

- o list of neurotoxicants

~~Stevenson, Todd A.~~

*insal*  
109

**From:** Vicky Brett [vicky.brett@khi-ro.co.uk]  
**Sent:** Tuesday, June 13, 2000 4:14 AM  
**To:** 'cpsc-os@cpsc.gov'  
**Cc:** 'SWOLFE@citizen.org', 'plurie@citizen.org', 'RKFABF@aol.com'  
**Subject:** Petition HP 00-3--Candle Wicks

Dear Sir or Madam,

I have just found out that I have been unknowingly poisoning my family with lead. To make matters worse the government was aware of this and did nothing to prevent this happening or inform me of the danger we were putting ourselves in in our own homes.

Please do not sweep this under the carpet again there are enough toxic substances out there without having to put up with this unnecessary incremental source of lead that can readily be controlled.

Yours Sincerely  
Vicky Brett

Stevenson, Todd A.

*Candles*  
*110*

**From:** Kristen Santangelo [santangelokristen@hotmail.com]  
**Sent:** Tuesday, June 13, 2000 7:33 AM  
**To:** cpsc-os@cpsc.gov  
**Subject:** "petition HP00-3--candlewicks containing lead"

Ban the use of lead in candle wicks! Why risk danger for our children.

Get Your Private, Free E-mail from MSN Hotmail at <http://www.hotmail.com>

*Cavaler*  
///

~~Stevenson, Todd A.~~

---

**From:** vetterz [vetterz@gateway.net]  
**Sent:** Tuesday, June 13, 2000 11:16 AM  
**To:** cpssc-os@cpssc.gov  
**Subject:** "Petition HP 00-3--Candle Wicks Containing Lead"

To Whom This Concerns:

I am in favor of banning candle wicks that contain lead.  
Please add my name to the petition that would put an end  
to allowing the use of lead in candle wicks.

Thank You,

Mary Vetter  
P.O. Box 254  
Wallingford, PA 19086

**Re: Petition No. HP 00-3 - - Candle Wicks Containing Lead**

The National Multi Housing Council (NMHC) and the National Apartment Association (NAA), submit these additional comments in support of our original petition to ban the use of lead in candle wicks. We believe that the Consumer Product Safety Commission (CPSC) should act decisively in the interests of the health and safety of the nation's million children under the age of 6 to protect them from a totally avoidable source of lead exposure and ban the use of lead in candle wicks.

NMHC/NAA participated in the May 5 meeting of the Lead Wick Task Group meeting at the American Society for Testing and Materials (ASTM) conference where we learned of the industry led initiative to allow candle wicks to have a lead content not exceeding 0.1%. We strongly believe (1) CPSC should not delegate responsibility for addressing this critically important issue to the ASTM and (2) candles offered for sale in the U.S. should be manufactured free of lead.

**Lead wicks in candles pose a significant and unnecessary risk of exposure to children.**

In 1974, the Administrator of the U.S. Environmental Protection Agency told CPSC that Agency research had determined "lead wicked candles represented a significant incremental and unnecessary source of lead that would likely aggravate the childhood lead problem... and could equal or exceed the exposure to airborne lead associated with the busiest freeways in America."<sup>1</sup> At that time, CPSC permitted the candle manufacturers to deal with this important environmental health issue through the development of an industry position paper.

According to the report of the President's Task Force on Environmental Health Risks and Safety to Children entitled *Eliminating Childhood Lead Poisoning: A Federal Strategy Targeting Lead Paint Hazards*, nearly one million children living in the United States have elevated blood lead levels.<sup>2</sup> The report cites numerous studies in which lead has been linked to impaired cognitive function, behavior difficulties, reduced intelligence, impaired hearing and reduced stature.<sup>3</sup>

<sup>1</sup>Letter of Russell Train, EPA Administrator, to Richard Simpson, Chairman of the CPSC. 1974.

<sup>2</sup>The report may be accessed at. <http://www.hud.gov/lea/leadhaz.pdf>.

The time is past for voluntary compliance with non-binding *ad hoc* standards. There is ample documentation of the toxic level of lead emissions associated with this product as well as the deleterious effect of lead on human health. An economic assessment of the costs associated with lead dust hazards in the residential environment is contained in Table 25 of the appendix to the Federal Strategy.<sup>4</sup> Federal regulators have justified billions of dollars in testing and remediation costs for the real estate industry based on the counter balancing costs to society in general, associated with neurologically impaired children, the cost of their education, and diminished lifetime learning abilities. We believe that this economic analysis is sufficient to justify an immediate recall of candles containing lead wicks and a ban on the future sale of such products.

**The candle industry has failed to adhere to the 1974 ban on lead wicks in candles.**

The National Candle Association (NCA) acknowledges that there has been an industry-wide voluntary ban of lead in wicks since 1974. Unfortunately, some of the largest U.S. manufacturers of this product have failed to adhere to this voluntary ban. According to a recently published analysis of candles manufactured in the U.S., China and Mexico, candles produced in the U.S. had highest level of lead emissions ranging up to 66 µg/hour.<sup>5</sup> This volatilized lead is subsequently deposited throughout the residential environment in dust where children may be exposed to deleterious levels through normal hand to mouth activities.

In allowing even trace contents of lead in wicks, CPSC places the consumer in the position of having to trust an industry that has been consistently untruthful to its consumers when it failed to follow the 1974 voluntary ban. While NCA did adhere to the voluntary ban in 1974, they conceded that they resumed the use of lead core wicks in the late 1970s or early 80s due to the strong consumer demand. In 1998 they admitted using lead core wicks and finally discontinued their use. Therefore, to ensure the safety of the consumer, it is imperative to enforce a complete ban on metal core wicks.

**There are existing alternatives to the use of lead-containing wicks.**

With new technologies available, there are clearly alternatives to using metal core wicks, such as the use of cotton and paper core wicks,<sup>6</sup> or waxing the wick prior to candle making to create a sturdier wick.<sup>7</sup> At the May 5 Lead Wick Task Group meeting, Steven West of WEDO, a German wick company confirmed that wire core wicks were not in use in Europe, due to the associated health risk.<sup>8</sup> Further, there are many U.S. manufacturers that make a full line of candles, who do

---

<sup>4</sup>Id at p. A-27.

<sup>5</sup>J.O.Nriagu and M.J. Kim. Emissions of lead and zinc from candles with metal-core wicks. *The Science of the Total Environment* 250 (2000) 37-41.

<sup>6</sup>Wick n'Clip, Inc, 1999 Quality wick Products Web Site: <http://www.wicknclip.com/typers2.html/>

<sup>7</sup>Id.

<sup>8</sup>Meeting notes from the May 5 meeting of the Lead Wick Task Group distributed by Jeb Head of Atkins & Pearce, Inc.

not use any wire core wicks.<sup>9</sup> Thus, candle manufacturers can still make an effective product without endangering the public.

**The proposed ASTM 0.1% standard fails to consider the accumulation of surface lead dust.**

---

<sup>9</sup>Id.

Lead particulates eventually settle in the form of house dust. The 0.1% number fails to take into account the accumulation of lead dust on surfaces in the home over the long-term. According to a recently published study "a single 38 cm long candle can emit approximately 104,000 ug Pb (lead) into the air. The deposition of as little as 5 to 10% of that Pb onto the floor of a 5 x 5 m room would result in a floor Pb loading of approximately 150 to 300 ug/m<sup>2</sup>. Such a floor Pb loading would readily be associated with elevations in child blood lead. With long-term burning of candles with Pb metal wick cores indoors, it is suggested that deposited Pb may in the longer-term be a significant and ongoing source of child Pb exposure."<sup>10</sup> In fact, in comments submitted to EPA in a rulemaking under Section 403 of the Toxic Substance Control Act (TSCA), Dr. Bruce Lamphear, Associate Professor of Pediatrics at Children's Hospital Medical Center, stated "at a floor lead level of 5 ug/ft<sup>2</sup>, 5% of children are estimated to have a blood lead level of 10 ug/dL or higher."<sup>11</sup> This blood level is considered to be elevated and associated with various adverse health effects. Even with core metal wicks of tin and zinc, the accumulation of trace lead contaminated dust can reach high levels at the risk of exposure to children.

Furthermore, once the lead dust has settled in the home it is very difficult to remove. A 1995 study reports that only 10% of lead dust was trapped by vacuuming.<sup>12</sup> The typical household does not possess a High Efficiency Particulate Air vacuum (HEPA-vac), which is the only type of vacuum with the ability to properly clean up lead dust and that which is required by the Environmental Protection Agency proposed regulation regarding required cleanup standards for lead dust minimization work practices for renovation, remodeling and repainting.<sup>13</sup>

### **CPCS, not ASTM, is the proper medium to address this issue.**

Having participated as members of prior ASTM task groups, we believe that the lengthy ASTM voluntary standard setting process is not the proper venue to use to ensure the immediate protection of human health. In addition, we have serious reservations about the diversity of perspectives represented on the work group, since it appears to be dominated by representatives of the candle manufacturing industry. Independent scientists who have conducted research on lead emissions from candles and the results of which have been published in peer-reviewed journals are not represented on the panel. Moreover, housing providers were not asked by the organizers to participate in the task group despite having raised serious concerns over our ability to assure a lead safe environment for our residents who may use these products.<sup>14</sup>

We petitioned the CPSC for a ban on the sale of candles containing lead wicks and respectfully

---

<sup>10</sup>Van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal wick cores. *Science of the Total Environment*. 243-244: 53-65 (1999).

<sup>11</sup>Docket control number OPPTS-62156 (1998).

<sup>12</sup>Roberts JW, Glass GL, and Sittler TM. Measurement of deep dust and lead in old carpets. In. *Measurement of toxic and related pollutants, Air and Waste Management Assoc*, Pittsburgh, pp. 186-191 (1995).

<sup>13</sup>US EPA, Training and Certification Program for Lead-Based Paint Activities in Target Housing and Child Occupied Facilities - Toxic Substances Control Act (TSCA) Section 402.

<sup>14</sup>We learned of the May 5 meeting of the ASTM group from Public Citizen a co-petitioner on this matter. Public Citizen was informed of the meeting by the Alliance to End Childhood Lead Poisoning.



believe that it is CPSC who should take immediate action to protect human health by recalling candles with lead containing wicks and ban the future sale of these products. The health risk posed by the use of lead in a non-essential product such as long-burning candles does not justify the continued sale of these types of products for the next two years while ASTM mulls the obvious.

~~Stevenson, Todd A.~~

---

**From:** Shari Solomon [ssolomon@NMHC.ORG]  
**Sent:** Monday, June 12, 2000 6:19 PM  
**To:** Cpsc-os@cpsc.gov  
**Subject:** Comments to Petition HP 00-3- Candle Wicks Containing Lead



WordPerfect 6.1

Attached are our comments. If you could please verify that you received them, it would be greatly appreciated. Thank you

Shari L. Solomon Esq.  
Legislative Analyst  
National Multi Housing Council  
1850 M Street NW Suite 540  
Washington, DC 20036  
Phone - 202-974-2345  
Fax - 202-775-0112  
Email - ssolomon@nmhc.org

  
Stevenson, Todd A.

*Candle*  
113

**From:** Tina Neece [TinaNeece@imtt.com]  
**Sent:** Tuesday, June 13, 2000 8:45 AM  
**To:** cpsc-os@cpsc.gov  
**Cc:** SWOLFE@citizen.org; plurie@citizen.org, RKFABF@aol.com  
**Subject:** "Petition HP 00-3--Candle Wicks"

Any thing that can help children and adults to feel better should be a first priority in our lives. I know that there are times when my son is so hyper he can't stand himself. I try to do anything and everything I can do to help him feel better. I was not aware that there is lead in some candle wicks, I am a big candle person and would like to know that something I enjoy so much can NOT hurt my children or myself. PLEASE MAKE IT A MANDATORY LAW THAT THIS IS NOT ALLOWED!!!

PLEASE!!!!  
Sincerely,  
Tina Neece

**Stevenson, Todd A.**

114

---

**From:** Al and Patti Erickson [waterratt@pa.freei.net]  
**Sent:** Monday, June 12, 2000 7:43 PM  
**To:** cpac-os@cpac.gov  
**Subject:** Petition HP 00-3 -- Candle Wicks Containing Lead

**To Whom it May concern:**

I support complete ban and recall on leaded candles. A voluntary ban is unacceptable, since it has already been in effect for many years and has been ignored. Thank you for your time.

Sincerely,  
Patricia Erickson

*candlewicks*  
*115*

~~Stevenson, Todd A.~~

---

**From:** Linda Menkins [MENKINSL@labs.wyeth.com]  
**Sent:** Tuesday, June 13, 2000 9:57 AM  
**To:** Cpssc-os@cpssc.gov  
**Subject:** Lead in candlewicks

Please ban lead in candlewicks.

Groupwise: Menkinsl  
Email: Menkinsl@labs.wyeth.com  
Phone: 610-902-3477  
Tie: 8-370-3477  
Fax: 610-964-3947

*Candle*

116

**Stevenson, Todd A.**

---

**From:** Rick & Grace Knelsen [grknelsen@home.com]

**Sent:** Tuesday, June 13, 2000 9 22 AM

**To:** cpssc-os@cpssc.gov

**Subject:** PetitionHP 00-3-Candle wicks containing lead

We ask that you take ACTION toward eliminating substantial and unnecessary useage of lead in candle wicks NOW.

Stevenson, Todd A.

*Candle*  
*117*

**From:** Geri Modell [gmodell@lds.com]  
**Sent:** Tuesday, June 13, 2000 11:30 AM  
**To:** cpssc-os@cpssc.gov  
**Cc:** SWOLFE@citizen.org; plurie@citizen.org; RKFABF@aol.com  
**Subject:** Petition HP 00-3--Candle Wicks



Card for Geri Modell

I urge that the Consumer Product Safety Commission

immediately ban and recall all candles with lead-containing wicks, candles in metal containers that contain lead, and wicks sold for candle-making that contain lead as an imminent hazard to the public health on the grounds that continued sale of these items violates provisions of the Federal Hazardous Substances Act and the Consumer Product Safety Act. Additionally, I urge the Consumer Product Safety Commission to warn consumers of the potential dangers from exposure to ambient air metals emitted from candles containing metallic cores such as zinc or tin but do not contain lead.

Thank you.  
Geri Modell

Stevenson, Todd A.

118  
candle

**From:** Potata1@aol.com  
**Sent:** Tuesday, June 13, 2000 11:39 AM  
**To:** cpssc-os@cpssc.gov  
**Cc:** SWOLFE@citizen.org; plurie@citizen.org; Rkfabf@aol.com  
**Subject:** Petition HP 00-3--Candle Wicks Containing Lead.

This should really be a no-brainer. We KNOW lead is dangerous, even in small quantities. We have tried a voluntary ban which has not worked. The time has come to cause this ban to be MANDATORY, and to strictly enforce it. This does not just affect children. This affects us all.



*Ach Letter sent Feb  
6/9/00 JZ  
119*



Buyers Up • Congress Watch • Critical Mass • Global Trade Watch • Health Research Group • Litigation Group  
Joan Claybrook, President

June 8, 2000

Office of the Secretary  
Consumer Product Safety Commission  
Washington, DC 20207

Re: Petition HP 00-3 -- Candle Wicks Containing Lead

To whom it may concern:

On February 24, 2000 we petitioned the Consumer Product Safety Commission (CPSC) to ban the use of lead in candle wicks and to recall all metal-containing wicks still on store shelves. Because that petition laid out in detail the reasons for requesting the ban and recall, we shall not reiterate those arguments here, but instead incorporate them by reference. We do, however, wish to make two supplementary points.

First, we have produced additional estimates of the average 24-hour air lead concentrations likely to result from the burning of lead-containing candles for three hours in a 51m<sup>3</sup> room with 20% air exchange and 20% vaporization of the lead in the wick. Using calculus (instead of the spreadsheet program described in our petition), we now estimate that the average 24-hour air lead levels resulting from the burning of the nine lead-containing candles identified in our study would be 15.2 to 54.0  $\mu\text{g}/\text{m}^3$ , 10.1 to 36.0 times the Environmental Protection Agency's air lead standard. All of these nine candles have more than ten times enough lead to raise an average child's blood level to above the Centers for Disease Control's limit of 10  $\mu\text{g}/\text{dl}$ , if the candles were burned daily under the conditions described above. These estimates are slightly higher than those provided in our petition, in which we estimated that the 24-hour air lead levels would be 13.9 to 49.2  $\mu\text{g}/\text{m}^3$ . We cannot provide you with the details of our calculations at the present time as they are in press in a medical journal, but we will forward them to you as soon as the article is published and expect that they will become part of the public record.

Second, we have given added consideration to the issue of lead contamination in zinc- and tin-wicked candles. At the Lead Wick Task Group meeting at the American Society for Testing and Materials (ASTM) conference on May 5, 2000, Jeb Head of Atkins and Pierce indicated that according to ASTM standards there are three grades of zinc, with the following levels of lead contamination: a. 0.003% lead by weight; b. 0.03% lead; and c. 0.5% to 1.4% lead. He further stated that the average amount of lead in zinc wicks is 0.002% and in tin wicks is 0.08%, although there are no ASTM standards for the latter. We continue to believe that the safest level of lead in candle wicks is 0% and that any candle manufacturer seriously committed to the public

Ralph Nader, Founder

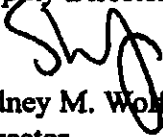
health would ensure that all lead was removed from candle wicks. While this would in effect result in the removal of all metal wicks from the market, it is clear that metal wicks are not essential to candle-making. Steve West of WEDO, a European candle manufacturer, indicated at the Lead Wick Task Group meeting that European manufacturers do not use metal wicks at all (Minutes of Lead Wick Task Group meeting, May 5, 2000).

Nonetheless, in the interest of concluding a proceeding that should have ended with a CPSC regulation when this issue was first raised in 1973, we are willing to accede to a lead level of 0.01%. This would permit only metal wicks containing the highest grade of zinc, would effectively eliminate tin wicks and would drastically reduce lead exposure from candles. We reiterate that a voluntary CPSC standard, whether dependent upon an ASTM standard or not, is wholly inappropriate in an area of such substantial health risk to small children, particularly with an industry that has already demonstrated its lack of trustworthiness by its failure to comply with the previous voluntary agreement. Rather than expending unnecessary resources on the ASTM process and perhaps a CPSC process thereafter, the time has come for the CPSC to simply ban candle wicks with lead levels exceeding 0.01% and to recall all metal-containing wicks unless the manufacturer can immediately provide proof that the lead content is below that level. Should you not follow this path, you might find yourself in court defending a lawsuit that seeks to accomplish these ends.

Yours sincerely,



Peter Lurie, MD, MPH  
Deputy Director



Sidney M. Wolfe, MD  
Director

Public Citizen's Health Research Group



Buyers Up • Congress Watch • Critical Mass • Global Trade Watch • Health Research Group • Litigation Group  
Joan Claybrook, President

---

## FAX Transmittal Form

---

To: *Office of the Secretary*

Number of pages: *3*  
(including this one)

CC:

From: *Sweeney*

Date: *w/ wife*  
*4/4/8*

Fax Number: *301 - 504 - 0127*

Message:

Ralph Nader, Founder

1600 20th Street NW • Washington, DC 20009-1001 • (202) 588-1000 • [www.citizen.org](http://www.citizen.org)



Buyers Up • Congress Watch • Critical Mass • Global Trade Watch • Health Research Group • Litigation Group  
Joan Claybrook, President

February 24, 2000

Ann Brown, Chairperson  
US Consumer Product Safety Commission  
Washington, DC 20207-0001

Dear Chairperson Brown:

We are petitioning the Consumer Product Safety Commission to immediately ban and recall all candles with lead-containing wicks, candles in metal containers that contain lead, and wicks sold for candle-making that contain lead as an imminent hazard to the public health on the grounds that continued sale of these items violates provisions of the Federal Hazardous Substances Act and the Consumer Product Safety Act. Additionally, we urge the Consumer Product Safety Commission to warn consumers of the potential dangers from exposure to ambient air metals emitted from candles containing metallic cores such as zinc or tin but do not contain lead.

In 1973, Public Citizen's Health Research Group petitioned the Consumer Product Safety Commission to remove candles with lead-containing wicks from the market.<sup>1</sup> However, in 1974, in lieu of a complete ban, the candle industry and CPSC arrived at a voluntary agreement to immediately stop making candles with lead-containing wicks. To determine whether this voluntary agreement has been effective, especially because of reports that these candles were once again being sold, we conducted a survey this month of 285 types of candles in 12 stores in the Baltimore-Washington D.C. area. We found that 3% (9/285) of all types of candles on store shelves had wicks containing significant quantities of lead, ranging from approximately 24,000 ug to 118,000 ug (33-85 percent lead by weight). Each of these 9 candles, when burned for 3 hours daily in a 15 ft. by 15 ft. by 8 ft. room, would result in average 24-hour air lead levels ranging from 14-49 ug/m<sup>3</sup>, 9-33 times the EPA Air Quality Standard for lead. Other studies done in the past two years found that candles purchased in Michigan and Florida also had lead-containing wicks. History has shown that the 1974 voluntary agreement has failed. Furthermore,

---

<sup>1</sup>Public Citizen's Health Research Group, Letter to Richard D Simpson, Chairman, Consumer Product Safety Commission, December 6, 1973.

labeling of lead-containing candles will not suffice to protect the people most susceptible to lead toxicity. fetuses, infants and young children. Even if all U.S. candle manufacturers, who currently sell \$2.3 billion dollars worth of candles annually,<sup>2</sup> stopped using lead now, millions of candles with lead-containing wicks would remain on the shelves and imports would probably continue or might even increase. These reasons necessitate a complete ban and recall of these hazardous products.

At least one country has recently tackled this problem definitively. In September 1999, Australian Minister of Financial Services and Regulation Joe Hockey ordered the ban of all candles with wicks containing lead. He recognized that "Public health experts have confirmed that lead emissions from any source pose an unacceptable public health risk and can result in increased blood lead levels in unborn babies, babies and young children....Public health experts have confirmed that the candles pose a risk to public health if burned in a confined space."<sup>3</sup>

In this petition, Public Citizen's Health Research Group documents the following:

1. *Candles with wicks containing lead are currently on store shelves and millions are sold annually.*
2. *Burning candles with wicks containing lead causes high lead exposure both through air and surface contact.*
3. *The air and surface lead levels produced by candles with lead-containing wicks are sufficient to significantly raise blood lead levels.*
4. *The increased blood lead levels from burning these candles can cause permanent deficits in development, behavior, and intelligence.*
5. *Alternatives to lead-containing wicks exist.*
6. *Labeling will not adequately protect candle-users.*
7. *The Consumer Product Safety Act and the Hazardous Substances Act require the Consumer Product Safety Commission to ban and recall these products.*

## **BACKGROUND ON LEAD**

***Effects of lead exposure:*** Lead has been known to adversely affect health since antiquity. Hippocrates (370 BC) noted lead to have caused a severe attack of colic.<sup>4</sup> The ruling class of Romans was heavily exposed to lead through wares and lead in syrups used to sweeten wine. Consequently, gradual lead poisoning may explain the eccentric behavior and insanity of many

---

<sup>2</sup>Candle industry facts. The National Candle Association home page Internet web site (<http://www.candles.org/facts.htm>). National Candle Association; 1030 15th Street, Suite 870, Washington, DC 20005.

<sup>3</sup>The Honorable Joe Hockey, The Minister for Financial Services & Regulation, Australia. Hockey Bans Lead Candle Wicks Press release, 9/1/99. Available at <http://www.minfsr.treasury.gov.au/>

<sup>4</sup> Hunter D. The Diseases of Occupations. The English Universities Press LTD, 4<sup>th</sup> ed p. 235, 1969.

of the Roman emperors that ultimately led to the fall of the Roman Empire.<sup>5</sup> Similar exposures may explain eccentric behaviors of the British ruling class in the 18<sup>th</sup> century.<sup>6</sup> More recently, chronic lead exposure has been implicated in high blood pressure, digestive problems, nerve disorders, memory and concentration problems, muscle and joint pain,<sup>7</sup> encephalopathy (pathologic changes of the brain) and death.<sup>8</sup> Furthermore, decreased intelligence,<sup>9</sup> minor antisocial behavior,<sup>10</sup> increased high school dropout rates,<sup>11</sup> and impaired development,<sup>12</sup>

---

<sup>5</sup> Emsley, J. When the Empire struck lead. The gradual poisoning of the ruling classes in ancient Rome with lead may have caused the downfall of their empire. Did the British Empire suffer the same fate? *New Scientist*, 25 December 1986- 1 January 1987, pp. 64-67.

<sup>6</sup> Ibid.

<sup>7</sup> Consumer Product Safety Commission, Protect your family from lead in your home. CPSC Document #426. EPA747-K-94-001, May 1995.

<sup>8</sup> Klaassen CD. Heavy metals and heavy-metal antagonists, in Goodman and Gilman's: The pharmacological basis of therapeutics 9<sup>th</sup> ed. Chapter 66, p 1650-1652, Mc Graw-Hill, New York. 1996.

<sup>9</sup> Baghurst PA, McMichael AJ, Wigg NR, et al. Environmental exposure to lead and children's intelligence at the age of seven years. The Port Pirie Cohort Study. *The New England Journal of Medicine* 327: 1279-1284, 1992.

Dietrich KN, Berger OG, Succop PA, et al. The developmental consequences of low to moderate prenatal and postnatal lead exposure: Intellectual attainment in the Cincinnati lead study cohort following school entry *Neurotoxicology and Teratology* 15:37-44, 1993.

Fulton M, Raab G, Thomson G, et al. Influence of blood lead on the ability and attainment of children in Edinburgh *Lancet* 1:1221-1226, 1987.

Needleman HL, Gatsonis CA. Low-level lead exposure and the IQ of children: A meta-analysis of modern studies. *Journal of the American Medical Association* 263: 673-678, 1990.

Needleman HL, Gunnoe C, Leviton A, et al. Deficits in psychologic and classroom performance of children with elevated dentine lead levels. *The New England Journal of Medicine* 300:689-695, 1979.

Needleman HL, Geiger SK, Frank R. Lead and IQ Scores: A reanalysis. *Science* 227, 701-704, 1985.

Schwartz J. Low-level lead exposure and children's IQ: A meta-analysis and search for a threshold. *Environmental Research* 65:42-55, 1994.

Tong S, Baghurst PA, Sawyer MG, et al. Declining blood lead levels and changes in cognitive function during childhood. The Port Pirie Cohort Study. *Journal of the American Medical Association* 280: 1915-1919, 1998.

Tong S, Baghurst P, McMichael A, et al. Lifetime exposure to environmental lead and children's intelligence at 11-13 years: the Port Pirie Cohort Study. *British Medical Journal* 312:1569-1575, 1996.

<sup>10</sup> Needleman HL, Schell A, Bellinger D, et al. The long-term effects of exposure to low doses of lead in childhood: An 11-year follow-up report. *The New England Journal of Medicine* 322: 83-88, 1990.

<sup>11</sup> Ibid.

coordination,<sup>13</sup> learning<sup>14</sup> and reading<sup>15</sup> occur at lead levels previously considered acceptable.

**Routes of exposure to lead:** In general, environmental lead is either inhaled or ingested. Lead in candles can enter the blood by both routes. The route of entry plays a major role in determining the amount of lead that enters the bloodstream.

The candlewick lead content and the percent lead vaporized determine the total lead emitted. In the past, industry argued that lead in wicks does not vaporize. In 1974, Corning claimed that "at candle temperature, lead vaporizes at the same rate as ice does at 13 degrees below zero."<sup>16</sup> However, two studies, one by EPA in 1973 and another recent study, have shown that 20-35% of the lead in pure lead candle wicks is vaporized.<sup>17, 18</sup> The total lead emitted and the size and ventilation of the room determine the ambient air lead concentration. The respiratory rates and volume, time of exposure and ambient air lead concentration determine the amount of lead that reaches the lung lining (the epithelium) and about 90% of that is absorbed into the blood.<sup>19</sup>

---

<sup>12</sup> Baghurst PA, Robertson EF, McMichael AJ, et al. The Port Pirie Cohort Study: Lead effects on pregnancy outcome and early childhood development. *Neurotoxicology* 8: 395-402, 1987.

Mendelsohn AL, Dreyer BP, Fierman AH, et al. Low-level lead exposure and cognitive development in early childhood. *Journal of Developmental and Behavioral Pediatrics*. 20: 425-431, 1999.

McMichael AJ, Baghurst PA, Wigg NR, et al. The Port Pirie Cohort Study: Environmental exposure to lead and children's abilities at the age of four years. *The New England Journal of Medicine* 319: 468-475, 1988.

Wigg NR, Vimpani GV, McMichael AJ, et al. Port Pirie Cohort Study: Childhood blood lead and neuropsychological development at age two years. *Journal of Epidemiology and Community Health* 42: 213-219, 1988.

<sup>13</sup> Dietrich KN, Berger OG, Succop PA. Lead exposure and the motor developmental status of urban six-year-old children in the Cincinnati Prospective Study. *Pediatrics* 91: 301-307, 1993.

<sup>14</sup> Needleman HL, Schell A, Bellinger D, et al. The long-term effects of exposure to low doses of lead in childhood: An 11-year follow-up report. *The New England Journal of Medicine* 322: 83-88, 1990.

<sup>15</sup> Needleman HL, Schell A, Bellinger D, et al. The long-term effects of exposure to low doses of lead in childhood: An 11-year follow-up report. *The New England Journal of Medicine* 322: 83-88, 1990.

<sup>16</sup> Press Release by Corning, January 8, 1974.

<sup>17</sup> Brndbord K, Medical Officer. Memo to Stanley Greenfield, Assistant Administrator for Research and Development, and Vaun A. Newill, Special Assistant to the Administrator: Hazards of burning candles with lead. US EPA, Research Triangle Park, December 14, 1973.

<sup>18</sup> Van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal wick cores. *Science of the Total Environment*. 243-244: 53-65, 1999.

<sup>19</sup> Goyer RA, Toxic effects of metals. In Casarett and Doull's, *Toxicology, The Basic Science of Poisons*. 4<sup>th</sup> ed. Pergamon Press, 1991.

Particulate airborne lead from burning candles settles as house dust. Children inhale and ingest dust stirred during crawl and play. They track it on their hands or clothes, pick up dust-laden objects and put them in their mouths. As lead tastes sweet, they may lick the dust from their hands. Furthermore, most vacuum cleaners stir up huge dust loads.<sup>20</sup> Finally, ventilation duct turbulence causes fine particulate matter typical of candle emissions, to become charged and attracted to plastic surfaces. Krause notes that this matter particularly covers kitchen surfaces, such as plastic utensils, ice cube trays and refrigerator/freezer surfaces.<sup>21</sup>

Additional lead exposure can occur from dust settling in food after being warmed by lead-containing warming candles and, less likely, from children ingesting the wick.

**Current Regulations:** There are four relevant government standards referred to in this petition:

1. **Blood lead levels:** The Centers for Disease Control and Prevention (CDC) currently recommend keeping children's blood lead levels below 10 ug/dl (100 ml). The CDC has stated that no threshold is known below which lead is safe and that harmful effects may occur at levels below 10 ug/dl, but that the body of information accumulated thus far is insufficient to prove this.<sup>22</sup>
2. **Average total daily dose of lead:** The Consumer Product Safety Commission (CPSC) recommends limiting chronic lead ingestion in children less than 6 years old to less than 15 ug/day to prevent blood lead levels from exceeding 10 ug/dl.<sup>23</sup>
3. **Ambient air lead level:** The Environmental Protection Agency (EPA) ambient air guideline for lead is 1.5 ug/m<sup>3</sup>.<sup>24</sup> This level corresponds to an average total daily dose of inhaled lead of 30 ug for an average child less than 6 years old,<sup>25</sup> double what the CPSC reports as a safe level.
4. **Surface lead levels:** The U.S. Housing and Urban Development (HUD) standard for surface lead dust levels of carpeted or bare floors, window sills and window wells are 100 ug/ft<sup>2</sup> (1075 ug/m<sup>2</sup>), 500 ug/ft<sup>2</sup> (5400 ug/m<sup>2</sup>) and 800 ug/ft<sup>2</sup> (8610 ug/m<sup>2</sup>).<sup>26</sup> As several studies have

---

<sup>20</sup> Lioy PH, Wainman T, Zhang J, et al Typical household vacuum cleaners: the collection efficiency and emissions characteristics for fine particles. *Journal of the Air and Waste Manage Association*. 49:200-206, 1999.

<sup>21</sup> Krause D., personal communication, 10 Feb 99. Mr Krause has written a Master's thesis on candle emissions.

<sup>22</sup> U.S. Department of Health and Human Services, *Public Health Service, Centers for Disease Control Preventing lead poisoning in young children*. pp. 7-8, October 1, 1991.

<sup>23</sup> Consumer Product Safety Commission. CPSC Staff report on lead and cadmium in children's polyvinylchloride (PVC) products. Page 5. 21 November 1997.

<sup>24</sup> Code of Federal Regulations. Title 40--Protection of Environment, Chapter 1--Environmental Protection Agency, Part 50, Sec 50.12 National primary and secondary ambient air quality standards for lead.

<sup>25</sup> Krause JD. Characterization of scented candle emissions and associated public health risks. Thesis. Department of Environmental and Occupational Health. University of South Florida. August 1999.

<sup>26</sup> <http://www.hud.gov/80/lea/leach1.pdf>: Chapter 1: Introduction Legislative Basis and Relationship to Federal Programs and Regulations. In *The Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in*



correlated high blood lead levels with these levels, the EPA is proposing lowering them to 50 ug/ft<sup>2</sup> (540 ug/m<sup>2</sup>) and 250 ug/ft<sup>2</sup> (2700 ug/m<sup>2</sup>) for bare floors and windowsills, respectively.<sup>27</sup> Even the latter may not be sufficiently low. One study found that 20% of children living with a lead dust level of 430 ug/m<sup>2</sup> had blood lead levels above 10 ug/dl and that lower lead dust levels predicted lower blood lead levels.<sup>28</sup> Another study found that decreasing the lead dust level from 240 ug/m<sup>2</sup> (less than half the EPA recommendation) to 160 ug/m<sup>2</sup> reduced average blood lead levels from 12.4 to 10.3 ug/dl,<sup>29</sup> still above the CDC levels.

***1. Candles with wicks containing lead are currently on store shelves and millions are sold annually.***

In February 2000, Public Citizen's Health Research Group conducted a study of the lead content of candles in the Baltimore-Washington area. We selected 11 chain stores and one dollar store to represent the places where candles are most commonly purchased. These were: CVS Pharmacy, The Dollar Shop, Hallmark, Walmart, Kohl's, Bath and Body Works, The Body Shop, Hecht's, Target, BJ's Wholesale, Jo-Anne Fabrics, and Bed, Bath and Beyond. We excluded candle stores because we believe that candles are more commonly purchased from non-specialty stores. (In fact, candle stores may be more likely to sell candles containing lead-wicks because of the properties lead confers on candles.) In each store, we selected one candle of each brand and type. Examples of candle types are pillars, containers, votives, tea lights, and novelty candles. Different colors, sizes and shapes of the same candle were considered a single type of candle. For each candle, we recorded the store name and location, manufacturer, candle type, and the presence or absence of a metallic wick. We then purchased one candle of each type containing a visible metallic wick. Each metallic wick was extracted from the wax, measured for length and mass, and tested for lead using Inductively Coupled Plasma Spectroscopy (ICP) by a laboratory accredited by the American Industrial Hygiene Association Environmental Lead Laboratory Accreditation Program.<sup>30</sup> The technique involves dissolving the samples in a known amount of nitric acid, performing spectroscopy on the solution, and comparing the intensity of the lead lines with samples of known quantities of lead.<sup>31</sup>

Thirty percent (86 of 285) of types of candles contained metallic wicks. We found that 10%

---

Housing, 1995.

<sup>27</sup> US Environmental Protection Agency. EPA Fact Sheet. Proposed rule on identification of lead-based paint hazards. #747-F-98-001, June 1998.

<sup>28</sup> Lanphear BP, Weitzman M, Winter NL et al. Lead-contaminated house dust and urban children's blood lead levels. *American Journal of Public Health* 86:1416-21, 1996.

<sup>29</sup> Rhoads GG, Ertinger AS, Weisel CP, et al. The effect of dust lead control on blood lead in toddlers: a randomized trial. *Pediatrics* 103: 551-555, 1999.

<sup>30</sup> Specimens were analyzed at RJ LeeGroup, Inc., Monroeville, PA.

<sup>31</sup> Elements by ICP, Method 7300, Issue 2 In NIOSH Manual of Analytical Methods (NMAM), 4<sup>th</sup> ed, August 14, 1994.

(9/86) of candles with metallic wicks contained lead for an overall prevalence of candles containing lead of 3% (9/285). Table 1 shows that the total lead content of the nine candles containing lead wicks ranged from approximately 24,000 ug to 118,000 ug, (accounting for 33% to 85% of the weight of the metal in the candlewick). Assuming that only 20% of the lead in the candlewick is emitted into the air, this corresponded to 4700 ug to 24,000 ug of airborne lead from a single wick. As the percentage of lead from a candlewick emitted into the air ranges from 20-35%,<sup>32</sup> the actual amount emitted may be considerably higher. A typical room of 15 ft. x 15 ft. x 8 ft. has a total volume of 51 m<sup>3</sup>. If these candles burned at a rate of 2 cm/hour for three hours daily (and were extinguished after 3 hours) in such a room with 25% per hour ventilation rates, they would yield ambient air lead concentrations ranging from 14 to 49 ug/m<sup>3</sup>, which is 9-33 times the EPA Ambient Air Quality Standard. If we assume instead that we burned the candle emitting the least lead under the same conditions, except that the burn rate is only 0.5 cm/hour (1/4 the original assumption), and that the room has a ventilation rate of 50% (twice the original assumption), we still get ambient air levels of 1.2 ug/m<sup>3</sup>, approximating the EPA Ambient Air Lead Standard.

Furthermore, lead exposure may occur due to dust and dust may accumulate even with vacuuming. Using van Alphen's assumption that between 5-10% of dust deposits on the floor,<sup>33</sup> and the results of Roberts et al. who found that only 10% of lead dust was trapped by vacuuming,<sup>34</sup> even with weekly vacuuming, dust lead levels may reach 540 ug/m<sup>2</sup>, the proposed limit set by the EPA.<sup>35</sup>

We found that 2 lead-containing candles were pillars, 6 were containers, and 1 was a votive. None of the tapers, novelty or tea lights tested contained lead.

We are aware of one previous case study and two previous lead wick prevalence studies. In 1999 in Australia, van Alphen reported that 7 candles imported from China had almost pure lead-core wicks (95-99% lead).<sup>36</sup> That same year Nriagu and Kim purchased 14 candles with wicks

---

<sup>32</sup>Bridbord K, Medical Officer. Memo to Stanley Greenfield, Assistant Administrator for Research and Development, and Vaun A. Newill, Special Assistant to the Administrator. Hazards of burning candles with lead. US EPA, Research Triangle Park, December 14, 1973.

Van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal wick cores. *Science of the Total Environment*. 243-244: 53-65, 1999.

<sup>33</sup> van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb metal wick cores. *Science of the Total Environment* 243-244: 53-65, 1999.

<sup>34</sup> Roberts JW, Glass GL, and Spittler TM. Measurement of deep dust and lead in old carpets. In: *Measurement of toxic and related pollutants*, Air and Waste Management Assoc., Pittsburgh, pp.186-191, 1995.

<sup>35</sup> US Environmental Protection Agency. EPA Fact Sheet. Proposed rule on identification of lead-based paint hazards. #747-F-98-001, June 1998.

<sup>36</sup> van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb metal wick cores. *Science of the Total Environment* 243-244: 53-65, 1999.

containing metallic cores in stores in Ann Arbor, Michigan. They reported that all 14 candles with metallic wicks emitted lead during burning.<sup>37</sup> In August 1999, Krause purchased candles with metallic wicks from every store selling candles in a mall in Tampa, Florida. He noted that each store was part of a different nationwide chain. He found that the 24% (5 of 21) of metallic candlewicks that contained lead did so at levels of 1.25, 9.5, 14, 42, and 46 weight % lead.<sup>38</sup> In an earlier study, he purchased 91 candles over a two-year period in both Florida and California. None of the 21 candles with metallic wicks and one with a metallic containers from California emitted lead. However, 4 of 6 candles with metallic wicks purchased in Florida emitted lead. Combining these results with previous work, he found that approximately 9 of 27 candles with metallic wicks contained lead. All candles with wicks containing lead were purchased in Florida.<sup>39</sup>

Atkins and Pierce, the major U.S. manufacturer of all types of wicks, admitted that because some candle makers kept using such wicks "since there wasn't an actual ban", they resumed the practice of making and selling wicks containing lead "in the late 70s or early 80s."<sup>40</sup> The company claims to have stopped the practice last year;<sup>41</sup> however, our study and others demonstrate that candles with lead-containing wicks are prevalent in many states.<sup>42</sup> Moreover, lead-containing wicks for candle making are currently sold directly over the Internet.<sup>43</sup>

---

<sup>37</sup>Nriagu JO, Kim MJ, Emissions of Lead and Zinc from Candles with Metal-Core Wicks. *Science of the Total Environment*, in press, 2000.

<sup>38</sup> Krause D. Personal communication, 26 January 2000.

<sup>39</sup>Krause JD. Characterization of scented candle emissions and associated public health risks. Thesis Department of Environmental and Occupational Health University of South Florida. August 1999.

Krause D. Personal communication, 26 January 2000

<sup>40</sup>Notes from the Meeting with CPSC and National Candle Association on 12/15/99.

<sup>41</sup>Ibid.

<sup>42</sup> Krause JD. Characterization of scented candle emissions and associated public health risks. Thesis. Department of Environmental and Occupational Health. University of South Florida. August 1999.

Krause D. Personal communication, 26 January 2000.

Nriagu JO, Kim MJ, Emissions of Lead and Zinc from Candles with Metal-Core Wicks. *Science of the Total Environment*, in press, 2000.

van Alphen M, Emission testing and inhalational exposure-based risk assessment for candles having Pb metal wick cores, *Science of the Total Environment* 243-244: 53-65, 1999.

<sup>43</sup> CANDLECHEM COMPANY, Inc. <http://www.alcasoft.com/candlechem/>

Candle sales exceeded \$2.3 billion last year.<sup>44</sup> We estimate that over 300 million candles were sold in the U.S. in 1999 based on our finding that the average candle costs \$7.35. If 3% of the candles sold contain lead, approximately 12 million candles sold in the United States each year contain lead, assuming our sample is representative of all candles sold.

## ***2. Burning candles with wicks containing lead causes high lead exposure both through air and surface contact.***

A. Ambient Air Exposure: The work of four groups of researchers discussed in this section pertains to the high ambient lead levels that result from burning lead-wick containing candles. The last study pertains to the resulting high surface lead concentration.

In 1973, immediately following our petition to ban lead wicked candles,<sup>45</sup> EPA researchers determined that burning candles with lead-containing wicks exceeded the current EPA air quality standard by over 10 times. In this experiment, they burned 4 candles with lead-core wicks on a dining room table in a 10 square foot dining room and monitored air lead for 13 hours. Over this period, the air lead concentrations averaged 16 ug/m<sup>3</sup>—over 10 times the current EPA air lead guideline. Their experimental apparatus was unable to detect lead in particles below 0.1 um and therefore the average lead concentrations may have been higher. The EPA researchers concluded, “Based upon these observations it would not be unreasonable to expect average indoor air lead levels in the range of 10-20 ug/m<sup>3</sup> [6-12 times above EPA’s air quality standard] as a result of regularly burning candles with lead wire core wicks in the home. Further...the remaining lead residue from these candles could also be a hazard by inadvertent contamination of food or by being available for children to ingest.”<sup>46</sup>

From October 1997 until August 1999, Krause purchased 85 candles of which 21 had metallic wicks and 1 had a container in California and 6 from Florida for a total of 27 candles with metallic wicks and one with a metallic container. He burned the candles in a chamber and characterized their emissions. For those candles containing metallic wicks, he estimated exposure using his own model and using an EPA exposure model (US EPA RISK V1.0 Indoor Air Quality Exposure Model), which produced similar results. Finally, he calculated lead exposure for children. None of the 21 candles with metallic wicks and the one metallic container candle from California emitted lead. However, 4 of 6 candles

---

<sup>44</sup>Candle industry facts. The National Candle Association home page. Internet web site (<http://www.candles.org/facts.htm>). National Candle Association; 1030 15th Street, Suite 870, Washington, DC 20005.

<sup>45</sup>Public Citizen’s Health Research Group, Letter to Richard D Simpson, Chairman, Consumer Product Safety Commission, December 6, 1973.

<sup>46</sup>Bridbord K, Medical Officer. Memo to Stanley Greenfield, Assistant Administrator for Research and Development, and Vaun A. Newill, Special Assistant to the Administrator. Hazards of burning candles with lead. US EPA, Research Triangle Park, December 14, 1973.

with metallic wicks purchased in Florida emitted lead. When burning one candle for 4 hours daily, he estimated that two of these candles would result in children under 6 inhaling an average daily dose of lead of 40 and 95 ug, respectively.<sup>47</sup> Both exceeded the maximum acceptable level recommended by the CPSC (15 ug) by several times.<sup>48</sup> A third candle resulted in an average daily dose of 13 ug.<sup>49</sup>

In 1999 in Michigan, Nriagu and Kim burned 15 types of candles (14 purchased in Michigan) with metallic wicks over 2 to 7 hours and measured the lead emitted into an experimental chamber. Lead emitted after burning one candle in a typical room for 2 hours extrapolated to air lead concentrations of 0.02 to 13.1 ug/m<sup>3</sup> with five candles exceeding the U.S. EPA ambient air lead guideline of 1.5 ug/m<sup>3</sup>.<sup>50</sup> However, 24-hour average air lead concentrations were not calculated.

In 1999, Van Alphen burned seven candles with high lead content in an experimental chamber to determine the amount of lead emitted. From this, he estimated average 24-hour air lead levels. He reported that burning one candle with high lead content for 3 hours could achieve a 24-hour average lead concentration of 10 ug/m<sup>3</sup>,<sup>51</sup> almost seven times the EPA ambient air guideline of 1.5 ug/m<sup>3</sup>.

Therefore, three studies have shown that episodic burning of candles with a lead-core wick can expose people to average ambient lead concentrations above the limit set by EPA and one study showed that inhaled lead exceeded the limits set by the CPSC for children.<sup>52</sup>

---

<sup>47</sup>Krause JD. Characterization of scented candle emissions and associated public health risks. Thesis. Department of Environmental and Occupational Health. University of South Florida. August 1999.

Personal communication with David Krause, 26 January 2000.

<sup>48</sup> Consumer Product Safety Commission. CPSC Staff report on lead and cadmium in children's polyvinylchloride (PVC) products Page 2. 21 November 1997.

<sup>49</sup>Krause JD. Characterization of scented candle emissions and associated public health risks. Thesis. Department of Environmental and Occupational Health. University of South Florida. August 1999.

<sup>50</sup>Nriagu JO, Kun MJ, Emissions of Lead and Zinc from Candles with Metal-Core Wicks. *Science of the Total Environment*, in press, 2000.

<sup>51</sup>Van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal wick cores *Science of the Total Environment*. 243-244. 53-65, 1999.

<sup>52</sup>Bridbord K, Medical Officer. Memo to Stanley Greenfield, Assistant Administrator for Research and Development, and Vaun A. Newill, Special Assistant to the Administrator: Hazards of burning candles with lead. US EPA, Research Triangle Park, December 14, 1973.

Krause JD. Characterization of scented candle emissions and associated public health risks. Thesis. Department of Environmental and Occupational Health. University of South Florida. August 1999.

Van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal

Thirty-five percent of candles in the Michigan study exceeded the EPA standards; however, Nriagu and Kim did not calculate 24-hour average air lead concentrations <sup>53</sup>

B. Surface Lead Exposure: Particulate vaporized lead eventually settles in the form of house dust and soot. Unlike ambient air lead, which requires a daily or weekly source to keep levels high, surface lead may accumulate from infrequently burning candles even with regular vacuuming, leading to ongoing exposure.<sup>54</sup> Van Alphen reports that "A single 38 cm long candle [with high lead content] can emit 104,000 ug Pb [lead] into the air. The deposition of as little as 5 to 10 % of that onto the floor of a 5x5 m room would result in a floor Pb loading of approximately 150 to 300 ug/m<sup>2</sup>. Such a floor loading would readily be associated with elevations in child blood lead."<sup>55</sup> Burning only two to four of these candles will result in surface lead concentrations exceeding even the EPA proposed limits of 540 ug/m<sup>2</sup> for floor surface lead concentration <sup>56</sup> Recall that these limits are not sufficient to protect children from high blood lead levels.<sup>57</sup>

**3. The air and surface lead levels produced by candles with lead-containing wicks are sufficient to significantly raise blood lead levels.**

A. Ambient Air lead: Exposing adult males 23 hours per day over 18 weeks to air lead levels of either 3.2 ug/m<sup>3</sup> or 10 ug/m<sup>3</sup> increased their blood lead concentrations by 12 ug/dl and 22 ug/dl, respectively.<sup>58</sup> The WHO reports that each 1 ug/m<sup>3</sup> ambient concentration of lead contributes 1.9 ug/dl of blood lead in children (approximately linearly in the lower part of the range), but that inhalation is relatively less important in children compared to ingestion. Thus, correcting for ingestion, the WHO estimates that each 1 ug/m<sup>3</sup> increase

---

wick cores. *Science of the Total Environment*. 243-244. 53-65, 1999.

<sup>53</sup>Nriagu JO, Kim MJ, Emissions of Lead and Zinc from Candles with Metal-Core Wicks. *Science of the Total Environment*, in press, 2000

<sup>54</sup> Roberts JW, Glass GL, and Spittler TM Measurement of deep dust and lead in old carpets. In: *Measurement of toxic and related pollutants*, Air and Waste Management Assoc., Pittsburgh, pp 186-191, 1995.

<sup>55</sup>Van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal wick cores *Science of the Total Environment*. 243-244. 53-65, 1999

<sup>56</sup> US Environmental Protection Agency. EPA Fact Sheet. Proposed rule on identification of lead-based paint hazards.

<sup>57</sup> Lanphear BP, Weitzman M, Winter NL et al. Lead-contaminated house dust and urban children's blood lead levels. *American Journal of Public Health* 86:1416-21, 1996.

Rhoads GG, Ettinger AS, Weisel CP, et al. the effect of dust lead control on blood lead in toddlers: a randomized trial. *Pediatrics* 103: 551-555, 1999.

<sup>58</sup>Griffin TB, Coulston F, Wills H, et al. *Clinical studies on men continuously exposed to airborne particulate lead*. *Environmental Quality and Safety Supplement* 2: 221-40, 1975.

in ambient air lead level contributes 5 ug/dl to the blood lead level.<sup>59</sup> Brunekreef critically reviewed 19 studies and found that in children the relationship between blood lead and ambient air lead is logarithmic. In young children at blood levels less than 25 ug/dl, he found that 1 ug/m<sup>3</sup> increases in air lead concentrations contributed 3-5 ug/dl increases in blood lead level. At lower air levels, increases in exposure produce even greater increases in blood lead levels. Brunekreef states that up to "a few ug/m<sup>3</sup>," each 1 ug/m<sup>3</sup> can increase blood lead levels by over 5 ug/dl.<sup>60</sup>

To our knowledge, only Krause and Van Alphen directly relate ambient air lead levels emitted from candles to children's blood lead levels. Krause determined that burning the candle with the highest lead content in his study for four hours daily may raise a 2-3 year-old child's blood lead level by 4.2 ug/dl to 13.4 ug/dl. He determined this using the Integrated Exposure Uptake Biokinetic Lead Model, a model that calculates serum lead levels by incorporating parameters such as ventilation rates, baseline indoor air lead concentrations, time indoors, and soil and house dust concentrations.<sup>61</sup>

Van Alphen burned candles with wicks containing very high lead content to determine the amount of lead emitted. From this, he estimated average 24-hour air lead levels and corresponding blood lead levels from burning one candle for three hours under varying conditions including room sizes, ventilation rates, and rates of increase of blood lead level for every unit increase in air lead level. Using a wide range of assumptions, he estimated that burning one candle three hours per week will raise a child's blood lead level by 3-11 ug/dl above the unexposed baseline and that burning one candle daily could raise it by 12-40 ug/dl. Van Alphen concludes, "There is the potential for entire families to have high Pb [lead] exposures because of such a Pb source. Where multiple Pb metal wick core candles are burned on a regular basis, for periods of >3 to 6 hours, in poorly ventilated settings, extreme levels of Pb exposure are possible. Clinical child Pb poisoning and death could be predicted."<sup>62</sup>

B. Surface lead. Rhoads et al. compared household lead dust levels to blood lead levels in children randomized to groups where members of the intervention group were instructed to regularly clean their household to reduce lead exposure. Prior to the intervention, the

---

<sup>59</sup>World Health Organization. Guidelines for Air Quality, 1999. Chapter 3: Health-based Guidelines, 41.

<sup>60</sup>Brunekreef B. *The Relationship between Air Lead and Blood Lead in Children: A Critical Review*. *Science of the Total Environment*, 38: 79-123, 1984.

<sup>61</sup>Krause JD. *Characterization of scented candle emissions and associated public health risks*. Thesis. Department of Environmental and Occupational Health. University of South Florida. August 1999.

Krause D. Personal communication, 26 January 2000.

<sup>62</sup>Van Alphen M. *Emission testing and inhalational exposure-based risk assessment for candles having Pb metal wick cores*. *Science of the Total Environment*. 243-244: 53-65, 1999.

intervention group had a mean floor dust lead level of 237 ug/m<sup>2</sup> and a mean blood lead level of 12.4 ug/dl. After the intervention, their floor dust lead levels decreased to 163 ug/m<sup>2</sup>, and their blood lead decreased to 10.3 ug/dl. The control group had floor dust lead levels of 275 at baseline and 207 ug/m<sup>2</sup> at follow up and the blood lead levels remained constant at 11.6 ug/dl.<sup>63</sup>

As Van Alphen estimated that burning one 38 cm long candle with a pure lead wick in a 5x5 m room will result in 150 to 300 ug/m<sup>2</sup> surface lead dust levels on floors, infrequent burning of these candles could easily accumulate lead sufficiently to cause elevated blood lead levels.<sup>64</sup>

#### ***4. The increased blood lead levels from burning these candles can cause permanent deficits in development, behavior, and intelligence.***

Most recent studies have shown that blood lead levels above 10 ug/dl adversely affect children. Unborn and young children are particularly susceptible to even low blood lead levels. Placental exposure may result in miscarriage or early neonatal death,<sup>65</sup> premature births<sup>66</sup> and decreased mental ability.<sup>67</sup> For example, table 2 shows two longitudinal studies. After adjusting for confounding, Bellinger et al. showed that infants previously exposed to umbilical cord blood lead levels of 10 ug/dl or greater performed 5.8 points lower at six months and 7.3 points lower at

---

<sup>63</sup> Rhoads GG, Ettinger AS, Weisel CP, et al. the effect of dust lead control on blood lead in toddlers a randomized trial. *Pediatrics* 103: 551-555, 1999.

<sup>64</sup> Van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal wick cores. *Science of the Total Environment*. 243-244: 53-65, 1999.

<sup>65</sup> Wibberley DG, Khara AK, Edwards JH, et al. Lead levels in human placentae from normal and malformed births. *Journal of Medical Genetics* 14: 339-345, 1977.

<sup>66</sup> Baghurst PA, Robertson EF, McMichael AJ, et al. The Port Pirie Cohort Study: Lead effects on pregnancy outcome and early childhood development. *Neurotoxicology* 8: 395-402, 1987.

<sup>67</sup> Bellinger DC, Needleman HL, Leviton A, et al. Early sensory-motor development and prenatal exposure to lead. *Neurobehavioral Toxicology and Teratology* 6: 387-402, 1984.

Bellinger DC, Leviton A, Wateraux C, et al. Methodological issues in modeling the relationship between low-level lead exposure and infant development: Examples from the Boston lead study. *Environmental Research* 38: 119-129, 1985.

Bellinger D, Leviton A, Needleman HL, et al. Low-level lead exposure and infant development in the first year. *Neurobehavioral Toxicology and Teratology* 8: 151-161, 1986.

Bellinger D, Leviton A, Wateraux C, et al. Longitudinal analyses of prenatal and postnatal lead exposure and early cognitive development. *The New England Journal of Medicine* 316: 1037-1043, 1987.

Dietrich KN, Krafft KM, Bornschein RL, et al. Low-level fetal lead exposure effect on neurobehavioral development in early infancy. *Pediatrics* 80: 721-730, 1987.



twelve months on the Mental Development Index (MDI) of the Bayley Scales of Infant Development than those with blood levels less than 3 ug/dl.<sup>68</sup> The MDI is a commonly used test based on the IQ scale for assessing early cognitive development.<sup>69</sup> In a second study, mean levels were 8.0 and 6.3 for maternal blood and umbilical cord blood, respectively. No blood levels were above 30 ug/dl. After adjusting for confounding, for every ug/dl increase in blood lead, there was a 0.34 point decrease in Bayley MDI score.<sup>70</sup> In summary, both studies found that at each level, as the umbilical cord blood or maternal blood lead level increased over a range starting well below 10 ug/dl, performance on a developmental test declined.

Lead has also been implicated in prematurity. One study found that those with maternal blood lead levels of greater than 14 ug/dl had 4.4 times the risk of prematurity of those with blood lead levels less than 8 ug/dl.<sup>71</sup>

There is evidence that damage caused by low-level lead exposure in children becomes evident at an early age and persists into adulthood. Tables 3 and 4 show that, after adjusting for socioeconomic factors and other potential confounders, this damage includes deficits in development, intelligence, learning, and behavior in early childhood-preschool children,<sup>72</sup> school-aged children,<sup>73</sup> and young adults.<sup>74</sup> Table 3 shows that incremental increases in blood

---

<sup>68</sup>Bellinger DC, Leviton A, Needleman HL, et al. Low-level lead exposure and infant development in the first year. *Neurobehavioral Toxicology and Teratology* 8: 151-161, 1986.

<sup>69</sup>Bayley N. *Bayley Scales of Infant Development*. New York, The Psychological Corporation, 1969.

<sup>70</sup>Dietrich KN, Krafft KM, Bornschein RL, et al. Low-level fetal lead exposure effect on neurobehavioral development in early infancy. *Pediatrics* 80: 721-730, 1987.

<sup>71</sup>Baghurst PA, Robertson EF, McMichael AJ, et al. The Port Pirie Cohort Study: Lead effects on pregnancy outcome and early childhood development. *Neurotoxicology* 8: 395-402, 1987.

<sup>72</sup>Baghurst PA, Robertson EF, McMichael AJ, et al. The Port Pirie Cohort Study. Lead effects on pregnancy outcome and early childhood development. *Neurotoxicology* 8: 395-402, 1987.

Mendelsohn AL, Dreyer BP, Fierman AH, et al. Low-level lead exposure and cognitive development in early childhood. *Journal of Developmental and Behavioral Pediatrics*. 20: 425-431, 1999.

McMichael AJ, Baghurst PA, Wigg NR, et al. The Port Pirie Cohort Study: Environmental exposure to lead and children's abilities at the age of four years. *The New England Journal of Medicine* 319: 468-477, 1988.

Wigg NR, Vimpani GV, McMichael AJ, et al. Port Pirie Cohort Study: Childhood blood lead and neuropsychological development at age two years. *Journal of Epidemiology and Community Health* 42: 213-219, 1988.

<sup>73</sup>Baghurst PA, McMichael AJ, Wigg NR, et al. Environmental exposure to lead and children's intelligence at the age of seven years. The Port Pirie Cohort Study. *The New England Journal of Medicine* 327: 1279-1284, 1992.

Burns JM, Baghurst PA, Sawyer MG, et al. Lifetime low-level exposure to environmental lead and children's emotional and behavioral development at ages 11-13 years. The Port Pirie Cohort Study. *American Journal of Epidemiology* 149: 740-749, 1999

lead over a range from 0 to 67 ug/dl at six months of age predicted poorer development and cognitive function in preschoolers using the MDI. Most children in these studies had blood lead concentrations below 30 ug/dl.<sup>75</sup> For example, Mendelsohn et al. found that children with blood levels between 0 and 9.9 ug/dl had 6.2 points higher MDI scores than children with blood lead levels between 10 and 25 ug/dl.<sup>76</sup>

---

Dietrich KN, Berger OG, Succop PA, et al. The developmental consequences of low to moderate prenatal and postnatal lead exposure: Intellectual attainment in the Cincinnati lead study cohort following school entry. *Neurotoxicology and Teratology* 15: 37-44, 1993.

Fulton M, Raab G, Thomson G, et al. Influence of blood lead on the ability and attainment of children in Edinburgh. *Lancet* 1: 1221-1226, 1987.

Needleman HL, Gatsonis CA. Low-level lead exposure and the IQ of children. A meta-analysis of modern studies *Journal of the American Medical Association* 263: 673-678, 1990.

Needleman HL, Gunnoe C, Leviton A, et al. Deficits in psychologic and classroom performance of children with elevated dentine lead levels. *The New England Journal of Medicine* 300: 689-695, 1979.

Needleman HL, Geiger SK, Frank R. Lead and IQ Scores: A reanalysis. *Science* 227, 701-704, 1985.

Schwartz J. Low-level lead exposure and children's IQ: A meta-analysis and search for a threshold. *Environmental Research* 65: 42-55, 1994

Tong S, Baghurst PA, Sawyer MG, et al. Declining blood lead levels and changes in cognitive function during childhood. The Port Pirie Cohort Study. *Journal of the American Medical Association* 280: 1915-1919, 1998.

Tong S, Baghurst P, McMichael A, et al. Lifetime exposure to environmental lead and children's intelligence at 11-13 years: the Port Pirie Cohort Study. *British Medical Journal* 312: 1569-1575, 1996.

<sup>74</sup>Needleman HL, Schell A, Bellinger D, et al. The long-term effects of exposure to low doses of lead in childhood: An 11-year follow-up report. *The New England Journal of Medicine* 322: 83-88, 1990.

<sup>75</sup> Baghurst PA, Robertson EF, McMichael AJ, et al. The Port Pirie Cohort Study: Lead effects on pregnancy outcome and early childhood development. *Neurotoxicology* 8: 395-402, 1987.

Mendelsohn AL, Dreyer BP, Fierman AH, et al. Low-level lead exposure and cognitive development in early childhood. *Journal of Developmental and Behavioral Pediatrics*. 20: 425-431, 1999.

McMichael AJ, Baghurst PA, Wigg NR, et al. The Port Pirie Cohort Study: Environmental exposure to lead and children's abilities at the age of four years. *The New England Journal of Medicine* 319: 468-475, 1988.

Wigg NR, Vimpani GV, McMichael AJ, et al. Port Pirie Cohort Study: Childhood blood lead and neuropsychological development at age two years. *Journal of Epidemiology and Community Health* 42: 213-219, 1988.

<sup>76</sup> Mendelsohn AL, Dreyer BP, Fierman AH, et al. Low-level lead exposure and cognitive development in early childhood. *Journal of Developmental and Behavioral Pediatrics*. 20: 425-431, 1999.

Table 4 shows that increases in blood lead levels in the range of 0 to 39 ug/dl at ages from birth to 6 years of age continue to predict impaired cognitive function into school age (6.5 to 13 year olds). Measures used to assess lead exposure include a single blood lead level, average lifetime blood lead levels, and dentin tooth lead levels. Lead in dentin shed from primary teeth (incisors), in bone, and average lifetime lead, consisting of 22 blood lead levels drawn over the first six years, are long-term measures of blood lead.<sup>77</sup> Higher blood lead levels, average lifetime blood lead levels or dentin lead levels predicted poorer IQ (or other intelligence) scores,<sup>78</sup> number

---

<sup>77</sup>Baghurst PA, McMichael AJ, Wigg NR, et al. Environmental exposure to lead and children's intelligence at the age of seven years. The Port Pirie Cohort Study. *The New England Journal of Medicine* 327: 1279-1284, 1992.

Burns JM, Baghurst PA, Sawyer MG, et al. Lifetime low-level exposure to environmental lead and children's emotional and behavioral development at ages 11-13 years. The Port Pirie Cohort Study. *American Journal of Epidemiology* 149: 740-749, 1999.

Dietrich KN, Berger OG, Succop PA, et al. The developmental consequences of low to moderate prenatal and postnatal lead exposure: Intellectual attainment in the Cincinnati lead study cohort following school entry. *Neurotoxicology and Teratology* 15: 37-44, 1993.

Fulton M, Raab G, Thomson G, et al. Influence of blood lead on the ability and attainment of children in Edinburgh. *Lancet* 1: 1221-1226, 1987.

Needleman HL, Riess JA, Tobin MJ, et al. Bone lead levels and delinquent behavior. *Journal of the American Medical Association* 275: 363-369, 1996.

Needleman HL, Gatsonis CA. Low-level lead exposure and the IQ of children. A meta-analysis of modern studies. *Journal of the American Medical Association* 263: 673-678, 1990.

Needleman HL, Gunnoe C, Leviton A, et al. Deficits in psychologic and classroom performance of children with elevated dentine lead levels. *The New England Journal of Medicine* 300: 689-695, 1979.

Needleman HL, Geiger SK, Frank R. Lead and IQ Scores: A reanalysis. *Science* 227, 701-704, 1985.

Schwartz J. Low-level lead exposure and children's IQ. A meta-analysis and search for a threshold. *Environmental Research* 65: 42-55, 1994.

Tong S, Baghurst PA, Sawyer MG, et al. Declining blood lead levels and changes in cognitive function during childhood. The Port Pirie Cohort Study. *Journal of the American Medical Association* 280: 1915-1919, 1998.

Tong S, Baghurst P, McMichael A, et al. Lifetime exposure to environmental lead and children's intelligence at 11-13 years: the Port Pirie Cohort Study. *British Medical Journal* 312: 1569-1575, 1996.

<sup>78</sup>Baghurst PA, McMichael AJ, Wigg NR, et al. Environmental exposure to lead and children's intelligence at the age of seven years. The Port Pirie Cohort Study. *The New England Journal of Medicine* 327: 1279-1284, 1992.

Dietrich KN, Berger OG, Succop PA, et al. The developmental consequences of low to moderate prenatal and postnatal lead exposure: Intellectual attainment in the Cincinnati lead study cohort following school entry. *Neurotoxicology and Teratology* 15: 37-44, 1993.

Fulton M, Raab G, Thomson G, et al. Influence of blood lead on the ability and attainment of children in Edinburgh.

skills,<sup>79</sup> word reading,<sup>80</sup> and fine and gross motor development.<sup>81</sup> Additionally, children with average lifetime blood lead levels greater than 15 ug/dl had more attention problems, delinquent and aggressive behavior, social problems, anxiety, depression and withdrawal than children with blood lead levels below 15 ug/dl.<sup>82</sup> Similar results were found for high bone lead levels.<sup>83</sup> For example, Schwartz conducted a meta-analysis and found that for an increase of blood lead from 10 to 20 ug/dl, there was a decrease in IQ of 2.6 points. The studies with average blood lead concentrations of 15 ug/dl or lower had higher estimated decreases in IQ per unit increase in blood lead. Further analysis led him to conclude that there was no evidence of a threshold even down to 1 ug/dl.<sup>84</sup> Another study found that children with average lifetime blood lead levels of less than or equal to 10 ug/dl had 7 points higher IQ scores than children with blood lead levels above 20 ug/dl.<sup>85</sup> Another study in Table 4 shows that blood lead levels also correlate negatively

---

*Lancet* 1: 1221-1226, 1987.

Needleman HL, Gatsonis CA. Low-level lead exposure and the IQ of children. A meta-analysis of modern studies. *Journal of the American Medical Association* 263: 673-678, 1990.

Needleman HL, Gunnoe C, Leviton A, et al. Deficits in psychologic and classroom performance of children with elevated dentine lead levels. *The New England Journal of Medicine* 300: 689-695, 1979.

Needleman HL, Geiger SK, Frank R. Lead and IQ Scores: A reanalysis. *Science* 227, 701-704, 1985.

Schwartz J. Low-level lead exposure and children's IQ: A meta-analysis and search for a threshold. *Environmental Research* 65: 42-55, 1994.

Tong S, Baghurst PA, Sawyer MG, et al. Declining blood lead levels and changes in cognitive function during childhood. The Port Pirie Cohort Study. *Journal of the American Medical Association* 280: 1915-1919, 1998.

Tong S, Baghurst P, McMichael A, et al. Lifetime exposure to environmental lead and children's intelligence at 11-13 years: the Port Pirie Cohort Study. *British Medical Journal* 312: 1569-1575, 1996

<sup>79</sup> Fulton M, Raab G, Thomson G, et al. Influence of blood lead on the ability and attainment of children in Edinburgh. *Lancet* 1: 1221-1226, 1987.

<sup>80</sup> Ibid.

<sup>81</sup> Dietrich KN, Berger OG, Succop PA. Lead exposure and the motor developmental status of urban six-year-old children in the Cincinnati Prospective Study. *Pediatrics* 91: 301-307, 1993.

<sup>82</sup> Burns JM, Baghurst PA, Sawyer MG, et al. Lifetime low-level exposure to environmental lead and children's emotional and behavioral development at ages 11-13 years. The Port Pirie Cohort Study. *American Journal of Epidemiology* 149: 740-749, 1999.

<sup>83</sup> Needleman HL, Riess JA, Tobin MJ, et al. Bone lead levels and delinquent behavior. *Journal of the American Medical Association* 275: 363-369, 1996.

<sup>84</sup> Schwartz J. Low-level lead exposure and children's IQ: A meta-analysis and search for a threshold. *Environmental Research* 65: 42-55, 1994.

<sup>85</sup> Dietrich KN, Berger OG, Succop PA, et al. The developmental consequences of low to moderate prenatal and



Buyers Up • Congress Watch • Critical Mass • Global Trade Watch • Health Research Group • Litigation Group  
Joan Claybrook, President

---

## FAX Transmittal Form

---

To: ANN BROWN

Number of pages: 29  
(including this one)

CC:

From: SIO WOLFE

Date: 6/8

Fax Number: 301-  
504-  
0127

Message:

*Bliss*

Please attach to comments  
submitted earlier today.

with motor development. Six-year old children were divided into four quartiles according to their average lifetime blood lead level. The lowest group had a level of 5-9 ug/dl and the highest group had a level of 17-39 ug/dl. After adjusting for confounding, children with blood lead levels in the lowest quartile exhibited the best motor development and those in the highest quartile exhibited the worst motor development.<sup>86</sup>

These problems continue into adulthood. Needleman et al. collected primary teeth from children over an eleven-year period. He found that after adjusting for confounders, 18 year olds who had previously shed teeth with dentin lead levels greater than 20 parts per million were 7.4 times more likely to drop out of high school, 5.8 times more likely to have a reading disability, had lower grammatical reasoning and vocabulary and had longer reaction times than those with dentin lead levels below 10 parts per million.<sup>87</sup>

Low-level lead exposure is also associated in adults with increased blood pressure,<sup>88</sup> renal impairment,<sup>89</sup> and gout.<sup>90</sup>

##### ***5. Alternatives to lead-containing wicks exist.***

Cored wicks are used in long-burning scented candles with self-supporting wicks in containers, votives, pillars, and novelties.<sup>91</sup> Metal cores in wicks are used to prevent the wick from bending

postnatal lead exposure: Intellectual attainment in the Cincinnati lead study cohort following school entry. *Neurotoxicology and Teratology* 15: 37-44, 1993.

<sup>86</sup>Dietrich KN, Berger OG, Succop PA, et al. Lead exposure and the motor development status of urban six-year old children in the Cincinnati Prospective study. *Pediatrics* 91: 301-307, 1993.

<sup>87</sup>Needleman HL, Schell A, Bellinger D, et al. The long-term effects of exposure to low doses of lead in childhood: An 11-year follow-up report. *The New England Journal of Medicine* 322: 83-88, 1990

<sup>88</sup> De Kort WLAM, Verschoor MA, Wibowo AAE, et al. Occupational exposure to lead and blood pressure: A study in 105 workers. *American Journal of Industrial Medicine* 11: 145-156, 1987

Harlan WR. The relationship of blood lead levels to blood pressure in the U S. population. *Environmental Health Perspectives* 78: 9-13, 1988.

Harlan WR, Landis JR, Schmouder RL, et al. Blood lead and blood pressure: Relationship in the adolescent and adult US population. *Journal of the American Medical Association* 253: 530-534, 1985.

Batumen V, Landy E, Maesaka JK, et al. Contribution of lead to hypertension with renal impairment. *The New England Journal of Medicine* 309: 17-21, 1983.

<sup>89</sup> Batumen V, Landy E, Maesaka JK, et al. Contribution of lead to hypertension with renal impairment. *The New England Journal of Medicine* 309: 17-21, 1983.

<sup>90</sup> Batumen V, Maesaka JK, Haddad B, et al. The role of lead in gout nephropathy. *The New England Journal of Medicine* 304: 520-523, 1981.

<sup>91</sup>Wick n'Clip, Inc, 1999Quality Wick Products Web Site: <http://www.wicknclip.com/types2.html>.

and extinguish in the molten wax of the candle. However, alternatives exist, including cotton and paper core-wicks that remain erect during burning.<sup>92</sup> Waxing the wick prior to candle-making constructs a sturdier wick.<sup>93</sup> Leaded wicks also burn more slowly and evenly. However, Krause indicated that 4 of 5 votives (2 in. candles burned in pans) with lead-containing candlewicks burned almost completely in 2 hours despite being advertised to burn for 15 hours.<sup>94</sup> Thus this assertion seems questionable. Finally, in our study, lead-containing wicks were a fraction of those not containing lead for every type of candle proving that the alternatives are viable options.

#### ***6. Labeling will not adequately protect candle-users.***

Some public health risks are too great to be handled by labeling. This is one. Besides, there are no public health benefits to lead-containing candles. Furthermore, the most at-risk populations, fetuses, infants and young children, do not choose whether a candle is burned. Labeling may ward off some from the danger of burning candles with lead-containing wicks, but it will not protect children, particularly if their parents cannot read or comprehend the warning. The only solution is to completely ban candles containing leaded wicks. Finally, as millions of such candles are sold each year because they are currently on store shelves, you must immediately order a recall of candles with lead-containing wicks.

#### ***7. The Consumer Product Safety Act and the Hazardous Substances Act require the Consumer Product Safety Commission to Ban and Recall these products.***

The provision of the Consumer Product Safety Act concerning "imminent hazards" posed by products as the basis for the Commission to issue a recall of lead-containing candles operates where products present "imminent and unreasonable risk of death, serious illness, or severe personal injury." 15 U.S.C. §2061(a).

Our study showed that the burning of presently-available lead-wicked candles, with wicks containing from 33% to 85% lead, could result in air lead levels as high as 50 ug/ m<sup>3</sup>, well in excess of the 1.5 ug per cubic meter EPA guideline for air lead levels. The Van Alphen study cited on pages 11-12 concluded that burning one high lead candle for three hours could achieve an average 24 hour air lead concentration of 10 ug per cubic meter, more than six times in excess of the EPA's ambient air guideline of 1.5 ug of lead per cubic meter. EPA's own earlier research found that burning candles with lead wicks also resulted in air lead levels similarly in excess of the EPA guideline. That air lead levels resulting from burning such candles can cause a dangerous increase in blood lead levels in children was determined by the aforementioned research of Van Alphen who estimated that burning one lead-wicked candle for three hours per week could raise the blood lead level in children by 3-11 ug/dl above what the levels were before exposure. For many children, this would raise their blood lead levels to well above 10 ug/dl, levels which both the Consumer Product Safety Commission and the Centers for Disease Control

---

<sup>92</sup>Ibid.

<sup>93</sup>Ibid.

<sup>94</sup>Krause D. Personal communication, February 11, 2000.

and Prevention have found to be dangerous. Additional lead exposure to children can occur from the ingestion of lead-containing dust from the burning of the candles which settles in rooms where candles are burned.

All of these findings clearly demonstrate that lead-based wicks in candles pose an imminent risk of injury. Although the manifestations of exposure to lead may not be immediately apparent--as in the ultimate lowering of IQ in lead-exposed children--the legal standard is imminent risk, not imminent injury.

The provision of the Consumer Product Safety Act pertaining to "banned hazardous products" authorizes the Commission to initiate rulemaking to ban consumer products that present an "unreasonable risk of injury" where "no feasible consumer product safety standard...would adequately protect the public from the risk of injury associated with such product." 15 U.S.C. §2057.

Finally, the Federal Hazardous Substances Act<sup>45</sup> "imminent hazard" provision, 15 U.S.C. §1261(q)(2), authorizes a ban only as a temporary remedy during the course of regulatory proceedings. However, Section 1261(q)(1) empowers the Commission to classify household products as "banned hazardous substances," as a permanent designation, upon a finding that "the degree or nature of the hazard involved in the presence or use of such substance in households is such that the objective of protection of the public health and safety can be adequately served" only by a ban. 15 U.S.C. §1261(q)(1)(B).

Several years ago, the CPSC asked manufacturers of vinyl miniblinds to stop using lead in the production of these blinds because of the "lead poisoning hazard" they posed to children. The CPSC found that "in some blinds, the levels of dust [from the deterioration of the blinds] was so high that a child ingesting dust from less than one square inch of blind a day for about 15 to 30 days could result in blood levels at or above the 10 microgram per deciliter amount CPSC considers dangerous for young children." (CPSC Press Release, June 25, 1996)

In summary, the Consumer Product Safety Commission has the legal authority, under the Consumer Product Safety Act and the Hazardous Substances Act, to immediately ban the manufacture, stop the importation and order the recall from all channels of commerce of all candles with lead-containing wicks and all lead-containing wicks sold for subsequent incorporation into candles. Any failure to do so will continue to jeopardize the health of millions of people, including tens if not hundreds of thousands of children by exposing them to the completely unnecessary risks of lead poisoning.

***Lead-containing wicks are a dangerous product.*** Through this petition, we have demonstrated that candles with lead-containing wicks are present on store shelves despite the voluntary agreement between the candle industry and the CPSC. We have shown that the candles with lead-wicks emit sufficient lead to exceed EPA air lead standards,<sup>45</sup> HUD floor surface lead

---

<sup>45</sup>Bridbord K, Medical Officer. Memo to Stanley Greenfield, Assistant Administrator for Research and



concentrations<sup>96</sup> and the CPSC's own recommendations for maximal lead intake by children.<sup>97</sup> Furthermore, we have demonstrated that the concentrations attained by burning these candles can raise children's blood lead levels sufficiently to impair intelligence and cause behavioral problems.<sup>98</sup> Finally, we have shown that 3% of candles have high lead content. In 1974, Russell Train, then Administrator of EPA, stated "Inhabitants of homes in which lead-wicked candles are burned could be exposed to substantial incremental quantities of lead which, if continued on a regular basis, would pose a significant risk to health especially among children with already elevated lead body burdens. In my opinion candles represent an unnecessary incremental source of lead that can readily be controlled."<sup>99</sup> His concern is as relevant now as it was then.

---

Development, and Vaun A. Newill, Special Assistant to the Administrator: Hazards of burning candles with lead. US EPA, Research Triangle Park, December 14, 1973

Krause JD. Characterization of scented candle emissions and associated public health risks. Thesis. Department of Environmental and Occupational Health. University of South Florida. August 1999.

Van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal wick cores. Science of the Total Environment 243-244 53-65, 1999.

Code of Federal Regulations. Title 40--Protection of Environment, Chapter I--Environmental Protection Agency, Part 50, Sec 50.12 National primary and secondary ambient air quality standards for lead.

<sup>96</sup> Van Alphen M. Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal wick cores Science of the Total Environment 243-244 53-65, 1999.

<http://www.hud.gov:80/lea/leach1.pdf> Chapter 1: Introduction. Legislative Basis and Relationship to Federal Programs and Regulations. In The Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, 1995.

<sup>97</sup> Consumer Product Safety Commission. CPSC Staff report on lead and cadmium in children's polyvinylchloride (PVC) products Page 3. 21 November 1997.

Krause JD. Characterization of scented candle emissions and associated public health risks. Thesis. Department of Environmental and Occupational Health. University of South Florida. August 1999.

<sup>98</sup>Bridbord K, Medical Officer. Memo to Stanley Greenfield, Assistant Administrator for Research and Development, and Vaun A. Newill, Special Assistant to the Administrator: Hazards of burning candles with lead. US EPA, Research Triangle Park, December 14, 1973.

Krause JD. Characterization of scented candle emissions and associated public health risks. Thesis. Department of Environmental and Occupational Health. University of South Florida. August 1999.


Van Alphen M Emission testing and inhalational exposure-based risk assessment for candles having Pb [lead] metal wick cores. Science of the Total Environment. 243-244: 53-65, 1999.

Consumer Product Safety Commission. CPSC Staff report on lead and cadmium in children's polyvinylchloride (PVC) products Page 2. 21 November 1997.

<sup>99</sup>Letter to Mr. Simpson, Chairman of CPSC, from Russell Train, Administrator of EPA, March 1974.

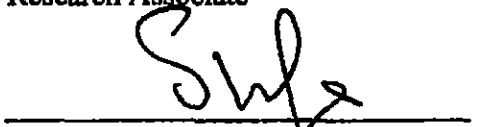
The Consumer Product Safety Commission has a clear mandate to protect the American public from these hazardous products.

Sincerely,




---

Howard L. Sobel, M.D., M.P.H., M.S.  
Research Associate



---

Sidney M. Wolfe, M.D.  
Director



---

Peter Lurie, M.D., M.P.H.  
Deputy Director  
Public Citizen's Health Research Group

Table 1. Lead content of lead-containing candles purchased for February, 2000 Health Research Group candle study.

Total lead in wick (ug)	Total lead emitted from wick (ug) <sup>100</sup>	Average 24-hour Air lead levels (ug/m <sup>3</sup> ) <sup>101</sup>	Multiples of EPA Ambient Air Lead Levels of 1.5 ug/dl
39400.0	7880.0	19.3	13
68058.0	13611.6	25.0	17
117935.5	23587.1	43.3	29
66956.5	13391.3	49.2	33
32112.9	6422.6	17.2	11
37795.3	7559.1	22.2	15
62152.2	12430.4	22.8	15
25785.7	5157.1	15.2	10
23618.4	4723.7	13.9	9
Average:			17
Median:			15

<sup>100</sup> Assumes that only 20% of lead in candlewicks is emitted. In previous studies, the actual amount emitted into the air ranged from 20 to 35%.

<sup>101</sup> First, the amount of lead emitted per cm was calculated. We assumed the burn rate was 2 cm/hour and that people burn candles only for 3 hours and then extinguish the candle. Other assumptions include that the ventilation rates are 25% per hour and that the room dimensions are 15 ft. x 15 ft. x 8 ft which converts to 51 m<sup>3</sup>. We then calculated lead concentrations for each of 24 hours.

For the first hour, the concentration was the lead/cm times 2 cm/hour times 20% (giving the total lead emitted during the first hour) divided by 51 m<sup>3</sup>, the total volume of the room. We then multiply this concentration by 0.75, because 25% is exchanged per hour.

For the second and third hour, it was 75% of the lead concentration at the end of the previous hour plus the newly emitted lead which is the lead/cm times 2 cm times 0.2 divided by 51 m<sup>3</sup>, as before.

For the fourth to 24<sup>th</sup> hour, because the candle was extinguished, the lead concentrations decrease by 25% of the value at the end of the previous hour each hour.

Finally, the hourly lead concentration were added and divided by 24 hours to determine the average concentration.

A Microsoft Excel Spreadsheet was used to perform these calculations.

Table 2. Comparison of prenatal exposure to low-level lead with clinical effect.

Clinical effect	Lead Exposure Level	Study finding
In Utero Exposure Placental lead in: Normal Birth Miscarriage Early Neonatal Death	Placental lead. 0.93 ug/g 1.45 1.73	Placental lead concentration is lower in placentas of children who survived the neonatal period than those who did not. <sup>102</sup>
Premature birth	> 14 ug/dl vs. <8 ug/dl maternal blood lead concentration at delivery.	4.4 times the risk of premature delivery in high compared to the low blood lead group. <sup>103</sup>

<sup>102</sup>Wibberley DG, Khera AK, Edwards JH, et al. Lead levels in human placentae from normal and malformed births. *Journal of Medical Genetics* 14: 339-345, 1977

<sup>103</sup>Baghurst PA, Robertson EF, McMichael AJ, et al. The Port Pirie Cohort Study. Lead effects on pregnancy outcome and early childhood development. *Neurotoxicology* 8: 395-402, 1987

Decreased mental or cognitive development	<3 ug/dl, 6-7 ug/dl, and >10 ug/dl umbilical cord blood	Highest cord blood lead level group performed 4-8 points lower on the Bayley Scale of Infant Development-Mental Development Index with incremental increase of umbilical cord blood level. <sup>104</sup>
	4.5 ug/dl (mean) in utero blood lead, maximum <30 ug/dl	For each 1-ug/dl increase in blood lead level, the MDI decreased 0.34 points (9.2 points across the range). <sup>105</sup>

<sup>104</sup>Bellinger DC, Needleman HL, Leviton A, et al. Early sensory-motor development and prenatal exposure to lead. *Neurobehavioral Toxicology and Teratology* 6: 387-402, 1984

Bellinger DC, Leviton A, Waternaux C, et al. Methodological issues in modeling the relationship between low-level lead exposure and infant development: Examples from the Boston lead study. *Environmental Research* 38: 119-129, 1985.

Bellinger DC, Leviton A, Needleman HL, et al. Low-level lead exposure and infant development in the first year. *Neurobehavioral Toxicology and Teratology* 8. 151-161, 1986.

Bellinger DC, Leviton A, Waternaux C, et al. Longitudinal analyses of prenatal and postnatal lead exposure and early cognitive development. *The New England Journal of Medicine* 36: 1037-1043, 1987.

<sup>105</sup> Dietrich KN, Krafft KM, Bornschein RL, et al. Low-level fetal lead exposure effect on neurobehavioral development in early infancy. *Pediatrics* 80: 721-730, 1987.

Table 3. Comparison of post-natal exposure to low-level lead with clinical effect in preschoolers.

Lead Exposure Level	Age	Effect
14-22 ug/dl blood level. Compares lowest quartile to highest.	2	1.9 point decrease in scores of the Mental Development part of the Bayley Scales of Infant Development for every 10 ug/dl increase in blood lead over the range of 14-22 ug/dl. <sup>106</sup>
10, 18.4, 29.9 ug/dl integrated postnatal blood lead.	2	1.6 point decrease in scores of the Mental Development part of the Bayley Scales of Infant Development for every 10 ug/dl increase in blood lead for levels <30 ug/dl. <sup>107</sup>
0-9.9 vs. 10-24.9 ug/dl blood lead.	1-3	Higher blood lead group had 6.2 points lower scores of the Mental Development part of the Bayley Scales of Infant Development than the lower blood group. <sup>108</sup>
5-57 ug/dl blood lead	4	Incremental increases in blood lead level from 10 to 30 ug/dl corresponds to a decrease of 7.2 units of the General Cognitive Index. Memory also impaired. <sup>109</sup>

<sup>106</sup> Baghurst PA, Robertson EF, McMichael AJ, et al. The Port Pirie Cohort Study: Lead effects on pregnancy outcome and early childhood development. *Neurotoxicology* 8: 395-402, 1987.

<sup>107</sup> Wigg NR, Vimpani GV, McMichael AJ, et al. Port Pirie Cohort Study: Childhood blood lead and neuropsychological development at age two years. *Journal of Epidemiology and Community Health* 42: 213-219, 1988.

<sup>108</sup> Mendelsohn AL, Dreyer BP, Fierman AH, et al. Low-level lead exposure and cognitive development in early childhood. *Journal of Developmental and Behavioral Pediatrics* 20: 425-431, 1999.

<sup>109</sup> McMichael AJ, Baghurst PA, Wigg NR, et al. The Port Pirie Cohort Study: Environmental exposure to lead and children's abilities at the age of four years. *The New England Journal of Medicine* 319: 468-475, 1988.

**Table 4. Comparison of post-natal exposure to low-level lead with clinical effect in school-age children**

Lead Exposure Level	Age	Effect
>24 PPM vs. <6 PPM lead in dentin	7-8	Higher lead levels corresponded to poorer performance on test of IQ, auditory and verbal processing, attention, and teachers behavioral rating. (1 <sup>st</sup> and 2 <sup>nd</sup> graders). <sup>110</sup>
6-100 ug/dl blood lead lead 2.4 to >150 PPM tooth lead levels	Meta-analysis	11/12 studies employing multiple regression found that increasing blood or tooth lead levels were associated with lower IQ. <sup>111</sup>
10 groups with mean blood lead levels from 5.6-22.1 ug/dl	6-9	Overall ability and attainment, and specifically, number skills and word reading decreased with increasing blood lead concentration. <sup>112</sup>
0-10, >10-15, >15-20, >20 ug/dl average lifetime blood lead.	6.5	IQ is 7 points lower in the lowest than the highest lead group. <sup>113</sup>
7.5-30 ug/dl average lifetime lead level	7	IQ decreases approximately 5 points for increases of blood lead from 10 to 30 ug/dl. <sup>114</sup>
11-18 6 ug/dl average lifetime lead level	11-13	Cognitive deficits in children whose blood lead concentration was high improve only partially with a subsequent decline of blood lead level <sup>115</sup>
11-18.6 ug/dl average lifetime lead level	11-13	Mean IQ decreased 3 points for an increase in blood lead level from 10 ug/dl

<sup>110</sup> Needleman HL, Gunnoe C, Leviton A, et al. Deficits in psychologic and classroom performance of children with elevated dentine lead levels. *The New England Journal of Medicine* 300:689-695, 1979.  
 Needleman HL, Geiger SK, Frank R. Lead and IQ Scores: A reanalysis. *Science* 227, 701-704, 1985.

<sup>111</sup> Needleman HL, Gatsonis CA. Low-level lead exposure and the IQ of children. A meta-analysis of modern studies. *Journal of the American Medical Association* 263. 673-678, 1990.

<sup>112</sup> Fulton M, Raab G, Thomson G, et al. Influence of blood lead on the ability and attainment of children in Edinburgh. *Lancet* 1: 1221-1226, 1987.

<sup>113</sup> Dietrich KN, Berger OG, Succop PA, et al. The developmental consequences of low to moderate prenatal and postnatal lead exposure: Intellectual attainment in the Cincinnati lead study cohort following school entry. *Neurotoxicology and Teratology* 15: 37-44, 1993.

<sup>114</sup> Baghurst PA, McMichael AJ, Wigg NR, et al. Environmental exposure to lead and children's intelligence at the age of seven years. The Port Pirie Cohort Study. *The New England Journal of Medicine* 327: 1279-1284, 1992.

<sup>115</sup> Tong S, Baghurst PA, Sawyer MG, et al. Declining blood lead levels and changes in cognitive function during childhood. The Port Pirie Cohort Study. *Journal of the American Medical Association* 280: 1915-1919, 1998.

<sup>116</sup> Tong S, Baghurst P, McMichael A, et al. Lifetime exposure to environmental lead and children's intelligence at

		to 20 ug/dl <sup>116</sup>
>15 vs. <15 ug/dl lifetime average lead level	11-13	Higher lead levels were associated with higher behavioral problem score. Boys had higher attention problems, delinquent behavior, and aggressive behavior. Girls had these and additionally had higher social problems, anxiety/depression, and withdrawal. <sup>117</sup>
5-9, 9-12,13-17, 17-39 ug/dl average lifetime blood lead	6	Fine and gross motor development decrease with increasing average blood lead level. (6 year olds). <sup>118</sup>
Mean blood lead levels of 11 -23 ug/dl	Meta-analysis	An increase from 10 to 20 ug/dl reduces IQ by 2.6 points. There is no threshold. Decreases in IQ continue to below 5 ug/dl. <sup>119</sup>
Quintiles according to Bone lead levels by backscattered Xray peak intensity vs standards.	7	Higher bone lead levels were associated with higher risk of antisocial and delinquent behavior. <sup>120</sup>

---

11-13 years. the Port Pirie Cohort Study. British Medical Journal 312 1569-1575, 1996.

<sup>117</sup> Burns JM, Baghurst PA, Sawyer MG, et al. Lifetime low-level exposure to environmental lead and children's emotional and behavioral development at ages 11-13 years. The Port Pirie Cohort Study. American Journal of Epidemiology 149. 740-749, 1999.

<sup>118</sup> Dietrich KN, Berger OG, Succop PA Lead exposure and the motor developmental status of urban six-year-old children in the Cincinnati Prospective Study. Pediatrics 91: 301-307, 1993.

<sup>119</sup> Schwartz J. Low-level lead exposure and children's IQ: A meta-analysis and search for a threshold. Environmental Research 65: 42-55, 1994.

<sup>120</sup> Needleman HL, Riess JA, Tobin MJ, et al. Bone lead levels and delinquent behavior. Journal of the American Medical Association 275: 363-369, 1996





U.S. CONSUMER PRODUCT SAFETY COMMISSION  
WASHINGTON, DC 20207

Todd A. Stevenson  
Deputy Secretary and  
Freedom of Information Officer  
Office of the Secretary

Tel 301-504-0785X1239  
Fax 301-504-0127  
Email [tstevenson@cpsc.gov](mailto:tstevenson@cpsc.gov)

June 9, 2000

Sidney M. Wolfe, MD, Director  
Peter Lurie, MD, MPH, Deputy Director  
Public Citizen's Health Research Group  
1600 20<sup>th</sup> Street NW  
Washington, DC 20009-1001

Dear Drs. Wolfe and Lurie:

Thank you for your letter dated June 8, 2000 to Chairman Ann Brown of the U.S. Consumer Product Safety Commission (Commission) regarding the Petition HP 00-3 on Candle Wicks Containing Lead. As you know, the Commission is presently reviewing the petition regarding this important topic and collecting information and comments from the public. We will make your comments part of the official records from the public regarding the issues. The Commissioners and the project staffs will consider your comments as the regulatory decisions are taken.

Sincerely,

A handwritten signature in black ink, appearing to read "T. Stevenson", with a long horizontal line extending to the right.

Todd A. Stevenson

*Candle*



Robert C. Byrd Health Sciences Center  
of West Virginia University  
Department of Community Medicine

120

June 6, 2000

Office of the Secretary  
Consumer Products Safety Commission  
4330 East West Highway  
Washington, DC 20814

RE: Lead in Candle Wicks  
Petition HP 00-3 – Candle Wicks Containing Lead

Gentlemen:

*This is to communicate that there are sound data from numerous studies concerning health hazards of air borne lead in homes. Lead in candle wicks, is a preventable source of such exposure. While the marketplace is already delivering a strong message to candle manufacturers, caveat emptor is really not adequate protection of the public for such a well-known and avoidable hazard.*

Lead should not be permitted in candle wicks.

Sincerely,

A handwritten signature in cursive script, appearing to read 'Alan M. Ducatman'.

Alan M. Ducatman, MD, MSc  
Chair, Department of Community Medicine

*candle*  
*121*

**Stevenson, Todd A.**

---

**From:** jshawsms [jshaw@sms k12.vt us]  
**Sent:** Wednesday, June 14, 2000 8 35 AM  
**To:** cpac-os@cpac.gov  
**Subject:** Petition HP 00-3--Candlewicks Containing Lead

Please, urgently issue a legal and mandatory ban & recall on the use of lead in candle wicks in all candles made and sold in the U.S. Many thanks for your consideration.  
Sincerely, Jennifer Shaw.

*Candles*  
*129*

~~Stevenson, Todd A.~~

---

**From:** Hartline [rchdrh@earthlink net]  
**Sent:** Tuesday, June 13, 2000 5 21 PM  
**To:** cpssc-os@cpssc.gov  
**Subject:** "Petition HP 00-3--Candle Wicks Containing Lead."

To whom it may concern:

I feel very strongly that all candles with lead in the wicks should be banned and the ones that are on the market should be recalled. Why would we want another thing out there that can harm our children. If we know about it, let's do something about it. Thank you for your time.

Danelle Hartline

Stevenson, Todd A.

Candler  
123

**From:** l palumbo@att net  
**Sent:** Tuesday, June 13, 2000 5.58 PM  
**To:** cpsc-os@cpsc gov  
**Subject:** Petition HP 00-3 -- Candle Wicks Containing Lead

To whom it may concern:

I urge you to enforce a ban on candle wicks containing lead.

I am a candle purchaser, and I was unaware of this hazard until receiving an e-mail about it from the Feingold Organization. I will be sharing news of this hidden toxin with the members of my MOMS Club (a national organization) as well.

Surely there are alternatives to a poison which has been known for decades to cause brain damage. Get the lead out!

Sincerely,  
Laura Palumbo

Sincerely,

~~Stevenson, Todd A.~~

*Candle 124*

**From:** Bunglerye@aol.com  
**Sent:** Tuesday, June 13, 2000 6:16 PM  
**To:** cpsc-os@cpsc.gov  
**Subject:** Petition HP 00-3--Candle Wicks Containing Lead

Dear Sir/Madam,

Was just apprised of the petition to obtain mandatory ban on candle wicks

containing

lead and want to add my approval of such a petition. As a mother, grandmother, and

teacher of 4-year-olds, I think it should not even be questioned whether we

should

be protecting children from unnecessary lead exposure. They are already

overloaded

with chemicals and other harmful substances in their environment, and it

would be

desirable if such were reduced or eliminated as much as possible, not on the

increase. Thank you. Carolyn Allen, Ft. Worth, TX

Stevenson, Todd A.

*Candles  
125*

**From:** Sootguy@aol.com  
**Sent:** Tuesday, June 13, 2000 8:08 PM  
**To:** cpsc-os@cpsc.gov  
**Subject:** Candle Pollution

To whom it may concern:

As a certified chimney sweep for over 11 years, I have seen the damage to homes caused by lead in candle soot. Please add my name to your list of those opposed to lead in candles.

Sincerely,  
Michael Elliott  
Central New England  
Chimney Sweeps  
North Oxford, MA  
sootguy@aol.com

Stevenson, Todd A.

126  
Candle

**From:** Ana [janet@bellsouth.net]  
**Sent:** Tuesday, June 13, 2000 8.08 PM  
**To:** cpsc-os@cpsc.gov  
**Subject:** LEAD

Just an added note to reiterate that parents have enough behavioral problems at home to deal with because of all the wrong messages today's american society gives, we certainly do not need additional chemical and health related problems such as the risks involved with candlewick lead.

Yours truly,

Concerned Mom



*candles*  
*127*

~~Stevenson, Todd A.~~

---

**From:** MICHAEL AUTORE [BAUTORE@email msn com]  
**Sent:** Tuesday, June 13, 2000 11 48 PM  
**To:** cpsc-os@cpsc gov  
**Subject:** Petition HP 00-3--Candle Wicks Containing Lead

Please institute a mandatory ban on the manufacture of candle wicks containing lead.  
Sincerely,  
B.Autore

~~Stevenson, Todd A.~~

*Candles*  
*128*

**From:** C & J Louttit [louttit@impop bellatlantic net]  
**Sent:** Tuesday, June 13, 2000 9.25 PM  
**To:** cpssc-os@cpssc.gov  
**Subject:** "Petition HP 00-3--Candle Wicks Containing Lead "

A mandatory recall should be required  
for all such candles containing lead in  
their wicks.

Thank you,  
Jeanine Louttit  
Ringwood, NJ

Stevenson, Todd A.

*Carols*  
*129*

**From:** JUDITH SCHULZ [jschulz@ozemail.com au]  
**Sent:** Wednesday, June 14, 2000 1:30 AM  
**To:** RKFABF@aol.com  
**Subject:** Petition HP 00-3 Candle Wicks containing Lead

When it comes to lead in candle wicks - SAY NO.

Chemical and pollutants such as this, cause learning difficulties and ADD in our children - as Hilary Clinton said 7 million children in the US are on drugs for learning, the figures in Australia are equally frightening. When you know the cause of a problem, you must eliminate it - and lead causes learning difficulties and Attention Deficit Disorder. I t is not a vital ingredient for a candle wick, so why would you add to the enormous problems of our children. They are the innocent party you are harming.

Have the courage the say NO.

The Wannabee Foundation for Children

# CITIZENS FOR HEALTH of The Inland Empire \_\_\_\_\_

Elle M. Grswold, Coordinator  
11231 Heathrow Dr.  
Riverside, CA 92503

June 14, 2000

Office of the Secretary  
Consumer Product Safety Commission  
Washington, DC 20207

Re: Petition HP 00-3 -- Candle Wicks Containing Lead

To whom it may concern:

We are a national grassroots consumer advocacy nonprofit organization committed to protecting and advancing consumer access, choice, information and safety for natural health products and therapies, with chapters in all 50 states.

Members have brought to our attention that the leaded candles have had a voluntary ban for many years, which candle manufacturers have been ignoring. These candlewicks which contain lead should be banned and recalled immediately!

Apparently the "voluntary ban" has not worked; therefore, we are urging you to take a permanent action and fix this problem once and for all so that we can all enjoy candles.

Lead is one additive that everyone should avoid, and can be a source of behavioral problems in children.

Peter Lurie, MD, MPH, Deputy Director and Sidney M. Wolfe, MD, Director for Public Citizen's Health Research Group has mailed you numerous documentation as to how much air lead concentrations are resulting from the burning of lead-containing candles.

Metal wicks are not essential to candle making. Steve West of WEDO, a European candle manufacturer, indicated at the Lead Wick Task Group meeting that European manufacturers do not use metal wicks at all (Minutes of Lead Wick Task Group meeting, May 5, 2000).

Nonetheless, in the interest of concluding a proceeding that should have ended with a CPSC regulation when this issue was first raised in 1973, we are willing to accede to a lead level of 0.01%. This would permit only metal wicks containing the highest grade of zinc, would effectively eliminate tin wicks and would drastically reduce lead exposure from candles. We reiterate that a voluntary CPSC standard, whether dependent upon an ASTM standard or not, is wholly inappropriate in an area of such substantial health risk to small children, particularly with an industry that has already demonstrated its lack of trustworthiness by its failure to comply with the previous voluntary agreement. Rather

than expending unnecessary resources on the ASTM process and perhaps a CPSC process thereafter, the time has come for the CPSC to simply ban candle wicks with lead levels exceeding 0.01% and to recall all metal-containing wicks unless the manufacturer can immediately provide proof that the lead content is below that level.

Sincerely,

Elle M. Griswold, Coordinator

CC: [plurie@citizen.org](mailto:plurie@citizen.org)  
[SWOLFE@citizen.org](mailto:SWOLFE@citizen.org)  
[RKFABF@aol.com](mailto:RKFABF@aol.com)

131

**Stevenson, Todd A.**

---

**From:** Carolyn Ross [cross002@san rr com]

**Sent:** Wednesday, June 14, 2000 11 40 PM

**To:** cpsc-os@cpsc.gov

**Subject:** Petition HP00-3--Candle Wicks Containing Lead

I am in support of a voluntary recall on candle wicks containing lead C Ross, M D.



THE UNIVERSITY OF MICHIGAN

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES

109 S OBSERVATORY STREET  
ANN ARBOR MICHIGAN 48109 2029  
PHONE: 734 764-3188 FAX: 734 936 7233  
WEB SITE: <http://www.sph.umich.edu/ehs/>

PROCESSED BY SECRETARY  
FREE

2000 JUN 16 A 11 24

*Woods 132*

June 7, 2000

Office of the Secretary  
Consumer Product Safety Commission  
4330 East-West Highway, Room 502  
Bethesda, MD 20814

**Re: Petition 00-3-Candle Wicks Containing Lead**

To Whom It May Concern:

This memo is in support of the petition by the Public Citizen to ban the use of lead in candle wicks. The effects of lead on children's health are well known and will not belabored here. Having lead in candle wicks is simply an un-necessary risk to children in this country.

I am equally concerned about the lead content of some zinc used in candle cores. Our study (reprint is enclosed) shows that significant amounts of lead can be released from burning some candles with zinc core. I am therefore concerned that 1000  $\mu\text{g/g}$  (or 0.1%) may be too high as the acceptable level of lead in zinc core. Laboratory grade zinc generally contains less than 40  $\mu\text{g/g}$  lead while the highest grade zinc contains 20  $\mu\text{g/g}$  lead or less. Setting the lead level for candle wick zinc at 100  $\mu\text{g/g}$  would be a prudent way to ensure that only high grade zinc is used in candles.

Yours sincerely,

Jerome O Nriagu, PhD, DSc  
Professor & Director  
Environmental Health Program  
Phone: 734-936-0706; E-mail: [jnriagu@umich.edu](mailto:jnriagu@umich.edu)

## Emissions of lead and zinc from candles with metal-core wicks

Jerome O. Nriagu\*, Myoung-Jin Kim

*Department of Environmental Health Sciences, School of Public Health, University of Michigan, 109 Observatory,  
Ann Arbor, MI 48109-2029 USA*

Received 8 October 1999, accepted 6 December 2000

---

### Abstract

We measured the amount of lead released from 14 different brands of candles with metal-core wicks sold in Michigan. The emissions of lead were found to range from 0.5 to 66  $\mu\text{g}/\text{h}$ , and the rates for zinc were from 1.2 to 124  $\mu\text{g}/\text{h}$ . It is estimated that burning four of the candles bought in Michigan for 2 h can result in airborne lead concentrations that can pose a threat to human health. In addition to inhalation of lead in the air, children get exposed to lead in candle fumes deposited on the floor, furniture and walls through their hand-to-mouth activity. Burning candles with leaded-core wick may be an important exposure route for lead that has generally been ignored. © 2000 Elsevier Science B.V. All rights reserved.

*Keywords:* Lead emission, Lead exposure, Candle fumes, Zinc emission, Lead poisoning

---

### 1. Introduction

In many societies, candles have lost their original utilitarian function (supplying lighting) and are used instead to create warmth and nostalgic atmosphere. The glow of a candle can make a

room more intimate and comforting and a flickering flame is able to transform ordinary dinner into a romantic occasion. Scented candles glowing in bathrooms and bedrooms transform the room into a pleasurable and fascinating experience. Some people even claim that aromatherapeutic candles can raise the consciousness level and promote a state of tranquility. For centuries, candles have served to enhance the spiritual significance of religious ceremonies. In view of the great popularity of candles for sensual, religious

---

\* Corresponding author. Tel. +1-734-936-0706, fax +1-734-764-9424.  
E-mail address: jnriagu@umich.edu (J.O. Nriagu).



and romantic purposes, they are typically associated with healthy living. Health risks associated with candle fumes have generally been ignored. In fact, release of dangerous levels of lead from the lead and lead alloys in candle wicks was first reported in the United States about a quarter of a century ago. In 1973, the Health Research Group alerted the Consumer Product Safety Commission (CPSC) to the fact that approximately 50% of all candles sold in the US had wicks with pure lead cores (HRG, 1974a). This prompted the CPSC to negotiate a voluntary program with the Candle Manufacturing Industry (CMI) for elimination of lead-core wicks in the manufacture and importation of candles. There was no requirement in the agreement, however, for monitoring of candles to ensure that member companies of the CMI and the imported candles were complying with this voluntary program. The voluntary program apparently served to reassure the public and the issue has been dormant since then.

Since the 1970s, candles have grown steadily in popularity in the US. During this decade, the candle industry has grown at an average rate of 10–15% annually and retail sales are expected to reach \$2.3 billion in 1999 (NCA, 1999). There are more than 200 commercial, religious and institutional candle makers in the US and a typical company can offer 1000–2000 varieties of candles (NCA, 1999). The growth in the use of candles implies that the US population is increasingly being exposed to candle fumes. This study examined the emissions of lead and zinc from candles sold in the State of Michigan. It was prompted by a recent study by Van Alphen (1999) which found that some candles sold in Australia could release high levels of lead into the home environment. Whether such a source of lead exposure still exists in the US was an original objective of this study.

## **2. Methodology**

Candles used in the study were bought in stores in various parts of south-east Michigan and were manufactured in the US, Mexico or China. They

came in various colors, size ranges (3.5–7-cm diameter) and lengths (5–15 cm). Since most of the candles sold in Michigan were made in other states or imported from foreign countries (especially China, Mexico and Taiwan), one would expect similar products to be available in other parts of the country as well. A metal core is used to provide rigidity to the wick, provide even and slower burn rate and reduce the carbon (mushrooming) at the tip (Wick n'Clip Inc., 1999). Metal-cored wicks also affect the diffusion of wax and air to the burning zone and the volatilization of odoriferous compounds from melted wax (Ahberg, 1999). They are therefore popular for long-burning scented candles with self-supporting wicks in containers, votives, pillars and novelties (Wick n'Clip Inc., 1999). Since lead and its alloys often melt at relatively low temperature, a large fraction of the wick core metal becomes volatilized as the candle is burned.

The experimental system consisted of a combustion chamber, an acid trap to collect candle fumes, and a pump to regulate the air flow into and out of the chamber. These units were connected with plastic tubing in a way that would maintain enough air in the system to induce a candle burn. The chamber, approximately 4 l in volume, was made of glass. The cap for the chamber, made of aluminum, was fitted with inlet and outlet glass tubes (0.25-inch i.d.). The tip of the air inlet tube was set at approximately 2 cm from the bottom of the chamber while the tip of the outlet tube was approximately 1 cm from the top of the candle flame. The outlet tube was connected with a plastic tube (0.25-inch i.d.) to a collection trap containing 20–50 ml of 7 M nitric acid (strong enough to dissolve most of the lead aerosols). The trap was connected to a vacuum pump, which was used to draw air at a fixed rate through the flux chamber system. No attempt was made to remove the lead and zinc in the ambient air employed in the candle combustion.

Candles were burned for periods of 2–7 h. Preliminary studies showed that most of the lead vented out the chamber was captured by the first trap and that the use of a second trap was not necessary. At the end of each burn cycle, the acid

solution in the trap was removed and stored for analysis after its volume had been measured. The combustion chamber was opened and the candle was carefully removed. The lid was rinsed with Milli-Q water (US Filter) while the interior of the chamber and connecting tubes were rinsed with 2 M nitric acid. The rinse solutions were also analyzed for lead and zinc.

Lead in each solution was determined using a graphite furnace atomic absorption spectrometer equipped with L'vov platform (Perkin-Elmer 4100ZL). Zinc contents of the solutions were measured using a flame atomic absorption spectrometer (Varian Techtron Model 1200). Replicate analyses show that the error range was  $\pm 10\%$  of the reported values. Blank tests were performed by pumping air at comparable rates through the system but without burning any candle. Concentrations of lead and zinc in the tap acid and rinse solutions were found to be below the instrumental detection limit in all the blank tests.

### 3. Results

The release of lead and zinc from 14 different brands of candles with metal-core wicks bought in Michigan is shown in Table 1. The emissions of lead from candles made in the US varied from 1.1 to 66  $\mu\text{g}/\text{h}$ , those from Mexico ranged from 0.5 to 5.9  $\mu\text{g}/\text{h}$ , while Chinese candles were found to release 1.8–51  $\mu\text{g}$  lead/h. The release of lead from the Chinese candle bought in Australia was much higher — 327  $\mu\text{g}/\text{h}$ . We did not investigate the composition of wick metals in this study. One would suspect that the wick metal in candles that released small amounts of lead was zinc, tin or other alloy. Lead was detected in small quantities in emissions from most candles with metal-core wicks, suggesting that the lead may also be a common contaminant in the zinc, wick or wax.

Our results for rates of lead release from candles were generally lower than the 20–3420  $\mu\text{g}/\text{h}$  reported in a number of studies done during the

Table 1  
Release of lead into the air during burning of candles with metallic wick-cores

Candle number (Country of origin)	Color of candle	Lead emission rate ( $\mu\text{g}/\text{h}$ )	Zinc emission rate ( $\mu\text{g}/\text{h}$ )	Calculated lead levels in air after 2.0 h ( $\mu\text{g}/\text{m}^3$ ) <sup>b</sup>
A01 (USA)	Orange	3.1	1.4	0.12
A03 (USA)	White	4.7	12.4	0.19
A05 (USA)	Blue and beige	2.8	2.6	0.11
A09 (USA)	Light pink	4.2	2.9	1.7
A10 (USA)	Yellow	1.1	5.4	0.04
A12 (USA)	Dark blue	66	1.2	2.6
M01 (Mexico)	Green			
M02 (Mexico)	Pink	5.9	4.2	0.24
M05 (Mexico)	Light blue	0.52	2.4	0.02
M07 (Mexico)	White	2.7	1.7	0.11
M08 (Mexico)	Red	1.7	5.5	0.07
C01 (China)	Blue	51	2.5	2.1
C02 (China)	Yellow	4.2	4.1	1.7
C04 (China)	Red	1.8	1.3	0.07
C03 (China) <sup>a</sup>	White	327	3.5	13.1

<sup>a</sup>Sample from Australia

<sup>b</sup>Assumes no air exchange in the 50 m<sup>3</sup> room

early 1970s (HRG, 1974a) Krause (1999) tested 28 candles with metal-cored wicks or in metal containers and found five to emit lead in significant quantities. The lead emission rates of 6–2200  $\mu\text{g}/\text{h}$  that Krause reported are consistent with results of this study. Van Alphen (1999) tested several white tall-form candles (38 cm long, 5.5 cm wide at the bottom and tapering to 4.8 cm at the top) with metal cores and found the lead emission rate to range from 450 to 1130  $\mu\text{g}/\text{h}$ , the average being 770  $\mu\text{g}/\text{h}$ . We analyzed one of these tall-form candles and obtained an emission rate of 327  $\mu\text{g}$  lead/h. These studies consistently show that some candles with metal-cored wicks can release high levels of lead into the home environment.

The release of zinc from metal-core wicks ranged from 1.2 to 124  $\mu\text{g}/\text{h}$  (Table 1). The large variation in rate of emission presumably reflects differences in physical and chemical characteristics of the metal core element. The release of zinc is not related to the emission of lead (Fig. 1) or to the country of origin of the sample (Table 1). The amounts of zinc being released do not appear to be high enough to constitute a health hazard in the indoor air.

Table 1 shows the calculated concentrations of lead in a closed bedroom 50  $\text{m}^3$  in volume (approx. 12 × 15 × 10 feet) after burning each brand of candle for 2 h. The calculation assumes little

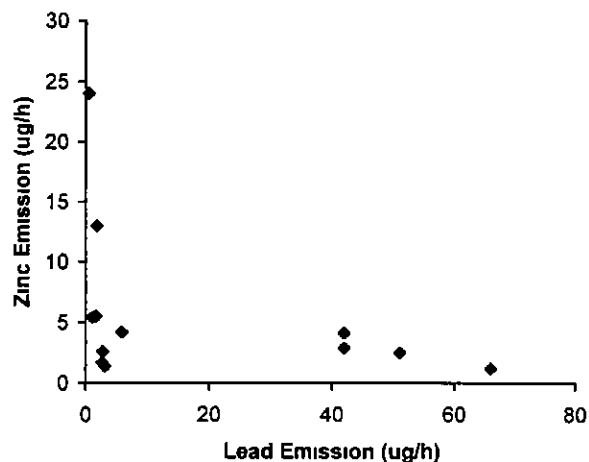


Fig. 1 Co-emissions of lead and zinc from candles with metal-core wicks

or no air exchange in the room, a likely scenario during winter time in Michigan. After the 2-h burn, emissions from five of the 14 brands tested (four of which were bought in Michigan) could result in airborne lead concentrations in the room that exceeded the US Environmental Protection Agency (US EPA) guideline for ambient air (of 1.5  $\mu\text{g}/\text{m}^3$ ).

The risk of inhaling the lead in candle fumes has been known for a long time. In his letter to the Chairman of Consumer Product Safety Commission, Russell E. Train (then Administrator of the US Environmental Protection Agency) noted that 'the preliminary conclusion from these studies [by US EPA staff] was that lead-wicked candles represented a significant incremental and unnecessary source of lead that would likely aggravate the childhood lead problem in this country. This exposure to lead from candles could equal or exceed the exposure to airborne lead associated with the busiest freeways in America' (HRG, 1974b). Our study shows that candle emissions remain an important route of exposure of many people to lead, in spite of the effort that has been made to phase out lead-wick candles in the US. Candles provide pleasurable scents, serve as aromatherapy or add sensuality to an intimate encounter, and these functional uses increase the likelihood of exposure to any lead in the fumes.

Aerosols released by candles during normal burn are usually < 0.1  $\mu\text{m}$  in diameter (Fine et al., 1999; Krause, 1999). Lead-containing particles should be expected to be in this size range and may get deposited on the walls, furniture and floor as candle soot. Deposition on the floor and furniture makes the lead available to children since house dusts are widely recognized as a primary route of childhood lead exposure through hand-to-mouth activities (IPCS, 1995; ATSRD, 1999). If some of the lead released is deposited in the room where the candle is burned, the inputs from prolonged burning of some of the candles can increase the lead content of house dust to levels that can represent a health risk to children in the house. Burning candles with significant amounts of lead in the wick can result in increased risk of childhood exposure through inhalation of contaminated air and hand-to-mouth

transfer of contaminated house dust Mark Van Alphen (1999) has done an assessment of the risks of poisoning children with lead released by candles sold in Australia Our results are consistent with his findings and point to the fact that many children in the US may be at risk of being poisoned by lead from candle fumes

Lead poisoning remains one of the most serious environmental health diseases in this country and other parts of the world (IPCS, 1995) It affects many organ systems and biochemical processes with the most serious sequelae often occurring in the central nervous, cardiovascular and blood systems (Palazuelos-Rendon, 1996) Recent studies show that the central nervous system of children is particularly sensitive to lead Some of the most damaging neuropsychological effects of lead poisoning of young children include learning disabilities, reduced psychometric intelligence, and behavioral disorders (Silbergeld, 1992, Schwartz, 1992, Bellinger, 1995) These effects have been associated with chronic low-level exposure to lead and are believed to be irreversible (ATSRD, 1999) Because it is costly and difficult to control lead once it is released to the environment, and medical treatment does not fully reverse the health effects, the optimal strategy for minimizing the risk involves the reduction or elimination of exposure in various forms As a consequence, concerted efforts have been made in many countries to reduce the public exposure to lead from industrial sources (primarily emissions from point sources and automotive tailpipes) as well as domestic sources (such as use of lead-glazed earthenware, saturnine cosmetics, leaded paint in residential housing, consumption of water from leaded pipes and food stored in lead-soldered cans) This study shows that there are still other important domestic sources of lead exposure that have escaped public scrutiny Because the exposure levels for lead from candles are influenced by customs, habits and household environment, the risk of acquiring lead poisoning from this hitherto unrecognized source is likely to be quite high Actual number of people in the US exposed to lead from this source is unknown

It should be emphasized that there are numerous brands of candles on the market with various

types of wicks (including square braid and flat/plyed) as well as cored wicks made of paper, cotton or zinc that release little or no lead when burned The use of lead or leaded alloy in candles is clearly dispensable and the health risks seem to outweigh any of the likely benefits Lead-wick candles should be banned in every country

## References

- Ahberg M Candlelight Web site <http://www.santesson.com/chris/ljus.htm>, 1999
- ATSRD Toxicological profile for lead Agency for toxic substances and disease registry Research Triangle Park, NC Public Health Service, US Department of Health and Human Services, 1999
- Bellinger D Neuropsychological function of children exposed to environmental lead *Epidemiology* 1995 6 101–103
- Fine PM, Cass GR, Simoneit BRT Characterization of fine particle emissions from burning church candles *Environ Sci Technol* 1999,33 2352–2362
- HRG Petition to the Consumer Product Safety Commission Unpublished Report Washington, DC Health Research Group, 1974
- HRG Letter from Russell Train to Richard Simpson Chairman of the Consumer Product Safety Commission, an attachment to the Petition Washington, DC Health Research Group, 1974
- IPCS Environmental health criteria 165 inorganic lead International program on chemical safety Geneva World Health Organization, 1995
- Krause JD Characterization of scented candle emissions and associated public health risks M S Thesis, Dept of Environ & Occupat Health, College of Public Health, University of South Florida, 1999
- NCA Candle industry facts National Candle Association, Washington, DC Home Page Web site <http://www.candles.org/facts.htm>, 1999
- Palazuelos-Rendon E Effects of lead on children's health In Howson CP, Hernandez-Avila M, Rali DP, editors *Lead in the Americas* National Academy of Sciences Press, 1996 59–65
- Schwartz J Low level health effects of lead growth, developmental and neurological disturbances In Needleman HL, editor *Human lead exposure* Boca Raton, FL CRC Press, 1992 233–242
- Silbergeld EK Neurological perspectives on lead toxicity In Needleman HL, editor *Human lead exposure* Boca Raton, FL CRC Press, 1992 89–104
- Van Alphen M Pilot testing and inhalation exposure-based risk assessment for candles having Pb metal cores *Sci Total Environ* 1999 in press
- Wick n'Chp Inc Quality wick products Web Site <http://www.wicknclp.com/types.html>, 1999

*Canada*

133

~~Stevenson, Todd A.~~

---

**From:** Mike & Daphne New [candlebarn@Lneti.com]  
**Sent:** Saturday, June 17, 2000 1:47 PM  
**To:** cpssc-os@cpssc.gov  
**Cc:** SWOLFE@citizen.org, plurie@citizen.org, Cathy Flanders  
**Subject:** Petition HP 00-3- Candle Wicks Containing Lead

Dear sirs,

I, as a candlemaker, would like to see this petition succeed its purpose To ban lead containing candle wicking As a candlemaker I can tell you that there are so many alternatives for us to use, and many times the alternatives even perform better (from a candlemaker's standpoint), and most definitely gives a cleaner burn There really is no excuse to continue the manufacture or use of these types of materials it is totally unnecessary

3 yrs ago, I purchased a spool of metal cored wick with nothing to identify it but a set of numbers and letters A couple of months ago I pulled this spool out and decided to use it on a new project I was working on The test burns and results went well, so I made more to sell at the local gift shop where my candle line is carried Only after I finished making a couple dozen of these did I notice the letter "L" on the spool Worried that "L" meant "Lead", I called the supplier I bought it from Guess what? Pure Lead core It angered me that I had this in my house, and more so that I had burned a couple of them in my house I would have been absolutely outraged if I'd sold any to unsuspecting consumers I want to know why the industry feels the need to manufacture and sell wicks containing lead in any amount (zinc and tin included) There IS no need, that's the point I hope the U S government will also realize that this is such an unnecessary useage of this material Off hand, I can think of several alternatives, including Hemp, Coreless, Cotton braids (flat and square), and Paper Core

I am asking you to please rule to ban this material for candle useage

Respectfully,

Daphne New

*Candle 134*

~~Stevenson, Todd A.~~

---

**From** Kristine Westrom [kwestrom@uswest.net]  
**Sent:** Thursday, June 29, 2000 10:32 AM  
**To:** cpssc-os@cpssc.gov  
**Subject:** petition HP00-3--candle wicks containing lead

As a family physician, I am aware of the toxicities of lead, especially neurodevelopmentally for infants and children. Many homes burn candles, candle burning is becoming more frequent for my patients as they use aromatherapy candles or candles during meditation. Lead wicks must have a mandatory ban, voluntary is not enough because it would allow the use of lead. A known toxic substance must not be allowed to cause exposures for unwitting citizens in their homes. Kristine Westrom MD  
e-mail [kwestrom@uswest.net](mailto:kwestrom@uswest.net) 501 West St Germain #307 St Cloud MN 56301