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Preventing Lead Poisoning in Children

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Every year thousands of children and adults are accidentally poisoned by lead. Childhood lead poisoning is one of the most common health problems in the United States today. The tragedy is that all lead poisoning is entirely preventable, if you know the source and precautions to take. Enough is now known about the sources and pathways of lead exposure and about ways of preventing this exposure to begin the efforts to permanently erase this disease. The persistence of lead poisoning in the United States, in light of all that is known, presents a singular and direct challenge to public health authorities, clinicians, regulatory agencies, educators and society.

Previous lead statements issued by the Center of Disease Control have acknowledged the adverse effects of lead at lower and lower levels. Some adverse effects occur at blood lead levels as low as 10 ug/dl in children. This has become so overwhelming and compelling that it must be a major force in determining how we approach childhood lead exposure. [1]

Because the adverse effects of lead occur at the lower level of the range at which effects are now identified, primary prevention activities, such as, community-wide environmental interventions and nutritional and educational campaigns should be directed at reducing children's blood head level below the border zone.

The purpose of writing this unit on Preventing Lead Poisoning In Children is to raise the level of awareness of some environmental problems and to brainstorm for possible solutions.

The unit will address the history of lead, where lead comes from, harmful effects of lead, sources and pathways of lead exposure, lead in paint, gasoline, and water. It will also look at testing for lead and lead prevention.

The unit will be written to address the needs of students in grades five through eight (5-8). the unit will include pre and post test, vocabulary, lesson plans, field trips, teacher and student resources and a bibliography.

The goal of the unit is to challenge teachers and students to become part of the solution to the problems and not part of the problems to our prevention of lead poisoning in children.

History of Lead

Lead was one of the earliest metals discovered by the human race and was in use by 3000 B.C. The ancient Romans used lead for making water pipes and lining baths, and the plumber who joins and mends pipes takes his name from the Latin word plumbum, meaning lead. Plumbum is also the origin of the terms plumb bob and plumb line, used in surveying and also the chemical symbol for lead, Pb. In medieval times, lead came to be used for roofing, coffins, cisterns, tanks, and gutters, and for statues and ornaments. Another early use of lead was for the strips joining the pieces of colored glass in church windows.

The dull gray color of lead pipes and cables is caused by the oxygen of the air combining with the metal so as to form a very thin film or skin composed of an oxide of lead. Lead is not at all easily corroded, or eaten away. Unlike iron and steel, it does not need protection by painting. Underneath the film, lead is a bright, shiny bluish-white metal. When you scrape it you notice how soft lead is. It is this softness that makes it easy to squeeze or roll lead into different shapes.

The ease with which lead can be shaped and its resistance to corrosion make it valuable as the outer covering, for electric cables. It protects the insulated wires inside without making the cable too stiff to bend. As lead has become much more expensive, it is used for roofing less often than in the past, and copper or plastics such as polythane are preferred materials, because we have learned that lead is poisonous. Sheet lead is used to line tanks holding corrosive liquids, such as acids, which would eat through other metals.

As lead is heavier than iron or brass, it is used for making weights that must not be too bulky. Some examples are the sinker of fishing tackles and the boots of divers. Lead also melts at a lower temperature, 327 degrees celsius, or 621 degrees farenhaiet than most of the other common metals. Lead’s boiling point is 1,620 degree celsius with a specific gravity, 11.35.

Where Does Lead Come From?

Most lead is obtained from galena, an ore consisting of a combination of lead and sulfur sometimes found in limestone. The lead is obtained by crushing the galena and then roasting it to drive off the sulfur. The roasted galena is mixed with coke and limestone and put into a furnace. Air is blown into the lower part of the furnace to make a draft for burning the coke, and the molten lead is drawn off from the bottom. The limestone helps to make the slag formed by the impurities run easily.

The lead thus obtained often contains small quantities of gold, silver, copper, and other metals, and requires further treatment to purify it. Sometimes enough silver is recovered to pay for the purification. The finished lead is cast into lumps called pigs. Much lead is obtained from scrap that is from old batteries and pipes which are melted down.

The Harmful Effects of Lead

Lead and the compounds which contain lead are poisonous. Although it has been used in numerous consumer products, lead is a toxic metal now known to be harmful to human health if inhaled or ingested. Lead poison is retained in the body, and if a person is exposed to lead over a long period, poison builds up and causes damage to the brain and nervous system. This affect can cause weakness and loss of coordination and mental powers. Lead can also be injurious to bone marrow.

Young children, infants, and fetuses appear to be particularly vulnerable to lead poisoning. A dose of lead that would have little effect on an adult can have a big effect on a small body. Growing children will absorb any lead they consume more rapidly. As already mentioned, a child's mental and physical development can be irreversibly stunted by over-exposure to lead. In infants, whose diet consists of liquids made with water, such as baby formula, lead in drinking water make up an even greater proportion of total lead exposure, forty (40) to sixty (60) percent.

It is estimated that lead in drinking water contributes between ten (10) and twenty (20) percent of total lead exposure in young children. In the last few years, federal controls on lead in gasoline have significantly reduced people's exposure to lead.

The degree of harm depends upon the level range from subtle biochemical changes at low levels of exposure to severe neurological and toxic effects or even death at extremely high levels.

Sources and Pathways of Lead Exposure

A child's environment is full of lead. Children are exposed to lead from different sources, such as ambient, paint, gasoline, and solder and through different pathways, such as air, food, water, dust and soil, which can be contaminated by lead in the air or in food containers and water from corrosion of plumbing. Although all U.S. children are exposed to some lead from food, air, dust and soil, some children are exposed to high dose sources of lead. Lead-based paint is the most widespread and dangerous high-dose source of lead exposure for preschool children.

Pica, the repeated ingestion of nonfood substances, has been implicated in cases of lead poisoning; however, a child does not have to eat paint chips to become poisoned. More commonly, children ingest dust and soil contaminated with lead from paint which flaked or chalked as it aged or which has been disturbed during home maintenance and renovation. This lead contaminated house dust, ingested via normal repetitive hand to mouth activity, is now recognized as a major contributor to the total body burden of lead in children.

Because of the critical role of dust as an exposure pathway, children living in sub-standard housing and homes undergoing renovation are particularly at risk for lead poisoning.

Many cases of childhood lead poisoning that result from renovation or remodelling of homes have been reported.

Main Source of Lead Paint

The single biggest source of lead poisoning is lead based paint. Usually, lead paint is found on the inside and outside of homes built before 1979. But lead based paint was also used on cars, trucks, old painted furniture and old toys. These items are sources of lead.

Dirt around old homes and sites of buildings which have been torn down may contain small chips of lead paint. Parents should protect their children from this source of lead.

Houses built before 1979 that are poorly maintained or being renovated are especially hazardous. More and more lead poisoning has been reported from families who move into a city as urban homeowners. Their children can be exposed to lead chips, lead fumes, and lead dust as this paint is removed from their homes.

How to Avoid This Source of Lead

You can keep your child away from any peeling paint which may contain lead. Children should not have toys or old furniture which may have lead paint. Other precautions taken should be to wet mop floors, furniture, and window sills to remove dust. Wash children's hands before they eat and wash objects children frequently put in their mouths.

The safest time to remove lead paint is when the home is unoccupied. Remember not to dump lead chips outside in the yard where children play. Avoid dry sweeping, because sweeping with a dry broom just creates more dust.

If you are exposed to lead dust at work, be careful with your work clothes. Lead dust can be carried into your home on your clothes. Shower completely and change clothes before going home to play with the children.

Lead Gasoline and Airborne Lead

The shift to unleaded gasoline is beginning to improve air quality in Connecticut. But our state has many heavily traveled highways and residential streets. Cars using leaded gasoline pump lead out of their cars into the air. From there, lead can end up in dirt around homes and playgrounds. Small children, while playing outside, may put dirty hands or objects in their mouths. That provides a direct route from lead into the body.

How to Avoid This Source of Lead

To avoid this source of lead don't set up a playground or a sandbox in areas near major highways. Wash your child's or children's hands frequently. you should not let your child play with objects from outside and avoid planting a vegetable garden near a major highway or other heavily traveled roads and streets.

Drinking Water as a Source of Lead

Typically, lead gets into your water after the water leaves your local treatment plant or your well. That is, the source of lead in your home's water is most likely pipe or solder in your home's own plumbing. The drinking water entering our homes and business from public water systems in Connecticut is essentially lead-free. But, as water stands in your copper plumbing, lead from soldered joints can dissolve into the water. The longer water stands unused in these pipes, the more lead is dissolved in the water. See figure 1.
(figure available in print form)
[Source: EPA Environmental News, R-110, May, 1993.]

The most common cause is corrosion, a reaction between the water and the lead pipes or solder. Soft water, which lathers soap easily is a common cause of corrosion. All kinds of water may have high levels of lead. [2]

One factor that increases corrosion is the practice of grounding electrical equipment, such as telephones to water pipes. Any electric current traveling through the ground wire will accelerate the corrosion of lead in pipes.

Lead contaminated drinking water is most often a problem in houses that are either very old or very new.

Up through the early 1900's, it was common practice, in some areas of the country, to use lead pipes for interior plumbing. Lead piping was often used for the service connections that join residences to public water supplies. This practice ended only recently in some localities. Plumbing installed before 1930 is most likely to contain lead. Copper pipes have replaced lead pipes in most residential plumbing. However, the use of lead solder with copper pipes is widespread. Experts regard this lead solder as the major cause of lead contamination of household water in the U.S. homes today.

Scientific data indicate that the newer the home, the greater the risk of lad contamination. Lead levels decrease as a building ages. This is because, as time passes, mineral deposits form a coating on the inside of the pipes, if the water is not too corrosive. This coating insulates the water from the solder. But, during the first five years, before the coating forms, water is in direct contact with the lead. More likely than not, water in buildings less than five years old has high levels of lead contamination.

How to Avoid This Source of Lead

You can easily avoid any lead which is in your drinking water by never using the hot water tap to make food, instant coffee, instant soup, cocoa or any other beverage. Never use water from the hot water tap to make formula, cereal or any beverage or food for an infant or child. Always use the cold water tap for drinking and cooking because hot water is likely to contain higher levels of lead. Anytime you haven't used a faucet for six or more hours, flush the old water out of your plumbing by running the water for three to five minutes or until it is as cold as it will get.

Testing For Lead in Water

Water samples from the tap will have to be collected and sent to a qualified laboratory for analysis. However, there is a lead testing kit for teachers to use when teaching this unit or other units on testing lead in water. This kit is located in Kline Biology Lab, Room 205 with Professor Tony Lasaga. You may contact him for the availability of the kit.

Otherwise, contact your local water utility or local health department for information and assistance.

You should be sure that the lab you use has been approved by your state or Environmental Protection Agency (EPA) as being able to analyze drinking water samples for lead contamination.

Federal standards limit the amount of lead in water fifty (50) parts per billion (ppb). In light of new health and exposure data, EPA has proposed tightening this standard to twenty (20) ppb. If tests show that the level of lead in your household water is in the area of twenty (20) ppb or higher, it is advisable, especially if there are young children in the home to reduce the lead level in your tap water as much as possible. EPA estimates that more than forty (40) million U.S. residents use water that can contain lead in excess of twenty (20) ppb. One ppb is equal to 1.0 micrograms per liter (ug/1 or 0.001 milligram per liter (mg/1).

Management of lead in the Environment of the Individual Child

Eliminating childhood lead poisoning requires a long-term active program of primary lead-poisoning prevention, including abatement of lead-based paint hazards in homes, day-care centers, and other places where young children play and live. For the child who is lead poisoned, however, efficient and effective interventions are needed as quickly as possible. Abatement means making the source of lead inaccessible to the child.

Each situation in which a child gets poisoned is unique and must be evaluated by a person or team of persons skilled and knowledgeable about lead poisoning, hazard identification, and intervention to reduce lead exposure, including abatement of lead-based paint in housing. Childhood lead poisoning prevention programs need to work closely with other relevant agencies, for example, housing and environmental agencies to, to ensure that the quickest and most effective approach is taken to remediating the environments of poison children.

Environmental case management includes a number of actions prescribed for a child with lead poisoning. Ideally, environmental case management should be conducted by a team of professionals in public health, environmental activities, medical management, and social management. A team approach to intervention will help ensure that followup is timely and effective. The management team may need to solve many related problems, such as whether to investigate supplemental addresses, where to find temporary alternate housing, and how to use community resources to assist the family in dealing with the lead poisoned child.

In theory, primary prevention has always been the goal of childhood lead poisoning prevention programs. In practice, however, most programs focus exclusively on secondary prevention, dealing with children who have already been poisoned. As programs shift the emphasis to primary prevention, their efforts must be designed to systematically identify and remediate environmental sources of lead, including, most importantly dwellings containing old lead paint.

The shift from case management to community-level intervention will require a fundamental shift in perspective. The focus must shift from the individual child to the population of children at risk and the environment in which they live. The purpose of community-level intervention is to identify and respond to sources, not cases, of lead poisoning. The responsibility for addressing lead poisoning will have to be expanded beyond health agencies to include a variety of housing, environmental, and social service agencies at the local, county, state, and national level.

What is the Government Doing About the Problem of Lead in Water?

The U.S. Environmental Protection Agency reported as of May, 1993 that the latest round of monitoring for lead in drinking water shows that 819 large and medium-sized pubic water systems exceed the lead action level of 15 parts per billion (ppb) established under the Safe Drinking Water Act (SDWA). An action level requires pubic water systems to take corrosion control measures to reduce lead levels, perform additional monitoring and inform the public. These 819 systems provide drinking water from approximately 30 million people across the nation.

In October 1992, EPA reported the results of monitoring conducted between July 1992 and June 1992. EPA now has compiled the results of required monitoring conducted between July 1992 and December 1992 by over 7,500 large and medium-sized public water systems. Monitoring results release as of May, from the large systems represent their second round of testing.

These monitoring results do not represent average drinking water lead levels in these communities. Systems are required to test the tap water in high-risk residences, those served by lead service lines or containing lead interior piping or copper piping with lead solder installed after 1982, where the higher lead levels are expected to be found. Under the law, systems exceed the lead action level if more than 10 percent of monitored high-risk residences have drinking water lead levels of more than 15 ppb.

The 10 large, serving over 50,000 people, public water systems with the highest reported lead levels are: Charleston, SC, at 165 ppb; Utica, NY at 160 ppb; Newton, MA at 110 ppb; Yonkers, NY at 110 ppb; Waltham, MA at 76 ppb; Brookline, MA at 72 ppb; and Taylor, MI at 69 ppb.

The 10 medium-sized, serving between 3,301 and 50,000 people, pubic water systems with the highest reported lead levels are: U.S. Marine Corps Camp Lejeune-Hadnot Point, NC at 484 ppb; Grosse Pointe Park, MI at 324 ppb; Goose Creek, SC at 257 ppb; Honesdale, PA at 210 ppb; Mangum, OK at 191 ppb; U.S. Marine Corps Camp Lejeune-New River, NC at 189 ppb; Clewiston, FL at 166 ppb; Stockton State College in Pomona, NJ at 160 ppb; Marcy, NY at 160 ppb; and New Hartford, NY at 160 ppb.

There are 1,100 large and medium systems that did not complete the required monitoring. These systems are targets for EPA or state action. Since December 31, 1992, EPA and states have issued 427 notices of violation

and 145 proposed or final administrative orders to public water systems for failure to conduct required lead monitoring. These orders specify the actions systems need to take to comply with the monitoring and reporting requirements. they also require the system to notify the public of failure to monitor. Failure to comply with the terms of the orders can lead to additional enforcement actions, including penalties. Further enforcement actions against the remaining monitoring/reporting violators are planned.

In June 1991, EPA issues new regulations which apply to approximately 85,000 drinking water systems that regularly serve at least 25 people. These regulations required all large water systems to complete the first round of monitoring by June 1992 and a second round by December 31, 1992. In addition, medium-sized systems were also required to complete their first round of monitoring by December 31, 1992. Small systems, those serving 3,300 and fewer people, must compete a round of monitoring by December 31, 1993, regardless of the monitoring results. Smaller systems are required to install corrosion control treatment if more than 10 percent of the monitored, high-risk household taps exceed 15 ppb. Most corrosion control efforts will attain full effect in systems of all sizes by 1997.

Although an exceedance of the lead action level by itself is not a violation of the regulation, it does trigger additional requirements for public water systems, including public education, additional monitoring, and corrosion control treatment. All 819 systems with high lead levels were required to notify their customers of their elevated lead levels and to offer tips on how to minimize drinking water lead exposure through an EPA developed public education program.

Corrosion control treatment generally involves the addition of any of a variety of mineral compounds such as lime, calcium carbonate, and orthophosphate. These compounds reduce the corrosivity of the water and leave a protective coating of minerals on pipes, minimizing the amount of lead leaching from pipes into the drinking water. If any system still exceeds the lead action level after optimal corrosion control is installed, it must replace the lead service lines in its distribution system to reduce tap water lead levels further.

Conclusion

In coming decades, maximizing the intellectual and educational capacity of our population will be critical to our success in dealing with many social and economic challenges. The importance of safeguarding the intellectual and educational development of our children against preventable disease is difficult to overestimate. Childhood exposure to lead is preventable.

Lesson Plan I

Objective:
Students will learn where lead might be found.

Discuss:
Lead might be found almost anywhere. It can be found in dirt or dust inside and outside the house; in peeling paint, window sills and in pipes that bring in water hot or chilled.

Things to do:
Have students list some things that can be done to make their homes safe. Have them to show their list of things to their parents. Students can encourage parents to bring household hazardous wastes to Hazwaste Central at 90 Sargent Drive, New Haven, CT. Parents can call for exact dates at 624-6671 or call the health department to come out to do a water test for lead and other hazardous waste products, such as paint, paint thinner and removers.

Make a List

Example:

Oven Cleaners Spot Remover
Rust Remover Paint, Paint thinner
Gasoline Kerosene

Parents can use non-toxic products that can do the same job as some of the toxic products.

Lesson Plan II

Objective:
Students will learn that lead is a problem to the human body.

Discuss:
Lead can cause problems in the body. It can affect the brain and nervous system. Lead poisoning causes the body to show symptoms that are associated with elevated blood level. See the chart, 1991 CDC Guidelines for Childhood Lead Poisoning. This is why we must prevent lead poisoning.

Activities:
Students can draw pictures, make collages or write about ways to prevent lead poisoning.

This student can analyze the data from the 1991 CDC Guidelines for Childhood Lead Poisoning to answer the following questions.

A. What is the level at which lead is considered to indicate lead poisoning?
B. What is the level full medical evaluation is indicated? Why? Explain what should happen under this condition.
C. Tell what level at which parents should receive education on preventing lead poisoning and on nutrition.
D. What happens at 45-69 ug/dl?

1991 CDC Guidelines for Childhood Lead Poisoning

/- 10 ug/dl: Not considered to indicate lead poisoning.
10-14 ug/dl: A high prevalence of children with levels $gt 10 ug/dl should stimulate community-wide lead poisoning prevention programs. Individual children should be retested more frequently.
15-19 ug/dl: Parents should receive education on preventing lead poisoning and on nutrition. Children should be retested more frequently; if levels persist, sources of lead exposure should be investigated.
20-44 ug/dl: Full medical evaluation is indicated. Sources of lead exposure should be removed from the child's environment. Drug therapy may be indicated.
45-69 ug/dl: Chelation therapy is indicated. The child should be removed to a lead-free environment and not returned until sources of lead exposure have been eliminated.
-/> 70 ug/dl: A medical emergency requiring immediate hospitalization and chelation therapy.

Use with Lesson Plan II.

Source: American Academy of Pediatrics, 1993.

Lesson Plan III

Objectives:
Students will learn how their family can stay safe around lead.

Discuss:
Your family can stay safe around lead by using a damp mop and get rid of loose paint chips, wipe window sills with damp cloth. you can let water for drinking or cooking run freely from your faucets until it gets really cold. If there are small siblings, you can wash the pacifiers and toys that go in the mouths of baby girls and boys. always wash your hands before eating. Remember to always eat healthy foods.

Activity:
List ways to help your family stay safe around lead. Create a story that will help you remember some key sources.

* paint

* gasoline

* soil

* solder

Lesson Plan IV

Objective:
Student will learn how water leaves a treatment system and enter into their homes.

Discuss:
Lead and your water. Explain a drinking water supply system.

Activity:
Have students to draw a water supply system and explain what could happen after water enters into the plumbing in a residence. Also, discuss the following:

* Water in a faucet for more than six hours

* Drinking water from a tap

Lesson Plan V

A. Hands-on Activity

Objective:
Students will test for the chemical pollution of water.

Activity:
pH Test-Use indicator paper to test for copper, lead and other chemical presence in water. The class also can perform pH test to determine if water is acidic or basic. pH meters are available by request to assist with this lesson.

*See Lab activity kits listed in the resource section of the unit.

Connecticut has a medium public water system. The following is a report from the EPA News about cities who are not in the lead 90th percentile exceedances and cities in Connecticut who have failed to conduct required initial lead tap monitoring and reporting as of May 6, 1993.

PWS Name	Population	Lead (ppb)
Connecticut		
New Milford Water Co.	6,588	28
Manchester Water Dept.	48,702	24
Westerly Water (Pawcatuck)	9,000	16

Medium System that Failed to Conduct Required Initial Lead Tap Monitoring and Reporting (as of 5/6/93)

Public Water System Name	Population	EPA Region I
Connecticut		
Portland Water Works	7,200	
University of Connecticut	21,700	

Source: EPA Environmental News, R-110, May, 1993.

Vocabulary

Celsius—A metric temperature scale in which 0 degrees celsius is the freezing point of pure water and 100 degrees celsius the boiling point under normal atmospheric pressure.
Contaminate—To make something impure, infected or polluted.
Corrosion—A dissolving and wearing away of metal caused by a chemical reaction in this case, between water and metal pipes, or between two different metals.
Environment—Everything that surrounds a living thing.
EPA—Environment Protection Agency.
Erosion—The wearing away of any part of the Earth's surface by water, wind or glaciers.
Flush—To open a cold-water tap to clear out all the water which may have been sitting for a long time in the pipes.
Galena—An ore consisting of a combination of lead and sulfur sometimes found in limestone.
Hazardous waste disposal facility—A place that collects dangerous contaminants for proper disposal.
Lead—A toxic metal, that has been widely used in paints, plumbing and fixtures, and in some water supply service lines.
Poisonous—The quality of degree of being toxic or harmful to plants or animal life.
PPb—Parts per billion.
Public Water System—Any system that supplies water to 25 or more people or has 15 or more service connections, building or customers.
Solder—A metallic compound used to seal joints in plumbing. Until recently, most solder contained about 50 percent lead.
Tap—Draw off water from a nearby source.
Water Treatment Plant—The place where water is filtered and chemicals are added to purify water.

Appendix I

CONSUMER FACT SHEET ON LEAD IN DRINKING WATER

ABOUT THE RULE

* Lead and Copper Rule requires national monitoring to determine lead concentrations in drinking water.
* The Rule also requires all large public water systems and smaller systems exceeding a lead level of 15 parts per billion (ppb) to take measures to reduce lead exposure of consumers.
* These measures include additional monitoring, installation of corrosion control treatment, public education, and possibly source water treatment and lead service line replacement.

ABOUT LEAD

* Lead, a toxic metal, has been widely used in paints, household plumbing and fixtures, and in some water supply service lines.
* Lead typically enters drinking water as a result of leaching from household plumbing and fixtures and/or water distribution lines.
* Infant and young children are most susceptible to lead.
* 80%—90% of lead blood levels in children are linked to sources other than drinking water.
* Health effects can include deficiencies in IQ, lower attention span, hearing problems, impaired mental development, and low birth weight.

WHAT CONSUMERS CAN DO

* Women who are pregnant or nursing small infants and families with small children may wish to:
* Run the tap for several minutes before drinking *
* Have your tap water tested for lead *
* Have your children’s blood levels tested *
* If testing shows high levels, consider installation of “point-of- entry devices” and be sure to maintain properly
* If testing shows high levels, consider use of bottled sources of known quality.*

Source: EPA Environmental News, May, 1993.

Appendix II

FACT SHEET ON LEAD HEALTH IMPLICATIONS

The health effects of most serious concern are:

* Disruptions in normal mental development in babies and young children.
* Small deficiencies in IQ, attention span, and hearing with low level exposure to lead.

Other effects are:

* Alteration in red blood cell metabolism.

* Alteration in vitamin D synthesis.

* Premature birth.

* Low birth weight.

* Small increases in blood pressure in adults.

Effects are generally associated with blood lead levels above 10 micrograms of lead per deciliter of blood (ug/dl), although some recent studies indicate subtle changes at even lower levels.

EPA estimates approximately 5 percent of U.S. children have baseline lead levels close to 10 ug/dl, independent of drinking water.

Source: EPA Environmental News, May, 1993.

Appendix III

FACT SHEET ON REQUIREMENTS OF THE LEAD AND COPPER RULE

LEAD REGULATION INCLUDES:

Monitoring Requirements	Treatment Technique
Tap water monitoring	Corrosion control treatment
Source water monitoring	Source water treatment
Water quality monitoring	Public education

Lead service line replacement

MONITORING REQUIREMENTS:

* Lead tap water monitoring. Public Water Systems (PWSs) must identify homes at high risk of lead contamination. These include homes supplied by lead service lines and homes with lead solder. A single one-liter sample must be collected at the tap of each home to determine water lead level. Collected once every 6 months.
* Water quality monitoring. Large PWSs (> 50,000 population) must sample water quality parameters at the treatment plant and in the distribution system to determine the effectiveness of existing treatment. Small (3,300 population) and medium (3,301—50,000) systems must conduct this monitoring only if they exceed the action level. Collected once every 6 months.
* Lead source water monitoring. When system exceeds the lead action level, supplier must sample lead in source water to determine contribution to total tap water lead levels.

TREATMENT TECHNIQUE: Triggered by exceedance of lead action level of 15 parts/billion measured in the 90th percentile.

* Corrosion Control. Supplier must install treatment that minimizes lead levels at consumers' taps without causing system to violate other standards. Optimal treatment developed through a comparative studies of several treatments. Must be operating within 2 years of state approval. Large systems by 1997. Medium by 1998 or sooner. Small by 1999 or sooner.
* Source Water. Supplier must install treatment if source water contributes significant levels of lead to tap water (i.e., > 5 ppb). Must be operating within 2 years of state approval. Installed in conjunction with corrosion control treatment.
* Public Education. System exceeding lead action level must deliver public education to all customers through water bills, brochures and newspapers annually. TV and radio every 6 months. Begin within 60 days of exceeding. Continues as long as system exceeds lead action level.
* Lead Service Line Replacement. Systems exceeding lead action level after installing treatment must replace all lead service lines that contribute > 15 ppb to tap water. Replace a minimum of 7% per year.

Appendix IV

PREVENTATIVE MEASURES

* Have your tap water tested for lead, and if testing indicates high lead levels:
* consider installation of reliable “point-of-entry” devices or “point-of-use” devices, *specifically designed to remove lead* , or
* consider the use of bottled water *of known quality* or alternative water sources of known quality;
* Ask your water authority whether you have a high risk residence, e.g., are serviced by lead service lines;
* Run the tap until the water turns cold or for at least 15—30 seconds before drinking the water;
* Have children’s blood lead levels tested;
* Use cold tap water for cooking; and,
* Avoid the use of hot tap water in preparing baby formulas.

Thank you. I can take questions at this time.

Appendix V

Assessing the Risk of High-Dose Exposure to Lead: Sample Questionnaire*

Does your child—

1. Live in or regularly visit a house with peeling or chipping paint built before 1960? This could include a day-care center, preschool, the home of a babysitter or a relative, etc.
2. Live in or regularly visit a house built before 1960 with recent, ongoing, or planned renovation or remodeling?
3. Have a brother or sister, housemate, or playmate being followed up or treated for lead poisoning (that is, blood lead > 15 ug/dl)?
4. Live with an adult whose job or hobby involves exposure to lead?
5. Live near an active lead smelter, battery recycling plant, or other industry likely to release lead?

*From CDC, Centers of Disease Control, Oct., 1993.

Notes

1. U.S. Department of Health/Services. Public Health Service/Service Centers for Disease Control, *Preventing Lead Poisoning in Young Children* , October, 1991, p. 87.
2. United States Environmental Protection Agency, Office of Water, *Lead in Your Drinking Water* , April, 1987.

Field Trip

Regional Water Authority, Education Department, Call (203) 562-4020 to set up trip.

Teacher Resources

Kits

Water Pollution: Solve realistic problems of water environments by varying temperature, type of waste, dumping rate and method of treatment comes with a program disk plus backup, study guide and 25 student lab books. For grades 7-12. Apple II, 5 1/4” disk.
Chemical Pollution of Water: This kit offers a safe way to test for potentially hazardous chemicals, by using indicator paper rather than liquid chemicals to test for copper, lead, oil, nitrates and ammonium oresence in water. The class also performs pH tests to determine if water is acidic or basic. All materials for 15 students working singly or 30 students working in pairs are included, along with a teacher’s manual and student instructions.
Qualitative Introduction to Water Pollution: Pollution may be a complex topic to discuss, but this lab activity takes a clearly uncomplicated approach to showing your students what pollution is. Simple and reliable tests on your natural or treated water samples reveal easy to-identify color results when one of ten different common pollutants is present. Along with pH determination, students test for ammonia, chlorine, chromium, copper, cyanide, iron nitrate, phosphate, silica and sulfide. You’ll receive all the chemical reagents, dropping plates, sample tubes and student worksheets to perform 50 individual experiments, with up to 12 groups able to work simultaneously. Complete teacher’s booklet and MSDS for each chemical reagent included.
Tapwater Tour Water Quality Test: This five part activity will really hit home, when students actually test their own water for pH, chlorine, hardness, iron and copper presence. Students can

conduct the tests safely and simply in their homes, with single unit dosages of reagents that come packaged in sealed foil pouches. Accompanying the test are complete instructions, lecture materials, illustrated handouts, teacher tips and fun wrapup activities, to reinforce key concepts in each unit. Designed for 35 students.

Pre- and Post-Test

Preventing Lead Poisoning in Children

Write T for the statements that are true and write F for the statements that are false. Write in the correct word(s) in the statements that are false to make them true.

1.____ Lead is a toxic metal, that has been widely used in paints, household plumbing and fixtures, and in some water supply service lines.
2.____ Adults are most susceptible to lead.
3.____ 80%-90% of lead blood levels in children are linked to sources other than drinking water.
4.____ Lead typically enters drinking water as a result of leaching from household plumbing and fixtures and/or water distribution lines.
5.____ Paint is the only source of lead poisoning.
6.____ All U.S. children are exposed to some lead.
7.____ Lead can enter into the body and affect the brain and the nervous system.
8.____ You should always use hot water from your tap when cooking or making a baby’s formula.
9.____ Children with lead poisoning always look sick.
10.____ To prevent this disease, you should test your home and the other places where children play a lot.
11.____ Every child between the ages of six months and six years should be tested for lead at least once a year.

Multiple Choice

Choose the best answer to each statement
1. Monitoring lead in drinking water should be done by
a. EPA b. state c. local d. all of these
2. Water systems should not exceed the lead action level of
a. 15 ppb b. 25 ppb c. 160 ppb d. 257 ppb
3. EPA estimates approximately ____ percent of children have baseline lead levels close to ug/dl, independent of drinking water.
a. 2 percent b. 5 percent c. 50 percent d. 75 percent
4. Public Water System must identify homes at ____ risk of lead contamination.
a. low b. high c. little d. all of these
5. The sources of lead may be found in
a. dust b. soil c. water d. all of these

Describe or explain three of the following

1. Where might lead be found?

2. How can you tell if lead is a problem?

3. How can your family stay safe around lead?

4. Should you eat food that is close to highways?

5. What might you do to help prevent lead poisoning?

Pre-Test/Post-Test Answers:

True or False

1. T, 2. F, children, 3. T, 4. T, 5. F, food, air, water, soil, dust, 6. T, 7. T, 8. F, 9. F, you can not always tell, 10. T, 11. T

Multiple Choice:

1. D

2. A

3. D

4. B

5. D

Describe or Explain: Answers may vary

1. Almost anywhere: water, dust, soil, air.
2. Get a lead test at your clinic at least once a year until 6.
3. Damp mop to get rid of loose paint, use cold water instead f hot, let water run about 20-6-seconds before use, don't pick up dirty toys or objects.
4. Not, it may had lead in it.
5. Run the tap for several minutes before drinking.
   Have your tap tested for lead.
   Have children's blood levels tested

Bibliography

Amann, Dick, *The Lead Poisoning of America's School Children: An Action* , Programmed Studies, Incorporated, Stow, MA, 1991.

American Academy of Pediatrics, Committees on Environmental Hazards and Accidents and Poison Prevention, "Statement on Childhood Lead Poisoning," 1987.

Centers for Disease Control, "Preventing Lead Poisoning in Young Children," US Department of health and Human Services, Atlanta, GA, 1991.

Connecticut Section American Water Works Association, "Lead Booklet for Pregnant Women and Parents with Small Children," Regional Water Authority, CT, 1991.

Douglas, Farguhar, *State Lead Poisoning Prevention Directory 1992* , National Conference of State Legislatures, Denver, CO, 1992.

Farmer, P., *Lead Pollution from Motor Vehicles* , 1974-86: A Selected Bibliography, 1992.

Lockery, Robert W., *Lead Poisoning: A Selected Bibliography* , Vance Bibliographies, Monticello, IL, 1988.

Mahaffrey, K.R., *Dietary and Environmental Lead: Human Health Effects* , Elsevier Science Publishing Company, Inc., New York, 1985.

Pesce, John, *The Lead Paint Primer,* Star Industries, Inc., Melrose, MA, 1987.

Regional Water Authority, “Exploring the Water World,” 1991.

US Department of Health and Human Services, “Strategic Plan to Eliminate Childhood Lead Poisoning,” 1992.

United States Environmental protection Agency, “Environmental News,” May, 1992.

United States Environmental Protection Agency, “Lead and Your Drinking Water, June, 1993.