

# nontoxicprint

Health in the Arts

LASER-CUTTING-SAFETY 3D PRINTING

## Lead Hazards in Art



Lead (Wikipedia) | Richard Serra, Lead Splashing, 1968

*"For centuries we have known that lead caused anemia, gastrointestinal problems ("painter's colic"), brain damage, peripheral nerve damage ("wrist drop"), kidney damage, birth defects, miscarriages, and sterility."*

### Lead Hazards

By Angela Babin, M.S.

### Introduction

Despite all the concern about lead poisoning, we are still seeing lead widely used in art - and we are still seeing lead poisoning cases in artists, children, hobbyists, elderly, etc. We have heard of cases of lead poisoning in people working in stained glass, painting, ceramics, enameling, and restoration of old houses, and those are only the cases when we were contacted. How many more cases of lead poisoning are out there? Lead poisoning in children is still one of the top public health concerns.

---

## LEAD POISONING

### History

The actual definition of "lead poisoning" has significantly changed over the past ten or so years. Prior to the late 1970s, a person wasn't considered to have lead poisoning unless his or her blood lead level was over 80 micrograms (microg)/deciliters (dL) of blood. (1 DL = 100 milliliters). The OSHA lead standard of 1978 set a limit of 60 microg/dL of blood for occupational exposure to lead, in the recognition that the old levels were too high. At a blood lead level of 60, a worker would be removed from lead exposure and not allowed back until his or her blood lead level was below 40. Even that level was recognized as not being safe for pregnant women and children, and blood lead levels of 30 microg/dL were

suggested as being safe.

In a recent article in the American Journal of Public Health, Dr. Philip J. Landrigan, Professor and Chairman of the Department of Community Medicine of Mt. Sinai Medical Center in New York City, and well-known lead expert, recommended even lower levels. Dr. Landrigan advocates removing workers from the workplace if their blood lead level is over 20 microg/dL, and not letting them back until the blood lead has fallen to 10 microg/dL.

While ten years ago, the average blood lead of the U.S. population was 15-20, the average blood lead now for the U.S. population has dropped below 10 microg/dL of blood. This is due primarily to mandatory cuts in leaded gasoline. A good suggestion for adult artists is that if your blood lead level is over 20 microg/dL you should investigate your work materials and environment to pinpoint and reduce this lead exposure.

---

## Children

Children are particularly susceptible to hazards from lead because their bones are still growing and their metabolism is faster. Children should not use lead-containing art materials.

Children can be exposed to lead through accidental ingestion of lead, or if they come into contact with their parents' work clothes, shoes, or unprotected hair, or if they are allowed to play in a studio that has lead dust or fumes. For example, a case of increased lead absorption and poisoning in a potter and her family was reported in Volume 91(7) 1991 of the New York State Journal of Medicine. The 35-year old potter and her daughter manifested significantly elevated blood lead level concentrations of 48 and 54 microg/dL respectively.

The mother mixed and used nonfritted lead glazes, and also air-brushed glazes containing fritted lead onto ceramic tiles. The studio was in the living loft, and there were no housekeeping controls or spraybooth. While the studio was separated by a plastic curtain, the patient's 5-year old daughter was often present in the studio, and in fact had recently started to spend more time in the studio, sometimes touching glazes and painting her own pottery. The girl was given a paper face mask for protection. This case illustrates the ongoing problem of safety in the home studio.

In particular, central nervous system (CNS) effects have been shown to be very serious in young children. These effects include attention deficit syndrome, slower learning, lowered scoring on I.Q. tests, and language disabilities.

---

## Reproductive Concerns

Both men and women are susceptible to hazardous reproductive effects from lead. Lead is a teratogen, and exposure can increase the risk of miscarriages and spontaneous abortions. When a pregnant woman absorbs, inhales, or ingests lead, lead can circulate through her bloodstream and pass through the placenta to the fetus. Lead exposure is also dangerous for the pregnant woman because during pregnancy, there is an increased demand for calcium. Lead can accumulate and actually replace the needed calcium that is stored in the bones.

For men, the most critical time is the period before conception, as during this time sperm are being developed. It has been noted that male workers exposed to high levels of lead have exhibited loss of sex drive, atrophy of testes, and decreased fertility.

---

## Symptoms

For centuries we have known that lead caused anemia, gastrointestinal problems ("painter's colic"), brain damage, peripheral nerve damage ("wrist drop"), kidney damage, birth defects, miscarriages, and sterility.

Research over the last decade, however, has demonstrated that lead can cause toxic effects at blood lead levels

previously thought to be safe. Often there are no apparent symptoms. This "subclinical toxicity" includes inhibition of enzymes making heme (a component of hemoglobin), delayed blood regeneration, impairment of the function of kidney tubular cells, hypertension, inhibition of sperm formation, slowing of nerve conduction velocities, and central nervous system problems.

---

### Recent Legislative Efforts

#### CDC Lead Exposure Levels

In 1992, the Centers for Disease Control (CDC) published more restrictive guidelines for childhood lead poisoning, as well as new intervention levels. The previous intervention level, set in 1985, was 25 microg/dL. The CDC now has a whole new series of levels at which certain specific actions are recommended. This "multi-tier" approach is as follows:

#### Lead Level Recommendations

- o 10 microg/dL No intervention.
- o 10 microg/dL Community prevention activity, more frequent screening.
- o 15 microg/dL Individual case management including: nutrition, education and more frequent screening.
  
- o 15-19 microg/dL Environmental investigation and intervention if persistent levels.
- o 20 microg/dL Medical evaluation, environmental investigation and re-mediation.

The CDC is recommending action at lead levels much lower than before. Copies of this statement can be requested from: Lead Poisoning Prevention Branch, National Center Environmental Health and Injury Control, Mailstop F-29, 1600 Clifton Rd., NE, Atlanta, GA 30333.

---

### Lead Exposure Reduction Bill

As proposed in the Lead Exposure Reduction Bill of 1990, which has not yet been passed, there were detailed restrictions on the uses of specific lead-containing products. Products used in the arts were recognized formally in these recommendations.

#### Allowable lead contents included:

##### Product Lead Content (%) by Dry Weight

- Paint 0.06 %
- Solder 0.1 %
- Plastic Additives 2.0 %
- Printing Inks or Pigments 2.0 %
- Plumbing Fittings % 2.0
- Pesticides 0.1 %
- Construction materials 0.1 %
- Fertilizers 0.1 %
- Glazes, Enamels and Frits 0.06 %
- Toy and recreational Game Pieces 0.1 %
- Curtain Weights 0.1 %
- Fishing Weights 0.1 %
- Stained Glass Came 0.1 %
- Wine Bottle Foils 0.1 %

### 1991 FDA Lead Levels

In 1971, the FDA set informal guidelines for levels of lead leaching from ceramic ware products. These levels were tightened in 1979. They are now further reduced because new information shows that lead can adversely affect the fetus, young children, and adults in amounts well below those previously believed harmful.

The new guideline levels for lead leaching from ceramic ware are:

- o 3 parts per million (ppm) for plates, saucers, and other flatware
- o 0.5 ppm for cups and mugs
- o 2 ppm for other small hollowware such as cereal bowls
- o 0.5 ppm for pitchers
- o 1.0 ppm for other large (> 1.1 liters) hollowware such as bowls

The amount of lead leaching from the pieces is measured in a standard test involving 24-hour contact of the piece with an acid solution.

---

### **LEAD IN THE ARTS**

Many questions to the Art Hazards Information Center focus on various ways in which artists, hobbyists and even children are using lead in artistic processes. In general, we recommend against using lead-based art materials in any process. The following list highlights the main usages.

---

#### **Ceramics**

- o Risk: Ceramic glazes, lustres and frits can contain lead.
  - o Exposure conditions: Mixing powdered glazes, spraying glazes, inhaling kiln fumes, and eating or drinking from improperly glazed foodware can result in lead poisoning.
  
  - o Example: At least ten cases of lead poisoning were reported in Arizona nursing home residents who swallowed lead-based ceramic glazes during 1987. Lead-based glazes were given to the elderly patients in plastic medication cups, and were accidentally ingested by the patients who thought they were medicines. Many of the victims had very high blood lead levels and required intensive chelation therapy.
  
  - o Precautions: Children, the elderly and other high-risk individuals should only use leadless or leadfree ceramic materials. Ceramic artists using lead frits and glazes should get routine lead level tests, and not lead-containing glazes for foodware, unless leaching tests are routinely performed.
  - o A NIOSH-approved toxic dust respirator should be worn while mixing lead-containing glazes, and cleanup should be done with wet mopping, wiping or vacuuming with a High Efficiency Particulate and Aerosol (HEPA) filter-vacuum cleaner.
- 

#### **Enameling**

- o Risk: Certain frit enamels contain lead.
- o Exposure conditions: Mixing colorants and frits, inhalation of kiln fumes.
- o Example: Two enamelists contacted CSA with lead levels of 53 microg/dL and 83 microg/dL from working with lead-containing enamel frits.
- o Precautions: Work with non-lead containing enamel frits. Make sure the ventilation system is working for the enamel

kiln.

*Use a NIOSH-approved toxic dust respirator for mixing lead frits. Wet mop and wipe surfaces after work.*

---

### **Glassblowing and Glasswork**

- o Risk: Lead is found in leaded glass, in certain colorants, some glass enamels, and glass paints.
  - o Exposure conditions: Fabricating and making leaded glassware, application and mixing of colorants and grinding or sanding finished glassware. Lead also leaches from some crystalware in the presence of acids such as orange juice.
  
  - o Example: The Food and Drug Administration (FDA) published recommendations about lead ceramics and glassware. Research has suggested that alcoholic and some other beverages stored for prolonged periods of time in crystalware decanters may leach lead. Also, the FDA tested 60 samples of crystalware from 17 countries, and found that lead released over a 24-hour period ranged from non-detectable levels to 7.2 parts per million (ppm).
  
  - o Precautions: Do not use leaded crystal for storage of alcohol or juice. Pregnant women and children should not drink from crystal beverage containers or bottles. Grinding of glass should be done with ventilation. Lead-containing batch glass or colorants should be avoided.
- 

### **Metalworking and Jewelry**

- o Risk: Certain bronzes, antique pewters contain lead. Lead is also used as a sculptural metal.
- o Exposure conditions: Casting lead-containing bronzes, working antique pewter, casting or dripping lead sculpture, banging or sawing sheet lead, soldering pewter, finishing, sanding or grinding lead sculpture, and chasing or finishing lead-containing bronzes can result in lead exposure.
- o Example: An artist who hammered and chased sheet lead sculpture had high lead levels. Also, the storage area for the rolls of sheet lead were dusty with lead-containing dust and debris.
- o Precautions: Work with non-lead containing pewter and bronze materials. Make sure lead metal is stored carefully and wrap it in plastic. Lead sculptures should be finished with a lacquer coating to prevent oxidation resulting in a lead powder residue. Use lead-free solders (those based on tin, copper and silver) rather than traditional (50/50 or 60/40) lead solder.

The Engelhard Corporation has recently formulated Silvabrite 100, free of lead, zinc and antimony. Call the Engelhard Corporation at: (732) 205-5000 for more information, or email [info@engelhard.com](mailto:info@engelhard.com).

---

### **Painting**

- o Risk: Certain pigments used in oils, acrylics, automotive paints, boat paints, rust-inhibiting paints and gessos contain lead as a pigment.
  
- o Exposure conditions: Using dry pigments or pastels that have lead as a pigment can result in inhalation, sanding or torching finished paintings, mixing lead-containing pigments for gesso and pigment recipes, tipping brushes with the mouth.
  
- o Example: [A case of lead poisoning in a 70-year-old Jewish scribe was reviewed in the Journal of Occupational Medicine.](#)  
The man was admitted to the hospital for a grand mal seizure and subsequent mental confusion, and had been complaining of fatigue and abdominal pain for the last year. Laboratory results included a blood lead level of 136 microg/100 ml of blood, and anemia. The source of the lead was thought to be special inks that the scribe prepared from

tree gum, oak bark, and a "greenish ore" which contained lead. The final ink contained about 1.3% lead. Preparation of these inks was done without ventilation. The scribe licked his loaded feather pen frequently during work.

- *Precautions: Avoid lead gesso, paint pigments, lead inks. Do not use lead-containing dry pastels or dry pigments.*
- 

### **Photography**

- Risk: Lead acetate can be used as a toner in cyanotype. Lead nitrate is used as a salted paper toner, and lead oxalate is used as a toner in platinum and palladium processing.
  - Exposure conditions: Mixing and handling these lead-containing toners.
  - Precautions: Avoid lead-containing toners. Substitutes include tannic acid for cyanotype, gold chloride for brown toning, and platinum chloride for use salted paper techniques. Potassium phosphate can be used for palladium and platinum toning.
- 

### **Printmaking**

- Risk: Certain printmaking inks contain lead as a pigment.
  - Exposure conditions: Mixing and handling these lead-containing inks.
  - Example: Lead white, flake white, chrome yellow and chrome green are examples of lead pigments.
  - Precautions: Avoid lead-containing printing inks.
- 

### **Restoration and Conservation**

- Risk: Old paints and gessos commonly contain lead. Historic buildings have lead-based paint in interiors and exteriors. Antique metal pieces can contain lead.
  - Exposure conditions: Sanding, stripping paint, refinishing, repairing and renovating lead-containing paint or surfaces can result in exposure.
  - Example: Restoring and stripping paint in historic structures can result in high lead levels. One artist had blood lead levels of over 100 microg/dL from stripping paint, and plastering and sanding the interior of a historic building.
  - Precautions: NIOSH-approved respirators, wet-mopping and wiping, vacuuming with a HEPA filtered vacuum can reduce exposure. There are several publications available on this type of work, including the Environmental Protection Agency (EPA) booklet "Reducing Lead Hazards When Remodeling Your Home" EPA 747-R-94-002. Call the National Lead Information Clearinghouse at (800) 424-LEAD for more information on this and other publications.
- 

### **Rubber Mold-making**

- Risk: The curing agent can be lead peroxide.
  - Exposure conditions: Accidental ingestion while handling these curing agents.
  - Precautions: Avoid lead peroxide as a curing agent. Follow health and safety procedures for handling organic peroxides. See the CSA data sheet on plastics for more information.
-

### Stained Glass

- o Risk: Lead came, solders, glass enamels and paints can contain lead. The copper foil method uses lead solders.
  - o Exposure conditions: Handling, soldering, sanding and finishing pieces, application lead-containing paint to glass, and firing of pieces can result in lead exposures.
  - o Example: Observation of a young female glass decorator showed high blood lead levels, resulting in an investigation of glass decorators in Northern Italy. Abnormal lead absorption was found in a large number of glass workers, the source of exposure being the high concentration of inorganic lead in the low-melting paints that were brushed and sprayed.
  - o Precautions: Stained glass artists who airbrush lead-based paints are at high risk of lead poisoning. Airbrushing should be done in a spray booth; otherwise, a NIOSH-approved toxic dust respirator should be worn. Other precautions include wet mopping of surfaces to remove accumulated lead dust, and regular blood lead tests.
- 

### Theatrical Makeup

- o Risk: Lead-containing makeup. Certain traditional Chinese makeup for opera, some Middle-eastern kohl or surma, and some imported face paints contain lead.
  - o Exposure conditions: Handling of the lead-containing powders, or makeups that have lead impurities.
  - o Example: Lead poisoning was reported in a Chinese opera actor who used lead carbonate facial powders.
  - o Precautions: Avoid imported make up products that may contain lead. Only use products for which are FDA-approved, and labeled with their ingredients.
- 

### Welding

- o Risk: Lead-containing metal and alloys, found metals that are painted with lead coatings.
  - o Exposure conditions: Welding lead metal or metal painted with lead coatings can result in exposure to lead fumes. Sanding or grinding of lead paint.
  - o Example: A sculptor had high levels of lead from exposure to lead fumes from welding sculpture made from old bicycle parts.
  - o Precautions: Do not weld or grind unknown or found metals. Arc welding creates more fumes than acetylene welding. Local exhaust ventilation for welding is needed.
- 

### General Environmental Concerns

- o Risk: Lead is found in old house paints, in certain old waterpipes, or the solders joints in water pipes, in contaminated soil, in the foils used to seal wine bottles.
  - o Exposure conditions: Leaching of lead into the water over time can contribute to higher lead levels. Removal of lead paint by a variety of methods including torching, scraping and sanding.
  - o Precautions: Reducing lead exposure overall results in a healthier environment. The elimination of lead from art materials is contributes to the general reduction of lead in the environment. See the CSA data sheet "Paint Removers" and the EPA Remodeling publication listed above for further information.
- 

### Lead-Test Kits

The following is a list of several lead-test kits. The prices vary from about \$25-\$35.

- Test for Lead in Pottery and The FRANDON Lead Alert Kit, Frandon Enterprises, Inc., P.O. Box 300321, Seattle, WA, 98103; telephone (800) 359-9000.
  - LeadCheck Swabs and LeadCheck Aqua from HybriVet Systems, Inc., P.O. Box 1210, Framingham, Mass. 01701; telephone (800) 262-LEAD.
  - LEADCHECK II distributed by Michigan Ceramic Supplies, 4048 Seventh Street, P.O. Box 342, Wyandotte, MI. 48192, telephone (313) 281-2300.
- Volume 17, No. 5, 1994

---

*This article was originally printed for Art Hazard News, © copyright Center for Safety in the Arts 1994. It appears on [nontoxicprint](#) courtesy of the **Health in the Arts Program, University of Illinois at Chicago**, who have curated a collection of these articles from their archive which are still relevant to artists today.*

---

© [nontoxicprint](#) | the authors, 2023