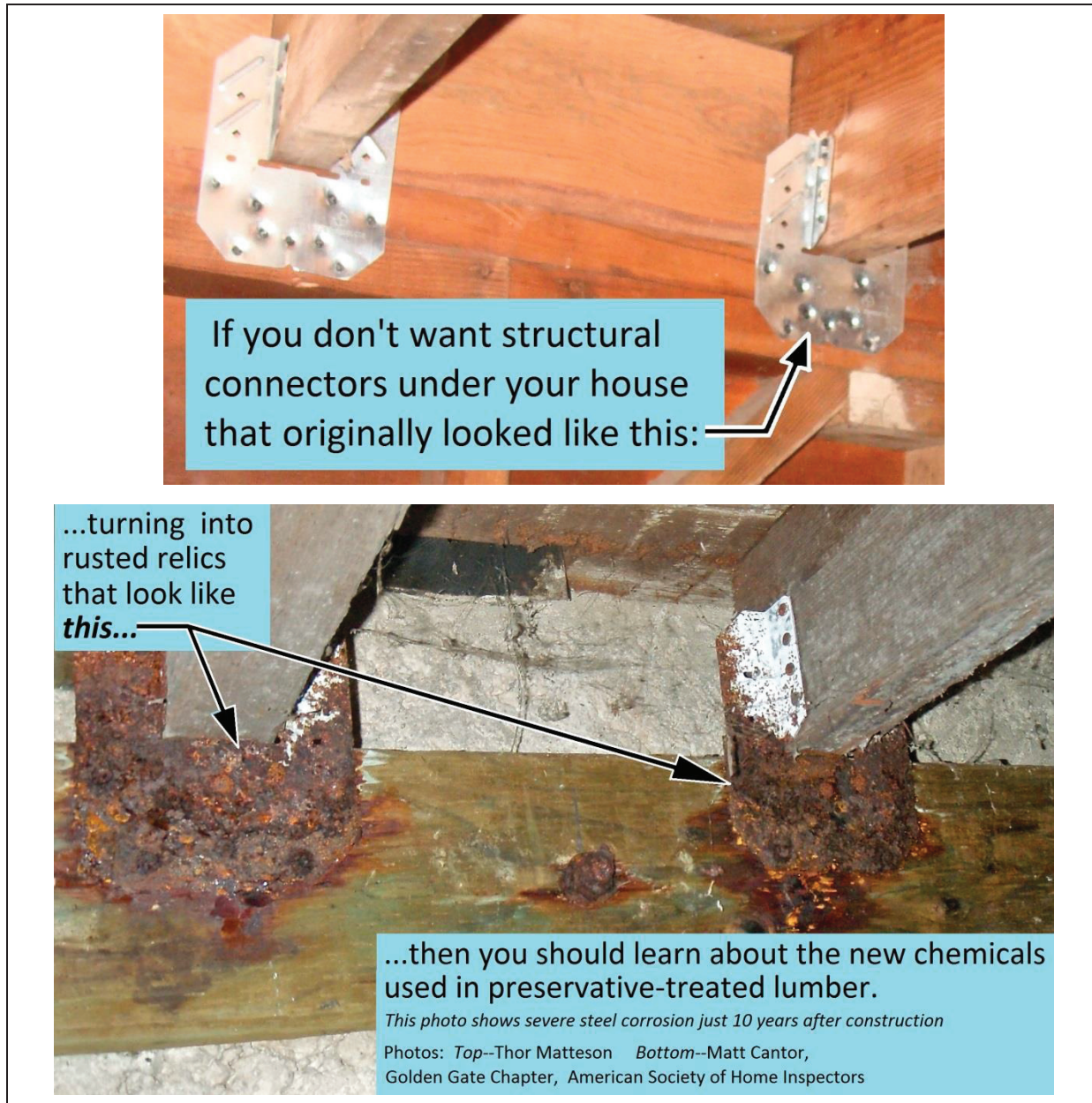


# Corrosion of Steel Hardware Caused by Pressure-Treated Lumber



This handout is from *Earthquake Strengthening for Vulnerable Homes—a Practical Guide for Engineers, Contractors, Inspectors, and Homeowners*, by Thor Matteson, Structural Engineer. Mr. Matteson has been concerned with fastener corrosion since 2004, when the wood-treating industry began using new preservative formulations that aggressively attack steel hardware.

## **8.5 Pressure-treated lumber: a ticking time-bomb since... 2004?**

Alert: This section is *long*; there is a great deal of misinformation to address, and the subject involves some technical information that needs explanation.

Imagine constructing a house using building materials that will quietly destroy each other. Millions of homes have been built using such materials; the hardware pictured in Figure 8-1 shows severe corrosion of steel connectors in contact with chemically treated lumber. Rust weakens connectors, making them more likely to fail during an earthquake. Future failures of structural connections will surprise a lot of building professionals and homeowners; if you have this material in your home you still have time to avert disaster.

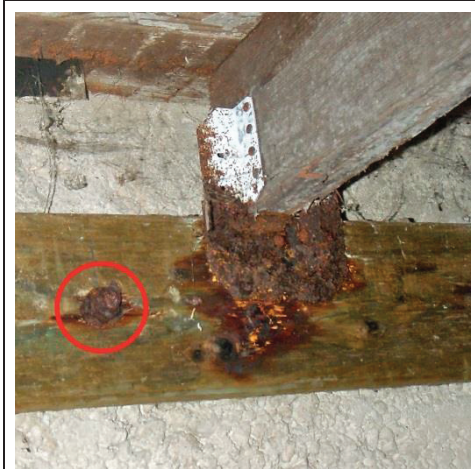
### **8.5.1 Background information**

Ever since the first building code there has been a requirement for mudsills or other wood members in contact with earth or footings to be decay-resistant. The codes allow foundation-grade redwood or cypress, or preservative-treated wood. “PT lumber”, or even just “PT” is the term used for wood that has been made artificially decay-resistant by the addition of preservatives. Technically the proper term is “*preservative pressure-treated*” lumber, as wood can also be pressure-treated with chemicals to make it fire-resistant (and possibly for other traits). I will stick with the term PT lumber here.

### **8.5.2 Alphabet soup—and unintended consequences**





**The chemicals:** Until 2004, the most common treatment chemical used in PT lumber intended for residential construction was chromated copper arsenate, or “CCA.” You may find PT lumber stamped with “CCA” or “CCA-C,” (or some other suffix letter; the trailing “C” is the third formulation they came up with, after A and B). Arsenate is a chemical compound that includes arsenic, which has been a known human poison for centuries. The chromate is probably not good for us either. Thankfully the CCA binds with the lumber and the toxins pretty much stay in the wood.

Since 2004, CCA has not been allowed as a treatment for wood used in residential construction in the US. Some of the more common new chemicals used for preservatives include CA (Copper Azole), ACZA (Ammoniacal Copper Zinc Arsenate), CC (Copper Citrate), ACQ (Ammoniacal Copper Quaternary). All of the preceding chemicals bond with



**Figure 8-1 Most wood now sold to resist decay also attacks steel connectors. The red circle shows a rusted concrete anchor. At center is a severely corroded H10A (compare to Figure 6-34). This installation was about 10 years old when photographed. Photo: Matt Cantor, GGASHI**

the wood cells, giving a “waterproof” treatment suitable for fence-posts, decks, etc. Figure 8-2 shows several labels from PT lumber.

 <p>ProWood<sup>®</sup> MICRO CA Ground Contact Use 4 STEP 6-3/4 X 10 SYP 0 90489 13534 8 SEE BACK OF TAG</p> <p>ENVIRONMENTALLY PREFERABLE Treated Wood Process™</p>	<p>Micron-ized CA</p>	 <p>CHEMONITE ACZA</p> <p>CAUTION: CHEMONITE IS IN THE PRESENCE OF... NEVER ALLOW CHEMONITE TO COME IN CONTACT WITH... ALWAYS WEAR... For the Customer: Safety Information Under the Label... WARNING: THIS WOOD CONTAINS CHEMONITE... Hazardous Chemicals (P) ALKALINE COPPER QUATERNARY COMPOUNDS ACQ-CA</p>	<p>ACZA</p>
 <p>020608 414787 UCIB ABOVE GROUND AWPA U1 STD. 0.06 pct CA-C plant COPPER AZOLE #993 7 37164 17921 0</p> <p>TrueGuard<sup>®</sup></p> <p>Due to a risk of corrosion, Hot Dipped Galvanized (ASTM A123 &amp; G185) or Stainless Steel (Type 304) Connectors &amp; Fasteners are recommended by Arch Treatment Tech, Inc. For Handling Precautions see backside label.</p>	<p>CA-C</p>	 <p>END USE - GROUND CONTACT NatureWood PRESERVED WOOD PRODUCTS LIFETIME LIMITED WARRANTY - Ask Dealer For a Copy of the Warranty - Farm &amp; Residential Use Allweather Wood - White City, OR 97503 See other side for Handling &amp; Use Information</p> <p>03 AWPA C2, C3 STD UCA4 04 ACQ-CA ALKALINE COPPER QUATERNARY COMPOUNDS</p>	<p>ACQ</p>
 <p>DO NOT BURN TREATED WOOD LIFETIME LIMITED WARRANTY Preserve Coast Wood Preserving, Inc. - Ukiah, CA NOT FOR USE IN DIRECT CONTACT WITH ALUMINUM ACQ-D 0.40</p> <p>Awarded by: AWWA U1 UCA4</p>	<p>ACQ-D</p>	 <p>HANDLING &amp; USE INFORMATION</p> <ul style="list-style-type: none"> <li>DO NOT BURN PRESERVED WOOD</li> <li>WEAR DUST MASK &amp; GOGGLES WHEN CUTTING OR SANDING WOOD</li> <li>WEAR GLOVES WHEN WORKING WITH WOOD</li> <li>DO NOT USE AS ANH CI</li> <li>DO NOT USE PRESERVED WOOD IN DIRECT CONTACT WITH ALUMINUM</li> <li>USE HOT-DIP GALVANIZED MEETING ASTM-A193 OR ASTM-A653, STAINLESS STEEL OR OTHER FASTENERS AND HARDWARE AS RECOMMENDED BY THE HARDWARE MANUFACTURER.</li> </ul> <p>For additional product information, ask for the NatureWood<sup>®</sup> Warranty brochure or visit <a href="http://www.osmose.com">www.osmose.com</a>.</p>	<p>ACQ + instructions</p>

All of the preceding treatment compounds contain copper. Copper and steel, in the presence of water and oxygen, create a “galvanic reaction” (*galvanic* and “*galvanized*” both give tribute to Italian scientist Luigi Galvani). This reaction occurs even with very small amounts of water, such as from humid air in a crawlspace. Oxygen molecules will travel through wood, so embedding nails or other fasteners into wood does not protect them. The steel corrodes as a result of this reaction. Corrosion is the chemical term for “rust.” Figure 8-3 shows some very disturbing examples of rapid corrosion.

The “white rust” often seen on galvanized steel connectors is the first corrosion by-product: zinc oxide. After

## Why the “teeth-marks” in PT lumber?

To speed up the process of getting the preservatives into the wood, the wood is immersed in chemicals inside huge vessels that are then pressurized to force the mixture into the wood cells.

Some species of wood will accept the chemical treatments more easily than others; wood that is difficult to treat otherwise is usually “incised” by sending the lumber through rollers studded with miniature knife-blades. Douglas fir is difficult to treat and needs to be incised for most chemicals. The “hem-fir” species group is also easier to treat, but woods in this group are softer and do not provide the same connection capacity as Douglas fir. (Since mudsills are not high-demand members, the reduced capacity can be addressed easily by using more edge-nails when connecting bracing panels.) Southern yellow pine accepts treatment readily and does not require incising.



the zinc corrodes away, the underlying steel is no longer protected and it begins to rust. ***This process continues until all the steel has corroded away. ALL of it.*** The time it takes depends on many variables—so: do you feel lucky? Note that hardware manufacturers advise if you see *any* “red rust” on a connector then it should be replaced.



## Are you finding this information valuable?

If so, please consider buying the book that contains the rest of the article--another 11 pages that describe how and why structural hardware in your house may be in danger, and how to prevent the problem and save money at the same time. You can order the book online at Builders Booksource in Berkeley, CA:

<https://www.buildersbooksource.com/pages/books/25749/thor-matteson/earthquake-strengthening-for-vulnerable-homes>

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The book is also available from the giant online supplier that probably owns your soul by now.