#	EQUIPMENT USED	ORIGINAL COST (if purchased)	DATE BOUGHT	ESTIMATED MONTHLY MAINTEN. EXP.	MONTHLY LEASE PAYMENT (if leased)
1					
2					
3					
4					
5					

LBP ABATEMENT DEMONSTRATION SUBSTRATE DATA

ROOM ID:

FLOOR:

SUBSTRATE ID:

GENERIC METHOD OF ABATEMENT:

SPECIFY DESCRIPTION OF ABATEMENT METHOD:

LABOR:	ID#	TIME SPENT (Hrs./Mins.)

MATERIALS/ PRODUCTS:	ID#	QUANTITIES

EQUIPMENT:	ID#	TIME IN USE

Tracor Technology Resources

LEAD DUST WIPE SAMPLE FORM

Project No. 123-111-11

Sample#	Type	Location/Descrption	Template	Date/Time	Resultug/ft^2
1-01-001	Bkgnd	Bsmt/Floor	12inx12in	7/4/89 1300h	20

Field Technician____________________

Employer____________________

Date Samples Shipped____________________

Date Results Received____________________

Results Received From____________________

conversion factor ug/ft^2 x 1000/929 = mg/cm^2

LEAD SAMPLING SHEET

EMPLOYEES SAMPLED/SSN	JOB CODE	WORK/TASK DESCRIPTION	Pb (Q)	PUMP TYPE & NO.	FILTER NO.	FLOW (ℓ/m) RATE START / STOP	AVG. FLOW RATE (ℓ/m)	SAMPLE TIME ON / OFF	TOTAL TIME (MIN)
			M ___ R ___ T ___						
			M ___ R ___ T ___						
			M ___ R ___ T ___						
			M ___ R ___ T ___						
			M ___ R ___ T ___						

INDUSTRIAL HYGIENE SAMPLING FORM

SAMPLING NO.

DATE SAMPLED

SAMPLED BY:

REPORT NO.

REPORT BY:

SHIFT

LOCATION

DEPT.

WIND

BAROMETRIC PRESS.

TEMP.

HUMIDITY

POSSIBLE INTERFERENCES

CALIBRATION COLLECTOR

SAMPLE COLLECTOR ➡

☐ CHARCOL TUBE ☐ FILTER AA

☐ FILTER (RESPIRABLE) ☐ IMPINGE

IF IMPINGER, GIVE COMPOSITION/OF ABSORBING SOLUTION:

DESCRIBE MFR/TYPE/LOT #:

COMPOSITION

8–HR. (TWA) IS IN $\mu g/M^3$

COMMENTS/SKETCHES

EMPLOYEES NOT SAMPLED (REPRESENTATIVE)

NAME	CODE	DEPT	SSN	JOB TITLE	Pb (Q) M	R	T

PURPOSE OF SAMPLING

INITIAL DETERMINATION ______

QUARTERLY ______

SEMI-ANNUAL ______

(CHNG) PERS. PROC. CONT. ______

OTHER (EXPLAIN) ______

EMPL. NOTIFICATION / /

PERSONAL PROTECTION

RESP ______

GLOVES ______

COVERALLS ______

SHOE COVERS ______

OTHER: ______

L.E. VENT " FPM

VAC. CLEANER ______

ROPE/SIGNS

2-2 (AIR)

INDUS. ..AL HYGIENE
SAMPLING FORM
NH 4282-1

REPORT NO. ▶

SAMPLED BY (LAST NAME & INITIALS)

ACCOUNTING CODE

DATE RECORDED

CONDITION OF SAMPLE UPON RECEIPT
☐ OK ☐ OTHER (DESCRIBE) ⟶

DATE REPORTED

WEEK

DA

ANALYZED BY

DATE

LAB RECORD NO.

METHOD NUMBER AND OR DESCRIPTION

REFERENCE

ANALYTICAL RESULTS (CORRECTED FOR BLANK)
REPORT, MAIN, BACKUP, TOTAL, BLANK

UNITS ☐ mg/m3 ☐ PPMV ☐ fiber/cc ☐

SUPERVISING CHEMIST

ND = NONE DETECTED
(REPORT LIMIT OF DETECTION)

EXPOSURE CALCULATION
TWA; PEAK

[illegible]

1-2 (AIR)

Tracor Jitco, Inc.

PROJECT # ☐☐☐☐☐☐☐☐☐☐

CHAIN OF CUSTODY FORM

BUILDING ID NUMBER ____________

SURVEY TEAM LEADER ____________

SAMPLE NUMBERS FROM ____________ TO ____________ TOTAL ________

	FROM SIGNATURE AND AFFILIATION	DATE	MIL. TIME	TO SIGNATURE AND AFFILIATION	DATE	MIL. TIME
1.						
2.						
3.						
4.						
5.						
6.						
7.						

PLEASE LIST ALL SAMPLE NUMBERS AS THEY APPEAR ON THE FIELD SURVEY RECORD. THEY CAN BE LISTED AS A GROUP (BA 0001 TO 0009, 01-0010 TO 01-0012) AS LONG AS ANY OMITTED NUMBERS ARE INDICATED, (NO SAMPLE BA-0006). THIS WILL HELP THE LAB TO IDENTIFY SAMPLE NUMBERING PROBLEMS. PLEASE INDICATE IF THEY ARE EMERGENCY SAMPLES.

ATTACHMENT B: QUALITY ASSURANCE PROCEDURES

This attachment is divided into two parts for your convenience:

- B1 - Collection and Analysis of Air and Wipe Samples
- B2 - Field Lead Testing, Laboratory Lead Analysis, and Documentation

QCP-T1 -- FIELD DETECTION OF LEAD USING PORTABLE XRF DETECTORS

1.0 Scope

1.1 This procedure outlines the operations followed for lead testing using portable XRF detectors.

1.2 The following attachments to this procedure are considered a part of the procedure:

Title	Attachment
Calibration Procedure (ML1)	Attachment IA
Calibration Procedure (XK3)	Attachment IB
Field Test Report XRF-IN1 (Interior)	Attachment IIA
Field Test Report XRF-EX1 (Exterior)	Attachment IIB
Field Test Report Coding System	Attachment III

2.0 Calibration

2.1 Each XRF device shall be calibrated during field use in accordance with manufacturer's instructions (see Attachment IA and IB).

2.2 Calibration frequency shall be as follows:

2.2.1 Before testing begins on a unit.
2.2.2 After unit test completion.
2.2.3 After any extended shutdown period (e.g., after lunch break).
2.2.4 After any series of readings are questioned by the operator.
2.2.5 When using XK3 device and value of 10 mg/cm^2 is obtained, or a series of readings of 5.0 mg/cm^2 or higher are obtained.
2.2.6 When using ML1 device and values of 15.0 mg/cm^2 or higher are obtained.

3.0 Base Readings -- In order to determine the true value of lead in paint, paint shall be removed from every unique substrate in the unit (e.g., wood, gypsum, concrete, etc.). NOTE: If each unit is of similar design, such as a multi-family housing, only one set of base readings are required.

3.1 An area approximately 4" x 4" shall be stripped entirely of paint.

3.2 A series of eight to ten readings are taken on the exposed surface and an average is obtained.

3.3 The average is recorded as the base reading.

3.4 When more than one XRF device is being utilized, base readings shall be obtained for each device.

4.0 Substrate Densities

4.1 Densities of various construction materials may affect the accuracy of the XRF devices.

4.2 Materials of similar densities shall be tested at the same time (e.g., test all wooden substrates before moving to concrete).

4.3 When changing densities, regardless of type of device being used, discard the first set of readings obtained (reading constitutes a series of three shutter releases) to be certain that the instrument has adjusted to the new substrate density.

5.0 Readings

5.1 Frequencies -- Each room within a unit shall be considered a separate testing area. Within each room, test each wall, each ceiling, and each floor. In addition, items of unique architecture identity will be combined, and a minimum of one test conducted for each. For example, if a room contains two windows, test one; if it contains four baseboards, test one; etc. The identity of the surfaces is found on the documentation form attached as Attachment II. The unit exterior is tested similarly.

5.2 Whenever sculptured or irregular surfaces are encountered which cannot be tested with an XRF device, samples will be retained for laboratory AA testing (see KTA Procedure QCP-RT1).

5.3 When testing, the XRF device shall not be moved so that all three shutter releases are taken in the same spot. If moved, discard all values and repeat the tests.

5.4 Concealed items within a surface may produce unusually high readings. Therefore, a stud finder and/or magnet may be used during testing to pinpoint any metal studs, pipes, conduits, etc.

5.5 When unusually high or inconsistent readings are obtained, the technician shall discard the readings and move the test site approximately one foot away.

5.6 Only XRF devices of similar manufacturer type (ML1 or XK3) shall be used together in testing any one unit.

5.7 When testing similar substrates, such as walls in a particular room, and if one reading is not consistent with readings from the other like substrates, the area or entity in question shall be retested.

6.0 Quality Control

6.1 The KTA testing team is comprised of a team leader and two testers. The team leader shall provide QC over the test data. The testers shall report all test values (the results of each shutter opening) to the team leader for documentation. When values are obtained that are inconsistent with the accuracy of the detector, he shall require additional readings. When readings on given surfaces appear inconsistent with surrounding values (e.g., three walls 1.5 and the fourth 0.1), he shall require additional readings.

6.2 The team leader shall continuously observe the procedures followed by the testers to verify that the XRF devices are being utilized according to manufacturer and KTA instructions.

7.0 Documentation

7.1 Technicians shall document the base reading and each of the individual shutter values obtained on painted surfaces at each test location on the forms attached as Attachments IIA and IIB.

7.2 In addition to the lead values, record (or verify the completion of) the data regarding substrate type, coating condition, surface area, etc. as found on the report forms.

2/15/89

CALIBRATION VERIFICATION OF ML1

Calibration verification of the Microlead 1, Revision 4 (ML1) manufactured by Warrington, Inc., Austin, TX will performed for each property to be tested or when excessively high values are obtained.

1.0 Warm-Up

1.1 Turn the ML1 on by the power switch at back of analyzer and allow the device to warm-up.

1.2 During warm-up cycle, take readings on any surface for approximately five minutes.

2.0 Zero Standardizing

2.1 Select one of the zero standards that most closely matches the density of the surfaces to be tested (e.g., wood, gypsum, concrete).

2.2 Place the probe on the device on one of the zero standards provided by the manufacturer and depress the trigger.

2.3 At the end of each reading cycle, a digital display will appear on the analyzer, showing the detected value and density.

2.4 Keep the trigger depressed until several readings have been displayed and record this final value as your zero reference and the density.

2.5 Repeat Steps 2.2 through 2.4 for each zero standard block.

3.0 Calibration Verification

3.1 Place the lead standard on one of the zero standards. Place the probe on the lead standard and depress the trigger.

3.2 At the end of a reading cycle, a digital display will appear showing the obtained value.

3.3 Keep the trigger depressed until four to five readings have been displayed and record the final value.

3.4 The instrument is calibrated for use on that particular substrate if the value obtained is ±0.3 mg/cm^2 of the lead standard.

3.5 If values obtained are greater than ±0.3 mg/cm^2 of the lead standard, a calibration correction may be required. See page 19 of Operating Manual.

3.6 Repeat Steps 3.1 through 3.4 for the remaining zero standard blocks and the lead standard.

NOTE: The manufacturer does not provide all the various types of zero standards that may be encountered in the field. Therefore, removing the paint on the various surfaces that are to be tested and performing the zero standard procedure on these surfaces, followed by calibration, is recommended.

2/15/89

CALIBRATION VERIFICATION PROCEDURE FOR THE XK-3 LEAD-IN-PAINT ANALYZER

Although the XK-3 is factory calibrated, calibration verification is performed in the field. The following calibration verification procedure shall be performed by the KTA testing personnel. This procedure is also in compliance with the manufacturer's (Princeton Gamma Tech) written instructions.

XK-3 Calibration Verification

1.0 Calibration verification shall be performed for each property to be tested and whenever an extremely high value is obtained.

2.0 Calibration verification shall be performed as follows:

2.1 Locate the lock switch underneath the handle toward the rear of the unit and push it forward. A red light over the display window will light up to indicate that the instrument is ready.

2.2 Position the XK-3 unit over the supplied calibration block. Align the arrows on the unit with the arrows on the calibration block.

2.3 Grasp the wooden handle, push down firmly and evenly on the handle to open the internal shutter. The red light over the display window will blink to indicate that the shutter is open and the measurement is being taken.

2.4 Approximately 15 seconds will be required for a reading.

2.5 Once the reading appears, compare the reading with the reading typed on the standard label.

2.6 Take two more readings to establish an average. The unit is properly calibrated if the three readings average within ±0.5 mg/cm^2 of the standard label.

2.7 If the average reading falls outside the specified range, depress the red reset button on the back plate of the XK-3 (above the coiled cable connection). This reset activates an internal circuit that instantaneously recalibrates the electronic circuit.

2.8 If reset button is pushed, recalibrate beginning with 2.1.

3.0 Zero Adjustment

A "zero" adjustment must be recorded for each particular surface that will be tested (e.g., wood, steel, concrete, etc). as follows:

3.1 Remove existing paint (4" x 4") from the surface to expose the substrate.

3.2 Position the XK3 on the exposed surface.

3.3 Grasp the wooden handle and depress firmly and evenly to open the internal shutter. The red light will blink indicating a reading is being taken.

3.4 Approximately 15 seconds after depressing the handle, a digital readout will be displayed. Record the reading.

3.5 Take a total of ten readings and average the readings.

3.6 The average of ten readings is then recorded as the "zero" adjustment.

3.7 If the zero adjustment is a positive number (e.g., +0.1), this value is deducted from values obtained on the actual painted surface and recorded as lead content.

Actual Value Obtained = 1.0
Less Zero Adjustment 0.1
Lead Content 0.9 mg/cm^2

3.8 If the zero adjustment is "0", the value obtained is recorded as lead content.

Actual Value Obtained = 1.0
Less Zero Adjustment 0.0
Lead Content 1.0

3.9 If the zero adjustment is a negative number (e.g., -0.1), this value is added to the actual obtained value.

Actual Value Obtained = 0.9
Plus Zero Adjustment -0.1
Lead Content 1.0 mg/cm^2

Page ___ of ___

LEAD BASED PAINT ABATEMENT DEMONSTRATION

LABOR SPOT CHECK FORM

UNIT________________

DATE___/___/___

EMPLOYEE	TIME ___________	TIME ___________	TIME ___________	TIME ___________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________
	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________	ROOM________ LEVEL________ LOC________ OTHER________

LBP ABATEMENT DEMONSTRATION

Materials Use Summary

Contractor Name:

Property Address:

MATERIALS USED	QUANTITY USED & UNIT OF MEASUREMENT	COST PER UNIT
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____
		$_____._____

LBP ABATEMENT DEMONSTRATION

Contractor Labor Summary

Contractor Name:

Property Address:

NAME OF EMPLOYEE	HOURLY WAGE	JOB DESCRIPTION	UNION/ NON-UNION U/NU
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		
	$____.____		

LBP ABATEMENT DEMONSTRATION

Equipment Use Summary

Contractor Name:

Property Address:

NUMBER & TYPES OF EQUIPMENT USED	EQUIPMENT OWNED (O) OR LEASED (L)	ORIGINAL COST (if owned) or MONTHLY LEASE PAYMENT (if leased)
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____
______________________	______________________	$_____._____

LBP ABATEMENT DEMONSTRATION CITY: DATE:

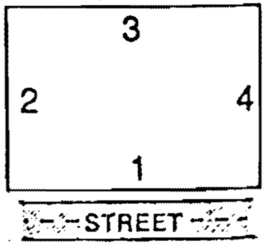
ADDRESS: PROPERTY ID:

TECHNICIANS

TECHNICIANS

ROOM:________ FLOOR:________ ML1 or XK3 S/N:________

TEST No.	SURFACE ID	QTY	SUB-STRATE TYPE	CTG GRADE	CTG COND	AREA	BASE VALUE	XK3 VALUES				ML1 VALUES				AAV
								#1	#2	#3	AVG	BAR 1	BAR 2	BAR 3	ACT	
1	CLG															
2	FLR															
3	1WL															
4	2WL															
5	3WL															
6	4WL															
7	WCT															
8	CGM															
9	CHR															
10	BSB															
11	WDW															
12	WSL															
13	WTM															
14	DOR															
15	DRF															
16	ICW															
17	CAB															
18	SHV															
19	MEC															
20	PIP															
21	STD															
22	HRL															
23	BAU															
24																
25																



LBP ABATEMENT DEMONSTRATION CITY: DATE:

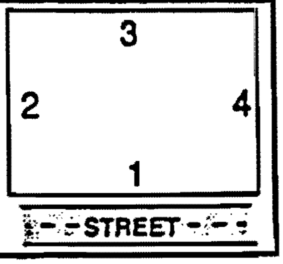
ADDRESS: PROPERTY ID:

TECHNICIANS

TECHNICIANS

EXTERIOR: ________ ML1 or XK3 S/N:____________

TEST No.	SURFACE ID	QTY	SUB-STRATE TYPE	CTG GRADE	CTG COND	AREA	BASE VALUE	XK3 VALUES				ML1 VALUES			ACT	AA V
								#1	#2	#3	AVG	BAR 1	BAR 2	BAR 3		
1	RFF															
2	1WL															
3	2WL															
4	3WL															
5	4WL															
6	FND															
7	WDW															
8	WSL															
9	WSL															
10	WTM															
11	DOR															
12	DOR															
13	DRF															
14	GUS															
15	SOF															
16	COL															
17	PO #															
18																
19																
20																
21																
22																
23																
24																
25																



Room

Living Room	LVG
Dining Room	DIN
Kitchen	KIT
Bathroom	BAT
Bedroom	BD__#
Hallway	HAL
Pantry	PAN
Stairway	STR
Attic	ATC
Laundry	LDY
Game Room	GAM

Floor

Basement	BLV
1st Floor	1LV
2nd Floor	2LV
3rd Floor	3LV

Coating Grade

Painted	A
Paneled	B
Stained	C
Paper/Vinyl	D
Plastic/Formica	E
Tile	F
Other	G
Not Painted	H
Factory Painted	J
Carpet	K
Basement	BSM

Condition

Not Ptd.	0
Chalking	1
Peeling	2
Damaged	3
Good	4

SUBSTRATES

Ceilings

Plaster Smooth	01
Plaster Ornate	02
Gypsum Board	03
Metal Ornate	04
Vinyl Asbestos Tile	05
Acoustical Tile	06
Drop Ceiling	07
Wood	08

Floors

Wood	10
Concrete	11
Brick	12

Walls

Plaster	20
Gypsum	21
Concrete Block	22
Concrete (Cast)	23
Precast Concrete	24
Brick	25
Wood Paneling	26
Wood Smooth	27
Wood Rough	28
Wall Paper	29
Oil Cloth	30
Ceramic Tile	31
Metal Smooth	32
Metal Rough	33
Wainscot	34
Stone	35
Vinyl Siding	36
Aluminum Siding	37
Shingle (Wood)	38
Shingle (Asbestos)	39
Stucco	40

Ceiling Moldings

Wood Smooth	95
Wood Ornate	96
Metal Smooth	97
Metal Ornate	98
Vinyl	99

Chair Rail

Wood Smooth	100
Wood Ornate	101
Metal Smooth	102
Metal Ornate	103
Vinyl	104

Baseboards

Wood Smooth	81
Wood Ornate	82
Metal	83
Vinyl	84

Window

Wood	50
Metal	51
Vinyl	52

Window Sill

Wood Smooth	55
Wood Ornate	56
Metal	57
Brick	58
Concrete	59

Window Trim

Wood Smooth	62
Wood Ornate	63
Metal Smooth	64
Metal Ornate	65

Door

Wood Smooth	70
Wood Ornate	71
Metal Smooth	72
Metal Ornate	73
Aluminum	74

Door Frame

Wood Smooth	75
Wood Ornate	76
Metal Smooth	77
Metal Ornate	78
Concrete	79

Cabinets

Wood	85
Metal	86

Shelving

Wood	90
Metal	91

Radiator/Mechanical Enc

Metal Smooth	87
Metal Rough	88

Piping

Metal	105

Stair Treads

Wood	110
Metal Smooth	111
Metal (Grille or Ornate)	112

Handrails

Wood	113
Metal	114

Balustrades

Wood Smooth	115
Wood Ornate	116
Metal Smooth	117
Metal Ornate	118

Other Surfaces

Wood Grille	155
Metal Grille	156
Gutters/Downspouts	157
Drain Pipe	158
Fencing	159
Clothes Pole	160
Oil/Fuel Tank	161

Roof

Flashing	120

Foundations

Concrete	145
Block	146
Brick	147
Wood	148
Stone	149

Soffits

Wood	122
Metal	123
Stucco	124
Cement Asbestos	125

Columns

Wood	140
Metal	141

Porch/Deck/Patio

Wood	130
Stone	131
Brick	132
Concrete	133
Metal	134

STD = Stair Tread
CHR = Chair Rail
SHV = Shelf
ICW = Interior Closet Wall
CGN = Closet Molding

GUS = Gutters
RFF = Roof Flashing
FND = Foundation
HRL = Handrail

QUALITY ASSURANCE PLAN FOR COLLECTION AND ANALYSIS OF FIELD LEAD TESTING, LABORATORY LEAD ANALYSIS, AND DOCUMENTATION

LEAD-BASED PAINT DEMONSTRATION
PREPARED BY KTA-TATOR, INC.
JUNE 16, 1989

TABLE OF CONTENTS

INTRODUCTION
KTA QA/QC PROCEDURES FOR LEAD-BASED PAINT DETECTION

1.0 General

1.1 The following are KTA-Tator, Inc. detailed QA/QC procedures for lead-based paint detection and analysis, both in the field and laboratory. The guidelines provided in the procedures are consistent with the requirements of the following:

1.1.1 National Institute of Building Sciences "Lead-Based Paint Testing, Abatement, Clean-up, and Disposal Guidelines", March 1989.

1.1.2 Warrington, Inc., Austin, Texas -- "Microlead I, Revision 4 Instruction Manual".

1.1.3 Princeton Gamma Tech, Inc., Princeton, NJ -- "XK3 Lead-In-Paint Analyzer".

1.1.4 Commonwealth of Pennsylvania, Department of Environmental Resources "Rules and Regulations/Radiation Protection".

1.1.5 KTA-Tator, Inc. "XRF Operator Training Manual", May 1989 (approved by the Pennsylvania Department of Environmental Resources, Bureau of Radiation Protection).

2.0 KTA QC/QA Procedures

2.1 The KTA QA/QC procedures for field lead testing are identified as follows:

2.1.1 QCP-C1 -- Training and Certification of Testing Personnel
2.1.2 QCP-T1 -- Field Detection of Lead Using Portable XRF Detectors
2.1.3 QCP-RT1 -- QA/QC Retesting of Candidate Units Selected for Abatement

2.2 The KTA QA/QC procedures for laboratory lead analysis are identified as follows:

2.2.1 QCP-LEP1 -- Procedure for EP Toxicity Testing of Building Materials
2.2.2 QCP-LL1 -- Method for Determining Total Lead Concentration in Paint Samples
2.2.3 QCP-LL2 -- Method for Determining Lead Concentration in Soil Samples

2.3 The KTA QA/QC procedure for verification of field and laboratory documentation:

2.3.1 QCP-CD1 "QC Verification of Documentation"

QCP-C1 -- TRAINING AND CERTIFICATION OF TESTING PERSONNEL

1.0 Scope

1.1 This procedure and attachments delineate the requirements for training and certification of KTA lead-based paint detection personnel. The training is conducted in accordance with the KTA XRF Operator Training Manual dated May 1989, which has been approved by the Pennsylvania Department of Environmental Resources Bureau of Radiation Protection. Excerpts from the manual are found in the following attachments to this procedure.

Title	Attachment
XRF Calibration (XK3)	Attachment I - Part A
XRF Calibration (ML1)	Attachment I - Part B
XRF Operation	Attachment II
Emergency Procedure (Theft)	Attachment III - Part A
Emergency Procedure (Accident)	Attachment III - Part B
Lead Testing/XRF Examination (Part A)	Attachment IV - Part A
Lead Testing/XRF Examination (Part B)	Attachment IV - Part B
Radiation Examination	Attachment IV - Part C

2.0 Training Instructors

2.1 KTA technicians are trained in accordance with the KTA XRF Operator Training Course by instructors who have successfully completed the XRF manufacturer's training seminars.

3.0 XRF Operator Training Course

3.1 Principles of X-Ray Fluorescence (XRF)

3.1.1 Technicians are instructed on the operational theory of XRF analyzers.

3.1.2 Technicians are required to understand how radiation stimulates lead atoms in paint and how this fluorescence is converted to a digital display on the instrument in mg/cm^2.

3.2 Calibration and Operation of XRF Devices

3.2.1 Calibration - Technicians are instructed on the calibration procedures for both the Warrington Microlead I Revision 4 (ML1) and the Princeton Gamma Tech XK3 (XK3).

3.2.2 Technicians are required to demonstrate proficiency in the calibration of the XRF devices.

3.2.3 See Attachment I for the detailed calibration procedures that are used for the training.

3.3 Operation of XRF Devices

3.3.1 Operation - Technicians are instructed in the safe operation of both XRF devices. Each instrument and its particular characteristics and components are explained in detail.

3.3.2 Technicians are required to demonstrate proficiency in the use of the XRF devices by actual "hands-on" simulated testings.

3.3.3 See Attachment II for the detailed XRF operating procedures that are used for training.

3.4 Radiation Safety

3.4.1 Due to the fact that XRF devices emit low levels of radiation, technicians are instructed in the types, measurement, and personal safety when dealing with radioactive materials.

3.4.2 Technicians must read the various rules and regulations governing the use of radioactive devices in Pennsylvania. These regulations are included the KTA training manual.

3.4.3 Technicians must understand the types and uses of various personnel radiation monitoring devices.

3.5 Emergency Procedures

3.5.1 Technicians are instructed in the step-by-step procedures to follow in the event of an accidental exposure of the radioactive source.

3.5.2 Technicians are instructed in the procedures to be followed in the event of loss or theft of an XRF device.

3.5.3 The emergency procedures above are found in Attachment III.

4.0 Testing

4.1 Each candidate must demonstrate proficiency in the calibration and use of XRF equipment by actual "hands-on" use of the devices. The candidate must achieve a minimum passing score of 80% on each of three written exams (see Attachment IV). Following successful completion of the above, the technician is provided with a certificate of achievement.

2/15/89

CALIBRATION VERIFICATION PROCEDURE FOR THE XK-3 LEAD-IN-PAINT ANALYZER

Although the XK-3 is factory calibrated, calibration verification is performed in the field. The following calibration verification procedure shall be performed by the KTA testing personnel. This procedure is also in compliance with the manufacturer's (Princeton Gamma Tech) written instructions.

XK-3 Calibration Verification

1.0 Calibration verification shall be performed for each property to be tested and whenever an extremely high value is obtained.

2.0 Calibration verification shall be performed as follows:

2.1 Locate the lock switch underneath the handle toward the rear of the unit and push it forward. A red light over the display window will light up to indicate that the instrument is ready.

2.2 Position the XK-3 unit over the supplied calibration block. Align the arrows on the unit with the arrows on the calibration block.

2.3 Grasp the wooden handle, push down firmly and evenly on the handle to open the internal shutter. The red light over the display window will blink to indicate that the shutter is open and the measurement is being taken.

2.4 Approximately 15 seconds will be required for a reading.

2.5 Once the reading appears, compare the reading with the reading typed on the standard label.

2.6 Take two more readings to establish an average. The unit is properly calibrated if the three readings average within ±0.5 mg/cm^2 of the standard label.

2.7 If the average reading falls outside the specified range, depress the red reset button on the back plate of the XK-3 (above the coiled cable connection). This reset activates an internal circuit that instantaneously recalibrates the electronic circuit.

2.8 If reset button is pushed, recalibrate beginning with 2.1.

3.0 Zero Adjustment

A "zero" adjustment must be recorded for each particular surface that will be tested (e.g., wood, steel, concrete, etc). as follows:

3.1 Remove existing paint (4" x 4") from the surface to expose the substrate.

3.2 Position the XK3 on the exposed surface.

3.3 Grasp the wooden handle and depress firmly and evenly to open the internal shutter. The red light will blink indicating a reading is being taken.

3.4 Approximately 15 seconds after depressing the handle, a digital readout will be displayed. Record the reading.

3.5 Take a total of ten readings and average the readings.

3.6 The average of ten readings is then recorded as the "zero" adjustment.

3.7 If the zero adjustment is a positive number (e.g., +0.1), this value is deducted from values obtained on the actual painted surface and recorded as lead content.

Actual Value Obtained =	1.0
Less Zero Adjustment	<u>0.1</u>
Lead Content	0.9 mg/cm^2

3.8 If the zero adjustment is "0", the value obtained is recorded as lead content.

Actual Value Obtained =	1.0
Less Zero Adjustment	<u>0.0</u>
Lead Content	1.0

3.9 If the zero adjustment is a negative number (e.g., -0.1), this value is added to the actual obtained value.

Actual Value Obtained =	0.9
Plus Zero Adjustment	<u>-0.1</u>
Lead Content	1.0 mg/cm^2

2/15/89

CALIBRATION VERIFICATION OF ML1

Calibration verification of the Microlead 1, Revision 4 (ML1) manufactured by Warrington, Inc., Austin, TX will performed for each property to be tested or when excessively high values are obtained.

1.0 Warm-Up

1.1 Turn the ML1 on by the power switch at back of analyzer and allow the device to warm-up.

1.2 During warm-up cycle, take readings on any surface for approximately five minutes.

2.0 Zero Standardizing

2.1 Select one of the zero standards that most closely matches the density of the surfaces to be tested (e.g., wood, gypsum, concrete).

2.2 Place the probe on the device on one of the zero standards provided by the manufacturer and depress the trigger.

2.3 At the end of each reading cycle, a digital display will appear on the analyzer, showing the detected value and density.

2.4 Keep the trigger depressed until several readings have been displayed and record this final value as your zero reference and the density.

2.5 Repeat Steps 2.2 through 2.4 for each zero standard block.

3.0 Calibration Verification

3.1 Place the lead standard on one of the zero standards. Place the probe on the lead standard and depress the trigger.

3.2 At the end of a reading cycle, a digital display will appear showing the obtained value.

3.3 Keep the trigger depressed until four to five readings have been displayed and record the final value.

3.4 The instrument is calibrated for use on that particular substrate if the value obtained is ±0.3 mg/cm^2 of the lead standard.

3.5 If values obtained are greater than ±0.3 mg/cm^2 of the lead standard, a calibration correction may be required. See page 19 of Operating Manual.

3.6 Repeat Steps 3.1 through 3.4 for the remaining zero standard blocks and the lead standard.

NOTE: The manufacturer does not provide all the various types of zero standards that may be encountered in the field. Therefore, removing the paint on the various surfaces that are to be tested and performing the zero standard procedure on these surfaces, followed by calibration, is recommended.

OPERATION OF THE XRF DEVICES

1. Do not place your hand on the opposite side of a door, wall, etc. while engaging the XRF.
2. When taking a reading on a door, always position the door to be completely closed or fully open, and make sure no one is on the opposite side.
3. When taking readings on interior walls be certain no one is on the opposite side of the wall.
4. Never point the XRF at anyone.
5. Do not use other portions of your body (eg. shoulder, knee, etc.) to help steady the XRF.
6. Always stand to the rear or left side of XK3 when operating the device. Radiation is emitted from the right side and at an angle.
7. When the ML1 is not being used the padlock shall be used to lock the trigger.
8. Never leave an XRF unattended, the device shall be in your possession and control at all times.
9. When more than one ML1 is being used in the same apartment - always maintain at least 10 feet between instruments.
10. When the XRF is not in use and placed into your vehicle and keep it "out-of-sight".
11. If an XRF is missing notify your supervisor immediately. (see Theft and Loss Procedure).
12. Do not mix and match XRF devices and carrying cases, keep the device and all components together.
13. Do not drop the device.
14. Make sure the base of XRF (area that is placed in contact with surface) is clean and free of dirt, dust, paint chips, etc..
15. When XRF is not in use, keep on charge.
16. The wrist strap must be worn when using the ML1.
17. When attaching the carrying strap to the ML1 analyzer, be sure attachment is secure.

THEFT/LOSS OF XRF DEVICE

Scope: In the event an XRF device is discovered to be stolen or lost the following shall be implemented.

1.0 Notify immediately by telephone the KTA Radiation Safety Protection Officer at the following:

Within the State of PA - (412) 788-1300
Outside the State of PA - 1-800-245-6379

2.0 Provide the KTA Radiation Safety Protection Officer with the following information:

2.1 City, state, and specific location where theft or loss occurred.

2.2 Time when theft or loss occurred or was discovered.

2.3 Name of KTA representative at site responsible for XRF equipment.

2.4 Description of circumstances under which loss or theft occurred.

2.5 Make, model, and serial number of device involved.

2.6 Condition of device when last seen.

3.0 Upon informing the KTA Radiation Safety Protection Officer the appropriate personnel shall be notified. (See Attachment).

322/3

ACCIDENT/EXPOSED SOURCE

Scope: This procedure shall be implemented in the case of an accident involving an XRF device in which case the sealed sources are believed to be damaged and/or exposed.

1.0 Immediately isolate all personnel from the instrument for a minimum radius of fifty feet.

1.1 Establish boundaries of the isolated area and assign an on-site KTA employee to assure no personnel enter the restricted area.

1.2 Immediately notify the local police/fire department of the situation.

1.3 Immediately notify the KTA Radiation Safety Protection Officer at the following number within the state of PA - 412-788-1300, outside of PA 1-800-245-6379.

2.0 Provide the KTA Radiation Safety Protection Officer with the following:

2.1 City, State, and specific location were emergency exists

2.2 Time and date the accident occurred.

2.3 Name of KTA representative on-site responsible for XRF devices.

2.4 Description of circumstances/events leading up to and creating the emergency.

2.5 Make, model, and serial number of device involved.

2.6 Visual condition of instrument involved.

3.0 The KTA Radiation Safety Protection Officer shall notify the appropriate personnel. (See Attachment).

322/2

LEAD-TESTING/XRF EXAMINATION

Name: ____________
Date: ____________

1. What do the letters "XRF" mean?

2. What do the letters "LBP" mean?

3. Define the term "base reading"?

4. KTA owns two types of portable XRF instruments. Name them and their manufacturer.

   1. ________________ 2. ________________

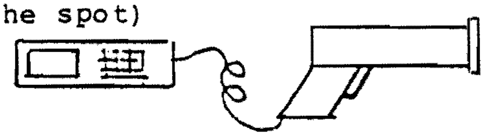
5. Which instrument is equipped with three (3) calibration blocks to zero standardize?

6. List the three (3) types of substrates these calibration blocks consist of.

7. Describe "zero standardizing" and the advantage of it.

8. Which instrument offers the capability to be operated around the clock with virtually no down-time to the operator? Explain.

9. Where is the radioactive source located in the ML-1 instrument? (X marks the spot)



10. Which instrument theoretically provides better accuracy of the values recorded during lead-based paint testing? Explain. Hint (standard deviation)

11. Define lead-based paint?

12. Currently what does the instrument's final value have to be for HUD to consider a substrate to contain lead-based paint (don't forget units).

TRUE OR FALSE
(circle one)

1. A portable XRF instrument contains a radioactive source. T F

2. Never point any XRF instrument in the direction of another person/animal. T F

3. Instruments should always be calibrated and operated ten feet apart from one another. T F

4. Substrate density has no effect on the values obtained with a portable XRF. T F

5. The standard deviation of the XK-3 is ±0.3 mg/cm^2 when three readings are taken. T F

6. Both types of instruments can operate several days without charging the batteries. T F

7. The XK-3 instrument shows a visual number display of the substrate density being tested. T F

8. Both types of XRF instruments can detect elements other than lead and give valid number values for these elements. T F

9. A "Thermoluminescence detector" (TLD), measures the amount of radiation an individual has been exposed to. T F

10. Technicians' badges and rings should be stored with the instruments to prevent loss, and provide easy access. T F

MATCHING

Princeton Gamma Tech	ML-1
Cobalt 57	TLD
Warrington	XK-3
Personal Monitoring Devices	Mass of matter per unit or volume
Milligram per sq. centimeter (mg/cm^2)	Radioactive source
Density	Units in which XRF instruments display lead values
±0.3 mg/cm^2	Standard deviation of ML-1 when three (3) readings are taken.
±0.5 mg/cm^2	Standard deviation of XK-3 when three (3) readings are taken.

WORK PROBLEMS

1. You are in the bathroom of a particular unit, testing for the presence of lead-based paint on an area known as a chair rail.

   What is the actual lead content on the chair rail if:

a) The base reading is 0.0 mg/cm^2 and the instrument value shows 1.5 mg/cm^2 ________________

b) The base reading is $^{+}0.5$ mg/cm^2 and the instrument value shows 1.5 mg/cm^2 ________________

c) The base reading is -0.5 mg/cm^2 and the instrument value shows 1.5 mg/cm^2 ________________

2. From the example above, the following statements can be made to always hold true.

a) Always (add/substract)________ a positive base reading from the instrument value.

b) Always (add/substract)________ a negative base reading from the instrument value.

3. A technician is testing for the presence of lead-based paint in a particular unit, using the ML-1 portable XRF instrument. What would you do, or how would you explain the following?

a) The display shows IEEE.

b) The display shows "LOWBAT".

c) The instrument beeps twice when the trigger is depressed.

d) The instrument is accidentally turned off.

e) The technician is to test the exterior of a building, and it's raining.

f) You are breaking for lunch. What should you do with the instrument?

4. Two technicians have accidentally tested the same area of a particular room one day, and each recorded the following data.

Technician 1	0.4	0.3	0.9
Technician 2	0.3	0.4	0.0

Assuming the standard deviation of the instruments used were the same, which technician(s) would have valid accurate data if the

a) Standard deviation was ±0.3

b) Standard deviation was ±0.5

c) Standard deviation was ±0.7

5. Describe how the portable XRF instrument works in detecting the presence of lead-based paint (Theory of X-ray Fluorescence).

HOUSTON
LOS ANGELES
PITTSBURGH

KTA-TATOR, INC.
115 Technology Drive, Pittsburgh, PA 15275

(412) 788-1300
TWX 510 697 3335
FAX (412) 788-1306

PROTECTIVE COATINGS (PAINT) CONSULTANTS: Testing • Instruments • Inspection • Analytical Laboratory

QCP-C1 Attachment IVB

NAME________________________

DATE________________________

SCORE_______________________

XRF OPERATORS DEVICE EXAM

1. How often shall "Leak Tests" be performed?

2. Explain how you would prepare a sample for a leak test.

3. T or F. A leak test which reveals 0.005 microcuries or more is considered to be leaking and must be repaired.

4. How often must KTA conduct a physical inventory to account for sealed sources possessed during that period?

5. Explain how you would deal with an emergency situation (eg. source is exposed after being dropped from a building).

6. Explain how you would deal with a theft or loss situation of an XRF device.

7. How often are pocket dosimeters (DRD) to be read and exposures recorded?

8. What federal document deals with the transportation of radioactive material?

9. T or F. KTA is licensed by State of PA to own and operate XRF devices, but in order for KTA to use the XRF devices outside the state of PA reciprocity from that state must be granted.

10. T or F. The XRF technicians while in the field are not required to have in their possesion emergency and operatinng procedures.

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PITTSBURGH

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PROTECTIVE COATINGS (PAINT) CONSULTANTS: Testing • Instruments • Inspection • Analytical Laboratory

NAME ____________________

DATE ____________________

SCORE ____________________

RADIATION EXAM

1. What are the four types of ionizing radiation?

    1.

    2.

    3.

    4.

2. Which of the four types is considered the highest penetrating when the primary shielding material is lead?

3. Define Millirem.

4. List the two types of background radiation.

    1.

    2.

5. Can an exposure rate of 0-100 REM within 24 hours cause a 100% lethal dose within 30 days?

    Yes _______ No _______

6. T or F. Exposure to 1 REM per year over a 30 year period may shorten life expectancy by 30 days.

7. What is Federal (NRC) Radiation accumulated dose limit for whole body?

8. What is the major advantage of a DRD over a TLD?

9. What are the three primary ways to reduce exposure to radiation?

    1.

    2.

    3.

10. What is the radioactive source of the XRF instruments and its half life?

QCP-T1 -- FIELD DETECTION OF LEAD USING PORTABLE XRF DETECTORS

1.0 Scope

1.1 This procedure outlines the operations followed for lead testing using portable XRF detectors.

1.2 The following attachments to this procedure are considered a part of the procedure:

Title	Attachment
Calibration Procedure (ML1)	Attachment IA
Calibration Procedure (XK3)	Attachment IB
Field Test Report XRF-IN1 (Interior)	Attachment IIA
Field Test Report XRF-EX1 (Exterior)	Attachment IIB
Field Test Report Coding System	Attachment III

2.0 Calibration

2.1 Each XRF device shall be calibrated during field use in accordance with manufacturer's instructions (see Attachment IA and IB).

2.2 Calibration frequency shall be as follows:

2.2.1 Before testing begins on a unit.
2.2.2 After unit test completion.
2.2.3 After any extended shutdown period (e.g., after lunch break).
2.2.4 After any series of readings are questioned by the operator.
2.2.5 When using XK3 device and value of 10 mg/cm^2 is obtained, or a series of readings of 5.0 mg/cm^2 or higher are obtained.
2.2.6 When using ML1 device and values of 15.0 mg/cm^2 or higher are obtained.

3.0 Base Readings -- In order to determine the true value of lead in paint, paint shall be removed from every unique substrate in the unit (e.g., wood, gypsum, concrete, etc.). NOTE: If each unit is of similar design, such as a multi-family housing, only one set of base readings are required.

3.1 An area approximately 4" x 4" shall be stripped entirely of paint.

3.2 A series of eight to ten readings are taken on the exposed surface and an average is obtained.

3.3 The average is recorded as the base reading.

3.4 When more than one XRF device is being utilized, base readings shall be obtained for each device.

4.0 Substrate Densities

4.1 Densities of various construction materials may affect the accuracy of the XRF devices.

4.2 Materials of similar densities shall be tested at the same time (e.g., test all wooden substrates before moving to concrete).

4.3 When changing densities, regardless of type of device being used, discard the first set of readings obtained (reading constitutes a series of three shutter releases) to be certain that the instrument has adjusted to the new substrate density.

5.0 Readings

5.1 Frequencies -- Each room within a unit shall be considered a separate testing area. Within each room, test each wall, each ceiling, and each floor. In addition, items of unique architecture identity will be combined, and a minimum of one test conducted for each. For example, if a room contains two windows, test one; if it contains four baseboards, test one; etc. The identity of the surfaces is found on the documentation form attached as Attachment II. The unit exterior is tested similarly.

5.2 Whenever sculptured or irregular surfaces are encountered which cannot be tested with an XRF device, samples will be retained for laboratory AA testing (see KTA Procedure QCP-RT1).

5.3 When testing, the XRF device shall not be moved so that all three shutter releases are taken in the same spot. If moved, discard all values and repeat the tests.

5.4 Concealed items within a surface may produce unusually high readings. Therefore, a stud finder and/or magnet may be used during testing to pinpoint any metal studs, pipes, conduits, etc.

5.5 When unusually high or inconsistent readings are obtained, the technician shall discard the readings and move the test site approximately one foot away.

5.6 Only XRF devices of similar manufacturer type (ML1 or XK3) shall be used together in testing any one unit.

5.7 When testing similar substrates, such as walls in a particular room, and if one reading is not consistent with readings from the other like substrates, the area or entity in question shall be retested.

6.0 Quality Control

6.1 The KTA testing team is comprised of a team leader and two testers. The team leader shall provide QC over the test data. The testers shall report all test values (the results of each shutter opening) to the team leader for documentation. When values are obtained that are inconsistent with the accuracy of the detector, he shall require additional readings. When readings on given surfaces appear inconsistent with surrounding values (e.g., three walls 1.5 and the fourth 0.1), he shall require additional readings.

6.2 The team leader shall continuously observe the procedures followed by the testers to verify that the XRF devices are being utilized according to manufacturer and KTA instructions.

7.0 Documentation

7.1 Technicians shall document the base reading and each of the individual shutter values obtained on painted surfaces at each test location on the forms attached as Attachments IIA and IIB.

7.2 In addition to the lead values, record (or verify the completion of) the data regarding substrate type, coating condition, surface area, etc. as found on the report forms.

2/15/89

CALIBRATION VERIFICATION OF ML1

Calibration verification of the Microlead 1, Revision 4 (ML1) manufactured by Warrington, Inc., Austin, TX will performed for each property to be tested or when excessively high values are obtained.

1.0 Warm-Up

1.1 Turn the ML1 on by the power switch at back of analyzer and allow the device to warm-up.

1.2 During warm-up cycle, take readings on any surface for approximately five minutes.

2.0 Zero Standardizing

2.1 Select one of the zero standards that most closely matches the density of the surfaces to be tested (e.g., wood, gypsum, concrete).

2.2 Place the probe on the device on one of the zero standards provided by the manufacturer and depress the trigger.

2.3 At the end of each reading cycle, a digital display will appear on the analyzer, showing the detected value and density.

2.4 Keep the trigger depressed until several readings have been displayed and record this final value as your zero reference and the density.

2.5 Repeat Steps 2.2 through 2.4 for each zero standard block.

3.0 Calibration Verification

3.1 Place the lead standard on one of the zero standards. Place the probe on the lead standard and depress the trigger.

3.2 At the end of a reading cycle, a digital display will appear showing the obtained value.

3.3 Keep the trigger depressed until four to five readings have been displayed and record the final value.

3.4 The instrument is calibrated for use on that particular substrate if the value obtained is ±0.3 mg/cm^2 of the lead standard.

3.5 If values obtained are greater than ±0.3 mg/cm^2 of the lead standard, a calibration correction may be required. See page 19 of Operating Manual.

3.6 Repeat Steps 3.1 through 3.4 for the remaining zero standard blocks and the lead standard.

NOTE: The manufacturer does not provide all the various types of zero standards that may be encountered in the field. Therefore, removing the paint on the various surfaces that are to be tested and performing the zero standard procedure on these surfaces, followed by calibration, is recommended.

2/15/89

CALIBRATION VERIFICATION PROCEDURE FOR THE XK-3 LEAD-IN-PAINT ANALYZER

Although the XK-3 is factory calibrated, calibration verification is performed in the field. The following calibration verification procedure shall be performed by the KTA testing personnel. This procedure is also in compliance with the manufacturer's (Princeton Gamma Tech) written instructions.

XK-3 Calibration Verification

1.0 Calibration verification shall be performed for each property to be tested and whenever an extremely high value is obtained.

2.0 Calibration verification shall be performed as follows:

2.1 Locate the lock switch underneath the handle toward the rear of the unit and push it forward. A red light over the display window will light up to indicate that the instrument is ready.

2.2 Position the XK-3 unit over the supplied calibration block. Align the arrows on the unit with the arrows on the calibration block.

2.3 Grasp the wooden handle, push down firmly and evenly on the handle to open the internal shutter. The red light over the display window will blink to indicate that the shutter is open and the measurement is being taken.

2.4 Approximately 15 seconds will be required for a reading.

2.5 Once the reading appears, compare the reading with the reading typed on the standard label.

2.6 Take two more readings to establish an average. The unit is properly calibrated if the three readings average within ±0.5 mg/cm^2 of the standard label.

2.7 If the average reading falls outside the specified range, depress the red reset button on the back plate of the XK-3 (above the coiled cable connection). This reset activates an internal circuit that instantaneously recalibrates the electronic circuit.

2.8 If reset button is pushed, recalibrate beginning with 2.1.

3.0 Zero Adjustment

A "zero" adjustment must be recorded for each particular surface that will be tested (e.g., wood, steel, concrete, etc). as follows:

3.1 Remove existing paint (4" x 4") from the surface to expose the substrate.

3.2 Position the XK3 on the exposed surface.

3.3 Grasp the wooden handle and depress firmly and evenly to open the internal shutter. The red light will blink indicating a reading is being taken.

3.4 Approximately 15 seconds after depressing the handle, a digital readout will be displayed. Record the reading.

3.5 Take a total of ten readings and average the readings.

3.6 The average of ten readings is then recorded as the "zero" adjustment.

3.7 If the zero adjustment is a positive number (e.g., +0.1), this value is deducted from values obtained on the actual painted surface and recorded as lead content.

Actual Value Obtained =	1.0
Less Zero Adjustment	0.1
Lead Content	0.9 mg/cm^2

3.8 If the zero adjustment is "0", the value obtained is recorded as lead content.

Actual Value Obtained =	1.0
Less Zero Adjustment	0.0
Lead Content	1.0

3.9 If the zero adjustment is a negative number (e.g., -0.1), this value is added to the actual obtained value.

Actual Value Obtained =	0.9
Plus Zero Adjustment	-0.1
Lead Content	1.0 mg/cm^2

FORM XRF-IN1

LBP ABATEMENT DEMONSTRATION CITY: DATE:

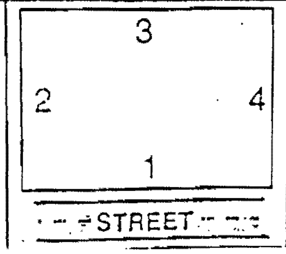
ADDRESS: PROPERTY ID:

TECHNICIANS

TECHNICIANS

ROOM:______ FLOOR:______ ML1 or XK3 S/N:______

TEST No.	SURFACE ID	QTY	SUB-STRATE TYPE	CTG GRADE	CTG COND	AREA	BASE VALUE	XK3 VALUES				ML1 VALUES			ACT	AA V
								#1	#2	#3	AVG	BAR 1	BAR 2	BAR 3		
1	CLG															
2	FLR															
3	1WL															
4	2WL															
5	3WL															
6	4WL															
7	WCT															
8	CGM															
9	CHR															
10	BSB															
11	WDW															
12	WSL															
13	WTM															
14	DOR															
15	DRF															
16	ICW															
17	CAB															
18	SHV															
19	MEC															
20	PIP															
21	STD															
22	HRL															
23	BAU															
24																
25																



FORM XRF-EX1

LBP ABATEMENT DEMONSTRATION

CITY:

DATE:

ADDRESS:

PROPERTY ID:

TECHNICIANS

TECHNICIANS

EXTERIOR:

ML1 or XK3

S/N:

TEST No.	SURFACE ID	QTY	SUB-STRATE TYPE	CTG GRADE	CTG COND	AREA	BASE VALUE	XK3 VALUES				ML1 VALUES			ACT	AA V
								#1	#2	#3	AVG	BAR 1	BAR 2	BAR 3		
1	RFF															
2	1WL															
3	2WL															
4	3WL															
5	4WL															
6	FND															
7	WDW															
8	WSL															
9	WSL															
10	WTM															
11	DOR															
12	DOR															
13	DRF															
14	GUS															
15	SOF															
16	COL															
17	PO #															
18																
19																
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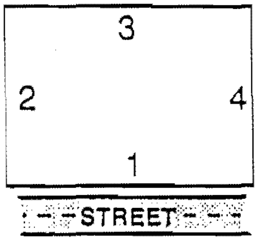


LEAD TESTING CODING SYSTEM

Room	
Living Room	LVG
Dining Room	DIN
Kitchen	KIT
Bathroom	BAT
Bedroom	BD__#
Hallway	HAL
Pantry	PAN
Stairway	STR
Attic	ATC
Laundry	LDY
Game Room	GAM
Basement	BSM

Floor	
Basement	BLV
1st Floor	1LV
2nd Floor	2LV
3rd Floor	3LV

Coating Grade	
Painted	A
Panelled	B
Stained	C
Paper/Vinyl	D
Plastic/Formica	E
Tile	F
Other	G
Not Painted	H
Factory Painted	J
carpet	K

Condition	
Not Ptd.	0
Chalking	1
Peeling	2
Damaged	3
Good	4

SUBSTRATES

Ceilings	
Plaster Smooth	01
Plaster Ornate	02
Gypsum Board	03
Metal Ornate	04
Vinyl Asbestos Tile	05
Acoustical Tile	06
Drop Ceiling	07
Wood	08

Floors	
Wood	10
Concrete	11
Brick	12

Window	
Wood	50
Metal	51
Vinyl	52

Window Sill	
Wood Smooth	55
Wood Ornate	56
Metal	57
Brick	58
Concrete	59

Walls	
Plaster	20
Gypsum	21
Concrete Block	22
Concrete (Cast)	23
Precast Concrete	24
Brick	25
Wood Panelling	26
Wood Smooth	27
Wood Rough	28
Wall Paper	29
Oil Cloth	30
Ceramic Tile	31
Metal Smooth	32
Metal Rough	33
Wainscot	34
Stone	35
Vinyl Siding	36
Aluminum Siding	37
Single (Wood)	38
Shingle (Asbestos	39
Stucco	40

Window Trim	
Wood Smooth	62
Wood Ornate	63
Metal Smooth	64
Metal Ornate	65

Status Codes

N/A (Not Applicable)

N/A = 0

A/A = Atomic Absorption

Door

Wood Smooth	70
Wood Ornate	71
Metal Smooth	72
Metal Ornate	73
Aluminum	74

Cabinets

Wood	85
Metal	86

Ceiling Moldings

Wood Smooth	95
Wood Ornate	96
Metal Smooth	97
Metal Ornate	98
Vinyl	99

Chair Rail

Wood Smooth	100
Wood Ornate	101
Metal Smooth	102
Metal Ornate	103
Vinyl	104

Piping

Metal	105

Balustrades

Wood Smooth	115
Wood Ornate	116
Metal Smooth	117
Metal Ornate	118

Roof

Flashing	120

Door Frame

Wood Smooth	75
Wood Ornate	76
Metal Smooth	77
Metal Ornate	78
Concrete	79

Baseboards

Wood Smooth	81
Wood Ornate	82
Metal	83
Vinyl	84

Radiator/Mechanical Enclosures

Metal Smooth	87
Metal Rough	88

Shelving

Wood	90
Metal	91

Stair Treads

Wood	110
Metal Smooth	111
Metal (Grille or Ornate)	112

Handrails

Wood	113
Metal	114

Soffits

Wood	122
Metal	123
Stucco	124
Cement Asbestos	125

Columns

Wood	140
Metal	141

Porch/Deck/Patio

Wood	130
Stone	131
Brick	132
Concrete	133
Metal	134

Foundations

Concrete	145
Blcck	146
Brick	147
Wood	148
Stone	149

Other Surfaces

Wood Grille	155
Metal Grille	156
Gutters/Downspouts	157
Drain Pipe	158
Fencing	159
Clothes Pole	160
Oil/Fuel Tank	161

QCP-RT1 -- QA/QC RETESTING OF CANDIDATE UNITS SELECTED FOR ABATEMENT

1.0 Scope

1.1 This procedure delineates the steps that will be taken to retest housing units that have been chosen as candidates for abatement. The testing covered by this procedure involves:

1.1.1 The retesting of various substrates with XRF devices.

1.1.2 Collection of soil and paint samples for laboratory Atomic Absorption Spectroscopy.

1.2 The following attachments form a part of this procedure:

1.2.1 Attachment I -- Report Form QC/A-1
1.2.2 Attachment IIA -- XRF Calibration (XK3)
1.2.3 Attachment IIB -- XRF Calibration (ML1)

2.0 Test Site Selection For XRF Retests

2.1 Technicians will be provided with Form QC/A-1 for candidate units selected for abatement. Form QC/A-1 identifies all previously obtained XRF values (see Attachment I).

2.2 Any substrate shown on the form that was previously tested and meets the following criteria shall be retested with XRF devices.:

2.2.1 Substrates of a similar type with inconsistent readings. Retest the outlier (e.g., four walls in one room, with one wall reading inconsistent with the others). Inconsistency shall be defined as a reading that is outside the manufacturer's expected tolerance for that particular XRF device (ML1 = ±0.3; XK3 = ±0.5).

2.2.1 A minimum of two locations per property with initial XRF values >2.0 mg/cm^2.

3.0 XRF Test Procedure

3.1 Calibration -- XRF devices shall be calibrated in accordance with Attachment II. Report that calibration was performed on Form QC/A-1.

3.2 Base Reading -- Base readings of the bare substrate (previously stripped) shall be taken in each unit for the surfaces that will be retested.

3.2.1 If more than one XRF device is utilized, base readings shall be recorded for each particular device.

3.2.2 Base readings shall be documented on Form QC/A-1.

3.3 XRF Readings

3.3.1 XRF readings shall be taken in accordance with KTA Procedure No. QCP-T1.

4.0 Paint Sample Collection for AAS Analysis

4.1 Grey Area -- Previous XRF values, or retest values between 0.2 and 1.8 are considered to be within the "grey area" of reliability for the XRF detectors according to current NIST work and their review of initial XRF data from all of the units. Paint samples from some of these surfaces shall be removed for AAS testing. In a given room, one sample shall be removed from similar architectural items that appear to be painted the same and have similar XRF readings (e.g., readings are similar if they fall within the machine tolerances). For example, if four walls in a room have XRF values from 0.8 to 1.2, a sample shall be removed from only one of the walls. Note: The grey areas requiring sampling for AAS may change based upon on-going research by NIST. If a new grey area is suggested, it will be followed.

4.2 Areas Inaccessible to XRF -- Samples shall be taken on all areas that were not tested by XRF devices due to inaccessibility or configuration limitations (e.g., rounded ceiling molding). One sample shall be taken per similar item in a room that visibly appears to be painted the same (e.g., sample only one radiator if two are present).

4.3 Sample Collection

4.3.1 It is extremely important that all the paint from the sample area is completely removed.

4.3.2 Sample contamination by substrate, soil, dust, or other foreign material shall be minimized, but a perfectly clean sample is less critical than removing a known surface area. (At HUD direction, the laboratory results will be reported as mg/cm^2 rather than on a weight basis, in which case foreign contamination is critical.)

4.3.3 The preferred sampling procedure involves the use of cellophane tape, a 1/4 square inch (1/2 x 1/2) KTA steel template, a Stanley knife, and a wood chisel. Apply the tape to the test area and press firmly to the surface. Hold the template to the surface (its thin-gage construction allows it to contour to round or slightly irregular surfaces) and score the paint to the substrate around the perimeter of the opening. The tape will hold the paint together, while the chisel is carefully worked into the paint/substrate interface. With care, the paint sample can be removed down to the substrate.

4.3.4 Note that the surface configuration and accessibility can affect the use of the template. Therefore, samples can be removed by various mechanical devices, such as a sharp utility knife, scraper, or punch and chisel, provided the surface area is known and recorded.

4.3.5 To provide QC checks for the variability of sample collection, three samples in the same location shall be taken in two test areas (different substrates) per house. One technician shall remove one of the samples; a second technician shall remove the remaining two.

4.3.6 Samples shall be sealed in a ziplock-type plastic bags labeled with at least the following:

a) Property address and city.
b) Technician's name and date.
c) Room/substrate location ID code.
d) Surface area of sample.

4.3.7 Sample location shall be documented on Report Form QC/A-1 in accordance with the instructions on the form.

5.0 Soil Sample Selection

5.1 One set of soil samples shall be removed prior to abatement from each side of the property that contains soil .

5.2 The samples shall be removed using a sharpened 3/4" ID tube (1/2 square inch surface area) marked in 1/2" increments. The sample along the outside wall will be comprised of separate plugs of soil combined. Each plug of soil will be removed by pushing the tube into the ground 1/2". The tube is twisted and snapped to one side to remove a core of soil 1/2" thick. The plug of soil is dropped into a plastic bag. This process is completed until five samples are collected and combined in the same plastic bag. This represents the soil sample.

5.3 Each of the individual soil plugs along each side of the property will be located as follows. One sample will be removed from the ground at each end of the wall and one at the center point of the wall. The fourth sample will be removed halfway between the center point and the far end of the wall and the fifth, halfway between the center point and the near end of the wall. Each of the five samples will be located at a distance of 1 foot from the foundation. If a sample cannot be collected at this point, it shall be moved closer to the foundation until the sample can be obtained. If sampling is still not possible, the location shall be moved from the 1 foot mark outward from the foundation to a distance of up to 2 feet. If the sample still cannot be obtained, the specific location along the length of the wall shall be moved until soil is encountered. The bag from one sample set shall be sealed before collecting the next set.

5.4 The bags shall be identified with the property address, city, sample location, technician's name, and date. In addition, the locations shall be identified on Form QC/A-1.

FORM OC / A-1 ABATEMENT UNIT LEAD DECTECTION QA/QC CONFIRMATION
CITY: BALTIMORE DATE: ________________________
ADDRESS: 5338 - 41ST STREET REFERENCE # 106

KTA TECHNICIANS ________________________________ CALIBRATION DATE: __________________
____
________________________________ TIME: PRETEST INPROCESS POST

ROOM: BD3 FLOOR: INSTRUMENT: (XK3) ML1 XK3 S/N: ____________________

TEST NO.	SURFACE ID	QTY	SUB-STRATE	CTG GRADE	ACT	XRF RETEST #1	#2	#3	AVG	BASE	ACT	AAS* LOC	AAS RESULT	LEAD** VALUE
1	CLG	1	03	A	0.2									
2	FLR	1	10	K	N/A									
3	1WL	1	21	A	-0.0									
4	2WL	1	21	A	-0.2									
5	3WL	1	21	D	-0.1									
6	4WL	1	21	A	0.1									
7	WCT													
8	CGM													
9	CHR													
10	BSB	4	81	A	N/A									
11	WDW													
12	WSL	2	55	A	0.0									
13	WTM													
14	DOR													
15	DRF													
16	ICW	1	21	A	-0.2									
17	CAB													
18	SHV													
19	MEC													
20	PIP													
21	STD													
22	HRL													
23	BAU													
24														
25														

* RECORD ID NO. OF WALL FROM WHICH SAMPLE IS REMOVED FOR AAS. PLACE THE NUMERICAL 'TEST NO' IDENTIFIER ON THE DRAWING IN THE APPROXIMATE LOCATION OF THE SAMPLE SITE. IF THE SAMPLE IS REMOVED FROM THE PRECISE LOCATION OF AN XRF RETEST, PLACE A '*' AFTER THE WALL NUMBER.

** THIS COLUMN PRESENTS THE FINAL LEAD VALUE FOR THE SURFACE. IF AAS WAS CONDUCTED, THE AAS RESULT IS REPORTED HERE, FOLLOWED BY 'A'. IF ONLY XRF WAS CONDUCTED, ITS VALUE IS REPORTED HERE, FOLLOWED BY 'X'.

I HAVE REVIEWED ALL OF THE ABOVE FIELD DATA FOR COMPLETENESS AND ACCURACY:
TECHNICIAN: ______________________________ DATE ____________

I HAVE REVIEWED THE FIELD DATA FOR ACCURACY AND TRANSFERED THE LABORATORY DATA:
SUPERVISOR: ______________________________ DATE ____________

```
              3
  +--------------------+
  |                    |
  |                    |
2 |                    | 4
  |                    |
  |                    |
  +--------------------+
              1
  |-------STREET------|
```

2/15/89

CALIBRATION VERIFICATION PROCEDURE FOR THE XK-3 LEAD-IN-PAINT ANALYZER

Although the XK-3 is factory calibrated, calibration verification is performed in the field. The following calibration verification procedure shall be performed by the KTA testing personnel. This procedure is also in compliance with the manufacturer's (Princeton Gamma Tech) written instructions.

XK-3 Calibration Verification

1.0 Calibration verification shall be performed for each property to be tested and whenever an extremely high value is obtained.

2.0 Calibration verification shall be performed as follows:

2.1 Locate the lock switch underneath the handle toward the rear of the unit and push it forward. A red light over the display window will light up to indicate that the instrument is ready.

2.2 Position the XK-3 unit over the supplied calibration block. Align the arrows on the unit with the arrows on the calibration block.

2.3 Grasp the wooden handle, push down firmly and evenly on the handle to open the internal shutter. The red light over the display window will blink to indicate that the shutter is open and the measurement is being taken.

2.4 Approximately 15 seconds will be required for a reading.

2.5 Once the reading appears, compare the reading with the reading typed on the standard label.

2.6 Take two more readings to establish an average. The unit is properly calibrated if the three readings average within ±0.5 mg/cm^2 of the standard label.

2.7 If the average reading falls outside the specified range, depress the red reset button on the back plate of the XK-3 (above the coiled cable connection). This reset activates an internal circuit that instantaneously recalibrates the electronic circuit.

2.8 If reset button is pushed, recalibrate beginning with 2.1.

3.0 Zero Adjustment

A "zero" adjustment must be recorded for each particular surface that will be tested (e.g., wood, steel, concrete, etc). as follows:

3.1 Remove existing paint (4" x 4") from the surface to expose the substrate.

3.2 Position the XK3 on the exposed surface.

3.3 Grasp the wooden handle and depress firmly and evenly to open the internal shutter. The red light will blink indicating a reading is being taken.

3.4 Approximately 15 seconds after depressing the handle, a digital readout will be displayed. Record the reading.

3.5 Take a total of ten readings and average the readings.

3.6 The average of ten readings is then recorded as the "zero" adjustment.

3.7 If the zero adjustment is a positive number (e.g., +0.1), this value is deducted from values obtained on the actual painted surface and recorded as lead content.

Actual Value Obtained = 1.0
Less Zero Adjustment 0.1
Lead Content 0.9 mg/cm^2

3.8 If the zero adjustment is "0", the value obtained is recorded as lead content.

Actual Value Obtained = 1.0
Less Zero Adjustment 0.0
Lead Content 1.0

3.9 If the zero adjustment is a negative number (e.g., -0.1), this value is added to the actual obtained value.

Actual Value Obtained = 0.9
Plus Zero Adjustment -0.1
Lead Content 1.0 mg/cm^2

2/15/89

CALIBRATION VERIFICATION OF ML1

Calibration verification of the Microlead 1, Revision 4 (ML1) manufactured by Warrington, Inc., Austin, TX will performed for each property to be tested or when excessively high values are obtained.

1.0 Warm-Up

1.1 Turn the ML1 on by the power switch at back of analyzer and allow the device to warm-up.

1.2 During warm-up cycle, take readings on any surface for approximately five minutes.

2.0 Zero Standardizing

2.1 Select one of the zero standards that most closely matches the density of the surfaces to be tested (e.g., wood, gypsum, concrete).

2.2 Place the probe on the device on one of the zero standards provided by the manufacturer and depress the trigger.

2.3 At the end of each reading cycle, a digital display will appear on the analyzer, showing the detected value and density.

2.4 Keep the trigger depressed until several readings have been displayed and record this final value as your zero reference and the density.

2.5 Repeat Steps 2.2 through 2.4 for each zero standard block.

3.0 Calibration Verification

3.1 Place the lead standard on one of the zero standards. Place the probe on the lead standard and depress the trigger.

3.2 At the end of a reading cycle, a digital display will appear showing the obtained value.

3.3 Keep the trigger depressed until four to five readings have been displayed and record the final value.

3.4 The instrument is calibrated for use on that particular substrate if the value obtained is ±0.3 mg/cm^2 of the lead standard.

3.5 If values obtained are greater than ±0.3 mg/cm^2 of the lead standard, a calibration correction may be required. See page 19 of Operating Manual.

3.6 Repeat Steps 3.1 through 3.4 for the remaining zero standard blocks and the lead standard.

NOTE: The manufacturer does not provide all the various types of zero standards that may be encountered in the field. Therefore, removing the paint on the various surfaces that are to be tested and performing the zero standard procedure on these surfaces, followed by calibration, is recommended.

QCP-LEP1 -- PROCEDURE FOR EP TOXICITY TESTING OF BUILDING MATERIALS

Scope

This procedure provides the steps for conducting the EP Toxicity test. The following attachments form a part of this procedure.

Attachment 1 - KTA Lead Analysis Method for EP Extracts
Attachment 2 - Laboratory QC Form E1 - EP Toxicity Testing
Attachment 3 - Laboratory QC Form E2 - AA Analysis of EP Tox Extracts

Reagents and Equipment

1.1 Acetic Acid (0.5N). Prepare 0.5N acetic acid by diluting concentrated glacial acetic acid (17.4N) by adding 57 ml of glacial acidic acid to 1 liter of deionized water, and dilute to 2 liters. Smaller portions can be made, using the same ratio.

1.2 Structural Integrity Tester. Use a device similar to that manufactured by Associated Design and Manufacturing Company of Alexandria, VA.

1.3 Agitator. Use a device capable of thoroughly agitating the solid sample so that it is well exposed to the extraction liquid. An orbital shaker is satisfactory.

1.4 Control Samples

  1.4.1 Blank Sample - Non lead containing blank shall be prepared using unpainted drywall.

  1.4.2 Split Sample - After preparation of the solid material as identified in 2.1 through 2.4 below, divide the sample into two halves by weight. Note that 100 grams are required for each of the samples.

Sample Preparation

2.1 Examine the sample of solid material as received to determine if it can pass through a 9.5 mm standard sieve. If the particle size of the sample is larger than specified above, prepare it for extraction by crushing, cutting, or grinding the material so that it passes through a 9.5 mm sieve or, if the material is in a single piece or several relatively large pieces (such as a number of core samples) by subjecting the material to the "Structural Integrity Procedure" described in paragraphs 2.2 through 2.4.

2.2 Cut, if necessary, the solid sample so that it fits into the Structural Integrity Tester described in paragraph 1.2.

2.3 Place the sample into the sample holder, assemble the tester, and raise the hammer to its maximum height and drop. Repeat 14 additional times.

2.4 Remove the solid material from the tester and scrape off any particles adhering to the sample holder.

2.5 Transfer 100 g (weighed to the nearest 0.01 g) of material to the extractor (typically a 2 liter Erlenmeyer Flask), if 100 g of sample is not available, use approximately 90% of the available sample.

2.6 Add deionized water to the extractor. The amount of water added should be 16 times the weight of the sample to be extracted. Measure out the water by volume in a 2 liter graduated cylinder, assuming a density of 1.00 g per ml. In other words, if a 100 g sample has been used, add 1600 ml of water.

2.7 After the solid material and water are added to the extractor, agitate for approximately 1 minute and measure the pH of the solution in the extractor using a pH meter which has been calibrated per manufacturer's instructions. The type of extractor should conform to that described in paragraph 1.3.

2.8 If the initial (1 minute) pH is greater than 5.0, adjust the pH of the solution by adding 0.5N acidic acid, using a burett or other appropriate means. Record the volume of acid added. If the pH is ≤ 5, do not add any acid. Resume the agitation. Monitor the pH of the solution during the course of the extraction, and if the pH rises above 5.2, add 0.5N acetic acid to bring the pH into the range 4.8 to 5.2. Record the volume of all additions of acetic acid. However, in no event shall the aggregate amount of acid added to the solution exceed 4 ml of acid per gram of solid. Agitate the mixture for 24 hours at a temperature of 68 to 104°F.

2.9 Check the pH of the solution and, if necessary, add 0.5N acetic acid, until the pH reaches 4.8 to 5.2. Monitor and adjust the pH of the solution at 15, 30, and 60 minute intervals, moving to the next longer interval if the pH does not have to be adjusted by more than 0.5 pH units.

2.10 Continue the adjustment procedure for at least six hours.

2.11 If, at the end of the 24-hour extraction period, the pH of the solution is not below 5.2, and the maximum amount of acid (4 ml per gram of sample) has not been added, adjust the pH to 4.8 to 5.2 and continue the extraction for an additional 4 hours, adjusting the pH, if necessary, at one hour intervals.

2.12 At the end of the extraction period, add deionized water to the extractor in an amount determined by the following equation:

$$V = (20)\ (W) - 16\ (W) - A$$

Where: V = ml of water to be added
W = weight in g of solid sample added to the extractor
A = ml of 0.5N acetic acid added during extraction

2.13 Allow the extractor to stand so that the solid and liquid phases have time to at least partially separate. Then filter approximately 200 ml of the liquid phase through a 0.45 micron membrane filter, using either a water aspirator or a vacuum pump to assist in the filtration.

2.14 Store the filtered extract in a clean glass or plastic bottle for subsequent analysis for lead by atomic absorption spectroscopy. If the sample is to be stored for longer than 12 hours prior to analysis, store under refrigeration.

Quality Assurance/Quality Control

3.1 The KTA laboratory director shall serve as the laboratory QA/QC officer for this project.

3.2 The field materials will be prepared and extracted in lots of 10 to 15. The laboratory director shall place one of the following controls into the sample stream for each lot, alternating equally between them (e.g. insert 3.2.1 into the first lot, 3.2.2 into the second, etc.).

3.2.1 Unpainted dry wall (1.4.1).

3.2.2 Split sample (1.4.2).

3.3.3 Remaining half of split sample in 3.2.2.

3.3 An additional split sample shall be removed for every 40 samples and sent to Dewberry & Davis for forwarding to another laboratory. Dewberry & Davis will renumber the sample to obscure its identity. The results from the other laboratory will be forwarded to KTA through Dewberry & Davis for entry onto laboratory QC Form E2.

3.4 If any of the above samples suggest discrepancies in the test data, the discrepancy shall be documented on QC Form E2 for consideration when conducting a statistical analysis of the results.

KTA LEAD ANALYSIS METHOD FOR EP EXTRACTS

Introduction

1.1 This method is an atomic absorption procedure, based upon Method 7420. It is to be used for the analysis of EP Toxicity extracts.

Apparatus and Materials

2.1 Atomic Absorption Spectrometer -- Single or dual channel, single or double beam instrument, with provision for background correction.

2.2 Lead Hollow Cathode Lamp.

2.3 Use only deionized water.

2.4 Lead standard stock solution (1,000 ppm). Use a certified aqueous standard from a supplier such as Fisher Scientific or VWR.

2.5 100 ppm lead standard. Using a pipette, add 10.0 ml of the 1,000 ppm lead standard into a 100 ml volumetric flask. Dilute to the mark with deionized water. This standard will not be used, except to prepare more dilute standards.

2.6 20 ppm lead standard. Using a pipette, add 1.0 ml of the 1,000 ppm lead standard into a 50 ml volumetric flask. Dilute to the mark with deionized water.

2.7 10 ppm lead standard. Using a pipette, add 1.0 ml of the 1,000 ppm lead standard into a 100 ml volumetric flask. Dilute to the mark with deionized water.

2.8 5 ppm lead standard. Using a pipette, add 5.0 ml of the 100 ppm lead solution prepared above into a 100 ml volumetric flask. Dilute to the mark with deionized water.

2.9 1 ppm lead solution. Using a pipette, add 1.0 ml of the 100 ppm lead standard prepared above into a 100 ml volumetric flask. Dilute to the mark with deionized water.

Procedure

3.1 Samples to be analyzed by this method include EP Toxicity extracts.

3.2 Set the atomic absorption spectrometer to the 283.3 nm line.

3.3 Employ background correction and an oxidizing air acetylene flame.

3.4 Follow the manufacturer's operating instructions for the atomic absorption spectrometer.

3.5 Obtain a calibration curve by analyzing the 1 ppm, 5 ppm, 10 ppm, and 20 ppm lead standards. Always aspirate a deionized water blank between all standards and samples.

3.6 Analyze all EP Toxicity extracts by the Method of Standard Additions.

3.6.1 Measure out two 25 ml aliquots of sample by filling two 25 ml volumetric flasks to the mark, labeling them Flask A and Flask B. Therefore, $V_x = 25$.

3.6.2 To Flask A add (by pipet) 1.0 ml of a 100 ppm lead standard (para. 2.5), and mix. Therefore, $V_s = 1.0$ and $C_s = 100$ ppm.

3.6.3 To Flask B add (by pipet) 1.0 ml of deionized water and mix.

3.6.4 Analyze the contents of Flasks A and B, determining the concentrations of lead in ppm (S_a and S_b).

3.6.5 Calculate the original concentration of lead in the sample, C_x, by:

$$C_x = \frac{S_b \ V_s \ C_s}{(S_a - S_b)\ V_x}$$

3.7 Run the 5 ppm lead standard after approximately every 20 samples. If the value varies by more than 5%, rerun the calibration curve.

3.8 Rerun the calibration curve at least once for every hour of continuous sample analysis.

LABORATORY QC FORM E1

LABORATORY EP TOXICITY TESTING (QCP-LEP1)

Property Address____

Sample____

Structural Integrity Test?________________________________

Weight Charged (W)__________ Initial Volume of Water__________

Time/Date When Test Started_______________________________

Time	pH	Volume of Acid Added

Total Volume of Acid Added, A:__________
Weight of Sample Charged, W:__________
Additional Water Added, V:__________

(Note: $V = 20(W) - 16(W) - A$)

Technician:____________________ Date:______________
Supervisor:____________________ Date:______________

LABORATORY QC FORM E2

AA ANALYSIS OF EP TOX EXTRACTS (QCP-LEP1)

Property Address____

Sample #	AA (ppm, stds.)	V_x	V_s	C_s	S_a	S_b	C_x	C_x (Ind. Lab or Blank)

V_x = Volume of two identical sample aliquots (aliquots A and B)

V_s = Volume of standard analyte solution added to Aliquot A/Vol. of blank solution added to Aliquot B

C_s = Concentration of standard analyte solution (ppm)

S_a = AA signal (ppm) of Aliquot A

S_b = AA signal (ppm) of Aliquot B

C_x = Concentration of lead in sample = $\frac{S_b V_s C_s}{(S_a - S_b) V_x}$

QCP-LL1 -- METHOD FOR DETERMINING TOTAL LEAD CONCENTRATION IN DRIED PAINT SAMPLES

Scope

Introduction

This procedure provides the steps for determining the total lead concentration in dried paint samples. It follows guidelines published in ASTM D3335 "Standard Method of Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectroscopy". The following attachments are used for documenting the test results.

Attachment 1 - "Laboratory QC Report Form P1 -- Total Lead".

Reagents

1.1 Use reagent grade chemicals and deionized or distilled water in all tests.

1.2 Prepare ammonium acetate solution (50% weight/volume) by dissolving 500 grams of ammonium acetate in water and diluting to 1 liter. If needed, small quantities may be used, keeping the ratio the same.

1.3 Prepare ammonium acetate diluting solution by adding 50 milliliters of nitric acid to 150 ml of 50% weight/volume ammonium acetate solution and dilute to 1 liter.

1.4 Use a certified atomic absorption standard, such as available through Fisher Scientific or VWR.

1.5 Prepare 1:1 nitric acid by adding one volume of nitric acid (concentrated) to one volume of water.

Preparation of Standards

2.1 One hundred part per million (ppm) standard. Pipette 10.0 ml of the 1,000 ppm standard into a 100 ml volumetric flask, and dilute to the mark with deionized water. This standard will not be used for atomic absorption spectroscopy, as it will be outside the linear range of the calibration curve. Rather, it will be used to make other, more dilute standards.

2.2 Twenty ppm standard. Pipette 2.0 ml of the 1,000 ppm lead standard into a 100 ml volumetric flask. Add 5 ml of concentrated nitric acid, and 15 ml of 50% ammonium acetate. Dilute to the mark with deionized water.

2.3 Ten ppm standard. Pipette 1.0 ml of the 1,000 ppm lead standard into a 100 ml volumetric flask. Add 5 ml of concentrated nitric acid, and 15 ml of 50% ammonium acetate solution. Dilute to the mark with deionized water.

2.4 Five ppm standard. Pipette 5.0 ml of the 100 ppm lead standard prepared above into a 100 ml volumetric flask. Add 5 ml of concentrated nitric acid, and 15 ml of 50% ammonium acetate solution. Dilute to the mark with deionized water.

2.5 One ppm standard. Pipette 1.0 ml of the 100 ppm lead standard prepared above into a 100 ml volumetric flask. Add 5 ml of concentrated nitric acid, and 15 ml of 50% ammonium acetate solution. Dilute to the mark with deionized water.

2.6 0 ppm standard. Add 5 ml of concentrated nitric acid and 15 ml of 50% ammonium acetate solution to a 100 ml volumetric flask. Dilute to the mark with deionized water.

2.7 Control Paint Samples

2.7.1 Blank Samples - Non-lead containing paint blank -- Apply non-lead containing house paint to celophane tape. Allow to dry and cut into samples 1/2" on a side (0.25 in^2).

2.7.2 Spiked Samples - Prepare spiked samples with known amounts of lead. Use samples from 2.7.1 above and while in the crucible, add a known amount of 1000 ppm AA lead standard. Two levels of lead shall be used; approximately equivalent to 0.6 and 0.3 mg/cm^2.

For approximately every 20 lots, the spike will be accomplished using NIST SRM #1579 (lead-based paint reference material).

2.7.3 Split Sample - Divide field samples in half. Note that such samples must be completely intact and adherent to the sampling tape used in the field in order for accurate surface area determinations to be made.

Sample Preparation

3.1 Empty the entire contents of the sample bag (tape plus loose pieces of paint/substrate) into a porcelain crucible. Also record the area from which the sample was taken, if known, in in^2 or cm^2. For all samples except splits, this should be 1.61 cm^2 (0.25 in^2).

3.2 Place the crucible containing the tape/paint on a hotplate, and increase the temperature of the hotplate until the material chars.

3.3 After charring, place the crucible in a pre-heated muffle furnace and ash for 1 to 1-1/2 hours at 475 to 500°C.

3.4 Remove the crucible from the muffle furnace and allow it to cool. Break up the ash into fine particles using a small glass stirring rod, leaving the rod with the container through the subsequent filtering step.

3.5 Add 10 ml of 1:1 nitric acid, taking care to avoid losses due to spattering in the event that the ash reacts vigorously with the acid. Heat carefully on a hot plate until 2 to 3 ml of solution remains. Add an additional 10 ml of 1:1 nitric acid and continue heating until less than 5 ml of solution remains.

3.6 Remove the crucible from the hotplate and allow it to cool. Filter the solution through medium-porosity filter paper into either a 50 ml or 100 ml volumetric flask. Wash the crucible three times with 2 to 3 ml of hot 50% ammonium acetate solution, each time transferring the washings to the filter paper and allowing it to filter into the volumetric flask. Wash the filter paper several times with deionized water, allowing it to filter into the flask. Finally, dilute to the mark with deionized water and mix.

Atomic Absorption Analysis

4.1 Following the manufacturer's instructions, turn on the atomic absorption instrument and set the wavelength to the 283.3 nanometer (nm) lead line. Allow the instrument to warm up for approximately 15 minutes, and adjust the instrument parameters in accordance with the manufacturer's instructions to obtain a maximum absorption reading when a standard lead solution is aspirated. Use an air-acetylene flame.

4.2 Construct a calibration curve by aspirating the blank (0 ppm), along with the 1 ppm, 5 ppm, 10 ppm, and 20 ppm lead standards. In every case, aspirate water between each standard and/or sample.

4.3 Aspirate the sample solution and determine the lead concentration from the calibration curve. If the absorbance is above the range covered by the calibration curve, dilute an aliquot of the sample solution to a suitable volume with ammonium acetate diluting solution and obtain another reading. From the calibration curve, determine the concentration of lead in part per million (ppm). The dilution factor is the final volume divided by the volume of the aliquot. For example, if a 1.0 ml aliquot is diluted to 50 ml, the dilution factor is 50.

4.4 Run the 5 ppm standard after approximately every ten to fifteen samples. Do so in a manner such that the 5 ppm standard is run after each lot of 10-15 samples from a given muffle furnace run. If the concentration of this 5 ppm sample varies by more than 5% from its original reading, either use an automatic one-point calibration curve adjustment if the instrument is so equipped, or rerun the calibration curve, then rerun the preceding approximately ten to fifteen samples.

4.5 Rerun the calibration curve at least once for every hour of continuous sample analysis.

Calculations

5.1 Determine the concentration of lead, C, in terms of milligrams of lead per cm^2 of surface area, as follows:

$$C = \frac{(\text{ppm})\ \ V\ \ (\text{dilution factor})}{1000\ \ (\text{area sampled, in } cm^2)}$$, where V = volume of flask in 3.6.

Quality Assurance/Quality Control

6.1 The KTA laboratory director shall serve as the laboratory QA/QC officer for this project.

6.2 The field paint samples shall be run through the muffle furnace in lots of 10 to 15. The laboratory director shall place both a spike (6.2.2 or 6.2.3) and either a blank (6.2.1) or a split (6.2.4) into the sample stream for each of the first 10 to 15 lots. The technicians will be unaware of the concentration of the spike. All successive lots will have only one of the following controls inserted, alternating equally between them (e.g. insert 6.2.1 into first lot, 6.2.2 into the second, etc.).

6.2.1 Blank (2.7.1)

6.2.2 Spiked (2.7.2) at one lead level

6.2.3 Spiked (2.7.2) at another lead level

6.2.4 Split (2.7.3)

6.2.5 Remaining portion of split sample in 6.2.4 above.

6.3 An additional split sample shall be removed for every 100 samples and sent to Dewberry & Davis for forwarding to another laboratory for analysis. Dewberry & Davis will renumber the sample to obscure its identity. The results from the other laboratory will be forwarded to KTA through Dewberry & Davis for entry onto QC Form P1.

6.4 If any of the above samples suggest discrepancies in the test data (note the published precision statement for ASTM D 3335), the discrepancies shall be documented on QC Form P1 for consideration when conducting a statistical analysis of the results. For spiked samples, a discrepancy is defined as a result differing by more than ±15% relative from the true value. For a blank, a discrepancy is defined as a concentration of lead, C, equal to or higher than 0.006 mg/cm^2.

LABORATORY QC FORM P1 -- TOTAL LEAD (QCP-LL1)

Property/ Sample #	Surface Area	Time In Furnace	Time Out Furnace	Dilution Factor	V	AA (ppm)	C (mg/cm²)	QC	
								Control	Results

Technician________________________________ Date_______________

Supervisor________________________________ Date_______________

QCP-LL2 -- METHOD FOR DETERMINING LEAD CONCENTRATION IN SOIL SAMPLES

Scope

This procedure provides the steps for determining the lead concentration in soil samples. The following attachments form a part of this procedure:

Attachment 1 - Laboratory QC Form S1 - Soil Analysis

Reagents

1.1 Use reagent-grade chemicals and deionized or distilled water in all tests.

1.2 Use a certified lead atomic absorption standard, such as available through Fisher Scientific or VWR.

1.3 Prepare 1.0N nitric acid by adding 63 ml of concentrated nitric acid to water, and diluting to 1 liter.

1.4 Prepare 7.0N nitric acid by adding 440 ml of concentrated nitric acid to water, and diluting to 1 liter.

Preparation of Lead Standards

2.1 100 part per million (ppm) standard. Pipette 10.0 ml of the 1,000 ppm standard into a 100 ml volumetric flask and dilute to the mark with 1.0N nitric acid.

2.2 20 ppm standard. Pipette 1.0 ml of the 1,000 ppm lead standard into a 50 ml volumetric flask. Dilute to the mark with 1N nitric acid.

2.3 10 ppm standard. Pipette 1.0 ml of the 1,000 ppm lead standard into a 100 ml volumetric flask. Dilute to the mark with 1N nitric acid.

2.4 5 ppm standard. Pipette 5.0 ml of the 100 ppm lead standard prepared above into a 100 ml volumetric flask. Dilute to the mark with 1N nitric acid.

2.5 1 ppm standard. Pipette 1.0 ml of the 100 ppm lead standard prepared above into a 100 ml volumetric flask. Dilute to the mark with 1N nitric acid.

2.6 0 ppm standard (blank). The blank will consist of 1N nitric acid.

2.7 Control soil samples.

  2.7.1 Non-lead containing soil blank (obtained from EPA Soils Study).

  2.7.2 Spiked samples (obtained from EPA Soils Study).

2.7.3 Split sample. Divide a prepared sample (after completion of 3.1 and 3.2 below) in half by weight.

Sample Preparation

3.1 Air dry the soil sample overnight at room temperature. When dry, pass through a 2 mm sieve, using the fingers or a stainless steel tool to crush the larger soil particles. Discard any material which does not pass through the sieve.

3.2 Save approximately 1/4 to 1/3 of the filtered soil fraction for possible reference analysis. Pass the larger fraction through a #60 mesh sieve (250 micron). Clean sieves by tapping on a hard surface to remove residual particles, or any other dry method. Wet washing is not recommended.

Sample Extraction

4.1 Oven dry the sieved soil sample for 24 hours at approximately 105°C.

4.2 Stir the dried soil sample, and transfer approximately 1 g (weighed to the nearest 0.1 mg on an analytical balance) to a glass beaker.

4.3 Add 50 ml of 7N nitric acid, cover the beaker with a watch glass, and digest gently at approximately 95°C for two hours, stirring occasionally. Remove from the heat periodically if excessive foaming occurs. Maintain at least 25 ml in the beaker by adding 7N nitric acid as necessary.

4.4 Remove from heat, allow to cool, and dilute with an additional 10 ml of 1N nitric acid. Filter through Whatman #42 filter paper or equivalent into a volumetric flask. Rinse the filter and labware with 1N nitric acid, add the rinsings to the volumetric flask, and dilute to the mark. Use 100 ml volumetric flasks.

4.5 If the sample will not be analyzed within 12 hours, transfer to clean plastic bottles and store refrigerated.

Atomic Absorption Analysis

5.1 Following the manufacturer's instructions, turn on the atomic absorption instrument and set the wavelength to the 283.3 nm lead line. Allow the instrument to warm up for approximately 15 minutes, and adjust the instrument parameters in accordance with the manufacturer's instructions to obtain a maximum absorption reading when a standard lead solution is aspirated. Use an air acetylene flame.

5.2 Construct a calibration curve by aspirating the blank, along with the 1 ppm, 5 ppm, 10 ppm, and 20 ppm lead standards. In every case, aspirate water between each standard and/or sample.

5.3 Aspirate the sample solution and determine the lead concentration from the calibration curve. If the absorbance is above the range covered by the calibration curve, dilute an aliquot of the sample solution to a suitable volume using 1N nitric acid, and obtain another reading. From the calibration curve, determine the concentration of lead in ppm.

5.4 Run the 5 ppm standard after approximately every 15 samples. If the concentration of this 5 ppm sample varies by more than 5% from its original reading, either use an automatic 1 point calibration curve adjustment if the instrument is so equipped, or rerun the calibration curve.

5.5 Rerun the calibration curve at least once for every hour of continuous sample analysis.

Calculations

6.1 Determine the concentration of lead in the soil sample, in ppm, using the following equation:

$$\text{Concentration of Lead in Soil} = C = \frac{\text{(ppm) (100) (dilution factor)}}{\text{(wt. of soil sample digested)}}$$

Quality Assurance/Quality Control

7.1 The KTA laboratory director shall serve as the laboratory QA/QC officer for this project.

7.2 The field soil samples shall be prepared in lots of 40. For the first 5-10 lots, the laboratory director shall place each of the four following controls into the sample stream. All successive lots will have only one of the controls, alternating equally between them (e.g. insert 7.2.1 into the first lot, 7.2.2 into the second, etc.).

- 7.2.1 Blank (2.8.1)
- 7.2.2 Spiked (2.8.2)
- 7.2.3 Split (2.8.3)
- 7.2.4 Remaining half of split sample in 7.2.3.

7.3 An additional split sample shall be removed for every 100 samples and sent to Dewberry & Davis for forwarding to another laboratory. Dewberry & Davis will renumber the sample to obscure its identity. The results from the other laboratory will be forwarded to KTA through Dewberry & Davis for entry onto QC Form S1.

7.4 If any of the above samples suggest discrepancies in the above data, the discrepancies shall be documented on QC Form S1 for consideration when conducting a statistical analysis of the results.

LABORATORY QC FORM S1 -- SOIL ANALYSIS (QCP-LL2)

	Sample	Start	End	Dilution			QC	
Sample #	Weight	Digest	Digest	Factor	AA (ppm)	C (ppm)	Control	Results

Technician________________________________ Date______________

Supervisor________________________________ Date______________

QCP-CD1 -- QC VERIFICATION OF DOCUMENTATION

1.0 Scope

1.1 This procedure delineates the process whereby data generated from field and laboratory testing is reviewed and entered into the KTA computer program, including reviews of the data entry.

1.2 The following attachments also form a part of this procedure:

Title	Attachment
XRF Field ReportForm (XRF-IN1)	Attachment IA
XRF Field Report Form (XRF-EX1)	Attachment IB
Form QC/A-1 (Abatement Unit Data)	Attachment II
Laboratory QC Form E1 (EP Tox)	Attachment IIIA
Laboratory QC Form E2 (EP Tox)	Attachment IIIB
Laboratory QC Form S1 (Soil)	Attachment IIIC
Laboratory QC Form P1 (Lead in Paint)	Attachment IIID
Laboratory QC Form I1 (Inventory)	Attachment IIIE

2.0 Field XRF Testing

2.1 KTA lead-based paint field testing crews are comprised of three members; one team leader and two testing technicians.

2.2 The testing technicians relay each XRF reading (each shutter opening) verbally to the team leader as the readings are registered on the XRF device. The team leader enters each reading onto a field test report (Attachment 1), examining them for consistency with other shutter values in the same location, as well as consistency with similar architectural surfaces tested in the same room. If erratic values appear to be reported, the team leader requires additional tests.

2.3 Before submitting the field reports to the KTA office, the team leader shall review reports to assure that all data has been completed properly and neatly.

3.0 Field AAS Sampling

3.1 One KTA testing technician is used for the return visits to candidate units selected for abatement. The purpose is to conduct back-up QC XRF testing and AAS sampling.

3.2 The testing technician uses Form QC/A-1 that identifies all of the previously obtained XRF values. The values that appear to be inconsistent will have been identified by the KTA Manager of XRF Operations for retesting. The technician shall retest such surfaces and others he deems necessary (e.g., a surface may have been missed during the initial testing). The new XRF values are documented on the report form.

3.3 The technician shall remove samples for AAS testing from surfaces not previously tested, and from representative architectural items with values in the grey area of the XRF reliability. These values are 0.2 to 1.8, but may be subject to change based on future guidance from NIST work. The technician shall document on Form QC/A-1 the location of paint samples and soil samples removed for AAS, and identify if the paint samples have been removed from the precise location where an XRF reading had been taken.

3.4 The technician shall label each sample bag with the property address, room identification, surface from which sample was removed, sample area (e.g., size), technician name, and date.

3.5 Upon completion of the retesting of each home, the technician shall review all of the data for accuracy and completeness, and shall sign the form indicating his complete review of the documentation.

4.0 Laboratory Paper Flow

4.1 The samples returned to KTA shall be inventoried by the XRF Manager on Form I1, following the instructions on the form. He shall turn over the form and samples to the Laboratory Director.

4.2 The Laboratory Director shall incorporate the necessary control samples into Form I1, following the directions on the form.

4.3 The laboratory director shall provide the laboratory technicians with the samples to be tested, along with the appropriate form (E1, E2, S1, or P1). The technicians shall complete the laboratory data columns on the form and submit the completed forms to the laboratory director for review. Both the technician(s) and laboratory director shall sign the forms upon completion to verify their review and concurrence with the information provided.

4.3 The laboratory director shall provide the completed forms to the Manager of XRF Operations to coordinate the data entry into the KTA computer program.

5.0 Manager of XRF Operations

5.1 The Manager of XRF Operations shall review Forms XRF-IN1, XRF-EX1, Form QC/A-1, and the laboratory test forms. He shall inventory the field samples as stated in 4.1.

5.2 He shall transfer the AAS results from the laboratory report forms into the AAS column of Form QC/A-1. He shall sign Form QC/A-1 indicating his review of the field data and the transfer of the laboratory data onto the form.

5.3 The completed forms shall be submitted to data entry personnel for input to the computer program.

6.0 Data Entry

6.1 Data entry personnel shall input all of the data from the initial XRF form and Form QC/A-1 into the computer program.

6.2 The Director of Computer Operations shall edit all of the entered data and run QC checks on the information. The QC checks include verification that all properties have been entered, and at a minimum, a 10% check of the accuracy of data entered. If flaws are encountered in the accuracy of the data entered, the frequency of rechecks shall be increased up to 100% manual verification of the data.

FORM XRF-IN1

LBP ABATEMENT DEMONSTRATION CITY: DATE:

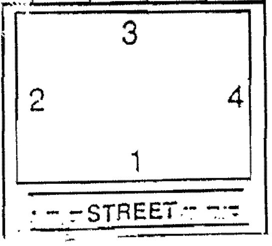
ADDRESS: PROPERTY ID:

TECHNICIANS

TECHNICIANS

ROOM:_______ FLOOR:_______ ML1 or XK3 S/N:_______

TEST No.	SURFACE ID	QTY	SUB-STRATE TYPE	CTG GRADE	CTG COND.	AREA	BASE VALUE	XK3 VALUES				ML1 VALUES				AA V
								#1	#2	#3	AVG	BAR 1	BAR 2	BAR 3	ACT	
1	CLG															
2	FLR															
3	1WL															
4	2WL															
5	3WL															
6	4WL															
7	WCT															
8	CGM															
9	CHR															
10	BSB															
11	WDW															
12	WSL															
13	WTM															
14	DOR															
15	DRF															
16	ICW															
17	CAB															
18	SHV															
19	MEC															
20	PIP															
21	STD															
22	HRL															
23	BAU															
24																
25																



FORM XRF-EX1

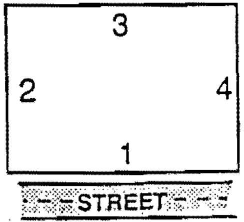
LBP ABATEMENT DEMONSTRATION CITY: ____________ DATE: ____________

ADDRESS: ____________ PROPERTY ID: ____________

TECHNICIANS	TECHNICIANS

EXTERIOR: ________ ML1 or XK3 S/N: ________

TEST No.	SURFACE ID	QTY	SUB-STRATE TYPE	CTG GRADE	CTG COND	AREA	BASE VALUE	XK3 VALUES				ML1 VALUES				AA V
								#1	#2	#3	AVG	BAR 1	BAR 2	BAR 3	ACT	
1	RFF															
2	1WL															
3	2WL															
4	3WL															
5	4WL															
6	FND															
7	WDW															
8	WSL															
9	WSL															
10	WTM															
11	DOR															
12	DOR															
13	DRF															
14	GUS															
15	SOF															
16	COL															
17	PO #															
18																
19																
20																
21																
22																
23																
24																
25																



FORM QC / A-1 ABATEMENT UNIT LEAD DECTECTION QA/QC CONFIRMATION

CITY: DENVER DATE: ________________________

ADDRESS: 1624 CHESTER STREET REFERENCE # 540

KTA TECHNICIANS ________________________________ CALIBRATION DATE: __________________

____

____ TIME: PRETEST INPROCESS POST

ROOM: LVG FLOOR: 1LV INSTRUMENT: (ML1) ML2 XK3 S/N: ____________________

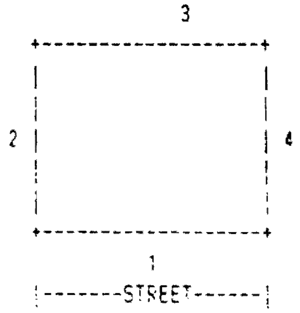
TEST	SURFACE	QTY	SUB-	CTG		XRF RETEST						AAS*	AAS	LEAD**
NO.	ID		STRATE	GRADE	ACT	#1	#2	#3	AVG	BASE	ACT	LOC	RESULT	VALUE
1	CLG													
2	FLR													
3	1WL													
4	2WL													
5	3WL													
6	4WL													
7	WCT													
8	CGM													
9	CHR													
10	BSB													
11	WDW													
12	WSL													
13	WTM													
14	DOR													
15	DRF													
16	ICW													
17	CAB													
18	SHV													
19	MEC													
20	PIP													
21	STD													
22	HRL													
23	BAU													
24														
25														

* RECORD ID NO. OF WALL FROM WHICH SAMPLE IS REMOVED FOR AAS. PLACE THE NUMERICAL 'TEST NO' IDENTIFIER ON THE DRAWING IN THE APPROXIMATE LOCATION OF THE SAMPLE SITE. IF THE SAMPLE IS REMOVED FROM THE PRECISE LOCATION OF AN XRF RETEST, PLACE A '*' AFTER THE WALL NUMBER.

** THIS COLUMN PRESENTS THE FINAL LEAD VALUE FOR THE SURFACE. IF AAS WAS CONDUCTED, THE AAS RESULT IS REPORTED HERE, FOLLOWED BY 'A'. IF ONLY XRF WAS CONDUCTED, ITS VALUE IS REPORTED HERE, FOLLOWED BY 'X'.

I HAVE REVIEWED ALL OF THE ABOVE FIELD DATA FOR COMPLETENESS AND ACCURACY:

TECHNICIAN: ________________________________ DATE ______________



I HAVE REVIEWED THE FIELD DATA FOR ACCURACY AND TRANSFERED THE LABORATORY DATA:

SUPERVISOR: ________________________________ DATE ______________

LABORATORY QC FORM E1

LABORATORY EP TOXICITY TESTING (QCP-LEP1)

Property Address______________________________________

Sample____

Structural Integrity Test?_______________________________

Weight Charged (W)__________ Initial Volume of Water_________

Time/Date When Test Started______________________________

Time	pH	Volume of Acid Added

Total Volume of Acid Added, A:__________
Weight of Sample Charged, W:__________
Additional Water Added, V:__________

(Note: $V = 20(W) - 16(W) - A$)

Technician:__________________ Date:____________
Supervisor:__________________ Date:____________

LABORATORY QC FORM E2

AA ANALYSIS OF EP TOX EXTRACTS (QCP-LEP1)

Property Address____

Sample #	AA (ppm, stds.)	V_x	V_s	C_s	S_a	S_b	C_x	C_x (Ind. Lab or Blank)

V_x = Volume of two identical sample aliquots (aliquots A and B)

V_s = Volume of standard analyte solution added to Aliquot A/Vol. of blank solution added to Aliquot B

C_s = Concentration of standard analyte solution (ppm)

S_a = AA signal (ppm) of Aliquot A

S_b = AA signal (ppm) of Aliquot B

C_x = Concentration of lead in sample = $\frac{S_b V_s C_s}{(S_a - S_b) V_x}$

LABORATORY QC FORM S1 -- SOIL ANALYSIS (QCP-LL2)

Sample #	Sample Weight	Start Digest	End Digest	Dilution Factor	AA (ppm)	C (ppm)	QC	
							Control	Results

Technician________________________________ Date______________

Supervisor________________________________ Date______________

LABORATORY QC FORM P1 -- TOTAL LEAD (QCP-LL1)

Property/ Sample #	Surface Area	Time In Furnace	Time Out Furnace	Dilution Factor	V	AA (ppm)	C (mg/cm^2)	QC	
								Control	Results

Technician________________________________ Date______________

Supervisor________________________________ Date______________

LABORATORY QC FORM I1
LABORATORY SAMPLE INVENTORY CONTROL

__________ PAINT __________ SOIL __________ EP TOX

PROPERTY ADDRESS ______________________________

LAB NO.	ROOM/SUBSTRATE	COMMENTS

XRF Manager____________________ Date________

Laboratory Director____________________ Date________

INSTRUCTIONS: XRF Manager shall inventory all field samples on this form using every other line. He will complete the first digit of the laboratory ID number for each sample using a unique number for each property (e.g. all samples from one home with be identified with 1-, all samples from the second home identified by 2-, and so forth.

The Laboratory Director shall insert the necessary control samples into the above inventory at the intervals stated in QCP-LL1, QCP-LL2, and QCP-LEP1, as appropriate. These will be inserted in the blank lines between the field samples. He shall complete the remainder of the "Lab Number" column by assigning a sequential number to each sample including the controls. He will also record this number on the sample tag labels attached to each sample bag.

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