



Recommendations 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) reviewed in spring 2011 a number of the letters received by U.S. Representative Bachus from families coping with problem drywall in their homes. Several public health entities and consumer groups have published original research and specific recommendations since our first edition of this document in March 2011. A multi-disciplinary team with specialties in pediatrics, occupational environmental medicine, medical toxicology, and industrial hygiene contributed to these recommendations.

While we cannot offer specific clinical opinions based on the symptoms reported, we do offer 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 without removing pieces of the wall by combined use of X-ray fluorescence (XRF) and Fourier-transform infrared reflectance (FTIR). The presence of both strontium levels > 1200 ppm AND carbonate absorbance > 5 units strongly indicates the presence of imported drywall, while the presence of both strontium levels < 1200 ppm AND carbonate absorbance > 5 units strongly indicates the presence of domestic drywall.

Recent research to determine the etiology of reported health effects associated with problem drywall seem to implicate the release of hydrogen sulfide (H₂S), carbonyl sulfide, and carbon disulfide gases from affected drywall as the primary link to 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. Some evidence suggests that a sulfur-reducing bacteria, *Thiobacillus ferrooxidans*, found in CDW may contribute to increased off-gassing of hydrogen sulfide gas. In addition, many homes with elevated H₂S levels demonstrated corrosion of both copper and silver building materials (wires, electrical outlets, switch receptacles, smoke detectors, carbon monoxide detectors, etc.).

The levels of H₂S measured in 51 affected homes often exceeded 0.59 ppb, and seemed to correlate with the presence of complaints about problem drywall issues, while homes without problem drywall all except for one home had H₂S levels below 0.35 ppb. All of these values are below the CDC’s Agency for Toxic Substance and Disease Registry’s (ATSDR) risk level of 20 ppb, but even this low-level exposure could be responsible for symptoms.

Furthermore, formaldehyde and volatile organic compounds (VOCs) concentrations were not determined to be significantly different in problem drywall and non-affected drywall homes. However, when present in combination with the irritating sulfur compounds, they may contribute to further respiratory irritation.

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 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)
 - H₂S appears to be present in higher concentrations in most affected homes as compared to homes unaffected by Chinese drywall.
 - H₂S has a low-odor threshold meaning it can be detected by humans at very low levels, especially in newly built “tight” homes.
 - The H₂S measured both in the homes and in laboratory simulation is usually far below ATSDR’s “minimum risk level” of 20ppb, but may still be causing symptoms, perhaps due to the ongoing nature of the exposure within a home.
 - H₂S off-gassing appears to be elevated with higher home humidity levels.
 - Corrosion of copper and silver building materials (associated with elevated H₂S levels) is consistently found in houses affected with CDW.

- Strontium
 - Elevated strontium levels have been found in CDW compared to non-affected drywall, but appear not to pose any health risk.
 - Rapid measurement of strontium levels in suspected drywall using portable Fourier Transform Infrared (FTIR) Spectroscopy and X-ray Fluorescence (XRF) is both sensitive and moderately specific for affected CDW.

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 American-made problem drywall and these symptoms is not as well established. Although some of these health effects are common in the general population, these symptoms taken together appear more frequently in settings where problem drywall is installed.

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) *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 aggravate illness symptoms.
- 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).*
- 6) Medical Monitoring.
- a) *Specific recommendations cannot be made regarding appropriate medical monitoring, 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 (ATSDR) – 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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