



## **Recommendations Related to Pregnancy and Developmental Outcomes from Chinese Drywall**

*Prepared by Robert J. Geller, MD, Southeast Pediatric Environmental Health Specialty Unit,  
September 2014*

The Association for Occupational and Environmental Clinics (AOEC) and its network of Pediatric Environmental Health Specialty Units (PEHSU) has provided general recommendations addressing concerns about health effects from problem drywall. This document specifically addresses concerns about problem drywall effects on fertility, pregnancy outcomes, and early childhood. For any other concerns, please refer to the other document.

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 health care provider.

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.

Recent research to determine the etiology of reported health effects associated with problem drywall seem to implicate the release of hydrogen sulfide (H<sub>2</sub>S), 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 H<sub>2</sub>S levels demonstrated corrosion of both copper and silver building materials (wires, electrical outlets, switch receptacles, smoke detectors, carbon monoxide detectors, etc.).

The levels of H<sub>2</sub>S 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 H<sub>2</sub>S 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.

There is no published research specifically addressing fertility, reproductive health, or early childhood development in individuals residing in homes with problem drywall. There is limited data about the health effects of low term, low level exposure to hydrogen sulfide and to a mixture of hydrogen sulfide and carbon disulfide.

A 1997 document produced by the Connecticut Department of Public Health regarding the Danbury Connecticut landfill reviewed the data existing at that point, and concluded that there was no evidence that hydrogen sulfide caused teratogenic or adverse reproductive effects at the levels found in the area around the landfill, which were 10 to 1000 times higher than the levels found in homes affected by problem drywall.

A 2000 study exposed Sprague-Dawley to hydrogen sulfide at levels between 0 and 80 ppm 6 hours per day starting 2 weeks prior to breeding and then continuing during pregnancy and after starting 5 days after birth to mothers and pups for 13 days. The study found no effect on reproductive performance, pup growth, pup development, or pup performance on behavioral tests. Other rat studies in 1989 and 1990 reached similar conclusions.

A 1998 study of Beijing petrochemical plant workers exposed to a mixture of gases and dusts found an increased risk of spontaneous abortion from benzene, gasoline, and hydrogen sulfide. However, it is important to note that exposure levels were not well quantified and that exposure occurred to many chemicals at the same time, limiting the ability to clearly apply these results to the problem drywall situation.

A 1989 study in Bulgarian petrochemical plant workers found an increase in chromosomal abnormalities in exposed workers and an increase in miscarriage rate. Because this exposure compared workers compared to a mixture of a large number of compounds at poorly quantified levels to a control population, these results probably do not apply to the problem drywall situation.

A 1989 study of pregnant rats exposed to various levels of carbon disulfide, hydrogen sulfide, or a mixture of the two found no maternal toxicity from hydrogen sulfide at 100 ppm. Carbon disulfide at levels of 400 ppm or 800 ppm showed a reduction in maternal weight gain, fetal body weight, and a low incidence of club foot. The combination of carbon disulfide at 400 ppm or 800 ppm together with 100 ppm hydrogen sulfide showed similar effects. These levels are more than 1000 times the levels observed in homes with problem drywall.

*The available evidence does not support any effect of residence in a home with problem drywall on fertility, miscarriage, or increased risk of teratogenicity.*

*The available evidence does not support any increased risk of developmental abnormalities in children residing in a home with problem drywall during early childhood.*

In the interest of maximizing safety, we recommend that families take the prudent measures discussed in the document entitled, “**Recommendations Related to Health Effects from Chinese Drywall, Revised**”.

For future information, families and their primary care providers 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](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>

Connecticut Department of Public Health. Reproductive Health and the Danbury Landfill. Fact Sheet- January, 1997. <http://www.atsdr.cdc.gov/hac/landfill/html/appe/ctrhdl.pdf>. Accessed September 11, 2014.

Donnan DC, et al. Fertility and developmental neurotoxicity effects of inhaled hydrogen sulfide in Sprague Dawley rats. *Neurotoxicol Terato* 2000; 22(1):71-84.

Hayden LJ, Goeden H, Roth SH. Growth and development in the rat during sub-chronic exposure to low levels of hydrogen sulfide. *Toxicol Ind Health*. 1990; 6(3-4); 389-401.

Saillenfait AM, Bonnet P, de Ceaurriz J. Effects of inhalation exposure to carbon disulfide and its combination with hydrogen sulfide on embryonal and fetal development in rats. *Toxicol Letters* 1989; 48: 57-66.

Simeonova M, Georgieva V, Alexiev C. Cytogenetic investigations of human subjects occupationally exposed to chemicals from the petroleum processing industry. *Environ Res* 1989;

48:145-149.

Xu X, et al. Association of petrochemical exposure with spontaneous abortion. *Occup Environ Med* 1998; 55:31-16.

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

---

This material was developed by the Association of Occupational and Environmental Clinics (AOEC) and funded under the cooperative agreement award numbers 1U61TS000118-02 and 1U61TS000118-05 from the Agency for Toxic Substances and Disease Registry (ATSDR).

Acknowledgement: The U.S. Environmental Protection Agency (EPA) supports the PEHSU by providing funds to ATSDR under Inter-Agency Agreement number DW-75-92301301-0.

Neither EPA nor ATSDR endorse the purchase of any commercial products or services mentioned in PEHSU publications.