

## Executive Summary of November 23, 2009 Release

### Overview

Released today is additional information from the investigation of problem drywall including the results from three preliminary scientific reports: a fifty-one home indoor air study; an electrical component corrosion study; and a fire safety component corrosion study. Most significantly, the fifty-one home report released today finds a strong association between the problem drywall, the hydrogen sulfide levels in homes with that drywall, and corrosion in those homes. The two preliminary component corrosion studies support this finding. The fifty-one home study also provides some basic tools necessary for development of processes to identify and remediate affected homes, and advances the Interagency Task Force's investigation to a new phase focused on these objectives.

In sum, the significant findings released today are:

- The study of fifty-one homes found a strong association between the problem drywall, the hydrogen sulfide levels in homes with that drywall, and corrosion in those homes.
- While the study of fifty-one homes detected hydrogen sulfide and formaldehyde in homes containing the problem drywall at concentrations below irritant levels, it is possible that the additive or synergistic effects of these and other compounds in the subject homes could cause irritant effects. The Interagency Task Force continues to investigate the nexus between the drywall and reported health symptoms.
- The two preliminary studies of corrosion of metal components, taken from homes containing the problem drywall, found copper sulfide corrosion in the initial samples tested, which supports the finding of an association between hydrogen sulfide and the corrosion. Ongoing laboratory tests continue to investigate the nexus between safety and the short and long-term effects of such corrosion.

Based on the scientific findings of the studies completed to date, particularly the fifty-one home report released today, the Interagency Task Force can begin a new phase by developing (1) a protocol to identify homes with corrosive drywall and (2) a process to address the corrosive drywall and its effects. The Task Force's work will serve as a foundation upon which informed decisions can be based by homeowners and local, state and federal authorities.

While the U.S. Consumer Product Safety Commission (CPSC) has aggressively pursued a detailed investigation into the Chinese drywall supply chain, it remains difficult to estimate the total number of homes that could contain problem drywall. CPSC recently reached out to the governors of all fifty states and the U.S. territories to assemble the fullest possible accounting of homes reporting Chinese drywall. The CPSC, working with U.S. Customs and Border Protection (CBP), is monitoring imports of possible Chinese drywall. We believe no new Chinese drywall has entered the United States in 2009. There are several known inventories of uninstalled Chinese drywall in the United States and the owners of these stockpiles have been notified of this ongoing investigation and advised to notify the CPSC if they sell or dispose of any drywall from their inventory.

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## **Introduction**

This scientific investigation has moved as quickly as possible to understand the complex problems presented by the issue of Chinese<sup>1</sup> drywall. While the science of indoor air environments presents significant challenges, the fifty-one home report released today finds a strong association between the problem drywall, the hydrogen sulfide levels in homes with that drywall, and corrosion in those homes. Two preliminary component corrosion studies, also released today, support this finding. The scientific methods used to establish this association in the fifty-one home study provide basic tools necessary for the development of means to identify and remediate affected homes and permit the Interagency Task Force's investigation to begin a new phase focused on these objectives.

This scientific work completed to date has been essential to building the foundation upon which decisions can be based by homeowners and local, state and federal authorities.<sup>2</sup> The investigation continues on several fronts to expand our understanding of this issue – but current information is sufficient to begin to develop and determine the effectiveness of identification and remediation processes that are integral to the path forward for impacted homeowners.

## **Fifty-One Home Study**

Environmental Health and Engineering (EH&E) completed a detailed study of fifty-one homes in Florida, Louisiana, Virginia, Alabama, and Mississippi. (The full report of EH&E is provided as Tab A). EH&E and CPSC staff selected forty-one “complaint” homes based on reported incidents from consumers and ten non-complaint homes as controls. EH&E's investigation of each home included a visit by a team of scientists who gathered detailed data at each location such as: the layout, building materials and air exchange rate of each structure; the configuration of the home's heating and ventilation systems; x-ray fluorescence (XRF) and Fourier transform infrared (FTIR) readings of the installed drywall; the presence and extent of corrosion; and detailed measurements of chemicals in the indoor and outdoor air. Copper and silver metal strips, called “coupons,” were also placed in the home for two weeks to test the corrosive environment of each house.

The report concluded that: (1) there was a strong association between the problem drywall, the hydrogen sulfide levels in homes with that drywall, and corrosion in those homes; (2) while hydrogen sulfide and formaldehyde concentrations were associated with corrosion, hydrogen sulfide was an essential component; (3) XRF and FTIR technology could potentially identify problem drywall without the destructive examination of each wall; and (4) while hydrogen sulfide and formaldehyde levels detected in homes containing the problem drywall were at

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<sup>1</sup> The Interagency Task Force on Chinese Drywall is conducting a broad investigation and its studies have included both Chinese and non-Chinese samples. While this work does reference “Chinese” drywall as a general term, we have not concluded that all Chinese-manufactured drywall may present corrosion or health issues, or that all non-Chinese drywall may not present such issues.

<sup>2</sup> All reports and information released regarding Chinese drywall can be found at [www.drywallresponse.gov](http://www.drywallresponse.gov).

concentrations below irritant levels, it is possible that additive or synergistic effects of these and other compounds in the subject homes could cause irritant effects.

The copper and silver coupons showed significantly higher rates of corrosion in complaint homes than in the control homes. The dominant species of corrosion on the coupons was copper sulfide and silver sulfide, as determined by additional laboratory tests. Visual inspection and evaluation of ground wire corrosion also revealed statistically significant greater ground wire corrosion in complaint homes compared to non-complaint homes. EH&E also used hand-held XRF and FTIR instruments to measure levels of strontium and carbonate absorbance in the installed drywall. The study found that the nondestructive XRF and FTIR testing could potentially identify the problem drywall in a home at a sheet-by-sheet level. A significant outcome of this testing is the establishment of these two methods as possible tools for an identification protocol or remediation.

Indoor air chemical monitoring in the fifty-one home study built upon the Interagency Task Force's ten-home air study, released on October 29, 2009. In the fifty-one home study, hydrogen sulfide gas was successfully measured at low levels in the majority of complaint homes by the use of passive samplers deployed in the homes for a two-week period. The concentrations of low-level hydrogen sulfide gas were statistically higher in homes identified as containing the problem drywall compared to control homes. Hydrogen sulfide has a low odor threshold and could contribute to the odors identified in the complaint homes. Levels of carbon disulfide, another sulfur gas of interest, varied between complaint and control homes, but the differences were not statistically significant.

Levels of formaldehyde and other aldehydes were comparable in complaint and control homes, and were consistent with levels that are expected in newly constructed homes. This finding was consistent with the previously released ten-home air study that also found formaldehyde in test and control homes.

Upper airway, skin, and eye irritation were common complaints from some occupants in the complaint homes. Both hydrogen sulfide and formaldehyde are known irritants at certain levels, although the concentrations found for each of these compounds in this fifty-one home study were below the irritant levels. Nevertheless, it is possible that additive or synergistic effects of these and other compounds in the subject homes could cause irritant effects.

### **Electrical Components Corrosion Study**

Sandia National Laboratories' (SNL) Materials Science and Engineering Center was tasked to evaluate the nature and extent of conductor metal corrosion that may have occurred in residential electrical components exposed to the problem drywall. The objective was to determine if the corrosion would result in either near or long term electrical safety hazards. (The preliminary report of SNL is provided at Tab B). Electrical components for SNL's analyses were harvested by CPSC staff from six homes in Florida and Virginia which were reported to contain the problem drywall. A preliminary visual inspection by CPSC Electrical Engineering staff of all of the harvested electrical components revealed substantial corrosion of copper wiring, but there were no indications of significant overheating of conductors or conductive parts due to the corrosion events.

SNL examined six severely corroded receptacles and found that wires attached to these receptacles showed several morphologies of copper corrosion products including cauliflower-shaped nodules and spongiform (sponge-like) texture. The corrosion nodules were readily found on the surface of the exposed copper wires, while the spongiform texture appeared in micro-cavities beneath the corrosion nodules. The overall thickness of the corrosion layer varied from almost zero to twenty micrometers.

Elemental analyses of both forms of corrosion indicated the presence of copper, sulfur, and small amounts of oxygen, which strongly suggested the presence of copper sulfide and copper oxide. One sample of corroded copper wire was examined via X-ray diffraction and found to contain copper sulfide in the variety known as digenite ( $\text{Cu}_9\text{S}_5$ ) and copper oxide in the variety known as cuprite ( $\text{Cu}_2\text{O}$ ).

Corrosion of copper wiring was most extensive where bare copper was exposed. Intact electrical insulation on copper wiring appeared to protect the underlying copper conductor from corrosion.

### **Fire Safety Components Corrosion Study**

The National Institute of Standards and Technology (NIST) presented a preliminary report in its investigation of corrosion on fire safety components based on an initial examination of copper natural gas supply tubing and two air conditioner heat exchanger coils. (The preliminary report of NIST is provided at Tab C).

A thin black corrosion product was found on all of the copper samples examined. Chemical and structural analysis of this layer indicated that this corrosion product was copper sulfide ( $\text{Cu}_2\text{S}$ ) and X-ray diffraction peaks from this corrosion corresponded with those of the mineral digenite ( $\text{Cu}_9\text{S}_5$ ). Corrosion products were also observed on other types of metals in the air conditioning coils in the areas where condensation would frequently make the metals wet. The thickness of the corrosion product layer on a copper natural gas supply pipe was measured and found to be between five and ten micrometers thick. Reduced sulfur compounds, such as hydrogen sulfide ( $\text{H}_2\text{S}$ ), were determined to be the most likely candidates to have caused this type of corrosion.

None of the samples examined were failed components and no evidence of an imminent failure was found on any of the samples in this batch. All of the corrosion damage observed was consistent with a general attack form of corrosion that progresses in a uniform manner. No evidence of any type of localized attack was found, but the unpredictable nature of corrosion attack on metals exposed to reduced sulfur components and the exposure duration necessary for initiation of these forms of attack, mean that the number of samples examined to date was too small to draw any conclusion on the relative probability of these forms of corrosion being able to cause or not cause a failure. Ongoing work is designed to determine the extent of corrosion possible during decades-long exposure.

## **Interagency Identification and Remediation Protocol Team**

Based on the scientific findings of the studies completed to date, particularly the fifty-one home report released today, the Interagency Task Force can begin a new phase by developing (1) a protocol to identify homes with corrosive drywall and (2) a process to address the corrosive drywall and its effects. The Task Force's work will serve as a foundation upon which informed decisions can be based by homeowners and local, state and federal authorities. Indeed, the Task Force will continue its cooperation with state partners in its development and evaluation of these identification and remediation processes.

The Interagency Task Force has assembled a multidisciplinary team to design a test to identify a home that contains the corrosive environment that we understand now to be characteristic of the problem drywall. This identification protocol could be employed in a screening program of affected homes. The positive results from the coupon and XRF/FTIR testing undertaken by EH&E suggest objective methods to evaluate potentially affected structures. Effectiveness, speed, ease of use, and cost will be principal factors in proposing a final identification protocol.

Remediation options will also be examined, in coordination with the identification protocol, to determine viable means of addressing the corrosive effects and environment in a home. The multidisciplinary team will review and consider all possible remediation approaches including the activities already undertaken by some builders and alternative methods proposed by other parties. The Interagency Task Force could also look to the federal government's experience addressing such contaminants as lead. Again effectiveness, speed, ease of use, and cost will be determinative factors in evaluating remediation methods.

The Interagency Task Force monitors closely the array of products and opinions offered to homeowners about Chinese drywall in the media and marketplace regarding identification and remediation. The Interagency Task Force is committed to sorting through the facts and conjecture and presenting consumers with substantiated scientific information.

## **Continuing Scientific Investigation**

This scientific work completed to date has been essential to building the foundation upon which decisions can be based by homeowners and local, state and federal authorities. Today's reports advance the work released on October 29, 2009, where the Interagency Task Force was able to identify preliminary differences in the chemical composition and emissions between Chinese and non-Chinese drywall. The scientific investigation of the drywall matter continues in parallel to the new path forward towards identification and remediation solutions. These ongoing studies are:

- *Chamber Studies* – Work at Lawrence Berkeley Laboratories (LBL) continues on samples of Chinese and non-Chinese drywall to isolate the chemical emissions. Results from this investigation will present a better understanding of the specific compounds the problem drywall is contributing to indoor environments. The identification of these specific compounds emitting from drywall is also necessary to know what chemicals to use in the investigation of long-term corrosion.

- *Investigation of Long-Term Corrosion* – Sandia National Laboratories (SNL) is continuing to study corrosion of electrical components harvested from problem drywall homes and will expose new components to particular environments, which will include the isolated drywall emissions from LBL, and seek to accelerate the corrosion process to observe long-term effects. (The ongoing work of SNL is discussed in greater detail in Tab B.) National Institute of Standards and Technology (NIST) is conducting a similar investigation on fire safety components, including smoke alarms, sprinklers, and gas service lines. Given the limits of how quickly a laboratory can simulate decades of exposure, this work will not be completed until at least June 2010.
- *Bacterial Study* – The Interagency Task Force is conducting an investigation into the possibility of a bacterial mechanism in the production of emissions from the problem drywall.

### **Chain of Commerce of Chinese Drywall**

While the CPSC has aggressively pursued a detailed investigation into the Chinese drywall supply chain, it remains difficult to estimate the total number of homes that could contain problem drywall. The investigation has worked from both ends of the manufacturer-to-consumer chain. CPSC began with information from CBP to identify importers and then expanded the inquiry to include drywall suppliers and builders. To date CPSC has contacted over 400 such entities. From the consumer end of the chain, CPSC has received over 2000 consumer reports from thirty-one states, the District of Columbia and Puerto Rico. CPSC recently reached out to the governors of all fifty states and the U.S. territories to obtain data on homes reporting Chinese drywall. This should better assist in understanding the full scope of this issue.

At present, the two metrics available for drywall full scope estimates, total imports and consumer complaints, both hold uncertainties. From the seven million sheets of Chinese drywall imported between 2000 and 2009, it is difficult to estimate the number of houses that might contain the drywall because a house could have just one or many sheets. Furthermore, CPSC does not yet know how many of these drywall sheets may be problematic. On the other hand, the over 2000 complaints received by CPSC probably do not include all affected consumers. A homeowner might not report their concerns because they have not yet associated issues in their home with drywall or out of a possible fear of the negative consequences of owning a property with Chinese drywall. Nevertheless, actual reports of drywall concerns may offer the best means for evaluating the scope of the problem drywall issue.

### **Current Imports and Existing Stockpiles of Chinese Drywall**

The CPSC, working with CBP, is monitoring imports of possible Chinese drywall. We believe no new Chinese drywall has entered the United States in 2009. There are several known inventories of uninstalled Chinese drywall in the United States and the owners of these stockpiles have been notified of this ongoing investigation and advised to notify the CPSC if they sell or dispose of any drywall from their inventory.

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