

EPA Report: Candles & Incense

"Black Soot Deposition (BSD) is also referred to as ghosting, carbon tracking, carbon tracing, and dirty house syndrome. Complaints of BSD have risen significantly since 1992 (Krause, 1999).

Black soot is the product of the incomplete combustion of carbon-containing fuels. Complete combustion would result in a blue flame, and would produce negligible amounts of soot and carbon monoxide. Until recently, the source for the black soot in homes was unknown.

Through interviews and recent experiments, it is now believed that frequent candle burning is one of the sources of black soot. The amount of soot produced can vary greatly from candle to candle.

One type of candle can produce as much as 100 times more soot than another type."

Note: The following is from the EPA Report "Candles and Incense As Potential Sources of Indoor Air Pollution: Market Analysis And Literature Review, " dated Jan. 2001. Prepared by National Risk Management, Research Laboratory.

Abstract

The report summarizes available information on candles and incense as potential sources of indoor air pollution. It covers (1) market information and (2) a scientific literature review. The market information collected focuses on production and sales data, typical uses in the US, and data on the sources and quantities of imported products.

The estimated total sales of candles in 1999 varied between \$968 million and \$2.3 billion, while imports were \$486 million. The US imports and exports of incense in 1999 were \$12.4 and 4.6 million, respectively. The scientific literature review gathered information regarding the emission of various contaminants generated when burning candles and incense, as well as the potential health effects associated with exposure to these contaminants. Burning candles and incense can be sources of particulate matter.

Burning candles with lead core wicks may result in indoor air concentrations of lead above EPA-recommended thresholds. Exposure to incense smoke has been linked with several illnesses, and certain brands of incense also contain chemicals suspected of causing skin irritation.

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1. Findings

The purpose of this report is to collect economic information regarding the production and sales of candles and incense in the US, including information about imports. A second objective is to review the scientific literature regarding emission rates and potential human health effects associated with burning candles and incense. The following is a brief overview of the findings.

1.A ECONOMIC DATA ON CANDLE AND INCENSE PRODUCTION AND SALES

The Census Bureau reports 107 manufacturing establishments; however, industry estimates range from 160 to over 200 manufacturers. Many manufacturers are very small.

- Candle sales have been growing rapidly in the last 10 years (10 to 15 percent per year), fueled by consumer interest in aroma therapy and increased demand for home fragrance products in general.

- The Census Bureau reports a total value of shipments in 1997 of \$968 million; industry estimates put 1999 sales at \$1.3 billion just for scented candles, and up to \$2.3 billion for all candles.

- The top five countries that export candles to the US are China, Taiwan, England, Hong Kong, and Mexico.

- There are no public data on incense manufacturers; private data show at least 26 manufacturers. Limited discussions with some industry representatives indicate that there are probably many more very small manufacturers.

- The top five countries that export incense to the US are India, China, Thailand, Japan, and Hong Kong.

1.B POTENTIAL INDOOR AIR QUALITY IMPACTS OF BURNING CANDLES AND INCENSE

- Burning candles containing lead core wicks can result in indoor air concentrations of lead above EPA-recommended thresholds.

- In the scientific literature we reviewed, zinc and tin were found not to be emitted at concentrations that would raise concerns when burned indoors.

- One study showed worst-case scenario concentrations of acrolein, formaldehyde, and acetaldehyde from candle emissions exceeding EPA-recommended thresholds.

- Sooting can occur when combustion conditions are impaired when burning candles. Scented candles are more likely to produce soot than unscented candles. Sooting can cause property damage by blackening surfaces. We could not identify any studies on potential human health effects associated with soot from candles.

- Several studies indicated links between exposure to incense smoke and health effects, including cancers and contact dermatitis. A few studies indicated possible mutagenic and genotoxic effects.

- Studies that examined the emissions of specific contaminants from incense smoke indicated that benzene and particulate matter may be emitted at concentrations that could pose human health risks.

2. BACKGROUND

The potential indoor air impacts of burning candles and incense have drawn increased attention in recent years. For example, candles with lead wicks have been found on the market and have been shown to emit lead when burned. Sooting associated with burning candles can cause property damage by blackening walls, ceilings, and carpets. Incense smoke can be a major

source of particulates in indoor air. Emissions from incense may contain contaminants that can cause a variety of health effects.

EPA is currently testing the emissions from candles and incense to generate data for analyzing risk management options. To support this effort, this report collects and presents information on the production and sales of candles and incense, the sources and quantities of imported products, and the typical product uses in the US. This information will help EPA in assessing the nature and extent of human exposure.

In addition, this report summarizes the results and findings in the scientific literature regarding the emission rates of the various contaminants generated when burning candles and incense, as well as the potential health effects associated with exposure to these contaminants. EPA will use this information to further their research and understanding of the potential impacts of these sources on indoor air quality.

3. ECONOMIC DATA ON CANDLE AND INCENSE PRODUCTION AND SALES

3.A CANDLES

A variety of candle types are manufactured in the US, including tapers, straight-sided dinner candles, spirals, column, votives, tealights, wax-filled containers, and novelties. Some are scented and all come in a wide range of colors. Wax candles contain petroleum wax, vegetable wax, animal wax, or insect wax as the primary fuel. The wax may contain additives for color, fragrance, stability, or to modify the burning characteristics.

Gel candles use liquids such as mineral oil, terpene-type chemicals, or modified hydrocarbons as their primary fuel. These candles also contain chemical agents to increase the viscosity of the fuel to the point where the candle has a quasi-rigid property.

Candles support one or more combustible wicks. Metal is put in some wick cores to keep the wick standing straight when the surrounding wax begins to melt. The metal prevents the wick from falling over and extinguishing itself as soon as the wax fails to support it. Many companies use a braided wick, which consists of three smaller wicks wound together to provide some stiffness.

Lead was commonly used as a core material until 1974 when the US candle manufacturing

industry voluntarily agreed to discontinue use of lead in wicks. There are, however, still candles on the market that contain lead wick cores. Most of these are imported. Zinc is commonly used as an alternative metal core for the wicks, since it provides the desired amount of stiffness, burns off readily with the rest of the wick, and the airborne particles from zinc wicks are considered safer. (Telephone communication between Marianne McDermott, Executive Vice President,

National Candle Association, and Lynn Knight, ERG, August 18, 2000.)

Scented candles have grown in popularity and are widely used. The majority of candle manufacturers offer scented candles. Seventy-five percent of the manufacturers who are members of the National Candle Association (NCA) listed fragranced candles among the types of candles they produce. Forty percent say they manufacture citronella candles (NCA, 1999). Citronella is an insect repellent.

Number of Candle Manufacturers

The candle industry is a relatively small industry and does not have an abundance of publicly available data. The 1997 Economic Census published by the US Census Bureau reports 107 manufacturing establishments with a primary North American Industry Classification System (NAICS) product classification code of 3399995, defined as "candles, including tapers" (US Census Bureau, 1999).

These establishments collectively employed 8,536 workers. The Census Bureau has very limited data available since the industry is identified at the 7-digit level. ERG conducted an online search of the Thomas Register of American Manufacturers. This search identified 160 candle manufacturers.

However, the National Candle Association (NCA) estimates there are over 200 known commercial, religious, and institutional manufacturers of candles in the US, as well as many small craft producers (NCA, 1999). The NCA reports that 70 of their members are manufacturers and represent roughly 80 percent of the market.

The three largest publicly traded manufacturers are Candle Corporation of America, Candle-Lite, Inc., and The Yankee Candle Company, Inc. (NCA, 1999). A Merrill Lynch Global Securities analyst reported that Yankee Candle Co. accounts for about 10 percent of industry sales. It has 100

stores and plans to open 40 per year (Fort Worth Star-Telegram, 1999).

A private market study by the Packaged Facts group reports that the candle industry is not only growing, but is undergoing some consolidation. This trend is not limited to smaller companies, but has included some of the leading manufacturers and marketers succumbing to stronger, better financed companies (Packaged Facts, 1999). This source believes that company buyouts are motivated by parent organizations attracted to making acquisitions in a thriving market and then helping these acquisitions grow their product lines and increase market share. For example, Yankee Candle's partnership with Forstmann Little was reportedly undertaken specifically to fund a major expansion (Packaged Facts, 1999).

Internet sales of candles have been increasing. Many smaller candle companies are emerging and doing well selling their products on the Internet, as the appearance of prominence can be obtained with a nice looking Web site. Selling on the Internet allows these manufacturers to sell candles at a reasonable price, since they can pass on savings accrued by avoiding middlemen, slotting fees paid to retailers, and advertising costs (Packaged Facts, 1999).

There have been many types of new entrants to the growing candle market. Market research analysts believe that new marketers are attracted to this burgeoning market because candles are relatively simple to make, color, and fragrance, and novelty designs easily attract the buyer's attention (Packaged Facts, 1999).

The scented candles market has seen a lot of cross-category encroachment, as fashion designers, perfume manufacturers, and specialty chain marketers introduce their own lines of candles. For example, upscale retailers, such as The Gap, Pottery Barn, Pier One, and the Bombay Company, are marketing scented candles under their own trademark. SC Johnson, too, began selling candles fragranced with many of Glade's air freshener trademark scents (Packaged Facts, 1999). Meanwhile, dedicated candle outlets, like Yankee Candle, White Barn Candle Company, and Illuminations, are expanding throughout the US (Packaged Facts, 1999).

Sales

The 1997 Economic Census reports a total value of shipments for candle manufacturers of

\$968.3 million. Companies with shipments of \$100,000 or more accounted for 98 percent of shipments, or \$951 million. In 1992, shipments for these larger companies were \$366 million. The value of shipments increased more than 2.5 times over this 5-year period.

The source of these estimates is not disclosed in the NCA publication.
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This figure was interpreted from the Freedonia Group's prediction that sales would increase 8.1 percent annually to reach \$1.6 billion in 2003.

The NCA states that the US candle consumer retail sales for 1999 are reported at \$2.3 billion, not including candle accessories. NCA further reports that sales of all candles (unscented, scented, and for institutional and religious uses) have been growing 10 to 15 percent a year since 1990

(the source of these estimates is not disclosed in the NCA publication) (NCA, 1999).

The Packaged Facts report claims that the growth of scented candles alone is close to 22 percent per year. This same report estimates that scented candles represent 55 percent of the \$2.4 billion total home fragrance market, or \$1.3 billion in scented candle sales. Another source, The Freedonia Group, estimated that 1999 candle sales were \$1.17 billion. (This figure was

interpreted from the Freedonia Group's prediction that sales would increase 8.1 percent

annually to reach \$1.6 billion in 2003.)

Unity Marketing, another private marketing research firm, conducts annual surveys among gift manufacturers who produce and market candles and candle accessories. The most recent survey, which had 37 respondents, was conducted in 2000 and covered 1999 sales. The survey results showed an upward trend in total annual sales for 1999, with average company sales among respondents up 39 percent from \$10 million in 1997 to \$14 million in 2000. In 1999, 39 percent of companies surveyed reported annual sales of more than \$10 million as compared with only 27 percent in 1997. (See Table 1.)

Table 1: Total Sales of Candle Companies in 1999

Total Annual Sales (Dollars in Thousands)	Percent of Candle Companies Surveyed (a)
> \$50,000	12
\$26,000 - \$50,000	9

\$11,000 - \$25,000	18
\$6,000 - \$10,000	9
\$1,000 - \$5,000	27
\$500 - \$999	15
<\$500	12

(a) These statistics do not cover only candle manufacturing. They include manufacturers of candle accessories as well. Fifty-three percent of companies surveyed owned their own factory facilities. Figures do not add to 100 percent.

Source: Unity Marketing, 2000.

Candles are sold through a variety of distribution channels. According to the Unity Marketing survey, specialty retail stores capture a large portion of candle sales. (See Table 2.) Packaged Facts estimates that 51 percent of 1998 scented candle sales were attributable to mass merchandisers, 36 percent to supermarkets, and 13 percent to drug stores. (Unity Marketing and Packaged Facts each based their estimates on different distribution channel categories, thus not allowing direct comparisons.)