

## Why GAO Did This Study

Since 1976, HUD has been responsible for developing construction and safety standards (the HUD Code) for manufactured homes. Concerns have been raised by Congress and others about existing HUD code requirements that are intended to ensure proper indoor air quality, including protecting occupants from potential carbon monoxide exposure. As requested, GAO examined 1) existing standards for separating air intakes and exhaust vents in both manufactured and site-built homes; 2) reasons for differences in ventilation standards for manufactured and site-built homes; and 3) the number of manufactured homes built, the distances between their air intakes and exhaust vents, and the performance of their ventilation systems. GAO reviewed documentation from HUD and building standards organizations to determine differences in requirements tied to ventilation and air quality, reviewed the rulemaking process and status of proposed updates to manufactured housing standards related to ventilation and air quality, analyzed data on the occupancy of manufactured houses subject to HUD's standards, assessed HUD's efforts to ensure compliance with certain standards, and interviewed agency officials and indoor air quality experts.

## What GAO Recommends

GAO recommends that HUD test the performance of installed ventilation systems and reassess its ventilation standards. HUD generally agreed with both recommendations and stated that it would bring them before the MHCC for consideration.

View [GAO-13-52](#). For more information, contact Mathew J. Scireà at (202) 512-8678 or [sciremj@gao.gov](mailto:sciremj@gao.gov).

# MANUFACTURED HOUSING STANDARDS

## Testing and Performance Evaluation Could Better Ensure Safe Indoor Air Quality

## What GAO Found

Key standards for manufactured homes provide a lower margin of safety against a carbon monoxide exposure incident than those for site-built homes, which are constructed at their permanent locations. For instance, the Department of Housing and Urban Development (HUD) Code requires a minimum 3-foot separation between air intakes and exhaust vents, while industry standards for site-built homes have required a greater distance for many years. The industry standards call for a greater separation between air intakes and exhaust vents to help reduce the risk that contaminants such as carbon monoxide will re-enter the home. Indoor air quality experts whom GAO interviewed stated that the exhaust of an improperly operating furnace combined with unique wind conditions could, in rare cases, present a risk of carbon monoxide exposure. GAO analysis shows that increasing the separation between an air intake and exhaust vents, using industry standards, can significantly dilute concentrations of contaminants.

The primary reason for the differences in ventilation standards for manufactured homes and site-built homes is the HUD Code has not been updated since 2005 and has not kept pace with standards tied to ventilation and air quality for site-built homes. For example, updates to standards for site-built homes made in 2003 requiring a greater separation between intakes and exhaust vents are only now being considered by HUD for manufactured homes. This update was recommended to HUD in 2010 by the Manufactured Housing Consensus Committee (MHCC), which is responsible for recommending proposed rule changes to HUD. Similarly, requirements for carbon monoxide detectors adopted in industry standards for site-built homes and recommended by the MHCC in 2009 have yet to be incorporated in the HUD Code. HUD did publish a proposed rule in the *Federal Register* in 2010 to update aspects of the HUD Code but has not issued a final rule because the rulemaking process is ongoing. Additional proposals, including the two above related to indoor air quality, are under consideration by HUD, but have not yet been published as proposed rules.

An estimated 5.5 million occupied manufactured homes were built under the HUD Code, according to 2009 American Housing Survey data. Although HUD retains copies of approved designs of manufactured homes, the agency does not maintain data on the actual distances between the air intakes and exhaust vents of each home. Further, once ventilation systems are installed in manufactured homes, HUD does not require manufacturers to test their performance. For example, manufacturers are not required to determine if the systems meet the requirements for the whole-house ventilation airflow rate, which quantifies the volume of air exchanged in the home over time. Without performance testing of the installed ventilation systems, HUD cannot fully ensure that the systems installed in manufactured homes are meeting performance specifications. In addition, HUD's standard for the whole-house airflow rate provided by mechanical ventilation was initially established assuming a certain level of natural air infiltration. This whole-house airflow rate standard has not changed since 1993. Air quality experts and research suggest that homes are increasingly being built with less air leakage, reducing the expected level of natural air infiltration. However, HUD has not reassessed the whole-house ventilation airflow rate standard to determine whether it continues to be sufficient to assure adequate air quality.