UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

VOTE SHEET

DATE: MAR 18 2002

TO: The Commission
Todd A. Stevenson, Secretary

FROM: Stephen Lemberg, Acting General Counsel
Lowell F. Martin, Attorney, GCAL (ext. 2217)

SUBJECT: Proposed FHSA Rules to Ban Lead-Cored Candle Wicks and Candles with Lead-Cored Wicks

VOTE SHEET

The attached staff briefing package recommends that the Commission issue proposed rules to declare lead-cored candle wicks and candles with lead-cored wicks to be hazardous substances and to ban them. The draft rules appear as TAB G to the briefing package. For purposes of the proposed rules, lead-cored candle wicks are those with a lead content of more than 0.06% of the total weight of the metal core of the wick. This is consistent with the advance notice of proposed rulemaking (ANPR) issued by the Commission in this proceeding on February 20, 2001 in response to Petition No. HP 00-03. 66 FR 10863.

Public Citizen, one of the petitioners in Petition No. HP 00-03, also requested that the Commission "immediately ban ... all candles with lead-containing wicks, ... and wicks sold for candle-making that contain lead as an imminent hazard ...." The staff concludes, as stated in the attached briefing package, that these wicks and candles with these wicks do not pose an imminent hazard to public health.

Please indicate your vote on the following options:

I. ISSUE THE PROPOSED RULES AS DRAFTED WITHOUT AN IMMINENT HAZARD FINDING.

_____ _____
(Signature) (Date)

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II. ISSUE THE PROPOSED RULES WITH THE ADDITION OF AN IMMINENT HAZARD FINDING.

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(Signature) (Date)

III. ISSUE THE PROPOSED RULES WITH THE FOLLOWING ADDITIONAL CHANGES (PLEASE SPECIFY).

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(Signature) (Date)

IV. DO NOT ISSUE THE PROPOSED RULES.

_____ _____

(Signature) (Date)

V. TAKE OTHER ACTION (PLEASE SPECIFY).

_____

_____

_____

_____ _____

(Signature) (Date)

Attachment:

Staff briefing package

Briefing Package

Proposed Ban of Candles with Lead-containing Wicks and Wicks Sold for Candle-making that Contain Lead

For Information Contact:

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Directorate for Health Sciences
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Executive Summary

An Advance Notice of Proposed Rulemaking (ANPR), published in the Federal Register on February 20, 2001, (66 FR 10863) requested comments on a rulemaking proceeding that could result in a mandatory rule addressing the use of lead in candlewicks.

Eleven comments were received in response to the ANPR; nine were in favor of the proposal to ban lead-cored wicks; one opposed imposing this kind of regulation on companies. In addition, one commenter, representing a standards organization, did not support the proposed mandatory rule, and submitted a voluntary standard that would eliminate the use of metal-cored wicks containing greater than 0.01 percent lead. Comments from the candle industry clearly state that they strongly support a mandatory standard.

The preliminary regulatory analysis indicates the costs of the ban to businesses, including small businesses, are likely to be small and the benefits, while also small, may have positive health benefits in some individual cases and may contribute to the gradual reduction in lead exposure.

On the basis of previous staff findings, additional information developed by the staff, and comments received in response to the ANPR, the staff concludes that: 1) lead exposure from burning candles with lead-cored wicks presents a risk of lead poisoning under certain expected use conditions; 2) past experience indicates that voluntary industry agreements to ban lead in candlewicks are unlikely to be effective over time; 3) substitutes for lead-cored wicks are available and currently in use; and 4) the costs of a ban would be small. In addition, the candle industry supports a ban on lead-cored wicks.

Therefore, the staff recommends that the Commission proceed with rulemaking under the Federal Hazardous Substances Act by issuing a Notice of Proposed Rulemaking (NPR) to ban metal-cored wicks containing more than 0.06 percent lead by weight in the metal and candles with such wicks. The staff also recommends that shipping cartons of metal-cored wicks and shipping cartons of candles with such wicks be labeled as complying with the ban, and that wick and candle manufacturers, importers, and distributors maintain records documenting compliance with the ban.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: MAR 18 2002

TO : The Commission
Todd A. Stevenson, Secretary

THROUGH: Stephen Lemberg, Acting General Counsel, Office of the General Counsel
THROUGH: for Thomas W. Murr, Jr., Acting Executive Director, Office of the Executive Director

FROM : Jacqueline Elder, Acting Assistant Executive Director, Office of Hazard Identification and Reduction
Kristina M. Hatlelid, Ph.D., M.P.H., Toxicologist, Directorate for Health Sciences

SUBJECT : Proposal to Ban Lead-cored Candlewicks

This briefing package summarizes the previous staff analysis of the available data on lead-cored candlewicks, provides additional data to support the proposed rulemaking, provides a summary of comments received in response to the Advance Notice of Proposed Rulemaking (ANPR) (66 FR 10863) and the staff responses to the comments, and provides a draft notice of proposed rulemaking (NPR) for consideration by the Commission.

Background

Petition HP 00-3

On February 24, 2000, the U.S. Consumer Product Safety
a petition from Public Citizen, requesting that the Commission ban candles with lead-containing wicks and wicks sold for candle-making that contain lead. On February 29, 2000, CPSC received a similar petition from the National Apartment Association and the National Multi Housing Council. These petitions were docketed collectively under the Federal Hazardous Substances Act (FHSA) (Petition No. HP 00-3) on March 17, 2000.

After analysis of the available data on lead-cored candlewicks and the information provided by the petitioners, the staff transmitted a briefing package to the Commission recommending that the Commission proceed with rulemaking to ban lead-cored candlewicks. The staff recommended that a lead-cored wick be defined as a wick containing a metal core with greater than 0.06 percent lead by weight in the metal. Laboratory test data indicate that burning candles with metal-cored wicks with lead concentrations of 0.06 percent or less by weight do not result in detectable emissions of lead into the air, and thus would not constitute a hazard. In contrast, tests indicate that although lead emissions from metal-cored wicks containing more than 0.06 percent lead by weight are unpredictable, some would present a risk to consumers from excessive exposure to emitted lead. In February 2001, the Commission voted to proceed with

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rulemaking to ban metal-cored wicks containing more than 0.06 percent lead by weight in the metal and candles with such wicks.

The petitioners requested an immediate ban and recall of candles with lead-containing wicks and wicks sold for candle-making that contain lead as imminent hazards. Although the term "imminent hazard" is not defined in the FHSA, the Office of the General Counsel has identified several factors that should be considered and addressed by the Commission.

Two of these factors concern how long rulemaking is likely to take, and the number and severity of injuries likely to occur during rulemaking. During the expected period of rulemaking, the number of children who would experience excessive lead exposure from burning candles with lead-cored wicks and the severity of the injury cannot be estimated. The candle industry states that that the production and use of lead-cored wicks has been broadly discontinued domestically in the past year (see public comment CH01-3-11). Although the staff believes that under certain expected use conditions, lead emissions from candles could present a risk to consumers, the risk is highly dependent on individual circumstances of exposure to candles with lead-cored wicks, as well as individual exposures to other sources of lead. Thus, the staff believes the potential for reducing excess lead exposures in the population by eliminating the product during the period of rulemaking is likely to be small. On this basis, the staff believes that the finding cannot be made that lead-cored wicks constitute an imminent hazard.

The Office of Compliance does not intend to pursue recalls of lead-core wick candles already in the market place. Imported candles comprise a large proportion of candles sold in the U.S. Based on our experience, importers do not have information about the material used in candlewicks, nor will most of them be able or willing to obtain reliable information about candles that have already been distributed. Absent such information, the only way with which to identify violative candles is to test them individually, a logistically massive undertaking. Moreover, even if the staff were able to identify specific lead-core wick candles and the firms responsible for selling them, most candles in use lack sufficient identifying information or characteristics to allow consumers to determine whether they are subject to any recall. The staff does not believe the public interest dictates pursuing a recall of these products because 1) the risk associated with lead-core wick candles relates to prolonged cumulative exposure, rather than immediate acute injury; 2) the resources necessary to investigate and recall these products would be prohibitively expensive; and 3) the rate of return of a recall at the consumer level can reasonably be expected to be extremely low.

International Activities

Several countries have acted on this issue. Officials in Canada issued an advisory in January 2001, warning consumers that some candles sold in Canada contained lead-cored wicks, and offered advice on making informed purchasing decisions[1]. Officials in Australia[2] and New Zealand[3] have instituted provisional bans of candles with wicks containing any amount of lead. Australia is now considering making the ban permanent.

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[1] Health Canada Advisory 2001-02, January 2001.

[2] Commonwealth of Australia Consumer Protection Notice No. 11 of 1999 under the Trade Practices Act 1974, September 1999.

[3] New Zealand Ministry of Consumer Affairs Unsafe Goods Notice under the Fair Trading Act 1986, June 2000.

Denmark issued a comprehensive order in December 2000, banning a number of products containing lead[4]. Chafing dish candles and other candles are specifically included in the ban. The order defines a lead-containing product as one in which lead represents more than 50 mg/kg (0.005 percent) of the homogeneous components.

Hazard

Lead-cored wicks are candlewicks with a metal wire in the center made of lead or lead alloy. The metal core is used to provide structural rigidity to the wick, *i.e.*, to keep the wick straight during candle production, and to provide an upright wick during burning.

As a lead-cored wick candle burns, some of the lead may vaporize and be released into the air. This airborne lead may be inhaled. Some of this lead may deposit onto floors, furniture, and other surfaces in the room where children may be exposed to it. One cannot tell by looking at the wick core if it is made of lead, and there is no simple way for a consumer to determine its lead content. The presence of lead in a wick can be determined only by laboratory analysis.

Similarly, one cannot tell if lead is being released from a burning candle by observing smoke or soot; nor can one tell that lead is not being released by the lack of visible emissions. Determination of lead in room air or on surfaces must be done by professionals using appropriate laboratory methods.

The toxic effects of lead and the risk to consumers, especially children, from exposure to lead emitted from lead-cored wick candles were detailed in the briefing package on Petition No. HP 00-3, Request to Ban Candles with Lead-containing Wicks and Wicks Sold for Candle-making that Contain Lead (December 12, 2000)[5]. In addition, laboratory investigations by CPSC staff and others indicate that lead-cored wick candles can emit more than 3,000 µg of lead per hour during candle burning (Tab A). The staff believes that under certain expected use conditions, the lead emitted from burning candles with lead-cored wicks presents a risk to consumers from exposure through inhalation of airborne lead. Children may also be exposed to lead that deposits onto surfaces in the room.

Since burning candles with lead-cored candlewicks can create a risk of serious injury to children who are exposed to them, these candles and candlewicks meet the definition for hazardous substances under the FHSA.

Economic Information

The staff evaluated available information on the candle and candlewick markets. This information is discussed below and detailed at Tab B.

Trade Associations

The major trade association, which represents candle and wick manufacturers and suppliers, is the National Candle Association (NCA). NCA members include about 74 candle manufacturers, ten of which are foreign. NCA states that its members produce about 90 percent

[4] Danish Environmental Protection Agency Ministry of Environment and Energy Council Directive 89/677/EEC and implementing orders.

[5] Memorandum from K.M. Hatlelid, "Review of Lead Emissions from Candles," November 15, 2000; Tab B in Briefing Package on Petition No. HP 00-3, December 12, 2000.

of the candles made in the U.S. Another U.S.-based organization, comprised of craftspersons, is The International Guild of Candle Artisans, with 800 members from around the world.

Candle Information

Based on current industry information, there are more than 400 candle manufacturers in the U.S. Of the 456 firms identified as candle manufacturers by ReferenceUSA, all but three firms had fewer than 500 employees and 253 (or 55 percent) had fewer than five employees.

In 1999, the latest year that factory shipment data are available, U.S. domestic candle shipments totaled approximately $1.3 billion. Imports amounted to $484 million in 1999, with candles from the Far East accounting for almost half of the imports. U.S. exports of candles amounted to about $72.6 million in 1999.

Retail prices of candles range from about 10 cents for a small tealight candle up to $75.00 for large columnar candles[6].

There are limited data available concerning use of candles in homes. According to the NCA, candles are used in 70 percent of U.S. households. They are burned one to three times a week by the majority of candle consumers. Half of the consumers burn one or two candles at a time.

Candlewick Information

There are three general types of candlewicks. Flat braided wicks, used in taper candles, make up about 50 percent of U.S. wick production. Square wicks, representing less than 10 percent of U.S. production, are used in production of beeswax candles and candles that develop small wax pools when burning. Cored wicks, which account for about 40 percent of wicks used in candles, are rigid and have a central core made of cotton, paper, hemp, metal, or polypropylene, surrounded by wicking material made of paper or fiber. The cores provide rigidity to wicks in candles that produce deep pools of molten wax, and are frequently used in votives, pillars, tealights, and other container candles.

Three domestic producers of candlewicks have been identified. The leading producer accounts for the majority of wicks used by the U.S. candle industry. In addition, there may be several small specialty producers of wicks.

Candlewick manufacturers sell their products to wholesalers (candle material suppliers) or large candle manufacturers. Some wholesale wick suppliers repackage wicks supplied by large producers. The ReferenceUSA database lists 115 wholesale suppliers of candle making materials. Small candle producers usually purchase wick material from wholesale firms.

Candlewicks may be purchased at craft stores in small quantities. In large quantities, they may be purchased from wholesale firms or direct from manufacturers. Wicks are available on reels or precut to desired lengths. Prices vary depending upon how the wick is supplied and the quantities ordered. For example, based on one manufacturer's list prices, pre-waxed wicks on reels were 12 cents per yard and pre-waxed, pre-cut, 2-inch wicks were 37 cents per yard. For this manufacturer, price did not depend on wick type.

[6] For detailed discussion of candle types, see Tab B.

No specific information is available on domestic shipments or sales of candlewicks. However, imports of all types of wicks, including candlewicks, were about $3.9 million in 1999.

Prior to the granting of the petition, candlewicks with some levels of detectable lead were found in the marketplace. In a non-statistical survey of candles for sale in the Washington, D.C. area in 1999, the petitioners found that about 30 percent of candles for sale had metal-cored wicks, and about 10 percent of these (or three percent of all candles sampled) had detectable levels (*i.e.*, at least trace levels) of lead in the wick.

According to the NCA, "use of lead cored wicks among U.S. manufacturers is negligible." Practically all metal-cored wicks currently produced in the U.S. are made of zinc. According to the NCA, zinc cored wicks account for about 15 to 20 percent of U.S. production. Zinc-cored wicks have trace amounts of lead, about 0.01 percent, substantially less than the lead limit proposed in the ANPR.

Public Comments

Eleven comments were received in response to the Advance Notice of Proposed Rulemaking (ANPR) (66 FR 10863; February 20, 2001). Nine comments were in favor of the proposal to ban lead-cored wicks (CH01-3-1, CH01-3-3, CH01-3-4, CH01-3-5, CH01-3-6, CH01-3-7, CH01-3-8, CH01-3-9, CH01-3-11). One commenter opposed forcing companies to do what parents should be doing (CH01-3-2). In addition, one commenter did not support the proposed mandatory rule, and submitted a voluntary standard that would ban the use of metal-cored wicks containing greater than 0.01 percent lead (CH01-3-10). A discussion of the issues raised by commenters and staff responses to them is summarized below and detailed at Tab C. The index of the public comments is in Tab D.

Federal regulation: Nine of the eleven comments support the proposal to ban lead-cored wicks. One dissenting comment from a consumer stated that "the candle industry should not be made to conform to parents who cannot do their job." One commenter, representing a standards organization, submitted a voluntary standard to take the place of a mandatory rule. About half of the commenters, including a representative of the National Candle Association (NCA), stated that a voluntary standard would not adequately remove lead-cored wicks from commerce.

Response: The staff does not believe it is reasonable to expect that parents alone can protect children from a potential consumer product hazard that is not readily apparent. The staff believes that a mandatory standard is necessary, in part because of the failure of the industry to maintain conformance with the voluntary agreement of 1974, and recognizes that the NCA and its member firms support the development of the mandatory rule.

A mandatory standard would 1) apply to all domestic and imported candle and wick products regardless of a company's membership in a trade organization or knowledge of applicable standards (*e.g.*, small businesses); 2) deter manufacturers from making non-conforming wicks or candles and enable the staff to seek civil penalties for violations; 3) increase compliance by retailers and distributors who often require that products meet applicable federal standards; and 4) prevent non-complying products from entering the U.S. through cooperative efforts with the U.S. Customs Service.

Voluntary standard: Voices of Safety International (VOSI) proffered a voluntary standard for lead in candlewicks, specifying that metal-cored wicks contain no more than 0.01 percent lead in the metal (CH01-3-10). The standard further specifies that imported candlewicks may not contain metal cores, and includes a methodology, based on tensile strength of metals, for determining whether metal-cored wicks comply with the specified maximum lead content.

Response: CPSC technical staff reviewed the requirements in the VOSI standard and noted a number of issues associated with deferring to this standard. Although the standard states that a maximum of 0.01 percent lead is required to protect consumer health, no technical or health basis for this level is provided. The staff maintains that the proposed limit of 0.06 percent lead by weight in the metal is appropriate and supported by the laboratory analyses performed by CPSC staff and others.

The analytical methodology in the submitted standard is not capable of reliably determining either the presence or concentration of lead in metal-cored candlewicks. The staff concludes that, based on physical characteristics of metal alloys, the tensile strength of a metal alloy would not definitively identify zinc-cored wicks with less than the maximum allowable lead content in the metal, but could falsely detect alloys not containing lead, causing them to fail the test and be needlessly prohibited from wick use (Tab E).

The VOSI standard specifies different standards for domestic and imported products. Specifically, the standard specifies that metal-cored wicks may contain no more than 0.01 percent lead in the metal but that imported candle wicks may not contain metal cores at all. The staff has no information on which to base different criteria for domestic and imported products.

The staff believes that international membership in standards organizations, such as ASTM, serves, in part, to transmit applicable standards to member firms. VOSI has offered no information that its members include candle and wick manufacturers. It has not shown that the standard was developed within a consensus framework or is otherwise widely known to candle and wick manufacturers in the U.S. or overseas. Nor has it shown that there is substantial compliance with the voluntary standard.

The staff finds that the VOSI standard is technically unsound and that substantial compliance is unlikely.

Health effects: A number of commenters reiterated the harmful effects of lead exposure in children and the potential for lead exposure from candles.

Response: As discussed above, the toxic effects of lead and the risk to consumers, especially children, from exposure to lead emitted from lead-cored wick candles were presented in the Briefing Package on Petition No. HP 00-3[7]. The staff believes that under certain expected use conditions, the lead emitted from burning candles with lead-cored wicks presents a risk to consumers from exposure through inhalation of airborne lead.

[7] Memorandum from K.M. Hatlelid, "Review of Lead Emissions from Candles," November 15, 2000; Tab B in Briefing Package on Petition No. HP 00-3, December 12, 2000.

Substitute materials: Three commenters discussed available substitutes and their use by manufacturers (CH01-3-1, CH01-3-7, and CH01-3-11). Three commenters reiterated that other countries have issued notices that ban the import and sale of lead-containing wicks (CH01-3-6, CH01-3-7, and CH01-3-10). John Root, of the National Candle Association, stated that the use of lead-cored wicks has been broadly discontinued domestically, and that zinc-cored wicks currently in use would comply with a ban on metal-cored wicks exceeding 0.06 percent lead by weight in the metal. One commenter claimed that paper- or cotton-cored wicks would not be acceptable because they are less rigid than zinc and have a higher burning rate (CH01-3-1).

Response: The economic information developed by CPSC staff (Tab B) supports the claim that alternatives to the use of lead core are available. In fact, no wick manufacturer in the U.S. currently uses lead core in the production of their wicks. Based on the economic analysis, the staff believes that the costs to manufacturers or consumers of replacing lead-cored wicks with non-lead substitutes would be negligible.

The staff has been unable to verify the commenter's claim that paper- or cotton-cored wicks are unacceptable alternatives to lead-cored wicks. The staff has found no information and received no comments from candle makers or industry representatives to support this claim.

As discussed above, Canada, Australia, New Zealand, and Denmark have acted on this issue, limiting the use of lead in candlewicks or providing guidance to consumers.

Metal-cored wicks: Two commenters expressed concern about the presence of even small amounts of lead in metal-cored wicks (CH01-3-3, CH01-3-7).

Response: Metals, such as zinc, may be used in candlewicks. The lead content of the zinc used in zinc-cored wicks has been determined by CPSC staff and others to range from about 0.0005 percent to 0.06 percent by weight in the metal[8]. CPSC laboratory and other tests have shown no detectable levels of airborne lead emissions from candles with metal wicks containing 0.06 percent lead or less by weight. Therefore, the staff is recommending a ban on metal-cored wicks containing more than 0.06 percent lead by weight in the metal and candles with such wicks, but is not proposing to limit the use of metals that contain 0.06 percent lead or less.

Labeling: Three commenters believe that regulating lead-cored wick candles by requiring warning labels would not adequately protect public health (CH01-3-1, CH01-3-6, and CH01-3-11), and one commenter suggested that candles that comply with the proposed 0.06 percent maximum lead limit should be labeled with that information (CH01-3-7).

Response: The staff agrees that lead-cored wicks and candles containing lead-cored wicks should be banned and that labeling is not an acceptable strategy for protecting vulnerable populations from lead poisoning that may be induced by burning candles with lead-cored wicks[9]. However, once a ban is in place, the staff does not believe that labeling individual candles would offer consumers any additional safety. On the other hand, the staff is proposing labeling of shipping containers, which would provide information useful to the Commission and to manufacturers, distributors, and retailers.

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[8] *Ibid.*

[9] Memorandum from C. Meiers, "Labeling of Candles with Lead-cored Wicks (Petition HP 00-3)," October 18, 2000; Tab C in Briefing Package on Petition No. HP 00-3. December 12, 2000.

Staff Proposal

The staff proposes that the Commission regulate lead-containing metal-cored candlewicks by banning metal-cored candlewicks containing more than 0.06 percent lead by weight in the metal and candles with such wicks.

The staff further proposes a record-keeping requirement in conjunction with the ban (detailed in Tab F). This would require manufacturers, importers, and private labelers of candles and candlewicks to be sold to consumers to test metal-cored wicks for lead content of the metal or obtain documentation of prior testing and the subsequent results from manufacturers or distributors of the metal-cored wicks or the metal used to produce the wicks. These records must be in English and be maintained in the United States for as long as the product the testing pertains to is being distributed plus three years. Firms must produce documentation containing testing results within 48 hours of a request from the Commission. Additionally, firms must label each shipping carton of metal-cored candlewicks and each shipping carton of candles with such wicks, including cartons to be distributed to retail outlets, with a label that the candlewicks or candles comply with the ban. The label will read, "Conforms to 16 CFR 1500.17(a)(13)," and will include a lot number or other designation that relates back to the test results for that lot. These requirements will serve to provide information to the Commission and to manufacturers, distributors, and retailers of metal-cored wicks and candles with such wicks that the wicks comply with the regulation.

Benefits of the Proposed Rule

While the benefits to consumers of eliminating lead candlewicks as a source of lead exposure are not quantifiable, they are likely to be small since few lead candlewicks are currently produced and sold in the US. However, because the likely benefits are dependent on individual circumstances, and because there is no "safe" blood lead level, such a ban may result in positive health benefits in individual cases. Additionally, in the mid-1970s, the Commission chose to defer to the industry's voluntary agreement to eliminate lead from candlewicks. Since this agreement did not prevent companies from returning to the use of lead-cored wicks in the 1980s and 1990s, a ban of the use of lead in candlewicks will therefore help ensure that lead will not be used in candlewicks in the future.

Costs of Rule

The costs of replacing lead-cored candlewicks with non-leaded wicks are expected to be negligible. The current use of lead in wicks is already small, since none of the NCA members use lead in their wicks beyond the acceptable trace levels found in zinc cores, and information obtained from an industry source indicates that the cost of substitutes for lead-cored wicks are not higher than wicks made with lead.

However, there are some costs associated with testing, tracking, maintaining records of candles and candlewicks with metal cores, and labeling of shipping containers (see detailed discussion in Tab B).

Based on discussions with representatives of the candle and candlewick industries, the metal-cored wick testing burden will likely be minimal for domestic manufacturers of candles and candlewicks, because most candlewicks used in the U.S. are produced by a small number of manufacturers, and the testing of the metal used in the wicks already takes place in the course of

manufacturing of the metal used in the wire. The recordkeeping associated with the testing by domestic candlewick manufacturers and distributors may require as much as 200 to 600 hours per year.

Developing an identification system for tracking lots of wicks and candles may involve some costs. According to the National Candle Association, lot identification might be somewhat problematic for the industry.

Domestic producers, distributors, private labelers, and importers of candles, as well as importers of candlewicks, would not have to conduct tests as long as they maintain copies of prior test results for metal candlewicks. Recordkeeping may require as much as 40 hours per firm per year. The exact number of manufacturers and importers is not known and not every firm uses metal-cored wicks. If there are 460 domestic producers of candles in the U.S., and an equivalent number of importers of candles and candlewicks, and if we assume that half of all manufacturers and importers have metal in their candlewicks, then the estimated number of hours for complying with the recordkeeping requirements of the rule for these firms could be as high as 18,400 hours. The total estimated annual salary cost for the paperwork burden may be as high as $400,000, industry wide.

For most candle producers, the costs of labeling shipping containers are likely to be small. The majority of candles are not produced with metal-cored wicks and therefore will not need to be labeled, and the labeling requirements would add little to the cost of manufacturing candles if existing labeling machines can be used. Estimated costs for labeling are $100,000 to $400,000 in annual costs that would be absorbed by the candle industry.

Combined, labeling and recordkeeping may cost the candle industry about $500,000 to $800,000 per year. On a percentage basis, these costs would represent a small fraction (about 0.03 to 0.04 percent) of the overall value of candle shipments which, in 1999, were about $1.8 billion.

Finally, there may be costs associated with inventories of uncertified or non-complying candlewicks held by candle manufacturers. These candlewicks would have to be certified or scrapped under the standard. The proposed rule would apply to candles and candlewicks manufactured after the rule's effective date. Although non-complying candlewicks may have been manufactured prior to the effective date, they would not be usable in candles manufactured after the effective date. It is not anticipated, however, that a large amount of candlewick inventory would be affected.

One possible impact of the rule is the movement away from the use of metal core wicks due to the added burden of recordkeeping, labeling, and testing. Based on discussions with several candle manufacturers, this has already started to occur. Manufacturers desiring to eliminate metal-cored wicks would have to perform product testing to find a suitable substitute wick for the candle design. The cost of the substitute wick material will not likely be a significant factor in the decision to change wicks because candlewicks are a very low cost item that do not vary much by type. Based on compliance cost and performance factors, each firm will decide whether it will continue to use metal-cored wicks in their candles.

It is anticipated that the costs of the proposed rule, although small, will be absorbed by both consumers and suppliers (including manufacturers and importers). Costs associated with the

initial implementation of the proposed rule are likely to be borne by the suppliers. These start-up costs will not likely be passed on to consumers, because the costs may not be uniform across the industry. As described above, some firms may have to develop lot identification systems, acquire labeling machinery, and certify or scrap old candlewicks. Costs associated with ongoing compliance with the proposed rule are expected to be small and these costs will likely be passed along to the consumer in the form of higher prices. The actual amount of these costs is not clear at this time.

In summary, while the benefits of a ban of lead in candlewicks are likely to be small, the costs of the ban are also small. The action will, however, contribute to the gradual reduction in lead exposure in the U.S. population.

Effective Date

The proposed rule seeks an effective date of 180 days after publication of the final rule in the Federal Register. It would apply to candles and candlewicks with metal cores imported or manufactured after the effective date. The 180-day time lag would allow manufacturers to deplete non-complying inventory. It would also provide adequate time for manufacturers, distributors, and importers to make the necessary changes to bring their products into compliance with the regulation. This would involve setting up the appropriate inventory controls, ensuring adequate testing, or procuring complying (already tested) products, and implementing a labeling system for shipping containers.

Initial Regulatory Flexibility and Environmental Analyses

Available evidence indicates that a ban on metal-cored wicks with lead in excess of 0.06 percent by weight in the metal and candles made from such wicks will not have a significant adverse impact on a substantial number of small businesses. Although most firms affected by the rule are small, costs of complying with this rule are expected to be small. Firms affected by the rule include candlewick producers, wholesalers, and importers; and candle manufacturers, wholesalers, and importers.

The transition to metal-cored candlewicks with less than 0.06 percent lead in the metal is not expected to have an adverse environmental impact especially if the effective date of a rule enables the firms to substantially deplete existing noncomplying inventory. U.S. wick manufacturers have stopped producing metal-cored wicks with more than 0.06 percent lead by weight in the metal, and a large portion of the U.S. candle manufacturing sector has already discontinued using lead-cored wick in their candles. It is not expected that a substantial amount of noncomplying inventory will remain as of the effective date of the rule and require disposal. Therefore, the environmental consequences are expected to be insignificant.

Alternatives to Proposed Ban

No Action

If the Commission decides to take no action, lead-cored candlewicks could continue to be sold in the U.S. In the mid-1970's the domestic candle industry stopped using lead in wicks, but lead-cored wicks reappeared on the domestic market some time afterward, and imports may continue to be a source of lead in the absence of a standard. The staff would then have to take action on lead-containing wicks on a case by case basis under the FHSA.

Voluntary Standards

In May 2000, a task group was formed under the ASTM F15.45 Candle Products subcommittee to develop a standard to address the lead content of lead in candlewicks. The task group stopped their standards development process in February 2001 in favor of supporting the CPSC rulemaking process.

During the public comment period on the ANPR, Voices of Safety International (VOSI) proffered a voluntary standard for lead in candlewicks. This standard specifies that metal-cored wicks may contain no more than 0.01 percent lead in the metal. The standard further specifies that imported candlewicks may not contain metal cores (see detailed discussion in the voluntary standards section of the Public Comments above).

The standard includes a methodology, based on tensile strength of metals, for determining whether metal-cored wicks comply with the specified maximum lead content.

The staff finds that the VOSI standard is technically unsound and that substantial compliance is unlikely. Even if a technically acceptable voluntary standard were developed, the staff maintains that a mandatory standard is necessary to protect public health and safety.

Precautionary Labeling

A CPSC Human Factors staff analysis concluded that labeling is not an acceptable strategy for protecting vulnerable populations from lead poisoning that may be caused by burning candles with lead-cored wicks[10].

The analysis showed that since lead is emitted from a candle when the wick is lit, no label or subsequent action by the consumer would prevent the release of lead into the air if the candle were used as intended. It is not realistic to expect a candle to be used for decorative purposes only and not be lit.

Options

The following options are available to the Commission:

1. Propose to amend the FHSA regulations to ban metal-cored candlewicks containing more than 0.06 percent lead by weight in the metal and candles with such wicks.

2. Do not propose a ban.

Conclusions and Recommendation

The comments provided in response to the ANPR offered little additional information to the staff, but emphasized that lead should not be used in candlewicks, and that a mandatory rule rather than a voluntary standard is necessary to protect public health and safety. Comments from industry clearly state that they strongly support a ban on lead-cored wicks.

[10] Memorandum from C. Meiers, "Labeling of Candles with Lead-cored Wicks (Petition HP 00-3)," October 18, 2000; Tab C in Briefing Package on Petition No. HP 00-3, December 12, 2000.

The preliminary regulatory analysis indicates the costs of the ban to businesses, including small business, are likely to be small and the benefits, while small, will be positive. The environmental consequences are expected to be insignificant.

Staff review of the available data results in the following conclusions: 1) lead exposure from burning candles with metal-cored wicks containing greater than 0.06 percent lead by weight presents a risk of lead poisoning under certain expected use conditions; 2) past experience indicates that voluntary industry agreements are unlikely to be effective over time; 3) substitutes for lead-cored wicks are available and currently in use; and 4) the costs of a ban would be small. In addition, the candle industry supports a ban on lead-cored wicks.

Therefore, the staff recommends that the Commission proceed with a rulemaking by publishing a Notice of Proposed Rulemaking (NPR) banning metal-cored candlewicks containing more than 0.06 percent lead by weight in the metal and candles with such wicks.

The staff further recommends a record-keeping requirement in conjunction with the ban. Manufacturers, importers, and private labelers of candles and candlewicks to be sold to consumers would be required to test metal-cored wicks for lead content of the metal or obtain documentation of prior testing and results from manufacturers or distributors of the metal-cored wicks or the metal used to produce the wicks. Additionally, the staff recommends that firms label each shipping carton of metal-cored candlewicks and each shipping carton of candles with such wicks, including cartons to be distributed to retail outlets, with a label that the candlewicks or candles comply with the ban.

These requirements will serve to provide information to the Commission and to manufacturers, distributors, and retailers of metal-cored wicks and candles with such wicks that the wicks comply with the regulation. The staff believes that absent such record-keeping and labeling requirements, enforcing a ban on metal-cored candlewicks containing greater than 0.06 percent lead in the metal would be resource intensive for the Commission.

The Office of the General Counsel has prepared a draft NPR (Tab G). The rulemaking would proceed under the Federal Hazardous Substances Act. The draft NPR proposes that the rule become effective 180 days after publication of a final order. This should not present an unreasonable burden to the industry since substitutes for lead-cored wicks are widely available and currently in use.

TAB A

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: Decemember 19, 2000

TO : Kristina M. Hatlelid, EHHS

THROUGH: Warren Porter, Director, LSC

FROM : Bhawanji K. Jain, Chemist, LSC

SUBJECT : Evaluation of Lead and Zinc emissions from Candles.

I. INTRODUCTION

On February 24, 2000 Public Citizen petitioned the U.S. Consumer Product Safety Commission (CPSC) to ban candlewicks containing lead and candles containing such wicks (1). The metal wire found in some candles acts as a support to stiffen the wick and ensure an upright position during burning. The CPSC staff collected a non-statistical sample of 29 candles and wicks from different vendors across the country to determine both the composition of the metal core in the wick and the amount of lead and zinc emitted from burning candles containing wicks with metal cores.

II. EXPERIMENTAL DESIGN

A. Apparatus:

Two apparatus measured candle emissions. The first consisted of a 51.2-liter stainless steel environmental chamber. Combustion air was supplied at a rate of 102.4 liters per hour. Two impingers, connected in series, each containing ten milliliters of 10 percent nitric acid, absorbed the airborne lead. The second apparatus consisted of a water-jacketed column gas scrubber, 25 mm by 300 mm, with a 25 mm by 95 mm conical funnel on the bottom. The bottom quarter of the column was packed with glass wool wetted with 10 ml of 10 % nitric acid. The column was cooled with a continuous flow of cold tap water. The airflow rate through the column was 37.5 liters/minute.

The type and amount of metal emitted from the candle wick was determined using a Thermo Jarrel Ash Atomscan 16 Inductively Coupled Plasma spectrometer (ICP). The instrument was run under following conditions:

- Nebulizer flow: 34 psig
- Pump speed: 100 rpm
- Radio Frequency setting: 1150 watts
- A wavelength calibration using an internal mercury lamp was done each time prior to analysis of lead, zinc, and tin.

B. **METHOD**

Metal content of candle wicks:

The analysis of the metal core in the candle wick consisted of dissolving a small weighed piece of the metal in two milliliters of concentrated nitric acid and heating it for 6 hours at 110-115° C. The digested solution was analyzed for lead, zinc, and tin with the ICP.

Efficiency of scrubber sampling technique:

The efficiency of lead and zinc vapor sampling was determined by vaporization of a known amount of lead or zinc metal and by trapping the vapors in the scrubbing column. A known amount of pure metal core was put on a Nichrome heating coil (22-gauge wire with known weight), which was connected to a power supply unit. The scrubbing column sampling assembly was placed with the coil at the midpoint of the funnel. The airflow through the column was maintained at 37.5-liters/minute. Ten ml of 10% nitric acid was added to glass wool in the scrubber column. A current of 6 to 8 amperes was supplied to the coil for vaporization of the metal. The coil was heated for about 4 hours or until it broke.

The glass wool and dilute acid rinses of the funnel and columns were pooled into a glass beaker and digested on a hot plate for about 2 hours at 95-100° C. The digested solution was transferred to a 250-ml volumetric flask. This was repeated three times to get all the metal out of glass wool. The digested solutions were pooled in same volumetric flask (A). This solution was analyzed for metal content after doing the dilutions necessary to bring the concentration within the range of the calibration curve. The coil used for vaporization of core metal was digested in a concentrated nitric acid/hydrochloric acid mixture (1:1). The Nichrome coil digested solution (B) was analyzed for the total lead and zinc metal. A piece of known weight of unused Nichrome wire coil was digested in a concentrated nitric acid/hydrochloric acid mixture (1:1). The digest from the unused Nichrome coil (C) was analyzed for lead and zinc. The difference in metal content between solutions (B) and (C) solution gave the amount of non-volatilized metal left on the coil. The difference between the total core metal used for vaporization and the amount of remaining core metal on the coil gave the amount of metal vaporized. The percentage recovery of lead and zinc vapor was calculated as follows:

$$\% \text{ Metal vapor recovery} = 100 * (\mu g \text{ in Scrubber}) / (Initial \mu g - residual \mu g)$$

Lead emission sampling using environmental chamber:

Lead emission from one of the burning candles was determined in 50-L environmental chamber (2). The candle containing a lead core was lit and put in an enclosed steel environmental chamber. Air was passed through the chamber at the rate of two-air changes per hour. Two-serially-connected impingers, each containing 10-ml of 10% nitric acid, collected airborne metal fumes. Air sampling was done for 4 hours after which the chamber was opened to ensure the candle was still burning. The contents of the impingers were transferred to test tubes. The impingers were rinsed with 10-ml of 10% nitric acid 3-4 times and the contents were transferred to test tubes. The chamber's walls, bottom and top, were individually wiped with 10% nitric acid moistened filter paper and transferred to separate test tubes. Two ml of concentrated nitric acid was added to each tube and digested on a hot plate for 6 hours at 110-115° C. After

digestion, the samples were diluted with deionized water to 10 ml and analyzed for lead content using the ICP spectrometer.

Lead and zinc emission sampling using scrubber technique:

Lead and zinc emissions from other candles were determined using the scrubber sampling technique. Each candle was lit and placed under the scrubbing unit containing 10% nitric acid moistened glass wool. Suction through the top of the scrubber maintained an airflow rate of 37.5 liters/minute. This flow prevented convective losses of the combustion products. The candle was allowed to burn for 1-2 hours and then extinguished. The glass wool was removed from the scrubbing unit and put in a beaker. The scrubber and funnel were rinsed with 10% nitric acid and combined with the glass wool. The contents in the beaker were digested for about 4-5 hours on a hot plate at 95-100° C. The mixture was filtered and the glass wool was washed 3-4 times with dilute nitric acid. The digest and rinsings were put in a 200-ml volumetric flask, diluted to volume with deionized water, and analyzed for lead or zinc. This was repeated for all the candles containing a metal core in their wick.

III. RESULTS AND DISCUSSION

The composition of various candlewick cores, in candles purchased at retail, is presented in table 1. Twenty two of twenty-nine candles contained metal cores. Lead cores were found in four candles and zinc cores in eighteen candles. Some cores containing zinc had lead contamination ranging from 0.01% to 0.06%. No candles contained a tin core. In addition to the 29 candles purchased for analysis, one candle (Lab-made) was prepared by replacing the non-metal wick in a votive candle with a wick containing a lead core.

The efficiency of the scrubber in collecting lead and zinc is shown in table 2. The total lead and zinc recovered (scrubber and coil residue) was complete, as shown by recovery rates of 100.02 ± 3.27% and 104.31 ± 4.07%, respectively.

Table 3 shows the data for lead and zinc emissions from the burning candles. The lead emissions were determined from four candles with high concentrations of lead in the metal-cored wick (00-490-1360, 00-830-4926, Lab-made, 99-490-1151). The lead emission for one candle (99-490-1151) was assessed using the chamber technique (2). Lead was found in the impingers, the sampling line, and on the top and walls of the chamber. The amount on the top of the chamber was higher than on the walls or floor. This indicates that as the lead vaporizes it rises with the combustion plume. The total airborne lead release rate was 235 µg/hour for this candle (table 4). The table, however, shows that the amount of lead recovered from the impingers and sampling lines only amounts to 40 percent of the total lead released, the remaining 60 percent was found on the walls, ceiling and floor of the chamber.

The use of chamber sampling technique for candle (99-490-1151) was successful; however, use of the chamber for other candles (00-490-1360, 00-830-4926, Lab-made) was not successful. In most cases, the flame extinguished prematurely. Since it was not possible to visualize the burning characteristics of candles, the scrubber technique was used for sampling metal vapors

from all the candles except candle (99-490-1151). The candle (99-490-1151) was consumed during chamber sampling and was not used for scrubber sampling.

The total airborne lead release rate for the Lab-made candle was 267.13 μg/ hour. Lead emission was not detected in the other two candles up to the detection limit (25.0 μg/ hour).

The zinc emissions were determined for eighteen candles. Two candles had a high emission rate of zinc, ranging from 1009 to 2659 μg/ hour. Three candles had moderate emission rates of zinc ranging from 199 to 297 μg/hour. The emission rate was below 100 μg/ hour for the remaining thirteen candles.

The candles that had a high lead and zinc emission rate had soft wax and appeared to have a flame that was more intense than that observed in other candles. It is possible that soft wax produces a higher flame temperature than is produced with harder or higher melting waxes. Some of the candles with zinc cores that exhibited low emission rates formed a white powder around the metal core. The powder coating may lower the emission rate of the zinc core. However, no additional testing was done to explore these observations.

The composition of the metal cores in six samples of wicks, presumably sold for crafts, is shown in table 5. These data indicate four cores lead. The other two samples contained either zinc or tin. No detectable lead was found in the zinc core. The tin core contained 0.042 percent lead trace. The tine and zinc cores were not tested for lead emissions.

In a previous study from this laboratory (2), the airborne lead release rates for a variety of lead core wick candles varied from 355 to 1525 μg/hour. These emission rates modeled to a 25 m^3 room (approximately 10 feet square and 8 feet high) with an air exchange rate of one per hour and no deposition of airborne lead, resulted in predicted room air concentrations of lead ranging from 15 to 61 $\mu g/m^3$ (2). If a similar calculation were done for the lab made candle in the present study, the maximum concentration of air borne lead would be 11 $\mu g/m^3$. The maximum concentration of airborne zinc would be 106 $\mu g/m^3$ for the candle (00-860-6006).

IV. CONCLUSION

The wicks from a sample of 29 candles were analyzed for their metal content. Lead cores were found in four of the candles (86%-99% lead) and 18 contained zinc cores (99+% zinc). One additional candle was constructed in the laboratory by replacing the non-metal wick in a votive candle with a wick containing a lead core. Seven of the candles had wicks with no metallic core. Lead and zinc emissions were evaluated by burning the candles with metal cores.

The lead emissions from two of the candles ranged from 234.89 to 267.13 μg/hour. The other two candles with lead cored wicks showed no lead emissions using the scrubber sampling technique (detection limit = 25.0 μg/ hour). Although the data are limited to one experiment, the deposition of lead on the surfaces of the chamber suggests that lead emissions determined through experiments done in chambers may lead to low estimates of emission rates. No detectable lead emission occurred with candles with zinc cores contaminated with trace amounts of lead.

Of the 18 candles with zinc-cored wicks, five had zinc emissions ranging from 199 to 2659 μg/hour. The zinc emission rate was below 100 μg/hour for the other thirteen candles.

Analysis of six samples of wicks, presumably sold for craft purposes, showed four cores were lead, one was zinc, and one was tin containing 0.04 percent lead. Emissions from these wicks were not determined.

TABLE 1

LEAD AND ZINC COMPOSITION OF CORES FROM VARIOUS CANDLE WICKS

Sample number	Candle description	Metal composition		Comments
		% Lead	% Zinc	
00-490-1350	Votive	98.92	NT	
00-490-1351	Votive	N/A	N/A	No metal core
00-490-1354	Votive	N.D.	99+	
00-490-1355	Votive	N.D.	99+	
00-490-1356	Votive	N.D.	99+	
00-490-1357	Votive	N.D.	99+	
00-490-1358	Votive	N.D.	99+	
00-490-1359	Tower	0.06	99+	
00-490-1360	Glass	99+	N.D.	
00-490-1361	Votive	N.D.	N.D.	No metal core
00-490-1362	Tower	N.D.	99+	
00-490-1363	Votive	N/A	N/A	No metal core
00-490-1364	Votive	N/A	N/A	No metal core
00-490-1365	Votive	N.D.	99+	
00-830-4925	Tower	N/A	99+	
00-830-4926	Cube	99+	N/A	
00-830-4927	Votive	N/A	N/A	No metal core
00-830-4928	Votive	N/A	99+	
00-830-4930	Tower	N.D.	99+	
00-830-4931	Tower	N/A	N/A	No metal core
00-860-5629	Tower	N/A	N/A	No metal core
00-860-5630	Votive	N.D	99+	
00-860-6006	Bowl	N.D.	99+	
00-860-6411	Glass	N.D.	99+	
00-800-3254	Votive	0.06	99+	
00-800-3255	Gel	0.01	99+	
00-800-3256	Glass	0.01	99+	
00-800-3257	Glass	0.02	99+	
Lab-made	Votive	99+	N.D.	
99-490-1151	Glass	86.35	N.D.	

Note: NT = not tested, N.D.= not detected, N/A = not applicable
Detection limit: Lead = 0.003 %, Zinc = 0.003 %

TABLE 2

LEAD AND ZINC VAPOR SAMPLING EFFICIENCY

Experiment #	Core metal	% Recovery
1.	Lead	97.71
2.	Lead	102.33
3.	Zinc	101.44
4.	Zinc	107.19

TABLE 3

LEAD AND ZINC EMISSIONS FROM BURNING CANDLES

USING SCRUBBER SAMPLING

Sample number	Candle description	EMISSION RATE µg/ hour		Comments
		Lead	Zinc	
00-490-1350	Votive	NT	NT	Candle consumed
00-490-1351	Votive	N/A	N/A	No metal core
00-490-1354	Votive	N/A	297.01	99+ % Zn Core
00-490-1355	Votive	N/A	30.960	99+ % Zn Core
00-490-1356	Votive	N/A	73.180	99+ % Zn Core
00-490-1357	Votive	N/A	199.40	99+ % Zn Core
00-490-1358	Votive	N/A	265.84	99+ % Zn Core
00-490-1359	Tower	N/A	45.15	99+ % Zn Core
00-490-1360	Glass	N.D	N.D.	99+% Pb Core
00-490-1361	Votive	N/A	N/A	No metal core
00-490-1362	Tower	N/A	7.72	99+ % Zn Core
00-490-1363	Votive	N/A	N/A	No metal core
00-490-1364	Votive	N/A	N/A	No metal core
00-490-1365	Votive	N/A	1009.43	99+ % Zn Core
00-830-4925	Tower	N/A	37.50	99+ % Zn Core
00-830-4926	Cube	N.D.	N/A	99% Pb Core
00-830-4927	Votive	N/A	N/A	No metal core
00-830-4928	Votive	N/A	42.18	99+ % Zn Core
00-830-4930	Tower	N/A	7.85	99+ % Zn Core
00-830-4931	Tower	N/A	N/A	No metal core
00-860-5629	Tower	N/A	N/A	No metal core
00-860-5630	Votive	N/A	89.84	99+ % Zn Core
00-860-6006	Bowl	N/A	2659.18	99+ % Zn Core
00-860-6411	Glass	N/A	9.15	99+ % Zn Core
00-800-3254	Votive	N.D.	3.45	99+ % Zn Core
00-800-3255	Gel	N.D.	10.89	99+ % Zn Core
00-800-3256	Glass	N.D.	57.12	99+ % Zn Core
00-800-3257	Glass	N.D.	18.68	99+ % Zn Core
Lab-made	Votive	267.13	N/A	99+% Pb Core

USING CHAMBER SAMPLING

99-490-1151	Glass	234.89	N/A	86.4% Pb Core

Note: NT = not tested, N.D.= not detected, N/A = not applicable
Detection limit: Lead = 25.0 µg/ hour, Zinc = 12.5 µg/ hour

TABLE 4
LEAD EMISSIONS FROM BURNING CANDLE (99-490-1151-03) IN CHAMBER

Lead Source	µg Pb/hr
Impinger-1	28.23
Impinger-2	0.58
Impinger-1, rinse-1	58.08
Impinger-2, rinse-2	1.26
Impinger-1, rinse-2	0.16
Impinger-2, rinse-2	0.15
Impinger-1, rinse-3	0.14
Impinger-1, wash	0.65
Intake line-1, rinse-1	4.06
Intake line-1, rinse-2	0.08
Chamber bottom wipe	6.12
Chamber wall-1 wipe	20.82
Chamber wall-2 wipe	7.46
Chamber wall-3 wipe	11.63
Chamber wall-4 wipe	7.78
Chamber top wipe	87.69

Total Lead emissions = 234.89 µg/hour
Total lead emissions based on the walls, floor, and ceiling = 141.5 µg/hour or 60.2%

TABLE 5

Metal Composition of Cores from Sample Wicks

Sample number	METAL COMPOSITION OF WICK'S CORE			Comments
	Lead	Zinc	Tin	
00-800-1802	99+	N.D	N.D.	
00-800-1803	99+	N.D.	N.D.	
00-800-1804	99+	N.D.	N.D.	
00-860-5903	99+	N.D.	N.D.	
00-490-1366	N.D.	99+	N.D.	
00-860-6229	0.042	N.D.	99+	

V. REFERENCES

1. Public Citizen's Health Research Group, letter to Ann Brown, chairman, Consumer Product Safety Commission, February 24, 2000.

2. Porter WK 1974. Airborne lead release from candles with cored wicks. Memo to Dr. Robert M. Hehir dated January 30, 1974.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: March 8, 2001

TO : Kris Hatlelid, Health Sciences

THROUGH: Andrew G. Stadnik, Associate Executive Director, Laboratory Sciences

FROM : Warren K. Porter, Jr., Director, Division of Chemistry

SUBJECT : Summary of Candle Emission Studies

Introduction

The U.S. Consumer Product Safety 's (CPSC) Laboratory Sciences Chemistry Division (LSC) staff investigated the presence and potential hazard associated with burning candles whose wicks contain a lead wire core. During the course of the investigation several studies were found where investigators had burned candles with lead cored wicks and collected all or a portion of the combustion products. The investigators determined the amount and rate of lead release during burning. This paper is a summary of the findings of the four laboratories. The five studies are two CPSC Chemistry Division studies, the University of Michigan, the University of South Florida, and Lead Sense in Australia.

Methods

Table 1 shows the different means of capturing the lead that vaporized during the burning of the candles.

Table 1. Methods of Air Sampling

Organization	Chamber Volume (liters)	Sampler Flow (l/min)	Sampling Method	Means of Quantitation
CPSC 1974	N/A[1]	3.8	Scrubber with HNO_3	Atomic Absorption (AAS)
CPSC 2000	50 N/A[2]	1.7 38	Impinger with HNO_3 Scrubber with HNO_3	Inductive Coupled Plasma
Nriagu et al, University of Michigan 2000	4[3]	Not given	Impinger with HNO_3	Graphite Furnace AAS
Krause, University of South Florida 1999	45[4]	Not given	Glass Fiber Filters	AAS
Van Alphen, Lead Sense, Australia 1999	58[4]	17	Glass Fiber Filters	AAS

[1] Air samples were obtained by use of a scrubber, 2cm in diameter by 20 cm long fitted with a 3.5 by 7.5 cm collar for the candle flame to burn in.

[2] Air samples were obtained by use of a scrubber, 2.5 cm in diameter by 30 cm long fitted with a 15.8 diameter funnel for the candle flame to burn in.

[3] Small flow through glass chamber, chamber was rinsed to remove deposited lead from the walls.

[4] Chamber walls were not wiped or rinsed to capture any deposited lead.

Results and Discussion

The range of emission rates of lead from burning the candles (table 2) varied from none detected to 3420 µg/hr (see Appendix 1 for data from individual candles). As seen in table 2, this wide variation between different candles is consistent among investigators. The cause of the range of emissions has not been established but may be due to factors such as the presence or absence of odorants, the type of wax, and the thickness of the lead wire used in the core. It should be noted that neither Krause (Krause, 1999) nor Van Alphen (Van Alphen, 1999) wiped or rinsed the walls, ceiling, and floor of their chambers to recover any deposited lead. In experiments conducted by the staff of the CPSC, table 3, the amount of lead deposited on the scrubber entry chamber represented 28 percent to 40 percent of the lead emitted (Porter, 1974). In one experiment with a 50 liter chamber, the LSC staff determined that the lead deposited on the chamber surfaces represented 60 percent of the lead emitted (Jain, 2000).

Table 2. Lead Emission Rates from Burning Candles

Laboratory (Investigator)	CPSC (Porter)	CPSC (Jain)	Michigan (Nriagu et al.)	South Florida[1] (Krause)	Australia[1] (Van Alphen)
Reported in	1974	2000	1999	1999	1999
Avg. (µg/hr)	992	235-267[2] (range of 2 candles)	39	692	746
Max. (µg/hr)	3420	267	327	2200	1130
Min. (µg/hr)	4	N/D	1	6	450

[1] The lead deposited on the interior of the chamber during burning was not recovered. Reported emission rates may be only 40 to 70 percent of that actual amount vaporized.

[2] The recent LSC study had only a limited number of tests with lead cored candles. The one tested in the 50 liter chamber exhibited an emission rate of 235 µg/hr. One of three tested in the scrubber system had an emission rate of 267 µg/hr, the other two had non-detectable emissions of lead.

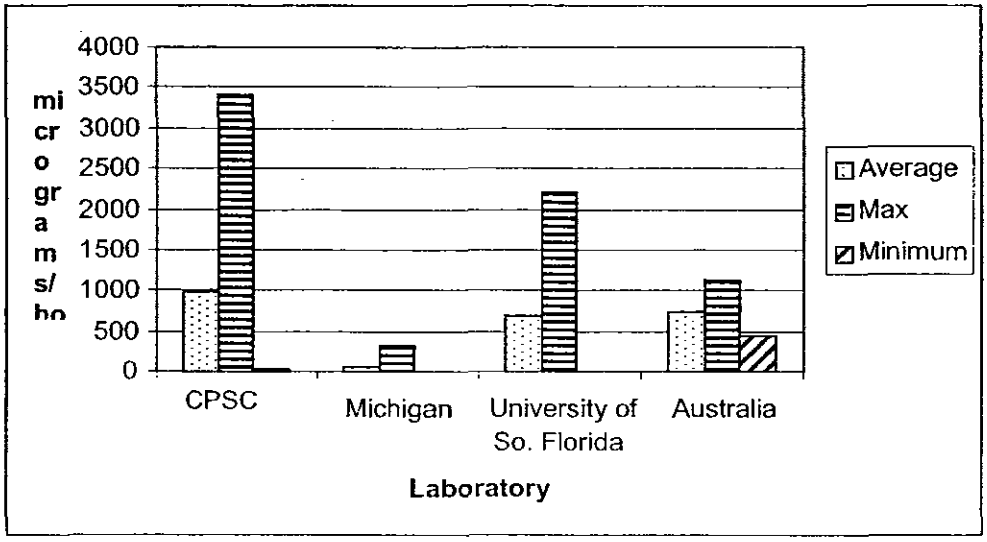
Table 3. Deposition of Lead in the Test Chamber or Entrance to the Scrubber

				Amount of lead found in: Scrubber or collector		Chamber or entrance to scrubber	
Test System	Investigator, Year	Candles Tested	Emission Rate (µg/hr)	Total Collected (µg)	% In Collector	Total Collected (µg)	% On Walls
Scrubber	Porter, 1974	2	2,037	9,730	60	6,560	40
	Porter, 1974	2	2,435	14,000	72	5,480	28
	Porter, 1974	2	1,265	9,020	71	3,630	29
Chamber	Jain, 2000	1	235	374	40	566	60

Conclusions

The data on lead emission rates showed a wide spread of values. As seen in figure 1, which combines the two CPSC Studies, a wide range of lead release was present in all six studies.

Figure 1. Range of Lead emission Rates



All studies reported emission rates within the range of 0 µg/hr to 3420 µg/hr. The Krause (South Florida) and Van Alphen (Australia) studies only reported lead collected on the filter media but none of the lead deposited on the walls of the chambers. Thus it is likely that the total lead emissions they reported represent only 40 percent to 70 percent of the actual amount emitted. Adjusting the results from the Krause and Van Alphen studies for the possible deposition on the chamber walls would increase their average emission rates to 982 µg/hr to 1730 µg/hr (Krause), and 1044 µg/hr to 1865 µg/hr (Van Alphen). Their maximum emission rates would be adjusted to 3080 µg/hr to 5500 µg/hr (Krause) and 1582 µg/hr to 2825 µg/hr (Van Alphen).

These data indicate a substantial amount of lead can be released during the burning of some candles that contain lead cores. Such emission rates could lead to exposures of undesirable levels of lead in both a closed room or in an open house.

References:

1. Porter, W. K., Jr., *Airborne Lead Release from Candles with Lead Cored Wicks*, memorandum to R. M. Hehir, 1974.
2. Jain, B. K., *Evaluation of Lead and Zinc Emissions from Candles,* memorandum to K. M. Hatlelid, December 19, 2000.
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Appendix 1 Emission Rates of Lead From Burning Candles with Lead Cored Wicks

CPSC, LSC		Michigan		University of So. Florida		Australia	
	Emission Rate (µg/hr)		Emission Rate (µg/hr)		Emission Rate (µg/hr)		Emission Rate (µg/hr)
Average	**992**		**39**		**692**		**746**
Max	**3420**		**327**		**2200**		**1130**
min	**20**		**1**		**6**		**450**
Candle (Tested 1974)		**Candle**		**Candle**		**Candle**	
Chafing Dish	422	A01	3	375	6	9904001	510
	245	A02	5	253	24	9904002	990
Food Warmer	1098	A05	3	100	300	9904010	450
	3420	A09	42	111	930	9904011	560
	792	A10	1	112	2200	9904011	580
	462	A12	66			9904024	920
Scented Chafing Dish	2240					9904025	830
	760	M02	6			9904032	1130
Decorative	71	M05	1				
	20	M07	3				
Decorative 2	250	M08	2				
Glass Jar	668						
	300	C01	51				
	820	C02	42				
Novelty figures or food items	1460	C03	327				
	1080	C04	2				
	2380						
	95						
	1818						
	1438						
Scrubber 2000							
00-490-1360 Glass Jar	ND						
00-830-4926 Cube	ND						
Lab made Votive	267						
Tests in single chamber experiment, 2000							
Tea Candle	235						

TAB B

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: March 5, 2002

TO : Kristina Hatlelid, Project Manager, Lead Candlewicks

THROUGH: Warren J. Prunella, AED, EC

FROM : Mary F. Donaldson, EC

SUBJECT : Preliminary Regulatory Analysis of a Proposed Ban of Lead in Candlewicks

Attached is the Preliminary Regulatory Analysis of a Proposed Ban of Lead in Candlewicks.

Attachment

Preliminary Regulatory Analysis of a Ban of Lead in Candlewicks

Introduction

In 2000, Public Citizen, the National Apartment Association and the National Multi-Housing Council petitioned CPSC to ban candlewicks containing lead and candles containing such wicks. The petitioners claimed these candles and candlewicks pose an "imminent hazard to the public health." The Commission granted the petition and an Advance Notice of Proposed Rulemaking (ANPR) was published in the *Federal Register* on February 20, 2001. Eleven comments were received in response to the notice.

The Commission is now considering proposing a rule that would ban candles made with metal-cored wicks and metal-core candlewicks unless the metal cores do not contain more than 0.06 percent lead by weight. The proposed rule would be issued under the Federal Hazardous Substances Act (FHSA). When the Commission proposes a rule under the FHSA, it must publish a preliminary regulatory analysis that includes:

- a preliminary description of the potential benefits and potential costs of the proposed regulation, including any benefits or costs that cannot be quantified in monetary terms, and an identification of those likely to receive the benefits and bear the costs;

- a discussion of reasonable alternatives to the proposed regulation, including voluntary standards, and a brief explanation of why such alternatives should not be published as a proposed regulation.

In addition to the requirements of the FHSA, the Commission is required by the Regulatory Flexibility Act of 1980 to consider the possible effects of the proposed rule on small businesses. It is also required by the National Environmental Policy Act of 1969 to consider the potential environmental impact of the proposed rule.

description of the market for candles and candlewicks, the preliminary regulatory analysis and a discussion of the likely effects of the rule on small businesses and the environment.

The Market for Candles and Candlewicks

The Candle Market

Candles are made using fuels such as paraffin wax, beeswax, or gelled mineral oil to which a wick is added. The major types of candles[1] are: *filled, freestanding, taper, tealight and votive.* Filled candles are fabricated and burned in glass, ceramic or other non-flammable containers. Freestanding candles are rigid, self-supporting candles that are designed to be used

[1] Based on information in *Standard Guide for Terminology Relating to Candles and Associated Accessory Items, ASTM, Designation F 1972-99,* ASTM.

on a non-flammable surface. Taper candles are slender and are used on a non-flammable candle-holder base for support. Tealight candles are small filled candles usually produced in a small metal cup. Votive candles are small candles designed to be used in a votive holder.

The National Candle Association (NCA) states that there are "more than 300 known commercial, religious and institutional manufacturers of candles in the United States, as well as many small craft producers for local, non-commercial use." The ReferenceUSA database of US manufacturers lists 456 companies as "candle manufacturers."

Most candle manufacturers are small businesses. Of the 456 firms identified as candle manufacturers by ReferenceUSA, all but three firms had fewer than 500 employees, the US Small Business Administration's threshold for defining a candle manufacturing business as small. Most firms were much smaller than the threshold limit. In fact, 253 (or 55 percent) had fewer than 5 employees. Since start up expenses are small, producers of candles may enter the market easily. Also, small candle manufacturers may not be active in trade associations and may not be aware of applicable standards.

Factory shipments and imports of candles have increased dramatically over the past decade (see Tables 1 and 2). Between 1992 and 1999, the latest year that factory shipment data are available, US domestic candle shipments rose from $366 million to about $1.35 billion, an increase of about 350 percent. Imports rose at a faster rate than domestic shipments. In 1999, US imports amounted to $484 million, an increase of over 800 percent since 1992. Candles from the Far East accounted for almost half of the imports, while imports from the Americas, mostly Canada and Mexico accounted for a little more than one third, and European countries and Great Britain accounted for less than 10 percent of imports (see table 3).

US exports of candles amounted to about $72.6 million in 1999. (See tables 2 and 4.) This represents an increase of more than 600 percent since 1992 when candle exports were about $10 million. Canada receives most of the US candle exports. In 1999, the value of US candle exports to Canada was $48.5 million or 67 percent of all US candle exports. The only other countries receiving more than $1 million value of US candles in 1999 were: United Kingdom, Mexico, Netherlands, Germany, Australia, and Spain.

In 1999, the apparent US consumption of candles, defined as domestic shipments plus imports and minus exports, was about $1.8 billion.

Candles are marketed to consumers and to commercial and institutional establishments such as restaurants and religious organizations. They are sold through grocery, discount, and department stores, mass merchandise retailers, specialty and gift shops, craft stores, catalogs, the Internet, and through direct sales at in-home shows. In recent years, several chains of candle stores have become established nationwide. They include Illuminations, Yankee Candle and White Barn Candle Company (1). Retail prices of candles range from about 10 cents for a small tealight candle up to $75.00 for large columnar candles (2,3).

There are limited data available concerning use of candles in homes. According to the NCA, candles are used in seventy percent of US households. They are burned one to three times

a week by the majority of candle consumers. Half of the consumers burn one or two candles at a time.

Several trends have contributed to the current year-round popularity of candles and the subsequent decline in the historically strong seasonality of candle sales. One is the increasing popularity of using candles to scent the home. According to a recent article in *Forbes*, scented candles currently represent 72 percent of industry sales (4). In 1992, 40 million scented candles were sold. By 1997, sales of scented candles increased to about 700 million (1).

The Candlewick Market

A candlewick is "a cord or strand of loosely woven, twisted or braided fibers...that draws up fuel to the flame by capillary action" (5). Manufactured candlewicks are predominantly braided and are made with industrial braiding machines. These machines are also used to produce other narrow fabrics such as rope, window cords, and braided trims.

There are three general types of candlewicks. The first, which makes up about 50 percent of US wick production, is the *flat braided* wick. Typically made of cotton fiber, flat braided wicks are used in taper candles.

A second type of wick is the *square* wick, representing less than 10 percent of US production. This type of wick is also made of fiber such as cotton and is used by manufacturers of beeswax candles and candles that develop small wax pools when burning (6).

A third type of candlewick is the *cored* wick, which may account for about 40 percent of wicks used in candles. Cored wicks are rigid and have a central core made of cotton, paper, hemp, metal or sometimes polypropylene. The cores are surrounded by wicking material made of paper or fiber. The central cores provide the necessary rigidity to wicks in candles that produce deep pools of molten wax. These are frequently used in votives, pillars, tealights and other container candles (6, 7).

A representative of a candlewick producer indicated that metal is not necessary to provide rigidity to wicks and that the industry is moving away from metal core wicks in favor of all natural fiber wicks that use cotton, hemp and paper in the cores. However, when wires are used in candlewick cores, they may be made of zinc, tin or lead.

Prior to the granting of the petition, candlewicks with some levels of detectable lead were found in the marketplace. In a non-statistical survey of candles for sale in the Washington, D.C. area in 1999, the Petitioners found that about 30% of candles for sale had metal core wicks. About 10 % of the metal core wicks (or 3% of all candles) had detectable levels (i.e., at least trace levels) of lead in the wick.

According to the NCA, "use of lead cored wicks among US manufacturers is negligible." Practically all metal core wicks currently produced in the US are made of zinc. According to the NCA, zinc cored wicks account for about 15 to 20 percent of US production. Zinc core wicks have trace amounts of lead that average about 0.01 percent lead, substantially less than the lead

limit of the proposed standard. Tin core wicks, which were discontinued in 2000, averaged about 0.08 percent lead. (Tin core wicks, prior to being taken out of production, accounted for less than 1 percent of domestic production.)

Three domestic producers of candlewicks have been identified. The leading producer, Atkins and Pearce, accounts for the majority of candlewicks used by the US candle industry. In addition, there may be several small specialty producers of candlewicks. Three foreign wick producers are members of the NCA; two are based in Germany and one in Brazil.

Candlewick manufacturers sell their products to either wholesalers (candle material suppliers) or large candle manufacturers. Some wholesale candlewick suppliers repackage candlewicks supplied by large producers. This may include cutting the wicking and adding metal tabs to the wicks to aid in the installation of the wick during candle production. The ReferenceUSA database lists 115 wholesale suppliers of candle making materials. Small candle producers usually purchase wick material from wholesale firms.

No specific information is available on domestic shipments or sales of candlewicks. Candlewicks are classified as part of the US Bureau of the Census' textile category, "narrow fabric mill products." Shipment data for narrow fabric mill products include a large variety of disparate products such as window blind cords, rope and decorative trims. Therefore, reporting shipments would not reveal relevant information.

Candlewicks may be purchased at craft stores in small quantities. In large quantities, they may be purchased from wholesale firms or direct from the manufacturers. Candlewicks are available on reels or precut to desired lengths. Prices vary depending upon how the wick is supplied and the quantities ordered. For example, based on one manufacturer's list prices, pre-waxed wicks on reels were 12 cents per yard and pre-waxed, pre-cut, 2-inch wicks were 37 cents per yard. For this manufacturer, the price did not depend on wick type.

Information on international trade of "textile wicks, woven, plaited or knitted, for lamps, stoves, lighters, candles, etc." is reported under SITC code 65772. Tables 5 & 6 (see appendix) provide information on the value of imports, exports and origin of imports of textile wicks. Total customs value for 1999 was about $3.9 million. The primary countries of origin were, in order of customs value, United Kingdom, Germany, Costa Rica, India, and Malta.

Trade Associations

The major trade association, which represents candle and wick manufacturers and suppliers, is the *National Candle Association (NCA)*. NCA members include about 74 candle manufacturers, ten of which are foreign. NCA states that its members produce about 90 percent of the candles made in the US. Another US based organization, comprised of craftspersons, is *The International Guild of Candle Artisans*, with 800 members from around the world.

Costs of Proposed Rule

The costs associated with replacing leaded candlewicks with non-leaded wicks are expected to be negligible, for two reasons. First, the current use of lead in candlewicks is already small, given that none of the NCA members use lead in their candlewicks beyond the acceptable trace levels found in zinc wicks. Second, information obtained from an industry source indicates that the cost of substitutes for leaded candlewicks is not higher than candlewicks made with lead. In fact, when lead candlewicks were available they cost more per yard than candlewicks made of other materials. This is because lead is a heavier material than substitutes such as zinc or cotton and candlewicks are sold by the pound.

However, there are some costs associated with testing, tracking, maintaining records of the handling of candles and candlewicks with metal cores, and labeling of shipping containers. This is because the proposed rule requires firms that manufacturer, import, or otherwise distribute metal core candles and candlewicks perform testing or obtain records of testing to assure compliance. According to the recordkeeping requirements proposed by the staff, records of testing would have to bear a lot designation that relates to the candles and candlewicks and be maintained in the United States for as long as the products are being distributed plus 3 years. Test records would have to be in English and be available within 48 hours of request by the Commission. In addition, firms would have to label shipping containers "Conforms to 16 CFR 1500.17(a)(13)" along with a lot designation that can be traced to the test results.

Based on discussions with representatives of the candle and candlewick industries, the metal wick testing burden will likely be minimal for domestic manufacturers of candles and candlewicks. This is because most candlewicks used in the United States are produced by a small number of manufacturers, and the testing of the metal used in the wicks already takes place in the course of manufacturing of the metal used in the wire. However, the paperwork associated with the (prior) testing and required recordkeeping may demand, from candlewick manufacturers and distributors, as much as 40 hours per metal candlewick lot produced annually. Based on a discussion with a representative of the industry, there may be between 5 and 15 lots of wire used in the candlewick production per year. Recordkeeping by the domestic candlewick manufacturers and distributors may require as much as 200 to 600 hours per year.

Developing a tracking system for lots may involve some costs. Candle and candlewick manufacturers would have to keep track of when the lot numbers for wicks with metal cores changed, and adjust any existing identification system to reflect this. According to the National Candle Association, lot identification might be somewhat problematic for the industry.

As with domestic producers, importers would also have to obtain appropriate test results traceable to individual lots for all candles with wire wicks, and develop a system of identification in order to track test results with the individual shipments. The differences in the costs of the testing and labeling requirements for importers, relative to domestic candle manufacturers, are not clear, but it seems likely that the coordination of testing and labeling would be somewhat more complex for importers and therefore more costly, especially since candles are imported

from many countries[2]. One large importer contacted did not think the impact of the rule would be substantial, but was unable to describe how the testing requirements would affect costs.

Domestic producers, distributors, private labelers, and importers of candles, as well as importers of candlewicks, would not have to conduct tests as long as they maintain copies of prior test results for metal candlewicks. Recordkeeping may require as much as 40 hours per firm per year. The exact number of manufacturers and importers is not known and not every firm uses metal core wicks. Based on information obtained from ReferenceUSA, there may be as many as 460 domestic producers of candles in the U.S. If there are an equivalent number of importers of candles and candlewicks, and if we assume that half of all manufacturers and importers have metal in their candlewicks, then the estimated number of hours for complying with the recordkeeping requirements of the rule for these firms could be as high as 18,400 hours.

Using a mean hourly employer cost per hour worked of $20.81 obtained from the Department of Labor for private industry workers, the total estimated annual employee compensation cost for the paperwork burden may be as high as $400,000, industry wide (8).

Labeling shipping containers of candles with lead wicks may also involve some costs. New labeling machines may cost as much as $15,000, according to a firm specializing in labeling machines for the candle industry. Individual labels may also cost as much as $5,000 for 50,000 to 100,000 labels, or about 5 to 10 cents each.

For most candle producers, the costs of labeling are likely to be small. As noted earlier, the great majority of candles are not produced with wire wicks and therefore will not need to be labeled. Additionally, the labeling requirements will add little to the cost of manufacturing candles when labels are needed if existing labeling machines can be used to add the information required by the proposed rule's labeling requirements.

Even though the labeling costs are likely to be low, we can get a rough idea of the number of boxes of candles that might be affected. If we assume that $270 to $540 million in candle shipments are affected (i.e., 15 to 30% of all candles are shipped with metal wicks), and that each shipping container holds 144 candles (i.e., 12 boxes of a dozen candles), perhaps 2 to 4 million shipping containers would need to be labeled annually. If a label's cost (not including the initial purchase of the labeling machine) is 5 to 10 cents each, then between $100,000 to $400,000 in annual costs would be absorbed by the candle industry for labeling.

Combined, labeling and recordkeeping may cost the candle industry about $500,000 to $800,000 per year. On a percentage basis, these costs would represent a small fraction (about .03 to .04 percent) of the overall value of candle shipments which, in 1999, were about $1.8 billion.

Finally, there might also be some costs associated with inventories of uncertified or non-complying candlewicks held by candle manufacturers. These candlewicks would have to be certified or scrapped under the standard. The rule, as proposed by the staff, would apply to candles (and candlewicks) manufactured after the rule's effective date. Although non-

[2] In 1999 candles were imported from over 36 countries.

complying candlewicks may have been manufactured prior to the effective date, they would not be usable in candles manufactured after the effective date. It is not anticipated, however, that a large amount of candlewick inventory will be affected.

One possible impact of the rule is the movement away from the use of metal core wicks due to the added burden of recordkeeping, labeling and testing. In discussions with several candle manufacturers, this has already started to occur. Candle manufacturers desiring to eliminate metal core wicks would have to perform "trial and error" product testing to find a suitable substitute wick for the candle design. The cost of the substitute wick material will not likely be a significant factor in the decision to change wicks because candlewicks are a very low cost item that do not vary much by type. It would therefore be a decision that each firm would make, based on compliance cost and performance factors, as to whether they would continue to use metal core wick material in their candles.

It is anticipated that the costs of the proposed rule, although small, will be absorbed by both consumers and suppliers. (Suppliers include manufacturers and importers.) Costs associated with the initial implementation of the proposed rule are likely to be borne by the suppliers. These start-up costs will not likely be passed on to consumers, because the costs may not be uniform across the industry. A firm which experiences higher costs than another will not be able to pass those costs on in the form of higher prices, because it must compete with the firm that experiences lower costs to come into compliance with the proposed rule. As described above, some firms may have to develop tracking systems for lot identification, acquire additional labeling machinery, and certify or scrap old candlewicks. Costs associated with ongoing compliance with the rule are expected to be small and these costs will likely be passed along to the consumer in the form of higher prices. The actual amount of these costs is not clear at this time.

Benefits of the Proposed Rule

While the benefits to *consumers* of eliminating lead candlewicks as a source of lead exposure are not quantifiable, they are likely to be small since few lead candlewicks are currently produced and sold in the US. However, because the likely benefits are dependent on individual circumstances, and because there is no "safe" level of blood lead levels, such a ban may result in some positive health benefits in some individual cases. Additionally, in the mid-1970's, the Commission chose to defer to the industry's voluntary agreement to eliminate lead from candlewicks. Since this agreement did not prevent companies from returning to the use of lead-cored wicks in the 1980s and 1990s, a ban of the use of lead in candlewicks will therefore help ensure that lead will not be used in candlewicks in the future.

In summary, while the benefits of a ban of lead in candlewicks are likely to be small, the costs of the ban are also small. The action will, however, also contribute to the gradual reduction in sources of lead exposure to the US population.

Effective Date

The proposed rule seeks an effective date of 180 days after publication of the final rule in the Federal Register. It would apply to candles and candlewicks with metal cores imported or manufactured after the effective date. The 180-day time lag would allow manufacturers to deplete non-complying inventory. It would also provide adequate time for manufacturers, distributors, and importers to make the necessary changes to bring their products into compliance with the regulation. This would involve setting up the appropriate inventory controls, ensuring adequate testing, or the procurement of complying (already tested) products, and the implementation of a labeling system for shipping containers.

Alternatives to a Ban

Alternatives to the regulation under consideration by the Commission include: taking no action, relying on voluntary standards, and relying on a labeling rule.

No Action

If the Commission decides to take no action, metal-cored candlewicks with lead in excess of 0.06 percent by weight in the metal could continue to be sold in the US. In the mid-1970's the domestic candle industry stopped using lead in candlewicks, but lead wicks reappeared on the domestic market some time afterward. While the domestic industry voluntarily in their candlewicks, imports may continue to be a source of lead in the absence of a standard.

Voluntary Standards

As an alternative to a possible ban of lead in candlewicks, the Commission could defer to a voluntary standard. At the time of the ANPR, ASTM was in the process of developing a voluntary standard that would have eliminated the use of lead in candlewicks. However, this voluntary standard effort was recently terminated. According to the NCA, the voluntary standard effort was stopped because NCA members preferred the development of a mandatory rule to address this hazard. The NCA argued that a "voluntary standard would be ineffective and potentially counterproductive..." due to the level of imports from countries where lead core wicks are "thought to still be widely used..."

The Commission also received, as a response to the ANPR, the submission of an existing voluntary standard developed by the Voices of Safety International (VOSI) that claims to address the hazard associated with lead in candlewicks. The Commission staff reviewed the standard's test methodology and found it to be unreliable. VOSI's test for determining whether metal cored wicks comply with a maximum lead content is based on the tensile strength of metals. The Commission staff believes the test will not detect lead over 0.06 percent used in certain metal alloys, while other metal alloys that do not contain lead may test positive when they actually do

not contain lead. For more detailed analyses of the standard, see *Memorandum from Thomas E. Caton, Engineering Sciences, "Comments about the Voices of Safety International Document V50.1" June 14, 2001*; and *Memorandum from Warren K. Porter, Laboratory Sciences, Chemistry Division, "Comments about 'Voices of Safety International Document V50.1'" May 11, 2001.*

Additionally, the VOSI standard specifies different requirements for domestic and imported products. The standard specifies that domestic metal-cored wicks may contain no more than 0.01 percent lead in the metal but that imported candlewicks may not contain metal cores at all. Finally, the VOSI standard was not developed within an industry consensus framework and may not be widely known to candle and candlewick manufacturers.

Labeling

The Commission could require a warning label on candles, advising consumers to use candles with lead wicks only for decorative purposes. However, according to Human Factors, such a label would likely be ineffective since it would advise consumers not to use candles for their intended purpose. Moreover, if such a warning label were affixed to candle packages, the labels would no longer be present after candles are taken out of the packages.

Initial Regulatory Flexibility and Environmental Analyses

Available evidence indicates that a ban on metal-cored candlewicks with lead in excess of 0.06 percent by weight in the metal and candles made from such candlewicks will not have a *significant adverse* impact on a *substantial number* of small businesses. Although most firms affected by the proposed rule are small, costs of complying with this proposed rule are expected to be small. Firms affected by the proposed rule include candlewick producers, distributors, and importers; and candle manufacturers, distributors, and importers.

The transition to candlewicks with less than 0.06 percent lead is not expected to have an adverse environmental impact, especially if the effective date of a rule enables the firms to substantially deplete existing non-complying inventory. A large portion of the US candle manufacturing sector has already discontinued using lead wick in their candles. US wick manufacturers have stopped producing wicks with more than 0.06 percent lead by weight. It is not expected that a substantial amount of non-complying inventory would be remaining as of the effective date of the rule. Therefore, the environmental consequences are expected to be insignificant.

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7. *Candle Wicking,* Atkins & Pearce, www.braidway.com, March 20, 2000.

8. U.S. Department of Labor, *2000 National Occupational Employment and Wage Estimate, 43-4111 Weighers, Measurers, Checkers, and Samplers, Recordkeeping.*

Appendix

Table 1: Domestic Factory Shipments of Candles, 1977-1999.

Year	Value of Shipments (in $ millions)
1977	160.3
1982	257.6
1987	202.1
1992	366.2
1993	421.6
1994	417.8
1995	500.8
1996	556.7
1997	907.7
1998	989.9
1999	1,354.9

Source: US Bureau of the Census

Table 2: Customs Value of Candle Imports, FAS[1] Value of Exports, 1992-1999.

Year	Value of Imports (in millions)	Value of Exports (in millions)
1992	53.2	9.9
1993	67.8	14.2
1994	95.3	21.7
1995	135.7	31.2
1996	197.8	49.9
1997	226.7	66.5
1998	341.6	68.6
1999	484.2	72.6
2000	504.6	68.5

[1] *Free alongside ship (FAS) value is the value of exports at the US port.*
Source: United States International Trade Commission

Table 3: Customs Value of Candle Imports, by Country of Origin, 1999.

Country of Origin	Customs Value ($ Millions)
China	131.7
Canada	73.7
Guatemala	55.7
Hong Kong	53.5
Mexico	50.9
Israel	19.4
Thailand	18.4
Taiwan	17.5
Italy	13.2
France	4.6
Macao	4.5
Germany	4.4
United Kingdom	4.4
Denmark	4.0
Netherlands	3.8
Korea	3.5
El Salvador	3.3
Portugal	2.7
India	2.0
Philippines	2.0
Malaysia	1.7
Spain	1.0
Swaziland	1.0
Others	7.3
Total	**484.2**

Source: United States International Trade Commission

Table 4: FAS Value of US Candle Exports by Receiving Country, 1999.

Country	Value of Exports (in $ millions)
Canada	48.5
U.K.	8.8
Mexico	2.4
Netherlands	2.3
Germany	1.8
Australia	1.5
Spain	1.0
All Other Countries[2]	6.3
Total	**72.6**

[2] *All other countries receiving less than $1 million in US candle exports*

Source: United States International Trade Commission

Table 5: Customs Value of Textile Wick Imports & FAS Value of Exports, 1992-1999.

Year	Value of Imports (in $ millions)	Value of Exports (in $ millions)
1992	1.4	5.3
1993	1.6	3.6
1994	2.8	3.6
1995	2.8	3.3
1996	3.4	4.0
1997	3.7	3.6
1998	3.0	4.9
1999	3.9	5.4

Source: United States International Trade Commission

Table 6: Customs Value of Textile Wick Imports, by Country of Origin, 1999.

Country of Origin	Value of Imports 1999 ($ 1,000's)
United Kingdom	969
Germany	652
Costa Rica	531
India	486
Malta & Gozo	461
Japan	166
China	124
Canada	109
Korea	90
Taiwan	65
Mexico	34
Israel	32
Philippines	30
Ireland	24
Netherlands	20
Dom ublic	12
Indonesia	12
Austria	10
France	9
Czech Republic	7
Italy	7
Hong Kong	5
Switzerland	4
Poland	3
Sweden	3
Greece	2
Venezuela	1
Total	**3,865**

Source: United States International Trade Commission
Note: Results may not add due to rounding.

TAB C

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: 20 August 2001

TO : Mary Ann Danello, Ph.D., Associate Executive Director, Directorate for Health Sciences

THROUGH: Lori E. Saltzman, M.S., Director, Division of Health Sciences, Directorate for Health Sciences

FROM : Kristina M. Hatlelid, Ph.D., M.P.H., Toxicologist, Directorate for Health Sciences

SUBJECT : Response to ANPR Public Comments

Introduction

The U.S. Consumer Product Safety Commission (CPSC) received public comments and information from eleven consumers and organizations in response to the Advance Notice of Proposed Rulemaking (ANPR) published in the Federal Register on February 20, 2001 (66 FR 10863). This memo provides a summary of those submissions and the staff's responses to them. Similar or related comments are addressed together under a single issue category. The index of the public comments is in Tab D.

All but two of the comments supported the proposal to ban metal-cored candlewicks containing greater than 0.06 percent lead by weight in the metal. A dissenting comment from a consumer opposed forcing companies to do what parents should be doing. In addition, one commenter, representing a standards organization, did not support the proposed mandatory rule, and submitted a voluntary standard that would ban the use of metal-cored wicks containing greater than 0.01 percent lead.

Three commenters represented professional organizations or industry groups (American College of Medical Toxicologists, Consumer Specialty Products Association, and National Candle Association). One commenter represented a standards organization, Voices of Safety International. Seven commenters were individual consumers or interested parties.

Discussion

Issue: A federal regulation is needed to ban the use of lead in candles. A voluntary standard is not an appropriate method to protect against lead exposure from candles.

Nine of the eleven comments support the proposal to ban lead-cored wicks (CH01-3-1, CH01-3-3, CH01-3-4, CH01-3-5, CH01-3-6, CH01-3-7, CH01-3-8, CH01-3-9, CH01-3-11). One dissenting comment from a consumer stated that "the candle industry should not be made to

conform to parents who cannot do their job" (CH01-3-2). She believes that parents must be responsible for their children's safety, and that the consequences of government intervention include her difficulty in using products such as cleaners and cigarette lighters that have child-resistant features. Voices of Safety International (VOSI) submitted a voluntary standard to take the place of a mandatory rule (CH01-3-10).

About half of the commenters stated that a voluntary standard would not adequately remove lead-cored wicks from commerce (CH01-3-1, CH01-3-5, CH01-3-6, CH01-3-7, CH01-3-9, CH01-3-11). Several of these comments mentioned the voluntary agreement drafted by the industry in 1974 that did not effectively stop the manufacture or sale of lead-cored wicks in the U.S. Two commenters, representing the Consumer Specialty Products Association (CH01-3-9) and the National Candle Association (NCA) (CH01-3-11), stated that the candle industry strongly supported a mandatory rule. The NCA stated their view "that a voluntary standard would be ineffective and potentially counterproductive."

CPSC Staff Response:

The staff recommends a ban of metal-cored wicks containing more than 0.06 percent lead by weight in the metal.

The staff does not believe it is reasonable to expect that parents alone can protect children from a potential consumer product hazard that is not readily apparent. The staff has determined that consumers cannot tell by looking at a wick core if it is made of lead and cannot tell if lead is being released from a burning candle. The staff has also concluded that labeling is not an acceptable strategy for protecting vulnerable populations from lead poisoning that may be caused by burning candles with lead-cored wicks[1]. Since lead is emitted from a lead-cored wick candle when the wick is lit, no label or subsequent action by the consumer would prevent the release of lead into the air when such a candle is used as intended.

The staff agrees with the commenters that the industry did not adhere to the voluntary agreement since some U.S. wick and candle manufacturers did produce lead-cored wicks or candles containing lead-cored wicks after 1974. The staff believes that a mandatory standard is necessary, in part because of the failure of the industry to maintain conformance with the voluntary agreement. The staff is aware that an ASTM F15.45 Candle Products subcommittee task group, established to develop a standard to address the lead content of lead in candle wicks, ended their activity in February 2001 in favor of supporting the development of a mandatory rule. The staff recognizes that the NCA and its member firms support the development of the mandatory rule. The staff also recognizes that a significant portion of candles sold in the U.S. are produced by many companies overseas (Tab B) and that some of the companies may not be aware of applicable voluntary standards.

A mandatory standard would: 1) apply to all domestic and imported candle and wick products regardless of a company's membership in a trade organization or knowledge of applicable standards (*e.g.*, small businesses); 2) deter manufacturers from making

[1] Memorandum from C. Meiers to K.M. Hatlelid, "Labeling of Candles with Lead-cored Wicks (Petition HP 00-3)," October 18, 2000; Tab C in Briefing Package on Petition No. HP 00-3, December 12, 2000.

non-conforming wicks or candles and enable the staff to seek civil penalties for violations; 3) increase compliance by retailers and distributors who often require that products meet applicable federal standards; and 4) prevent non-complying products from entering the U.S. through cooperative efforts with the U.S. Customs Service.

Issue: A voluntary standard has been drafted that would ban lead-cored candle wicks. The rulemaking process should end and CPSC should endorse the voluntary standard.

VOSI has drafted a voluntary standard for lead in candlewicks (CH01-3-10). This standard specifies that metal-cored wicks may contain no more than 0.01 percent lead in the metal. The standard further specifies that imported candle wicks may not contain metal cores.

The standard includes a methodology, based on tensile strength of metals, for determining whether metal-cored wicks comply with the specified maximum lead content.

Donald Meserlian, VOSI chairman, states that there is "substantial compliance" with the VOSI standard and that the Commission must end rulemaking proceedings and defer to the VOSI standard. He also states that this activity is subject to the National Technology Transfer and Advancement Act (NTTAA).

Response:

CPSC technical staff reviewed the requirements in the VOSI standard and noted a number of issues associated with deferring to this standard. Although the standard states that a maximum of 0.01 percent lead is required to protect consumer health, no technical or health basis for this level is provided. The staff maintains that the proposed limit of 0.06 percent lead by weight in the metal is appropriate and supported by the laboratory analyses performed by CPSC staff and others.

The analytical methodology in the submitted standard is not capable of reliably determining either the presence or concentration of lead in metal-cored candle wicks. The staff concludes that, based on physical characteristics of metal alloys, the tensile strength of a metal alloy would not definitively identify zinc cored wicks containing less than 0.01 percent lead in the metal, but could falsely detect alloys not containing lead, causing them to fail the test and be needlessly prohibited from wick use (additional discussion of these technical issues is in Tab E).

The VOSI standard specifies different standards for domestic and imported products. Specifically, the standard specifies that metal-cored wicks may contain no more than 0.01 percent lead in the metal but that imported candle wicks may not contain metal cores at all. The staff has no information on which to base different criteria for domestic and imported products.

If the Commission finds that an applicable voluntary standard has been adopted and implemented, the Commission could not issue the ban unless it found either that compliance with the voluntary standard would not adequately reduce the risk or that it is unlikely that there will be substantial compliance with the voluntary standard. 15 U.S.C. § 1262(I)(2)(A).

The staff believes that international membership in standards organizations, such as ASTM, serves, in part, to transmit applicable standards to member firms. In this case, Mr. Meserlian has offered no information that VOSI members include candle and wick manufacturers, and he has not shown that the standard was developed within an consensus framework or is otherwise widely known to candle and wick manufacturers in the United States or overseas. Nor has he shown that there is substantial compliance with his voluntary standard.

The staff finds that the VOSI standard is technically unsound and that substantial compliance is unlikely. Therefore, the staff believes that a mandatory standard is appropriate, and that the proffered VOSI standard is not a suitable voluntary standard.

The Office of the General Council will address the applicability of the NTTAA to this proceeding in a separate legal memorandum.

Issue: Exposure to lead causes adverse health effects. Exposure to lead from candles with lead-cored wicks is hazardous.

The harmful effects of lead exposure in children and the potential for lead exposure from candles were reiterated by a number of commenters (CH01-3-1, CH01-3-6, CH01-3-7, and CH01-3-10).

Response:

The staff agrees that the adverse health effects of lead exposure in children are well-documented and may have long-lasting or permanent consequences.

The toxic effects of lead and the risk to consumers, especially children, from exposure to lead emitted from lead-cored wick candles were detailed in the Briefing Package on Petition No. HP 00-3[2]. Under certain expected use conditions, the staff believes that lead emissions from candles with wicks containing metal cores with a lead content exceeding 0.06 percent by weight could present a risk to consumers of illness through inhalation of airborne lead and through contact with lead that deposits onto surfaces in the room.

Issue: Substitute materials are available. Other countries have acted to eliminate lead-cored wicks.

Three commenters discussed available substitutes and their use by manufacturers (CH01-3-1, CH01-3-7, and CH01-3-11). John Root, of the National Candle Association, stated that the use of lead-cored wicks has been broadly discontinued domestically, and that zinc-cored wicks currently in use would comply with a ban on metal-cored wicks exceeding 0.06 percent lead by weight in the metal.

One comment from a consumer (CH01-3-1) asserted that zinc-cored wicks would be acceptable alternatives to lead, but that paper- or cotton-cored wicks would not be acceptable because they are less rigid than zinc and have a higher burning rate.

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[2] Memorandum from K.M. Hatlelid to M.A. Danello, "Review of Lead Emissions from Candles," November 15, 2000; Tab B in *Briefing Package on Petition No. HP 00-3, December 12, 2000.*

Three commenters reiterated that other countries have issued notices that ban the import and sale of lead-containing wicks (CH01-3-6, CH01-3-7, and CH01-3-10).

Response:

The economic information developed by CPSC staff (Tab B) supports the claim that alternatives to the use of lead core are available. In fact, no wick manufacturer in the U.S. currently uses lead core in the production of their wicks. Based on the economic analysis, the staff believes that the costs to manufacturers or consumers of replacing lead-cored wicks with non-lead substitutes would be negligible.

The staff has been unable to verify the commenter's claim that paper- or cotton-cored wicks are unacceptable alternatives to lead-cored wicks (CH01-3-1). The staff has found no information and received no comments from candle makers or industry representatives to support this claim.

Several countries have acted on this issue. Officials in Canada issued an advisory in January, 2001, warning consumers that some candles sold in Canada contained lead-cored wicks, and offered advice on making informed purchasing decisions. Officials in Australia and New Zealand have instituted provisional bans on candles with wicks containing any amount of lead. Australia is now considering making the ban permanent.

Denmark issued a comprehensive order in December 2000, banning a number of products containing lead. Chafing dish candles and other candles are specifically included in the ban. The order defines a "lead-containing product" as one in which lead represents more than 50 mg/kg (0.005 percent) of the homogeneous components.

This definition differs from the staff recommendation that a lead-cored wick be defined as a wick containing a metal core with greater than 0.06 percent lead by weight in the metal. Since laboratory test data indicate that burning candles with metal-cored wicks with lead concentrations of 0.06 percent or less by weight do not result in detectable emissions of lead into the air, the staff believes such wicks are unlikely to release hazardous amounts of lead (Tab A).

Issue: Some candles use metal-cored wicks. The low lead levels in metal-cored wicks should be evaluated.

One commenter mentioned that a particular brand of candles uses metal-cored wicks (CH01-3-3). Another commenter expressed concern that because of the known hazards of lead, the presence of even small amounts in metal cores should be evaluated (CH01-3-7). The VOSI voluntary standard specifies that metal-cored wicks may have no more than 0.01 percent lead in the metal.

Response:

The staff agrees that metals, such as zinc, may be used in candle wicks. The lead content of the zinc used in zinc-cored wicks has been determined by CPSC staff and others to range from

about 0.0005 percent to 0.06 percent by weight in the metal[3]. CPSC laboratory and other tests have shown no detectable levels of airborne lead emissions from candles with metal wicks containing 0.06 percent lead or less by weight.

The documentation submitted with the VOSI standard provides neither a technical nor a health basis for establishing 0.01 percent rather than 0.06 percent as the maximum lead content of metals used in wicks.

Therefore, the staff is recommending a ban on metal-cored wicks containing more than 0.06 percent lead by weight in the metal and candles with such wicks, but is not proposing to limit the use of metals that contain 0.06 percent lead or less.

Issue: Labeling lead-cored wick candles is not sufficient to protect public health. Candles that do not contain lead should be labeled.

Three commenters believe that regulating lead-cored wick candles by requiring warning labels would not adequately protect public health (CH01-3-1, CH01-3-6, and CH01-3-11). One commenter suggested that candles that comply with the proposed 0.06 percent maximum lead limit should be labeled with that information (CH01-3-7).

Response:

Staff analysis[4] showed that since lead is emitted from a lead-cored wick candle when the wick is lit, no label or subsequent action by the consumer would prevent the release of lead into the air when such a candle is used as intended. It is not realistic to expect a candle to be used for decorative purposes only and not be lit.

The staff agrees that lead-cored wicks and candles containing lead-cored wicks should be banned and that labeling is not an acceptable strategy for protecting vulnerable populations from lead poisoning that may be induced by burning candles with lead-cored wicks.

However, once a ban on metal-cored wicks containing more than 0.06 percent lead by weight in the metal and candles with such wicks is in place, the staff does not believe that labeling individual candles would offer consumers any additional safety. On the other hand, the staff is proposing that shipping containers of metal-cored wicks or candles with such wicks be labeled, which would provide information useful to the Commission and to manufacturers, distributors, and retailers.

Conclusions

The commenters focused on several issues regarding the use of lead-cored wicks in candles. Many comments focused on the need for a federal regulation, rather than a voluntary standard. There was general agreement that lead should not be used in candle wicks.

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[3] Memorandum from K.M. Hatlelid to M.A. Danello, "Review of Lead Emissions from Candles," November 15, 2000; Tab B in Briefing Package on Petition No. HP 00-3, December 12, 2000.

[4] Memorandum from C. Meiers to K.M. Hatlelid, "Labeling of Candles with Lead-cored Wicks (Petition HP 00-3)," October 18, 2000; Tab C in Briefing Package on Petition No. HP 00-3, December 12, 2000.

The staff agrees with many of ' positions. The staff agrees that exposure to lead from consumer products should be minimized and that alternatives to the use of lead core are available. In fact, no U.S. manufacturer currently uses lead core in the production of wicks, and several countries have acted to eliminate the sale or import of candle wicks containing lead. The staff also believes that a mandatory standard is necessary, in part, because of the failure of the industry to maintain conformance with a prior voluntary agreement, and because many manufacturers are small businesses and may be unaware of applicable voluntary standards.

On the other hand, the staff does not agree that a maximum of 0.01 percent lead in metal-cored wicks is necessary to protect consumer health. Rather, the staff believes that a maximum lead level in metal-cored wicks of 0.06 percent by weight is an appropriate limit. The staff does not agree that the proffered VOSI standard, rather than a mandatory rule, would adequately protect public health and safety because the staff believes that it is technically unsound and that substantial compliance is unlikely.