PREVENT LEAD POISONING

BEFORE IT POISONS YOUR BUSINESS

State of California
Department of Health Services
California Occupational Health Program
(Edited by DHHS, PHS, CDC, NIOSH for a national audience)

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Purpose

This booklet is based on a product originally developed by the California Occupational Health Program (COHP), California Department of Health Services to deal with the hazards of lead in radiator shops in California. The original booklet was developed and written by: Jim Bellows, Joan Sprinson, Glenn Shor, Robin Dewey, and Sarah Royce, all of the COHP staff, and Pat Sutton, Environmental Epidemiology and Toxicology Branch, California Department of Health Services. Essential contributions to this project were also made by other members of the COHP staff: David Harrington, Kate Nichol, Neil Maizlish, Elizabeth Abello, Pat Young, and Linda Rudolph. The original workbook was designed and illustrated by Jane Norling, and typeset by Fifth Street Computer Services.

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Prevent Lead Poisoning: A Step-by-Step Guide

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How to Use This Manual

➡ ➡ ➡ WHAT IS THE PURPOSE OF THE MANUAL?

This manual was originally developed by the California Occupational Health Program (COHP) as part of a model project. The project's goal was to prevent lead poisoning in Southern California radiator shops. The project also included seminars, a video, worker training classes, and other technical assistance. This revised national version of the manual provides important information on how to prevent lead poisoning in radiator shops without the supporting material provided to radiator shops in Southern California by COHP.

This manual was designed to be easy to use. The most important and easy-to-accomplish steps are first. Start at the beginning and work through it one step at a time.

➡ ➡ ➡ HOW THE MANUAL IS ORGANIZED.

This manual is organized to make it easy for you to use. It is broken down into ten chapters which address different areas related to the prevention of lead poisoning. When there are several ways of reaching a single goal, we describe the pros and cons of each. Then we let you choose, and direct you to step-by-step lists of what-to-do and how-to-do-it for each option.

The Appendices contain "Progress Reports" to help you keep track of your efforts. Fill them out and keep one for your records. These provide your company a way to record your achievements. If OSHA knocks on your door, the Progress Reports could help prove that you have taken steps to comply with existing regulations. They can also demonstrate the good faith you have shown in protecting your workers.

Many public and nonprofit agencies can help you create a safe and healthy workplace. These are listed in the Getting Help section. If you want more information about the subjects in this manual, check the Q&A section. Check the Glossary if you find words you don't know.

Summary

➡ ➡ ➡ WHAT IS THE DANGER?

Lead is a serious hazard in the radiator repair industry. It is the main metal in the solder most shops use, and spreads throughout the workplace when heated. Workers at many companies have so much lead in their bodies that they are slowly being poisoned. Working owners of small shops also face the same risk. The symptoms may hardly be noticeable at first. Over time, lead can damage the brain, blood, nerves, kidneys, and reproductive organs. This damage can cause permanent disability: memory loss, extreme fatigue, emotional problems, even kidney failure, or death.

Lead threatens the health of businesses, too. The cost of lead problems can be huge: medical bills, workers' comp claims, lost work time, poor morale, and low productivity. A business with serious OSHA violations could be fined thousands of dollars. It could even be shut down until the worst hazards are fixed. Workers with dangerous blood-lead levels could be barred from working around lead until their levels come down. OSHA requires the company to continue paying those workers full wages for up to 18 months.

Tragically, the children of many radiator repair workers and owners are also in danger. In many cases, lead dust collects on work clothes during the day. When those clothes are worn home, the lead can contaminate the workers' cars and homes. These workers never suspect that their children are playing in dust loaded with toxic lead. In children, lead can cause behavioral problems and lower-than-average mental development. These problems may be life long.

Grim statistics have been compiled by the California Occupational Health Program (COHP), California Department of Health Services. During 1987-90, dozens of radiator shops learned that they had one or more workers with dangerous blood-lead levels (40 µg/dl or higher). (That's more than twice as many companies as in any other type of business.) Hundreds of other shops also have workers who are being slowly poisoned. They just don't know it yet, because they have never done the testing required by OSHA.

➡ ➡ ➡ CAN LEAD POISONING BE PREVENTED?

Yes. Technology for protecting workers in lead-using industries has been available for decades. In most cases, simple steps can solve a serious problem. Radiator shop owners have been surprised to find that the costs are affordable. Many owners discover unexpected benefits. The most important of these is loyalty and respect from their employees that can add up to higher profits. In companies where lead is dulling workers' mental and physical health, fixing the lead problem can cut the amount of sick time and boost productivity.

This manual was produced by the California Occupational Health Program to help radiator company owners protect their workers and themselves from lead poisoning. We believe most compa-

Summary

nies will choose to create safe workplaces if they are given some basic tools. To help, this manual includes solid information and clear instructions. It focuses on the most important steps and provides tips for getting cost-effective results.

➡ ➡ ➡ WHY ARE THERE SO MANY NEW REGULATIONS?

This manual does not add new regulations. OSHA has required most of the steps since 1979, and it will enforce the regulations when necessary. In a few areas, we have added specific recommendations to make requirements clearer. Of course, other agencies also have regulations covering waste water treatment, hazardous waste disposal, and air pollution (See Chapter 8 for more information).

➡ ➡ ➡ WHAT STEPS SHOULD YOU TAKE TO PROTECT WORKERS?

The first step is to find out whether or not your company has a lead problem. Blood-lead testing or air sampling are the only ways to find out (See Chapter 3: Blood Testing and Air Sampling). The results of these tests will help show what else is necessary (See Chapter 1: Overview).

Most radiator shops must also take some other basic steps. Make sure your workers are not getting lead on their hands, faces, or food (See Chapter 4: Cleaning Up). Provide your workers with information about working safely with lead (See Chapter 6: Safety Training For Workers).

For companies with high airborne lead levels, OSHA requires equipment that removes fumes from the workplace (See Chapter 5: Cutting Airborne Lead). Other high-cost items may also be required: a special lunchroom, showers and locker rooms, and a medical program to monitor employees' health (See Chapter 7: If You Still Have Problems . . .).

Fortunately, there is a way to bypass the most difficult and expensive OSHA regulations. These apply only to companies that have moderate or high amounts of airborne lead. Companies that get their lead levels low enough are exempt from the toughest rules. This is most often done by using special ventilation equipment. An exciting new development may provide another option. Several lead-free solders are now being tested by a private laboratory. If lead-free solder passes the tests, companies that use it may solve their lead problems with little up-front cost (See Chapter 5: Cutting Airborne Lead).

Summary

If the initial testing shows that any workers have extremely high blood-lead levels (60 µg/dl or higher), you must assign them to work in lead-free areas until their levels drop (See Chapter 7: If You Still Have Problems . . .). Don't try to save money by firing or laying off these workers; that's against the law.

Some people think that having workers take vitamins or drink milk will prevent lead poisoning. Don't bother. These methods don't work.

Overview – Chapter 1

➡ ➡ ➡ IF YOUR SHOP USES LEAD, YOU MUST:

• Find out if your company has a lead problem.

This can only be done by scientific testing — blood lead testing or air sampling — as described in Chapter 3.

• Rate the lead hazard in your shop, using the table below.

Lead Hazard	Blood-Lead Level	Airborne Lead
Low	less than 30 µg/dl	less than 30 µg/m³
Moderate	30-39 µg/dl	30-49 µg/m³
High	40-59 µg/dl	50 µg/m³ or greater
Extreme	60 µg/dl or more OR 50 µg/dl for six months	50 µg/m³ or greater –

Note: Use the highest results for any worker or any job to determine the degree of lead hazard in your shop.

• Set up a lead safety program to meet your company's needs.

The common elements of a lead safety program are shown on pages 10 and 11 of this chapter.

THIS CHAPTER GIVES AN OVERVIEW OF HOW A TYPICAL LEAD-USING COMPANY CAN PREVENT LEAD POISONING. THE FOLLOWING CHAPTERS DESCRIBE EACH STEP.

➡ ➡ ➡ WHY ARE THESE STEPS IMPORTANT?

You have received this manual because lead may be a serious health hazard to you and your workers. It may also be a real threat to your business. The Q&A section of this manual answers several important questions that you might have: Why is lead poisoning a problem? Why will it be worthwhile for my company to start a lead poisoning prevention program?

Throughout this step-by-step guide, we will assume that you have decided that protecting your workers is a good investment. If you still aren't convinced, we suggest that you read the Q&A section, or read the examples at the beginning of each chapter. These examples describe real events at real companies. If you're still not sure you want to get involved, don't just rely on our advice. Talk to your business associates, your workers' comp provider, or your doctor. Otherwise, you might end up talking to your lawyer.

Overview

➡ ➡ ➡ WHAT ARE THE LEGAL REQUIREMENTS?

The parts of a lead safety program are described in the following chapters. Many requirements apply only to companies that have moderate or high amounts of airborne lead. That's why the first step is to arrange blood-lead testing or air sampling.

OSHA—the Occupational Safety and Health Administration—has many regulations for protecting workers in lead-using companies. Federal OSHA adopted these rules in 1979, with specific requirements phased in over several years. The federal OSHA lead regulations are reprinted in the Appendix.

Your company can comply with the major OSHA requirements by following this step-by-step guide. Just to be sure, we suggest that you also check the regulations themselves.

A note about timing: Your company has probably been required (for at least 10 years) to take most of the actions described in this manual. If it has not, the company may be violating several regulations right now. To be within the law, you'd have to set up a lead safety program immediately. However, we realize that most small businesses can't act that quickly. Most companies will make the best progress at a steady pace. The typical action plans in this chapter can guide you towards protecting you and your workers as soon as possible. They are a compromise between business realities and strict compliance with the law.

As you set up each part of a lead safety program, please remember to fill in a copy of the related Progress Report to keep track of your efforts. For more information about the Progress Reports, see How To Use This Manual in the Summary.

A LEAD SAFETY PROGRAM — WHAT SHOULD IT INCLUDE?

➡ ➡ ➡ TESTING

Blood-lead testing or air sampling to find out whether your company has a lead problem.

➡ ➡ ➡ MEDICAL REMOVAL

If any workers have blood-lead levels of 60 µg/dl or more (or average 50 µg/dl or more for six months), you will have to reassign them to work in a lead-free area until their levels come down.

See Chapter 7 for details.

Overview

➡ ➡ ➡ RESPIRATORS

Workers don't like them and they often aren't as effective as people imagine. Still, you may need them for a while until you can cut the amount of airborne lead in your shop.

See Chapter 4.

➡ ➡ ➡ CLEANING UP

One of the main ways workers can get lead in their bodies is by eating or smoking while their hands are contaminated with lead-containing dust and dirt. The solution: make sure that everyone eats only in a lead-free area, and only after washing.

See Chapter 4.

➡ ➡ ➡ SAFETY TRAINING

Your efforts to create a safe workplace may be wasted if your employees don't understand the importance of working safely.

See Chapter 6.

➡ ➡ ➡ CUTTING AIRBORNE LEAD

If testing shows that your company has a lead problem (test results above 50 $\mu g/m^3$ for air sampling or above 40 $\mu g/dl$ for blood-lead testing), you will have to cut down the lead dust and fumes in your workplace.

Chapter 5 presents several ways to do this.

➡ ➡ ➡ IF YOU STILL HAVE PROBLEMS

Companies that can't (or don't) reduce airborne lead enough must invest in special lunchrooms, showers, and locker rooms. They must also provide annual physical exams for high-lead workers.

See Chapter 7.

➡ ➡ ➡ KEEPING YOUR FAMILY SAFE

This manual is mainly about protecting your workers from lead poisoning. It's also important to protect their families, the community, and your own family.

Check Chapter 8 to see how you're doing.

NOTES:

Getting Organized – Chapter 2

➡ ➡ ➡ IF YOUR SHOP USES LEAD, YOU MUST:

• Understand why lead is a problem.

To prevent lead poisoning and comply with OSHA regulations, you must be well-informed. This manual is an ideal place to start.

• Put one person in charge.

Usually, small business owners handle worker health and safety themselves. You could assign a manager or foreman to be in charge. Whatever your choice, make sure that everyone knows who is responsible for health and safety.

• Consider starting a health and safety committee.

See "About Health and Safety Committees" below.

• Get any related records in one place.

If your company has ever taken actions to prevent lead poisoning, find any records that were kept. Read them over to see if they contain information that you can still use. Set up a place to file all the records together. As you use this manual, you will build up a more complete record of your efforts.

➡ ➡ ➡ WHAT ARE THE LEGAL REQUIREMENTS

Currently no federal regulations require the actions in this chapter. However, OSHA lead regulations place many legal duties on lead-using companies. To comply with these regulations, most companies will need to put one person in charge of the lead safety program. That person will probably start by understanding the problem and reviewing company records.

ALL LEAD-USING COMPANIES SHOULD READ THIS CHAPTER.
READ IT BEFORE CONTINUING TO OTHER CHAPTERS.

➡ ➡ ➡ ABOUT HEALTH AND SAFETY COMMITTEES

For many companies, the best way to set up an effective safety program is to start a health and safety committee. The company official in charge of health and safety runs the committee. Usually one or more workers are also on the committee.

Employees have day-to-day awareness of working conditions, so they can help identify hazards and suggest. Putting employees on the committee can show all your workers that the committee is designed to benefit them, not just the company. Workers on the committee can help motivate everyone to follow any new safety rules.

(Continued on page 15)

ONE COMPANY'S STORY

WHO'S IN CHARGE HERE?

In late 1989, the California Occupational Health Program (COHP) received a report (from a blood-lead testing laboratory) of a welder with an extremely high blood-lead level. COHP experts investigated the case to find out how the welder had been exposed to so much lead.

The answer was a new twist on an old story. Other welders have been poisoned by fumes from metal coated with lead-based paint. This welder was making repairs on the ductwork of an old industrial ventilation system. The ductwork was loaded with lead — on the inside. Why? The ventilation system was in a large battery manufacturing plant, removing lead dust from the most dangerous workstations.

The worker was poisoned because no individual took responsibility for his health and safety. His employer, a sheet metal contractor, didn't bother to find out from the plant owner what was inside the ductwork. The plant owner didn't even know that the sheet metal company (including the sick welder) was working in the plant, because his plant manager was in charge of coordinating the contractors.

The plant manager didn't think about health and safety at all, because the company had placed a full-time nurse and a part-time doctor in charge of preventing lead poisoning. The nurse and doctor were never informed about the sheet metal work, so they didn't know to include the welder in their medical program.

When the worker finally figured out the cause of his health problems, everyone was caught pointing their fingers at someone else, but no one had acted properly to protect the worker.

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This case was also particularly tragic because the worker, in addition to his other problems, also received poor medical care. Over the course of two years, he had gone to two family doctors. Neither of them were able to find the cause of his symptoms — extreme fatigue, headaches, anxiety, and muscle spasms. He was eventually sent to see a blood specialist, who did a painful (and useless) test of the worker's bone marrow. All he really needed was protection from the lead-containing fumes his welding produced. He did not get that protection, because there were too many gaps in the health and safety programs of both his employer and the plant owner.

Getting Organized

Consider the pros and cons of setting up a health and safety committee:

PROS

- Can help you identify problems that workers consider most important.
- Can help you find creative solutions to safety problems.
- Can help you meet new regulations requiring illness and injury prevention program.
- Can boost employees' loyalty and morale by getting them involved in an issue that's important to them.
- If you need to make new work rules, a committee can help make sure workers accept and follow them.

CONS

- Committee members will lose some regular work time.

➡ ➡ ➡ What Should a Health and Safety Committee Do?

Start by identifying all the places lead is used and stored. Decide which areas or jobs are hazardous. Make a list of the actions needed to fix each hazard. Collect suggestions from committee members and other employees. Set goals and priorities. Hold regular safety committee meetings to review your progress towards correcting each hazard. As the changes are made, check each one to make sure it works as planned. Use employees on the committee to get feedback about whether your workers understand what the lead safety program is about and why it's important.

When your original goals have been met, review the company's entire lead safety program to see whether it works. The committee can help you use this manual to set up a safety program that really protects workers.

Don't limit the safety committee just to lead. Check for any other hazards in the shop as well.

NOTES:

Blood Testing & Air Sampling
Chapter 3

➡ ➡ ➡ IF YOUR SHOP USES LEAD-CONTAINING SOLDER, YOU MUST:

- **Test whether lead is a hazard in your shop.**
  Two options are available—blood-lead testing and air sampling. See page 20 for a description of their pros and cons.

- **Notify workers of test results.**
  This must be done in writing. You must also maintain records of the test results.

- **If needed, take actions to fix any lead hazards.**
  The results of this testing will be your guide for further action. If the results are high or moderate, various safety measures may be required or recommended.

➡ ➡ ➡ WHY ARE THESE STEPS IMPORTANT?

No one can tell whether your employees are being poisoned simply by looking around the shop. Severe lead-poisoning cases sometimes occur at companies that look clean. The people affected (your employees or yourself) may not even know they are getting sick until it is too late. Then the effects can be devastating for both the employees and the company.

The only solution is scientific testing-—either blood-lead testing or air sampling—to measure the amount of lead present. The results will indicate whether your shop must be made safer.

By themselves, blood-lead testing and air sampling do nothing to make your shop safer. If testing shows that there is a lead problem in your shop, take steps to protect your workers. This is the only way to correct the problem before it gets worse.

ALL LEAD-USING COMPANIES SHOULD READ THIS CHAPTER.

Blood Testing & Air Sampling

➡ ➡ ➡ WHAT ARE THE LEGAL REQUIREMENTS?

OSHA lead regulations have specific legal requirements for blood-lead testing and air sampling. The main requirements are summarized below. For additional details, consult an expert or read the regulations themselves.

• Air Sampling

OSHA requires lead-using companies to conduct air sampling at least once.[1] This is called the initial determination. It is the key to other OSHA requirements, such as blood-lead testing, cutting airborne lead levels, and follow-up air sampling.

Air sampling must be repeated if 30 $\mu g/m^3$ or more of airborne lead is found. (See Chapter 9 for a schedule of required testing.) Fortunately, the regulations have built-in incentives that reward companies for controlling lead successfully. Repeat air sampling is not required if you reduce airborne lead below that level.

• Blood-Lead Testing

Blood-lead testing is required for all employees who work in areas with 30 $\mu g/m^3$ or more of airborne lead.[1] Research studies have shown that virtually all radiator repair shops are above this level. They are required to have blood testing.

Blood-lead testing can also identify lead problems that are missed by air sampling alone. It is recommended that all radiator shops check all employees' blood-lead levels at least once.

The blood tests must be repeated at least every 6 months, depending on the workers' individual blood-lead levels (See Chapter 9). The testing must be supervised by a licensed medical doctor. Make sure the doctor in charge is familiar with the OSHA requirements.

• Notification

For both air sampling and blood-lead testing, workers must be notified of the test results in writing.[1] Test results must be made available to individual employees, their doctors or other representatives, and OSHA. For blood-lead test results of 40 $\mu g/dl$ or higher, notification must be made within 5 days. The results must be kept for 40 years, or sent to OSHA if your business closes.

ONE COMPANY'S STORY

WHAT CAN HAPPEN IF A PROBLEM IS IGNORED

By late 1988, a San Diego, California radiator mechanic was desperate. His health had been declining steadily for at least four years. He had been plagued by nausea and lack of appetite; he couldn't sleep at night. The worst of his problems was extreme fatigue, sapping him of energy throughout the day. Recently, he found that he was rapidly losing his memory. He was often cranky and irritable, even with his wife and kids. Every morning, he woke with a metallic taste in his mouth.

He had been to several doctors over the years. One thought he had an ulcer. Others apparently didn't ask enough questions about his work. Perhaps they didn't realize that radiator mechanics work daily with toxic lead. The final clue to his problem was numbness and tingling he developed in his arms — a classic symptom of lead poisoning. Finally, he saw an occupational medicine specialist and had a blood test. Then the source of his troubles was clear. He had lead poisoning. His blood-lead level was 80 µg/dl. That's twice the level OSHA considers acceptable and four times what many experts consider safe.

Months later, the worker was still on the job, under doctor's orders to stay away from lead until the amount in his body dropped. He still had headaches every morning, and his fatigue had eased only slightly. But his biggest concern was for something even more precious — his two young children. The doctor warned him that in some cases children have been poisoned by lead dust carried home on their parent's clothes or shoes. If he found that his kids had lead poisoning too, what would he do? There is no special treatment for the permanent damage lead can cause in children.

What about the owner of the shop? The experience was a nightmare for him, too. He spent thousands of dollars (and weeks of his time) eliminating the lead hazards from the shop. But the worst impact for the owner was the guilt he felt about running a shop that had caused so much suffering for a loyal, long-term employee.

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Fortunately, the worker's children were found to be normal when their blood was tested. The worker wasn't so lucky. Much of the health damage from his lead poisoning may never go away. In this case, as in so many others, workplace lead caused a disaster because no action was taken until it was too late. Periodic blood-lead testing could have helped prevent the problem.

Blood Testing & Air Sampling

TESTING

BLOOD TESTING

PROS

- Gives best indication of whether too much lead is entering workers' bodies.
- Can detect overexposure caused by breathing lead OR by eating lead-contaminated food.
- Initial blood-lead tests are cheap (compared to air sampling), usually less than $50 per worker.
- Test results are reliable, they don't change much from day to day.
- A worker's own blood test results can provide great motivation for working safely.
- Employees will know that you care about their health.

CONS

- Results can be misunderstood if not interpreted by a medical doctor.
- Some workers may refuse to have a blood sampling taken.
- If you have too many workers with high blood-lead levels, medical follow-up can be expensive. However, this follow-up is essential.
- By itself, blood testing may not meet all OSHA testing requirements.

AIR SAMPLING

PROS

- Meets OSHA requirement that lead-using companies measure airborne lead levels at least once. (Blood-lead testing may still be required.)
- Can help pinpoint the main sources of lead dust or fumes in your shop.
- After you make changes to cut the amount of airborne lead, air sampling can show whether they worked.

CONS

- Could miss a serious lead poisoning problem, if it is caused by unsafe personal habits rather than by air-borne dust or fumes.
- May be variable, because airborne lead levels change from day-to-day and from one work area to another.
- Cost is very high (approximately $1,500-3,500) if it is done by a private firm.
- Results are usually worthless if the air sampling is not done by a qualified industrial hygienist.

Blood Testing & Air Sampling

BOTH BLOOD-LEAD TESTING AND AIR SAMPLING

PROS

- Is most likely to show correctly whether or not your company has a lead problem – whatever its source.
- Gives best start toward meeting all legal requirements for testing.
- Provides best indication of the steps that would be most valuable in correcting any lead problems found.

CONS

- Cost is high.

NO ACTION

PROS

- None.

CONS

- Company will probably be in violation of OSHA regulations
- Workers may suffer lead poisoning.
- True cost may be high, if indirect costs such as workers' compensation, disability, and possible fines or lawsuits are included.
- Simply delays the time when your company will start taking required actions to protect workers.

YOU DECIDE . . .

A.	BLOOD-LEAD TESTING	Use the step-by-step instructions on page 22.
B.	AIR SAMPLING	Use the step-by-step instructions on page 24.
C.	BOTH BLOOD AND AIR TESTING	Follow instructions above for both.
D.	NO ACTION	Wait for OSHA or a worker's representative to initiate action.

Blood Testing & Air Sampling

BLOOD-LEAD TESTING	WHAT TO DO
1 Choose a doctor. Decide whether you want the doctor in charge to be a qulaified specialist in occupational medicine. (We recommend that you do use a specialist.)	Pros and cons of using a specialist are shown on the opposite page. Some qualified specialists (but not all) are "board certified" in occupational medicine. Doctors in the phone book under "Industrial Medicine" may or may not be specialists.
2 Make a list of the workers to be included in the blood testing program.	Include on the list all employees who work in areas where lead-containing materials are handled.
3 Meet with your doctor to work out details of the program. Ask about other medical services.	Be certain you understand what services the doctor will provide, and their cost. Learn what your responsibilites are.
4 Arrange for employees to have their blood tests.	Tell your workers about the importance of the tests.
5 When you get the test results, look them over and discuss them with the doctor.	Your doctor can help you understand the results and help you plan any needed follow-up measures.
6 If any worker has a blood-lead level of 60 µg/dl or higher, move the worker immediately to a job that involves no contact with lead.	Reassignment is also required by OSHA for workers averaging above 50 µg/dl for six months, or when ordered by a doctor.[1]
7 Other follow-up measures will be required if any workers have blood-lead levels above 40 µg/dl or if ordered by a doctor.	These measures may include cutting down airborne lead, preventing lead contamination of workers' hands, faces, and food, training employees to work safely, additional testing, and complete medical evaluations
8 Inform each employee of his or her test results.	OSHA requires that workers be informed in writing. Talk with each person about their results.

Blood Testing & Air Sampling

9 File the results (and any doctor's reports) so you can find them when you need them.

OSHA requires that this information be kept available for 40 years.

10 Fill in Progress Report:
Testing included in the Appendix.

BLOOD-LEAD TESTING HOW TO DO IT

QUALIFIED OCCUPATIONAL MEDICINE SPECIALIST (MAY BE "CERTIFIED")

PROS

- Are trained and experienced in handling lead and other work-related health problems
- Generally are familiar with OSHA regulations and provide all required medical services.
- Specialists who order a large number of blood-lead tests may be able to obtain lower charges for lab services.

CONS

- Locations may be inconveient for some companies or workers.
- Because specialists generally provide all required services, cost is sometimes higher.

NONSPECIALIST (SUCH AS A FAMILY DOCTOR)

PROS

- Are often conveniently located. Charges are sometimes lower, because limited services are provided.
- You may already have a company doctor whom you like or trust.

CONS

- In several cases, nonspecialists have provided inadequate care. Workers who should have been protected have gotten sick.
- If your blood testing does not meet OSHA requirements, your company (not the doctor) could be fined.

Blood Testing & Air Sampling

AIR SAMPLING	WHAT TO DO
1 Decide whom you want to provide the air sampling:	The basic choices are: a private industrial hygiene consultant, OSHA, Consultation Service, or your workers' comp. provider. Some pros and cons of each are listed on the opposite page.
2 If you plan to use a private industrial hygiene consultant, choose one. (If you plan to use a free service, an industrial hygienist will be assigned.)	Contact the American Industrial Hygiene Association for a list of industrial hygiene consultants.
3 Meet with the industrial hygienist to plan your air sampling program.	Make sure you understand what services will be provided, and what the cost will be.
4 With the industrial hygienist, make a list of the jobs or work areas to be included in the air sampling.	Include all work areas where lead-containing materials are handled.
5 During the air sampling, help out with whatever on-site assistance is needed.	Talk with your workers about the importance of cooperating with the air sampling.
6 When you get the test results, look them over and discuss them with the industrial hygienist.	Make sure that you get a complete written report. Ask about any information that is not clear to you.
7 If any test results are above 30 $\mu g/m^3$ or higher, additional safety measures are required.	These measures may include blood-lead testing, cutting down airborne lead, preventing lead contamination of workers' hands, faces, and food, training employees to work safely, additional testing, and complete medical evaluations.
8 Inform each employee of his or her own test results. (For other employees, inform them of results for workers in similar jobs.)	OSHA requires that workers be informed in writing.

Blood Testing & Air Sampling

9 File the air sampling results and the industrial hygienist's written report so you can find them when you need them. OSHA requires that this information be kept available for 40 years.

10 Fill in Progress Report on Testing included in the Appendix.

AIR SAMPLING HOW TO DO IT

OSHA CONSULTATION SERVICE OR YOUR WORKERS COMP. COMPANY

PROS

- Do not issue citations or fines.
- Are experienced in helping small businesses fix lead problems and other workplace hazards.
- Provide limited services free-of-charge.
- OSHA staff are most familiar with OSHA regulations, and can help you make sure your company is in compliance.

CONS

- Not available to all companies.
- May be in such demand that you have to wait weeks or months for service.
- Generally provide only initial air sampling and recommendations. For follow-up sampling, you would have to switch to a private consultant.

PRIVATE INDUSTRIAL HYGIENE CONSULTANTS

PROS

- Can often provide services quickly.
- Can maintain complete privacy from both OSHA and your insurance company.
- Can provide whatever follow-up is needed.

CONS

- Charges are high, typically $1,500 to $3,000 for a basic air sampling for lead.
- To keep costs down, may limit their services to those that you specifically request. Hazards in your workplace other than lead may be overlooked. Some OSHA lead regulations may not be met fully.

Blood Testing & Air Sampling

➡ ➡ ➡ UNDERSTANDING AIR SAMPLE RESULTS

If the result is below 30 $\mu g/m^3$, the risks to your health are low, and OSHA requires no further action.

If the result is between 30-50 $\mu g/m^3$, exposures high enough to damage health might be occurring. OSHA requires the company to:[1]

- provide blood-lead tests (every 1-6 months)
- repeat the air sampling (within 6 months)
- provide workers with training on lead safety

If the result is between 50 and 150 $\mu g/m^3$, damage to health is likely to occur if it continues for months or years. OSHA requires the company to:[1]

- reduce exposures to 50 $\mu g/m^3$ or below, by installing special equipment, such as ventilation systems that collect lead dust and fumes
- provide you with a respirator and require you to use it until exposures have been reduced
- provide clean work clothing, showers, and separate lunchroom
- provide blood-lead tests (every 1-6 months)
- repeat the air sampling (within 3 months)
- provide workers with training on lead safety

If the result is above 150 $\mu g/m^3$, health may be damaged in a relatively short time. OSHA requires the company to take all of the actions above and to provide clean work clothing daily.[1]

➡ ➡ ➡ REFERENCES

1. OSHA Lead Standard. (See Appendix)

Cleaning Up – Chapter 4

➡ ➡ ➡ IF YOUR COMPANY USES LEAD, YOU MUST:

- **Provide sinks, soap, and clean towels for hand washing.**
  These are essential for workers to get the lead off their hands before eating or smoking. Provide fingernail brushes, too, for hard-to-clean areas. Don't let workers dry their hands on shop rags or on their work clothes.

- **Clean your shop.**
  See the cleanup options and instructions on page 29.

- **Set up a separate eating area and keep it clean.**

- **Make rules about eating, smoking, and personal cleanliness.**
  See pages 31-32 for step-by-step instructions about keeping food and cigarettes out of work areas, and for motivating workers to follow the rules. Many companies have decided to completely prohibit smoking at work.

- **Provide clean work clothing.**
  The easiest way is to contract with an industrial laundry service. Tell the service that the clothing may get contaminated with lead dust.

- **Provide respirators if necessary.**
  Workers don't like them. Often they don't work as well as people expect. But you may need them to provide short-term protection. See "All About Respirators" on page 33.

ALL LEAD-USING COMPANIES SHOULD READ THIS CHAPTER.

Cleaning Up

➡ ➡ ➡ WHY ARE THESE STEPS IMPORTANT?

Workers with lead poisoning often get lead in their bodies by breathing air loaded with lead-containing dust or fumes. But this isn't always the case, some workers simply eat lead accidentally.

It happens like this: Lead dust settles onto work surfaces. Later it can end up contaminating workers' hands. Next their hands contaminate anything they touch, such as food or cigarettes. When they eat the contaminated food, the lead enters the body through the stomach. Lead is so toxic that eating food containing even a tiny bit of lead can cause lead poisoning, if it happens day after day.

The steps in this chapter are all necessary to prevent this type of lead poisoning. They can also help prevent lead poisoning in worker's children (See Chapter 8).

Sometimes it's hard to get workers to follow the rules described in this chapter. After all, personal habits are hard to change. Your job is to make sure your employees understand what can happen if they aren't serious about keeping clean, then don't let them forget. Workers who recognize the danger of lead will scrub thoroughly before eating. Others may just go through the motions, and end up sick. The lead under a single fingernail could cause big trouble, if it got into a worker's food day after day.

➡ ➡ ➡ WHAT ARE THE LEGAL REQUIREMENTS?

OSHA requires hand-washing facilities in all workplaces.[1] Lead-using companies are required to clean up lead dust and to keep all surfaces as lead-free as possible. Cleaning with compressed air is prohibited. Sweeping, brushing, and shoveling are allowed only when vacuuming (or "other equally effective methods") has been tried and found to be ineffective.

Companies with high-lead areas (50 $\mu g/m^3$ or more) are required to:

- have specially designed lunchrooms (described in Chapter 7);
- post signs in high-lead areas that say: "WARNING. LEAD WORK AREA. POISON. NO SMOKING OR EATING."
- keep workers from bringing food, drinks, tobacco, and makeup into high-lead areas;
- make sure that people who work in high-lead areas wash up before eating or smoking;
- provide protective work clothing (free of charge) for all employees who work in high-lead areas. (Clothing must be cleaned at least weekly.)

Cleaning Up

CLEAN YOUR SHOP	WHAT TO DO
1 Decide which cleanup methods to use.	Only two methods are safe: vacuuming or wet sweeping and mopping. Other methods put too much lead dust in the air. See pros and cons on the next page.
2 Get the right equipment for the job. Choose a doctor.	To do the job right, get a vacuum with a HEPA (high efficiency particulate air) filter. An ordinary shop vacuum can blow small but highly toxic lead particles back into the room. Respirators may be needed for emptying the tank or changing filters.
3 Train the workers assigned to the cleanup crew about lead hazards and show them how to clean up safely.	They must be careful to remove lead dust rather than just push it around. Tell them about any safety equipment they will use.
4 If you use a vacuum, follow carefully the manufacturer's instructions for removing the dust and changing filters.	The vacuum may not work properly if the filter isn't changed from time to time. If the job is done wrong, someone could end up with toxic lead dust all over themselves.
5 The dust you collect is probably a hazardous waste. Dispose of it properly.	Check with a state or local environmental agency for hazardous waste disposal information.
6 Fill in the information about cleaning your shop in the Progress Report in the appendix.	

Cleaning Up

CLEAN YOUR SHOP

HOW TO DO IT

USE A HEPA VACUUM CLEANER

A HEPA vacuum cleaner is a specialized vacuum for cleaning up toxic materials. Other vacuums let many small particles through their filter bags into the air.

PROS

- Doesn't blow dust around.
- Makes collection and disposal easier.
- Meets OSHA requirements.
- Doesn't require wetting down surfaces or keeping them moist.
- Safety is built-in, rather than relying on cleanup crew to follow special safety procedures.

CONS

- Expensive – typical models cost about $600 – $1,000.
- Requires special filters (HEPA) to assure that small particles of lead dust don't escape.
- Some places may be hard to reach with a vacuum.

WET SWEEPING, OR WET MOPPING

PROS

- Doesn't require special equipment.
- Much safer than dry methods.
- Can be used in places where vacuum is unable to reach.
- Useful where no better method can work.

CONS

- To keep dust down, surfaces must be completely wet when cleaned.
- Dust that is not really wet will get in the air, increasing the hazard.
- OSHA regulations allow these methods only when HEPA vacuuming has been tried and found to be ineffective.

Cleaning Up

DRY METHODS: SWEEPING, BRUSHING, OR COMPRESSED AIR

PROS	CONS
• None.	• Extremely hazardous to workers. • Much of the dust gets back into the air and could contribute to lead poisoning rather than preventing it. • Use of compressed air for cleaning lead dust is completely prohibited by OSHA regulations.

EATING AREA	WHAT TO DO
1 Set up a lunchroom that is separated from work areas.	The eating areas must have walls and a door to keep lead dust and fumes from entering. In some cases, an office or storeroom will do. If work area lead levels are high, you may need to add a special room. (See Chapter 7.)
2 Clean the lunchroom until it's spotless.	Follow the cleaning instructions on page 29 of this chapter.
3 Keep it clean.	Put one person in charge of keeping it clean.
4 Make sure that workers wash their hands and faces thoroughly before using the lunchroom.	Provide paper towels or clean towels so workers don't dry their hands on shop rags or their work clothes. Provide fingernail brushes for cleaning hard-to-reach areas.
5 Make sure that workers do not bring lead dust into the lunchroom on their clothing.	If airborne lead is above 50 $\mu g/m^3$, workers cannot enter the lunchroom without changing their clothes or vacuuming them clean.
6 Prohibit in work areas and other lead areas: eating, drinking, smoking, food preparation, and applying makeup.	These can all contribute to high blood-lead levels. Make sure your workers understand how important it is to keep food, drinks, and cigarettes lead-free.

Cleaning Up

7	Put up OSHA-required signs in lead areas to remind workers that eating and smoking are prohibited.	If any workers don't speak and read English, post signs in whatever language they understand best.
8	Let your workers know the rules by having safety meetings, writing a letter to all workers, or posting a sign.	See below for some ideas about motivating workers to follow the rules.
9	Set a good example by following the rules yourself.	If you eat or smoke while you work, how can you convince your employees not to do the same?
10	Record the information in Progress Report 2 in the Appendix.	

MOTIVATE WORKERS TO FOLLOW SAFETY RULES

HOW TO DO IT

PROVIDE COMPLETE LEAD-SAFETY TRAINING (SEE CHAPTER 6).

PROS

- Gives workers a complete overview of the hazards of lead and how to avoid them
- Helps workers understand the importance of washing before eating.
- Satisfies OSHA requirements for training workers.

CONS

- Training requires both time and expertise.

HAVE A LEAD SAFETY MEETING WITH YOUR WORKERS.

PROS

- Shows workers that you care about their health.
- Allows you to focus on specific work practices and rules that you are concerned about.
- Limited time commitment involved.
- Can help reinforce what your workers learn at training session.

CONS

- May raise questions you can't answer.
- You will still need to provide more complete training later.

Cleaning Up

ALL ABOUT RESPIRATORS

When workers are breathing too much lead dust or fumes, the real solution is to cut down the amount of airborne lead. (See Chapter 5.) But cutting airborne lead sometimes takes several months. Workers with high blood-lead levels need protection now, not later.

Respirators are a way to protect workers from airborne lead until the levels can be cut permanently. They are also useful for hazardous jobs that aren't done often, such as changing the filters in a dust-collection system.

Respirators should never be considered a final solution.

OSHA[1] requires respirators temporarily in high-lead areas (50 $\mu g/m^3$ or above) until the amount of lead can be brought down. Respirators are definitely not allowed as a permanent way of preventing lead poisoning, unless all other methods have been tried and failed. OSHA regulations about the use of respirators are quite detailed (see pages 35-36).

If your company needs respirators for temporary use or for jobs that are done infrequently, follow the step-by-step instructions on the page 35.

USING RESPIRATORS INSTEAD OF CUTTING AIRBORNE LEAD.

PROS

- Low initial investment to get cheap respirators for each worker (but the costs add up when you include replacement cartridges, etc.)
- Useful for jobs that aren't done often.

CONS

- Makes workers uncomfortable (especially in hot weather or when the straps are tight enough to keep lead out).
- Expensive, when all costs are added up.
- Gives no protection if the respirator fits poorly or is worn out.
- Lead has no smell, so workers with ineffective respirators can't tell whether they are breathing lead.
- OSHA requires cutting airborne lead instead of using respirators, whenever possible.

ONE COMPANY'S STORY

EXAMPLE: A GUN FIRING RANGE CLEANS UP

Owners of a new Southern California indoor firing range thought they had taken all the right steps. With advice from the National Rifle Association, they installed state-of-the-art equipment so noise wouldn't bother nearby residents. They put in an expensive ventilation system to keep smoke away from patrons.

They first heard about lead poisoning from a friend who worked for a competing range when he learned that his blood-lead level was sky-high. One owner figured that their new, modern range must be safe, so they shouldn't bother testing. But the other owner was his older brother. Testing was ordered for everyone who worked at the range. The results? Several employees had dangerously high blood-lead levels. The younger brother's was the highest, at 67 μg/dl. He maintained the equipment in the back of the range after closing hours. A light coating of dust usually covered his equipment. He took no special steps to keep lead-containing dust off his hands, face, food and cigarettes.

The owners and staff decided to act quickly. Better ventilation didn't seem to be the answer. Instead, they all began eating only in the lunchroom. They all washed carefully before eating. Workers wore coveralls and gloves when they cleaned guns or entered the back of the range. They showered as soon as they took off the coveralls. They even wore respirators for some tasks. The effects were dramatic. All employee's blood-lead levels are now well within range OSHA considers acceptable.

• • •

Firing ranges are a good example of the importance of keeping a workplace clean. Airborne lead comes from gunbarrel smoke and from bullets smashing into the range's "bullet-trap." Usually, no one stands close enough to breathe the lead immediately. Later toxic lead dust settles on the floor and other surfaces. Any jobs that disturb the dust can also contaminate the workers.

Cleaning Up

RESPIRATORS	WHAT TO DO
1 Make sure you really need respirators to keep workers safe.	Other methods are almost always better. If possible, use lead-free products or install special ventilation equipment. See Chapter 5.
2 Respirators can only be required as part of a complete respiratory protection program, including all the the steps described below.[1]	Respirators used incorrectly can be a real hazard, because they give workers a feeling of safety, but no real protection.
3 Decide when and where respirators will be required. Make a list of the workers who will be required to wear respirators, and the tasks for which respirators are required.	Results of your blood-lead testing or air sampling will show which jobs or tasks are most dangerous.
4 Arrange for a medical doctor to make sure that each of these workers is healthy enough to wear a respirator.	Wearing a respirator can strain a person's heart and lungs. Ask your doctor (See "Blood-Lead Testing: How To Do It" in Chapter 3) to let you know whether each worker is fit enough to handle the strain.
5 Choose the type of respirators that are most suitable.	See pages 37 and 38 for pros and cons of the common respirators used in lead work.
6 Make sure that the respirators are certified by NIOSH for protection against toxic lead dusts and fumes. Every certified respirator or cartridge has a small symbol and an explanation of intended use.	If other hazards are present (such as paint fumes), make sure your respirators also protect against those hazards.
7 Arrange for fit-testing to make sure that each worker's respirator fits properly and seals against his or her face. Workers must be cleanshaven to get a good seal.	Some workers' faces can only seal properly with certain brands or sizes. For each worker, get a properly-fitting respirator and a fit test – complete with written certification – from a safety supply company (See "Safety Equipment" in the telephone directory).

Cleaning Up

8	Buy respirators and related supplies (extra cartridges, sterilizing swabs, etc.).	If the respirators you buy are disposable or or have replaceable cartridges, buy plenty of extras. Replace disposable respirators daily, and old cartridges as soon as they start to get clogged.
9	Provide workers with a clean place to store their respirators when they are not in use, and a way to keep their respirators clean.	Your safety supplier can sell you sterilizing swabs for each worker. Or, you could assign one person to clean all the respirators.
10	Train each worker in proper use of respirators.	Show them how to: check the respirator's fit, wear it, keep it clean, store it when not in use, change cartridges, and recognize whether or not it is working properly. Emphasize the importance of keeping cleanshaven.
11	Set up a program of inspecting each respirator regularly. Repair or replace them as needed.	A worn-out respirator (or one with worn-out cartridges) can be worse than no respirator at all.
12	Check your entire respirator program from time to time. Make sure workers are wearing the right respirators, the right way, at the right times.	Most workers don't like to wear respirators. Probably you wouldn't like it either. It's your job to make sure that your employees wear respirators whenever they are needed.
13	Make a written description of your company's respiratory protection program.	The description should include information about all the steps above, and any related company policies.

Cleaning Up

RESPIRATORS

POWERED, AIR-PURIFYING RESPIRATORS

PROS

- Most comfortable to wear for long periods.
- Most comfortable in hot weather.
- Does not need a close fit to give good protection.
- Power for cleaning the air comes from a battery, not a worker's lungs.

WHICH TO USE

CONS

- Expensive (approximately $500 each)
- Large, may be too awkward for some uses.
- Batteries must be recharged daily

HALF-FACE CARTRIDGE RESPIRATORS

PROS

- Cost is moderate (approximatley $30 for a respirator and $6 per pair of cartridges).
- Workers can check for leaks by covering the cartridges, then inhaling and exhaling.

CONS

- Hot and uncomfortable when worn for more than a few minutes.
- Protection is poor unless the respirator fits well and seals against face.
- Often do not seal well against face unless straps are worn tightly.
- Rubber face-piece may get deformed and fit poorly if not properly stored.

Cleaning Up

DISPOSABLE RESPIRATORS (CERTIFIED FOR TOXIC DUSTS AND FUMES)

PROS	CONS
• Cost is moderate (approximately $2 each, but must be replaced daily).	• Wear out quickly and must be replaced frequently, so the cost adds up.
• Do not need to be cleaned or sterilized; simply replace them instead.	• Often don't seal well against face, so the protection isn't as great as it should be.
• Reasonable choice for tasks that are only done occasionally.	• Workers themselves cannot check how well respirators are sealing against their faces.

DISPOSABLE RESPIRATORS NOT CERTIFIED FOR LEAD AND OTHER TOXIC MATERIALS

PROS	CONS
• None.	• Do not provide enough protection for use around lead.
	• Do not meet OSHA requirements.
	• Might not make workers think they are protected when in fact they are not.

➡ ➡ ➡ REFERENCES

1. OSHA lead standard. (See Appendix)

Cutting Airborne Lead
Chapter 5

➡ ➡ ➡ IF ANY OF THE AIR OR BLOOD TEST RESULTS ARE HIGH, YOU MUST:

- **Make a control plan.**
  You may make a plan yourself or get help from an industrial hygienist. See pages 46-47.

- **Cut down the amount of airborne lead in your shop.**
  There are several options for reducing the amount of airborne lead in your shop. See page 42 for the pros and cons of each option.

➡ ➡ ➡ WHY ARE THESE STEPS IMPORTANT?

Reducing the amount of airborne lead is the most important part of any lead-safety program. If any of your blood-lead testing or air sampling results are high, your workers face a risk of lead poisoning. Cutting the amount of lead in the air reduces that risk. The amount of airborne lead in your shop can be reduced by using lead-free solder, by installing good dust and fume collectors, by using safer work practices, and by using a bead blaster instead of wire wheels.

Cutting down airborne lead is often the most expensive part of a lead safety program. Fortunately, it can also be a great way of reducing the number of OSHA requirements you must meet. If you get the airborne lead levels in your shop low enough, you will not have to take the expensive steps described in Chapter 7: If You Still Have Problems . . . Many radiator repair companies have been able to cut their lead levels enough to accomplish this goal.

The best way to make sure your efforts are successful is to develop a control plan. In making the control plan, you identify the main sources of airborne lead in your shop and decide how to reduce the amount of lead from each source.

ALL COMPANIES THAT HAVE ANY AIR SAMPLING RESULTS ABOVE 50 $\mu g/m^3$ OR ANY BLOOD-LEAD TEST RESULTS ABOVE 40 $\mu g/dl$ SHOULD READ THIS CHAPTER. IF YOU HAVEN'T DONE AIR OR BLOOD TESTING, READ CHAPTER 3.

ONE COMPANY'S STORY

INSTALL THE RIGHT EQUIPMENT THE FIRST TIME

A doctor treating a patient for a high blood-lead level referred the patient's employer, a radiator shop, to OSHA. An OSHA inspection was done, which included air sampling in the shop. The results of the sampling showed that the mechanic was exposed to lead levels more than three times the legal limit. OSHA issued several citations to the shop owner, among them for failing to provide an effective fume collection system at the mechanic's bench. The only ventilation in the shop was provided by open shop doors and room fans.

The employer contacted a local sheet metal firm, which installed a hood like you might use over your kitchen stove. Two years later, the California Health Department, following up on the same mechanic's continuing elevated blood-lead levels, did air sampling at the shop. The mechanic's lead exposure was almost four times the legal limit, **despite** the canopy hood. Meanwhile, the mechanic's blood-lead levels were so high that he had to be removed from any further lead exposure. OSHA regulations required the shop owner to pay the mechanic his full salary and benefits during the five months' time that he was off work.

What happened? Why was the mechanic still overexposed to lead even after the canopy hood was installed? A canopy hood may be OK to control smoke while cooking a hamburger on a kitchen range, but it's the wrong type of fume collection system for a radiator repair bench.

After the sampling, the shop owner installed a booth fume collection system which surrounds the test tank on three sides and exhausts contaminated air away from the mechanic and out of the shop. Finally, airborne lead exposures were reduced to levels below the legal limit.

• • •

This unfortunate shop owner could have avoided the costs of an extra fume collection system and of his mechanic's lead poisoning, if he installed the right type of fume collection the first time around. This chapter contains information on fume collection systems that are appropriate for radiator repair shops.

Cutting Airborne Lead

➡ ➡ ➡ WHAT ARE THE LEGAL REQUIREMENTS?

If your company has airborne lead above the legal limit of 50 $\mu g/m^3$, OSHA requires you to:

- make a control plan (OSHA calls it a "compliance plan") for getting lead below the legal limit,[1]
- reduce airborne lead below 50 $\mu g/m^3$, and keep it down.

OSHA specifies that you must cut down airborne lead by changing your starting materials, processes, or facilities. In many cases, the best solution is install dust and fume collection systems and to teach your employees safer work practices. Quick fixes such as making workers wear respirators, or rotating workers in the most hazardous jobs are not permitted as long-term solutions. If you install dust and fume collectors to cut airborne lead below the legal limit, you must check them at least every three months to make sure they are working properly.

Air pollution control requirements may also affect your plans. For more information, see Chapter 8.

CUTTING AIRBORNE LEAD OPTIONS

INSTALL FUME COLLECTION SYSTEMS AT EACH REPAIR BENCH.

PROS	CONS
• Gets lead out of the workplace before it can hurt anyone.	• Expensive – typically $1,200 to $3,000 per bench, depending on the type of equipment you choose.
• Can help you bypass other costly OSHA rules if airborne lead levels are reduced enough.	• Equipment needs to be checked and maintained regularly.
• Some systems protect employees without slowing their work, and with little supervision.	• These systems take air from the workplace and blow it outside, so your heating or cooling bills may increase.

Cutting Airborne Lead

USE A BEAD BLASTER INSTEAD OF A WIRE WHEEL.

PROS	CONS
• Often more effective and faster than a wire wheel.	• Cost ranges from $1,500 to $3,000, depending on size.
• Helps keep lead dust from contaminating the shop.	

ENCOURAGE WORK PRACTICES THAT REDUCE AIRBORNE LEAD.

PROS	CONS
• Often the cheapest way of reducing lead exposure.	• May take time to figure out how to do a job more safely.
• Some work practices – like using less solder on each joint – are both safer and more efficient.	• You must train employees in new work practices and supervise them to make sure the new practices are used.
• Focusing on how a job is done can make employees more safety conscious.	

➡ ➡ ➡ LEAD-FREE SOLDER – A NEW OPTION

Many radiator repair shop owners feel discouraged by all the steps that are necessary to set up a complete lead safety program. Have you ever wished that you could just skip the whole problem by using lead-free solder?

Good news—several lead-free solders are now being tested by an independent laboratory to find out whether or not they are suitable for radiator repair.

Switching to lead-free solder could completely eliminate a major source of lead in your shop. Unfortunately, used radiators will still come in with lead-containing solder joints. You will still need a lead safety program, but the task of getting airborne lead below the OSHA limits will be much easier.

Cutting Airborne Lead

Many radiator shops will want to get the benefits of using lead-free solder when—and if—it becomes available. For those companies, spending money now on costly equipment may seem wasteful. If you are sure that you will want to switch to lead-free solder, we recommend the plan below for making the switch. We call it the lead-free solder plan.

Consider the pros and cons below. If you choose the lead-free solder plan, follow all the step-by-step instructions on the next page.

USE THE LEAD-FREE SOLDER PLAN.

PROS

- No lead used during soldering, so less lead is spread throughout the shop and the environment.
- Probably the most reliable way of preventing lead poisoning.
- Lower initial investment for protecting workers.
- Can help you bypass costly OSHA rules if airborne lead levels are reduced enough.

CONS

- Fumes from burning off old solder will still contain lead, so workers will only be protected if you take all the steps of the lead-free solder plan.
- Lead-free solders are likely to cost more than 60/40 solder.
- Company may be violating some OSHA rules until the switch to lead-free solder has been completed.

Cutting Airborne Lead

LEAD-FREE SOLDER PLAN	WHAT TO DO
1 Install a fume collection system for at least one radiator repair bench.	Follow the step-by-step instructions in "Fume Collection Systems: What To Do."
2 Make sure the system is working properly before you count on it to protect your workers.	Have the air flow measured by the installer or manufacturer, as described in "Fume Collection Systems: What To Do."
3 Organize your shop so that all radiators are torn apart at the bench with the fume collection system.	This may require steady supervision. If you allow workers to burn off old solder at other benches, the lead-free solder plan won't work.
4 Decide which workers will be required to wear respirators. This will be necessary if you don't install fume collection systems for each worker with a blood-lead level of 40 µg/dl or higher, or if air sampling results are 50 $\mu g/m^3$ or higher.	Remember, you will need at least one fume collection system. This system can protect one worker with a high level. Workers with blood-lead levels of 60 µg/dl or higher need medical removal (See Chapter 7).
5 If needed, set up a respirator program.	Follow the instructions in Chapter 4.
6 Set up a schedule for checking and maintaining the fume collection system, and stick to it.	OSHA requires that airflow measurements be made every three months.
7 Switch to lead-free solder when it becomes commercially available.	Watch for announcement that the results of tests of lead-free solder are completed.
8 If no lead-free solder passes the test, use the other methods described in this chapter to control airborne lead.	Encourage your solder supplier to continue research on lead-free solder.
9 Fill in Progress Report in the Appendix.	Keep a copy for your records.

Cutting Airborne Lead

BEAD BLASTER	WHAT TO DO
1 Decide what size, brand, and model to buy, and where to install it.	This is part of your control plan.
2 Buy and install the bead blaster.	Make sure to vent the blaster outside the shop.
3 Develop a maintenance schedule for the blaster.	Blasters must be well maintained to keep lead dust from escaping. Gaskets around the door must make a good seal, and gloves should be free of holes. Check with the manufacturer for specific maintenance instructions.
4 Change the abrasive beads regularly, according to the manufacturer's recommendations.	Beads that are not replaced regularly are less efficient and can build up dangerous amounts of lead. Used beads are a hazardous waste; dispose of them properly.
5 Show workers how to use the blaster.	If the blaster door is open before the dust is cleared, a dangerous amount of lead dust can escape. Make sure workers understand.
6 Require workers to use the blaster instead of a wire wheel whenever possible.	Most people find that blasters work better and faster.
7 Show employees how to clean the dust collector.	Care should be taken to prevent dust from becoming airborne. Require the person doing this job to wear a respirator. The dust is a hazardous waste, so dispose of it properly.

Cutting Airborne Lead

CONTROL PLAN	WHAT TO DO
1 Decide whether you want professional help from an industrial hygienist.	See the pros and cons on the opposite page.
2 If you decide you want professional help, contact an industrial hygienist.	Use the instructions for getting hygiene assistance in Chapter 3, "Air Sampling: What To Do."
3 Decide whether to follow the lead-free solder plan or to continue using leaded solder in your repair work.	If you choose the lead-free solder plan, include in your control plan all the measures described in "Lead-Free Solder: What To Do."
4 Survey your shop to find the main sources of airborne lead. (An industrial hygienist can really help with this step.)	Use air sampling results (if you have any) as a guide, and read "What are the sources of lead in radiator repair?" in the **Q&A section**. Ask workers what they think, too.
5 Decide which repair benches need fume collection systems. Shut the others down to avoid temptation.	Plan to install fume collectors at all benches if you stick with lead-containing solders, or at least one bench if you switch to lead-free solder.
6 Decide what kind of fume collection system to install — ventilation booths or elephant trunks.	See "Fume Collection Systems: Which Ones To Use" on page 50.
7 If you don't already have a bead blaster, consider buying one.	We recommend bead blasters for every shop to cut down the amount of lead dust.
8 List any work practices that need to be changed.	Follow the steps in "Safer Work Practices: What To Do."
9 Choose which brands and models you will purchase (fume collection systems and abrasive blaster).	For recommendations or ideas, check the trade associations and trade magazines. For custom systems, contact a ventilation contractor experienced in industrial ventilation.

Cutting Airborne Lead

10	Make a schedule for buying and installing any new equipment you need.	Include in the schedule any other plans you have for making your workplace safer.
11	Put your plan in writing, including the schedule for getting everything done.	If you are working with an industrial hygienist, review carefully any plans they write for you.
12	Let your employees know what your plans are.	Have a saftey meeting, or describe your plans in a letter to all employees. Consider posting a large copy of your schedule so everyone can see what changes are coming.
13	Fill in Progress Report in the Appendix.	Keep one copy of your records.

CONTROL PLAN — HOW TO DO IT

CONSULT WITH AN INDUSTRIAL HYGIENIST.

PROS	CONS
• If an industrial hygienist does air sampling in your shop, a control plan may be included in the amount you pay.	• Can be costly if your industrial hygienist is a private consultant.
• Likely to meet all OSHA requirements.	• Some consultants will not write a control plan without air sampling first.
• Saves your time.	
• Might save money if the industrial hygienist makes a more cost-effective plan than you could on your own.	• Still takes a lot of your time to make a plan that works well in your shop.

Cutting Airborne Lead

MAKE A PLAN YOURSELF.

PROS	CONS
• Much cheaper, unless you can arrange free industrial hygienist services (from the OSHA Consultation Service or your workers' comp. insurance company).	• Takes time.
• You can get the job done on your schedule, not the industrial hygienist's.	• A plan you develop without professional help might not be as effective as it could be.
• Will give you a good understanding of what needs to be done.	

FUME COLLECTION SYSTEMS	WHAT TO DO
1 Decide how many benches will need fume collection systems, and where they will be located.	This is part of making your control plan, as described in "Control Plan: What To Do."
2 Decide what type of fume collection systems you want.	The main choices are ventilation booths and "elephant trunks." See page 50 for pros and cons.
3 Decide whether you want to include any air pollution control device in your system.	See Chapter 8 to learn about the importance of preventing air pollution. You may need a permit for any air pollution control device.
4 Decide whether you want a custom system or one that is prefabricated.	Some manufacturers now offer prefab systems specially designed for radiator repair work. These are generally much cheaper than custom systems.
5 Choose the brands and models you want to buy.	For recommendations or ideas, check the trade associations and magazines.

Cutting Airborne Lead

6	If you need a custom system, choose a ventilation contractor to design and install it for you.	Choose a contractor experienced in industrial ventilation, or make sure that an industrial hygienist is involved.
7	If you buy a prefabricated system, decide whether you want to install it yourself.	The manufacturer or a ventilation contractor could do a professional job, for a price.
8	Buy the equipment and get it installed.	You'll probably need an electrician for minor electrical work.
9	Have the air flow of your systems measured by the installer or manufacturer to make sure they meet specifications.	If your systems come with built-in gauges, ask the manufacturer to set them and show you how to use them.
10	Arrange air sampling when the systems are in use to make sure they protect workers well enough.	This sampling is required by OSHA. See Chapter 3 for step-by-step air sampling instructions.
11	Show employees how to use the systems.	Supervise them to make sure they are using the equipment properly.
12	Develop a schedule for checking your systems' performance, at least every three months (an OSHA requirement).	Built-in gauges can save money fast, compared to hiring an expert every three months. Keep written records of airflow measurements.
13	Develop maintenance schedules for your fume collection systems and stick to them.	Fumes from burning flux are corrosive. Ask the systems' installer for maintenance recommendations.
14	Fill in Progress Report.	Keep a copy for your records.

Cutting Airborne Lead

FUME COLLECTION SYSTEMS

VENTILATION BOOTHS

PROS

- Most foolproof fume collection system for radiator repair. Requires little supervision.
- Booths can reduce airborne lead effectively, even in very busy shops.
- Does not require any special repositioning, so mechanics simply work as usual.
- Some models have a built-in gauge to let you know whether they are working properly. You can use this gauge for OSHA-required airflow readings.

"ELEPHANT TRUNK" FUME COLLECTORS

PROS

- May be a bit cheaper than booths – about $1,000-$2,500 for a single trunk.
- Costs for multiple systems may be somewhat less.

WHICH TO USE

CONS

- Costs about $1,000-$3,000 per bench.
- Booths blow a large volume of air out of the shop, so your heating, cooling, and electricity costs may be higher than with elephant trunk systems.

CONS

- Mechanic must reposition frequently, so that the opening is within 12 inches of the flame. If the opening isn't close enough to the flame, the system doesn't protect the worker.
- Much more supervision is necessary for elephant trunks compared with booths. Otherwise, workers may not use them correctly.

Cutting Airborne Lead

- Removes less air from workplace, so added heating, cooling, and electrical costs will be less.

- Frequent repositioning takes time, so work may be slightly less efficient.
- No built-in gauge for checking air flow. To meet OSHA rules, you would need to hire an expert every three months or buy special equipment and learn how to do it yourself.
- Requires more maintenance than booth – moving parts wear out.

SAFER WORK PRACTICES	WHAT TO DO
1 Observe your employees carefully to see if any of them have work habits that put too much lead into the air.	To identify hazardous work practices, answer the questions below:
a Do any workers use too much solder on each joint they make? Do any use too much tinning compound?	Too much solder simply wastes money and creates extra airborne lead.
b Do any workers use too much heat when soldering or burning off old solder?	Using too much torch heat can cause a big increase in the amount of lead that becomes airborne.
c Do any workers seem to always have their head in the fumes?	Simply keeping away from the worst of the fumes can help cut a worker's lead exposure, if the shop has effective ventilation or fume collection systems.
d Do any workers use a wire wheel instead of the bead blaster to clean solder joints?	A wire wheel throws lead dust into the room, a blaster captures the dust.
e Do any workers open the blaster door before the dust has cleared?	The dust that escapes may be loaded with lead.

Cutting Airborne Lead

f	Do any workers forget to use their fume collection systems properly?	Any system must be turned on to work. Elephant trunk systems must be positioned within 12 inches of the flame.
2	For each unsafe practice you find, show your employees a safer way to get the job done.	Often, employees themselves can figure out safer work practices. Sometimes, you can show your employees how to work more efficiently at the same time you show them how to work safely.
3	Supervise all employees closely enough to make sure they use the safe work practice you require.	Also, set a good example by working safely yourself.
4	Make sure new employees learn to work safely as soon as they are hired.	New workers sometimes run into the most problems, until you've shown them what to do.
5	Make sure your workers also protect themselves by washing before eating, not eating or smoking in lead areas, and showering and changing before they go home.	These measures are described in Chapter 4.
6	Encourage your employees to suggest any safety ideas they think up.	Employees are most likely to use safe work practices that they've helped develop.

→ → → REFERENCES

1. OSHA lead standard. (See Appendix)

Safety Training For Workers
Chapter 6

➡ ➡ ➡ IF YOUR COMPANY USES LEAD, YOU MUST:

- **Make sure your workers receive training about the health hazards of working with lead.** You also have several options for training your workers. See page 54 for a description of the pros and cons of each option.

- **Tell your workers about how to work safely in your shop.** No matter which option for training you choose, you must still tell your employees how to protect themselves from lead dust and fumes in your shop.

➡ ➡ ➡ WHY ARE THESE STEPS IMPORTANT?

Safety training for workers is one key to making your workplace safer. No company would assign employees to solder radiators without first making sure they knew how to do the job. You should also teach them how to work safely, and what might happen if they don't.

Employees who haven't gotten good training cannot be expected to know how to work safely. Often they don't feel motivated to protect themselves. The more employees know, the better they can protect themselves and their co-workers.

ALL COMPANIES THAT USE LEAD-CONTAINING MATERIALS SHOULD READ THIS CHAPTER.

➡ ➡ ➡ WHAT ARE THE LEGAL REQUIREMENTS?

Not only does training your employees make good sense, it is also legally required by OSHA regulations, especially for employees who work in areas with 30 $\mu g/m^3$ or more of lead.[1]

OSHA requires training that includes:

- the health effects of lead,
- the OSHA lead regulations,
- the work processes in your company that can result in overexposure,
- ways to control exposure to lead (such as ventilation systems, safe work practices, respirators, and other protective equipment),
- the purpose of a lead medical program (including blood-lead testing and medical removal),
- employee rights under the OSHA lead regulations.

Safety Training For Workers

If your company uses lead, you must have a copy of the OSHA lead regulations, and make it available to all employees.[1] A copy of the OSHA lead regulations is in the Appendix of this manual.

OSHA requires you to train all your employees once each year. You must provide extra training if a new work process is introduced. You must also train new employees—or existing employees who are transferred to jobs where they may contact lead—before they begin working.

If your employees primarily speak some other language besides English, provide their training in the language they understand best.

WORKER SAFETY TRAINING OPTIONS

CONDUCT THE TRAINING YOURSELF.

PROS

- Cheapest option.
- Training is held at your workplace and is tailored to specific needs of your workplace.

CONS

- Most time-consuming option for you (about 25 hours of your time will be needed to plan and conduct the training).
- No guarantee that training will meet OSHA requirements.

HIRE A PRIVATE TRAINING CONSULTANT.

PROS

- Training is held at your workplace.
- Training can be tailored to the needs of your employees.

CONS

- Typically very expensive (approximately $1,000 for a half-day program).
- Can take much of your time to hire a consultant and familiarize the trainer with your shop.
- May be difficult to be sure consultant gives high-quality, interesting presentation.
- No guarantee that training will meet OSHA requirements.

Safety Training For Workers

➡ ➡ ➡ YOU DECIDE . . .

A.	CONDUCT TRAINING YOURSELF	Follow the instructions below.
B.	PRIVATE TRAINING CONSULTANT	Follow the instructions on page 56.

TRAIN WORKERS YOURSELF		WHAT TO DO
1	Educate yourself about lead.	Read the OSHA lead regulations and this manual.
2	Make sure you know the hazards of your shop, and decide what work rules you want your workers to follow.	Chapter 3 describes how to find out where the hazards are in your shop. Chapters 4, 5, and 6 tell how to control them.
3	List all the topics that will be covered in the training.	
4	Think of ways to make these topics interesting.	Don't embarrass yourself – and bore your workers – by just talking on and on.
5	Find written materials to help reinforce what you say.	Contact your state public health department or NARSA for written materials.
6	Include a way of finding out whether your employees actually learned the main points.	If you give quizzes or exams, save them for your records. They can help show how much your employees learned.
7	Conduct your training program.	Make sure all workers attend.
8	Fill in Progress Report.	Keep a copy for your records.
9	Make sure that any new employees also get trained, and schedule a refresher course within one year.	New employees often make the worst mistakes, so be sure to give them good safety training.

Safety Training For Workers

PRIVATE TRAINING CONSULTANT	WHAT TO DO
1 Choose the training consultant you will hire to train your workers. Be sure to ask about their experience and check references.	How can you find a trainer? Try your telephone directory (under "Safety Consultants").
2 Discuss with your trainer the services that will be provided and the price.	Specify services and price.
3 Make sure the trainer knows the hazards and work rules of your shop.	We suggest that the trainer come to your shop to see your facilities and review your records (such as blood testing or air sampling results).
4 Work with the trainer to make an outline of all the topics to be covered.	
5 Make sure that the trainer's plan includes some way of finding out whether your employees actually learned the main points.	If the trainer gives any quizzes or exams, save them for your records. They can help show how much your employees learned.
6 Arrange a time for the class and make sure all your workers attend.	Some employees are afraid to ask questions with their boss present. Don't spend much time at the class yourself.
7 Fill in Progress Report.	Keep a copy for your records.
8 Make sure that any new employees also get trained, and schedule a refresher course within one year.	New employees often make the worst mistakes, so be sure to give them good safety training.

➡ ➡ ➡ REFERENCES

1. OSHA lead standard. (See Appendix)

If You Still Have Problems
Chapter 7

➡ ➡ ➡ IF ANY WORKERS HAVE BLOOD-LEAD LEVELS OF 40 µg/dl OR HIGHER, OR WORK IN AREAS WITH 30 µg/m^3 OR MORE OF AIRBORNE LEAD, YOU MUST:

- **Provide a complete lead medical program.**
  Medical evaluations are required in addition to blood-lead testing for these workers. See page 60 for step-by-step instructions.

➡ ➡ ➡ IF YOUR COMPANY HAS 50 µg/m^3 OR MORE OF AIRBORNE LEAD, YOU MUST:

- **Provide showers and lockers so that workers can change before going home.**

- **Set up a special lunchroom with a filtered air supply.**
  Companies with airborne lead levels above 50 µg/m^3 must construct special facilities. These may cost several thousand dollars. We recommend that you consult with an industrial hygienist to make sure that your facilities meet OSHA requirements.

➡ ➡ ➡ IF ANY WORKER HAS A BLOOD-LEAD LEVEL OF 60 µg/dl OR HIGHER (OR AN AVERAGE LEVEL OF 50 µg/dl OR MORE FOR SIX MONTHS), YOU MUST:

- **Reassign the worker to a job requiring little or no contact with lead dust or fumes.**

- **Arrange for the worker to have a complete medical evaluation, and monthly follow-up blood tests.**
  Workers cannot legally be fired or laid off for having high blood-lead levels. You must keep paying their regular wages. Together, these benefits are called medical removal protection, described on page 59. See page 60 for detailed instructions.

THIS CHAPTER IS FOR COMPANIES THAT CAN'T ELIMINATE THEIR LEAD HAZARDS, OR THAT HAVEN'T. IF YOU PREFER TO REDUCE YOUR AIRBORNE LEAD LEVELS, SEE CHAPTER 5.

If You Still Have Problems

➡ ➡ ➡ WHY ARE THESE STEPS IMPORTANT?

A medical program is needed to make sure that your company's lead is not harming your workers. Physical examinations are an important part of the program. Blood tests are very useful, but they don't tell everything. Some workers with extremely high blood-lead levels have no signs or symptoms of lead poisoning. Others have real damage at lower levels. Only a doctor's evaluation can tell whether anyone in your company is being affected. A medical evaluation can also help by identifying any medical conditions (such as kidney disease) that might make lead exposure extra hazardous for certain workers.

Don't get any wild ideas about medical programs, though. The only way to prevent lead poisoning is to prevent lead exposure. Some people think that, as a substitute, they can just have workers take vitamins or drink lots of milk. Don't bother. These methods don't work.

In companies with high airborne lead levels, preventing contamination of workers' hands, food, cars, and homes is not a simple matter. Inexpensive solutions—such as having everyone eat outside, or providing coveralls—just aren't good enough. That's when you may need high-cost items such as showers, lockers, and a filtered-air lunchroom.

➡ ➡ ➡ WHAT ARE THE LEGAL REQUIREMENTS?

OSHA requires a medical program for all employees who work in areas with 30 $\mu g/m^3$ or more of airborne lead or who have blood-lead levels of 40 $\mu g/dl$ or higher. A licensed medical doctor must supervise the program.[1] Specific requirements for the medical program are rather complex. Rather than try to learn all the regulations yourself, we suggest that you make sure the doctor in charge is familiar with the regulations. If you take this approach, work only with a medical doctor who has experience running a lead medical program.

Workers must be given written notice of their blood-lead test results within 5 days if their level is 40 $\mu g/dl$ or higher. Individual workers must also be provided copies of any written medical opinions about them. All testing results must be made available to individual employees, their doctors or other representatives, and OSHA. The results must be kept for 40 years, or sent to OSHA if your business closes.[1]

OSHA requires a filtered-air lunchroom, showers, and locker facilities in companies with 50 $\mu g/m^3$ or more of airborne lead.[1] The specific requirements for setting these up are quite detailed. If you need these facilities, read the OSHA regulations (included in the Appendix) and get professional assistance.

If You Still Have Problems

Fortunately, you can bypass these difficult and expensive requirements. They apply only to companies that have moderate or high amounts of airborne lead. If you can keep the airborne lead levels in your shop low enough, you will not have to take the other steps described. Many radiator repair companies have been able to cut their lead levels enough to accomplish this goal. See Chapter 5 for information about reducing airborne lead.

➡ ➡ ➡ ALL ABOUT MEDICAL REMOVAL

Medical removal is essential to protect workers' health when all else fails. A worker with a blood-lead level of 60 µg/dl or greater may suffer permanent damage unless action is taken immediately. This is no time for making small changes in the worker's job, or trying a new respirator. The worker must be temporarily given a safer job – completely away from lead dust and fumes – until his or her blood-lead drops to a less dangerous level.

OSHA requires medical removal protection whenever:[1]

- a worker has a blood-lead level of 60 µg/dl or higher, OR
- a worker has a blood-lead level of 50 µg/dl or higher, and his or her level has averaged 50 µg/dl or higher for six months or on the last three tests, OR
- a doctor notifies you that medical removal is necessary to protect a worker's health.

Workers on medical removal must be assigned to safer work areas, with less than 30 $\mu g/m^3$ of airborne lead.[1] If your company has no areas below that level, the worker must stay away from the workplace entirely. During medical removal, you must continue paying the worker's full wages for up to 18 months.[1] If you try to avoid these duties by firing or laying off the worker, you may be violating state and federal laws and regulations.

Any worker on medical removal must have a medical evaluation and regular testing.[1] In most cases, a worker on medical removal cannot return to work until two blood tests in a row show that his or her blood-lead level has dropped to 40 µg/dl or less.[1] OSHA prohibits use of respirators as a substitute for medical removal.[1]

OSHA absolutely prohibits using drugs to bring down workers' blood-lead levels instead of removing them from lead exposure. Similarly, drugs cannot be given to get a worker back on the job quicker.[1]

For step-by-step instructions on coping with medical removal, see page 60.

If You Still Have Problems

MEDICAL REMOVAL	WHAT TO DO
If you find out that any worker has an extremely high blood-lead level, the steps on this page must all be taken AS SOON AS POSSIBLE to prevent permanent health damage.	
1 Inform the worker in writing of his or her most recent blood-lead level and of the need for medical removal.	Check page 59 of this chapter to make sure medical removal is required. Discuss the health effects of lead and ways to keep hands, face, and food lead-free.
2 Arrange for the worker to have a complete medical evaluation as soon as possible.	The doctor will check to see whether the worker has any signs of lead poisoning, and will order a repeat blood test.
3 Make a list of jobs in your company that require little contact with lead dust or fumes (less than 30 $\mu g/m^3$).	You may need air sampling; see Chapter 3.
4 Decide which of these jobs is most suitable. If you have no jobs in your company that are lead-free, the worker may have to stay home.	See the opposite page for pros and cons of several options.
5 Assign the worker to the selected job until his or her blood-lead level drops.	Medical removal must continue until the worker's blood-lead level gets down to 40 µg/dl or less for two tests in a row.
6 Make sure the worker does not do high-risk tasks while on medical removal.	Also make sure that personal habits, such as eating or smoking in the workplace, are not part of the problem.
7 Continue paying the worker's full wages and benefits, even if the new job requires less skill.	You must always pay full wages even if your company has no work area safe enough and the and the worker stays at home. Check with your workers' comp. company; they may pay a part of the worker's wages.

If You Still Have Problems

8	Arrange repeat blood-lead testing every month while the worker is on medical removal.	If the blood-lead level does not drop, check again to see if the worker's new job involves any contact with lead dust or fumes. Talk with the doctor about how quickly the blood-lead level should drop.
9	Before assigning a temporary substitute to the job, make it safer.	Blood-lead levels above 50 µg/dl usually indicate that the job or work area is unsafe. If you don't make it safer, you may simply end up with another worker on medical removal.

MEDICAL REMOVAL — HOW TO DO IT

ASSIGN THE WORKER TO A LEAD-FREE WORK AREA.

PROS

- The worker can still be productive.
- Some common choices, such as office job or delivery jobs, are usually quite safe for medical removal.

CONS

- Air sampling may be required to show whether or not a work area or job is safe enough.

HAVE THE WORKER STAY AT HOME.

PROS

- This is the safest alternative. The worker will be far away from workplace lead.

CONS

- Expensive. You will be paying full wages and getting nothing in return.
- This may make medical removal seem too much like vacation. In fact, it's serious business.

If You Still Have Problems

HAVE THE WORKER WEAR A RESPIRATOR INSTEAD OF CHANGING JOBS.

PROS	CONS
• The worker will be able to keep doing his or her regular tasks.	• Illegal if the worker's regular job has 30 $\mu g/m^3$ or more of airborne lead. • Unwise regardless of airborne lead level. • Worker's blood-lead level might keep going up if the respirator doesn't work properly (which is common) or if habits such as eating in the workplace are part of the problem.

FIRE OR LAY OFF THE WORKER.

PROS	CONS
• Saves cost in the short run (but high legal fees may result).	• Illegal under Federal law. • Legal fees may be high if OSHA or lawyers get involved. • Without income (and perhaps without health insurance), worker's health may suffer even more.

MEDICAL EVALUATIONS	WHAT TO DO
1 Choose a medical doctor to do medical evaluations and to run your company's medical program.	You may already have a doctor. If not, see "Blood-Lead Testing – What To Do" in Chapter 3. Make sure the doctor knows about lead poisoning and how to prevent it. Many doctors don't know much about either.
2 Make sure your doctor provides all required services.	See Blood-Lead Testing – How To Do It in Chapter 3.
3 Discuss with your doctor which workers need medical evaluations. Remember, this might include you, as well as your employees.	OSHA requires evaluations for all employees who work in areas with 30 $\mu g/m^3$ or more of airborne lead. For new employees, the

If You Still Have Problems

		evaluation should be done before work in a lead area begins. For workers with blood-lead levels of 40 µg/dl or higher, evaluations must be repeated annually.
4	If any workers need evaluations at this time, arrange them as soon as possible.	Long-time employees – or you yourself– may be years overdue. Don't wait any longer.
5	If any workers need annual evaluations, make appointments now for the appropriate times.	Write the appointments on your calendar so you and the workers can't forget.
6	Make sure that "baseline" evaluations are included in your routine for hiring new employees.	Employees who switch from lead-free jobs to lead-handling jobs must also get baseline evaluations.
7	Give workers time off work to get their medical evaluations.	Workers cannot be expected to have the evaluations done on unpaid time.
8	Make sure you get a doctor's written report on each evaluation when it is complete.	This written report lets you know whether the worker can continue working safely with lead.
9	Follow any written recommendations made by your medical doctor.	Discuss with the doctor any questions you have about written recommendations. Make records of how you responded to each recommendation.
10	Let the employees know that they have a right to a second medical opinion if they disagree with the results of their evaluations.	See the OSHA regulations reprinted in the back of this manual for details.
11	File all doctors' reports so you can find them when you need them.	OSHA reports that this information be kept available for 40 years.

➡ ➡ ➡ REFERENCES

1. OSHA lead standard. (See Appendix)

NOTES:

Keeping Your Family Safe
Chapter 8

Although this workbook is mainly about preventing lead poisoning in workers, the health of others who may be harmed by lead is also a concern. Much lead in the environment comes from industrial use. We are frequently asked about regulations covering air pollution, hazardous waste, and water pollution. This chapter is included as a basic guide to those subjects. For additional and up-to-date information about regulations, contact local and state environmental agencies in your area.

➡ ➡ ➡ IF YOUR COMPANY USES LEAD, YOU MUST:

- **Make sure your workers don't take lead home.**
  Lead dust can be taken home on contaminated work clothes or shoes — your workers' or your own. Children at home can be poisoned by this lead. (See the description on page 66.) Many experts recommend regular blood-lead tests for any preschool children of lead workers.

- **Don't let lead fumes or dust pollute the air.**
  Ventilation systems, including those described in Chapter 5, reduce the amount of lead in the workplace by gathering contaminated air and blowing it outside. If the ventilation system includes no filtering mechanism, a workplace lead problem may turn into a community air pollution problem. We recommend that you consider including some lead-removal mechanism in your system. Discuss this with your ventilation engineer while the system is being designed.

- **Keep lead out of the sewer system.**

- **Dispose of hazardous waste properly.**

ALL COMPANIES SHOULD READ THIS CHAPTER. COMPANIES WITH LEAD PROBLEMS INSIDE THEIR WORKPLACES ARE MOST LIKELY TO ALSO HAVE LEAD PROBLEMS OUTSIDE.

➡ ➡ ➡ WHY ARE THESE STEPS IMPORTANT?

This book is mainly about preventing lead poisoning in workers who handle lead. But those people are not just workers. Many are also parents, and all are members of their communities. Lead-using businesses have a responsibility to make sure that lead dusts, fumes, and wastes from their facilities are not endangering families and communities.

Perhaps the most heart-wrenching kind of lead poisoning is that in which a parent who handles lead at work unknowingly takes home traces of the brain-damaging dust to his or her own children. The typical story is this:

Keeping Your Family Safe

The worker just does his (or her) job during the day. In the course of his work, he gets contaminated with lead dust. The worker may not feel sick himself. At the end of the day, he just wants to go home to his family. Since his clothes may not really seem dirty, he doesn't shower or change. Perhaps his employer doesn't even provide showers and clean work clothing.

After he gets home, he changes into something more comfortable, and piles his work clothes by the washing machine. What next? Maybe his kids want to give him a kiss. Now the lead dust on his face gets on their lips. It may be too little to see or taste, but enough to raise the amount of lead in their bodies a bit. Maybe the baby of the household wants to play with Daddy's shoes, and maybe even puts one in his mouth. That's normal childlike behavior, but the result can be devastating.

Children's bodies are much more efficient than adults' at absorbing lead once it has gotten into their mouths. Their developing brains and bodies are much more easily damaged by lead's toxic effects. On average, children with excess lead in their bodies have permanently lowered intelligence and more than their share of behavioral problems.

Of course, if the parents understood what could be happening to their kids, they would take almost any steps to prevent it. All too often, however, workers in lead-using companies do not know of the risks. And all too often, owners of lead-using companies cannot imagine the damage that their lead can be doing, even far away from the work site.

Most lead workers also don't know about yet another way children get lead poisoning. Think about the kid's mother. Does she pick up contaminated work clothes around the house, and wash them? If so, her blood-lead level might be going up a bit, too. Ordinarily that might not pose much of a problem. But if she's pregnant, some of that lead will be passed on to the developing fetus. Lead's damage occurs most easily during pregnancy, so even at birth the baby may have been harmed by lead. As with childhood poisoning, they may have lasting behavior problems and lowered intelligence.

Many owners also are unaware of an important legal point: Workers' compensation laws represent a trade-off between employers and employees. The employer (through a workers' comp. insurance company) has to pay the bills for any on-the-job injury or illness. The employees usually give up the right to sue in court for damages. There's one big catch: the employees' children aren't part of this deal. They can't collect workers' comp. if they are damaged by lead from their parent's workplace. However, they can sue the company. Sometimes they do, and if they win the money involved can make workers' comp. payments seem tiny.

Keeping Your Family Safe

Some owners of small lead-using businesses take more chances than they should, by taking few precautions against lead poisoning. Some hope that they won't suffer any consequences, but reason that even if they do it's just part of the cost of staying in business. But if they knew that the price might really be paid by their children, would they make the same decision? We think that most owners, once aware of these risks, will move swiftly and surely to protect everyone's families—their workers' and their own.

Lead that moves into the surrounding community by polluting the air, water, or soil can have similar effects, reaching more people. Because lead in the environment never breaks down, contamination of a community with lead represents an enduring liability. Cleanup costs are likely to far exceed the cost of handling lead safely. Even a company that contaminates nothing beyond their own property can be hurt—they may be unable to sell the property until all hazardous wastes are removed.

➡ ➡ ➡ WHAT ARE THE LEGAL REQUIREMENTS?

- **OSHA Regulations**

  Some elements of the OSHA lead regulations[1] were designed both to reduce worker exposure to lead and to protect young children from "take-home" lead exposures. The law requires employers to provide showers and change rooms for their workers if lead levels are high (above the Permissible Exposure Limit of 50 $\mu g/m^3$). Workers must shower and change from their work clothes into their street clothes before leaving work. After showering, no clothing or equipment worn at work may be worn home, including shoes and underwear. Change rooms must be clean, and must have separate lockers for work clothes and street clothes in order keep the street clothes lead-free.

  In addition, companies with 50 $\mu g/m^3$ or more of airborne lead must provide their workers with protective work clothing, at no cost to the employees. The clean clothing must be provided at least weekly, or daily if lead levels are 200 $\mu g/m^3$ or more. Contaminated clothing must be stored in a closed, labelled container. The employer must arrange for work clothes to be cleaned by a laundry service, and must notify the service that lead is present.

- **Air Pollution Regulations**

  Most air pollution regulations are made and enforced by state or local air quality districts. Whether or not your ventilation system is legally required to have pollution control equipment included depends upon the type of operation, how much lead is released, and your location. Radiator shops do not account for a large fraction of environmental air pollution.

Keeping Your Family Safe

- **Waste Water Regulations**
  Regulations governing waste water discharges vary among municipalities and by industry. Contact your local municipal utility district and environmental agency for the regulations in your area.

- **Hazardous Waste Regulations**
  Regulations specify requirements for the handling, transport, and disposal of lead from the point of generation to its final disposal. Your local environmental agency can help you understand how these regulations apply to your business.

  In some areas, lead-using companies are routinely classified as hazardous waste generators, and are required to have special permits.

➡ ➡ ➡ REFERENCES

1. OSHA Lead Standard. (See Appendix)

ONE COMPANY'S STORY

CHILDREN POISONED BY LEAD FROM A RADIATOR SHOP

A two-year old boy and his nine-month old sister were found to have unusually high blood-lead levels. The paint in their house was suspected as the source, but it turned out to be almost completely lead-free.

To track down the source of the children's high blood-lead levels, health officials pieced together a profile of the family. The children's father and their uncle (who also lived with them) were both radiator repair mechanics. In fact, the father hadn't been feeling to great recently. Both men were checked, and both had blood-lead levels high enough to cause serious health damage. The father was hospitalized.

The question remained: How could lead from the radiator shop be getting in the kids? A few tests were enough to provide the answer. Dirt on the father's shoes was loaded with lead. The van that the two drove back and forth to work was grossly contaminated, and the children often played in it at home. Substantial amounts of lead were also found on the floor in the family's kitchen, bathroom and bedroom.

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After the lead problem was eliminated, the girl's lead level dropped by itself as she grew. The boy was treated with potent chemicals to bring his blood-lead level down immediately. Whether or not the children suffered permanent damage to their mental development is not known. Knowing what they know now, is there any chance that the father and uncle would ever leave their workplace without showering and changing their clothes and shoes?

Checking Your Progress
Chapter 9

➡ ➡ ➡ IF YOUR COMPANY USES LEAD, YOU MUST:

- **Review your operations from time to time to check for new hazards.**

- **Keep your workers' safety training up-to-date.**
  Any workers hired since your last training session need to learn about working safely with lead. Employees who work in areas with 30 $\mu g/m^3$ or more of lead must be provided refresher courses annually.

- **Repeat your blood-lead testing, medical evaluations, and air sampling, if necessary.**
  OSHA requires frequent re-testing if your previous results were high or moderate. None are required if they were low.

- **Make sure any special safety equipment is working properly.**
  Ventilation systems must be checked every three months to make sure they are operating properly. (See Chapter 5 for details.)

➡ ➡ ➡ WHY ARE THESE STEPS IMPORTANT?

Earlier chapters in this manual have described the importance of blood-lead testing, air sampling, worker safety training, and cutting down airborne lead. By now, you may have in place a complete lead safety program. No system runs perfectly forever. New employees are hired. Other employees forget the importance of safe work habits. Perhaps there is some change in the type of products you handle. Perhaps you installed new equipment, or existing safety equipment stopped working. Any of these can cause new hazards to crop up.

By checking your program's performance from time to time, you can find out about any new problem before it gets out of hand.

ALL COMPANIES SHOULD READ THIS CHAPTER. ONCE YOU HAVE A LEAD POISONING PREVENTION PROGRAM IN PLACE, SET UP PERIODIC REVIEWS.

➡ ➡ ➡ WHAT ARE THE LEGAL REQUIREMENTS?

Previous chapters describe the requirements for keeping various parts of your lead-safety program up-to-date. Unfortunately for small business owners, the OSHA lead regulations are long and complicated. Blood-lead testing, air sampling, medical evaluations, ventilation system checks, and worker safety

Checking Your Progress

training could all end up on different schedules. A company could end up having to update some part of their lead poisoning prevention program every week of the year—a nightmare!

You have two basic choices for how to keep up with all the required dates and deadlines. You could post a calendar in your office, and mark on the calendar the date the next blood testing is due, when your ventilation equipment must be checked, and so forth. (You'd have to keep this workbook and the OSHA regulations handy.)

The alternative is to check your entire program from time to time. When you do your periodic review, you may find that you are behind schedule (and temporarily out of compliance with OSHA regulations) in some areas. Other activities may be up-to-date. Next, bring your company up-to-date in the activities that have fallen behind. Set the date for your next periodic review. Following this plan, you won't get too far off track. If you do no periodic reviews at all, your entire lead safety program could fall apart in a few years.

How often to schedule a review? Once each year is enough for many small businesses with airborne lead levels below OSHA's "action level" of 30 $\mu g/m^3$. Twice each year would be better for companies with moderate lead levels (30-50 $\mu g/m^3$). Companies with high levels (50 $\mu g/m^3$ or more) may need a review every three months if they want to stick close to the OSHA regulations. (See Chapter 5 for information about getting below the action level in your company.) When you decide on a review schedule for your company, consider workers' blood-lead levels, too.

You may also need to take actions between reviews. For example, workers with blood-lead levels above 60 $\mu g/dl$ must have repeat tests monthly. Don't put those off for six months.

CHECKING YOUR PROGRESS	WHAT TO DO
1 Make a note of any changes in your operation that might have increased the amount of lead in your shop.	These might include: new machinery, more employees, or updated production processes.
2 Check to make sure all employees (who work in areas with 30 $\mu g/m^3$ or more of airborne lead) have gotten safety training within the past year.	New employees need a complete training program. Other employees need a refresher course. See Chapter 6.

Checking Your Progress

3	Check whether you need to update your blood-lead testing.	See the chart on page 73.
4	Check to see if any workers need to have complete medical evaluations.	All employees who work in areas with 30 $\mu g/m^3$ or more of airborne lead must receive at least one baseline evaluation. Employees who have had blood-lead levels of 40 µg/dl or higher within the previous year must have annual evaluations. See Chapter 7 for details.
5	Check whether you need to update your air sampling.	See the chart on the opposite page.
6	Check to see that your ventilation equipment is performing up to specifications.	You are required to check the performance of your ventilation equipment every three months, if the equipment was installed to help you meet the OSHA limit for airborne lead – 50 $\mu g/m^3$. See Chapter 5 for details.
7	Record the information in the Progress Report in the Appendix.	
8	Decide when you will conduct your next review, and mark the date on your calendar.	Companies with 30 $\mu g/m^3$ or more of airborne lead (OSHA's "action level") will probably need a review every three months. All lead-using companies should do a review at least annually.
9	Mark on your calendar the next times any other important actions will be required.	Make sure that workers with high blood-lead levels get their regular testing between scheduled reviews.

ONE COMPANY'S STORY

A PROGRAM THAT WASN'T SO GREAT AFTER ALL

A certain battery manufacturing company had good reasons to be familiar with the hazards of lead. Its workers handled thousands of pounds of lead and lead oxide. The company had been inspected by OSHA. Worker's blood-lead levels had been tested in years past and found to be high, but not extremely high. The company had even installed a complex ventilation system — which cost many thousands of dollars — to remove lead dust from the plant. But they didn't pay attention to whether their efforts had effectively protected their workers. They didn't conduct any periodic review to check whether their workers were healthy and whether the company was complying with OSHA regulations.

The bad news struck when one of their workers was hospitalized with lead poisoning. He had such severe fatigue that he simply could not continue working. His blood-lead level was above 80 µg/dl, more than twice the level OSHA considers acceptable. His wife told investigators, "He's just not the same man I married."

Rather than using this worker's illness as a warning that drastic action was needed, the company dragged its feet. OSHA eventually got involved, and found that airborne lead levels at the company were far above the legal limit, despite the expensive ventilation system. The workers had received little training in working safely with lead. Showers had been installed, but workers were never required or encouraged to use them. In the end, OSHA shut down the plant temporarily until improvements were made.

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Although the company's owner had made some efforts to protect his employees, the efforts were poorly coordinated. The owner never checked whether or not they were effective. He didn't know that the ventilation system wasn't working correctly until OSHA conducted air sampling. By then it was too late. A worker had a tragic illness, and OSHA fines were on the way. This illustrates the importance of re-checking air and blood levels from time to time. It also shows how important it is to work with a qualified ventilation contractor and to have the contractor demonstrate that the system works properly before paying for it.

Checking Your Progress

CHECKING YOUR PROGRESS — WHEN TO DO IT

BLOOD-LEAD TESTING

Most recent blood-lead level, µg/dl	Blood testing required by OSHA
none	immediately (if working in an area with 30 $\mu g/m^3$ or more of airborne lead)
0-39	every six months (if working in an area with 30 $\mu g/m^3$ or more of airborne lead)
40-59	every 2 months
60 or above	monthly
worker on medical removal for any reason	monthly

Note: The time for re-testing each worker's blood-lead level depends on his or her previous results. Check the required testing for each worker.

AIR SAMPLING

Most recent airborne lead levels, $\mu g/m^3$	Air sampling required by OSHA
no previous sampling, or operations have changed since previous air sampling	as soon as possible (an inital determination has been required by regulations in effect since 1979)
leass than 30 (if this was the first air sampling or if previous results were also less than 30)	none
30-50	every 6 months
above 50	every 3 months

Note: The time for re-testing each type of job in your company depends on the previous test results. Check the required testing for each job.

NOTES:

Q & A

THE INFORMATION IN THIS SECTION MAY BE USEFUL OR INTERESTING, BUT IT IS NOT ESSENTIAL FOR SETTING UP A LEAD SAFETY PROGRAM. READ IT ONLY IF YOU WANT TO LEARN MORE.

➡ ➡ ➡ LEAD—THE PROBLEM THAT WON'T GO AWAY.

Think about lead: It's heavy. It's soft and easy to work. It doesn't corrode. These basic properties have made lead an often-used metal for thousands of years. It's been used to make pipes, bullets, boat keels, leaded glass, and pottery glazes. More recently, other properties have been discovered that make lead the metal of choice for products such as rechargeable batteries and X-ray shielding.

How tragic it is that a substance so useful is also so toxic. As a result, lead poisoning has also existed for thousands of years. At least since the Greek civilization (and perhaps the Egyptian), lead has been known to cause illness among workers in lead-using occupations.

Q & A

➞ ➞ ➞ IS LEAD POISONING SERIOUS?

Yes. Classic lead poisoning occurs when large amounts of lead get into the body. It can permanently damage the brain, nerves, and kidneys. In the worst cases, this damage can cause serious disability or death. Fortunately, cases this severe are now uncommon. Lead also has serious effects on blood and on reproductive functions.

Less severe cases can also have a heavy impact on those who are affected. Some of the first noticeable effects on a person who is becoming lead poisoned are difficulty concentrating, irritability, headaches, constant fatigue, and depression. While none of these is life-threatening, each can contribute to other problems: poor performance at work, emotional problems, or unbearable stress on family life. Unfortunately, the people affected — and their doctors — often don't recognize the link between these symptoms and workplace lead.

If too much contact with lead continues, damage to internal organs progresses. Often there are no outward signs until irreversible harm has been done.

In some cases, the children of lead-exposed workers get poisoned by lead dust carried home on their parents' work clothes or shoes. Children's mental development is highly sensitive to damage from lead. In fact, lead's damage happens most easily during pregnancy in the developing fetus. Tiny amounts of lead in a pregnant woman — amounts that wouldn't harm an adult — can cause permanent damage to the fetus. Lasting behavior problems and lowered intelligence can result.

For most cases of lead poisoning, there is no medical treatment. For that reason, prevention is absolutely essential.

➞ ➞ ➞ IS LEAD POISONING STILL A PROBLEM IN THE 1990s?

Some workers and employers in lead-using industries think that lead poisoning is a thing of the past. That's wishful thinking.

Here's the real picture: In 1989, the California Occupational Health Program received reports of 2,545 people with too much lead in their blood. The vast majority of these people picked up their lead at work. But these 2,545 cases in one year are just the tip of the iceberg. Most people who are exposed to lead at work never get blood-lead tests at all, so the official count is just a fraction of the true number who have high lead levels.

Not surprisingly, this typical high-lead worker hasn't gotten adequate safety training. His workplace lacks the special dust-collection equipment that is needed to handle lead safely, and it doesn't have showers where he could clean up before going home.

Q & A

➡ ➡ ➡ HOW DOES RADIATOR REPAIR COMPARE WITH OTHER INDUSTRIES?

By many measures, radiator repair has the worst record of protecting its workers among all lead-using industries. Here are the facts for California in 1989:

Q: What industry had the most companies with *known* elevated blood-lead levels (40 µg/dl or higher) in one or more workers?

A: Radiator repair had dozens — more than twice as many companies as the next-worse industries: battery manufacturing, foundries, and firing ranges.

Q: What industry had the most workers with *known* blood-lead levels above 60 µg/dl (the level at which a person cannot legally stay on the job)?

A: Radiator repair had the most — more than one-fifth of all the Californians known to have such extreme levels.

Q: In a study of five high-risk lead-using industries, which had the worst record for doing any blood-lead testing to see if workers were getting too much lead?

A: Radiator repair companies were worst. Fewer than one of every six radiator shops had tested workers' levels. This suggests that many more radiator repair workers may be getting poisoned than the statistics show.

➡ ➡ ➡ HOW CAN LEAD POISONING BE PREVENTED?

Lead poisoning is a disease that can be prevented in every single case. The general idea is simple: lead has no useful role in the human body, so keep it out. Two kinds of actions are required. First, cut the amount of lead-containing dusts and fumes in your workplace. Second, give workers the knowledge and tools to protect themselves from the lead that remains.

Some companies can eliminate the risk altogether by switching to lead-free products. Others must rely on protective measures: special equipment for collecting lead dust and fumes, frequent safety training for workers, and perhaps respirators and other safety equipment.

The goal of preventing lead poisoning can be achieved. But as long as lead use is so widespread, progress must be achieved by changes made in individual companies such as yours. This will require commitment from employers, cooperation from workers, and assistance from government. The California Occupational Health Program prepared this manual to help employers understand that they can — and must — clean up the lead in their workplaces.

Q & A

➡ ➡ ➡ WHY SHOULD THIS COMPANY WORRY ABOUT LEAD POISONING?

The statistics leave no doubt that lead poisoning is a danger to workers' health. Certainly no employer wants to be responsible for exposing employees to a risk of serious illness.

Consider also the day-to-day business costs: Does your workers' comp. bill seem too high? Do you lose money when employees are out sick repeatedly? Do you have any problems with employee morale or productivity? If you answered "Yes" to any of the questions, then creating a safe and healthy workplace can bring you real benefits.

Many business experts believe that employees' loyalty to the company is a key to productivity and profitability. To gain that loyalty, show them you are protecting their health by providing the tools they need to work efficiently and safely.

There is another, darker side as well. Companies that use lead-containing materials without correcting the potential hazards are taking a big risk. What will happen if an OSHA inspector knocks on your door? If any employee gets sick from lead poisoning? Or if an employee's child gets sick? And what about *your* blood-lead level? Perhaps you know the answers to these questions. But just in case, consider this:

If an OSHA inspector finds serious uncontrolled lead problems in your company, you could have to pay a substantial fine, *and* you could be required to comply quickly with every element of the OSHA regulations, reporting your progress to OSHA. If any workers get lead poisoning, the OSHA bars them from working in lead areas until their blood-lead levels come down. Meanwhile, you would be legally required to pay them *even if they cannot come to work!* If lead from your company makes anyone else sick, you could face an enormous lawsuit. And finally, think about yourself and your family. Small business owners and managers some times have *higher* blood-lead levels than their employees. Every one of these problems is likely to be far worse if you wait for them to happen, rather than taking action now.

As you make plans for your company's future, consider the benefits and the risks. Fixing any potential lead problem now could make the difference between success and failure.

➡ ➡ ➡ IT'S A HEAVY PROBLEM, BUT YOU CAN COPE WITH IT.

Many lead-using companies, even entire industries, have realized the value of setting up lead-safety programs. The transition isn't always simple, and it may require skills or information that you don't have yet. On the bright side, there are organizations you can call on for assistance. Companies that fix workplace health problems often find that their operations have become better organized as a result, or that their workers have become better trained and more productive.

Q & A

➡ ➡ ➡ WHAT IS BLOOD-LEAD TESTING?

The blood-lead test itself is relatively painless and reliable. One small tube of blood is drawn from a worker's vein and is analyzed for lead content at a laboratory. A blood-lead testing program should include all workers who may come in contact with lead. Some companies arrange to have blood samples drawn at the work site by a qualified professional from the medical lab. Others send their workers to a nearby medical lab to have blood drawn.

Blood-lead testing must be under the direction of a licensed physician. The doctor will be responsible for ordering the blood tests from a certified blood-testing laboratory, reviewing the test result, and performing any needed follow-up medical examinations. All tests must be free of charge to the employees. New employees should have a blood test before they start work, to establish their "baseline" blood-lead level. Periodic follow-up tests are required for most lead-exposed employees at least every six months.

A blood-lead test cannot be used alone to assess a person's health. The blood-lead test only helps show how much lead is in the person's body, not whether the lead has caused any damage. To find whether any damage has been done, a doctor must do a thorough medical evaluation, including physical exam.

The OSHA lead regulations require a full medical evaluation for employees who work in areas with 30 $\mu g/m^3$ of more of airborne lead, to find out whether the lead has actually done any damage.

➡ ➡ ➡ WHAT DOES A MEDICAL PROGRAM INCLUDE?

The OSHA lead regulations require employers to have a medical program, set up and run by a medical doctor. He must provide several services, including blood-lead testing, medical evaluations, and communication with both you and the employee.

➡ ➡ ➡ WHAT IS AIR SAMPLING?

Air sampling is a way of measuring how much lead dust or lead fumes are in the air that workers breathe. This is important because breathing lead dust or fumes is the usual way lead gets into the body. Samples of workplace air are collected by special pumps; the lead is trapped on small, ultra-efficient filters; and the filters are sent off to a laboratory for analysis. The sample collection equipment is lightweight and portable. Usually, several workers at each work site wear sampling pumps throughout one or more work days. Air samples should be collected on days when production is in full swing.

Q & A

To be valid, air sampling must be done under the supervision of an industrial hygienist—a qualified professional trained in workplace air sampling. The industrial hygienist will plan the number of air samples needed, and will select the workers who will wear the sampling equipment and the days on which sampling should be done. The industrial hygienist will also be responsible for assuring that high-quality, reliable results are obtained.

➡ ➡ ➡ WHICH IS BETTER, BLOOD-LEAD TESTING OR AIR SAMPLING?

Air sampling has a few advantages and several disadvantages as a tool to help you figure out whether you have a lead problem in your workplace. Properly done, air sampling can help pinpoint the source of lead dust or fumes in a workplace. Unlike a blood-lead test, it can identify a potential problem area before lead builds up in any worker's body. For some companies, air sampling is legally required, but blood-lead testing is only recommended.

Unfortunately, air sampling alone sometimes fails to detect serious workplace lead problems. For example, if the sampling is done on a day when a major lead-using process is temporarily shut down, the results may be unrealistically low. Some workers — perhaps as a result of particular work habits — are exposed to more lead dust and fumes than their coworkers are. Finally, lead poisoning is sometimes caused by lead contamination of work clothes, food, and lunchrooms, rather than by airborne dust and fumes.

Blood-lead testing has the advantage of showing the amount of lead that has entered a worker's body. It can help detect a problem before any signs of lead poisoning have developed. For that reason, periodic blood-lead testing is recommended (and often legally required) for all workers who handle lead or who may be exposed to lead dust and fumes. One note of caution: a low blood-lead level is not always a sure sign that the job is safe. That's why it's especially important to discuss the test results with your doctor.

Q & A

➡ ➡ ➡ WHAT AIRBORNE LEAD LEVELS ARE SAFE?

Once you have received the results from your air sampling, check to see how they compare to the categories shown below.

Airborne ($\mu g/m^3$)	Health Risks	OSHA Requirements
0-30	Relatively safe	No further actions required.
30-50	Exposure high enough to damage workers' health might be occurring	Above the OSHA "Action Level" of 30 $\mu g/m^3$. Blood lead-testing, follow-up air sampling (within six months), and worker training required.
50-150	Damage to workers' health is likely to occur with prolonged exposure.	"Permissible Exposure Limit" of 50 $\mu g/m^3$. In additon to the above, airborne lead levels must be reduced. Respirators may be required as a temporary measure, while equipment to cut down airborne lead levels is being installed. Follow-up air sampling must be conducted within 3 months. Clean work clothing, showers, and lunchrooms must be provided.
over 150	Workers' health may be damaged in a relatively short time.	Airborne lead levels must be reduced. Clean work clothing must be provided daily.

➡ ➡ ➡ WHAT ARE THE SOURCES OF LEAD EXPOSURES IN RADIATOR SHOPS?

There are three main processes which result in lead exposure in radiator shops: tearing the radiator apart, soldering it back together, and cleaning the tanks with wire wheels. Running the headers is an additional source of lead exposure. Since lead-containing solder is used, lead fumes or dust are produced during all of these processes. Since radiator mechanics are closest to these processes, their airborne lead

exposures are usually higher than other employees in the shop, and they are at the greatest risk of lead poisoning. In shops where lead exposures are poorly controlled, other shop employees, in addition to mechanics, may also be at risk of lead poisoning.

➡ ➡ ➡ WHAT KIND OF VENTILATION WORKS BEST TO REDUCE THE AMOUNT OF AIRBORNE LEAD DURING RADIATOR REPAIR?

Many radiator shops do not have effective exhaust ventilation systems to remove lead dusts and fumes from the shop. Wall and ceiling exhaust fans, open doors and windows, canopy hoods, and electrostatic precipitators are sometimes used to control lead exposures. But none of these devices is a recommended method of controlling the mechanic's lead exposure. All of these devices are positioned too far away from torching, soldering, and tank cleaning to prevent the inhalation of large amounts of airborne lead by the mechanic before it is collected by the device. In addition, these devices fail to capture lead in the air before it is spread through the shop, putting other employees at risk.

Three main types of dust/fume collection systems are recommended to control lead exposures in radiator repair shops. Booths and elephant trunk systems are effective in controlling lead fumes generated during tear down and soldering. Abrasive blasting cabinets (bead or sand blasters), which are used in many shops, are effective in controlling lead dust exposures during the cleaning of tanks. Each of these types of local exhaust systems is described below.

Booth (Backdraft hood)—This system consists of a large hood or booth which completely encloses the sides, back, and top of the test tank. The front of the booth, where the mechanic stands, is open. Since the booth encloses the test tank and the torching and soldering operations, lead fumes are drawn away from the mechanic as they are produced and are captured by the hood. Booths can be very effective in controlling mechanics' lead exposures, if the radiator is positioned inside the hood face (above the test-tank), if the fan pulls enough air into the system, and if cross-currents do not interfere with the flow of air into the hood.

Elephant trunk or adjustable arm exhaust—These systems consist of a flexible duct attached to the hood which the worker positions so that the hood is within 12 inches of the tear down or soldering operation. The hood needs to be repositioned frequently so that the distance between it and the point of generation of lead fumes is not more than 12 inches. If the hood is greater than 12 inches away, sufficient air velocity is generally not available to capture the lead fumes and pull the lead-contaminated air into the hood.

Q & A

The need for frequent repositioning is a major difference between the booth and elephant trunk systems, making exposure control more difficult to ensure with the elephant trunk than with the booth. If you use an elephant trunk system, it is essential for you to train mechanics on the need for repositioning the hood and to supervise them to ensure proper use. Otherwise, you may not succeed in controlling lead exposures. The need for frequent repositioning may make the use of an elephant trunk especially burdensome if mechanics are involved in piece work.

For shops which repair large industrial radiators, positioning of the elephant trunk system is much more difficult and more time consuming than for automobile radiators. In addition, in spite of the proper placement of the hood, lead fumes can escape from the radiator hose connections of industrial radiators several feet from the hood. At this distance from the hood, fumes will not be captured by the hood and will be spread through the shop.

Since the elephant trunk hood needs to be repositioned frequently, the quality of the arm is an important long-term investment. Poor quality arms are difficult to position, do not maintain their position well, and break down frequently. A cheap arm may cost more in the long run and fail to provide the exposure control for which it was purchased. To make it easier to reposition the hood, you should make sure that the handle on the hood is easy to reach even by short employees.

If you already have a booth around your test tank or an elephant trunk system, and the mechanic's airborne lead exposure or blood lead level is still too high, you will need the help of a ventilation contractor. If you have other types of ventilation systems, such as a canopy hood or wall or ceiling exhaust fan, and the mechanic's airborne lead exposure is too high, it will probably be easier and cheaper in the long-run for you to abandon your system and install either a booth or elephant trunk.

Since radiator repair results in airborne by-products which are corrosive to metals, it is important that any fume collection system that you install is made of nonmetal materials or metal which is coated with substances which will resist corrosion. If your system is made of metal, all parts, including fan blades and the inside and outside of ducts and hoods, which may come into contact with corrosive by-products, should be coated. Otherwise, your system will not last. Since corrosion-resistant coatings need to be reapplied periodically in order to provide ongoing protection, you may prefer to purchase fume collection systems which use nonmetal parts, such as fiberglass and plastics. If you purchase an elephant trunk system, make sure that there are no metal parts *inside* the flexible ducts, because reapplication of the corrosion-resistant coating will be extremely difficult.

Check with your state or local environmental agency about the requirements for pollution control devices, such as filters on ventilation systems for hand-held soldering operations.

Q & A

Bead blaster—The use of a wire wheel to clean tank surfaces has a high potential for lead exposure and should be avoided when possible. Many shops have replaced wire wheels with bead blasters for most tank cleaning. In addition to controlling lead dust exposures, bead blasters are labor-saving devices which often do a better cleaning job than wire wheels. The bead blaster completely encloses the cleaning operation, and provides a viewing window and two inlets with sturdy gloves so that the worker can manipulate the tank. Bead blasters must be vented to the outside to ensure that lead dust does not enter the workroom. If bead blasters are well maintained and used properly, they control lead exposures during cleaning operations very effectively. However, holes in the gloves and deteriorated gaskets around the door, can result in significant leakage of lead dust into the shop. In order to prevent the contamination of your shop with lead, the door of the blaster should not be opened to remove a tank until the dust has completely settled. Likewise, be careful to prevent lead dust from becoming airborne when cleaning out the blaster's dust collector.

➡ ➡ ➡ HOW CAN WE MAKE SURE THAT OUR FUME COLLECTION SYSTEMS ARE WORKING CORRECTLY?

After any dust or fume collection system is installed, check the system's air flow to make sure that the system is operating properly. It is not unusual, even for systems that are professionally designed and installed, to require adjustments so that the system functions correctly and controls exposures. Air flow should be measured by the firm that installs your ventilation system. The OSHA Lead Regulations also require that airflow measurements of ventilation systems used to control lead exposures be made every 3 months or within 5 days after any change in production or work process which might result in an increase in workers' exposure to lead. Records should be kept of all tests of ventilation systems.

In addition to testing the air flow in your shop's ventilation system, it is important to monitor the mechanic's full-shift exposure to lead to make sure that lead exposures are well controlled by the system which is installed. Whether you install an elephant trunk system or a booth, you should plan to have exposure monitoring done as soon as it is installed. For information about help with exposure monitoring, see Chapter 3. Regardless of which system you install, the OSHA Lead Regulations require that the effectiveness of your ventilation system be demonstrated by air monitoring.

Q & A

➡ ➡ ➡ HOW SHOULD WE MAINTAIN OUR FUME COLLECTION SYSTEMS?

Once you've tested the ventilation system and verified that it controls exposures, periodic maintenance is the only way to ensure that the system continues to work effectively and controls exposures. Otherwise, problems such as corrosion of ducts and fans, plugged ducts and filters, and loose fan belts can make the system ineffective in controlling lead exposures. Regular maintenance is also the best way to protect the investment that you made in your shop's ventilation system. Developing a maintenance schedule can be helpful in this regard. At a minimum, to maintain your ventilation system you should:

1. lubricate the fan, motor, and drive;
2. inspect the fan wheel and housing for dust buildup and wear;
3. inspect the fan belt, if present, for proper tension;
4. inspect the ducts to make sure that they're not partially plugged;
5. inspect the entire system for corrosion;
6. for elephant trunks, inspect and lubricate the metal parts of the adjustable arm and inspect the flexible duct to make sure that it's not collapsed.

Maintaining your fume collection system can also result in lead exposure. Care should be taken to keep exposures during these operations as low as possible. Respirators should be worn if lead dust can become airborne during maintenance. See Chapter 4 for information about respirators.

Glossary

air sampling — Test of the amount of dust or fumes in the air workers breathe. Lightweight, portable equipment is usually used. Air sampling must be done by a trained professional.

blood-lead level — The amount of lead in a worker's blood. This helps show how much lead has been absorbed in the body. Blood-lead levels are usually reported in µg/dl (see below) or µg/100 g, which are basically the same.

COHP — California Occupational Health Program — a program of the California Department of Health Services, which conducts practical research about the causes of work-related injuries and illness, and develops measures for protecting workers. COHP has no enforcement or regulatory authority.

exposure — The amount of lead (or other toxic substance) in a workers' environment that can be absorbed into the body.

fumes — The mixture of gases and tiny particles released into the air by hot or smokey processes. For lead-using processes, the particles usually contain lead.

industrial hygienist — An expert in recognizing and controlling workplace health hazards. Air monitoring is usually done by industrial hygienists.

NIOSH — The National Institute for Occupational Safety and Health — the Federal Institute responsible for ensuring safe and healthful working conditions for all Americans by conducting research, recommending standards, providing technical assistance, and training health and safety professionals.

OSHA — Occupational Safety and Health Administration — the agency that enforces workplace safety regulations.

µg/m^3 — micrograms (µg) per cubic meter (m^3). Airborne lead levels are usually described in µg/m^3 — the amount of lead in each cubic meter of air. A typical worker breathes about 10 cubic meters of air during a workday.

µg/dl — micrograms (µg) per deciliter (dl). In this book, blood-lead levels are described in µg/dl — the amount of lead in each deciliter of blood. Adults have about 50 deciliters of blood.

Standards & Interpretations

1910.1025 — FEDERAL LEAD STANDARD

(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.

[44 F.R. 50338, August 28, 1979.]

(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 divided by the 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.

(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 employee 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 analytical methods used meet the accuracy and confidence level of paragraph (d)(9) of this section; 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 concentration 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 (d)(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 (d)(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 work site, 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 include 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 (page 93), 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 $\mu g/m^3$.

(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 work site 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.

Standards & Interpretations

TABLE I – IMPLEMENTATION SCHEDULE

Industry[1]	Compliance Dates		
	200 µg/m³	100 µg/m³	50 µg/m³
Primary lead production	(3)	June 29, 1984[2]	June 29, 1991[2]
Secondary lead production	(3)	June 29, 1984[2]	June 29, 1986[2]
Lead acid battery manufacture	(3)	June 29, 1983[2]	June 29, 1986[2]
Automobile manufacture/solder grinding	(3)	N/A	June 29, 1986[2]
Electronics, gray iron foundries, ink manufacture, paints and coatings manufacture, wall paper manufacture, can manufacture, and printing	(3)	N/A	June 29, 1982[2]
Brass and bronze ingot manufacture, lead chemical manufacture, and secondary copper smelting	(3)	N/A	5 years[4]
Nonferrous foundings	(3)	N/A	5 years[4,5]
All other industries	(3)	N/A	2 years[4]

[1] Includes ancillary activites located on the same work site.

[2] This date is calculated by counting, from June 29, 1981 (the date when the United States Supreme Court denied certiorari and lifted the stay on the implementation of paragraph (e) (1)), the number of years specified for the particular industry in the original lead standard for compliance with the given airborne exposure level. The denial of certiorari followed a decision of the United States Court of Appeals for the District of Columbia Circuit finding compliance with paragraph (e) (1) to be feasible for the relevant industries.

[3] On the effective date of this standard, March 1, 1979. This continues an obligation from Table Z-2 of 29 CFR 1910.1000, which has been in effect since 1971 but was deleted from the Code of Federal Regulations upon the effectiveness of this standard.

[4] Expressed as the number of years from the date on which the court lifts the stay on the implementation of paragraph (e) (1) for the particular industry.

[5] Large nonferrous foundries (20 or more employees) are required to achieve 50 µg/m3 by means of engineering and work practice controls. Small nonferrous foundries (fewer than 20 employees), however, are only required to achieve 75 µg/m3 by such controls. All foundries are required to comply within five years.

(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 workstation 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 (page 95).

(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.

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 (2000X)	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.

(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 $\mu g/m^3$ 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)-(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/100 ml, whichever is greater, and shall be conducted by a laboratory licensed by the Center for Disease Control (CDC), United States Department of Health, Education, and Welfare 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)(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 nonoccupational), 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)-(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 $\mu g/100$ 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 $\mu g/m^3$ 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 70 $\mu g/100$ 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 $\mu g/100$ 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, where 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 measures 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 limitation 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 (g)-(i). Medical removal records shall be provided in the same manner as environmental monitoring records.

[45 F.R. 54333, August 15, 1980.]

(iii) Upon request, the employer shall make an employee's medical records required to be maintained by this section available to the affected employee or former employee or to a physician or other individual designated by such affected employee or former employees for examination and copying.

(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).

[45 F.R. 35283, May 23, 1980.]

(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 February 24, 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) Startup 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) 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) 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 lead smelting and refining and in lead storage battery manufacturing — 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.

(E) All other industries — 1 year from the date on which the court lifts the stay on the implementation of paragraph (e)(1) for the particular industry.

[52 F.R. 29274, July 11, 1989]

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

[43 F.R. 53007, November 14, 1978.]

[corrected at 44 F.R. 5446, January 26, 1979.]

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

[54 F.R. 24334, June 7, 1989]

APPENDIX A - 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 workday. 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 your 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.

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A significant portion of the lead that you inhale or ingest gets into your bloodstream. Once in your bloodstream, 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, 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/100 g). The blood lead levels of workers (both male and female workers) who intend to have children should be maintained below *30* µg/100 g 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 (g) of lead (1 mg = 1000 µg) per 100 grams (100 g), 100 milliliters (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 100 g, 100 ml, or dl.

PbB measurements show the amount of lead circulating in your bloodstream, 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/100 g, 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/

100 g. Other studies have shown other forms of diseases in some workers with PbBs well below 80 µg/100 g. 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/100 g. 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.

[56 F.R. 24686, May 31, 1991]

APPENDIX B - EMPLOYEE STANDARD SUMMARY

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

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

The standard sets a permissible exposure limit (PEL) of fifty micrograms of lead per cubic meter of air (50 $\mu g/m^3$), averaged over an 8-hour workday. 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 workday 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 $\mu g/m^3$.

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 $\mu g/m^3$) 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 three 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.

[56 F.R. 24686, May 31, 1991]

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). 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.

[56 F.R. 24686, May 31, 1991]

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 through 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 $\mu g/m^3$. Appropriate protective work clothing and equipment can include coveralls or similar full-body work clothing, gloves, hats, shoes or disposable shoes 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 vacuuming 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, 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, 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 nonoccupational 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. Thus biological monitoring under the standard is currently limited to PbB testing. If a worker's PbB exceeds 40 µg/100 g 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/100 g. Each time your PbB is determined to be over 40 µg/100 g, 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/100 g. Anytime your PbB exceeds 80 µg/100 g 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/100 g 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.

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Medical examinations beyond the initial one must be made available on an annual basis if your blood lead level exceeds 40 µg/100 g 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).

The standard specifies the minimum content of pre-assignment and annual medical examinations. The content of other types 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. 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 opinions 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 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, ($CaNa_2EDTA$), 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 involves giving a patient a dose of the drug then collecting all urine excreted for some period of time as an aid to the diagnosis of lead poisoning.

In cases where the examining physician determines that chelation is appropriate, you must be notified in writing of this fact before such treatment. This will inform you of a potentially harmful treatment, and allow you to obtain a second opinion.

IX. MEDICAL REMOVAL PROTECTION - PARAGRAPH (K)

Excessive lead absorption subjects you to increased risk of disease. Medical removal protection (MRP) is a means of protecting you when, for whatever reasons, other methods, such as engineering controls, work practices, and respirators, have failed to provide the protection you need. MRP involves the temporary removal of a worker from his or her regular job to a place of significantly lower exposure without any loss of earnings, seniority, or other employment rights or benefits. The purpose of this program is to cease further lead absorption and allow your body to naturally excrete lead which has previously been absorbed. Temporary medical removal can result from an elevated blood lead level, or a medical opinion. Up to eighteen 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 long-term 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 µg/100 g 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 µg/100 g. These criteria for removal and return will change according to the following schedule:

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	Removal blood lead (µg/100g)	Air lead (µg/m³)	Return blood lead (µg/100 g)
After March 1, 1980	70 and above	50 and above	At or below 50
After March 1, 1980	60 and above	30 and above	At or below 40
After March 1, 1983	50 and above averaged over six months	30 and above	At or below 40

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 situations, 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 include more than just your base wage; it includes overtime, shift differentials, incentives, and other compensation you would have earned if you had not been removed. During the period of removal you must also be provided with appropriate follow-up medical surveillance. If you were removed because your blood lead level was too high, you must be provided with a monthly blood test. If a medical opinion caused your removal, you must be provided medical tests or examinations that the doctor believes to be appropriate. If you do not participate in this follow-up medical surveillance, you may lose your eligibility for MRP benefits.

When you are medically eligible to return to your former job, your employer must return you to your "former job status." This means that you are entitled to the position, wages, benefits, etc., you would have had if you had not been removed. If you would still be in your old job if no removal had occurred that is where you go back. If not, you are returned consistent with whatever job assignment discretion your employer would have had if no removal had occurred. MRP only seeks to maintain your rights, not expand them or diminish them.

If you are removed under MRP and you are also eligible for worker compensation or other compensation for lost wages, your employer's MRP benefits obligation is reduced by the amount that you *actually* receive from these other sources. This is also true if you obtain other employment during the time you are laid off with MRP benefits.

The standard also covers situations where an employer *voluntarily* removes a worker from exposure to lead due to the effects of lead on the employee's medical condition, even though the standard does not require removal. In these situations MRP benefits must still be provided as though the standard required removal. Finally, it is important to note that in all cases where removal is required, respirators cannot be used as a substitute. Respirators may be used before removal becomes necessary, but not as an alternative to a transfer to a low exposure job, or to a lay-off with MRP benefits.

X. EMPLOYEE INFORMATION AND TRAINING - PARAGRAPH (L)

Your employer is required to provide an information and training program for all employees exposed to lead above the action level or who may suffer skin or eye irritation from lead. 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.

Standards & Interpretations

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

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 then 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 personnel 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 date 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. (pages for this notice), 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 D TO SECTION 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. The 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 a "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 #6 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 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 mask shall be changed at least weekly.

3. After selecting, planning, 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 shoulder. 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 to 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 breathe through his open mouth with tongue extended.

5. Using a DeVilbiss Model 40 Inhalation Medication Nebulizer, the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer or equivalent.

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) 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 particular 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 particular 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 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 or equivalent.

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 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 B10.)

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 its characteristic odor.

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 test 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 test agents (IAA, 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. [Appendix D amended at 48 F.R. 9641, 3/8/83.]

Progress Report 1
Testing

NAME

STREET

CITY STATE ZIP

NAME

POSITION

DATE: ____/ ____/ ____

Complete all sections. For items that refer to "workers," include yourself (or other owners, managers, etc.) If *you work in areas that may have lead dust or fumes.*

BLOOD-LEAD TESTING

1. This company has done blood-lead testing.
   _ Yes _ No

2. The medical doctor in charge is:

NAME

STREET

CITY STATE ZIP

Progress Report 1
Testing

3. Blood-lead testing has been provided as follows:
(Fill in a number in each space below.)

a. ____ workers had blood-lead tests.

b. ____ workers declined to have their blood-lead levels tested free-of-charge.

c. ____ workers were not offered blood-lead tests because they have no possible contact with lead-containing dusts or fumes.

4. Write the results of each worker's most recent blood-lead test on page 146.

AIR SAMPLING

1. This company has done air sampling.
_ Yes _ No

2. The industrial hygienist in charge is:

NAME

STREET

CITY STATE ZIP

3. This industrial hygienist is employed by:
_ OSHA Consultation Service
_ an insurance company: _____
_ a consulting firm: _____
_ this company.

Progress Report 1
Testing

4. Air sampling has been done on: *(Fill in a number in each space below.)*

   a. ___ work days,

   b. ___ workers (one or more days each)

5. Write the results for each worker tested on a separate sheet of paper and attach it and a copy of the industrial hygienist's report.

RESULTS

1. The results of the testing described above show that:

   _ No further testing or lead-control measures are required at this time.

   _ Too much airborne lead is present and/or workers' blood-lead levels are too high. (Be sure to follow the steps described in the manual's *Chapter 5: Cutting Airborne Lead* and Chapter 7: If You Still Have Problems...)

   (If you are unsure what the testing results show, review the manual's Chapter 3: Blood Testing and Air Sampling, or talk to the medical doctor or industrial hygienist who did the testing.)

Progress Report 1
Testing

D. Testing results Please list all employees below. Fill in their testing results or explain why they were not tested.

If your employees do not all fit on this page, use additional copies.

Employees who had blood-lead testing and/or air sampling. (For tests not done, write "none" under Results.)

Name	Job	Date Hired	Date of Birth	Blood lead testing	
				Date	Result

Progress Report 1
Testing

Employees who have not had blood-lead testing and/or air sampling.

Name	Job	Date Hired	Reason not tested (Check one)
			___no contact with lead. ___refused.
			___no contact with lead. ___refused.
			___no contact with lead. ___refused.
			___no contact with lead. ___refused.

NOTES:

Progress Report 2
Cleaning Up

CLEANING UP SHOP

1. Work areas were cleaned thoroughly on:
   (List the most recent date.) ___/___/___

2. This cleaning was done by:
   _ a cleaning service
   _ employees
   _ other: _____
   (Fill in name of cleaning service or employees below.)

_____
NAME

_____
ADDRESS/NAME

3. Cleaning was done by:
   _ wet sweeping, mopping, hosing, etc.
   _ wet vacuuming with shop vacuum
   _ vacuuming with HEPA vacuum

_____
BRAND MODEL
_ other: _____

4. The next thorough cleaning is scheduled for:
   (Fill in date.) ___/___/___

WORK CLOTHING

1. This company provides work clothing for all workers who may contact lead dust or fumes.
   _ Yes _ No

2. Work clothing is cleaned by:
   _ a laundry service

_____
NAME

_____
ADDRESS/NAME

Progress Report 2
Cleaning Up

_ employees clean their own
_ other: _____

3. Clean clothing is available:
_ daily
_ weekly
_ other: _____

4. Before going home, workers are required to:
(Check all that apply.)
_ take off work clothes
_ change clothes completely
_ change shoes
_ shower
_ none of the above
_ other:_____

EATING AREA

1. This company has an eating area separated by walls and doors from any work area where lead dust or fumes may be present.
_ Yes _ No

2. The eating area is best described as:
_ lunchroom only (in which no work is done)
_ office
_ outside
_ other:_____

3. Before using the eating area, workers are required to: *(Check all that apply.)*
_ wash hands
_ wash face
_ shower
_ take off work clothes, gloves, etc.
(Describe.) _____
_ none of the above

Progress Report 2
Cleaning Up

4. The following activities are allowed in the eating area only: *(Check all that apply.)*
   _ eating and drinking
   _ chewing gum, toothpicks, etc.
   _ warming food
   _ other:_____

5. Smoking is allowed:
   _ in work areas
   _ in eating area/lunchroom only
   _ nowhere in the company
   _ other:_____

RESPIRATORS

1. One or more employees are required to wear respirators.
   _ Yes _ No *(Please list.)*

_____
NAME

_____
NAME

_____
NAME

2. These workers will be required to wear respirators:
   _ as long as they work here
   _ temporarily *(Describe when they will no longer be required.)* _____

3. The type of respirators used by most of these workers is:
   _ powered, air purifying (PAPR)
   _ half-face, with cartridges
   _ disposable
   _ disposable, certified for use with toxic dusts
   _ other:_____

Progress Report 2
Cleaning Up

4. The brand and model used by most workers is:

BRAND MODEL

5. The fit of each workers' respirator has been tested to make sure it forms a good seal.
_ Yes _ No

6. Fit tests were conducted by:
_ OSHA Consultation Service
_ insurance company
_ respirator supplier
_ other:_____
_ doesn't apply (no fit tests)

WORKER MOTIVATION

1. To help employees understand the importance of keeping clean, this company has:
(Check all that apply.)
_ posted signs that prohibit eating and smoking in work areas
_ held one or more meetings to talk about safety and about cleanliness
_ used the sample letter "Dear Employees: About Cleaning Up."
_ set up a system of giving bonuses (money) to reward good performance.
_ other:_____

2. Workers generally follow the rules about personal cleanliness as described below:

a. wash *thoroughly* before eating
_ few _ most _ all

b. eat and drink in eating area only
_ few _ most _ all

c. smoke in designated areas only
_ few _ most _ all

d. shower before going home
_ few _ most _ all

Progress Report 2
Cleaning Up

e. change clothes before going home
_ few _ most _ all

f. change shoes before going home
_ few _ most _ all

g. wear respirator (if required)
_ few _ most _ all

3. Workers generally eat lunch as described below:

a. in the lunchroom
_ few _ most _ all

b. in work areas
_ few _ most _ all

c. in their cars
_ few _ most _ all

d. off company property
_ few _ most _ all

4. One or more workers don't seem to be able to follow the safety rules.
_ Yes *(Optional-list below.)* _No

NAME	PROBLEM

NAME	PROBLEM

NOTES:

Progress Report 3
Control Plan

LEAD SOURCES

1. In most the most recent testing, the highest test results were:
   Highest blood lead level:_____µg/dl
   Highest airborne lead level:_____$\mu g/m^3$

2. These test results show that airborne lead levels must be reduced to within acceptable limits.
   _Yes _No

3. This company's goal is to get and keep airborne lead levels below:
   _30 $\mu g/m^3$
   _50 $\mu g/m^3$
   _other:_____

4. The main sources of lead dust and fumes in the company are: *(Check all that apply.)*
   _ repair benches without fume collectors
   _ fume collectors that don't work properly
   _ wire wheels
   _ unsafe work practices
   _ other *(Describe below.)*

WORKSTATION	PROBLEM
WORKSTATION	PROBLEM
WORKSTATION	PROBLEM
WORKSTATION	PROBLEM

LEAD-FREE SOLDER

1. The company intends to switch to lead-free solder when (or if) it becomes available, and is committed to following the "lead-free solder plan."
   _ Yes _ No

2. The company will participate in field testing of lead-free solders, if requested.
   _ Yes _ No

Progress Report 3
Control Plan

1. The company plans to install new fume collection equipment at one or more work stations.
   _ Yes
   _ No
   _ All work stations already have fume collection systems

2. The type of equipment that will be installed is:
   _ ventilation booth(s)
   _ elephant trunk(s)
   _ other:_____

3. The system to be installed will be:
   _ prefabricated
   _ custom made

4. The system will include a built-in gauge to check its performance.
   _ Yes _ No

5. Fume collection systems will be installed at _____ workstations. *(Fill in number.)*

6. The following employees will work at the work stations with new fume collection systems:

_____
NAME

_____
NAME

_____
NAME

_____
NAME

7. *(Optional)* The equipment to be installed is:

_____
MANUFACTURER MODEL NO.

_____
MANUFACTURER MODEL NO.

Progress Report 3
Control Plan

BEAD BLASTER

1. The company plans to install a bead blaster.
   _ Yes
   _ No
   _ Already have one

2. Use of wire wheels instead of the bead blaster will not be allowed.
   _ Yes _ No

3. The bead blaster will be installed by:
   (Date) ___/ ___/ ___

4. The following workers who now use wire wheel will not use them after that date:

   NAME

   NAME

   NAME

   NAME

WORK PRACTICES

1. The work practices listed below can add extra lead dust and fumes into the air. Workers in the company generally use these work practices as described below.

   a. use too much solder or tinning compound
      _ no one _ few _ all or most
      _ doesn't apply _ not sure

   b. use too much heat when soldering or burning
      _ no one _ few _ all or most
      _ doesn't apply _ not sure

   c. work with their head in path of the fumes
      _ no one _ few _ all or most
      _ doesn't apply _ not sure

Progress Report 3
Control Plan

d. use wire wheel, even though bead blaster is available
_ no one _ few _ all or most
_ doesn't apply _ not sure

e. forget to turn on the fume collection system at their work station
_ no one _ few _ all or most
_ doesn't apply _ not sure

f. don't bother to position their "elephant trunk"properly
_ no one _ few _ all or most
_ doesn't apply _ not sure

g. other (Describe.)
_ few _ most _ all
_ few _ most _ all

2. One or more workers have work practices that seem to expose them to more lead dust or fumes than other workers.

_ Yes *(Optional—list below.)* _ No

NAME	PROBLEM
NAME	PROBLEM
NAME	PROBLEM
NAME	PROBLEM

Progress Report 4
Cutting Airborne Lead

FUME COLLECTION SYSTEMS

1. The company has installed fume collection systems at one or more work stations.
   _ Yes _ No

2. The table below lists *all* the fume collection systems in the shop, along with the workers who use each system, the date they were installed, the manufacturer, whether or not they have been tested, and their air flow rates. *(Also list workstations without fume collection systems, and check "none.")*

Workstation, Workers Tested?	System Type	Manufacturer	Model	Date Installed
a.	__booth __elephant trunk __none __other:			___Yes, air flow was ___ft. per minute ___No
b.	__booth __elephant trunk __none __other:			___Yes, air flow was ___ft. per minute ___No
c.	__booth __elephant trunk __none __other:			___Yes, air flow was ___ft. per minute ___No
d.	__booth __elephant trunk __none __other:			___Yes, air flow was ___ft. per minute ___No
e.	__booth __elephant trunk __none __other:			___Yes, air flow was ___ft. per minute ___No

Progress Report 4
Cutting Airborne Lead

3. The systems' performance was tested by: _____
NAME METHOD

4. An industrial hygienist or other safety specialist assisted in the design of these systems.
_Yes *(List name and company.)*

_____

_ No _ Not sure

5. Air sampling has been done since one or more of these systems were installed
_ Yes *(List sampling results in the "Tested" column of the table above.)*
_ No _ Not sure

BEAD BLASTER

1. The company has installed a bead blaster.
_ Yes _ No

2. The bead blaster was installed on:
(Date) ___/___/___

3. Use of wire wheels instead of the bead blaster is prohibited except in special circumstances.
_ Yes _ No

OTHER EQUIPMENT

1. The company has installed other types of equipment to help control airborne lead dust and fumes.
_ Yes *(Describe below.)* _ No

_____
WORK AREA/WORKER

_____
TYPE OF EQUIPMENT

_____
WORK AREA/WORKER

_____
TYPE OF EQUIPMENT

Progress Report 4
Cutting Airborne Lead

WORK PRACTICES

1. Since the Control Plan was completed, one or more workers have improved their work practices and are now working more safely.
   _Yes _ No

2. Listed below are workers who have *stopped* using the following unsafe work practices.
   a. used too much solder or tinning compound

_____
NAME

_____
NAME

b. used too much heat when soldering or burning

_____
NAME

_____
NAME

c. worked with their head in path of the fumes

_____
NAME

_____
NAME

d. used wire wheel, even though bead blaster is available

_____
NAME

_____
NAME

Progress Report 4
Cutting Airborne Lead

e. forgot to turn on the fume collection system at their work station

NAME

NAME

f. didn't bother to position their "elephant trunk"properly

NAME

NAME

g. other *(Describe.)*

NAME	PROBLEM
NAME	PROBLEM
NAME	PROBLEM

Progress Report 4 A
Lead-Free Solder

LEAD-FREE SOLDER

1. This company has switched *completely* to lead- free solder.
   _ Yes *(Date switched.)* ___/___/___
   _ No, but we're experimenting with it
   _ No, not available yet
   _ No, price too high or doesn't work well
   _ other: _____

2. The company intends to switch to lead-free solder when (or if) it becomes available, and is committed to following the "lead-free solder plan."
   _ Yes _ No

FUME COLLECTION

1. The company has installed fume collection equipment at one or more work stations.
   _ Yes _ No

2. The type of equipment that will/has been installed is:
   _ ventilation booth(s) _ elephant trunk(s)
   _ other: _____

3. The equipment that has been installed is:

_____

MANUFACTURER MODEL

_____

DATE INSTALLED

_____

MANUFACTURER MODEL

_____

DATE INSTALLED

Progress Report 4 A
Lead-Free Solder

WORK ORGANIZATION

1. All radiator disassembly (torching) is done at a bench that has a fume collection system.
   _ Yes _ No

2. This is accomplished by:
   _ one worker does all disassembly
   *(List name.)*_____
   _ various workers go to the disassembly bench as necessary
   _ other: _____

BEAD BLASTER

1. The company has installed a bead blaster.
   _Yes _No

2. The bead blaster was installed on:
   (Date) ___/___/___

3. Use of wire wheels instead of bead blaster is prohibited except in special circumstances.
   _Yes _No

RESPIRATORS

1. One or more employees are required to wear respirators.
   _ Yes _ No
   (Please list.)

_____
NAME

_____
NAME

_____
NAME

2. These workers will be required to wear respirators:
   _ as long as they work here
   _ temporarily *(Describe when they will no longer be required.)*_____

Progress Report 4 A
Lead-Free Solder

3. The type of respirators used by most of these workers is:
   _ powered, air purifying (PAPR)
   _ half-face, with cartridges
   _ disposable
   _ disposable, certified for use with toxic dusts
   _ other: _____

4. The brand and model used by most workers is:

   BRAND MODEL

5. The fit of each workers' respirator has been tested to make sure it forms a good seal.
   _ Yes _ No

6. Fit tests were conducted by:
   _ OSHA Consultation Service
   _ insurance company
   _ respirator supplier
   _ other: _____
   _ doesn't apply (no fit tests)

WORK PRACTICES

1. Since the Control Plan was completed, one or more workers have improved their work practices and are now working more safely.
   _ Yes _ No

2. Listed below are workers who have *stopped* using the following unsafe work practices.

   a. used too much solder or tinning compound

   NAME

   NAME

Progress Report 4 A
Lead-Free Solder

b. used too much heat when soldering or burning

NAME

NAME

c. worked with their head in path of the fumes

NAME

NAME

d. used wire wheel, even though bead blaster is available

NAME

NAME

e. forgot to turn on the fume collection system at their workstation

NAME

NAME

f. didn't bother to position their "elephant trunk" properly

NAME

NAME

g. other *(Describe.)*

NAME PROBLEM

Progress Report 5
Worker Safety Training

PRIVATE TRAINING CONSULTANT

1. A consultant provided safety training for this company's workers.
   _ Yes _ No

2. The training consultant was:

_____
NAME

_____
STREET

_____
CITY STATE ZIP

3. This consultant is employed by:
   _ OSHA Consultation Service
   _ an insurance company:
   _ a consulting firm: _____

4. On a separate sheet of paper, write the names of the workers who were trained, and attach it and the trainer's description of the program.

COMPANY TRAINED ITS WORKERS

1. The company developed and conducted its own worker safety training program.
   _ Yes _ No

2. The program used materials developed by:
   _ California Occupational Health Program
   _ other *(Describe below.)*
   _ no written or other materials used

_____
MATERIALS

_____
PREPARED BY

Progress Report 5
Worker Safety Training

3. The number of hours that each worker spent in safety training was: _____.

4. The person who developed and conducted the training was: _____

5. The training program consisted of: *(Describe.)*

_____

TOPICS, TEACHING METHODS, ETC.

_____

6. On a separate sheet, write the names of the workers who were trained and attach.

FOLLOW-UP TRAINING

1. Follow-up training will be provided.
   _ Yes _ No

2. This training will be provided:

By: _____

_____

TRAINER

3. The training is scheduled for: ___/___/___
   DATE

EVALUATION

1. The training program included a method for evaluating whether or not the workers had actually learned about working safely with lead.
   _ Yes _ No

Progress Report 5
Worker Safety Training

2. The method used to evaluate the effectiveness of the training program was:
   _ a written test for each worker
   _ a test, given to a group of workers
   _ a "hands-on" test
   _ no specific test; just used judgement
   _ not sure
   _ other: _____

3. What subjects were workers most interested in?

4. What subjects were hardest to teach?

WORKERS TRAINED

1. The following workers received safety training as described in this progress report.
   (For each worker, indicate how well you think they learned about working safely with lead.)

Worker Safety Knowledge
Name _____ ___Excellent ___Good ___Fair ___Poor
Name _____ ___Excellent ___Good ___Fair ___Poor
Name _____ ___Excellent ___Good ___Fair ___Poor
Name _____ ___Excellent ___Good ___Fair ___Poor
Name _____ ___Excellent ___Good ___Fair ___Poor
Name _____ ___Excellent ___Good ___Fair ___Poor

NOTES:

Progress Report 6 Review

NEW EMPLOYEES

1. The following workers have been hired since the company completed earlier Progress Reports. Testing.

NAME

NAME

NAME

2. The following have been provided for new employees:
   _ baseline blood-lead test
   _ baseline physical exam
   _ training about the danger of lead
   _ training in safe work practices, using ventilation systems, keeping clean, etc.

BLOOD TESTING AND AIR SAMPLING

1. The most recent blood-lead testing was on:
   (List the most recent date.) ___/___/___

2. Blood-lead testing is up-to-date for all workers.
   _ Yes _ No

3. The most recent air sampling was on:
   (List the most recent date.) ___/___/___

4. Air sampling is up-to-date for all worker areas.
   _ Yes _ No

5. Testing shows that the company needs to reduce airborne lead levels and/or take other safety measures.
   _ Yes *(One or more workers have blood-lead levels of 40 µg/dl or higher, OR some work areas have 30 µg/m^3 or more of airborne lead.)*
   _ No *(All test results are below those levels.)*

Progress Report 6 Review

6. Fill out an updated *Progress Report 1: Testing,* showing the results of the company's most recent blood-lead testing and air sampling. Attach it to this *Progress Report.*

KEEPING CLEAN

1. Cleaning the shop is done by:
   _ wet sweeping, mopping, hosing, etc.
   _ wet vacuuming with shop vacuum
   _ vacuuming with HEPA vacuum

   BRAND MODEL
   _ other: _____

2. Workers generally follow the rules about personal cleanliness as described below:
   a. wash *thoroughly* before eating
      _ few _ most _ all
   b. eat and drink in eating area *only*
      _ few _ most _ all
   c. smoke in designated areas *only*
      _ few _ most _ all
   d. shower before going home
      _ few _ most _ all
   e. change clothes before going home
      _ few _ most _ all
   f. change shoes before going home
      _ few _ most _ all
   g. wear respirator (if required)
      _ few _ most _ all

3. Workers generally eat lunch as described below:
   a. in the lunchroom
      _ few _ most _ all
   b. in work areas
      _ few _ most _ all
   c. in their cars
      _ few _ most _ all

Progress Report 6 Review

d. off company property
_ few _ most _ all

4. One or more workers are required to wear respirators.
_ Yes *(Describe below.)* _No

NAME REASON

NAME REASON

NAME REASON

WORKER SAFETY TRAINING

1. Workers last received safety training on:
(List most recent date.) ___/___/___

2. The training was conducted by:
_ COHP Training Program
_ professional training consultant
_ the company did its own training
_ other: _____

3. Safety training is up-to-date for all workers.
_ Yes _ No

CUTTING AIRBORNE LEAD

1. Additional equipment to control airborne lead has been installed since the company completed *Progress Report 4: Cutting Airborne Lead.*
_ Yes *(Fill in an up-to-date* Progress Report 4, *and attach it to this* Progress Report.)
_ No

2. The company uses fume collection systems and/or other equipment to keep airborne lead within acceptable limits.
_ Yes _ No

Progress Report 6
Review

3. The performance of this equipment was last checked on: *(Date)* ___/___/___

4. This equipment is now due to have its performance re-checked.
   _ Yes *(This can be done by conducting either air flow measurements or air sampling, or both.)*
   _ No

5. Additional safety equipment is needed and/or planned.
   _ Yes _ No

MEDICAL EVALUATIONS

1. Within the previous 12 months, one or moreworkers have had complete medical evaluations to find out whether lead might be affecting their health.
   _ Yes *(List below.)* _ No

_____
NAME

_____
NAME

_____
NAME

2. The medical doctor who performed the evaluations is:

_____
NAME

_____
STREET

_____
CITY STATE ZIP

Progress Report 6
Review

3. This doctor is:
   _ personal physician of employee or employer
   _ the company's *medical supervisor*
   _ other: _____

4. Medical evaluations are up-to-date for all workers who need them.
   _ Yes _ No

MEDICAL REMOVAL

1. During the previous twelve months, one or more workers have been temporarily reassigned (on *medical removal)* because of high blood-lead levels (60 µg/dl or higher, or averaging 50 µg/dl for six months.)
   _ Yes *(List below.)* _ No

Medical removal to lead-free work			
Name	Job or work area while on medical removal	Date started	Ended

GETTING HELP

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To get a full safety and health survey of the hazards which exist in your workplace, you can request a consultation visit from your State Consultation Program listed below:

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