UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

MEMORANDUM

DATE: May 26, 2006

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THROUGH: Hugh M. McLaurin, Associate Executive Director,
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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.[1] The staff included this label in its comments to Underwriters Laboratories (UL) for its Outline of Investigation, which was published in April 2006.

[1] 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.

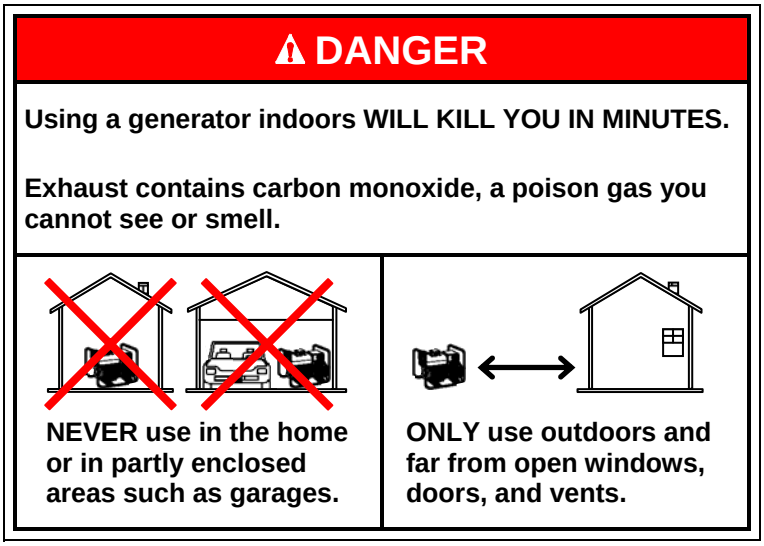

FIGURE 1. Recommended product label.

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

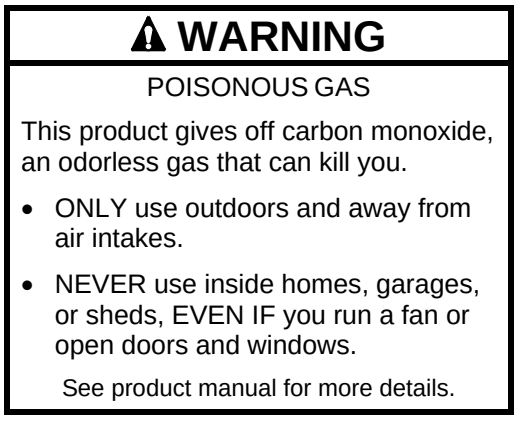

FIGURE 2. Original label from CPSC staff.

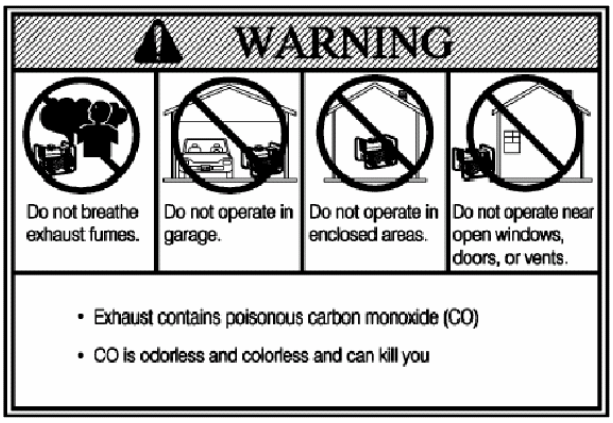

FIGURE 3. Label from UL STP.

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.

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