

Part 1

Lead in Drinking Water Overview

Section 1

Background Information

This section provides general information concerning the health effects of lead, how lead is used and distributed in the environment, how lead gets into drinking water, why it may be a problem in your facility, and, finally, how lead in drinking water is regulated. This background information should provide you with a framework for embarking upon your own lead testing program.

Health Effects of Lead: Why You Should Be Concerned

Lead is a toxic metal that can be harmful to human health when ingested or inhaled. Even small doses of lead can be harmful. Unlike most other contaminants, lead is stored in our bones, to be released later into the bloodstream. Thus, even small doses can accumulate and become significant. The groups most vulnerable to lead include fetuses and young children.

Pregnant Women and Fetuses: Accumulated lead stored in mothers may damage a child before it is born, causing a lower birth weight and slowing down normal physical and mental development. Recently published studies suggest that even low levels in a mother may later affect an infant's mental performance.

Young Children: Young children, especially those under the age of six, are particularly sensitive to the effects of lead. Because their bodies are still developing, small children process lead differently than adults. Their growing bodies tend to absorb more lead than an adult. Thus, lead can affect them at smaller doses. Even at low levels of lead exposure, children may experience lower IQ levels, impaired hearing, reduced attention span and poor classroom performance. At high levels, lead can seriously damage the brain.

Middle-aged Men and Women: Some recent studies have found an association between blood-lead levels and slight increases in blood pressure among adults. The relationship is more marked in middle-aged men but is also significant for middle-aged women. The significance of any lead-related increases in blood pressure in connection to more serious cardiovascular diseases remains to be determined.

The degree of harm from lead exposure depends on a number of factors including the frequency, duration, and dose of the exposure(s) and individual susceptibility factors (e.g., age, previous exposure history, nutrition and health). In addition, the degree of harm depends on one's total exposure to lead from all sources in the environment—air, soil, dust, food, and water. Lead in drinking water can be a significant contributor to overall exposure to lead, particularly for infants whose diet consists of liquids made with water, such as baby food formula.



Background Information

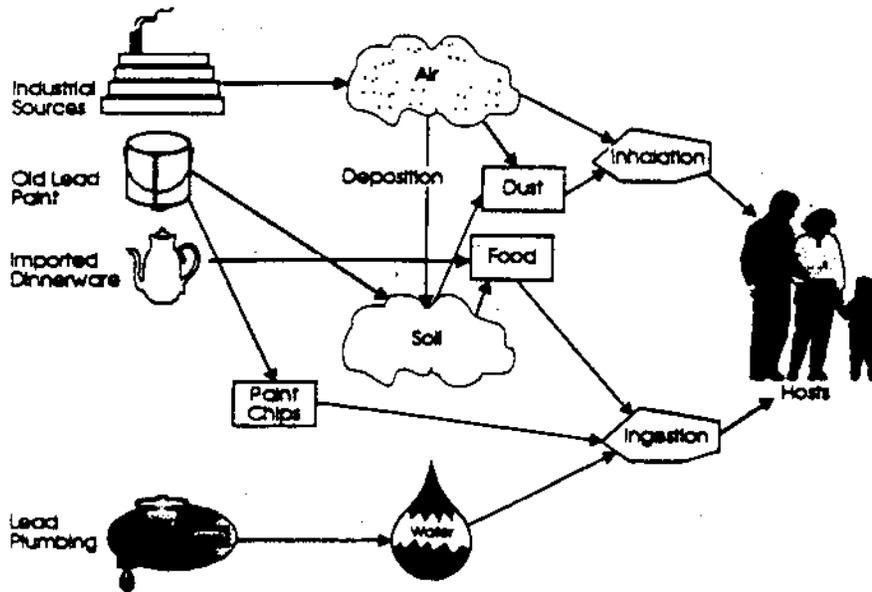


Exhibit 1 Distribution and Uses of Lead

Distribution and Uses of Lead

Lead is distributed in the environment through both natural and man-made means. Today, the greatest contributions of lead to the environment stem from past human activities. As illustrated in Exhibit 1, sources that produce excess lead exposure include the following:

- **Lead based paint** (which can flake off onto soil or be ingested by children).
- **Lead in the air** (from industrial emissions).
- **Dust and soil** (lead deposits in soils around roadways and streets from past emissions by automobiles using leaded gas, together with paint chips and lead paint dust, find their way into the mouths of young children living in polluted environments).
- **Lead in food** (deposited from air onto crops or lead glaze on imported dinnerware).

- **Lead dust** (brought home by industrial workers on their clothes and shoes).
- **Lead in water** (through corrosion of plumbing products containing lead).

The U.S. government has taken steps over the past several decades to dramatically reduce new sources of lead in the environment (e.g., by banning the manufacture and sale of leaded paint, by phasing out lead additives in gasoline, and by encouraging the phaseout of lead seams from food cans). More recently, the government has begun to attack existing sources of lead in the environment. For example, programs have been instituted to minimize the hazards posed by old lead paint covering millions of homes across the United States, more stringent air control standards are being applied to industries emitting lead, and more stringent regulations are in place to control lead in drinking water.

How Lead Gets into Drinking Water

Lead can get into drinking water in two ways: (1) by being present in the water entering the treatment plant (i.e., source water) or (2) through an interaction of the water and plumbing materials containing lead (i.e., through corrosion).

At the Source

Most sources of drinking water have no lead or very low levels of lead (i.e., under 5 parts per billion). However, lead naturally occurs in the ground and in some instances can get into well water. Lead can enter surface waters (e.g., waters from rivers, lakes, streams) through direct or indirect discharges from industrial or municipal wastewater treatment plants or when lead in air settles into water or onto city streets and eventually, via rain water, flows into storm sewers. Lead from these sources can be easily removed by existing treatment plant technologies.

Through Corrosion

Most lead gets into drinking water after the water leaves the local treatment plant or private well and comes into contact with plumbing materials containing lead. The physical/chemical interaction that occurs between the water and plumbing is referred to as corrosion. The extent to which corrosion occurs contributes to the amount of lead that can be picked up by the drinking water.

As illustrated in Exhibit 2, drinking water comes into contact with plumbing materials that may contain lead once the water leaves the treatment plant. Some lead may get into the water from the distribution system — the network of pipes that carry the water to homes, businesses and schools in the community. Some communities have lead components in their distribution systems (i.e., lead joints in cast iron mains, pipes, service connections, pigtails and goosenecks). However, the public water supplier is responsible for making sure that the distribution system under the utility's control does not contribute harmful amounts of lead. See *"How Lead in Drinking Water is Regulated"* in this section for further information on this topic.

Interior plumbing, soldered joints, and various drinking water outlets that contain lead materials are the primary contributors of lead in drinking water. Pictures of some of the common drinking water outlets are reflected in Exhibit 3. *The glossary in Appendix B provides definitions of the various drinking water outlets discussed in this document.*

The critical issue is that even though your public water supplier may send you water that meets all Federal and State public health standards for lead, you may end up with too much lead in your drinking water because of the plumbing in your facility. That is why testing water from your drinking water outlets for lead is so important.

Factors Contributing to Corrosion

What causes lead to possibly leach from your plumbing into drinking water? Actually, no single situation or activity causes this interaction. Rather, it is a combination of several factors. The corrosion of lead tends to occur more frequently in "soft" water (i.e., water that lathers soap easily) and acidic (low pH) water. Other factors, however, also contribute to the corrosion potential of the water and include water velocity and temperature, alkalinity, chlorine levels, the age and condition of plumbing, and the amount of time water is in contact with plumbing. The occurrence and rate of corrosion depend on the complex interaction between a number of these and other chemical, physical, and biological factors.

Public water system officials routinely undertake activities aimed at controlling the corrosion characteristics of their water supplies. Their treatment activities can lead to a protective coating of minerals being formed on the inside layer of pipes, thereby insulating the drinking water, in effect, from lead. Given that the health effects of lead occur at very low levels, these activities are critical. The activities undertaken by individual homeowners and building owners/operators to identify and remove problem plumbing are also critical.

Background Information

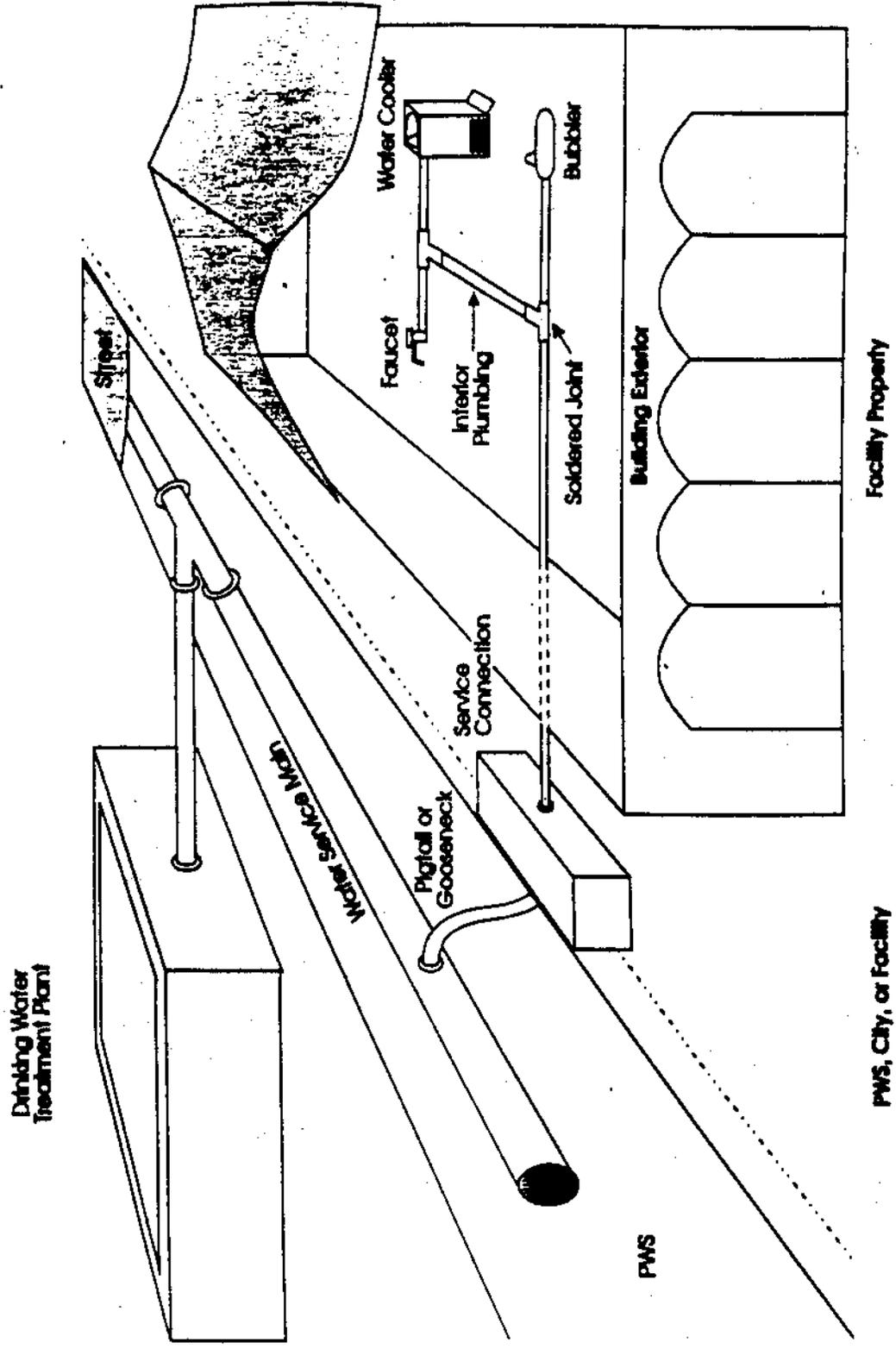
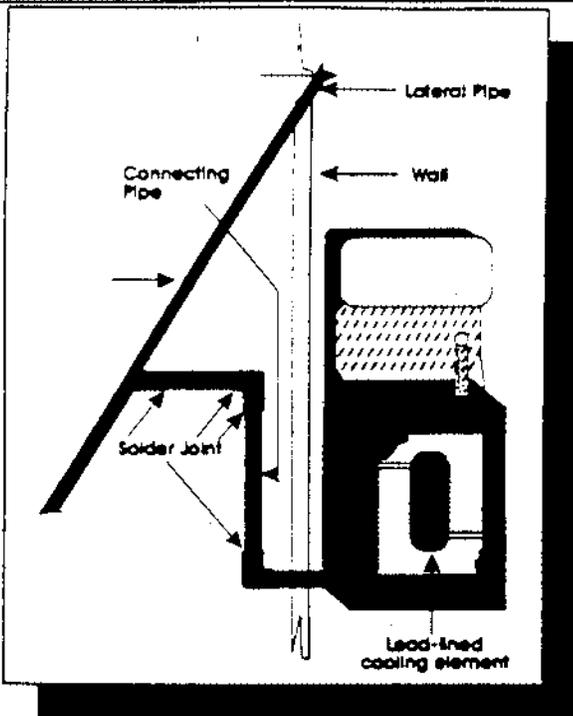
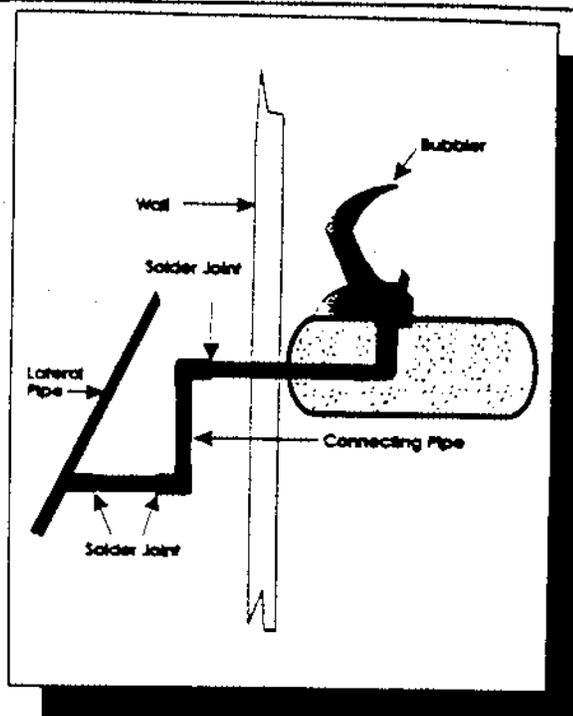


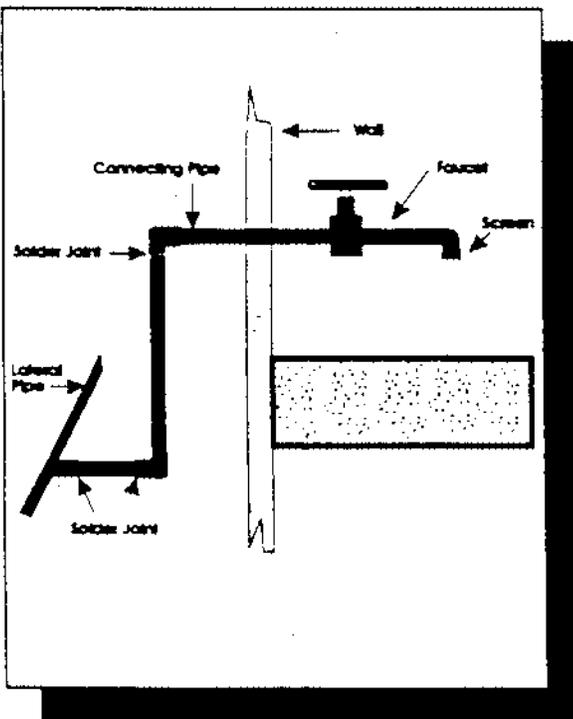
Exhibit 2 Sources of Lead in Plumbing



Water Cooler



Bubbler



Faucet (Tap)

Sources of Lead in Drinking Water

Common sources of lead in drinking water include:

- solder
- fluxes
- pipes and pipe fittings
- fixtures (e.g., brass faucets containing alloys of lead)
- sediments

Exhibit 3 Common Drinking Water Outlets

Background Information

How Lead in Drinking Water is Regulated

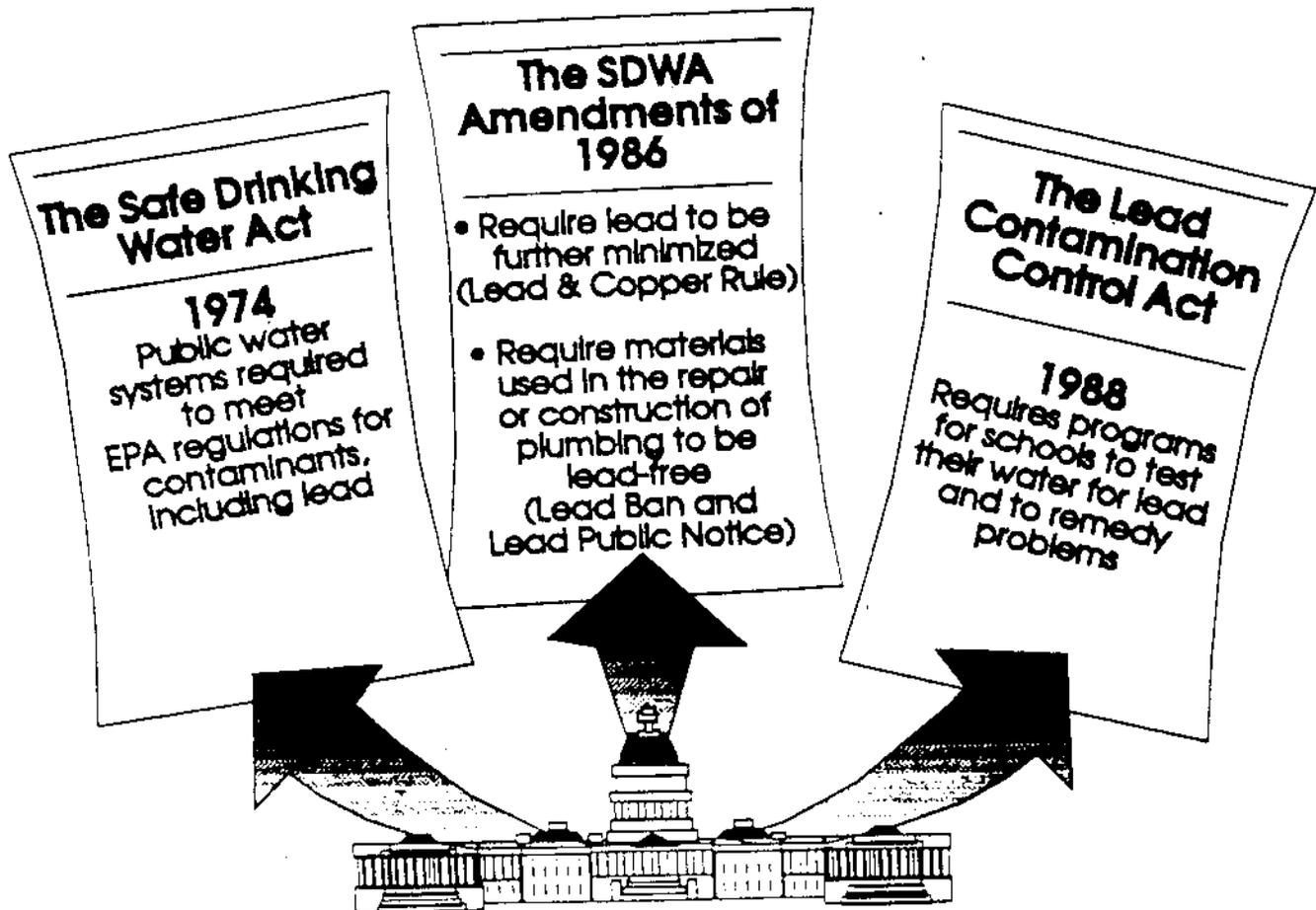
Lead is regulated in drinking water under a Federal body of law known as the Safe Drinking Water Act (SDWA). This Act was initially passed in 1974 and, in part, requires EPA to establish regulations for known or potential contaminants in drinking water for the purpose of protecting public health.

The regulations developed by EPA are aimed at public water systems. These systems are defined as those with 15 or more service connections in operation at least 60 days a year or systems serving 25 or more persons daily at least 60 days a year. *Schools or non-residential buildings that own or operate their own water supply and that meet this or the State's definition of a public water supply are subject to the provisions of the SDWA. Facilities in this position should already be knowledgeable of their legal responsibilities. Any questions in this regard should be directed to the appropriate State drinking water office. See Appendix A for a directory of State programs.*

Major amendments were passed to the SDWA in 1986. These amendments include some specific provisions for controlling lead in drinking water:

- A new regulation by EPA to minimize the corrosivity and amount of lead in water supplied by public water systems (known as the **Lead and Copper Rule**).
- A requirement that only lead-free materials be used in new plumbing and in plumbing repairs (called the **Lead Ban**).
- A one-time lead public notification requirement.

In 1988, Congress passed the **Lead Contamination Control Act (LCCA)**, which further amended the SDWA. The LCCA is aimed at the identification and reduction of lead in drinking water at schools and day care facilities.



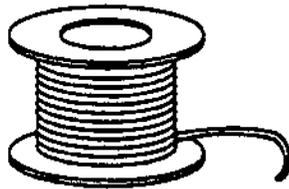
Public Water
Systems Lead
and Copper Rule



In June 1991, EPA revised the National Primary Drinking Water Regulation for lead (by promulgating the Lead and Copper Rule). The regulation requires public water systems to take 1-liter tap water samples at representative high-risk residences served by the system. The total quantity and dates by which the samples are to be taken are specified in the regulation and are based on the total population served by the public water system.

If 10 percent or more of the tap samples exceed an action level of 15 parts per billion (ppb) or micrograms per liter ($\mu\text{g}/\text{l}$), then the public water system must conduct additional monitoring, implement or enhance corrosion control programs, educate consumers served by the system about lead, and possibly replace lead service lines owned by the system, if they exist.

Requirement that
Only Lead-Free
Materials be Used in
New Plumbing and in
Plumbing Repairs
(Lead Ban)



This provision of the SDWA requires the use of "lead-free" pipe, solder, and flux in the installation or repair of any public water system or any plumbing in a residential or non-residential facility connected to a public water system. Solders and flux are considered to be lead-free when they contain less than 0.2 percent lead. (Before this ban took effect in 1986, solders used to join water pipes typically contained about 50 percent lead.) The Lead Ban requires that any lead solders carry a warning label indicating that they are not to be used in connection with potable water plumbing. Pipes, pipe fittings, faucets, and other fixtures are considered lead-free under the Lead Ban when they contain less than 8 percent lead.

If you purchase your water, you may wish to contact your public water system to determine whether the system is in compliance with the National Primary Drinking Water Regulation for lead. Ask system officials to explain the results of their lead tap water sampling efforts and whether 10 percent or more of these samples exceeded EPA's action level of 15 ppb. If so, ask them what corrosion control measures are being taken to ensure that the drinking water delivered to consumers will minimize lead exposure. Your water supplier may be able to give you a good indication of what you might expect in terms of lead problems in your building, based on the utility's knowledge of the water supply and lead issues in general. Your water supplier may also be willing to assist you in conducting a lead testing program at your facility, although there is no requirement that they provide this service. *A summary of topics to discuss with your water supplier is included in the Sample Plumbing Profile Questionnaire on page 14.*

Under the Lead Ban, States were to adopt a version of the prohibition that is at least as stringent as the Federal version by June 1988. To date, all States have a lead-free plumbing materials requirement in place that is at least as stringent as the Federal version. All major national plumbing codes have also incorporated these requirements. You may wish to contact your local plumbing code officials to ascertain which code(s) is used in your area, if any. Typically, codes are required on a statewide or smaller jurisdictional basis. In any event, the codes should reflect either the national or State lead-free plumbing requirements.

As another measure, check with plumbers or contractors who are making additions or repairs to any plumbing in your facilities to ensure that only lead-free materials are being used. Test kits may be available to determine the presence of lead solder in plumbing. Any violations of the lead-free requirements should be reported to State officials (*see Appendix A*). You should also insist that any lead materials used in new construction or recent repairs be replaced with lead-free materials.

Background Information

One-Time Lead Public Notification Requirement



The SDWA also required that all public water systems provide a one-time special notice by June 1988 to educate their customers about the lead-in-drinking-water issue. The format and content of these notices were specified by EPA. The intent behind the notices was to inform consumers about the lead-in-drinking-water issue, about the steps their water system was taking to reduce opportunities for lead exposure, and about steps that could be taken in the home to minimize exposure.

The Lead Contamination Control Act (LCCA)



The LCCA required that a number of activities be conducted by Federal and other parties to identify and correct lead-in-drinking-water problems at schools and day care facilities. A listing of some of the major activities and parties responsible is provided in Exhibit 4. One principal activity to be conducted by EPA was the development of a guidance document and testing protocol that could be used by schools to determine the source and degree of lead contamination problems and how to remedy such contamination if found. This document reflects EPA's second edition of the guidance manual and testing protocol developed in response to the LCCA.

At the time the LCCA was passed, considerable attention was being given to water coolers with lead-lined tanks. The law defined these sources as "imminently hazardous consumer products." As a result, the legislation specifically stated requirements to result in the repair, replacement, or recall and refund of these water coolers and attached civil and criminal penalties to the manufacture and sale of any drinking water cooler containing lead. *See Appendix C for a summary of water cooler issues, how to identify whether you have a problem cooler, and what steps can be taken if you do.*

While the LCCA was geared toward identifying and remedying lead contamination problems in school and day care drinking water, lead may also pose problems in other buildings. EPA, therefore, advocates that the owners and/or managers of non-residential buildings also conduct testing of drinking water outlets. Since the lead testing protocol to be followed is the same for non-residential facilities as for school buildings, this guidance manual has been addressed to representatives of both facilities. EPA has a separate manual available that demonstrates how to test drinking water for lead in small nursery schools and day care facilities. In addition, EPA has a brochure for homeowners that are interested in testing their water for lead. *See Appendix D for a listing of lead testing and other information available from EPA.*

Since some States and local jurisdictions have established programs for testing lead in schools and other buildings, it is to a school or non-residential building owner/manager's advantage to learn whether additional requirements beyond those summarized in this section exist. Consult your State or local education or drinking water program to learn whether statewide or local legislation is in effect that relates to lead testing in schools and/or non-residential buildings. *See Appendix A for a list of State contacts.*

Exhibit 4
Key Provisions of the LCCA

- EPA**
- Publish a list of each brand and model of water cooler that is not lead-free, including a separate list of the brand and model of water coolers with a lead-lined tank and distribute lists to States.
 - Publish a guidance document and testing protocol to assist schools in determining the source and degree of lead contamination in school drinking water supplies and in remediating such contamination. (Document is to, in part, include a testing protocol for identifying coolers that may contribute lead to drinking water.)
- EPA and States**
- Publish and make available to the public upon request a list of laboratories certified by EPA (or the State if the State has been delegated certification authority) to conduct analyses of lead-in-drinking-water.
- Consumer Product Safety Commission (CPSC)**
- Issue an order requiring manufacturers and importers of water coolers with lead-lined tanks to repair, replace, or recall and provide a refund for such coolers.
- Water Cooler Manufacturers, Importers, and Others**
- Do not sell in interstate commerce, or manufacture for sale in interstate commerce, any drinking water cooler listed by EPA or any cooler that is not lead-free, including a lead-lined cooler. (Civil and criminal penalties are associated with violations.)
- States and Local Governments**
- Provide for the dissemination to local educational agencies, private nonprofit elementary or secondary schools, and day care centers EPA's guidance document and testing protocol and list of water coolers.
 - Establish a program to assist local educational agencies in testing for and remediating lead contamination in drinking water from coolers and other sources of lead contamination at schools under the jurisdiction of such agencies.
 - Make available any lead testing results in the administrative offices of the local educational agency for inspection by the public, including teachers, other school personnel, and parents.
 - Notify parent, teacher, and employee organizations of the availability of lead testing results.
 - Repair, replace, permanently remove, or render inoperable water coolers that are not lead-free and that are located in schools, unless the coolers are tested and found (within the limits of testing accuracy) to not contribute lead to drinking water.