Conclusions and Summary Brief

Environmental Life Cycle Assessment of

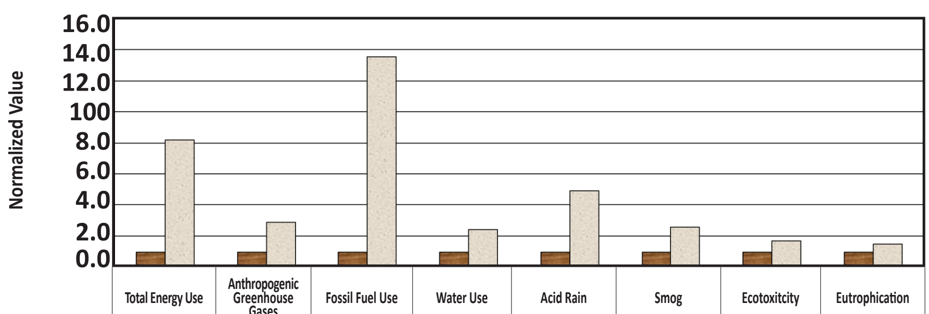
Copper Azole-Treated Lumber Decking with Comparisons to Wood Plastic Composite Decking

Arxada has completed a quantitative evaluation of the environmental impacts associated with the national production, use, and disposition of copper azole-treated lumber decking (Wolmanized® Residential Outdoor® wood) and wood plastic composite decking using life cycle assessment (LCA) methodologies and following ISO 14044 standards. The comparative results confirm:

- **Less Energy & Resource Use:** Copper azole decking requires less total energy, less fossil fuel, and less water than wood plastic composite decking.
- **Lower Environmental Impacts:** Copper azole decking has lower environmental impacts in comparison to wood plastic composite decking in all five of the impact indicator categories assessed: anthropogenic greenhouse gas, acid rain, smog potential, ecotoxicity, and eutrophication-causing emissions.
- **Less Fossil Fuel Use:** The fossil fuel footprint of a copper azole-treated wood deck is equivalent to driving a car 40 miles/year. In comparison, the fossil fuel footprint of a wood plastic composite deck is equivalent to driving a car 540 miles/year.
- **Recoverable Energy:** The carbon embodied in wood makes out-of-service wood products excellent candidates for energy recovery. Treated wood can be used in cogeneration facilities or synthetic fuel manufacturing facilities as a non-fossil fuel source.

Impact indicator values for the cradle-to-grave life cycle of copper azole-treated lumber decking were normalized to one (1.0), with wood plastic decking impact indicator values being a multiple of one (if larger) or a fraction of one (if smaller). The normalized results are provided in Figure 1.

Figure 1.
Impact indicator comparison (normalized to copper azole-treated lumber = 1.0)



	Total Energy Use	Anthropogenic Greenhouse Gases	Fossil Fuel Use	Water Use	Acid Rain	Smog	Ecotoxitcity	Eutrophication
CA-A Lumber	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
WPC Decking	8.2	2.9	14	2.4	5.0	2.6	1.7	1.5

Scope

The scope of this study includes:

- A life cycle inventory of copper azole-treated lumber decking and wood plastic composite decking, modified from a life cycle inventory of ACQ-treated lumber decking done for the Treated Wood Council.
- Calculation and comparison of life cycle impact assessment indicators: anthropogenic greenhouse gas, acid rain, smog, ecotoxicity, and waterborne eutrophication impacts potentially resulting from life cycle air emissions.
- Calculation of energy, fossil fuel, and water use.

ISO 14044 Compliant Prepared by: AquAeTer, Inc.

Impact Category	Units	Copper azole-treated lumber deck	Wood plastic composite deck
Energy Use			
Energy input from technosphere	MMBTU	0.25	1.4
Energy Input from nature	MMBTU	0.17	2.1
Biomass energy	MMBTU	0.15	0.0083
Impact indicators			
Anthropogenic GHG emissions	lb-CO_2-eq	113	330
Acid rain potential	lb-H+ mole-eq	21	105
Smog potential	g NOx/m	0.11	0.28
Ecotoxicity potential	lb-2,4-D-eq	0.25	0.43
Eutrophication potential	lb-N-eq	0.010	0.015
Resource use			
Fossil fuel use	MMBTU	0.25	3.4
Water use	gal	14	34

Table 1. Environmental performance (per representative deck per year of use)

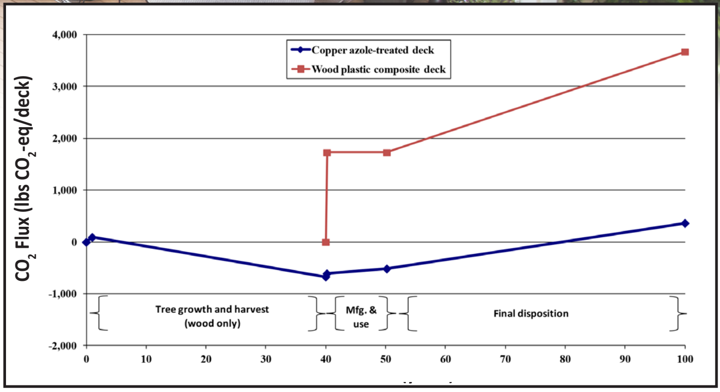


Figure 3. Carbon balance (per deck)

Environmental Performance

The assessment phase of the LCA uses the inventory results to calculate total energy use, impact indicators of interest, and resource use. For environmental indicators, USEPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) is used to assess anthropogenic greenhouse gas, acid rain, smog potential, ecotoxicity, and eutrophication impacts potentially resulting from air emissions. The categorized energy use, resource use, and impact indicators provide general, but quantifiable, indications of environmental performance. The results of this impact assessment are used for comparison of copper azole-treated lumber decking and wood plastic composite decking as shown in Table 1.

The carbon balance of copper azole-treated lumber decking and wood plastic composite decking, through the life cycle stages, is shown in Figure 3. Wood products begin their life cycles removing carbon from the atmosphere (as carbon dioxide) and atmospheric carbon removal continues as trees grow during their approximate 40-year growth cycle, providing an initial life cycle carbon credit. Approximately half the mass of dry wood fiber is carbon. Wood plastic composite is composed of wood from recovered/recycled cellulose fiber materials and virgin and/or waste plastics.

Transportation and manufacturing operations are the primary sources of carbon emissions in the manufacture of wood products. Wood plastic composites require the conversion of fossil fuels into plastics for virgin materials and collection and processing of wood scrap. Some manufacturers of wood plastic composites use recycled plastics, however burdens associated with transportation, sorting, cleaning, and melting must be included.

During use, this assessment assumes that one application of sealant is applied to the copper azole-treated lumber deck. Minimal carbon use or release occurs during use of wood plastic composites. Following the service life stage, both copper azole-treated lumber decking and wood plastic composite decking are assumed to be disposed in a landfill.

Quality Criteria

This study was done as an extension of work performed by the Treated Wood Council and is not intended as a stand-alone LCA. The study includes most elements required for an LCA meeting the International Organization for Standardization (ISO) guidelines as defined in standards ISO/DIS 14040 "Environmental Management – Life Cycle Assessment – Principles and Framework" and ISO/DIS 14044 "Environmental Management – Life Cycle Assessment – Requirements and Guidelines". However, there was no external peer review of the copper azole components of this LCA.

Additional Information

This study is further detailed in a Life Cycle Assessment Report completed in March 2011 and is available upon request from Arxada at 1200 Bluegrass Lakes Parkway, Alpharetta, GA 30004 (WolmanizedWood.com).

This study is based on data collection and analysis done as part of an LCA on ACQ-Treated Lumber used as Decking. A manuscript of the ACQ-treated lumber decking findings was published in the peer-reviewed Journal of Cleaner Production and is available at http://dx.doi.org/10.1016/j.jclepro.2010.12.004.