



# **Non-Fire Carbon Monoxide Deaths Associated with the Use of Consumer Products 2003 and 2004 Annual Estimates**

Matthew V. Hnatov  
U.S. Consumer Product Safety Commission  
Directorate for Epidemiology  
Division of Hazard Analysis  
4330 East West Highway  
Bethesda, MD 20814  
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*This analysis was prepared by the CPSC staff, has not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.*

## **Executive Summary**

This report provides information about the number of unintentional non-fire deaths attributed to carbon monoxide (CO) poisoning that were associated with the use of consumer products in 2003 and 2004.

In 2003, there were an estimated 154 unintentional non-fire CO poisoning deaths associated with consumer products under the jurisdiction of the U.S. Consumer Product Safety Commission (CPSC). In 2004, the estimated number of deaths was 162. From 2002-2004, there was an estimated yearly average of 166 unintentional non-fire CO poisoning deaths associated with consumer products. It should be noted that data collection is not complete for 2003 and 2004 at this time and, therefore, estimates for these years may change in future reports.

From the total 316 product associated non-fire CO fatalities across 2003 and 2004, 47 percent of the estimated deaths were associated with the use of heating systems. An estimated 35 percent of the 2003 and 2004 CO poisoning deaths were associated with engine-driven tools, three percent were associated with charcoal or charcoal grills, three percent were associated with gas water heaters, two percent were associated with gas ranges and ovens, and three percent were associated with gas grills, camp stoves and lanterns. Additionally, four percent were associated with multiple products.

Of the estimated 150 heating system-related fatalities in 2003 and 2004, 81 percent involved gas heating; natural gas heating accounted for 38 percent, liquefied petroleum (LP) gas heating accounted for 31 percent, and an additional 12 percent could only be identified as unspecified gas heating. The remaining 19 percent comprised incidents involving wood, coal, kerosene or oil heating or a heating system where the fuel type was not specified.

Of the estimated 112 CO fatalities in 2003 and 2004 that were associated with engine-driven tools, 81 percent involved generators. Additionally, generator usage was associated with half of the estimated 12 multiple appliance CO poisoning fatalities.

From the estimated 316 fatalities in 2003 and 2004, 51 percent of the estimated deaths were associated with gas fueled (natural gas or LP gas) appliances, five percent were associated with solid fuel (wood or coal) appliances, and 39 percent were associated with liquid fueled (primarily gasoline, kerosene or oil) appliances. An additional four percent involved multiple appliances. Two thirds of these incidents involved products of different fuel types and, therefore, no specific fuel type was associated with these incidents.

According to 2003 and 2004 data, adults between 25 and 44 years of age represented 29 percent of the CO poisoning deaths and adults over 45 years of age represented 55 percent of the CO poisoning deaths. Nine percent of the CO fatalities were children under 15 years old. Seventy-three percent of CO deaths occurred in the home, while deaths in tents, campers and other temporary shelters accounted for an estimated 14 percent of deaths. Deaths in these temporary types of shelters were mostly associated with gas or LP gas heaters. In 2003 and 2004, a large percentage (81%) of the fatal CO incidents involved a single fatality. These single-fatality incidents comprise 64 percent of all non-fire CO poisoning deaths associated with consumer products. Although it was not uncommon for non-fatal injuries to accompany

fatalities in the fatal CO incidents, they were not quantified for analysis in this report.

## Introduction

Carbon monoxide (CO) is a colorless, odorless, and poisonous gas that results from the incomplete combustion of fuels such as natural or liquefied petroleum (LP) gas, gasoline, oil, wood, coal, and other fuels. The health effects related to CO depend upon its concentration in blood, which in turn depends on its concentration in air, the duration of exposure, and each individual's general health. Carbon monoxide combines with hemoglobin (Hb) with an affinity about 250 times that of oxygen, forming carboxyhemoglobin (COHb) and interfering with oxygen transport, delivery, and utilization. Generally, there are no perceptible health effects or symptoms in healthy individuals at COHb levels below 10 percent. Symptoms associated with blood levels at or above 10 percent COHb include headache, fatigue, nausea, and cognitive impairment. Loss of consciousness, coma, and death can occur at COHb levels greater than 20 percent, although for healthy adults CO fatalities typically require levels above 50 percent COHb<sup>1</sup>.

Some symptoms of CO poisoning may mimic common illnesses, such as influenza or colds; thus, there likely is a high incidence of initial misdiagnosis by physicians and victims (Long & Saltzman, 1995). Patients are frequently unaware of exposures, and health care providers may not always consider CO poisoning as a cause of such non-specific symptoms. COHb formation is reversible, as are some clinical symptoms of CO poisoning. However, some delayed neurological effects that develop following severe poisonings, especially those involving prolonged unconsciousness, may not be reversible. Prompt medical attention is important to reduce the risk of permanent damage.

Any fuel-burning appliance can be a potential source of fatal or hazardous CO levels. Fuels, such as natural and LP gas, kerosene, oil, coal, and wood can produce large amounts of CO when there is insufficient oxygen available for combustion. Consumer products that burn kerosene, oil, coal or wood (such as wood stoves, oil boilers, and kerosene heaters) produce an irritating smoke that can alert the victim to a potentially hazardous situation. Engine-driven tools powered by gasoline engines produce large amounts of CO even when they are run where there is sufficient oxygen available for combustion yet they may not emit an irritating exhaust smoke. Other fuels, such as charcoal briquettes and pressed wood-chip logs, produce relatively smokeless fires, even at times of inefficient combustion. In these cases, victims receive no obvious sensory warning that high CO levels are present. Another hazard scenario is present when gas appliances are not vented properly or are malfunctioning. Natural and LP gas burn more efficiently and cleanly compared with other forms of fuel. In circumstances of poor maintenance, inadequate ventilation, or faulty exhaust pathways, natural and LP gas appliances may emit potentially lethal amounts of CO without any irritating fumes. Again, many victims may be unaware of a potential problem.

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<sup>1</sup> Inkster S.E. *Health hazard assessment of CO poisoning associated with emissions from a portable, 5.5 kilowatt, gasoline-powered generator*. Washington, D.C.: U.S. Consumer Product Safety Commission. 2004.

## National Estimates of Non-Fire CO Poisoning Deaths Associated with Consumer Products

During 2004, the most recent year for which nearly complete data are available, there were an estimated 162 carbon monoxide (CO) poisoning deaths associated with the use of a consumer product under the jurisdiction of the U.S. Consumer Product Safety Commission (CPSC). There were an estimated 154 fatalities in 2003. Carbon monoxide poisonings referred to in this report do not include those where the CO gas resulted from a fire or a motor vehicle, were intentional in nature or were directly work-related.

Although there can be multiple factors contributing to a CO poisoning fatality, the source of CO is virtually always a fuel-burning product. As mentioned earlier, poor product maintenance by professionals or consumers, inadequate ventilation, faulty exhaust pathways, and poor user judgment in operating these products can result in fatal scenarios. It should be noted that CPSC staff produces the CO estimates by associated consumer products in order to identify product groups involved in fatal CO scenarios and to monitor this distribution over time. It is within the individual, product-specific CPSC projects that further analysis is done to consider whether improvements are warranted in the areas of product design, ventilation safeguards, or user information and education.

The annual CO estimates for the years 1999 through 2004 are presented in two formats: by product type (Table 1) and by product within fuel type (Table 2). The data are presented as yearly estimates for each of the six years covered by this report and as an average of the most recent three year period (2002 through 2004). Data collection is incomplete for 2003 and 2004 at this time. Hence estimates for these years may change in the future and are reported using italic font in the tables.

Table 1 presents the consumer product distribution of CO poisoning deaths. The estimate for Heating Systems, historically a large percentage of the consumer product estimate, is further distributed among the various fuel types. Fatality estimates for the Engine-Driven Tools category were further distributed between generators and other engine-driven tools. The consumer product estimate and product distributions were derived using the methodology described in Appendix A.

Of the estimated 316 CO poisoning deaths associated with a consumer product that occurred between January 2003 and December 2004, heating systems were associated with 150 deaths (47% of the total consumer product estimate). Of the 150 deaths associated with heating systems, the majority (81% or 122 fatalities) involved gas heating systems. Among gas heating systems, natural gas heating was associated with an estimated 57 deaths (38% of heating deaths), LP gas heating was associated with an estimated 47 deaths (31% of heating deaths) and unspecified gas heating was associated with an estimated 18 deaths (12% of heating deaths). Coal/wood heating systems and kerosene/oil heating were associated with an estimated six deaths (4% of heating deaths) and an estimated ten deaths (7% of heating deaths), respectively. CPSC has no reported diesel-fueled heating systems fatalities in the 2003 or 2004 data. An additional estimated 12 deaths were associated with a heating system, not specified (8% of heating deaths).

**Table 1**  
**Estimated Non-Fire Carbon Monoxide Poisoning Deaths**  
**By Associated Fuel-Burning Consumer Product, 1999-2004.**

Consumer Product	2002 - 2004 <sup>+</sup>		Annual Estimate					
	Average Estimate	Average Percent	1999	2000	2001	2002	2003 <sup>+</sup>	2004 <sup>+</sup>
<b>Total Deaths</b>	<b>166</b>	<b>100%</b>	<b>109</b>	<b>137</b>	<b>122</b>	<b>181</b>	<b>154</b>	<b>162</b>
<b>Heating Systems</b>	<b>82</b>	<b>49%</b>	<b>50</b>	<b>81</b>	<b>72</b>	<b>97</b>	<b>66</b>	<b>84</b>
Unspecified Gas Heating	7	4%	5	1	5	2	4	14
LP Gas Heating	29	18%	22	28	24	41	22	25
Natural Gas Heating	30	18%	20	42	28	32	27	30
Coal/Wood Heating	3	2%	0	2	6	4	2	4
Kerosene/Oil Heating	6	4%	2	8	6	8	6	4
Diesel Fuel	< 1	< 1%	*	*	*	1	*	*
Heating Systems, Not Specified	7	4%	1	*	3	9	5	7
<b>Charcoal Grills or Charcoal</b>	<b>7</b>	<b>4%</b>	<b>17</b>	<b>8</b>	<b>10</b>	<b>11</b>	<b>8</b>	<b>3</b>
<b>Gas Water Heaters</b>	<b>3</b>	<b>2%</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>7</b>	<b>1</b>
<b>Gas Grills, Camp Stoves, Lanterns</b>	<b>5</b>	<b>3%</b>	<b>14</b>	<b>4</b>	<b>1</b>	<b>5</b>	<b>2</b>	<b>8</b>
<b>Gas Ranges/Ovens</b>	<b>3</b>	<b>2%</b>	<b>6</b>	<b>12</b>	<b>9</b>	<b>3</b>	<b>3</b>	<b>4</b>
<b>Other Appliances</b>	<b>1</b>	<b>1%</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Multiple Appliances</b>	<b>8</b>	<b>5%</b>	<b>6</b>	<b>2</b>	<b>7</b>	<b>12</b>	<b>8</b>	<b>4</b>
<b>Engine-Driven Tools</b>	<b>54</b>	<b>33%</b>	<b>13</b>	<b>27</b>	<b>22</b>	<b>51</b>	<b>57</b>	<b>55</b>
Generators	44	27%	7	19	21	41	50	41
Other Engine-Driven Tools	10	6%	6	8	1	10	7	14

+ Data collection for 2003 and 2004 is incomplete. Italicized estimates may change in the future.

\* No reports received by CPSC staff.

Source: U.S. Consumer Product Safety Commission / EPHA.

CPSC Death Certificate File, CPSC Injury or Potential Injury Incident File, CPSC In-Depth Investigation File, National Center for Health Statistics Mortality File, 1999 - 2004.

Note: Reported average percentages by product may not add to total due to rounding.

Of the 47 estimated deaths in 2003 and 2004 that were associated with LP gas heating systems, 32 (68%) involved unvented portable propane heaters. These unvented portable propane heaters were fueled by a propane tank and were not a component of an installed heating system. Unvented portable propane heaters were either camping heaters that used disposable propane tanks, one pound propane bottles, or tank top heaters that used bulk tanks larger than one pound. For one death involving an LP gas heating system in this time period, it could not be determined if the death associated with a propane heater was specifically associated with an unvented portable propane heater or another type of propane heater. Therefore, this incident was not included when calculating the estimate of deaths associated with unvented portable propane heaters.

In 2003 and 2004, an estimated 11 CO deaths (3% of the 316 total consumer product estimate) were associated with charcoal or charcoal grills; an estimated eight deaths (3% of the

total consumer product estimate) were associated with a gas water heater; gas grills, camp stoves and lanterns were associated with an estimated eight deaths (3% of the total consumer product estimate); gas ranges and ovens were associated with an estimated seven deaths (2% of the total consumer product estimate); and three deaths were either associated with consumer products that did not fit into the categories given above or there was insufficient detail to categorize the appliance. One fatality was associated with a propane-fueled refrigerator, one was associated with a product simply defined as a “propane appliance” and another as a “gas-fueled appliance”. These incidents were categorized as “Other appliances”. Additionally, in 2003 and 2004 an estimated 12 deaths were associated with multiple appliances (4% of the total consumer product estimate). The multiple appliances category included all incidents where multiple fuel-burning products were used simultaneously such that a single source of the CO could not be determined. Of the 12 multiple appliance fatalities, six were associated with a generator and another product. These other products were a kerosene heater (three deaths), an LP gas heater (two deaths) and a wood stove. Other fatalities where multiple products were simultaneously used and associated with a CO poisoning death involved a portable propane heater and a gas-powered snow thrower; a portable propane heater and a propane lantern; a kerosene heater and a propane heater; a natural gas heater and hot water heater; a propane furnace and a propane oven in a travel camper; and a natural gas furnace and natural gas oven.

An estimated 112 CO poisoning deaths (35% of the estimated total from 2003 and 2004) were associated with engine-driven tools, which includes generators, riding mowers, a concrete cutter, a gas-fueled welder, power washers, a water pump, an air compressor and an ATV. Generator associated deaths comprise the majority of this category. There were an estimated total of 91 generator-related CO poisoning deaths in 2003 and 2004 (81% of all engine-driven tool fatalities and 29% of the total consumer product estimate).

Table 1 shows the estimated average annual number of deaths associated with a consumer product for 2002-2004. The average yearly total CO deaths for this three-year period is estimated to be 166 (with a standard error of approximately 8.0). The 95 percent confidence interval<sup>+</sup> for this estimated average ranged from 131 to 200 deaths. Appendix B contains a graph and the data point values for the annual estimates of CO poisoning deaths associated with a consumer product for 1980 through 2004.

Detailed information regarding the conditions of products associated with fatalities could not be reliably collected, and the availability of such information in the CPSC’s files varied widely. However, information collected often did describe conditions regarding compromised vent systems, flue passageways and chimneys for furnaces, boilers, and other heating systems. Vent systems include the portion of piping that connects the flue outlet of the appliance and exhausts air to the outside through a ceiling or sidewall, or connects to a chimney. Some vented products had vents that became detached or were improperly installed or maintained. Vents were also sometimes blocked by soot caused by inefficient combustion, which in turn may have been caused by several factors, such as leaky or clogged burners, an over-firing condition, or inadequate combustion air.

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<sup>+</sup> Confidence interval based on a t-distribution with two degrees of freedom.

Other conditions related to furnaces included compromised heat exchangers or filter doors or covers that were removed or not sealed. Some products were old and apparently poorly maintained such that there were several factors involved in generating and exacerbating the amount of CO produced. Other incidents mentioned a backdraft condition, large amounts of debris in the chimney, and the use of a product that was later red-tagged by the utility company (taken out of commission by the utility company and not to be turned on until repaired).

Table 2 organizes the estimates by product with fuel type. The three major fuel types include Gas Fueled (natural gas and liquid petroleum [LP] gas); Solid Fueled (charcoal, coal and wood); and Liquid Fueled (gasoline, kerosene and oil). Of these fuel types, Gas Fueled Appliances were associated with 161 of the 316 (51%) estimated CO fatalities in 2003 and 2004. Solid Fueled and Liquid Fueled Appliances were associated with 17 (5%) and 123 (39%) estimated fatalities in the same time period, respectively. An additional 12 (4%) fatalities were associated with multiple products.

In the Gas Fueled category, the vast majority of CO fatalities in 2003 and 2004 were associated with heating-related products. Of the estimated 161 gas fueled appliance fatalities in 2003 and 2004, 135 (84%) were associated with heating systems or heaters. In the Solid Fueled category, 11 of the estimated 17 CO fatalities (65%) in 2003 and 2004 were associated with charcoal or charcoal grills. Of the 123 liquid fueled appliance-related fatalities in 2003 and 2004, 112 (91%) were associated with all engine-driven tools (generators, lawn mowers, power washers, concrete saws, etc.). Generators accounted for 91 of the estimated 123 fatalities (74%) in the Liquid Fueled Appliances category.

Table 3 shows a break-down of the fatalities estimates for the six years 1999 through 2004 in the Engine-Driven Tools category. During 2003 and 2004, engine-driven tools were associated with an estimated 112 carbon monoxide poisoning deaths over the two-year period (35% of the total consumer product estimate). Ninety-one of these 112 engine-driven tool-related CO poisoning deaths (81%) were associated with generators and the remaining 21 were associated with the classification Other Engine-Driven Tools. In 2003 and 2004, the other engine-driven tools-related fatalities included an estimated 14 deaths that were associated with lawn mowers (this includes riding mowers, garden tractors, and gas-fueled powered push mowers), two deaths were associated with power washers and one death each was associated with a concrete cutter, a welder, an air compressor, a water pump, and an ATV.

As can be seen in Table 3, the estimated numbers of fatalities associated with engine-driven tools increased dramatically from 1999 to 2004. The estimated annual deaths from generators nearly tripled from 1999-2001 to 2002-2004 and doubled for other engine-driven tools. Lawnmowers were associated the majority of the deaths in this category for each three-year period. Ten of the 29 estimated deaths from 2002-2004 involved product types that were not represented in the 1999-2001 period.

Table 4 shows estimated CO poisoning fatalities categorized by age for the six most recent years of data (1999-2004). For the three most recent years (2002-2004) children less than 15 years of age accounted for an annual average of eight percent of yearly CO poisoning deaths. In 2002-2004 adults aged 25 years and older accounted for an average of approximately 85 percent of yearly CO poisoning deaths. The annual average percentage of deaths represented by adults 45 years and older was 56 percent in 1999-2004. In 2002-2004, adults aged 65 years and older accounted for an average annual percentage of 22 percent of CO poisoning fatalities.

**Table 2**  
**Estimated Non-Fire Carbon Monoxide Poisoning Deaths**  
**Associated with Consumer Products Organized by Fuel Type, 1999-2004.**

Consumer Product	2002-2004 <sup>+</sup>		Annual Estimate					
	Average Estimate	Average Percent	1999	2000	2001	2002	2003 <sup>+</sup>	2004 <sup>+</sup>
<b>Total Deaths</b>	<b>166</b>	<b>100%</b>	<b>109</b>	<b>137</b>	<b>122</b>	<b>181</b>	<b>154</b>	<b>162</b>
<b>Gas Fueled Appliances</b>	<b>84</b>	<b>51%</b>	<b>67</b>	<b>91</b>	<b>71</b>	<b>92</b>	<b>72</b>	<b>89</b>
<b>Room / Space Heater</b>	<b>33</b>	<b>20%</b>	<b>20</b>	<b>39</b>	<b>23</b>	<b>35</b>	<b>30</b>	<b>34</b>
Natural Gas Fueled	8	5%	3	17	5	9	8	8
Propane Fueled	19	12%	16	21	17	21	19	18
Other / Unspecified	5	3%	1	1	1	5	3	8
<b>Furnace</b>	<b>40</b>	<b>24%</b>	<b>25</b>	<b>33</b>	<b>37</b>	<b>48</b>	<b>28</b>	<b>43</b>
Natural Gas Fueled	22	13%	16	25	23	24	19	23
Propane Fueled	10	6%	6	8	7	20	3	7
Other / Unspecified	8	5%	3	*	7	4	6	13
<b>Range, Oven</b>	<b>3</b>	<b>2%</b>	<b>6</b>	<b>12</b>	<b>9</b>	<b>3</b>	<b>3</b>	<b>4</b>
<b>Water Heater</b>	<b>3</b>	<b>2%</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>7</b>	<b>1</b>
<b>Refrigerator</b>	<b>&lt; 1</b>	<b>&lt; 1%</b>	<b>1</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>1</b>	<b>*</b>
<b>Lantern</b>	<b>2</b>	<b>1%</b>	<b>8</b>	<b>3</b>	<b>*</b>	<b>2</b>	<b>1</b>	<b>4</b>
<b>Gas Grill, Camp Stove</b>	<b>2</b>	<b>1%</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>2</b>
<b>Other</b>	<b>1</b>	<b>&lt; 1%</b>	<b>1</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>1</b>	<b>1</b>
<b>Solid Fueled Appliances</b>	<b>11</b>	<b>7%</b>	<b>17</b>	<b>10</b>	<b>16</b>	<b>15</b>	<b>10</b>	<b>7</b>
<b>Charcoal / Charcoal Grill</b>	<b>7</b>	<b>4%</b>	<b>17</b>	<b>8</b>	<b>10</b>	<b>11</b>	<b>8</b>	<b>3</b>
<b>Wood / Coal Heater</b>	<b>3</b>	<b>2%</b>	<b>*</b>	<b>2</b>	<b>6</b>	<b>4</b>	<b>2</b>	<b>4</b>
Coal Furnace	1	< 1%	*	1	1	1	*	1
Wood / Coal Stove	1	1%	*	1	5	1	2	1
Chimney / Fireplace	1	1%	*	*	*	2	*	2
<b>Liquid Fueled Appliances</b>	<b>61</b>	<b>37%</b>	<b>16</b>	<b>34</b>	<b>28</b>	<b>59</b>	<b>63</b>	<b>60</b>
<b>Oil Heater / Heating</b>	<b>1</b>	<b>1%</b>	<b>*</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>1</b>	<b>*</b>
<b>Kerosene Heater / Heating</b>	<b>5</b>	<b>3%</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>4</b>	<b>5</b>	<b>4</b>
<b>Generators</b>	<b>44</b>	<b>27%</b>	<b>7</b>	<b>19</b>	<b>21</b>	<b>41</b>	<b>50</b>	<b>41</b>
<b>Other Engine-Driven Tools</b>	<b>10</b>	<b>6%</b>	<b>6</b>	<b>8</b>	<b>1</b>	<b>10</b>	<b>7</b>	<b>14</b>
<b>Lantern / Product / Appliance</b>	<b>&lt; 1</b>	<b>&lt; 1%</b>	<b>1</b>	<b>1</b>	<b>*</b>	<b>1</b>	<b>*</b>	<b>1</b>
<b>Multiple Products Involved</b>	<b>8</b>	<b>5%</b>	<b>7</b>	<b>2</b>	<b>8</b>	<b>13</b>	<b>8</b>	<b>4</b>

+ Data collection is incomplete for 2003 and 2004. Italicized estimates may change in the future.

\* No reports received by CPSC staff.

Source: U.S. Consumer Product Safety Commission / EPHA.

CPSC Death Certificate File, CPSC Injury or Potential Injury Incident File, CPSC In-Depth Investigation File, National Center for Health Statistics Mortality File, 1999 - 2004.

Note: Reported average percentages by product may not add to total due to rounding.



**Table 3**  
**Estimated Non-Fire Carbon Monoxide Poisoning Deaths Associated with Engine-Driven Tools, 1999-2001 vs. 2002-2004.**

Engine-Driven Tools	1999-2001	2002-2004 <sup>+</sup>	Annual Estimate					
	Average Estimate	Average Estimate	1999	2000	2001	2002	2003 <sup>+</sup>	2004 <sup>+</sup>
<b>Total</b>	<b>21</b>	<b>54</b>	<b>13</b>	<b>27</b>	<b>22</b>	<b>51</b>	<b>57</b>	<b>55</b>
<b>Generators</b>	<b>16</b>	<b>44</b>	<b>7</b>	<b>19</b>	<b>21</b>	<b>41</b>	<b>50</b>	<b>41</b>
<b>Other Engine-Driven Tools</b>	<b>5</b>	<b>10</b>	<b>6</b>	<b>8</b>	<b>1</b>	<b>10</b>	<b>7</b>	<b>14</b>
Lawn Mowers <sup>1</sup>	5	6	6	7	1	5	6	8
Gas Welder	*	1	*	*	*	2	1	*
Concrete Saw	*	1	*	*	*	1	*	1
Power Washer	*	1	*	*	*	*	*	2
ATV	*	1	*	*	*	1	*	1
Snow Blower	< 1	*	*	1	*	*	*	*
Air Compressor	*	< 1	*	*	*	*	*	1
Water Pump	*	< 1	*	*	*	*	*	1

<sup>1</sup> Lawn Mowers includes riding mowers, garden tractors and gas-fueled powered push mowers.

<sup>+</sup> Data collection is incomplete for 2003 and 2004. Italicized estimates may change in the future.

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No reports received by CPSC staff.

Source: U.S. Consumer Product Safety Commission / EPA.  
 CPSC Death Certificate File, CPSC In-Depth Investigation File, CPSC Injury or Potential Injury Incident File, National Center for Health Statistics Mortality File, 1999 - 2004.

Note: Reported average percentages by product may not add to total due to rounding.

**Table 4**  
**Estimated Non-Fire Carbon Monoxide Poisoning Deaths by Age of Victim, 1999-2004.**

Age	2002-2004 <sup>+</sup>		Annual Estimate					
	Average Estimate	Average Percent	1999	2000	2001	2002	2003 <sup>+</sup>	2004 <sup>+</sup>
<b>Total</b>	<b>166</b>	<b>100%</b>	<b>109</b>	<b>137</b>	<b>122</b>	<b>181</b>	<b>154</b>	<b>162</b>
Under 5	4	2%	*	3	3	2	6	3
5 – 14	10	6%	7	3	6	9	9	11
15 – 24	11	6%	8	10	16	11	17	4
25 – 44	49	30%	32	42	23	57	47	44
45 – 64	56	34%	45	56	40	51	55	62
65 and over	36	22%	16	23	33	51	20	38

<sup>+</sup> Data collection is incomplete for 2003 and 2004. Italicized estimates may change in the future.

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No reports received by CPSC staff.

Source: U.S. Consumer Product Safety Commission / EPA.  
 CPSC Death Certificate File, CPSC In-Depth Investigation File, CPSC Injury or Potential Injury Incident File, National Center for Health Statistics Mortality File, 1999 - 2004.

Note: Reported average percentages by product may not add to total due to rounding.

In 2003 and 2004, 74 percent of CO victims were males and 26 percent were females. This percentage has varied slightly from year to year but was relatively consistent in recent years. Over the 1999-2004 time span the average percentage of male CO victims was 73 percent with 27 percent female victims.

Anecdotally, it appears that adults in the older age groups were more frequently reported to have pre-existing health conditions affecting the heart, lungs and circulatory system. The presence of one or more of these conditions raises an individual's susceptibility to CO poisoning, increasing the risk of a fatal CO exposure. However, there is insufficient data to quantify the extent or impact of pre-existing health issues. In 2003, only 61% of the death certificates indicated that there was an autopsy performed. In 2004, the proportion of death certificates that indicated that an autopsy was performed was even lower at 55%. Even if an autopsy was performed, it is unknown to what extent complicating health issues were sought and what effect any found health issues contributed to the CO poisoning fatality. Another possible complicating factor is that consumers in the older age groups may also own older products, especially installed appliances, which are not affected by recent safety improvements in voluntary standards. Lack of routine product maintenance, especially in older products, may further increase the potential for a fatal scenario. For these reasons, no attempt was made to assess pre-existing health issues on CO fatalities. Any information presented would be anecdotal at best and perhaps even misleading.

Alcohol and recreational drug use can act as a central nervous system depressant causing dulled reactions, which could likely impair a person's ability to react appropriately to a CO hazard, thus potentially prolonging exposure and increasing the chance of a fatal outcome. Information regarding a CO victim's usage of alcohol or recreational drugs during the time period surrounding an incident was obtained from the Medical Examiner or Coroner, but was not provided for every CO poisoning fatality. As with pre-existing health conditions, there is insufficient information to assess the frequency of drug and alcohol usage and to what extent or degree the usage affected the fatal outcome.

Table 5 shows that in 2003 and 2004, 81 percent of fatal CO incidents reported to the CPSC involved a single death. Table 5 accounts for only the fatally injured victims in each CO poisoning incident. It is not uncommon for CO incidents involving one or more fatalities to also result in one or more non-fatal CO poisoning injuries, but they were not quantified for analysis in this report. It should be noted that these are the incidents reported in CPSC databases and do not represent the national estimates of fatalities per CO incident. Death certificates do not include information about other fatalities for the same incident. The number of fatalities for a particular incident are based on CPSC In-Depth Investigation files and may include fatalities for which CPSC does not have death certificates. Some additional multiple fatality incidents were identified by matching date of death and location of death on death certificates.

**Table 5**  
**Number of Carbon Monoxide Poisoning Incidents Reported to CPSC**  
**By Number of Deaths Per Incident, 1999-2004.**

Number of Deaths Reported in Incident	2002-2004 <sup>+</sup>		Annual Incidents					
	Annual Average	Average Percent	1999	2000	2001	2002	2003 <sup>+</sup>	2004 <sup>+</sup>
<b>Total Incidents</b>	<i>125</i>	<i>100%</i>	<b>79</b>	<b>104</b>	<b>89</b>	<b>131</b>	<i>122</i>	<i>121</i>
1	<i>100</i>	<i>80%</i>	64	82	72	103	97	99
2	<i>20</i>	<i>16%</i>	14	19	15	23	22	14
3	<i>3</i>	<i>2%</i>	*	2	2	1	2	7
4	<i>1</i>	<i>1%</i>	1	*	*	2	*	1
5 or more	<i>1</i>	<i>1%</i>	*	1	*	2	1	*

+ Data collection is incomplete for 2003 and 2004. Italicized incident data for these years may change in the future.

\* No incident reports received by CPSC staff for this time period.

Source: U.S. Consumer Product Safety Commission / EPHA.

CPSC Death Certificate File, CPSC In-Depth Investigation File, CPSC Injury or Potential Injury Incident File, 1999 - 2004.

Note 1: Reported average percentages by product may not add to total due to rounding.

Note 2: Data in Table 5 do not add to totals presented in Table 1. Data presented in Table 5 are not national estimates derived from the NCHS totals, but reported deaths contained in the CPSC files. NCHS data do not contain enough detail to identify multiple victims of the same CO poisoning incident. These figures include fatalities reported in CPSC In-Depth Investigation files for which CPSC may not have a death certificate.

Table 6 shows that in 2003 and 2004, an estimated 230 CO poisoning deaths occurred in homes, including manufactured and mobile homes. From 2002-2004, an annual average of 72 percent of CO poisoning deaths occurred in homes, including manufactured and mobile homes. In 2003 and 2004, an estimated 45 deaths took place in temporary shelters, such as tents, recreational vehicles, cube vans, seasonal cabins, and trailers (including horse trailers). In 2002-2004, an annual average of 17 percent of CO poisoning deaths took place in temporary shelters. In 2003 and 2004, 25 of the 45 estimated deaths in temporary shelters were most commonly associated with portable gas or LP gas heating or cooking appliances. Generator usage in a temporary shelter was the second largest product category with an estimated 11 deaths in 2003 and 2004. Other scenarios included charcoal and charcoal grills, LP gas lanterns, kerosene heaters and a kerosene cooker. A consistently small percentage of deaths occurred in passenger vans, trucks, or automobiles in which victims were spending the night. For 2003 and 2004, of the estimated 13 CO fatalities in this category, nine were associated with portable LP gas heaters.

**Table 6**  
**Estimated Non-Fire Carbon Monoxide Poisoning Deaths by Location of Death,**  
**1999-2004.**

Location of Death	2002-2004 <sup>+</sup>		Annual Estimate					
	Average Estimate	Average Percent	1999	2000	2001	2002	2003 <sup>+</sup>	2004 <sup>+</sup>
<b>Total</b>	<b><i>166</i></b>	<b><i>100%</i></b>	<b><i>109</i></b>	<b><i>137</i></b>	<b><i>122</i></b>	<b><i>181</i></b>	<b><i>154</i></b>	<b><i>162</i></b>
Home	<i>119</i>	<i>72%</i>	60	88	85	128	<i>110</i>	<i>120</i>
Temporary Shelter	28	<i>17%</i>	35	34	24	39	23	22
Auto	7	<i>4%</i>	7	2	10	8	8	5
Other	<i>10</i>	<i>6%</i>	7	13	3	5	<i>10</i>	<i>15</i>
Unknown	<i>1</i>	<i>1%</i>	*	*	*	2	2	*

+ Data collection is incomplete for 2003 and 2004. Italicized estimates may change in the future.

\* No reports received by CPSC staff.

Source: U.S. Consumer Product Safety Commission / EPHA.

CPSC Death Certificate File, CPSC In-Depth Investigation File, CPSC Injury or Potential Injury Incident File, National Center for Health Statistics Mortality File, 1999 - 2004.

Note: Reported average percentages by product may not add to total due to rounding.

CPSC data indicate that there were more CO fatalities in the colder months than there were in the warmer months. This is most likely because of the use of furnaces and portable heaters in the colder months. Additionally, generators may be used in the winter months because of power outages due to snow and ice storms. Table 7 shows the annual estimated CO fatalities categorized by month of death for the six years covered by this report. In 2003 and 2004, 196 of the 316 estimated CO fatalities (62%) occurred during the colder months of November, December, January and February. In the transition months of March, April, September and October, an estimated 79 fatalities occurred (25%) and in the warmer months of May, June, July and August, an estimated 40 fatalities occurred (13%).

**Table 7**  
**Estimated Non-Fire Carbon Monoxide Poisoning Deaths by**  
**Month of Year of the Fatality, 1999-2004.**

Location of Death	2002-2004 <sup>+</sup>		Annual Estimate					
	Average Estimate	Average Percent	1999	2000	2001	2002	2003 <sup>+</sup>	2004 <sup>+</sup>
<b>Total</b>	<b>166</b>	<b>100%</b>	<b>109</b>	<b>137</b>	<b>122</b>	<b>181</b>	<b>154</b>	<b>162</b>
<b>Cold Months</b>	<b>96</b>	<b>58%</b>	<b>60</b>	<b>88</b>	<b>87</b>	<b>93</b>	<b>95</b>	<b>101</b>
November	27	17%	7	28	14	27	32	22
December	27	17%	16	32	23	26	29	25
January	25	16%	28	17	28	20	22	34
February	17	11%	9	11	22	20	12	20
<b>Transition Months</b>	<b>50</b>	<b>30%</b>	<b>31</b>	<b>31</b>	<b>30</b>	<b>69</b>	<b>37</b>	<b>42</b>
March	16	10%	17	9	5	30	8	11
April	10	6%	2	3	13	9	12	8
September	9	6%	6	7	5	4	8	14
October	15	9%	6	12	7	26	9	9
<b>Warm Months</b>	<b>19</b>	<b>11%</b>	<b>18</b>	<b>18</b>	<b>7</b>	<b>19</b>	<b>20</b>	<b>20</b>
May	3	2%	3	7	5	4	3	3
June	7	4%	5	3	*	5	7	8
July	4	3%	5	5	*	2	6	5
August	5	3%	5	3	2	8	4	4

+ Data collection is incomplete for 2003 and 2004. Italicized estimates may change in the future.

\* No reports received by CPSC staff.

Source: U.S. Consumer Product Safety Commission / EPHA.

CPSC Death Certificate File, CPSC In-Depth Investigation File, CPSC Injury or Potential Injury Incident File, National Center for Health Statistics Mortality File, 1999 - 2004.

Note: Reported average percentages by product may not add to total due to rounding.

## Appendix A: Methodology

This appendix describes the data sources and methodology used to compute the national estimate of non-fire carbon monoxide (CO) poisoning deaths associated with the use of consumer products and the estimates by product, victim age, and incident location.

All death certificates filed in the United States are compiled by the National Center for Health Statistics (NCHS) into a multiple cause of mortality data file. The NCHS Mortality File contains demographic and geographic information, as well as the International Statistical Classification of Diseases and Related Health Problems codes for the underlying cause of death. Data are compiled in accordance with the World Health Organization instructions, which request that member nations classify causes of death by the current Manual of the International Statistical Classification of Diseases and Related Health Problems. The International Classification of Diseases, Tenth Revision (ICD-10) was implemented in 1999. Although the NCHS data contain cause of death codes that are helpful in identifying deaths due to CO poisoning, the data do not contain any narrative information that might indicate the involvement of a consumer product.

To complement the NCHS mortality data, the CPSC staff purchases death certificates from the 50 states, the District of Columbia, and New York City. Specifically, the CPSC staff purchases death certificates with certain cause of death codes for which there is a high probability that consumer products are involved. In addition to the cause of death codes and demographic and geographic information, the death certificate contains information about the incident location and a brief narrative describing the incident. Any references to consumer products are usually found in these narratives. The CPSC staff conducts follow-up in-depth investigations on selected deaths to confirm and expand upon the involvement of consumer products, as resources allow.

ICD-10 classifies deaths associated with CO poisoning with the codes listed below. The focus of this report is unintentional CO poisoning deaths and concentrates on those deaths coded as X47 and Y17. That is, code X67 records of intentional CO poisonings are excluded from this analysis.

ICD-10 Code	Definition
X47	<b>Accidental</b> Poisoning by and exposure to other gases and vapors. Includes: carbon monoxide, lacrimogenic gas, motor (vehicle) exhaust gas, nitrogen oxides, sulfur dioxide, utility gas
X67	<b>Intentional</b> Poisoning by and exposure to other gases and vapors. Includes: carbon monoxide, lacrimogenic gas, motor (vehicle) exhaust gas, nitrogen oxides, sulfur dioxide, utility gas
Y17	<b>Undetermined intent</b> Poisoning by and exposure to other gases and vapors. Includes: carbon monoxide, lacrimogenic gas, motor (vehicle) exhaust gas, nitrogen oxides, sulfur dioxide, utility gas

The first step in compiling the annual estimates is computing the total estimates of CO poisoning deaths associated with consumer products. The CPSC's Death Certificate (DTHS)

File and the CPSC's Abbreviated Death Certificate (ABDT) File were both searched for cases associated with ICD-10 codes X47 and Y17.

Each death found in the CPSC's Death Certificate File and coded as X47 and Y17 was reviewed by an analyst and categorized as in-scope, out-of-scope, or whether the source of the CO was unknown or questionable. In-scope cases are unintentional non-fire CO poisoning deaths associated with a consumer product under the jurisdiction of the CPSC. Out-of-scope cases are cases that involve CO sources that are not under the jurisdiction of the CPSC (including motor vehicle exhaust cases), fire or smoke-related exposures, or intentional CO poisonings. Examples of out-of-scope cases include poisonings due to gases other than CO (i.e., natural gas, ammonia, butane), motor vehicle exhaust- or boat exhaust-related poisonings, and work-related exposures. The source of CO was classified as unknown or questionable in cases where a consumer product was possibly associated with the incident but the exact source of CO was unknown.

Deaths found in the CPSC's Abbreviated Death Certificate (ABDT) File are categorized as out-of-scope cases. The ABDT File contains death certificates for CO poisonings (X47 and Y17) that involve motor vehicle exhaust, cases where the source of the CO is unknown, or where the death certificate does not mention a consumer product. Other examples of out-of-scope cases that may appear in the abbreviated file are cases associated with farm accidents, smoke inhalation from a structural fire, or other gas poisonings. Occasionally, newer information from CPSC In-Depth Investigations may be matched with ABDT cases which were classified as having no known source or did not mention a consumer product. In the cases where the CPSC IDIs indicate the CO source was from a consumer product and should be considered in-scope, it was assumed that the death certificate was misclassified and the ABDT File was included with the DTHS database files.

In previous years, a small number of cases (three deaths in 1999 and two deaths in 2000) in the ABDT File were identified as in-scope based on further information collected during in-depth investigations. The method used to identify those 1999 and 2000 cases is found in Appendix A of the 1999 and 2000 Annual Estimate Report (Vagts, 2001). For 2001 data, no ABDT File cases were reclassified as in-scope based on additional information. For the 2002 data, additional information on one incident in the ABDT File resulted in the incident being reclassified as in-scope. This fatality was not included in the NCHS file. Since the incident was not included in the NCHS data, it was also removed from the ABDT File and thus not used in calculations for the weights. For the 2003 data, there were seven reclassified in-scope cases in the ABDT File and five in 2004.

The results of the initial categorization for 2003 data are found in the table below.

ICD-10 Code	NCHS Total	DTHS File				Total in ABDT File	Total in CPSC Database (ABDT + DTHS)
		In-scope	Unknown Source	Out-of-Scope	Total		
<b>X47</b>	633	152	9	245	406	228	634
<b>Y17</b>	89	0	2	38	40	37	77
<b>Total</b>	<b>722</b>	<b>152</b>	<b>11</b>	<b>283</b>	<b>446</b>	<b>265</b>	<b>711</b>

Source: U.S. Consumer Product Safety Commission / EPHA.  
 CPSC Death Certificate File, CPSC In-Depth Investigation File, Abbreviated Death Certificate File, National Center for Health Statistics Mortality File, 2003.

The results of the initial categorization for 2004 data are found in the table below.

ICD-10 Code	NCHS Total	DTHS File				Total in ADBT File	Total in CPSC Database (ABDT + DTHS)
		In-scope	Unknown Source	Out-of-Scope	Total		
<b>X47</b>	566	148	24	202	374	171	545
<b>Y17</b>	86	1	6	36	43	35	78
<b>Total</b>	<b>652</b>	<b>149</b>	<b>30</b>	<b>281</b>	<b>411</b>	<b>206</b>	<b>625</b>

Source: U.S. Consumer Product Safety Commission / EPHA.  
 CPSC Death Certificate File, CPSC In-Depth Investigation File, Abbreviated Death Certificate File,  
 National Center for Health Statistics Mortality File, 2004.

The proportion of death certificates found in the CPSC database associated with non-fire accidental X47 or Y17 deaths and associated with consumer products was applied to the NCHS totals to calculate the total estimated number of non-fire CO poisoning deaths associated with consumer products. In theory, the NCHS totals comprise all death certificates in the U.S. and the same proportion of in-scope cases should exist in the death certificates that are missing from the combined CPSC Death Certificate and Abbreviated Death Certificate files. Applying the proportion of in-scope cases to the NCHS database totals should, therefore, provide an estimate on in-scope cases nationwide. This was done in the following way and was done for ICD-10 codes X47 and Y17 separately.

1. The number of in-scope deaths in the CPSC's Death Certificate File coded as X47 and Y17 separately that were associated with an accidental non-fire CO poisoning and a consumer product were identified ( $n_1$ ).
2. The total number of deaths in the CPSC's Death Certificate File and the Abbreviated Death Certificate File coded as X47 and Y17 were summed separately excluding cases with an unknown or highly questionable source ( $n_2$ ).
3. The total number of deaths in the NCHS data associated with X47 and Y17 was counted ( $n_3$ ).
4. The estimate of the number of non-fire CO poisoning deaths associated with consumer products in codes X47 and Y17 was calculated separately using the formula:

$$N = (n_1 / n_2) * n_3$$

The proportion ( $n_1/n_2$ ) represents the number of in-scope cases found in the CPSC's files divided by the total of in-scope and out-of-scope cases.

5. The estimates of the number of non-fire CO poisoning deaths associated with consumer products in codes X47 and Y17 were summed to calculate the total estimate of non-fire CO poisoning deaths.

$$\text{Total Estimate} = N_{X47} + N_{Y17}$$

The ratio ( $n_3/n_2$ ) represents the weighting factor used to calculate the annual estimates. The CPSC's Death Certificate File does not contain death certificates for all deaths listed in the



NCHS file; therefore a weighting factor was calculated to account for those death certificates that are missing. The weighting factor allows the computation of national estimates of CO deaths by consumer products and by other characteristics collected by CPSC about each death.

The following table contains the values for the variables used in the calculation as well as the final computed 2003 estimate of non-fire CO poisoning deaths associated with consumer products.

Variable	ICD-10 Code	
	X47	Y17
$n_1$	152	0
$n_2$	$634-9 = 625$	$77-2 = 75$
$n_3$	633	89
<i>Weighting Factor</i> ( $n_3/n_2$ )	<i>1.0128</i>	<i>1.1867</i>
N	153.9456	0
<b>Total Estimate</b>	<b><math>153.9456 + 0 = 153.9456 \sim 154</math></b>	

Source: U.S. Consumer Product Safety Commission / EPHA.  
 CPSC Death Certificate File, CPSC In-Depth Investigation File, Abbreviated Death Certificate File,  
 National Center for Health Statistics Mortality File, 2003.

The following table contains the values for the variables used in the calculation as well as the final computed 2004 estimate of non-fire CO poisoning deaths associated with consumer products.

Variable	ICD-10 Code	
	X47	Y17
$n_1$	148	1
$n_2$	$545-24 = 521$	$78-6 = 72$
$n_3$	566	86
<i>Weighting Factor</i> ( $n_3/n_2$ )	<i>1.0864</i>	<i>1.1944</i>
N	160.7831	1.1944
<b>Total Estimate</b>	<b><math>160.7831 + 1.1944 = 161.9775 \sim 162</math></b>	

Source: U.S. Consumer Product Safety Commission / EPHA.  
 CPSC Death Certificate File, CPSC In-Depth Investigation File, Abbreviated Death Certificate File,  
 National Center for Health Statistics Mortality File, 2004.

The table below shows the weighting factors used to calculate the estimates for the years 1999-2004.

Year	NCHS Total	Total in CPSC Databases*	In-Scope Cases	Weighting Factor
<b>1999</b>				
X47	542	469	93	1.1557
Y17	80	66	1	1.2121
<b>2000</b>				
X47	600	551	125	1.0889
Y17	76	70	1	1.0857
<b>2001</b>				
X47	596	520	103	1.1462
Y17	79	62	3	1.2742
<b>2002</b>				
X47	642	599	169	1.0718
Y17	71	61	0	1.1639
<b>2003</b>				
X47	633	625	152	1.0128
Y17	89	75	0	1.1867
<b>2004</b>				
X47	566	521	148	1.0864
Y17	86	72	1	1.1944

\* This is the total number of deaths in the Death Certificate File and Abbreviated Death Certificate File, excluding deaths associated with an unknown or questionable source of CO. Totals for 1999 through 2002 have been updated.

Source: U.S. Consumer Product Safety Commission / EPHA.  
 CPSC Death Certificate File, CPSC In-Depth Investigation File, Abbreviated Death Certificate File, National Center for Health Statistics Mortality File, 1999-2004.

Incidents with unknown or highly questionable CO sources were excluded from the denominator of the weighting factor. The group of cases with unknown or highly questionable sources was assumed to contain the same proportion of cases associated with a consumer product as the group of cases within the CPSC database with known CO sources (this is the same assumption that is made for those cases where the death certificate is missing). To include these cases within the denominator assumes that these cases can be classified as in-scope or out-of-scope when actually their scope status is unknown. Therefore, for weighting purposes, cases where the source was unknown or highly questionable were treated in the same way as missing cases were treated.

In-scope cases were further examined to determine which product was associated with the incident. Further information on the CO deaths was obtained from review of the CPSC's In-Depth Investigation File.

Reports of non-fire CO poisoning deaths were retrieved from the DTHS and ABDT files based on the following criteria: date of death between 1/1/99 and 12/31/04 and ICD-10 code of

X47 or Y17. Death certificates entered into CPSC's database prior to March 30, 2007 were included in this analysis. Each CO death was reviewed and coded by the author according to the consumer product and type of fuel involved, incident location, and whether multiple deaths resulted in the same incident, whenever possible. If information about the product's condition, venting system, or installation environment was provided in the in-depth investigation report, this information was coded for informational purposes.

In Table 1 of this report, the heating systems category combined CO poisoning fatalities from furnaces, boilers, vented floor and wall heaters, unvented space heaters, camping heaters, and other miscellaneous heating systems. Deaths associated with charcoal being burned alone and in the absence of an appliance (e.g., in a pail or in the sink) were presented with charcoal grills, even though this practice was usually done for heating purposes. Examples of products historically included in the 'other' category include LP gas refrigerator and gas pool heater. LP gas grill, LP fish cooker and other LP gas portable cooking appliance incidents are classified in the camp stove and lanterns category from 1999 to 2004. Deaths where multiple fuel-burning products were used simultaneously such that a single source of the fatal CO could not be determined were classified under other/multiple appliances. Engine-driven tools included generators and power gardening equipment, such as power lawn mowers, garden tractors, concrete cutters and snowblowers. Generators that were original equipment installed on a recreational vehicle (RV), trailer, camper, or boat were considered out-of-scope, as they are outside the jurisdiction of the CPSC.

**Appendix B: National Estimates of Consumer Product-Related CO Poisoning Deaths, 1980 - 2004**

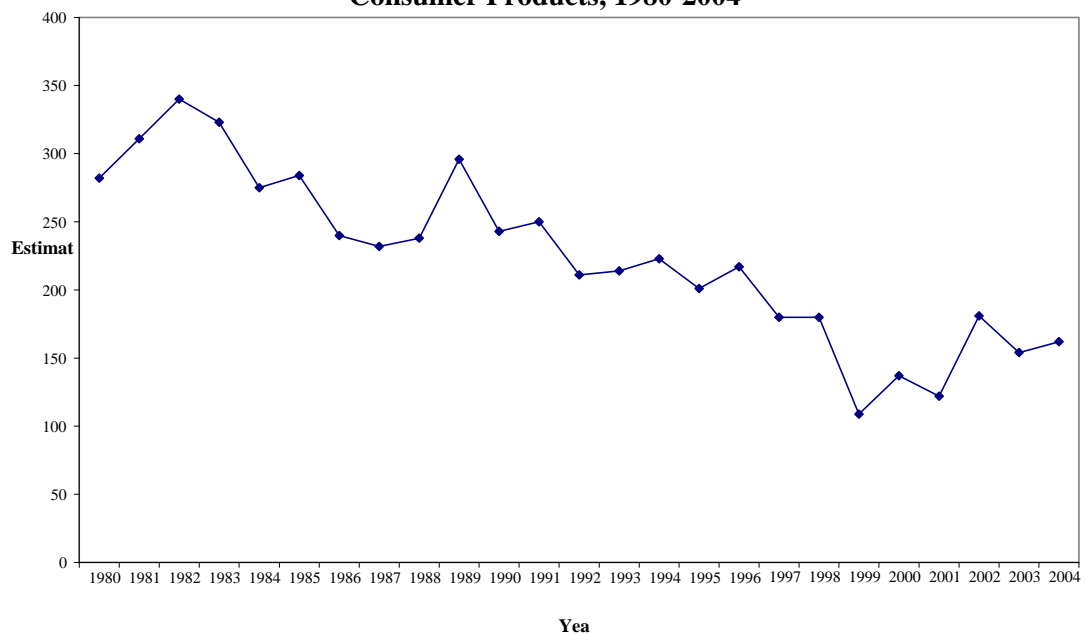
**Estimated Non-Fire Carbon Monoxide Poisoning Deaths  
Associated with Consumer Products, 1980-2004**

Year	Estimate
1980	282
1981	311
1982	340
1983	323
1984	275
1985	284
1986	240
1987	232
1988	238
1989	296
1990	243
1991	250
1992	211
1993	214
1994	223
1995	201
1996	217
1997	180
1998	180
1999*	109
2000	137
2001	122
2002	181
2003	154
2004	162

\* The Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) was implemented.

Source: U.S. Consumer Product Safety Commission / EPHA.

**Figure 1: Estimated Non-Fire CO Poisoning Deaths Associated with Consumer Products, 1980-2004**



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