

---

# Arsenic and Old Lead

---

**DEBORAH E. COHEN, PH.D.**

**EXECUTIVE DIRECTOR**

**NEW JERSEY OFFICE FOR PREVENTION OF MENTAL RETARDATION AND  
DEVELOPMENTAL DISABILITIES**

## Background

We live in a world that is infused with chemicals and toxins. Many of these elements make our lives easier and more comfortable. Our homes, both inside and out, are built and furnished with materials that are treated or have substances added to them to make them more durable and attractive. Necessities, including our food and clothing, are subjected to chemical exposures—both natural and synthetic. Common appliances, like washing machines and dishwashers, and conveniences, such as dry cleaners, all require the use of harmful substances. As these toxins accumulate in fat, blood, organs, hair and nails, or are passed through the body in amniotic fluid, breast milk, urine, feces, sweat, and semen, our health and that of generations to come is greatly threatened.

## Two National Reports

Two reports recently issued by federal agencies underscore the magnitude of our environmental problems. The Centers for Disease Control and Prevention (CDC) report, [Second National Report on Human Exposures](#)” documents the extent to which our bodies are subjected to numerous chemicals and heavy metals on a daily basis (1). While improvement was found in some areas, e.g., decreased levels of exposure to lead and cotinine, increased levels of exposure were cited for other toxins, e.g., phtalates found in common household products such as soap, shampoo, and flexible plastics. The report issued by the Environmental Protection Agency (EPA), “America’s Children and the Environment” (2), found that:

- Almost 8 percent, or 5 million, women of child-bearing age have mercury concentrations greater than the maximum precautionary level. Children born to these women are at increased risk of cognitive and developmental damage. Mercury in fish is the greatest source of exposure, with coal burning serving as the highest source of mercury.
- Children whose parents worked with pesticides and wood preservatives were at a higher risk for having birth defects and for dying young.
- Pesticides, other chemicals, and radiation may contribute to an increased frequency of some childhood cancers. Children born to parents who work with or use certain chemicals are more likely to have cancer in childhood.

- The number of children having respiratory illnesses, particularly asthma, is increasing due to exposure to air pollution. This has resulted in difficulties in breathing resulting in increased use of medication, visits to doctors' offices, and outpatient emergency rooms and hospitalization.
- Children of women who were exposed to chlorinated solvents have an increased risk for heart and oral cleft defects.

## Purpose

The purpose of this paper is to review the common chemicals and metals to which we are exposed daily. This paper raises issues about the effects these exposures may have on persons with mental retardation and other developmental disabilities. In preparing this document, a broad literature search was conducted to try to locate research addressing this issue. While much is becoming known about toxins and reproductive health, fetal development, and child development, and as a cause of birth defects, little research was found regarding the effects on persons currently living with mental retardation. In fact, the research that was found was concerned primarily with the ethical issues associated with using institutionalized persons as “guinea pigs” in determining the efficacy of new products, e.g., testing of retinol A at Vineland Developmental Center. Thus, several assumptions are posited here with respect to persons with mental retardation. Some are also applicable to the general population. These assumptions serve as the foundation for policy recommendations in the concluding section.

## Assumptions

**ASSUMPTION 1:** Persons whose neurological systems may already be compromised may exhibit behaviors, illnesses, and secondary conditions following exposure to pollutants. It is likely that these conditions are attributed to the primary cause of the disability rather than resulting from the noxious exposure.

**ASSUMPTION 2:** Toxic exposures result in poor developmental outcomes or illnesses in an equal opportunity fashion. Differences in the expression of the outcomes may be attributed to age, e.g., child versus adult, and socioeconomic standing. Race and ethnicity are greatly influenced and affected by socioeconomic status, e.g., where one lives and works (3). Thus, persons with mental retardation are likely to be as adversely affected as all other populations.

**ASSUMPTION 3:** For the most part, our health care providers do not know more about environmental exposures than most patients. A recent survey by Emory University researchers found that “the importance of environmental exposures to children’s health is well known to pediatricians, but they need more training in that area (4).” One-quarter of medical schools offer no instruction in environmental medicine. Those that do offer training average less than 10 hours of education over four years.

**ASSUMPTION 4:** We really know very little about the effects of most modern day pollutants. Under the Toxic Substances Control Act (TSCA), chemical companies are allowed to release new compounds on the market without conducting any studies of their effects on humans or the environment. Some manufacturers conduct rudimentary research prior to production, but fewer than half of all applications to the EPA for new chemical production include any toxicity data. Eighty percent of new chemicals receive approval in less than three weeks with an average rate of seven a day (5, 6). Therefore, it is reasonable to assume that the health of persons with mental retardation are affected by exposures equally and, in some cases, to a greater extent, e.g., the effect of synthetic materials on a person who has tactile sensitivities.

## Implications

### Our Homes

#### THE CONTINUING LEAD THREAT

Historically, the most well-known toxin found in our homes is lead. Despite decades of evidence that lead is harmful to the developing neurological systems of young children, manufacturers continued to add this heavy metal to house paint until it was banned in 1978. (It is important to note that this legislation applied only to house paint. Lead continues to be added to other types of paint, e.g., paints used for boats and some art supplies.) The good news is that, as new housing has been built and lead has been removed from paint, gasoline, water pipes and solder, fewer children are experiencing high blood lead levels. A significant decline in both the number of children with elevated blood lead levels and in the blood level considered to need medical intervention has occurred over the past three decades. In 1970, the U.S. Public Health Service established a blood lead level of 60 ug/dl as the standard requiring medical intervention. This standard was revised in 1971, with the level dropped to 40 ug/dl; in 1975 with the level set at 30 ug/dl; and in 1985 at a level of 25 ug/dl (7). The CDC established our current limit of 20 ug/dl for medical intervention and greater than 10 ug/dl for environmental and nutritional intervention in 1991.

As a result of changes in the rates of exposure, 4.4 percent of children ages 1-5 had blood lead levels greater than 10 ug/dl in the early 1990s. By 1999-2000, the percentage of this cohort with elevated blood lead levels had decreased to 2.2 percent (7).

An estimated 38 million housing units throughout the United States contain lead-based paint (8-10). This is a substantial decrease from 1990 when an estimated 64 million homes were contaminated. Of those units with hazards, 1.2 million housed low-income families (less than \$30,000/year) with children under 6 years of age. Although 17 percent of government-supported, low-income housing had hazards, 35 percent of all low-income housing had significant lead-paint problems. A high proportion of the residents of these housing units are minority populations. The most recent report on Human Exposure to Environmental Chemicals shows that minority children continue to carry a higher lead burden than white children (1, 2).

For households with incomes greater than \$30,000, 19 percent had hazards. Fourteen percent of all houses had significantly deteriorated lead-based paint, and 16 percent and 7 percent, respectively, had dust lead and soil lead levels above current standards of the U.S. Department of Housing and Urban Development (HUD) and the EPA. Housing in the Northeast and Midwest had about twice the prevalence of hazards as compared with housing in the South and West (8-10).

In addition, recent research has demonstrated that even low blood lead levels (below 10 ug/dl) can result in loss of IQ and other health problems (3, 11-13). However, the true toll that exposure to lead is extracting is incalculable as only an estimated one third of all children are tested for lead poisoning. The percentage of children with mental retardation who are screened is not known.

While federal agencies are struggling to rectify the problems inherent in residual lead in older housing, other lead-related problems regularly crop up in an insidious fashion. Lead has been found in the paint used on plastics covering our foods, e.g., bread bags, in children's toys, in decaying venetian blinds, in calcium supplements and in many other common products. Lead has been banned from pencils, crayons and chalk. However, many American companies have plants in foreign countries, notably Southeast Asia. Despite packages having the appropriate federal regulations citing these products to be lead-free, some have been shown to have lead in them upon testing (14). This is of particular concern for persons with mental retardation who may continue to exhibit pica behaviors beyond the formative years.

#### **DANGEROUS TOYS**

In addition to lead, our children are exposed to a multitude of other chemicals and pollutants through their toys. For example, many toys are made from synthetic vinyl that includes cadmium and other toxins (15). Beginning in infancy with coolers that hold breast milk and continuing throughout their formative years, children play with and use hundreds of vinyl-based products on a daily basis. Some common products are teething rings, backpacks, dolls, coaxial cables for computers and computer games, placemats, raincoats and hats, and costume jewelry, to name a few.

#### **OTHER DANGERS**

Our homes include other agents that have toxic effects on child development and our health. Tobacco smoke is an irritant to the eyes, nose, throat, and lungs. Children exposed to tobacco smoke have increased bouts of ear infections, upper respiratory infections, and colds. The levels of cotinine, a metabolite of nicotine, dropped significantly for all age groups from 1991-1994 to 1999-2000. However, in 1999-2000, cotinine levels in children were more than twice that found in adults (1). Non-Hispanic blacks had levels more than twice those of Mexican-American and non-Hispanic whites. Tobacco smoke, as well as dust and dust mites, molds, furry pets and roaches, are all triggers for asthma and allergies (16).

Combustion products are gases and fine particles produced when any fuel is burned. All of these products are unhealthy, causing irritation and illness. In normal operation of a

furnace, these pollutants go up the chimney, but these pollutants are also produced by fuel-fired space heaters and gas ranges. When appliances are not properly vented, combustion products collect in the building and may include formaldehyde, oxides of nitrogen, carbon monoxide, carbon dioxide, and other chemicals as well as fine particles of soot (16).

## Our Food

### **PREGNANCY AND BREAST FEEDING**

Our daily food is not immune from toxins. While studies have shown that lead stored in bones is released during pregnancy, recent investigations are beginning to document that breast feeding may also stimulate and promote the release of lead from bone. Children who were exclusively breast fed by their mothers had higher blood lead levels than children whose mothers both breast fed and used formula and those who were not breast fed at all (17).

### **FISH**

High levels of mercury, commonly found in fish like tuna, have also been found in breast milk. Because this metal remains in the body, and travels easily through the placenta and breast milk, women of childbearing age need to limit some fish intake before and during pregnancy and while breast feeding (18-19).

Despite research on the benefits of eating fish, this food source has emerged as a host for a broad assortment of pollutants. Mercury, polychlorinated biphenyls (PCBs), dioxins, flame retardants and other toxic chemicals build up in fish and seafood. Big predatory fish tend to have higher pollutant levels. Fatty fish species tend to carry higher levels of PCBs and dioxins. Mercury and PCBs are particularly toxic to the brain, so exposure early in life when the brain is still developing can lead to IQ loss and changes in learning and behavior (18).

### **VEGETABLES, GRAINS, AND MEAT**

Lead arsenate was used as a common pesticide for decades and leached into our foods (carrots, onions, potatoes and other root crops as well as fruits and grains). Currently, there are no federal regulations requiring fertilizer manufacturers to test their products to determine the amounts of heavy metals, dioxin, or other pollutants they may contain, nor are fertilizer companies required to list the sources from which they obtain minerals (20). Humans are subjected to numerous chemicals and pollutants through meats and poultry. Both types of livestock are subjected to high levels of toxins through their feed, both that occur naturally or through additives as well as through the air.

Cadmium, chromium, dioxins, and mercury are also found in many vegetables. These metals have been found to have known or probable carcinogenic effects. Some (dioxins, lead, and mercury) have been linked to infertility, birth defects, and neurological system abnormalities (20). Some heavy metals do occur naturally in the environment, e.g., rock phosphate fertilizers contain high levels of cadmium. However, many micronutrient fertilizers contain heavy metals and dioxins that come from the “recycling” of hazardous

industrial waste. These include aluminum or copper smelting; the manufacture of cement, and steel production (20).

### Our Day Care Centers, School, Work, and Leisure

It is impossible to name an environment where we spend our time in which we are not subjected to pollutants. Paints, varnishes, solvents, pesticides, new carpets, and poor indoor air quality and inadequate ventilation in schools can be harmful to children's physical and mental health. From aggravating asthma and allergies to causing cancer and brain damage, these powerful toxins may be at the root of illness and behavior problems for millions of children. Most states, for example, do not have regulations regarding where child day care centers are situated. Thus, many are based in church basements, old buildings and other places that are covered with lead-based paint.

Recess and outdoor athletic events do not necessarily provide our children with a breath of fresh air. A recent report by the National Environmental Trust, Physicians for Social Responsibility and the Learning Disabilities Association of America estimate that industry releases 24 billion pounds of neurological toxins annually (5). However, only 5 percent of the estimated total emissions, 1.2 billion pounds, are reported to the EPA.

With over 80,000 chemicals included in the federal inventory, it is impossible to calculate the number of neurological toxins to which Americans are exposed in their workplaces—and which may be carried home in their bodies and in their hair and nails or on their clothes. For example, the safety and health topics page for the National Institute for Occupational Safety and Health (NIOSH) includes about 70 different topics, each of which has numerous subcategories. One of these topics is relevant to environmental workplaces and persons with mental retardation and is one of the very few instances of documented concern in this area.

### SHELTERED WORKSHOPS

In 1998, a representative of NIOSH contacted The Arc of the United States and met with its Health Promotion and Disabilities Committee to discuss environmental health and work safety practices for persons with mental retardation working in sheltered workshops. As a result, NIOSH conducted a health hazard evaluation of one workshop and found that sheltered workshop employees had low management awareness of worker health and safety issues. Because of these findings and an inability to identify additional occupational health and safety information, NIOSH evaluated 10 additional sites. In 1999, NIOSH published a report, "Protecting Workers with Developmental Disabilities" in the February 2000 issue of *Applied Occupational and Environmental Hygiene* (21) and has made the report available on its website. Exposure of chemical and physical agents, hazard communication training, pica behaviors, and warning devices and alarms are among the topics addressed.

The specific types of work that persons in sheltered workshops carry out are of concern as well. Some instances of poor environmental conditions have been reported to The Arc of the United States. While two examples are offered that are anecdotal, it is likely that such situations are common. First, plastic shrink wrapping of packages was the primary

occupation of one workshop. The site did not have proper ventilation, resulting in employees being subjected to toxic fumes and high heat levels. In addition, safety precautions were minimal and burns were common.

In the second instance, manufacture of lead fishing weights was the primary occupation. Several employees became ill. However, because these employees had secondary conditions relative to their mental retardation, their behaviors were not immediately associated with their occupational exposure to lead. Ultimately, they were tested and found to have blood lead levels elevated high enough to be in need of medical intervention.

## Conclusions and Recommendations

### Arsenic and Old Lead Revisited

#### **ASSUMPTION 1 RECOMMENDATION**

Little or no research into the effects of toxic exposure on persons with mental retardation has been conducted. Differences in the toxic threshold relative to differing etiologies and causes of mental retardation have not been determined. Further, the contribution of pollutant exposures to poorer intellectual as well as to physical, behavioral and mental health is not part of any research agenda. It is, therefore, recommended that AAMR and other organizations join forces to work with federal agencies, e.g., NICHD to develop and implement a research agenda. These agencies should work with CDC, the Office of Disability and Health, to develop a research agenda addressing secondary conditions arising from toxic exposures.

#### **ASSUMPTION 2 RECOMMENDATION**

Both mental retardation and toxic exposures occur across all racial, ethnic and socioeconomic levels. However, while surveillance systems typically include demographic information regarding racial and social status, information on disabilities of all types is generally excluded. As a result, data documenting the degree to which persons with developmental disabilities are being injured by pollutants are unavailable. It is recommended that AAMR and other organizations work with CDC, the National Center for Health Statistics and other federal agencies to identify and include this population in their surveillance systems. (No system currently exists to determine the prevalence of developmental disabilities. It is thus also recommended that CDC, the National Center on Birth Defects and Developmental Disabilities (NCBDDD) implement a national surveillance system specific to developmental disabilities.)

#### **ASSUMPTION 3 RECOMMENDATION**

The lack of education and training in environmental health among our health care providers must be rectified. Recently, the NCBDDD funded four regional Fetal Alcohol Syndrome Training Centers. The purpose of these centers is to develop and implement a standardized curriculum to be used by medical schools and other allied health professionals and as part of continuing education programs. AAMR and partners should work with CDC and other relevant agencies to develop and implement a similar program

for training medical and allied health personnel in environmental health. The curriculum should include training in the possible effects of toxic exposures on persons with developmental disabilities.

#### **ASSUMPTION 4 RECOMMENDATION**

Our low level of knowledge about the effects of modern day pollutants and the rate at which new chemicals are being introduced into the market place without appropriate testing is extraordinarily poor. The lack of assurance for human and environmental safety is unconscionable. AAMR and collaborators should work with Congress to enact legislation that safeguards our society and world by mandating testing of all possible toxins before they are allowed on the market. In addition, Congress should re-enact and tighten legislation to control industrial and automotive emissions, toxic dumping, and enact and enforce other related health and environmental standards.

Finally, the President extended the Executive Order for the Task Force on Environmental Health and Safety Risks to Children in April 2003. Co-chaired by the EPA and the U.S. Department of Health and Human Services, the Task Force has undertaken the National Children's Study which will follow about 100,000 children before birth, through childhood, up to adulthood to investigate the relationships between environmental exposures and potential health effects. AAMR and partners should insure that the study's sample includes children born with mental retardation and other developmental disabilities.

---

## References

1. U.S., Department of Health and Human Services, Second National Report on Human Exposure to Environmental Chemicals, Centers for Disease Control and Prevention, February 2003.
2. U. S. Environmental Protection Agency, America's Children and the Environment: A First View of Available Measures, Washington, DC 2003.
3. Sandel, M. and J. Zotter, How substantial housing affects children's health. *Contemporary Pediatrics*. 2000; 17:134-148.
4. Frumkin H. et al., Pediatrician prescription: More environmental training needed. *Environmental Health Perspectives, Science Selections* 2002:110(8): A475.
5. National Environmental Trust, et al., Polluting our Future: Chemical Pollution in the US that Affects Child Development and Learning, September, 2000.
6. Greater Boston Physicians for Social Responsibility. In Harm's Way: Toxic Threats to Child Development, Cambridge, MA, 1999.

7. U.S. Department of Health and Human Services, Screening Young Children for Lead Poisoning: Guidance for State and Local Public Health Officials, Centers for Disease Control and Prevention, November, 1997.
8. U.S. Department of Housing and Urban Development, Office of Lead Hazard Control. The Healthy Homes Initiative: A Preliminary Plan. Washington, DC: USDHUD, 1999.
9. U.S. Department of Housing and Urban Development. Comprehensive and Workable Plan for the Abatement of Lead-Based Paint in Privately Owned Housing. Report to Congress. Washington, DC: December 1990: 2-5.
10. Jacobs, David, et al. The prevalence of lead-based paint hazards in US housing. *Environmental Health Perspectives*. 2002, 110:599-A606.
11. Canfield, R.L. et al. Intellectual impairment in children with blood lead concentrations below 10 ug per deciliter. *New England Journal of Medicine*. April 17, 2003:348(16): 1517-1526.
12. Needleman H.L. et al. Bone lead levels in adjudicated delinquents. A case control study. *Neurotoxicology Teratology* 2002 Nov-Dec; 24(6): 711-7.
13. Dietrich K., et al. Lead exposure linked to antisocial behavior. *Lead Safe America*, March 5, 2000.
14. At the request of the New Jersey Office for Prevention of Mental Retardation and Developmental Disabilities, the University of Medicine and Dentistry of New Jersey – Environmental and Occupational Health Sciences Institute completed analyses of several brands of crayons and chalk. All products had been manufactured by an American company but were produced in Southeast Asia and all had the appropriate lead-free regulation citation on their packaging. Varying amounts of lead were found in all products.
15. DiGangi J. Lead and cadmium in vinyl children's products: A Greenpeace Expose. *The National Post*, 1998, November 13, Section A:10.
16. Ponessa, Joseph. Draft curriculum for child care centers to protect young children from environmental toxins. Rutgers University Cooperative Extension, New Brunswick, New Jersey, 2001.
17. Hernandez-Avila, M. Impact of breastfeeding on the mobilization of lead from bone. *American Journal of Epidemiology*, 2000, 155:420-428.
18. Institute for Agriculture and Trade Policy. Safe, sustainable fish consumption for women and children. Smart guide #1. Minneapolis, MN

19. Hightower, J.M. and D. Moore. Mercury levels in high-end consumers of fish. *Environmental Health Perspectives*. 2003, 111(4) 604.
20. Institute for Agriculture and Trade Policy. Safe fields and safe foods: Keeping toxic industrial waste off the farm and out of our food. IATP Food Safety Project, 1999. Minneapolis, MN.
21. U.S. Department of Health and Human Services, NIOSH, Protecting workers with developmental disabilities. *Applied Occupational and Environmental Hygiene* 2000:15(2):171-181