



Standards &
Engagement



Understanding the Silent Threat:

Early Detection and Prevention of
Carbon Monoxide Poisoning



Carbon monoxide poisoning is a serious public health threat, [claiming hundreds of lives](#) and sending more than 100,000 people to the emergency department in the United States each year. These numbers may be higher, as symptoms of unintentional CO poisoning — which include headache, dizziness, nausea, vomiting, and confusion — are easily misdiagnosed.

UL Standards & Engagement’s ongoing consumer research on the topic reveals alarming misconceptions and knowledge gaps among the American public that can have devastating consequences, including a lack of awareness of common sources of CO in the home, underrating the importance of having functioning CO detection devices, and assuming protection when away from home.

Carbon monoxide is found in fumes produced by common fuel-burning household appliances such as furnaces, stoves and gas ranges, vehicles in enclosed spaces, and portable generators, among others. According to ULSE surveys conducted across four waves between August and December 2023, nine in ten American households currently have at least one fuel-burning appliance, with the average household owning four such products. Yet nearly half of U.S. adults surveyed were unaware that these types of appliances are potential sources of CO emissions.

Despite the prevalent use of fuel-burning appliances, consumers miscalculate the personal relevance of CO exposure risks — more than one-third of U.S. adults are not concerned with CO exposure or unintentional poisoning at home, and twice as many do not perceive CO to be a risk to themselves or their households. This sense of assumed safety extends outside of the home as well, where the common assumption is that public spaces — businesses like hotels, daycares, restaurants, and other establishments — are required by law to have CO alarms installed. In reality, the state patchwork of requirements is limited and inconsistent. For example, the [Jenkins Foundation](#), founded in the name of Daryl and Shirley Jenkins who lost their lives to CO poisoning in a North Carolina hotel, reports that only 14 states require alarms in short-term lodging.

Detection is often the first, and sometimes only, means to prevent tragedy, but far too many people are leaving themselves unprotected. ULSE surveys consistently show that consumers are unsure if or what kind of detection options are installed at home and mistake fire protection as CO protection. More than one-third of American adults — an estimated 86.2 million people — do not have a CO alarm in their home.

Portable generators are a leading cause of unintentional CO poisoning. Gaps in consumer education about the safe use of generators contributes to such incidents: one-third of portable generator owners think it’s safe to run a generator in a garage if the door is open; another one-third think portable generators can be run near windows if they are placed outdoors.

These concerning misconceptions highlight the imperative for greater consumer education, enhanced product safety guidelines, and more widespread and stringent use of standards to protect against the potentially fatal consequences of carbon monoxide exposure.



36% of U.S. consumers have no means of carbon monoxide detection at home



29% of U.S. consumers think smoke alarms eliminate the need for CO detection

86 Million Americans Are Unprotected as CO Detection Is Overlooked

Despite the widespread use of fuel-burning appliances in U.S. households, there is little awareness of the risk of CO exposure, and more than one-third of households lack CO detection options.



Low awareness of CO emission sources:

A significant majority (89%) of U.S. adults own some type of fuel-burning appliance — one that uses natural gas, propane, gasoline, fuel oil, wood, or coal — which carries the risk of a CO leak if it is malfunctioning. Despite prevalent use, on average, 45% are unaware that these appliances can be potential sources of CO exposure.



CO detection absent in more than a third of U.S. homes:

One-third (36%) of U.S. adults — 86.2 million individuals — have no means of detecting CO leaks in their homes. Further, many Americans are confused about what counts as detection. Nearly three in ten (29%) U.S. consumers — more than an estimated 69 million Americans — say they do not need (17%) or are unsure (12%) if they need a CO alarm in the home if smoke alarms are present. Additionally, one in ten have never replaced the battery in their CO alarm.



Risky beliefs lead to risky behaviors:

A significant portion of U.S. adults hold misconceptions that could potentially expose them to further dangers: 30% mistakenly believe it's safe to run a vehicle inside a garage with the door open, while 17% incorrectly think that CO alarms remain effective indefinitely and never require replacement, regardless of age.



One in four generator owners don't feel it's necessary to keep portable generators at least 20 feet from people and pets

Unknowingly at Risk: Most Generator Owners Are Unaware of CO Dangers

Portable generators play a critical role in the wake of severe weather, offering an energy source to power light, refrigeration, heating and cooling, medical equipment, and more. Most owners purchased theirs for backup power in case of emergency (52%) or because of frequent storm-related outages (19%). With portable generators as a leading cause of unintentional CO poisoning, owners show gaps in knowledge that can kill.



Majority of generator owners do not feel at risk — or know there is one:

An estimated 29 million Americans own a portable generator. A substantial group of these owners aren't aware of the risks associated with these appliances, and even more think that these risks don't apply to them. One in five (23%) owners did not even realize that portable generators are a potential source of CO. Four in ten owners (41%) are not concerned that they will be exposed to CO from their portable generators, and nearly two-thirds (62%) do not feel that they or their households are at risk of CO exposure or poisoning from their generators.



Limited research on portable generator purchases:

Generators are often bought for emergency situations, perhaps explaining why more than one-third (34%) of portable generator owners say they did not use any type of information sources to learn about portable generator safety standards before purchasing, and another 26% said they did not look up or receive information on safe operation upon purchase. Furthermore, 30% did not verify if their generators comply with safety standards.



Gaps in knowledge can lead to tragedy:

Perhaps due to these gaps in information, 29% of generator owners mistakenly believe it's safe to operate a generator in the garage with the door open, while another quarter (25%) don't feel it's necessary to keep portable generators at least 20 feet from people and pets. Even more concerning, 23% are under the misconception that a carbon monoxide detector is unnecessary when running a portable generator.



More than 153 million do not believe that they or their families are at risk of CO exposure

Assumed CO Protection at Home and in Public Spaces

Most Americans feel safe from unintentional carbon monoxide poisoning at home. This misplaced trust extends to businesses open to the public, like hotels and restaurants, where alarms may not be present, leaving consumers with a false sense of security.



Misplaced sense of security at odds with high levels of risk:

According to ULSE, 36% of U.S. adults are not concerned about carbon monoxide exposure or unintentional poisoning within their homes, while 64% — an estimated 153.7 million — do not perceive any risk to themselves or their households. Older consumers (65 years or older) are the least likely to express concern, with 77% saying they do not feel at risk. Urban residents are more likely (46%) than suburban or rural residents (30%) to feel they are at risk. Their concern is reasonable, as [62% of CO poisonings](#) occur in urban locations, compared to 19% suburban and 18% rural.



Widespread assumption of safety in public places:

Unintentional carbon monoxide poisonings have been documented in public settings including churches, daycares, and more. Still, half (50%) of Americans do not worry about exposure to CO in these settings because they trust that CO alarms are installed. Similarly, nearly half (46%) of travelers do not worry about CO exposure when staying in hotels and rental properties because they assume alarms are installed. And, while only 14 states require that hotels and vacation rentals have carbon monoxide alarms installed, 44% feel they are protected because they believe every state has laws that require alarms.



Consumers claim competency but not responsibility:

More than three in five (63%) consumers claim that they are familiar with how to mitigate the risk of CO exposure or unintentional poisoning at home. Yet they don't think that consumers (61%) themselves should be the first line of defense, instead indicating that product manufacturers (65%) should bear the responsibility of reducing the risk of CO exposure.

Mitigating the Risk of CO Poisoning Through Safety Standards

UL Standards & Engagement has more than 75 standards in its catalog that address carbon monoxide safety in residential, commercial, and industrial environments. These include standards for detectors and alarm systems, home heating and cooking appliances, and fuel-burning industrial products like portable generators. Some of these standards are summarized below:

UL 2034, Standard for Single and Multiple Station Carbon Monoxide Alarms, features performance requirements to ensure fixed and portable alarms are functional and reliable in detecting dangerous levels of carbon monoxide. The standard requires alarms to report before CO reaches levels that cause a loss of ability to react. In August 2023, [UL 2034 was updated to expand coverage](#) to non-dwelling units such as motels, restaurants, and other indoor locations that do not have more sophisticated detection systems installed. It also requires CO alarms to sound an audible end-of-life tone that is different from the alarm signal, indicating the need for device replacement.

UL 2201, Standard for Safety for Carbon Monoxide (CO) Emission Rate of Portable Generators, is the first standard for portable generators to address the mitigation of carbon monoxide emissions. In order to conform to the standard, a portable generator must limit the active CO emissions produced while its engine is running, and it must also be equipped with a sensor that will shut the unit off if it detects a high output or accumulation of carbon monoxide. In February 2022, the U.S. Consumer Product Safety Commission published a report that determined [UL 2201 would avert nearly 100% of deaths from carbon monoxide poisoning by generators](#) in enclosed spaces.

ANSI/CAN/UL 1008M, Standard for Transfer Switch Equipment, Meter-Mounted, provides requirements for equipment that enables homeowners to safely connect portable generator power to a home at the meter base outdoors, greatly reducing the likelihood of individuals running generators indoors in the event of a power outage.

These standards save lives. Consumers should always have carbon monoxide detection throughout their homes, when they travel, and wherever they are operating equipment like portable generators. Portable carbon monoxide alarms can keep travelers safe in locations where CO detectors are not required; and standards like UL 2034 ensure that these alarms will detect and report as intended in the event of a CO emergency. Likewise, safeguards like those in UL 1008M and UL 2201 can help account for consumer education gaps by enhancing product safety and preventing or discouraging product misuse that would otherwise lead to CO poisoning.



Survey Methodology

The results are taken from four ULSE Insights surveys, each consisting of responses from 2,000+ U.S. adults conducted August 30 – September 3, 2023, September 29 – October 4, 2023, October 28 – November 1, 2023, and December 14-18, 2023. All studies were designed and formulated by UL Standards & Engagement. Surveys were administered online by BV Insights. As a member of the Insights Association and ESOMAR (the European Society for Opinion and Marketing Research), BV Insights adheres to industry ethics and best practices, including maintaining the anonymity of respondents.

After data collection was completed, completed interviews were weighted by five variables: age, sex, geographic region, race, and education, to ensure reliable and accurate representation of the total U.S. population, 18 years of age and older. In the analysis and presentation of some data, calculations reference U.S. online adult population estimated at 240.2 million using two sources of publicly available data: 2020 wave of the U.S. Census for U.S. adult population estimate of 258.3 million, and Pew Research Center's Internet/Broadband Fact Sheet which estimates 93% of U.S. adults use the internet, as of 2021.

The margin of sampling error at 95% confidence for aggregate results is +/- 2.2%. Sampling error is larger for subgroups of the data. As with any survey, sampling error is only one source of possible error. While non-sampling error cannot be accurately calculated, precautionary steps were taken in all phases of the survey design and the collection and processing of the data to minimize its influence.

Note: All numbers are percentages unless otherwise noted. Figures may not total 100% due to rounding.

A False Sense of CO Security

01 More than one-third of U.S. homes have no CO detection

36%

of U.S. adults – 86.2 million individuals – have no means of detecting CO leaks in their homes



29%

of U.S. consumers say they do not need (17%) or are unsure (12%) if they need a CO alarm in the home if smoke alarms are present



02 Americans Assume CO protection in public places

Half of Americans trust that CO alarms are installed in public spaces such as:



Daycares



Restaurants



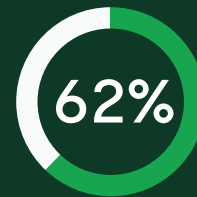
Churches



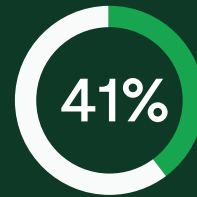
46% of travelers do not worry about CO exposure when staying in hotels and rental properties because they assume CO alarms are installed

03 Generator owners do not feel at risk — or know there is one

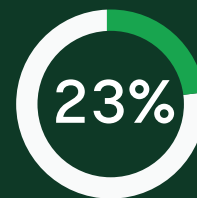
An estimated 29 million Americans own a portable generator, primarily to deal with power outages in extreme weather



of generator owners said they do not feel that they or their households are at risk of CO exposure or poisoning from their generators



are not concerned that they will be exposed to CO from their portable generators



of generator owners did not realize that portable generators are a potential source of CO

