

*Pollution Prevention Opportunities for PBT Chemicals*

## Lead and Lead Compounds

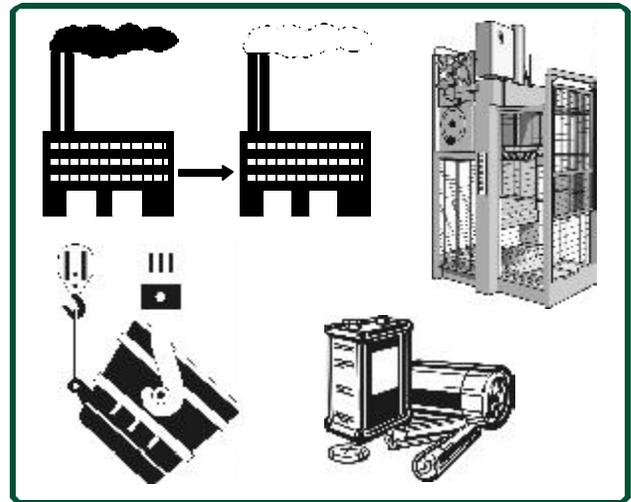
Lead poisoning affects virtually every system in the body, especially the nervous system. Often it occurs with no distinctive symptoms at low levels. Lead tends to bioaccumulate in bone after long-term exposure.

Lead can damage a child's central nervous system, kidneys and reproductive system. At very high levels, lead can cause coma, convulsions and death. Even low levels of lead are harmful and are associated with decreased intelligence, impaired neurobehavioral development, decreased stature and growth and problems with coordination.

### Where are Opportunities for Pollution Prevention?

Before its harmful effects were known, lead was widely used in paint, gasoline, water pipes and many other commonly used products. Today, lead-based paint, leaded gasoline and lead-based household plumbing are mentioned mostly in past tense. However, remnants of the old hazards remain.

Lead is still used in a wide variety of industries. The largest usage is in storage battery manufacturing. Some of the other uses include: solders, ammunition, electroplating, electrical equipment, X-ray and nuclear shielding, specialty casting, cement glazes and stabilizer in plastics. It is also used in lining pipe and sheet in chemical installations.



### What is Pollution Prevention?

Pollution prevention means using source reduction techniques in managing waste problems and, as a second preference, environmentally sound recycling. The benefits of practicing pollution prevention include reduced operating costs, improved worker safety, reduced compliance costs, increased productivity, increased environmental protection, reduced exposure to future liability costs, continual improvement, resource conservation and enhanced public image. For more details, see Ohio EPA's Office of Pollution Prevention fact sheet, *What Is Pollution Prevention?* at [www.epa.state.oh.us/opp/fact1\\_web.pdf](http://www.epa.state.oh.us/opp/fact1_web.pdf).

- ✓ **One Ohio Company completely removed lead in its chemical processes. It replaced the old system of lead cathodes and copper busbar for each anodizing tank to an all aluminum cathode system. This switch replaced the only source of lead in the anodizing process. The aluminum is a better conductor than lead. This also increased productivity. The facility paid for the aluminum by selling the lead and copper from the tanks to a scrap dealer. This process change also reduced energy consumption by 30 percent.**

### Lead Pollution Prevention in Industries

Pollution prevention in a manufacturing setting generally means material substitution, process improvement and product change or redesign. Often, pollution prevention practice involves applying one or more of these strategies in tandem.

**Material Substitution** is the use of different materials that are less toxic or non-toxic. This may include the use of a lead-free raw material or different equipment that does not require lead.

By changing to a non-lead, waterborne paint, one company eliminated 18,000 pounds of paint filters that were shipped off-site as hazardous waste. This change also reduced worker exposure to lead.

A manufacturer of electric lift trucks and antenna rotators removed lead and chromium from most paint formulations, eliminating paint waste as a hazardous waste stream. Paint sludge is now recycled into building materials such as quarry tile, asphalt, mastic and binder.

Beginning in 1994, as part of one city's pollution prevention efforts, its Department of Public Works' Highway Maintenance Division converted from solvent-based paints to waterborne paints for highway line striping. To accomplish this, the city conducted research, converted equipment, purchased new equipment and trained managers and painting crew employees.

The waterborne paints have significant environmental advantages. This project eliminated the harmful cleaning solvents and resulting hazardous waste generated from the cleaning process. Hazardous waste disposal resulting from the paint residues and empty paint drums was eliminated. The paints no longer contained lead, cadmium and other heavy metals. Lastly, this process produced significantly lower emissions of volatile organic compounds (VOCs) from both yellow and white paints.

The use of toxic materials and hazardous waste has been eliminated totally by this conversion. Based on an estimated annual use of 22,000 gallons of line stripe paints, approximately 33,000 pounds of lead and approximately 36,000 pounds of VOCs have been eliminated from this city's environment.

A truck manufacturer instituted a lead-free electro deposition coating operation. This company was also using lead solder in its battery cable assembly process. Battery cable ends were dipped in solder for electrical conductivity. After extensive testing for performance two materials were eventually approved. The result was a decrease in the lead content of solders from 45 percent to 0.5 percent by weight. Approximately 16,000 pounds of lead solder was used each year before this change.

**Process Improvement** means to improve the operational process, thereby reducing or eliminating the need for lead usage. This includes, for

example, increasing the operating efficiency of an equipment or a process, good maintenance programs and training to reduce the risk of waste generation.

In a tools manufacturing facility, floor dry was used throughout the manufacturing area to absorb oil drips, leaks and small spills. Used floor dry was considered hazardous waste due to suspected lead content in the oil. A maintenance program to service and repair equipment reduced leaks and drips. Training raised the understanding of, and means to reduce, the occurrence of spills. In 1995 and 1996 the company switched from using absorbents to using floor mats which could be wrung out and cleaned. The mats were reused and the oil was recycled. Later, they substituted an oil that does not contain lead. Hazardous waste generation from this source was eliminated.

One company worked to reduce fresh water consumption and generation of electroplating sludge from wastewater treatment. Three evaporative separators were installed to recover lead plating bath from rinse waters. Seven cooling towers were installed, recycling 5.3 million gallons of water per day. A computer-controlled cascade rinse water system was installed to conserve water and optimize the rinse process. A new computerized system was installed in the pretreatment system to control and minimize chemical addition and monitor performance.

By combining the reduction of water with improvement to the pretreatment process, this company has reduced water consumption by 48 million gallons/year and reduced the generation of hazardous waste by 320,000 pounds/year. It has reduced stack emission of particulate by 1,388 tons/year and has initiated research into alloys to eliminate the need for lead in its products.

**Product Change or Redesign** has the potential to eliminate lead from the manufacturing process, especially when lead becomes incorporated into the product.

An Ohio manufacturer of X-ray products decided to move from lead foil/paper X-ray grids to an aluminum grid. This not only eliminates lead but also eliminates the lacquers used to coat the paper, the adhesive containing methyl isobutyl ketone and the acetone used to clean the grid.

A producer of colorants, adhesives and dispersions for the plastics industry replaced lead chromate pigment with organic compounds.

### Systematic Approaches to Pollution Prevention

A systematic approach to pollution prevention establishes and maintains a systematic management plan designed to continually identify and reduce environmental impacts through pollution prevention. Many facilities are incorporating pollution prevention into their quality programs or environmental management systems.

Since the early 1990s, International Truck and Engine Corporation - Springfield Operation has reduced lead use and lead byproducts from more than 100,000 pounds to less than 200 pounds per year using a systematic approach to pollution prevention. One recent example is summarized as follows. (*International Truck and Engine Corporation, "The Green Report." Volume 6, Issue 1, November 2001.*)

In the old cab and stamping facility, damage occurred to cabs regardless of the care taken during the manufacturing process. Damage to cabs ranged from minor scratches to dents the size of golf balls. The main causes of the damage included impact between cabs on conveyors and in storage, die marks and the movement of people with welders or tools in and out of cabs. In order to salvage the damaged cabs, a method used throughout the truck industry known as "lead soldering" was performed. Lead solder was heated until workable or soft. It was then smoothed into shape to cover up the dents in the

## Pollution Prevention Opportunities for Lead Usage

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cab. This created a smooth surface for painting that is not subject to rust and is more durable than plastic putty.

A team was formed at the Springfield Operations and given the task of finding replacements for the two types of lead solder then used to repair truck cabs. This required the creation of a cross-functional team with diverse backgrounds. The knowledge and experience of staff, management and employees was vital to the success of implementing any process change. The team consisted of representatives from Quality, Engineering, Management, Environmental, Safety and the United Auto Workers members. The team was allowed to think out-of-the-box, and not just look at alternative solders or putty. The easy solution was to replace the lead bars with a lead-free solder. The innovative solution was to find a way to reduce or even remove the solder application altogether. After searching and evaluating alternatives, the team found its answer in a portable device used to pull dents out of metal. With the dents removed, solder was not required to fill in the defects. The dents were pulled without drilling and without draw pins that must be ground out. Also, because of the low operating temperature, there was less deformation of the metal. The \$1,700 investment in the device has saved Springfield Operations time, money, energy and eliminated the disposal of used lead solder.

In the few short months after the unit was purchased, it returned its investment. The production department embraced the technology since it reduced repair time and ensured on-time delivery to the next department on the assembly line. Employees liked the ease of use and the reduced potential for breathing in lead emitted from the soldering method. Damage that cannot be repaired with the unit is now repaired with a lead-free solder. The Body Plant reduced the amount of lead used to repair cabs from 30 pounds a month to zero by switching to the dent pulling device and the lead-free solder.

### Contact OPP

For more information and assistance on pollution prevention, contact Ohio EPA's Office of Pollution Prevention (OPP) at (614) 644-3469 or visit OPP's Web site at [www.epa.state.oh.us/opp](http://www.epa.state.oh.us/opp).

Ohio's Materials Exchange (OMEx) at [www.epa.state.oh.us/opp/omex](http://www.epa.state.oh.us/opp/omex), lists "*materials wanted*," including metal wastes, metal-bearing sludges and filter cakes. Users may also post their "*materials available*" on the listing. The exchange proves valuable in the reuse of materials and preventing them from becoming a waste.

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[www.epa.state.oh.us/opp](http://www.epa.state.oh.us/opp)

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The Office of Pollution Prevention was created to encourage multi-media pollution prevention activities in Ohio to reduce risk to public health, safety, welfare and the environment. Pollution prevention stresses source reduction and, as a second choice, environmentally-sound recycling, while avoiding cross media transfers. The office develops information related to pollution prevention, increases awareness of pollution prevention opportunities, and can offer technical assistance to business, government and the public.



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