



UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
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MEMORANDUM

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**Subject:** Proposed Warning Language to Accompany Generators

Burning fossil fuels such as gasoline can produce carbon monoxide (CO), a potentially lethal gas. As a consequence, some people who have used generators and other tools with small gasoline-powered engines have experienced CO poisonings. This is often due to use of the tool in enclosed or semi-enclosed spaces. In June 2002, staff from the Division of Human Factors (ESHF) presented staff from the Division of Combustion and Fire Sciences (ESFS) with a memorandum discussing the potential effectiveness of current product labels and instruction manuals in addressing this hazard, and changes that might improve their effectiveness (Smith, 2002). This memorandum expands upon the 2002 Smith memorandum by proposing specific warning language to accompany generators. The staff believes that the proposed warning language could be applied to other engine-driven tools that generate CO, but that slight changes may be necessary depending on the specific tool and application.

As discussed in detail within the 2002 Smith memorandum, CO hazard labels must instruct consumers to keep generators outdoors, away from semi-enclosed spaces, and away from air intakes during use. However, current electrocution warnings on generators instruct consumers to keep the generator dry and out of damp conditions—weather conditions that are likely to precipitate generator use. The proposed warning language in this memorandum, therefore, has been prepared under the assumption that this conflict can and will be resolved by eliminating the electrocution warning. This could be accomplished by designing generators to permit their use outdoors in poor weather conditions. Another way to eliminate this conflict would be to

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discourage generator use during such weather conditions; however, ESHF staff believes use of the generator under these conditions is clearly a reasonably foreseeable use of the product.

## DISCUSSION

Generator warnings associated with CO poisoning generally appear in two places: on the product itself and within the instruction manual accompanying the product (Smith, 2002). The on-product warning is typically in the form of a label. In general, product labels present an abbreviated description or discussion of hazards, and those accompanying generators are no exception. Instruction manuals, on the other hand, allow for longer, more detailed descriptions of hazards. ESHF staff's proposed warning language for generator instruction manuals will be discussed first.

### Instruction Manuals

ESHF staff's proposed warning language for generator manuals appears in Figure 1. As described in the 2002 Smith memorandum, generator instruction manuals reviewed by the staff tended to group warnings together in a safety section near the beginning of the manual. The presence of this warning in such a section would be beneficial to consumers who specifically look for all safety information available on the product. Furthermore, if the safety section includes "▲ WARNING" or a similar safety-related signal word at the beginning of the section, ESHF staff believes it may be unnecessary to include the signal word at the beginning of this particular warning. However, this option should only be considered if the other warnings within that section also lack an initial signal word.

<p><b>▲ WARNING – Poisonous Gas</b> Generators give off carbon monoxide, a poisonous gas that can kill you. You CANNOT smell it, see it, or taste it.</p> <ul style="list-style-type: none"><li>• ONLY run generator outdoors and away from air intakes.</li><li>• NEVER run generator inside homes, garages, sheds, or other semi-enclosed spaces. These spaces can trap poisonous gases, EVEN IF you run a fan or open doors and windows.</li></ul> <p>If you start to feel sick, dizzy, or weak while using the generator, shut it off and get to fresh air RIGHT AWAY. See a doctor. You may have carbon monoxide poisoning.</p>
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Figure 1. Proposed Warning Language for Generator Manuals.

Research suggests that consumers often skip over safety sections, focus on information that describes how to use the product, and are more likely to read warnings in manuals if they are interspersed within the operating instructions (Silver & Braun, 1999; Wogalter & Leonard, 1999; Croft & Harris, 1998). Therefore, ESHF staff proposes that the above warning not be restricted to a safety section. The staff further proposes that the first step of the operating instructions tell the consumer to find a safe place to operate the generator—for example, "1. Place the generator outdoors and away from open windows, doors, or other air intakes"—and that this be followed immediately by the proposed warning.

The rationale for the content of the proposed warning is based primarily on the analyses performed and discussion presented in the prior ESHF staff memorandum (Smith, 2002). The hazard, probable consequences of exposure to the hazard, and how to avoid the hazard are explicitly stated, and the signal word "WARNING" was chosen to identify "a potentially

hazardous situation which, if not avoided, could result in death or serious injury” (ANSI Z535.4-2002). The signal word is preceded by a safety alert symbol, which is recommended in ANSI Z535.4-2002 and indicates the potential for personal injury. The message that is conveyed by this warning is generally consistent with that of the Commission’s mandatory labeling for packages of charcoal (see Figure 2),<sup>1</sup> which is also associated with CO poisoning.

ESHF staff believes it is important for the warning to identify CO by name for those consumers who are familiar with CO and the hazard it presents. However, the phrase “carbon monoxide” is unlikely to be recognized by some of the general public, especially those with lower levels of education. Terms that are unfamiliar or that are perceived to be technical may

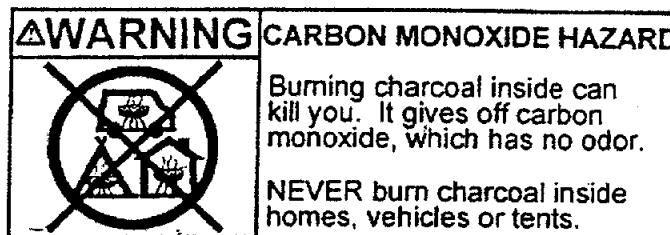


Figure 2. Mandatory Labeling for Packages of Charcoal.

dissuade consumers from continuing to read the warning and may even lead those consumers to believe that the warning is not personally relevant. Therefore, ESHF staff selected the phrase “Poisonous Gas” to immediately follow the signal word in the warning. CO is referred to by name, however, within the more detailed description of the hazard in the warning.

Consumers who are familiar with CO may have mistaken beliefs about it and about how to avoid CO poisoning (Smith, 2002; Speed, Dickson, & Birtles, 1999). For example, even consumers who are aware that CO is potentially deadly may be unaware that it is essentially undetectable to the senses. Some consumers may believe that they will be able to detect CO if they are exposed to it, and therefore may not take the precautions necessary to avoid potential exposure in the first place. This may be especially true for those who have appliances that use natural gas, to which a distinctive odor has been added to aid in the detection of leaks (Wogalter & Leonard, 1999). This is consistent with the findings of some in-depth investigations of CO poisonings associated with generators, in which people stated that they did not “smell” CO (Smith, 2002), and is supported by research commissioned by the United Kingdom’s Department of Trade and Industry (Croft & Harris, 1998). Although CO overexposure may result in symptoms mimicking the flu, and would therefore be indirectly detectable by consumers, the symptoms’ very similarity to those of the flu may mislead consumers about the cause. Furthermore, if consumers exhibit these symptoms, they have already been overexposed to CO, so ESHF staff believes it is inadvisable to use these symptoms as exclusive identifiers of the presence of CO. Nevertheless, CO poisonings have occurred to consumers who had a generator outdoors but whose exhaust entered an air intake to the house, suggesting that CO overexposure can occur despite consumers’ efforts to avoid it (Smith, 2002). Because knowledge and awareness of the symptoms of CO overexposure could prevent deaths in situations such as this, it was included in ESHF staff’s proposed warning.

ESHF staff chose the specific sites identified in the warning—that is, homes, garages, and sheds—based on its review of CO poisonings associated with generators. Although ESHF staff realizes that these incidents are not a statistical sample, the aforementioned sites were common spaces in which consumers involved in these incidents used generators. Therefore, the staff believes they are reasonably likely to represent semi-enclosed spaces in which consumers might

<sup>1</sup> 16 CFR § 1500.14(b)(6)

use a generator. A more generic term, such as “inside,” may suggest to consumers that the CO hazard exists only if generators are used in completely enclosed spaces. The use of more specific examples, as identified above, combined with a positive instruction about where generators should be used—that is, “ONLY run generator outdoors and away from air intakes.”—provides consumers with better information and is less likely to be misinterpreted. The staff further believes that it is important for the warning to tell consumers that opening doors and windows or operating fans may not sufficiently ventilate a space, hence the addition of the phrase, “[t]hese spaces can trap poisonous gases, EVEN IF you run a fan or open doors and windows.”

## **Product Labels**

One of the difficulties associated with developing the on-product warning label was striking a balance between keeping the label concise and providing consumers enough information about the hazard, consequences of exposure to the hazard, and ways to avoid the hazard. The latter factors are especially important because collateral materials, such as instruction manuals, may not be read, may be read and then forgotten, or may not even be available if the consumer is renting or borrowing the product or had purchased it second-hand. Yet if a warning label is too lengthy or there are too many warnings on the product, consumers may become overloaded and be unable or unwilling to process the information (Wogalter & Leonard, 1999). Therefore, it is necessary to prioritize the information presented in a warning label and to place only the most important information on a label. ESHF staff addressed these concerns in the following ways:

- The characteristics of CO were limited to “odorless.” Although CO is also colorless and tasteless, the staff believes consumers are most likely to believe they will be able to smell CO if it is present. As stated earlier, natural gas has a distinctive odor that has been specifically added to aid in consumer detection, and consumers’ experiences with this may lead many to believe they will be capable of smelling CO when it is present.
- The specific locations in which one should not use a generator do not include the more generic “other semi-enclosed spaces.” The staff believes this term is more open to interpretation than the other sites specified, and that instructing consumers to only use the generator outdoors should reduce any ambiguity associated with its absence.
- The inadequacy of running a fan or opening doors and windows for ventilation was merged with the statement describing where not to use a generator.
- Descriptions of the symptoms of CO overexposure and what consumers should do if they encounter them have been deleted. This information would add a substantial amount of text to the label and is of limited value given that the label is to be placed directly on the generator. The primary function of the product label is to prevent exposure to the hazard in the first place. Although it is possible that CO overexposure can occur even if one follows the advice of the label, virtually all cases of CO poisoning associated with generators would be eliminated if consumers were to follow the advice on the proposed label. Therefore, the addition of this information is likely to add little value to a product label.

- “See product manual for more details” was added to the bottom of the warning label. If a consumer adheres to the label, they will still obtain the more detailed information present in the manual. If a consumer chooses not to refer to the manual or is unable to do so, the information that is provided in the label should address most of the key safety information that consumers must be aware of when using a generator.

ESHF staff also suggests that the product label be consistent with the performance requirements of the *American National Standard for Product Safety Signs and Labels* (ANSI Z535.4). Based on this and the above points, ESHF staff proposes that generators use a product label similar to that shown in Figure 3. Note that ESHF staff chose the phrase “[t]his product gives off carbon monoxide...” rather than “[g]enerators give off carbon monoxide....” This was for two reasons. First, it more explicitly identifies the specific product to which it is attached as the product that gives off CO, thereby eliminating any potential ambiguity. Second, the proposed label can be more readily applied to other small engine-driven tools other than generators.

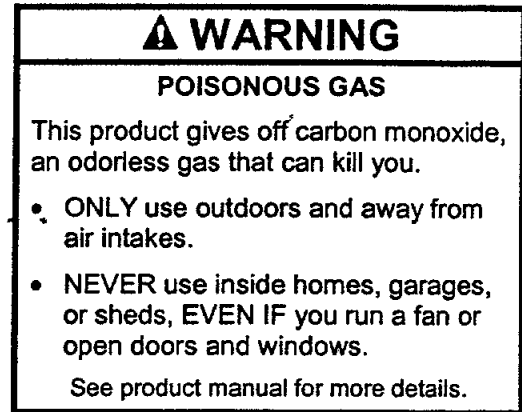


Figure 3. Proposed Product Label.

### Pictogram Use

Research suggests that pictograms can improve the salience and understandability of a warning (Wogalter & Leonard, 1999; Leonard, Otani, & Wogalter, 1999; Croft & Harris, 1998), so incorporating one into the proposed warnings may be worth considering. Some labels that currently appear on generators include a pictogram of a person breathing gas, which is essentially identical to that used in Westinghouse Electric Corporation’s *Product Safety Label Handbook* (1985) to identify hazardous “gas or vapors.” (see Figure 4). A study involving 16 pictograms from that handbook found that 85% of participants were able to correctly recognize this particular pictogram (Mayer & Laux, 1989). Although the study-participant population may not be representative of the general population, the results do suggest that this pictogram is likely to be reasonably well understood and effective, which is something that cannot be said of many pictograms. Even so, ESHF staff has concerns that the visible gas in the pictogram could mislead some consumers into believing that CO is visible. This might be remedied by changing the statement “This product gives off carbon monoxide, an odorless gas that can kill you” to language similar to that proposed for the instruction manual: “This product gives off carbon monoxide, a poisonous gas that can kill you. You CANNOT smell it, see it, or taste it.” However, consumers might be confused by the apparent conflicting messages. Consumer testing of labels using the pictogram would be valuable to determine the extent to which this may be cause for concern and to determine other potential sources of critical confusion. If one elected to use this pictogram, the following examples

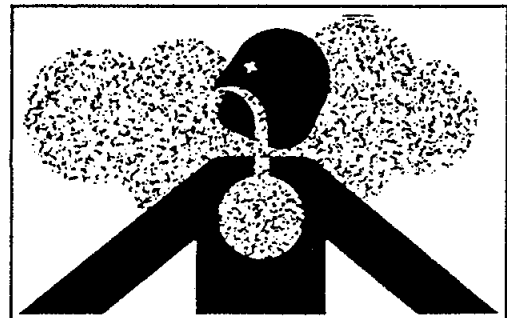


Figure 4. Hazardous Gas/Vapors Pictogram.

demonstrate possible ways of incorporating it into ESHF staff's proposed instruction-manual warning and product label.<sup>2</sup>

Instruction Manual:

**⚠ WARNING – Poisonous Gas**



Generators give off carbon monoxide, a poisonous gas that can kill you. You CANNOT smell it, see it, or taste it.

- ONLY run generator outdoors and away from air intakes.
- NEVER run generator inside homes, garages, sheds, or other semi-enclosed spaces. These spaces can trap poisonous gases, EVEN IF you run a fan or open doors and windows.

If you start to feel sick, dizzy, or weak while using the generator, shut it off and get to fresh air RIGHT AWAY. See a doctor. You may have carbon monoxide poisoning.

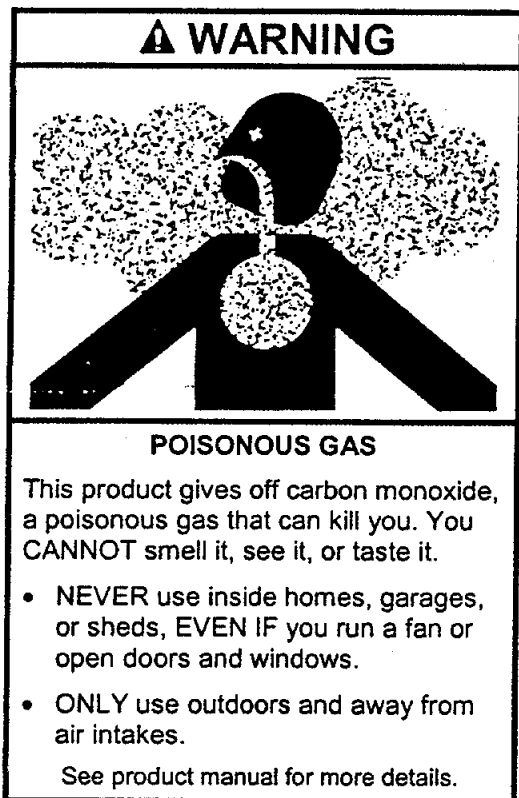
Product Label, Horizontal Formats (2):

	<p><b>⚠ WARNING</b></p>
	<p style="text-align: center;"><b>POISONOUS GAS</b></p> <p>This product gives off carbon monoxide, a poisonous gas that can kill you. You CANNOT smell it, see it, or taste it.</p> <ul style="list-style-type: none"> <li>• ONLY use outdoors and away from air intakes.</li> <li>• NEVER use inside homes, garages, or sheds, EVEN IF you run a fan or open doors and windows.</li> </ul> <p style="text-align: center;">See product manual for more details.</p>

<p><b>⚠ WARNING</b></p>	
	<p style="text-align: center;"><b>POISONOUS GAS</b></p> <p>This product gives off carbon monoxide, a poisonous gas that can kill you. You CANNOT smell it, see it, or taste it.</p> <ul style="list-style-type: none"> <li>• ONLY use outdoors and away from air intakes.</li> <li>• NEVER use inside homes, garages, or sheds, EVEN IF you run a fan or open doors and windows.</li> </ul> <p style="text-align: center;">See product manual for more details.</p>

<sup>2</sup> Pictograms developed by FMC Corporation, and obtained from the *Product Safety Sign and Label System* (FMC Corporation, 1985) and the *Product Safety Label Handbook* (Westinghouse Electric Corporation, 1985).

Product Label, Vertical Format:



A pictogram similar to that used in the Commission's required charcoal labeling may also be worth considering (see Figure 2).<sup>1</sup> This would entail designing a pictogram of a generator being used within semi-enclosed spaces and the use of a prohibition symbol or "X" to denote that the displayed action is undesirable. Accomplishing this, however, may be more difficult than was the case with the charcoal label since generators do not have as distinctive and recognizable a shape as charcoal grills, in general. Consequently, consumers may be unable to correctly interpret such a pictogram.

## CONCLUSIONS & RECOMMENDATIONS

ESHF staff has proposed specific warning language to accompany portable generators in an effort to reduce CO poisonings associated with their use. Specifically, the staff has proposed language to appear in generator manuals and a label to appear on generators themselves. ESHF staff believes these recommendations may be generally applied, with minor modifications, to other small engine-driven tools that generate CO. Consumer testing of the proposed language and of any pictograms that might accompany the language would be beneficial and may identify sources of critical confusion, in which consumers' interpretations of the warnings are opposite the intended message or can lead to other dangerous behaviors.

## REFERENCES

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