The Complexities of Evaluating Occupant Exposures in Homes with Drywall Associated Corrosion

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Introduction

Reports of rapid, recurring copper corrosion in relatively new homes, associated with the use of imported drywall, prompted concerns of associated health hazards by Florida public health officials. To further evaluate the potential for health effects, a study was prompted by the Florida Department of Health to evaluate occupant exposure to chemicals in affected homes. These studies measured chemical concentrations present in the indoor air of homes which met the case definition and in neighboring homes which did not meet the case definition.

Florida DOH Case Definition

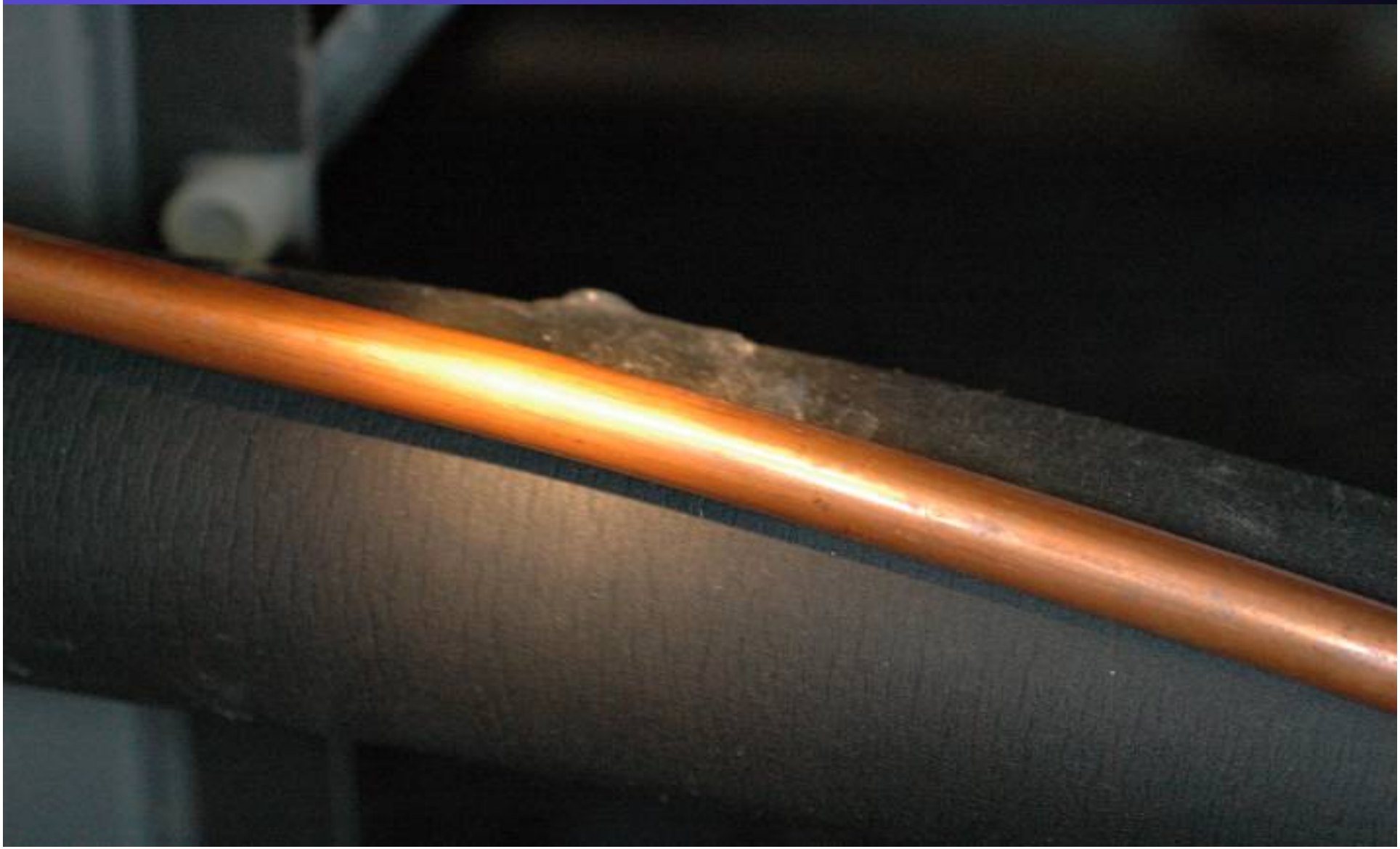
1. There is a sulfur-like or other unusual odor.
2. *Confirmed presence of defective Chinese manufactured drywall in the home (by printed label or validated materials testing).*
3. Observed copper corrosion, indicated by black, sooty coating of Un-insulated copper pipe leading to the air handling unit present in the garage or mechanical closet of home.
4. Documented failure of air conditioner evaporator coil due to corrosion (located inside the air handling unit).
5. *Confirmation by an outside expert or professional for the presence of premature copper corrosion on Un-insulated copper wires and/or air conditioner evaporator coils (located inside the air handling unit).*

Control home – no black corrosion observed

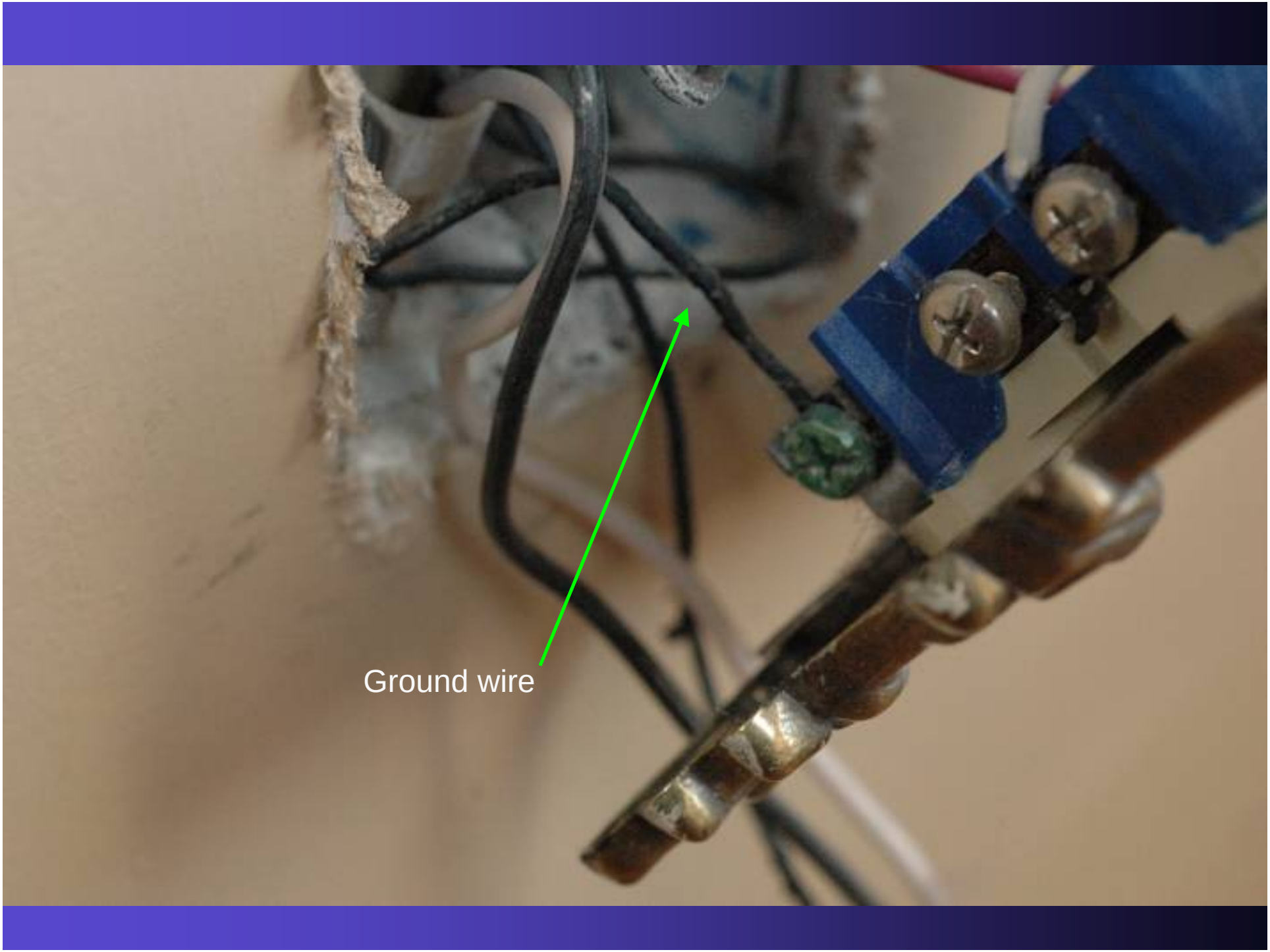
Control home – no black corrosion observed

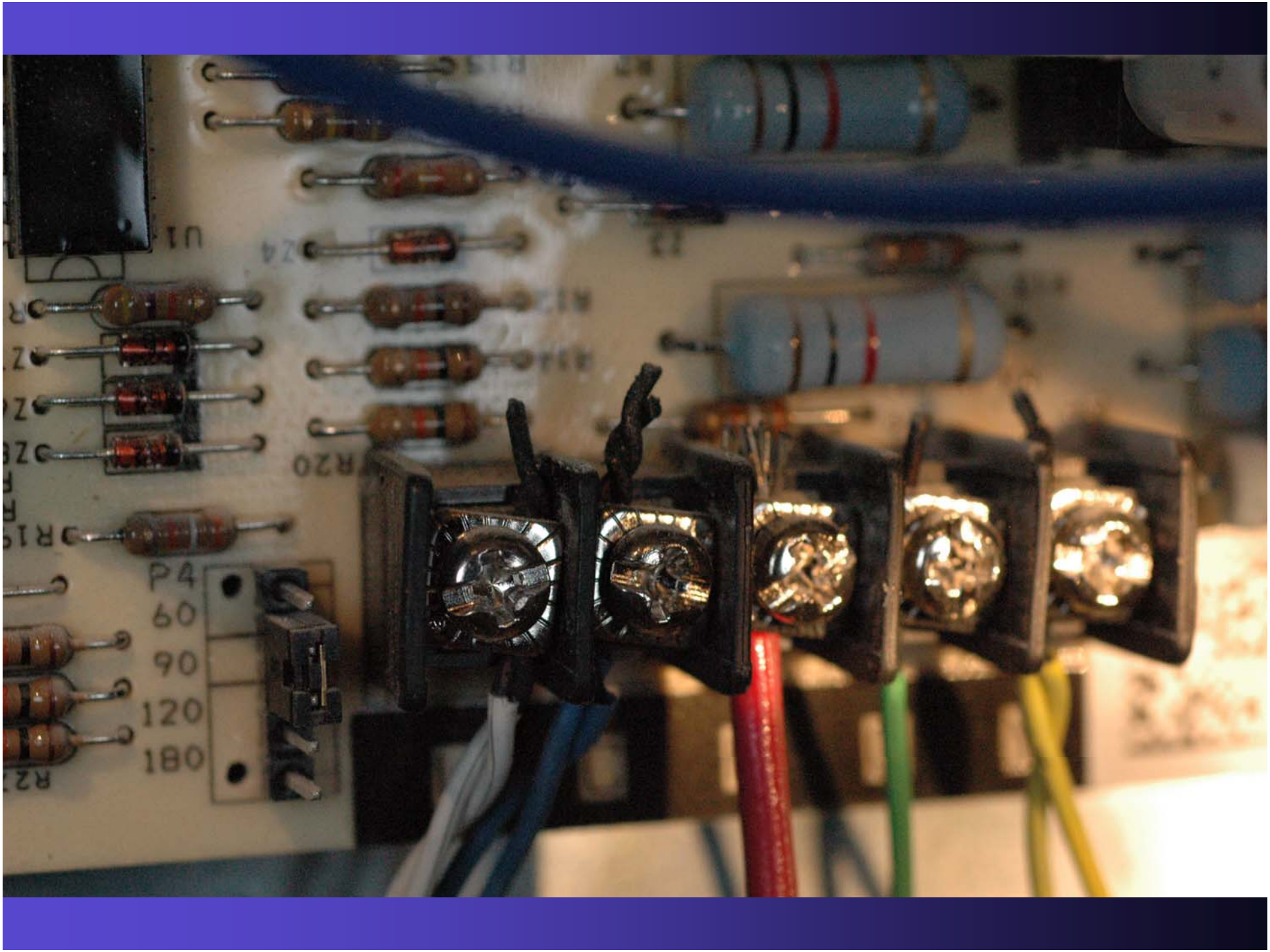
Corrosion of Copper in Evaporator Coils

“Normal” Copper – no significant corrosion

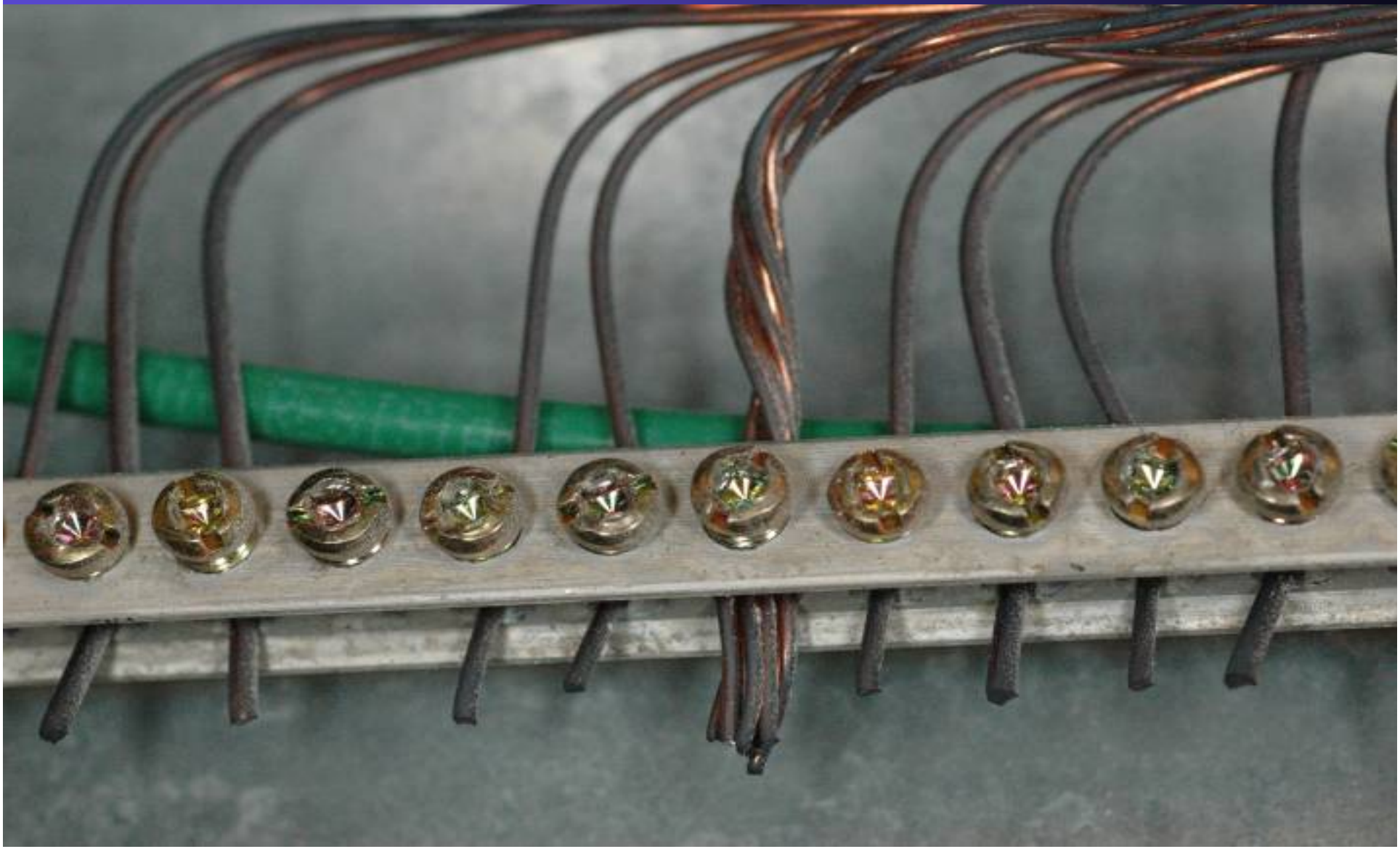


Corrosion of Copper Outside of Evaporator Coils ("hot line")

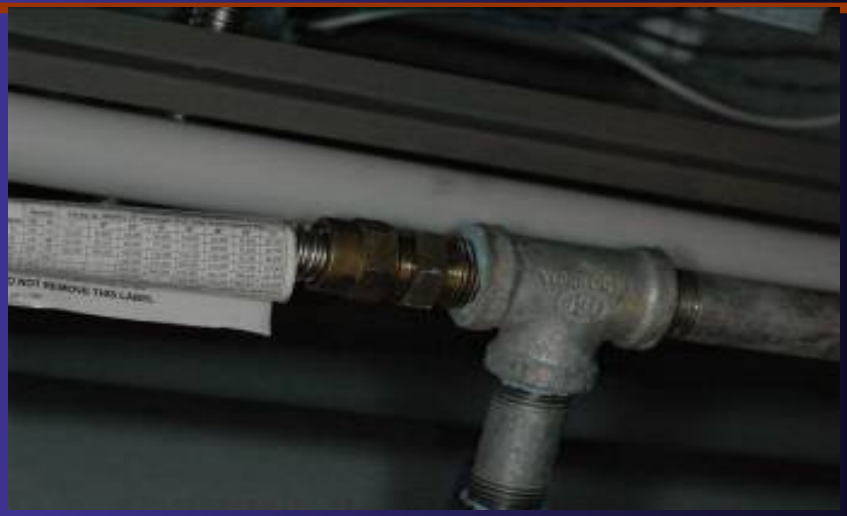

Ground wire

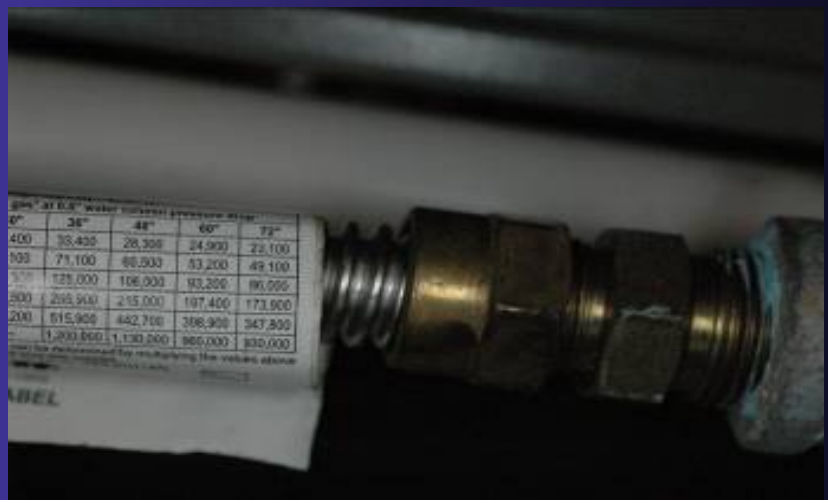

P4
60
90
120
180

Corrosion of Wiring
(ground wires in breaker box)



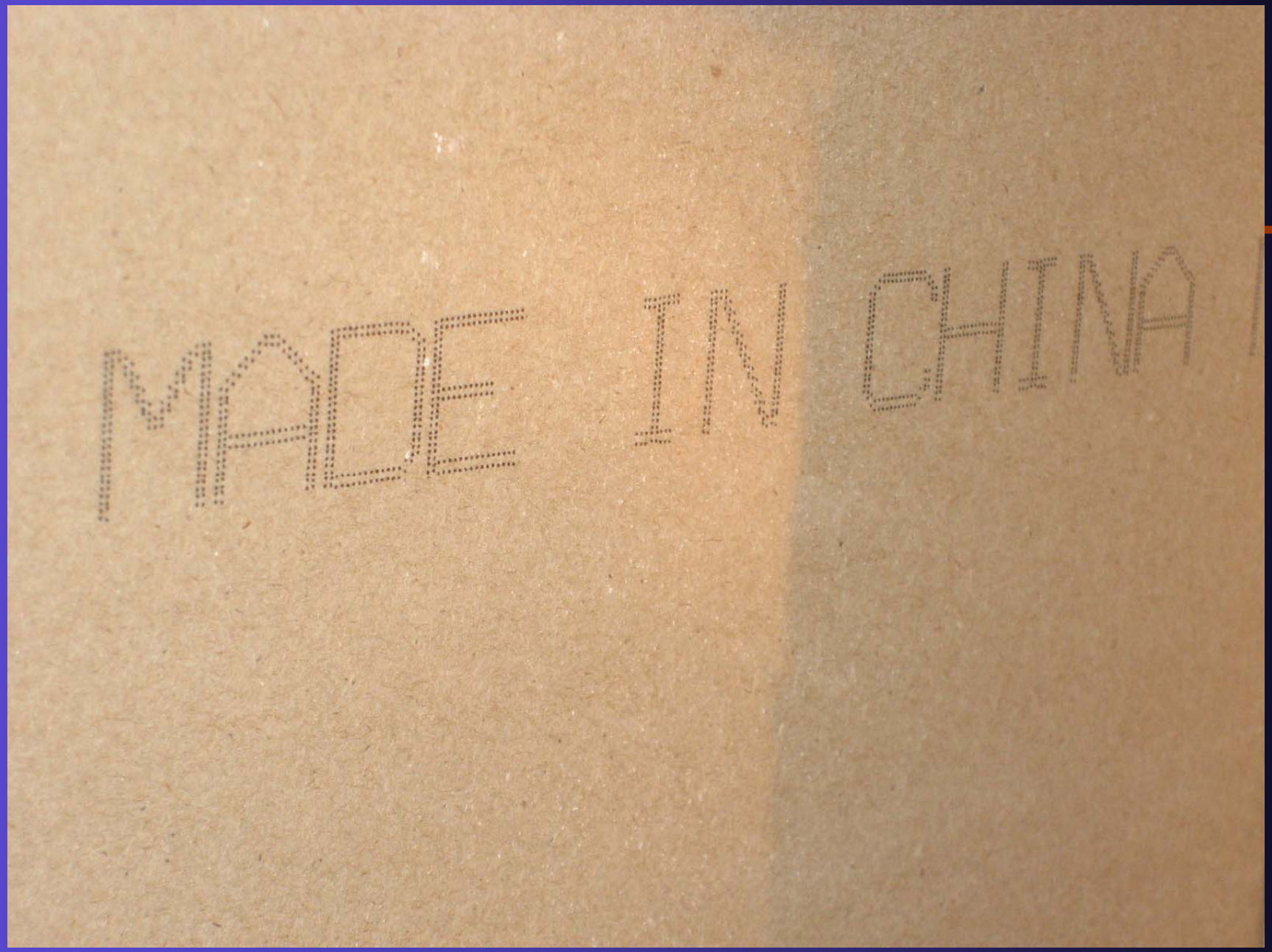
NG Furnace





Corrosion of Copper at Water Heater


National Gypsum
COMPANY


MADE IN CHINA


KNAUF-TIANJIN CHINA-AST

Drywall (ceiling of garage)

Objectives

- Determine if building characteristics for affected homes differ from unaffected homes.
- Evaluate the reliability and repeatability of available sample collection and analysis methods.
- Measure the in-home concentrations of corrosive gasses emitted from defective drywall.

Objectives

- Estimate changes in concentrations of corrosive gasses and volatile organic compounds (VOCs) due to diurnal cycles.
- Evaluate the influence of chemicals in outdoor air and environmental conditions on indoor air chemical concentrations.
- Evaluate the presence and in-home concentrations of secondary by-products perhaps attributable to corrosive emissions from drywall reacting with other materials, coatings, adhesives, or chemicals in the indoor environment.

Methods Used by Florida DOH

Phase I: Two Sampling Events (Units 80, 81, outdoors) AM & PM

Sulfur-containing gasses

Collection - 1L Tedlar Bags, collected using a lung sampler

Analysis - ASTM Method D 5504-01

Volatile Organic Compounds

Collection - Carbo-Pack B sorbent tubes via personal sampling pumps at 0.2 LPM

Analysis - thermal desorption into a gas chromatograph with mass spectrometric detection (GC/MS) (Air Quality Sciences)

Methods Used by Florida DOH

Phase II: Sampled sulfur-containing gasses and VOCs throughout a twenty-four (24) hour cycle within Unit 90 (Test) and Unit 91 (Control) homes. Two locations within each home plus outdoors.

Twelve (12) sampling events to evaluate possible diurnal effects on Sulfur-containing gasses.

Collection – Same as Phase I

Analysis - ASTM Method D 5504-08

Laboratory - Lakeland Laboratories, LLC (Courier to Lab)

Volatile Organic Compounds (Same as Phase I)

Formaldehyde – 24 Hr Diffusion Badges (UMEX) analyzed by Galson Laboratories.

Conclusions

- Construction styles, materials and ages of test and control homes were similar, except for the use of imported drywall. Air change rates per hour (ACH) for test homes were 0.12 and 0.22, while for control homes were 0.16 and 0.17. All homes in this study had low air exchange with the outdoors and effectively controlled temperature and relative humidity, suggesting that uncontrolled environmental conditions within test homes was not a major factor in drywall emissions or copper corrosion.

Conclusions

- Out of 22 samples from Test homes, hydrogen sulfide was found at 5.72 ppbv in one sample; carbonyl sulfide was found at 4.14 ppbv in one sample; and carbon disulfide was found at 2.5 ppbv in one sample. No positive results for sulfur-containing drywall emissions were detected in Control home samples.

Hydrogen sulfide was detected in two outdoor samples.

Conclusions

Because sulfur-containing gasses were rarely detected above detection limits in test homes using the ASTM D 5504 method, an assessment of the method's variability and possible diurnal cycles in homes could not be performed.

Instances of VOC from outdoor sources were observed in the data, however most indoor VOCs were attributable to indoor sources common in new homes.

No specific secondary by-products of chemical reactions were identified in VOC sample results.

Formaldehyde concentrations were within the range of those reported in prior studies of new homes, for both Test and Control homes.

Conclusions Relevant to a Health Assessment

Early results did not identify chemical levels that pose a toxic hazard to occupants.

Numerous compounds were found above their odor threshold, including some sulfur-containing compounds.

Many of the chemicals found in Test and Control homes are known respiratory irritants or malodorants (having an objectionable odor) when present above certain threshold levels.

The presence of objectionable odors increases the sensitivity of trigeminal nerve endings to multiple chemical irritants.


Thank You
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