Linda Chalker-Scott, Ph.D., Extension Horticulturist and Associate Professor,
Puyallup Research and Extension Center, Washington State University

The Myth of Protected Preservatives

"The chemicals in pressure-treated lumber will not affect adjacent soils or plants"

The Myth

One of the functional drawbacks of organic materials used in a landscape is the eventual disintegration of those materials through insect and microbial activity. This is especially true of lumber used for decks and raised beds, where direct contact with soil and moisture enhances its decomposition. The advent of pressure-treatment as a wood preservative process in the early half of the last century greatly increased the functional life span of outdoor wooden structures. The treatment process, usually in the form of chromated copper arsenate (CCA), renders the wood resistant to fungi (copper) and insects (arsenic). Chromium serves to lock the arsenic and copper into the wood, which then resists degradation by insects and fungi. The process was perfected by the 1960's, and by the 1970's most of the lumber used outdoors was pressure-treated with CCA.

In the last few decades, concerns have been raised as to the environmental and human health risk posed by pressure-treated lumber, especially timbers used for creating vegetable gardens. One university Q&A web page fielded such a question: "Are cross timbers ok for a vegetable bed?" The answer: "If by cross timbers they mean pressure treated landscape timbers or railroad ties, the answer is yes." This same university has been quoted as concluding "...that arsenic was not leaching from timbers used in raised bed gardens varying in age from 6 months to 9 years of age." Another university web page states that wood treated with CCA and related compounds "are the safest for the garden because of their very low tendency to leach into the soil. Research studies have shown that there is very little chance of ingesting arsenic in vegetables near treated lumber." If this is true, then why is CCA-treated lumber being phased out for residential use?

The Reality

There is no doubt that pressure-treatment with CCA works well to preserve outdoor lumber. Unfortunately, the properties that make CCA a potent, broad-spectrum pesticide also make it hazardous to humans and other non-target organisms.

The USEPA is currently assessing the risks associated with CCA-treated lumber, especially when associated with children's play structures. Their website recommends against using CCA-treated wood "under circumstances where the preservative may become a component of food or animal feed," including as a mulch and in compost bins. In light of these cautions, it is odd that there is nothing mentioned regarding the potential risk of arsenic uptake by vegetables grown near CCA-treated timbers.

There is a significant body of recent literature that addresses leaching and environmental uptake of chromium and arsenic from a variety of sources, including CCA-treated lumber. Space constraints preclude an in-depth review of this literature, but some of the salient points are these:

- CCA-treated wood leached arsenic at concentrations above the U.S. federal toxicity characteristic limit (5 mg/L).
- CCA-treated wood exposed to solar ultraviolet leaches more arsenic than unexposed wood.
- Arsenic has the highest bioavailability (i.e. it can be most easily taken up by roots) in contaminated sandy soils compared to contaminated clay soils.

- CCA-treated lumber is a significant non-point source of arsenic in suburban catchments.
- The release rates of copper, chromium, and arsenic from CCA-treated chain saw sawdust, circular saw sawdust, and spade bit shavings were many times higher than from solid wood.
- Sawdust made from CCA-treated lumber and used as a soil amendment released high levels of chromium, copper and arsenic into the soil.
- Significant leaching of metals from CCA-treated lumber occurs under acidic conditions

How does this translate to vegetable gardens and food safety? Again, there is a substantial collection of recent scientific articles that address this concern, with results such as these:

- Basil and zucchini accumulate toxic levels of arsenic when grown in soils amended with fly ash.
- Some plants compartmentalize arsenic in their roots (e.g. tomatoes, beets, lettuce), while others transport it to shoots (e.g. beans).
- Likewise, some plants compartmentalize chromium in their roots (e.g. soybeans, beets, onion, lettuce), while others transport it to shoots (e.g. radishes, leeks)
- Members of the Brassicaceae (including cauliflower, kale, and cabbage) concentrate chromium at levels far above other, unrelated species.

Most relevant of all are those studies that combined CCA-treated lumber and/or adjacent soils with tissue analysis of plants grown in their presence. One study reported a ten-fold increase in arsenic levels in lettuce and tomatoes grown in CCA-treated raised beds compare to those grown in beds made from untreated wood. Another study in 2004 found elevated levels of arsenic in soils adjacent to CCA-treated utility poles and fences and correlated this to enhanced arsenic accumulation in carrots and lettuce. The accumulation was magnified when phosphate was added (a ubiquitous component of most fertilizers) and could be reduced by addition of compost, which apparently serves to bind the arsenic and prevent its uptake.

Existing CCA-treated lumber can be treated with film sealants or wrapped in heavy-duty plastics that prevent arsenic and chromium leaching into the soil. In constructing new raised beds and other landscape structures, consider the alternatives to CCA-treated lumber, including

- Naturally resistant types of wood, including cedar, redwood, and juniper;
- Lumber treated with less toxic solutions, particularly those containing copper and boron;
- Synthetic lumber, including those made from recycled plastics or rubber;
- Concrete blocks and other inorganic structural materials

A wood-products industry spokesman recently interviewed about the hazards of CCA-treated lumber asserted, “Scientifically, there’s really no data to back up any dangers. It’s mostly emotionally based.” This hearkens back to 1941, when a wood products researcher stated that “treated timber is non-poisonous to warm-blooded animals,” and that once it was air-dried it could “be handled with complete safety.” Fortunately, science does progress and hopefully industry viewpoints will do the same.

CCA-treated lumber, easily recognized by incised pattern, should never be used where fruits and vegetables are grown.

The Bottom Line

- Pressure-treated lumber containing chromated copper arsenate should never be used in vegetable gardens
- Soils that are acidic and sandy are more likely to leach heavy metals from treated lumber
- Exposure to sunlight and other weathering activities will increase the leaching rate of CCA-treated lumber
- Many common vegetable species will accumulate arsenic and chromium in their tissues; members of the Brassicaceae may be the worst accumulators
- Phosphate addition will enhance the ability of plants to take up arsenic and chromium
- Addition of compost to CCA-contaminated soils may help bind arsenic and chromium, reducing uptake by plant roots

For more information, please visit Dr. Chalker-Scott's web page at http://www.theinformedgardener.com.