



# THE

# CONSULTANTS

# PERSPECTIVE

A SUGAR/VER EECKE PUBLICATION

**FORENSIC ENGINEERING AND EXPERT WITNESS SERVICES**

**WINTER 2009**

**PROPERTY/CASUALTY EDITION**

## **Chinese Drywall- Determining the Facts**

by  
**Michael L. Cannon, CIH**

### **Introduction**

By now you have all heard plenty about the chinese drywall (CDW) problem and many of you are dealing with CDW claims. Forcon has been following the developments as well and we have been asked to investigate some CDW claims. This article is meant to share what we know about the problem including some of the background information, the approach that we have taken to investigating these claims, and some of what we've learned from these investigations. We hope that you find this information helpful.

### **Background**

The United States began importing drywall from China in 2003. As a result of the housing boom from 2004-2007 and the natural disasters that occurred in the Gulf Coast region of the United States during this time frame, the demand for imported CDW increased dramatically. This convergence of events resulted in an estimated 100,000 homes being constructed using CDW. Some of the producers of CDW that have been identified by the Consumer Products Safety Commission (CPSC) have included Knauf Plasterboard Tianjin; Beijing New Building Materials and Taian Taishan Plasterboard. The use of CDW has resulted in numerous homeowner complaints that have included a rotten egg odor, corrosion of electrical systems, e.g. copper wiring, oxides on electronics, corrosion and failure of HVAC cooling coils, e.g. copper refrigerant lines, and health effects that have included headaches, sore throats and sinus problems.

In late December 2008 the CPSC began to receive numerous complaints regarding CDW and launched an investigation of four Tampa Florida homes with the Florida Department of Health (FLDOH) in March 2009. This investigation led to a meeting on April 14, 2009 that included the CPSC, the EPA, the Centers for Disease Control/Agency for Toxic Substances and Disease Registry (CDC/ATSDR) where it was determined that the CPSC would take the lead on the investigation of CDW in the United States. The EPA conducted elemental analysis of two known CDW samples supplied by the FLDOH. The CDW samples were analyzed along with drywall manufactured in the US for comparison purposes. The results of this limited analysis found that sulfur was detected at 83 parts per

million (ppm) and 119 ppm in the CDW samples and was not detected in the US-manufactured drywall samples. Strontium was detected at 2570 ppm and 2670 ppm in the CDW and 244 ppm to 1130 ppm in the US samples. It was noted that no total acid soluble sulfides were detected in any samples. Iron concentrations found in CDW ranged from 1390 ppm to 1630 ppm as compared to 841 ppm to 3210 ppm in the US-manufactured drywall. According to the EPA additional tests were going to be performed to determine if the iron content is present as a sulfide, sulfate or oxide. Additional FLDOH analysis surmised that the Strontium contained in the CDW was Strontium Sulfide based on a lack of oxygen. As a note of interest strontium sulfide is a fireworks additive that creates a red flame when burned. The FLDOH analysis also found that the CDW had a higher organic matter content 5% vs 1% when compared to US-manufactured drywall. The off-gassing test performed for the FLDOH determined that when the CDW was exposed to 95% relative humidity that hydrogen sulfide, carbonyl sulfide and carbon disulfide gas was released at detectable concentrations of less than 1 ppm. Hydrogen sulfide and carbonyl sulfide can produce a rotten egg odor and in the presence of wet air both can also cause corrosion of copper and other metals. The release of hydrogen sulfide and carbonyl sulfide from CDW may explain why visible dark corrosion of copper HVAC condenser coil components and corrosion of other copper materials where micro-condensation occurs, e.g. cold water copper plumbing lines, refrigerator compressor lines, exposed copper wiring, have been reported by from these early investigations. These early studies have not been able to confirm that the health effects reported by some homeowners are a result of the presence of CDW in their houses.

As of September 4, 2009, the CPSC had received 1,192 reports from residents in 23 states and the District of Columbia who believe their health symptoms or the corrosion of certain metal components in their homes are related to the presence of CDW. Seventy-six percent (76%) of the complaints have been from homeowners in Florida. The states currently with the most CDW complaints include Florida, Louisiana and Virginia.

### **Investigating CDW Claims**

Investigations into the presence of CDW in houses, condominiums, townhouses, hotels and other related buildings are just beginning to emerge. How do you approach a CDW investigation? Does an investigation begin and end with the determination that CDW was used in the construction of a dwelling? Taking a narrow view of the cause and effect in CDW cases may not provide the needed data and/or facts to support claims decisions, provide guidance for legal claims and/or to understand potential subrogation of third parties. Forcon believes that a multidisciplinary team of professionals is necessary for conducting a CDW investigation.

The team should consist of a structural engineer to determine the integrity of the building envelope relative to water intrusion and elevated relative humidity within the space, a mechanical/materials engineer to evaluate the condition of building components relative to corrosion and performance of the HVAC system and a Certified Industrial Hygienist (CIH) to evaluate airborne concentrations of potential gases emitted by CDW and to collect other relevant samples to determine if conditions reported by the building occupants are related to the CDW. This team can provide the needed data and insight into the cause and effect issues claimed to be the result of a building constructed with CDW. Some basic elements of a CDW building inspection conducted by this team would include:

#### **Structural Inspection:**

- Inspects for evidence of CDW in construction of building, e.g. stamps, labels, endtapes. Borescope will be used to inspect interior wall cavities.
- Does the construction of the house contribute to the available indoor moisture content and create a favorable environment for the release of sulfur based gases. Insulation issues, attic space, crawl space etc.
- Are there other sources of hydrogen sulfide in the house from improperly installed plumbing vents.
- Does a building constructed on slab have a vapor barrier, does the floor covering show signs of damage from potential chemical reaction with moisture and sulfur based gases.
- Check the foundation for water infiltration into basements/crawlspaces.
- Check the crawl space for a vapor barrier.
- Check for plumbing leaks from toilets, water lines and hot water heater.
- What type of water sources are supplied to the building, e.g. well versus municipal water.
- Repair/Remodeling History of the building.

#### **Mechanical/Materials Inspection:**

- Inspects the electrical/electronic systems for evidence of corrosion and collect surface samples for verification. Evaluate electrical systems for fire risks and possible damage to electronic equipment.
- Inspects the HVAC system/cooling coil for evidence of corrosion and collect surface samples for verification and determination of potential for system failure.
- Evaluates the design of HVAC system for providing proper conditioning of house/interior space. Is it sized properly for controlling relative humidity in the summer cooling season; is there a humidifier being used for the heating season? Is an outside air source being incorporated into the HVAC system?
- Evaluates gas versus electrical HVAC heating systems and hot water heaters. Performance of gas performance may contribute to odor issue, e.g. mercaptans, and/or health issues e.g. carbon monoxide. An electric hot water heater may produce hydrogen sulfide from the sacrificial anode.
- Inspects contents of house to determine if there are signs of damage/corrosion from sulfur based gases to mirrors, jewelry, and other metal surfaces.

#### **Certified Industrial Hygienist Inspection:**

- Documents conditions/sources inside and outside the house that may contribute hydrogen sulfide and other sulfur compound exposures such as automobile traffic patterns, surrounding industrial/retail facilities, landfills, waste water treatment plants, compost piles, farming.

- Conducts a chemical inventory of the building to determine potential sources of hydrogen sulfide, other sulfur compounds and chemical use in general.
- Investigates temporal relationships regarding detection of odor and possible health symptoms, e.g. time of day, certain types of weather, heating/cooling, upon entry into the building etc.
- Evaluates the house for hydrogen sulfide concentrations using proper methods and instrumentation to insure integrity of the data. Data points to include both indoor and outdoor sampling for hydrogen sulfide and corresponding temperature/relative humidity measurements.
- Conducts source testing for hydrogen sulfide other than drywall e.g. plumbing vent lines, drain traps, basement floor drains, heating oil storage/spills.
- Confers with structural and mechanical/materials engineers to collect representative samples of suspect drywall for documentation and analysis where required. Samples to be analyzed for both elemental content and off-gassing potential. Minimally invasive/destructive techniques used when possible.
- Evaluates condition of household contents for odor possibly related to hydrogen sulfide or from other sulfur compounds.
- Notes whether water damage and mold contamination is present. Mold and bacteria from water damage or from excessive relative humidity can produce potential odors that are similar to hydrogen sulfide.
- Uses qualified accredited labs for analysis of sample collected.

#### **Testing Results:**

Recently, the Consumer Product Safety Commission reported that "When investigators tested homes, some findings surprised them. Researchers were looking for hydrogen sulfide, carbon disulfide and carbonyl sulfide, which have been suspected of being related to the contaminated drywall due to reports of "rotten egg" smells and sulfur-like corrosion of copper and other metals in the homes. These gasses were only found occasionally when outdoor air levels were elevated as well." The CPSC continues to conduct air quality studies to evaluate the potential health risk. The CPSC also found "... elevated levels of two elements in some Chinese-made drywall: sulfur and strontium" and "...are conducting additional scientific tests to find the connection between these elevated levels and any reported health symptoms or corrosion effects." Forcon has found the results reported from the CPSC for both bulk drywall analysis and air contaminant analysis to be consistent with those found in our investigations.

#### **Conclusions:**

Upon completion of the investigation, the observations, air monitoring results and the CDW drywall elemental and off-gassing analysis are reviewed to develop the conclusions of the investigation. The report is designed to address whether or not CDW was used in the construction of the building, whether there are structural issues that are contributing to the release of hydrogen sulfide and other sulfur gases, e.g. elevated relative humidity, plumbing vent leaks, if the electrical systems and related electronics/appliances have been adversely impacted by corrosion, if the HVAC system has been adversely impacted by corrosion and its risk of failure, whether the plumbing system has been adversely impacted by corrosion and if detected, whether the airborne sulfur gases such as hydrogen sulfide in the building are a result of the CDW and present a health risk. Recommendations would be developed based on whether or not CDW is present in the building. Where CDW is present in the building, controlled removal of all CDW would be recommended (sledge hammer demolition would not be suitable) along with repair of electrical systems, repair or replacement of affected HVAC systems or appliances, cleaning of porous household contents if needed, and repair of other sources

of sulfur gases if identified, such as a leaking plumbing vent line or dry plumbing trap.

A team approach using the right professionals will provide the detailed information needed to assist the claims professional, legal professional or building owner in making an informed decision with regards to Chinese drywall.

---

## ABOUT THE AUTHOR

Michael L. Cannon, CIH has over 30 years of comprehensive industrial hygiene experience including asbestos contamination & abatement; mold contamination assessment and remediation, risk assessment of major corporations including asbestos abatement contractors, petroleum refineries, chemical manufacturers, chemical distributors, hazardous waste processors, TSDR's, transportation firms, and lead-based paint abatement contractors.

Mr. Cannon has provided industrial hygiene services for investigations of possible exposures to hydrogen sulfur/ sulfide compounds, inorganic arsenic, respirable crystalline silica, benzene, hydrogen fluoride, radon, methylene chloride, formaldehyde, fungi, welding fumes, lead, phenols, metal fumes, carbon monoxide, elemental carbon, CTPV's, benzidine - based dyes, aromatic and chlorinated hydrocarbons, rosin core pyrolysis products, and many other sources of possible toxic exposure.

---

### FORCON International Offices

<b>Lynchburg, VA</b>	(434) 384-6504	<b>Atlanta, GA</b>	(770) 390-0980
<b>Red Hill, PA</b>	(215) 541-1450	<b>Zeeland, MI</b>	(616) 879-0702
<b>Richmond, VA</b>	(804) 285-7870	<b>Tampa, FL</b>	(813) 684-7686

---

PROPERTY / CASUALTY ASSIGNMENT HOTLINE

1-800-390-0980

OR ASSIGN IT ON LINE AT

[www.forcon.com/pcwrf.htm](http://www.forcon.com/pcwrf.htm)

ACCIDENT RECONSTRUCTION ASSIGNMENT HOTLINE

1-800-877-3260

---

### FORCON Summary of Expertise

Accident Reconstruction	Architecture
Automotive Fires, Failures	Biomechanics
Boat Accident Reconstruction	Catastrophe Engineering
Chemical Engineering	Chemistry
Chinese Drywall	Civil Engineering
Codes & Standards	Construction
Electrical Engineering	Electronics
Environmental Engineering	Fire Protection Engineering
Geohydrology	Geology
Geotechnical Engineering	Green Construction
Highway Engineering	Industrial Hygiene
Injury Causation	Materials Engineering
Marine Engineering	Mechanical Engineering
Metallurgy	Roofing
Safety/OSHA	Soils Science
Structural Engineering	Toxic Torts

---

For a complete listing visit [www.forcon.com](http://www.forcon.com).

## FORCON News!

### Heather Laird promoted -

In recognition of her efforts in running the day to day operations of Forcon's Richmond engineering office and her increased responsibility as Forcon expands those engineering services into Maryland with a planned office in Annapolis, Heather Laird was recently promoted to Operations Director, Forensic Engineering Services, Mid-Atlantic Region. Congratulations Heather!

### Scott A. Conrad joins FORCON Richmond Office -

FORCON International is pleased to announce that Scott A. Conrad, P.E. has joined FORCON's Richmond office as a mechanical engineering expert. Mr. Conrad earned his Bachelor of Science Degree in Mechanical Engineering Technology from the University of Pittsburgh in 1987. After graduation he worked as a mechanical engineer at several engineering consulting firms. Mr. Conrad has over twenty years of engineering, maintenance and project management experience involving mechanical systems in numerous commercial, industrial and residential buildings. He is a Registered Professional Engineer in Virginia and Pennsylvania.

Mr. Conrad's 20+ years of mechanical engineering experience includes the following:

- Forensic engineering investigations for mechanical systems
- Mechanical component failure investigations
- Mechanical Building System Engineering and Design
- Building Code Compliance
- Heating, Ventilation and Air Conditioning Systems
- Plumbing Systems
- Compressed Air Systems
- Medium and Low Temperature Refrigeration Systems
- Steam and Hot Water Heating Systems
- Gas Storage and Distribution Systems
- Water Treatment Systems
- Wastewater Treatment Systems
- Hydraulics Systems
- Fire Protection
- System Operation
- Equipment Maintenance

His design experience includes various types of commercial, industrial and residential buildings as well as other mechanical systems. Mr. Conrad can be reached by calling our Richmond Engineering office 804-788-9003.

His full resume is available at [www.forcon.com](http://www.forcon.com) under the Richmond office.

---

### EDUCATION SEMINARS AVAILABLE

In-house educational and C.E. approved seminars are available to insurance / self-insured / TPA claims, defense law firms and conference / meetings as part of their agenda. For additional information, please contact Bob Dwyre [radwyre@forcon.com](mailto:radwyre@forcon.com).

**FORCON INTERNATIONAL CORPORATION**

PRESENTS

**THE CONSULTANTS PERSPECTIVE**

IN THIS ISSUE ! - AN ARTICLE ON

***Chinese Drywall- Determining the Facts***