

UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
WASHINGTON, DC 20207

BALLOT VOTE SHEET

DATE: AUG - 8 2006

TO: The Commission  
Todd A. Stevenson, Secretary

THRU: Patricia M. Semple, Executive Director *PS*

FROM: Page C. Faulk, General Counsel *PC*  
Jeffrey R. Williams, Assistant General Counsel  
Barbara E. Parisi, Attorney *BEP*

SUBJECT: Portable Generators: Notice of Proposed Rulemaking

BALLOT VOTE DUE: AUG 15 2006

The Office of General Counsel recommends that the Commission issue a notice of proposed rulemaking ("NPR") regarding labeling requirements for portable generators. A draft *Federal Register* notice and staff briefing package are attached.

Please indicate your vote:

- I. Approve the attached draft *Federal Register* notice without change.

\_\_\_\_\_  
Signature Date

- II. Approve the attached draft *Federal Register* notice with the following changes.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Signature Date

CPSC Hotline: 1-800-638-CPSC(2772)  CPSC's Web Site: <http://www.cpsc.gov>

**NOTE: This document has not been reviewed or accepted by the Commission.**  
Initial *rh* Date 8/8/06

III. Do not approve the attached draft *Federal Register* notice.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



UNITED STATES  
 CONSUMER PRODUCT SAFETY COMMISSION  
 WASHINGTON, DC 20207

Memorandum

Date: AUG - 8 2006

TO : The Commission  
 Todd Stevenson, Secretary

THROUGH: Page Faulk, General Counsel  
 Patricia Semple, Executive Director

FROM : Jacqueline Elder, Assistant Executive Director for Hazard Identification and Reduction  
 Janet Buyer, Directorate for Engineering Sciences, Project Manager

SUBJECT : Portable Generators: Notice of Proposed Rulemaking

The Office of General Counsel is forwarding to the Commission under separate cover a draft Notice of Proposed Rulemaking (NPR) concerning portable generators. The U.S. Consumer Product Safety Commission (CPSC) staff prepared this draft NPR in response to Chairman Stratton's October 12, 2005 memorandum directing the staff to conduct a thorough review of the status of portable generator safety in light of carbon monoxide (CO) deaths and injuries attributable to the consumer use of portable generators.

In the NPR, the staff proposes that manufacturers be required to label portable generators with a warning label that would include pictograms and inform purchasers of the following: "Using a generator indoors will kill you in minutes;" "Exhaust contains carbon monoxide, a poison gas you cannot see or smell;" "Never use in the home or in partly enclosed areas such as garages;" "Only use outdoors and far from open windows, doors, and vents." The following supporting documentation by the staff is also provided with the NPR: a discussion of the rationale behind the content and formatting of the proposed label (TAB A), an overview of the economic issues related to the proposed requirement for a label (TAB B), and generator-related CO poisoning death data reported to CPSC from 1990 through 2005 (TAB C).

The staff believes the label will help reduce the rising CO death toll associated with consumer use of portable generators. The staff recommends that the Commission issue the NPR for a seventy-five day comment period.

CPSC FORM 101 (10/05) PUBLIC  
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CPSC Hotline: 1-800-638-CPSC (2772) ★ CPSC's Web Site: <http://www.cpsc.gov>  
 NOTE: This document has not been reviewed or accepted by the Commission.  
 Initial rh Date 8/8/06

## TABS

- TAB A Memorandum from Timothy P. Smith, Engineering Psychologist, Division of Human Factors, Directorate for Engineering Sciences, to Janet L. Buyer, Project Manager, Division of Combustion and Fire Sciences, Directorate for Engineering Sciences, "Product labels for generators to address carbon monoxide poisonings," May 26, 2006.
- TAB B Memorandum from Robert Franklin, Economist, Directorate for Economic Analysis, to Janet Buyer, Project Manager, Portable Generator Project, Directorate for Engineering Sciences, "Economic Issues Related to a CO Warning Label on Portable Generators," July 19, 2006.
- TAB C Memorandum from Natalie E. Marcy, Mathematical Statistician, Division of Hazard Analysis, Directorate of Epidemiology, and Debra S. Ascone, Mathematical Statistician, Division of Hazard Analysis, Directorate for Epidemiology, to Janet Buyer, Project Manager, Division of Combustion and Fire Sciences, Directorate for Engineering Sciences, " Incidents, Deaths, and In-Depth Investigations Associated with Carbon Monoxide from Engine-Driven Generators and Other Engine-Driven Tools, 1990-2004," December 1, 2005.
- Memorandum from Robin L. Ingle, Health Statistician, Division of Hazard Analysis, Directorate for Epidemiology, to Janet Buyer, Project Manager, Division of Combustion and Fire Sciences, Directorate for Engineering Sciences, "Non-fire Carbon Monoxide Fatalities Associated with Engine-Driven Generators and Other Engine-Driven Tools in 2004 and 2005," January 13, 2006.

# TAB A



UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
WASHINGTON, DC 20207

MEMORANDUM

DATE: May 26, 2006

TO: Janet L. Buyer, Project Manager, Generator Project,  
Division of Combustion and Fire Sciences, Directorate for Engineering Sciences

THROUGH: Hugh M. McLaurin, Associate Executive Director, *HMM*  
Directorate for Engineering Sciences

Robert B. Ochsman, Ph.D., CPE, Director, *BO*  
Division of Human Factors, Directorate for Engineering Sciences

FROM: Timothy P. Smith, Engineering Psychologist, *TS*  
Division of Human Factors, Directorate for Engineering Sciences

SUBJECT: Product labels for generators to address carbon monoxide poisonings

BACKGROUND

On October 12, 2005, Chairman Hal Stratton directed the staff of the U.S. Consumer Product Safety Commission (CPSC) to undertake a thorough review of the status of portable generator safety (Stratton, 2005). As part of this review, Chairman Stratton requested that the staff address the sufficiency of warning labels to address the carbon monoxide (CO) poisoning hazard posed by portable generators that are used within or near residences.

Prior to Chairman Stratton's request, the staff from the CPSC Division of Human Factors had written two previous memoranda related to CO poisonings, product labels, and engine-driven tools such as portable generators. One memorandum, from 2002, discussed the potential effectiveness of product labels and instruction manuals in addressing the carbon monoxide (CO) poisoning hazard associated with engine-driven tools and identified changes that might improve their effectiveness (Smith, 2002). The following year, the Human Factors staff proposed specific recommendations for warning language to accompany generators and other engine-driven tools (Smith, 2003). The current memorandum summarizes the Human Factors staff's new recommendations for a product label to be affixed to portable generators to address the CO poisoning hazard.<sup>1</sup> The staff included this label in its comments to Underwriters Laboratories (UL) for its Outline of Investigation, which was published in April 2006.

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<sup>1</sup> These comments are those of the CPSC staff and have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

## DISCUSSION

The product label recommended by the Human Factors staff appears in Figure 1. A discussion of the reasoning behind the content and formatting of the label, to the extent that it differs from what was recommended in the 2003 Smith memorandum, follows.

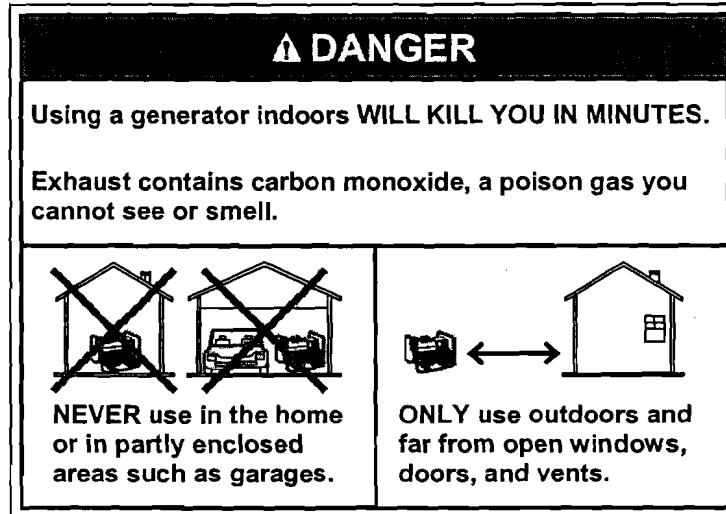


FIGURE 1. Recommended product label.

## THE HAZARD AND ITS CONSEQUENCES

The label originally recommended by the Human Factors staff (see Figure 2) was designed so it could also be applied to engine-driven tools other than generators (Smith, 2003). The wording of the label, therefore, was intentionally written in a more general or generic form. The new staff-recommended label is intended for generators only and, therefore, specifically identifies generators within the label. The Human Factors staff recommends that the product label include a description not just of the hazard (CO), but of the primary hazard pattern associated with CO-poisoning deaths. Both the staff's original label (Figure 2) and the label prepared by the UL STP as of December 2005 (Figure 3) identify the immediate hazard of CO and its consequences, but fail to describe the usage pattern that often leads to death. The available incident data shows that

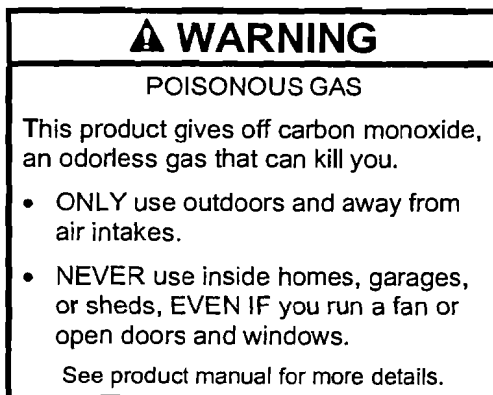


FIGURE 2. Original label from CPSC staff.

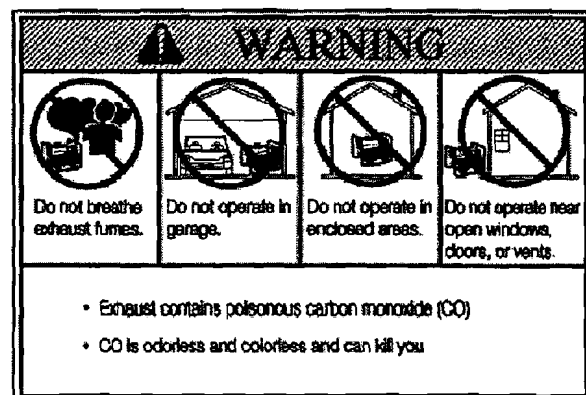


FIGURE 3. Label from UL STP.

indoor use of a generator is both the primary hazard pattern and is the hazard pattern most likely to lead to death. Although one might infer this from the hazard-avoidance recommendations within the label, starting the label with an explicit and succinct description of the hazard pattern would quickly provide consumers with a better understanding of the primary scenario that could lead to death. Research indicates that information about hazard scenarios affects consumers' risk judgments (Hendrickx, Vlek, & Oppewal, 1989), so the Human Factors staff believes that including this information would be highly beneficial.

The Human Factors staff also recommends that the label emphasize the imminence of the hazard. This piece of information is often lacking in CO-poisoning labels and is unlikely to be obvious to consumers. Additionally, consumers are more likely to comply with a warning about an imminent hazard since imminence tends to increase the perceived threat associated with a hazard (Gass & Seiter, 1999). The phrase "in minutes" should provide consumers with a better understanding of the speed with which incapacitation can occur.

Lastly, the staff recommends the use of the phrase "you cannot see or smell" rather than terms such as "odorless" and "colorless," which may be less familiar and understandable to some consumers. The term "colorless," in particular, could be misinterpreted as meaning that it is lacking a color other than that usually associated with exhaust or smoke. The phrase "you cannot see" is less likely to lead to critical confusion.

#### HAZARD AVOIDANCE

In its original proposal, the Human Factors staff recommended identifying in the label specific locations where a generator should not be used: homes, garages, and sheds (Smith, 2003). The label prepared by the UL STP as of December 2005 specifically warned against the use of generator in a garage, but did not identify other locations; it did, however, warn against the use of a generator in "enclosed areas." The Human Factors staff believes that this portion of the STP label is inadequate because it implies that a generator is only hazardous when used within a *fully* enclosed area or garage. The staff does agree, however, that the use of a more wide-reaching phrase such as "partly enclosed" could be useful in broadening the perceived range of potentially dangerous areas in which to operate a generator. The staff, therefore, recommends that the label warn specifically against use in the home and in garages, since these are known places in which consumers use generators, but that the label also refer to partly enclosed areas, as in "NEVER use in the home or in partly enclosed areas such as garages." The accompanying pictograms (see Figure 1) are based on the pictograms developed by the UL STP. Research shows that labels with pictograms tend to capture a consumer's attention more readily than a label without pictograms (Wogalter & Laughery, 2005; Wogalter & Leonard, 1999).

The Human Factors staff recommends that the pictograms use prohibition "X"s rather than circle-slash prohibition symbols. Both the circle-slash and "X" symbols are commonly recognized as conveying the prohibition concept (Dreyfuss, 1972; Wogalter & Leonard, 1999), and the ANSI Z535 series of standards generally recommends the use of a circle-slash symbol. However, the results of charcoal-pictogram testing previously performed for the CPSC found that some non-English-reading consumers did not understand the meaning of the circle-slash symbol but did understand the meaning of prohibition "X" symbols (Requirements for Labeling of Retail Containers of Charcoal, 1996). Additionally, there is no evidence that English-reading



consumers would have difficulty understanding the meaning of a prohibition “X” symbol (Freeman & Wogalter, 2001). Thus, to improve the likelihood of comprehension by all consumers, the staff prefers the use of “X” symbols to convey prohibition except in cases in which a circle-slash symbol would render the prohibited act more understandable; for example, because it does not cover or obscure critical details of the underlying pictogram as much as an “X” symbol. In keeping with ANSI Z535.4 – 2002, the staff recommends that the “X” symbol be in safety red.

As before (Smith, 2003), the Human Factors staff continues to recommend that the CO poisoning label include a prescriptive, or positive action that consumers can take to avoid the hazard rather than focusing exclusively on prohibited behaviors, or what consumers should *not* do. This is consistent with the requirements of ANSI Z535.4 – 2002, and warning design guidelines commonly recommend that hazard-avoidance statements explicitly describe appropriate actions to be taken (for example; Wogalter, Conzola, & Smith-Jackson, 2002; Wogalter and Laughery, 2005). More importantly, a warning that focuses exclusively on prohibited behaviors forces the consumer to infer the appropriate behavior from what they are told not to do. Not only are messages that “fill in the blanks” more persuasive than messages that do not (Stiff & Mongeau, 2003), but forcing consumers to infer the appropriate behavior could result in consumers using the generator in unanticipated ways that, while not specifically prohibited in the label, still expose consumers to the hazard. The staff, therefore, recommends that consumers be told to use the generator outdoors only and far from open windows, doors, and vents.

The pictogram that accompanies this message (see Figure 1) is based on the other pictograms in the label, but has been designed to show the concept of keeping the generator away from the home; the use of a double arrow to indicate keeping a safe distance is consistent with ANSI Z535.3 – 2002. The UL STP label, in contrast, tells consumers to not operate the generator near open windows, doors, and vents, and includes a pictogram of a generator near the home with a prohibition symbol over the generator and home (see Figure 3). The danger of the UL STP pictogram is that someone who is rushed or is not English-literate could easily misinterpret the pictogram as meaning that the generator should not be used outside, which is precisely opposite the desired behavior.

Smith (2003) originally suggested that manufacturers consider the use of the hazardous gas/vapors pictogram, which shows a profile view of a person breathing poisonous gas (see Figure 4), but expressed reservations about the use of this pictogram since the gas in the pictogram is visible and carbon monoxide is not. The Human Factors staff continues to be concerned about this possibility and, because other pictograms have been developed that convey the desired information, does not recommend the use of this pictogram in the label. The UL STP label includes a version of this pictogram, and raises another potential problem with its use. The hazardous gas pictogram is commonly used alone, yet the modified version used in the STP label includes an overlying prohibition symbol (see Figure 3). Although the

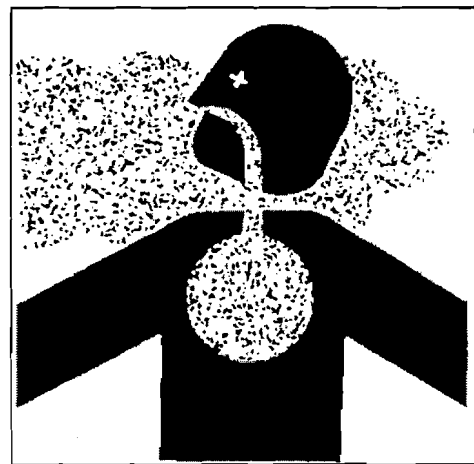


FIGURE 4. Hazardous gas/vapors pictogram.

hazardous gas pictogram may be understood by many consumers, it is unclear how one with an overlying prohibition symbol would be understood. Those who are familiar with the hazardous gas pictogram may have special difficulties due to negative transfer (Leonard, Otani, & Wogalter, 1999). For example, these consumers may be critically confused by the combined pictogram and prohibition symbol since the combination, by definition, should convey the opposite message as the pictogram without an overlying prohibition symbol.

#### HAZARD SEVERITY

The staff originally recommended that the label use the signal word WARNING (Smith, 2003), but now recommends the use of the signal word DANGER. Although the presence of carbon monoxide in generator exhaust, on its own, could lead to death or serious injury, indoor use of generators—the hazard scenario specifically identified in the label—would almost certainly result in death or serious injury. The key issue, therefore, is the hazard scenario or situation identified in the label, not the hazard itself. This is consistent with the process through which one should select an appropriate signal word. For example, ANSI Z535.4 – 2002 states that product safety labels are classified using DANGER, WARNING, and CAUTION based on the relative seriousness of the “hazard *situation*” (Section 5.1, emphasis mine), and defines DANGER as an imminently “hazardous *situation* which, if not avoided, will result in death or serious injury” (Section 4.13.1, emphasis mine). The staff has also found that some generator manufacturers are already using DANGER on CO-poisoning labels for generators.

In keeping with the switch from WARNING to DANGER, the Human Factors staff also recommends that the signal word panel be changed from black text on an orange background to white text on a red background. This change is consistent with the colors recommended for DANGER by ANSI Z535.4 – 2002, and red is commonly viewed as indicating a more hazardous situation than orange or yellow (Leonard, Otani, & Wogalter, 1999). Some generator manufacturers are already using red rather than orange even when accompanied by the signal word “WARNING,” and using red will allow generator manufacturers to create the labeling using only three colors (white, black, and red) rather than four (white, black, orange, and red for the prohibition “X” symbols).

#### CONCLUSIONS

The Human Factors staff recommends the use of the label shown in Figure 1 to address the CO poisoning hazard associated with generators. The rationale behind the recommended label is described in detail within the *Discussion*, above.

#### REFERENCES

- American National Standard for product safety signs and labels* (ANSI Z535.4 – 2002). (2002). Rosslyn, VA: National Electrical Manufacturers Association.
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**TAB B**



UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
WASHINGTON, DC 20207

**Memorandum**

Date: July 19, 2006

TO : Janet Buyer  
Project Manager, Portable Generator Project  
Directorate for Engineering Sciences

THROUGH: Gregory B. Rodgers, Ph.D., Associate Executive Director, Directorate for Economic Analysis *GBR*

Deborah V. Aiken, Ph.D., Senior Staff Coordinator, Directorate for Economic Analysis *DVA*

FROM : Robert Franklin *RF*  
Economist  
Directorate for Economic Analysis

SUBJECT : Economic Issues Related to a CO Warning Label on Portable Generators

This memorandum provides an overview of the economic issues related to requiring portable generators to bear a label warning consumers of the risks of carbon monoxide (CO) poisoning. These issues include the potential benefits and costs of the warning label, the potential impact on small businesses, and the impact on the environment.

**Benefits**

Portable generators are powered by gasoline, diesel, or propane engines; and they exhaust CO. If the generator is used in enclosed or even partially enclosed spaces, the CO can very quickly build to hazardous levels. Serious injury can also result when the generator is placed outdoors, but near an open window or vent and the exhaust is pulled into a house. In the 6-year period from 2000 through 2005, CPSC staff is aware of at least 222 deaths related to CO poisoning associated with generators.<sup>1</sup> Non-fatal CO injuries can have serious consequences since permanent brain or neurological damage can result.

A well-designed warning label could inform the consumer of the CO hazard associated with generators and how to avoid the hazard while using the generator. A label placed in a

<sup>1</sup> Natalie E. Marcy and Debra S. Ascone, "Incidents, Deaths, and In-Depth Investigations Associated with Carbon Monoxide from Engine-Driven Generators and Other Engine-Driven Tools, 1990-2004," CPSC Memorandum to Janet Buyer, Directorate for Engineering Sciences, U.S. Consumer Product Safety Commission, Washington, DC (1 December 2005) and Robin L. Ingle, "Non-fire Carbon Monoxide Fatalities Associated with Engine-Driven Generators and Other Engine Driven Tools in 2004 and 2005," CPSC Memorandum to Janet Buyer, Directorate for Engineering Sciences, U.S. Consumer Product Safety Commission, Washington, DC (13 January 2006).

prominent position on the generator could reinforce this information each time the consumer used it. For example, the label recommended by the Consumer Product Safety Commission (CPSC) Human Factors staff reminds the consumer that generator exhaust contains CO, which cannot be seen or smelled, and can quickly kill. The label also clarifies that a generator should only be used outside and away from windows and vents and should not be used in partly enclosed spaces such as garages.<sup>2</sup> This information is important since some consumers have apparently been aware that a CO hazard was associated with generators, but believed that they would avoid the hazard by running the generator in a garage with the door open or outside the house, but did not understand that it was necessary to place it away from open windows and vents.<sup>3</sup>

## **Costs**

The costs of a warning label include the one-time cost of designing the label and the continuing costs of printing and applying the labels to the generators. These costs are expected to be low – less than one dollar per generator. Moreover, many generators already have warning labels regarding the CO hazard. Therefore, for some generators there would be few, if any, added costs since the required label would simply replace an existing label.

## **Impact on Small Businesses**

CPSC staff has identified more than 40 suppliers of generators to the U.S. consumer market. Although a few large firms dominate the market, a number of these suppliers are likely to be small businesses. The small businesses include firms that import generators from foreign manufacturers as well as equipment assemblers, which assemble generator sets from purchased components.

The small manufacturers will be responsible for ensuring that their generators are properly labeled. However, the labeling requirement is not expected to pose a significant burden to small businesses because the cost of adding the labels per generator is expected to be less than a dollar per generator set.

## **Environmental Impact**

Labeling requirements are not expected to have an adverse impact on the environment and are considered to be “categorical exclusions” for the purposes of the National Environmental Policy Act according to the CPSC regulations that cover its “environmental review” procedures (16 CFR § 1021.5(c)(2)).

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<sup>2</sup> Timothy P. Smith, “Product labels for generators to address carbon monoxide poisonings,” CPSC Memorandum to Janet L. Buyer, U.S. Consumer Product Safety Commission, Washington, DC (26 May 2006).

<sup>3</sup> Timothy P. Smith, “Human Factors Assessment for the Small Engine-Driven Tools Project,” CPSC Memorandum to Janet L. Buyer, U.S. Consumer Product Safety Commission, Washington, DC (18 June 2002).

**TAB C**



UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
WASHINGTON, DC 20207

Memorandum

Date: December 1, 2005

TO : Janet Buyer  
Project Manager, Division of Combustion and Fire Sciences  
Directorate for Engineering Sciences

THROUGH: Russell H. Roegner *RR*  
Associate Executive Director, Directorate for Epidemiology

FROM : Natalie E. Marcy *RR for NM*  
Mathematical Statistician, Division of Hazard Analysis  
Directorate for Epidemiology

Debra S. Ascone *RR for DA*  
Mathematical Statistician, Division of Hazard Analysis  
Directorate for Epidemiology

SUBJECT : Incidents, Deaths, and In-Depth Investigations Associated with Carbon  
Monoxide from Engine-Driven Generators and Other Engine-Driven  
Tools, 1990-2004

This memorandum summarizes carbon monoxide (CO) incidents from the Consumer Product Safety Commission (CPSC) databases that were associated with engine-driven generators and other engine-driven tools that occurred between 1990 and 2004.<sup>1</sup> Other engine-driven tools include tools such as power lawn mowers, garden tractors, portable pumps, power sprayers and washers, snow blowers, and floor buffers. This memorandum summarizes the characteristics of CO poisoning deaths and investigated incidents reported to CPSC associated with engine-driven tools. This memorandum also provides a more detailed summary of fatal CO poisoning incidents associated with engine-driven tools found in CPSC's In-depth Investigation (INDP) File.

The following CPSC databases were searched: the In-depth Investigation (INDP) File, the Injury or Potential Injury Incident (IPII) File, and the Death Certificate (DTHS) File. See Appendix A for the codes and keywords used in the database searches. It should be noted that reporting may not be complete, and this memorandum reflects only those incidents entered into CPSC databases before June 27, 2005. All CO incidents found during the database search that were associated with at least one CO fatality or a non-fatal exposure to CO that resulted in one or more individuals attending a medical facility for treatment were included. Appendix B provides a listing of the incidents referenced in this memorandum.

Twenty-two incidents associated with both an engine-driven tool and a non-engine driven tool source of CO (such as a gas space heater or water heater) were considered out of scope for this

<sup>1</sup> 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.



memo, since the exact source of the CO could not be determined.<sup>2</sup> Incidents associated with multiple engine-driven tools (such as a generator and a lawn mower) were included. Incidents associated with generators that were specifically reported as integral parts of recreational vehicles (RVs), motor homes, or boats were not included. For example, generators that were reported as mounted to the bottom of an RV were not included, nor were boat generators that were installed by the boat manufacturer. Since incidents in recreational vehicles and boats can be associated with either a portable generator or an integral generator, those incidents in which the type of generator was not specifically stated were excluded from the analysis. For one fatal incident in a boat and two separate fatal incidents in a motor home, CPSC staff could not specifically conclude that the generator was an integral part of the boat or motor home. In addition, a non-fatal incident in a camper and a non-fatal incident in a boat were associated with generators where it could not be specifically determined if the generator was an integral part.<sup>3</sup> Therefore these five incidents were excluded. Also, one incident that was determined to be work-related was not included.<sup>4</sup>

**Table 1: Number of Non-fire Carbon Monoxide Potential Exposure Incidents and Deaths Reported to CPSC Associated with Engine-Driven Tools, 1990-2004**

Product	Number of Incidents	Number of Deaths
<b>Total</b>	<b>317</b>	<b>318</b>
Generator	263	274
Garden tractor and lawn mower	35	33
Snow blower	5	5
Floor buffer	3	0
Pumps	3	2
Power washer and sprayer	4	1
Other engine-driven power tools or internal combustion engine (non-vehicular)	3	2
Multiple engine-driven tools	1	1

Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

Table 1 shows the number of carbon monoxide exposure incidents and deaths in CPSC files associated with generators and other engine-driven tools that occurred between January 1, 1990 and December 31, 2004. Staff found in CPSC's files 317 incidents and 318 deaths that occurred between 1990 and 2004 inclusive involving engine-driven tools and a potential CO exposure. The term *potential* is used to characterize these incidents because the CO exposure could not be confirmed for some of the non-fatal incidents. Incidents were associated with portable generators, garden tractors, lawn mowers, snow blowers, floor buffers, portable pumps, power washers and sprayers, other engine-driven power tools, and multiple engine-driven tools. The category 'other engine-driven power tools' includes gas floor and concrete cutters. The category

<sup>2</sup> 0021038891, 0156001192, 0227037489, 0302000494, 030219HEP9015, 9845030920, 9926010886, B9529423A, G9130305A, N0120209A, X0231359A, X0310578A, X0331336A, X9122456A, X9176126A, X9621373A, 0134003962, 0218009073, 0218008207, 0355044625, 0451005498, and X0452231A.

<sup>3</sup> These incidents were excluded from the analysis: X99B3684B and 010301HEP9009 (non-fatal incidents); and 9522020180, G9160205A, and N9470214A (fatal incidents). In all five of these incidents, the integral nature of the involved generator was unknown. These incidents were included in analyses in previous memoranda.

<sup>4</sup> This incident was excluded: 050223HCC1506.

'multiple engine-driven tools' includes an incident that involved both a generator and a power lawn mower.

Two hundred and sixty-three of the 317 incidents reported to CPSC were associated with generators. Two hundred seventy-four (86%) of the deaths were associated with generators. Throughout the remainder of this memo, incidents associated with all engine-driven tools will be reported as a group. In addition, since the majority of incidents were associated with portable generators, characteristics of these incidents will be reported separately.

CPSC staff examined the number of deaths occurring during each incident (Table 2). Twenty-two percent of the CO exposure incidents reported to CPSC and associated with an engine-driven tool were not associated with a CO poisoning fatality. Of those incidents that did involve at least one death (246 incidents), 77% involved a single fatality. Seventy-three percent of fatal generator incidents involved a single fatality. Of the 43 fatal incidents in the 'all other engine-driven tools' category, all but one incident were associated with a single fatality. The one multiple CO fatality incident in this category involved a sump pump.

**Table 2: Number of Carbon Monoxide Poisoning Incidents Reported to CPSC by Number of Deaths per Incident, 1990-2004**

<b>Number of Deaths Reported in Incident</b>	<b>Total</b>		<b>Generator</b>		<b>All Other Engine-Driven Tools</b>	
<b>Total Incidents</b>	<b>317</b>	<b>(100)</b>	<b>263</b>	<b>(100)</b>	<b>54</b>	<b>(100)</b>
0	71	(22)	60	(23)	11	(20)
1	190	(60)	148	(56)	42	(78)
2	45	(14)	44	(17)	1	(2)
3	6	(2)	6	(2)	0	(0)
4	5	(2)	5	(2)	0	(0)

Note: Numbers in parentheses represent percentages. Totals may not add to 100% due to rounding.  
 Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

Due to the difficulties in defining a CO poisoning injury or confirming a CO exposure, the remainder of this memorandum will focus only on CO poisoning incidents that involved a death associated with an engine-driven tool. Throughout this memorandum, the number of deaths represents the actual number of deaths that have been entered in the CPSC databases by June 27, 2005. The count is the unweighted, actual number of CO poisoning deaths in the CPSC files associated with generators and other engine-driven tools.

CPSC staff summarized the number of reported deaths associated with engine-driven tools by year of death (Table 3). It should be noted that the figures in Table 3 represent the numbers of deaths reported to CPSC as of June 27, 2005. Some deaths are reported to CPSC shortly after an incident occurs, while other deaths are reported to CPSC months or years after an incident occurs. Therefore, counts for more recent years may not be as complete as counts for earlier years. It should also be noted that death certificates for years 1999 and later were coded under the Tenth Revision of the International Classification of Diseases (ICD-10). With the transition to ICD-10 in 1999, the types of death certificates purchased by CPSC changed. These changes could affect the numbers of deaths associated with engine-driven tools that are reported to CPSC. Prior to 1999, these deaths were normally coded with an ICD-9 e-code (868.2) for motor vehicle

exhaust deaths. These death certificates were not routinely purchased by CPSC. Occasionally, some death certificates that were related to the products in this memo were reported to CPSC under other e-codes, (usually under e-codes 868.8 [carbon monoxide from other sources] and 868.9 [unspecified carbon monoxide]). In January of 1999, CPSC began purchasing death certificates classified in ICD-10 codes that contain all unintentional CO poisoning deaths associated with all sources of carbon monoxide, including motor vehicles.

**Table 3: Number of Non-fire Carbon Monoxide Poisoning Deaths Reported to CPSC Associated with Engine-Driven Tools By Year, 1990-2004**

Year	Total	Generators	All Other Engine-Driven Tools
<b>Total</b>	<b>318</b>	<b>274</b>	<b>44</b>
1990	18	18	0
1991	4	3	1
1992	7	7	0
1993	14	11	3
1994 <sup>+</sup>	8	5	3
1995 <sup>+</sup>	11	10	1
1996	20	17	3
1997	20	18	2
1998	14	13	1
1999*	11	6	5
2000	26	20	6
2001	21	18	3
2002	47	42	5
2003	57	51	6
2004	40	35	5

\* The ICD-10 system was implemented in 1999

+ The number of deaths associated with engine-driven products in 1994 and 1995 differ from those reported in the annual estimate report.<sup>5,6</sup> This is due to the exclusion of products that were integral parts of boats in this report.

Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

Staff further examined reported deaths associated with engine-driven tools by the season when the incident occurred (Table 4). Seasons were defined as winter (December, January, and February), spring (March, April, and May), summer (June, July, and August), and fall (September, October, and November). About 39 percent of the deaths associated with an engine-driven tool occurred in the winter.

<sup>5</sup> Ault K. "Estimates of Non-fire Carbon Monoxide Poisoning Deaths and Injuries," Washington, D.C.: U.S. Consumer Product Safety Commission. 1997.

<sup>6</sup> Mah J. "Non-Fire Carbon Monoxide Deaths Associated with the Use of Consumer Products, 1998 Annual Estimates." Washington, D.C.: U.S. Consumer Product Safety Commission. 2001.

**Table 4: Number of Non-fire Carbon Monoxide Poisoning Deaths Reported to CPSC and Associated with Engine-Driven Tools by Season, 1990-2004**

Season Incident Occurred	Number of Deaths Reported to CPSC					
	All Engine-Driven Tools		Generators		All Other Engine-Driven Tools	
<b>Total</b>	<b>318</b>	<b>(100)</b>	<b>274</b>	<b>(100)</b>	<b>44</b>	<b>(100)</b>
Winter	124	(39)	108	(39)	16	(36)
Spring	50	(16)	39	(14)	11	(25)
Summer	65	(20)	56	(20)	9	(20)
Fall	79	(25)	71	(26)	8	(18)

Note: Numbers in parentheses represent percentages. Totals may not add to 100% due to rounding.

Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

There were 12 reported incidents relating to the 2004 hurricane season that involved a CO poisoning death or injury that received medical treatment. There were eight hurricane-related deaths reported, five of which occurred in Florida.<sup>7</sup> There were 29 reported injuries that resulted in medical treatment.

Incidents involving deaths were further examined in Table 5 by the location where the death occurred. The majority of CO poisoning deaths (77%) reported to CPSC and associated with engine-driven tools occurred at a home, which included single-family homes, apartments, and mobile homes. The home location also includes garages or sheds at homes or residences. The temporary shelter category includes trailers, horse trailers, motor homes, recreational vehicles, vans, cabins, and campers. The 'other' category includes incidents occurring in some of the following locations: bar, building, church, greenhouse, mineshaft, public place, and storage shed (offsite from home).

**Table 5: Number of Non-fire Carbon Monoxide Poisoning Deaths Reported to CPSC and Associated with Engine-Driven Tools by Location, 1990-2004**

Location	Number of Deaths Reported to CPSC					
	All Engine-Driven Tools		Generators		All Other Engine-Driven Tools	
<b>Total</b>	<b>318</b>	<b>(100)</b>	<b>274</b>	<b>(100)</b>	<b>44</b>	<b>(100)</b>
Home	246	(77)	204	(74)	42	(95)
Temporary shelter	40	(13)	40	(15)	0	(0)
Boat	7	(2)	7	(3)	0	(0)
Other	12	(4)	12	(4)	0	(0)
Not reported	13	(4)	11	(4)	2	(5)

Note: Numbers in parentheses represent percentages. Totals may not add to 100% due to rounding.

Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

<sup>7</sup> There was one case, 050223HCC1506, that was not included in this count because the incident was work-related. It was, however, included in the count of cases reported in the MMWR article entitled Carbon Monoxide Poisonings from Hurricane-Associated Use of Portable Generators – Florida, 2004, July 22, 2005.

Tables 6 and 7 present the distribution of age and sex of the deceased in the incidents. Table 6 shows that adults aged 25 years and older accounted for about 83% of reported CO poisoning deaths associated with all engine-driven tools. Adults age 25 years and older accounted for about 81% of CO poisoning deaths associated with generators and accounted for all deaths associated with other engine-driven tools. Males accounted for 75% of the deaths associated with all engine-driven tools and 71% of the deaths associated with generators. One female death was associated with a sump pump, and another female death was associated with a lawn mower in a different incident; both of these deaths were categorized as 'all other engine-driven tools'.

**Table 6: Non-Fire Carbon Monoxide Poisoning Deaths Reported to CPSC and Associated with Engine-Driven Tools by Age of Victim, 1990-2004**

Age	Number of Deaths Reported to CPSC					
	All Engine-Driven Tools		Generators		All Other Engine-Driven Tools	
<b>Total</b>	<b>318</b>	<b>(100)</b>	<b>274</b>	<b>(100)</b>	<b>44</b>	<b>(100)</b>
Under 5	8	(3)	8	(3)	0	(0)
5 – 14	20	(6)	20	(7)	0	(0)
15 – 24	19	(6)	19	(7)	0	(0)
25 – 44	99	(31)	90	(33)	9	(21)
45 – 64	105	(33)	83	(30)	22	(50)
65 and over	61	(19)	48	(18)	13	(30)
Unknown	6	(2)	6	(2)	0	(0)

Note: Numbers in parentheses represent percentages. Totals may not add to 100% due to rounding.  
Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

**Table 7: Non-Fire Carbon Monoxide Poisoning Deaths Reported to CPSC and Associated with Engine-Driven Tools by Sex of Victim, 1990-2004**

Sex	Number of Deaths Reported to CPSC					
	All Engine-Driven Tools		Generators		All Other Engine-Driven Tools	
<b>Total</b>	<b>318</b>	<b>(100)</b>	<b>274</b>	<b>(100)</b>	<b>44</b>	<b>(100)</b>
Male	237	(75)	195	(71)	42	(95)
Female	81	(25)	79	(29)	2	(5)

Note: Numbers in parentheses represent percentages. Totals may not add to 100% due to rounding.  
Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

### **In-Depth Investigations of Engine-Driven Tool Incidents**

Data from CPSC's In-depth Investigation File are not a statistical sample and national totals may not be derived from the number of incidents investigated. Data provide examples of actual incidents and anecdotal information. Incidents in the CPSC In-depth Investigation File were examined to obtain more detailed information about the scenarios related to CO incidents associated with engine-driven tools. Not all information examined is available for each investigation.

CPSC staff further investigated 216 of the 317 incidents referenced in this memorandum. In-depth investigations associated with engine-driven tools have been requested more frequently in recent years. For example, 94% of the incidents associated with engine-driven tools that were reported to CPSC were investigated in 2004, and only 10% of the incidents were investigated in 1990. Of the 216 in-depth investigations investigated, 164 involved at least one fatality. These 164 in-depth investigations of fatal incidents involved 216 deaths. One hundred and eighty-nine of these deaths were associated with generators and 27 deaths were associated with other engine-driven tools.

Pre-existing health conditions affecting the heart, lungs, liver, and circulatory system can increase an individual's susceptibility to elevated carboxyhemoglobin (COHb) levels in the bloodstream, increasing the risk of a fatal CO exposure. Although this information was not available for all investigated deaths, 22 of the 216 CO deaths investigated that were associated with engine-driven tools involved individuals who had pre-existing health conditions not related to CO poisoning at the time of death.

Alcohol and 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. Although this information was not available for all investigated deaths, 39 of the 216 deaths investigated noted that the victim had used alcohol or recreational drugs during the time period surrounding the incident.

#### *In-Depth Investigations Associated with a Fatal CO Poisoning and a Generator*

CPSC staff further explored the 189 fatalities, which involved 137 in-depth investigations of fatal generator incidents. The characteristics of age and sex of victim, location of death, and number of fatalities per incident were similar in the total group of reported deaths associated with generators to those that were further investigated. About 82% of the deaths reported to CPSC involved adults aged 25 years and older, and about 80% of the deaths investigated involved adults 25 years and older. Males accounted for 71% of the reported CO deaths associated with generators and 67% of deaths investigated. The location of the death was also similar for those cases that were investigated versus all CO poisoning deaths reported. The majority of deaths investigated (77%) occurred in a home, while 73% of deaths reported occurred in a home. Fifteen percent of the deaths investigated occurred in a temporary shelter, while 16% of the total reported deaths occurred in a temporary shelter. Incidents investigated that involved at least one death were similar to reported generator incidents that involved at least one death in that 77% of all the fatal incidents reported involved a single fatality, while 70% of the investigated deaths involved a single fatality.

Information provided in investigations that was not available as regularly from the Injury or Potential Injury Incident (IPII) File and Death Certificate (DTHS) File source documents included information about the specific location of the generator, the venting of the generator, the rating of the generator, the fuel used with the generator, the reason the generator was being used, whether the generator was owned by the deceased or a member of the deceased's

household, the concentration of the CO at the location where the generator was used, and the carboxyhemoglobin (COHb) levels of the deceased.

The main reasons reported for using a generator were to provide electricity to a location that did not have electricity due to a temporary situation, or to provide power to a temporary location. Sixty investigated deaths involved generators used during a temporary power outage stemming from a weather problem or a problem with power distribution; 39 investigated deaths involved generators used to supply power to a temporary shelter, storage-shed (offsite from the home), or boat that did not have electricity; 23 investigated deaths involved generators used in a situation where the utility company, often because of an overdue payment, turned off the power; 26 investigated deaths were associated with locations where the electricity was off due to another reason, such as recent fire at the location, the home was abandoned, the home was a new home that did not have electricity at the time of the incident, the residents of the home requested that the electricity be turned off, or a home was undergoing a remodeling project. Twenty-five of the deaths investigated involved incidents where the electricity was off at the location but the reason why was unknown. Fourteen of the deaths investigated involved a generator used in a more permanent situation, such as to supply power to a home or mobile home that did not normally have electricity or to provide power to a garage of a home. Two deaths were associated with incidents where the user was repairing a generator or was preparing the generator for use due to forecasted bad weather.

**Table 8: In-Depth Investigations Associated with Generators and Carbon Monoxide Poisoning Deaths in the Home by Location of the Generator, 1990-2004**

<b>Generator Location</b>	<b>Number of Deaths</b>
<b>Total</b>	<b>146</b>
Basement/crawl space	48
Garage/enclosed carport	41
Living space	33
Inside house, no further information reported	8
Closet	3
Doorway	2
Outside home	7
Shed	2
Other, inside a nearby mobile home	1
Unknown location, but at home	1

Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

In-depth investigations of CO deaths that occurred in a home were further classified by the specific location of the generator (Table 8). The category 'living space' includes rooms reported as bedrooms, bathrooms, dens, living rooms, landings, offices, rear rooms, enclosed porches, and converted garages. The category 'outside home' includes incidents where the generator was placed outside a home but near an open window, door, or vent of the home. Although this information was not available for all incidents, 30 of the deceased individuals were found in the same room or space of the home as the generator, and 105 of the deceased individuals were found in different rooms or spaces of the home. In some cases, individuals were found in rooms

located above the basement or in rooms next to or above the garage where the generator was located.

Conclusions about a consumer's reasons for placing a generator indoors, along with determinations of the consumer's awareness of the carbon monoxide hazard associated with the use of a generator in an enclosed space, are difficult to make from information obtained in the typical investigation. The reason a generator was operated in a certain location was provided in the investigations for only 32 deaths. The most common reason mentioned for using the generator indoors was that the user feared that someone might steal the generator (11 deaths). Other reasons for using the generator indoors included: to muffle the sound (6 deaths), the users didn't want the neighbors to know their electricity had been turned off (3 deaths), complaints of property owners or neighbors (2 deaths), a user attempting to fix a generator (1 death), users not realizing their generators should be operated outside (5 deaths), a case in which the user ran the generator outside, where it would stall, so the user operated it inside for some time and then put it back outside (1 death), and cases in which an attempt was made to directly vent the generator exhaust to the outside (3 deaths).

There was little information available in the investigations about whether users were aware of the CO hazard associated with using generators indoors. Some investigations reported that family, friends, or landlords stated that they had forewarned the user of the potential CO hazard, but otherwise there was no way to assess whether users were or were not aware of the CO issue.

Many of the death investigations (85 of the 189 deaths investigated) did not contain information about the exact venting of the generator. In 63 of the 104 deaths investigated in which information on the venting was available, the generators were not vented at the time of the incident. In one investigated death where there was no venting, the room with the generator was thought to be sealed off from the rest of the house. There were 40 investigations that reported that some type of venting was employed. Twenty-four investigated deaths reported an open window, an open door, an open garage door, or a combination of these. In five investigated deaths, a window or door was open during some period of use but later closed. Five investigated deaths were associated with a generator that was placed outside the home near an open window, door, or vent. Two investigated deaths were associated with a portable generator used on a boat; the users attempted to vent the generator by modifying the exhaust system in place for an installed generator. In one investigated death the associated generator was operated outdoors for some time. It would stall and would then be operated in the doorway for a period of time. In three investigated deaths, the generator exhaust was directly vented to the outside but the vent leaked.

The size of the generator and the fuel used with the generator were both examined. The size of the generator was examined by the wattage rating (Table 9). In most cases, the running wattage rating was used to categorize a case. In some instances, however, a wattage rating was obtained but it could not be determined whether this rating was the rated running wattage or maximum/surge wattage. For 32 incidents in which the in-depth investigation provided the make, model, and/or engine size of the associated generator but not the wattage rating, CPSC staff used the identifying information to ascertain the power rating. When the wattage rating of the generator was known or could be determined (108 investigated deaths), 53 investigated deaths were associated with a generator in the five-kilowatt rating range. Almost all of the generators



were referred to as gas or gasoline generators. One generator was identified as a propane generator and one was identified as a natural gas generator.

**Table 9: Wattage Rating Reported in In-Depth Investigations Associated with Generators and a Carbon Monoxide Poisoning Death, 1990-2004**

Wattage Rating (in Kilowatts)	Number of Deaths
<b>Total</b>	<b>189</b>
Under 1	3
1-1.9	7
2-2.9	8
3-3.9	20
4-4.9	8
5-5.9	53
6-6.9	8
Greater than 7	1
Not reported	81

Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

In many of the investigations (109 of the 189 fatalities), staff could not determine whether the generator was owned by the deceased or a member of the deceased's household, whether it was borrowed, or whether it was rented. In the investigations of 41 of the deaths, the deceased or a member of the deceased's household owned the generator. In investigations of 33 of the deaths, staff determined that the generator was borrowed. In investigations of six of the deaths, the generator was rented.

**Table 10: Carboxyhemoglobin Levels Reported in In-Depth Investigations Associated with Generators and a Carbon Monoxide Poisoning Death, 1990-2004**

COHb Level	Number of Deaths
<b>Total</b>	<b>189</b>
Less than 30%	2
30-39.9%	4
40-49.9%	12
50-59.9%	14
60-69.9%	38
70-79.9%	29
80-89.9%	10
90-99.9%	1
Not Reported	79

Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

Carboxyhemoglobin (COHb) levels were provided in the investigations for 110 of the 189 fatalities. Table 10 provides a breakdown of the COHb levels. In healthy adults, a COHb level of 40 to 50% approximately correlates with symptoms of 'confusion, unconsciousness, coma, possible death'; a level of 50 to 70% approximately correlates with symptoms of 'coma, brain

damage, seizures, death’; and a level greater than 70% is ‘typically fatal’.<sup>8</sup> The majority of individuals with reported COHb levels (92 of the 110) had levels greater than 50% COHb.

Twenty-seven investigations (associated with 36 deaths) provided ambient levels of carbon monoxide at the location, measured as parts per million (ppm). Some values were measured only after the location had been vented and/or the generator had been shut down, often because the generator had run out of fuel, for some time prior to the measurement. The six investigations that did not have maximum CO levels greater than 150 ppm reported that the location had been vented prior to the measurement of the CO level, or the measurement of the CO level took place hours after the incident. Twenty-one of the investigations had maximum CO levels that measured greater than 150 ppm: six investigations had CO levels between 150 and 299 ppm, two investigations had levels between 300 and 449 ppm, three investigations had levels between 450 and 599 ppm, and ten investigations had levels higher than 600 ppm.

*In-Depth Investigations Associated with a Fatal CO Poisoning and a Tool Included in the ‘All Other Engine-driven Tool’ Category*

Twenty-seven of the 44 deaths associated with other engine-driven tools were investigated further. All 27 of the incidents investigated involved a single fatality. Twenty-six of the investigated deaths involved a garden tractor or a power lawn mower, although one investigation involved both a generator and a power lawn mower. One investigated incident involved a gas concrete cutter. All the deceased in these investigations were males and roughly half of the investigations (14 out of 27) involved individuals between the ages of 45-64. Five fatal investigations involved deaths of individuals in the 25-44 age group and eight fatal investigations involved deaths of individuals in the 65-and-over age group.

**Table 11: Carboxyhemoglobin Levels Reported in In-Depth Investigations Associated with Other Engine-driven Tools and a Carbon Monoxide Poisoning Death, 1990-2004**

COHb Level	Number of Deaths
<b>Total</b>	<b>27</b>
30-39.9%	1
40-49.9%	3
50-59.9%	5
60-69.9%	6
70-79.9%	6
80-89.9%	4
Unknown Level	2

Source: U. S. Consumer Product Safety Commission, Directorate for Epidemiology, 2005

For 25 of the 27 deceased, the carboxyhemoglobin level was provided (Table 11). Ambient CO levels were provided in only four of the investigations. One investigation reported an ambient CO level of 20 ppm in the garage and a maximum of 80 ppm in the house. These measurements were taken after venting. One investigation reported a maximum ambient CO level of 740 ppm

<sup>8</sup> Burton LE. Toxicity from Low Level Human Exposure to Carbon Monoxide. Washington, D.C.: U.S. Consumer Product Safety Commission. 1996.

with the doors open. For the two other incidents reported, ambient CO levels of 101 ppm and 76.9 ppm were recorded when the police or fire department responded to the scene after the deceased had been discovered.

All 26 of the investigated deaths associated with a lawn mower or garden tractor occurred in an enclosed space at a home, with 14 investigated deaths occurring in the garage of a home, 11 in the shed of a home, and one in a utility building. Twenty-two of these investigations provided details as to why the lawn mower or garden tractor was being used within an enclosed space. The majority of these investigated deaths (17 out of 22) involved the victim working on or repairing a garden tractor or power lawn mower within an enclosed space. The one death associated with the concrete cutter occurred in the basement of a home.

## **Conclusion**

Between 1990 and 2004 there were 318 CO poisoning deaths reported to CPSC that were associated with engine-driven tools. The majority of these deaths (274) involved generators. Other engine-driven tools that were associated with a much smaller number of deaths included garden tractors, lawn mowers, snow blowers, pumps, power washers or sprayers, and other engine-driven power tools. The majority of fatal incidents reported to CPSC involved a single fatality. Most reported deaths occurred while an individual was at home.

Adults aged 25 years and older accounted for about 81% of CO poisoning deaths reported to CPSC associated with generators, and the majority (71%) was male. Seventy-four percent of the reported deaths associated with generators occurred at home. Generators were commonly placed in the basement or garage of the home. Generators were often used as alternative sources of electricity due to temporary power outages or as power sources for temporary shelters. Generators were often used with little or no ventilation. Conclusions about why consumers used generators indoors or determinations about whether users were aware of the potential CO hazards are difficult to make with the available information.

Adults aged 25 years and older accounted for all of the CO poisoning deaths reported to CPSC associated with engine-driven tools, excluding generators. Males accounted for all but two of the 44 deaths reported to CPSC associated with other engine-driven tools. Deaths associated with garden tractors and lawn mowers were often associated with an individual repairing or working on the product in an enclosed space.

## References

Ault K. Estimates of Non-fire Carbon Monoxide Poisoning Deaths and Injuries, memorandum. December 1, 1997. U.S. Consumer Product Safety Commission.

Burton LE. *Toxicity from Low Level Human Exposure to Carbon Monoxide*. U.S. Consumer Product Safety Commission. 1996.

Carlson S. Incidents, Deaths, and In-Depth Investigations Associated with Carbon Monoxide and Engine-Driven Tools, 1990-2003, memorandum. March 8, 2004. U.S. Consumer Product Safety Commission.

Mah J. *Non-Fire Carbon Monoxide Deaths Associated with the Use of Consumer Products, 1998 Annual Estimates*. U.S. Consumer Product Safety Commission. 2001.

Marcy NE, Ascone DS. *Non-Fire Carbon Monoxide Deaths Associated with the Use of Consumer Products, 2002 Annual Estimates*. U.S. Consumer Product Safety Commission. July 2005.

## **APPENDIX A**

The queries below were submitted through the EPIR application. Query results were manually reviewed to include only carbon monoxide poisoning hazards and to exclude duplicates and out-of-scope cases, which were cases that did not involve an incident that was associated with a non-fire carbon monoxide exposure and an engine-driven tool. Work-related cases were also excluded.

Date of Queries: 06/27/2004

Incident dates: 1/1/90 – 12/31/04

Product Codes: 113, 606, 809, 820, 887-888, 1062, 1400-1464

Narrative/Text contains: 'CO\_' or 'CARB' or 'MONO'

**APPENDIX B**

Document Number	Investigation Task Number
NEISS	980901HEP5441
NEISS	981118HEP1681
NEISS	990903HEP1683
NEISS	020705HEP9005
NEISS	020724HEP9004
NEISS	021219HEP9012
NEISS	030403HEP9001
NEISS	030403HEP9018
NEISS	031009HEP9007
NEISS	040901HEP9010
NEISS	041112HEP9004
0004000376	021031HCC3059
0005025284	020228HCC2282
0012022297	021107HCC1123
0022034412	010628HCC2616
0023012228	021023HCC1078
0026039416	021121HCC2124
0032013569	
0037071040	011126HCC1143
0039010605	021227HCC2232
0039088650	021023HCC2060
0039100337	021227HCC2234
0042046788	021227HCC1229
0102000958	020529HCC3217
0118012182	020306HCC2308
0118044256	030213HCC2329
0122008422	020426HCC2439
0122025070	020425HCC2431
0127533637	020814HCC2604
0128004205	021213HCC1207
0128006226	021213HCC1206
0129025962	020219HCC2228
0130000295	
0132003301	021213HCC3125

Document Number	Investigation Task Number
0134003957	
0153030992	021025HCC3042
0153040464	021025HCC3041
0201008704	040225HCC1455
0201036056	040225HCC1456
0206234753	040106HCC3130
0213060674	040602HCC1733
0217004345	041103HCC2097
0217618034	041103HCC2094
0226024060	030404HCC2388
0226081321	030620HCC2524
0228022524	031029HCC1093
0236097443	050113HCC1354
0237011849	021203HCC1172
0240002682	021211HCC2193
0240028028	031119HCC2109
0244003625	040409HCC1599
0245027455	030620HCC1664
0249001175	031202HCC3068
0301022230	050107HCC1317
0306239610	050425HCC3327
0313045168	040602HCC1732
0318040631	050325HCC2567
0322025038	031224HCC2207
0324018248	031224HCC1285
0326021031	031119HCC2115
0326022653	030416HCN0477
0326025249	030408HCN0462
0326025620	030408HCN0463
0326034084	031119HCC2117
0326034084	031119HCC2117
0326038216	030411HCN0468
0326055156	040316HCC2390
0328015477	041216HCC1212

Document Number	Investigation Task Number
0328026142	041216HCC1213
0329030467	050609HCC2816
0334056625	050304HCC1546
0336054441	050113HCC1346
0336058704	
0347032769	
0349002370	040226HCC3188
0353039112	050425HCC3326
0355022002	040607HCC2545
0355041661	050513HCC2711
0426033664	050110HCC2276
0455014682	050513HCC2706
0455018799	
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9017047646	
9042017400	
9042106564	
9051043586	
9142077948	
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UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
WASHINGTON, DC 20207

Memorandum

Date: January 13, 2006

TO : Janet Buyer, Project Manager  
Division of Combustion and Fire Sciences  
Directorate for Engineering Sciences

THROUGH: Russell H. Roegner, Associate Executive Director *RR*  
Directorate for Epidemiology

FROM : Robin L. Ingle, Health Statistician *RI*  
Division of Hazard Analysis  
Directorate for Epidemiology

SUBJECT : Non-fire Carbon Monoxide Fatalities Associated with Engine-Driven  
Generators and Other Engine-Driven Tools in 2004 and 2005

This memorandum provides an updated number of non-fire carbon monoxide fatalities associated with engine-driven generators and other engine-driven tools that occurred in 2004, and a preliminary, initial count for 2005.<sup>1</sup> It includes fatalities reported for 2004 and 2005 as of December 31, 2005. This is a preliminary count of incidents for this time period since reporting is not complete for 2004 and 2005 (nor is reporting complete for 2002 or 2003). An earlier memorandum titled "Incidents, Deaths, and In-Depth Investigations Associated with Carbon Monoxide from Engine-Driven Generators and Other Engine-Driven Tools, 1990-2004," dated December 1, 2005 included fatalities through December 31, 2004 and reported as of June 27, 2005. The criteria used to search the data for the December 1, 2005 memorandum and this memorandum were the same.

CPSC has reports of 41 fatalities associated with engine-driven tools in 2004. Thirty-six fatalities involved generators and five fatalities involved other engine-driven tools including tractors and lawn mowers. In 2005, CPSC has reports of 61 fatalities associated with engine-driven tools. Fifty-five fatalities involved generators and six fatalities involved other engine-driven tools including lawn mowers, lawn tractors, a snow blower and a pressure washer.

**Non-fire Carbon Monoxide Fatalities Associated with Engine-Driven Tools in 2004 and 2005**

	2004		2005
	Fatalities Reported as of 6/27/2005	Additional Fatalities Reported Between 6/27/2005 and 12/31/2005	Fatalities Reported as of 12/31/2005
<b>Generator</b>	35	1	55
<b>Other Engine-Driven Tool</b>	5	0	6
<b>Total</b>		41	61

<sup>1</sup> 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.

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Billing Code 6355-01-P

**CONSUMER PRODUCT SAFETY COMMISSION**

**16 CFR Part 1407**

**Portable Generators; Notice of Proposed Rulemaking; Proposed Labeling Requirements; Request for Comments and Information**

**AGENCY:** Consumer Product Safety Commission.

**ACTION:** Notice of proposed rulemaking.

**SUMMARY:** In this document the Consumer Product Safety Commission (Commission or CPSC) proposes to require manufacturers to label portable generators with performance and technical data related to performance and safety. The warning label would inform purchasers that: "Using a generator indoors will kill you in minutes;" "Exhaust contains carbon monoxide, a poison gas you cannot see or smell;" "Never use in the home or in partly enclosed areas such as garages;" "Only use outdoors and far from open windows, doors, and vents." The warning label will also include pictograms. The Commission believes that providing this labeling information will help reduce risks to consumers. The Commission invites public comment on this proposal.

**DATE:** Written comments in response to this notice must be received by [**insert date that is 75 days after publication**].

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**ADDRESSES:** Comments should be e-mailed to [cpssc-os@cpssc.gov](mailto:cpssc-os@cpssc.gov), and should be captioned "PORTABLE GENERATOR NPR." Comments may also be mailed, preferably in five copies, to the Office of the Secretary, Consumer Product Safety Commission, Room 502, 4330 East-West Highway, Bethesda, Maryland 20814, or delivered to the same address (telephone (301) 504-0800). Comments also may be filed by facsimile to (301) 504-0127.

**FOR FURTHER INFORMATION CONTACT:** Janet L. Buyer, Project Manager, Directorate for Engineering Sciences, Consumer Product Safety Commission, 4330 East-West Highway, Bethesda, Maryland; telephone (301) 504-7542 or email: [jbuyer@cpssc.gov](mailto:jbuyer@cpssc.gov).

**SUPPLEMENTARY INFORMATION:**

**A. Background**

The total yearly estimated non-fire related carbon monoxide (CO) deaths for each of the years 1999 through 2002 are 109, 138, 130 and 188, respectively. Since 1999, the percentage of estimated CO poisoning deaths specifically associated with generators has been increasing annually. In 1999, generators were associated with 7 (6%) of the total yearly estimated CO poisoning deaths for that year. In 2000, 2001 and 2002, they were associated with 19 (14%), 22 (17%) and 46 (24%) deaths out of the total estimates for each of those years.

DRAFT

On October 12, 2005, Commission Chairman Hal Stratton sent a memorandum to the Executive Director directing the staff to undertake a thorough review of the status of portable generator safety. As part of this review, Chairman Stratton requested that the staff address the sufficiency of warning labels to address the CO poisoning hazard posed by portable generators that are used within or near residences.

**B. The Product**

Portable generators offer a portable means of providing electrical power to a location that either temporarily lacks it or is not provided with electrical service at all. A portable generator has an internal combustion engine to produce rotational energy, which is used to generate electricity. The engine may be fueled by gasoline, diesel, natural gas, or liquid propane. It is the engine that is the source of carbon monoxide.

Estimates of sales of portable generators for consumer use vary, but could be more than a million units annually. The most popular of these generators are gasoline-powered and are priced in the \$500 to \$800 range. The output of the majority of light duty generators sold to consumers in 2005 was in the 3.5 kW to 6.5 kW range. This is the size of most of the units involved in the fatal CO poisoning incidents

CPSC staff investigated in which the rating of the involved generator was identified.

**C. Relevant Statutory Provisions**

Section 27(e) of the Consumer Product Safety Act (CPSA) authorizes the Commission, by rule, to "require any manufacturer of consumer products to provide the Commission with such performance and technical data related to performance and safety as may be required to carry out the purposes of this Act, and to give such notification of such performance and technical data at the time of original purchase to prospective purchasers and to the first purchaser of such product for purposes other than resale, as it determines necessary to carry out the purposes of this Act." As provided in section 2(b)(1) of the Consumer Product Safety Act (15 U.S.C. 2051(b)(1)), one purpose of the CPSA is "to protect the public against unreasonable risks of injury associated with consumer products."

**D. Development of Proposed Rule**

In 2002, CPSC staff assessed the effectiveness of current CO poisoning warnings found on the product and within the owner's manuals of several models of portable generators found on store shelves. Staff found that the guidance provided for avoiding the hazard was typically twofold: (1) do not use in a confined or enclosed space, and (2) provide proper ventilation. None of the evaluated

DRAFT

warnings defined "confined or enclosed space" or "proper ventilation."

The Commission believes these ambiguous instructions and warnings do not adequately advise the user how to avoid the CO poisoning hazard. Furthermore, the incident data includes fatalities where it appears that the victims attempted to provide adequate ventilation, to open confined areas, or to do both by, for example, opening doors, opening windows, and running exhaust fans. Prior research has shown that tools with gasoline-powered engines produce CO that "can rapidly accumulate, even in areas that appear to be well-ventilated, resulting in dangerous and fatal concentrations within minutes."<sup>1</sup> Thus, evidence suggests that the methods consumers typically use to provide ventilation or to open confined areas are insufficient to prevent hazardous levels of CO buildup. Even locating a generator outdoors can be insufficient if the generator is near enough to openings to the home or other occupied structure to allow CO to permeate and subsequently accumulate indoors. CPSC is aware of at least 5 deaths that occurred when the generator was situated outdoors but near openings to the home. In addition, the Centers for Disease

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<sup>1</sup>Earnest, G.S., *Carbon Monoxide Poisonings from Small, Gasoline-Powered, Internal Combustion Engines: Just What is a "Well-Ventilated Area"?*, American Industrial Hygiene Association Journal, November 1997.

DRAFT

Control and Prevention recently reported the results of a study of post-hurricane related generator use in 2005 that found up to 50% of non-fatal CO poisoning incidents involved generators operated outdoors but within one to seven feet from the home.<sup>2</sup>

The staff believes that there are too many unknown variables to be able to recommend one single safe distance for the location of a portable generator relative to a home or dwelling. Variables such as the wind speed and direction relative to openings to indoor spaces, relative proximity of other structures in the area that could create wind vortices, direction in which the engine exhaust is pointing, and a multitude of other factors complicate attempts to define a safe distance. Notwithstanding the issue of defining a safe operating distance, the staff believes that warning labels must instruct consumers to keep generators outdoors and away from air intakes during use.

In 2003, the staff developed recommended warning language for engine-driven tools, with particular focus on portable generators, as a follow-up to the staff's assessment of the inadequacy of current warnings. This was later provided to the Underwriters Laboratories (UL) voluntary standard development committee. In February 2006,

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<sup>2</sup>CDC, *Carbon Monoxide Poisoning After Two Major Hurricanes-- Alabama and Texas, August - October 2005*, MMWR March 10, 2006; 55(09); 236-239.



DRAFT

staff developed a further refined warning label for portable generators and presented it to UL in response to their request for CPSC staff comments on a proposed UL Outline of Investigation. UL incorporated staff's proposed warning label into their Outline of Investigation, which became effective April 2006 and serves as the requirements with which a product must conform in order to be eligible to bear the UL mark. This document is not a consensus standard. The Commission believes the proposed rule is needed to ensure that all products will bear the proposed warning label as opposed to only those that seek UL's mark.

**E. Description of the Proposal**

The proposed warning label appears at fig. 1 (and fig. 3 for the on-package label). The warning label provides technical data, i.e., it indicates the presence of carbon monoxide in the portable generator exhaust and informs that carbon monoxide is a gas you cannot see or smell. The label uses the phrase "you cannot see or smell" rather than terms such as "odorless" and "colorless," because the latter terminology may be less familiar and understandable to some consumers.

The label also includes statements which connect the technical data with safety concerns. Specifically, the label warns: "Using a generator indoors WILL KILL YOU IN MINUTES." The phrase "in minutes" is intended to emphasize

DRAFT

the imminence of the carbon monoxide poisoning hazard to provide consumers with a better understanding of the speed with which incapacitation can occur. In addition, research indicates that information about hazard scenarios affects consumers' risk judgments. Thus, the label includes a description not just of the hazard, carbon monoxide, but of the primary hazard scenario associated with CO-poisoning deaths, i.e., using a generator indoors. The label also warns, "NEVER use in the home or in partly enclosed areas such as garages." The label warns specifically against use in the home and in garages, since these are known places in which consumers use generators. Furthermore, the use of a more wide-reaching phrase, "partly enclosed," is intended to broaden the perceived range of potentially dangerous areas in which to operate a generator, since this range does include partly enclosed areas. The label includes prescriptive advice to "ONLY use outdoors and far from open windows, doors, and vents," so consumers can know what positive action they can take to avoid the hazard, rather than focusing exclusively on prohibited behaviors, or what consumers should not do. This is consistent with the requirements of ANSI Z535.4-2002, which is the primary U.S. voluntary consensus standard on product safety signs and labels, and with warning design guidelines in general. The accompanying pictograms are based on the pictograms

developed by the Underwriters Laboratories Standards Technical Panel. Research shows that labels with pictograms tend to capture a consumer's attention more readily than a label without pictograms.

**F. UNREASONABLE RISK OF INJURY**

Portable generators are powered by gasoline, diesel, or propane engines and exhaust CO. If the generator is used in enclosed or even partially enclosed spaces, the CO can very quickly build to hazardous levels. Serious injury can also result when the generator is placed outdoors but near an open window or vent and the exhaust is pulled into a house. In the 6-year period from 2000 through 2005, CPSC staff is aware of at least 222 deaths related to CO poisoning associated with generators.<sup>3</sup> Non-fatal CO injuries can have serious consequences since permanent brain or neurological damage can result.

A well-designed warning label could inform the consumer of the CO hazard associated with generators and how to avoid the hazard while using the generator. A label placed in a

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<sup>3</sup>Natalie E. Marcy and Debra S. Ascone, "Incidents, Deaths and In-Depth Investigations Associated with Carbon Monoxide from Engine-Driven Generators and other Engine-Driven Tools, 1990-2004," CPSC Memorandum to Janet Buyer, Directorate for Engineering Sciences, U.S. Consumer Product Safety Commission, Washington, DC (1 December 2005) and Robin L. Ingle, "Non-fire Carbon Monoxide Fatalities Associated with Engine-Driven Generators and Other Engine Driven Tools in 2004 and 2005," CPSC Memorandum to Janet Buyer, Directorate for Engineering Sciences, U.S. Consumer Product Safety Commission, Washington, DC (3 January 2006).

DRAFT

prominent position on the generator could reinforce this information each time the consumer used the generator. For example, the proposed label reminds the consumer that generator exhaust contains CO, which cannot be seen or smelled, and can quickly kill. The label also clarifies that a generator should only be used outside and away from windows and vents and should not be used in partly enclosed spaces such as garages. This information is important since some consumers have apparently been aware that a CO hazard was associated with generators, but believed that they would avoid the hazard by running the generator in a garage with the door open or outside the house, but did not understand that it was necessary to place it away from open windows and vents.<sup>4</sup> The costs of a warning label include the one-time cost of designing the label and the continuing costs of printing and applying the labels to the generators and packages. These costs are expected to be low - less than one dollar per generator. The Commission therefore preliminarily concludes that there is an unreasonable risk of injury associated with portable generators and that providing the information required by the proposed rule will

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<sup>4</sup>Timothy P. Smith, "Human Factors Assessment for the Small Engine-Driven Tools Project," CPSC Memorandum to Janet L. Buyer, U.S. Consumer Product Safety Commission, Washington, DC (18 June 2002).

help reduce the rising CO death toll associated with consumer use of portable generators.

**G. Environmental Considerations**

Labeling requirements are not expected to have an adverse impact on the environment and are considered to be "categorical exclusions" for the purposes of the National Environmental Policy Act according to the CPSC regulations that cover its "environmental review" procedures (16 CFR Part 1021.5(c)(2)).

**H. Impact on Small Business**

CPSC staff has identified more than 40 suppliers of generators to the U.S. consumer market. Although a few large firms dominate the market, a number of these suppliers are likely to be small businesses. The small businesses include firms that import generators from foreign manufacturers as well as equipment assemblers, which assemble generator sets from purchased components. The small manufacturers will be responsible for ensuring that their generators are properly labeled. However, the labeling requirement is not expected to pose a significant burden to small business because the cost of adding the labels per generator is expected to be less than a dollar per generator set.

**I. Effective Date**

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The proposed effective date of Part 1407, which requires labeling for portable generators, is 90 days from issuance of any final regulation in the *Federal Register*. The labeling requirement would apply to all portable generators imported or introduced into commerce after the 89<sup>th</sup> day following publication of any final regulation in the *Federal Register*.

**J. Request for Information and Comments**

Interested persons are invited to submit comments regarding this proposal. Comments should be e-mailed to cpsc-os@cpsc.gov and should be captioned "PORTABLE GENERATOR NPR." Comments may also be mailed, preferably in five copies, to the Office of the Secretary, Consumer Product Safety Commission, Room 502, 4330 East-West Highway, Bethesda, MD 20814, or delivered to the same address (telephone (301) 504-0800). Comments also may be filed by telefacsimile to (301)504-0127. All comments and submissions should be received no later than [insert date that is 75 days from publication].

**K. Conclusion and Proposal**

On the basis of the information discussed above, the Commission preliminarily finds that there is an unreasonable risk of injury associated with portable generators, and concludes that a requirement for a carbon monoxide identification and warning statement on portable generators

is necessary to help protect the public against the risk of CO poisoning associated with such products.

Therefore, under provision of the Consumer Product Safety Act (section 27(e), 86 Stat. 1227-9, as amended; 15 U.S.C. 2076(e)), the Commission proposes that Title 16, Chapter II, be amended by adding to Subchapter B the following new Part 1407:

**List of Subjects in 16 CFR Part 1407**

Consumer protection, labeling.

**PART 1407-PORTABLE GENERATORS: REQUIREMENTS TO PROVIDE PERFORMANCE AND TECHNICAL DATA BY LABELING**

Sec.

1407.1 Purpose, Scope, and Effective Date.

1407.2 Definitions.

1407.3 Providing performance and technical data to purchasers by labeling.

**Authority:** 15 U.S.C. 2076(e).

**§ 1407.1 Purpose, Scope, and Effective Date.**

This part 1407 establishes requirements under section 27(e) of the Consumer Product Safety Act (15 U.S.C. 2076(e)) for manufacturers to provide consumers with a specified notification concerning the carbon monoxide poisoning hazard associated with the use of portable generators. The notification is intended to provide consumers with technical and performance information related to the safety of

portable generators. This part becomes effective [INSERT DATE 90 DAYS FROM ISSUANCE OF FINAL RULE].

**§ 1407.2 Definitions.**

(a) The definitions in section 3 of the Consumer Product Safety Act (15 USC 2052) apply to this part 1407.

(b) A portable generator is an internal combustion engine-driven electric generator, which is intended to be moved for temporary use at a location where utility-supplied electric power is not available. It has receptacle outlets for the alternating-current output circuits and may also have a direct current (DC) battery charging outlet.

**§ 1407.3 Providing performance and technical data to purchasers by labeling.**

(a) *Notice to purchasers.* Manufacturers of portable generators shall give notification of performance and technical data related to performance and safety to prospective purchasers of such products at the time of original purchase and to the first purchaser of such product for purposes other than resale, in the manner set forth below.

(1) *On-product label.* The CO poisoning hazard label shown in fig. 1 shall be used on the product. A different representation of the generator may be substituted for accuracy if consumers are more likely to recognize the



DRAFT

substituted representation as the generator to which this label is affixed.

(I) The signal word "DANGER" shall be in letters not less than 0.15 inch (3.8 mm) high. The remaining text shall be in type whose uppercase letters are not less than 0.1 inch (2.5 mm) high.

(ii) The signal word "DANGER" shall appear in white letters on a safety red background. The safety alert symbol shown in fig. 2 shall appear immediately before and next to the signal word and be no smaller than the height of the signal word with the base of the triangle on the same horizontal line as the base of the signal word. The solid portion of the triangle (within the lines of the triangle, around the exclamation mark) shall be white and the exclamation mark shall be safety red. The prohibition "X"s shall be safety red.

(iii) The on-product hazard label shown in fig. 1 shall be located:

(A) On a part of the portable generator that, if removed, would impair the operation of the generator assembly, and

(B) On a location that is prominent and conspicuous to an operator while performing at least two of the following actions: filling the fuel tank, accessing the receptacle panel, and starting the engine.

DRAFT

(iv) The on-product hazard label shown in fig. 1 shall be designed to remain permanently affixed, intact, legible, and largely unfaded in the environment in which the product is expected to be operated and stored over the life of the product.

(2) *Carbon monoxide poisoning hazard label for package.* The CO poisoning hazard label shown in fig. 3 shall be affixed to the principal display panel(s) of the package, as well as the surface containing the top flaps of the package. The principal display panel(s) of the package is the portion(s) of the outer packaging that is designed to be most prominently displayed, shown, presented, or examined under conditions of retail sale. Any panel of the package that includes text in a language other than English shall also include a CO poisoning hazard label in that language.

Alternate-language versions of this label may also appear on the top flaps of the package as long as they are physically separate from one another. A different representation of the generator may be substituted for accuracy if consumers are more likely to recognize the substituted representation as the generator contained within the packaging.

(I) The signal word "DANGER" shall be in letters not less than 0.15 inch (3.8 mm) high. The remaining text shall be in type whose uppercase letters are not less than 0.1 inch (2.5 mm) high.

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(ii) The signal word "DANGER" shall appear in white letters on a safety red background. The safety alert symbol shown in fig. 2 shall appear immediately before and next to the signal word and be no smaller than the height of the signal word with the base of the triangle on the same horizontal line as the base of the signal word. The solid portion of the triangle (within the lines of the triangle, around the exclamation mark) shall be white and the exclamation mark shall be safety red. The prohibition "X"s shall be safety red.

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[INSERT FIGURES 1-3]

List of Relevant Documents

1. Memorandum from Timothy P. Smith, Engineering Psychologist, Division of Human Factors, Directorate for Engineering Sciences, to Janet L. Buyer, Project Manager, Division of Combustion and Fire Sciences, Directorate for Engineering Sciences, "Product labels for generators to address carbon monoxide poisonings," May 26, 2006.

2. Memorandum from Robert Franklin, Economist, Directorate for Economic Analysis, to Janet Buyer, Project Manager, Portable Generator Project, Directorate for Engineering Sciences, "Economic Issues Related to a CO Warning Label on Portable Generators," July 19, 2006.

3. Memorandum from Natalie E. Marcy, Mathematical Statistician, Division of Hazard Analysis, Directorate of Epidemiology, and Debra S. Ascone, Mathematical Statistician, Division of Hazard Analysis, Directorate for Epidemiology, to Janet Buyer, Project Manager, Division of Combustion and Fire Sciences, Directorate for Engineering Sciences, " Incidents, Deaths, and In-Depth Investigations Associated with Carbon Monoxide from Engine-Driven Generators and Other Engine-Driven Tools, 1990-2004," December 1, 2005.

4. Memorandum from Robin L. Ingle, Health Statistician, Division of Hazard Analysis, Directorate for Epidemiology, to Janet Buyer, Project Manager, Division of Combustion and Fire Sciences, Directorate for Engineering Sciences, "Non-fire Carbon Monoxide Fatalities Associated with Engine-Driven Generators and Other Engine-Driven Tools in 2004 and 2005," January 13, 2006.

Dated:

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Todd A. Stevenson, Secretary  
Consumer Product Safety Commission

Figure 1 On-product carbon monoxide poisoning hazard label

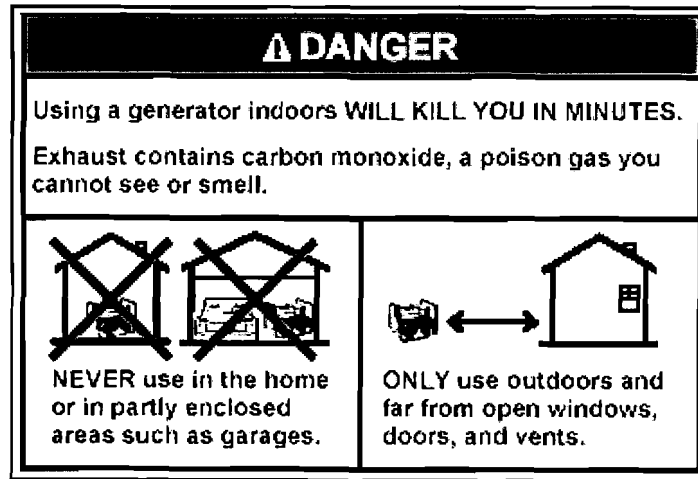


Figure 2 Safety Alert Symbol



Figure 3 Carbon monoxide poisoning hazard label for package

