



Recommendations for the General Public Related to Health Effects from Chinese Drywall Revised

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The Association for Occupational and Environmental Clinics (AOEC) and its network of Pediatric Environmental Health Specialty Units (PEHSU) has updated its recommendations since the original 2011 document, based on new information. A team of people in pediatrics, occupational environmental medicine, medical toxicology, and industrial hygiene contributed to these recommendations.

While we cannot provide specific clinical opinions based on the symptoms reported, we do offer this precautionary health guidance for these families to consider and share with their physicians.

Chinese drywall (CDW) was imported in 2004-9 from China and installed in homes, mostly in the southeastern United States in 2004 to 2006. Approximately 7,000 homes are known to have been built with this Chinese drywall, though estimates report enough drywall was imported to build over 100,000 homes. Additional homes may have been built with a mixture of imported and US-made drywall, and may not have sufficient problem drywall installed to cause adverse health or structural issues. Approximately 74% of complaints were from the state of Florida, with Louisiana (17%), Virginia (3%), Alabama (1%), Mississippi (1%), and other states comprising the final 4% of homes.

Some owners of homes built using US-made drywall have also reported similar symptoms. This document will therefore use the term “problem drywall” to refer to situations resulting from use of either Chinese or US-made drywall that has or is causing health or structural effects.

The presence of imported problem drywall usually can be determined by specific tests that do not require removing existing drywall. The best test seems to be the combined use of X-ray fluorescence (XRF) and Fourier-transform infrared reflectance (FTIR). XRF can determine the level of strontium in the drywall, and FTIR can measure carbonate absorbance. On these tests, the presence of both strontium levels > 1200 ppm AND carbonate absorbance > 5 units strongly supports the presence of imported drywall, while the presence of both strontium levels < 1200 ppm AND carbonate absorbance > 5 units strongly supports the presence of domestic drywall.

Recent research to find out the cause of reported health effects associated with problem drywall seems to show that the release of hydrogen sulfide (H₂S) and other related gases from affected drywall increases the reported health concerns.

Hydrogen sulfide is a flammable, colorless gas with a “rotten-egg” odor that can be irritating to one’s eyes, nose, and throats at low levels. In addition, many homes with high hydrogen sulfide levels have corrosion of both copper and silver building materials (as found in wires, electrical outlets, switch receptacles, smoke detectors, carbon monoxide detectors, etc.).

The levels of hydrogen sulfide were measured in 51 homes studied by the US Consumer Product Safety Commission, many of which had installed problem drywall. Hydrogen sulfide in those homes with CDW often *exceeded* 0.59 ppb, which seemed to match with complaints about problem drywall issues. Almost all homes without problem drywall had hydrogen sulfide levels *below* 0.35 ppb. All of these values are below the CDC’s Agency for Toxic Substance and Disease Registry’s (ATSDR) “minimum risk level” of 20 ppb, but even the exposure to hydrogen sulfide at levels exceeding 0.59 ppb on an ongoing basis could be responsible for symptoms.

Formaldehyde and volatile organic compounds (VOCs) concentrations were not significantly different in problem drywall and non-affected drywall homes. However, because formaldehyde and volatile organic compounds can also irritate the breathing tract, irritation of the airway may be increased in the presence of both sulfur compounds and these chemicals.

Based on data reported by families living in these homes and subsequent studies at Lawrence Berkeley National Labs and Georgia Institute of Technology:

1. It is likely that the levels of these gases attained after exposure to problem Chinese-manufactured drywall were sufficient to cause adverse health effects.
2. It is not likely that the levels attained after exposure to *typical* American-manufactured drywall were sufficient to cause adverse health effects.
3. No conclusions are available about the likelihood of problem American drywall to cause adverse health effects, due to limited data.

There appears to be a connection between exposure to Chinese drywall and these adverse health and structural effects. The connection between these adverse health and structural effects to US-made drywall is less clear.

Data from Chinese drywall off-gassing incidents have found:

- Hydrogen Sulfide (H₂S)
 - Hydrogen sulfide appears to be present in higher concentrations in most affected homes as compared to homes unaffected by Chinese drywall.
 - Hydrogen sulfide has a low odor threshold, meaning it can be detected by humans at very low levels. This is especially true in newly built homes that have less air leakage between the outdoors and indoors.
 - The Hydrogen sulfide measured both in the homes and in laboratory tests is below ATSDR’s “minimum risk level” of 20ppb. The fact that the measured level is less than the “minimum risk level” does *not* mean that Hydrogen sulfide is not causing

- symptoms.
- Hydrogen sulfide release from drywall appears to occur more at higher home humidity levels.
- Corrosion of copper and silver building materials, associated with elevated Hydrogen sulfide levels, are consistently found in houses affected with CDW.
- **Strontium**
 - Elevated strontium levels have been found in CDW compared to non-affected drywall, but do not appear to pose any health risk.
 - The measurement of strontium levels in suspected drywall using portable Fourier Transform Infrared (FTIR) Spectroscopy and X-ray Fluorescence (XRF) is fairly accurate for affected CDW when used together with measurement of carbonate absorbance.

The health effects (respiratory irritation, headaches, sinusitis, eye irritation, throat irritation, malaise/weakness and others) reported by these families are consistent with known health effects from sulfur gases, and with symptoms reported by others living in homes constructed with Chinese drywall.

The relationship between these symptoms and American-made drywall is not as well established. Although some of these health effects are common in the general population, this group of symptoms appears to be more frequent in similar situations when problem drywall is present.

Given what is currently known about problem drywall, we recommend taking prudent actions that limits or ends this exposure as soon as possible. We recognize the difficult economic situation families face in renovating or leaving these homes. However, families who have either removed the problem drywall or moved out of homes with problem drywall have reported improvements in these symptoms. These families' experience suggests that those still living in problem drywall homes are likely to experience similar health improvements if they can eliminate this exposure (by changing ventilation and/or by removing the product, or by moving out).

Summary of Recommendations

The recommendations we offer are based on a general public health approach used in similar exposure issues in addition to current research on this topic. We advise:

- 1) Reduce exposure to problem drywall to the extent practical.
 - a) *Where possible, if the Chinese drywall can be removed and replaced, this is appropriate. The Internal Revenue Service (IRS) has allowed for a tax deduction for costs associated with replacing "corrosive drywall". IRS Publication 547 is the most recent publication that describes this deduction and instructions on how to qualify.*
 - b) *To the extent feasible, increase home ventilation and determine if the symptoms improve. (Since the goal is to increase fresh air intake and exhaust of indoor air, setting the thermostat to run all of the time will not achieve this goal unless the thermostat also controls fresh air intake.)*
 - c) *Cleaning vents or ducts is unlikely to reduce exposure to problem gases.*

- d) *Reduce the relative humidity in the home to between 40 - 50%. (High humidity may increase hydrogen sulfide formation.)*
- 2) Correct potential home safety hazards associated with problem drywall
 - a) *If corrosion of copper and silver building materials are noted, it is recommended that electrical distribution components such as switches, receptacles and circuit breakers be replaced. Copper wiring may or may not need to be replaced. HVAC plumbing (such as air exchange coils and coolant tubing) may or may not need to be replaced, depending on the extent of corrosion. Smoke and carbon monoxide detectors should also be replaced.*
 - b) *If corrosion of copper and silver building material are noted, it is recommended that all fusible types of fire sprinkler-heads (typically found in commercial buildings) be replaced.*
 - c) *Gas service pipes with evidence of corrosion should be inspected and may or may not need to be replaced. The amount of corrosion is often minimal compared to pipe thickness.*
 - 3) Minimize environmental factors that make illness symptoms worse.
 - a) *Eliminate other irritants from the home environment to the extent possible, such as second-hand tobacco smoke and harsh cleaners (e.g., those with a strong odor themselves).*
 - b) *Use high quality air filters on central heating/ cooling systems to minimize dust and other particulate irritants from recirculating throughout the home.*
 - 4) Assistance to help a family cope with stress may be needed. Raising a family and taking care of children is challenging when there are tough economic conditions, and ongoing illness and worry about possible chronic health effects can increase stress and further complicate the health of parents and children. Moving from one home to another can cause additional stress. Children can sense stress and become anxious or upset if no one communicates with them. Some children may develop a range of stress-related symptoms. Parents should:
 - a) *Watch for signs of stress such as sleep problems, behavior change, change in school performance, increased fighting with siblings, and substance abuse.*
 - b) *Take steps to talk with their children and help them understand and cope with the situation. Local mental health organizations are good resources to assist parents in helping children cope with stress.*
 - c) *Make their child's physician aware of any signs of stress they observe in their child or teen.*
 - 5) Obtain appropriate medical care.
 - a) *Where health effects are present, it is helpful to have medical care coordinated by your primary care health care provider.*
 - b) *Changes in health status should be discussed with your primary health care provider.*
 - c) *For persistent respiratory health effects the primary care physician may recommend a specialist. Referrals of:*
 - i) *Adults to a pulmonologist and/or environmental medicine specialist may be useful.*
 - ii) *Children to a pediatric pulmonologist and/or pediatric environmental medicine specialist may prove valuable in mitigating the severity of illness.*
 - iii) *A Pediatric Environmental Health Specialty Unit (PEHSU) can assist families or physicians in identifying pediatric environmental medicine specialists. The PEHSU serving the Southeast US can be reached at 1-877-33-PEHSU (1-877-337-3478).US can be reached at 1-877-33-PEHSU (1-877-337-3478).*

6) Ongoing medical observation

- a) *There is not enough information available to make any specific recommendations about steps needed during long term medical follow up, if any, after exposure to gases released from problem drywall.*

For future information, families and their primary care physicians may benefit from the references below:

* Imported Drywall and Health - A Guide for Healthcare Providers

http://www.atsdr.cdc.gov/drywall/docs/Drywall_for_Healthcare_Providers.pdf

* Imported Drywall Issues – U.S. Consumer Product Safety Commission

<http://www.cpsc.gov/info/drywall/index.html>

* U.S. Department of Health and Human Services: Enviro-Health Links – Imported (Chinese Drywall)

<http://sis.nlm.nih.gov/enviro/drywall.html>

* For clinical advice regarding health effects for children, locate your regional Pediatric Environmental Health Specialty Unit (PEHSU):

<http://aoec.org/PEHSU/findhelp.html>

* Agency for Toxic Disease Substance Disease Registry (ATDSR) – Hydrogen Sulfide

<http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=388&tid=67>

*Cherry Jr, Robert L., and John P. Geary. “Chinese Drywall and Homeowners Insurance: An Update.” (2012).

*Hooper, Dennis G., et al. “Isolation of Sulfur Reducing and Oxidizing Bacteria Found in Contaminated Drywall.” *International Journal of Molecular Sciences* 11.2 (2010): 647-655.

*Internal Revenue Service (IRS) Publication 547 – Corrosive Drywall Deduction

<http://www.irs.gov/publications/p547/ar02.html>

*Kominsky, John R. “Relationship Between Strontium, Orthorhombic Cyclooctasulfur (S₈), and Reduced Sulfur Gases in Drywall.”

US Consumer Product Safety Commission. “Summary of Contractor’s Indoor Air Quality Assessment of Homes Containing Chinese Drywall.” November 23, 2009.

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