

**“Environmental and
Health Risk Evaluation of
Copper Naphthenate and
Copper Naphthenate
Treated Wood”**

Conducted by T.J. Leech III, CHMM

**E. Roberts Alley & Associates Inc.
Environmental Engineering Consultants
Memphis, TN**

This document provides an overview of the health risks associated with copper naphthenate and copper naphthenate treated wood.

MERICHEM
CHEMICALS & REFINERY SERVICES LLC

E ROBERTS
Alley &
Associates

INCORPORATED

Environmental Engineering
& Consulting

230 Wilson Pike Circle
Brentwood, TN 37027

615-373-1567
FAX 615-373-3697

*ENVIRONMENTAL AND HEALTH RISK EVALUATION OF COPPER
NAPHTHENATE AND COPPER NAPHTHENATE TREATED WOOD*

Copper naphthenate has been used for over 50 years in the United States in various wood treating applications. Copper naphthenate is a copper carboxylate made with naphthenic acid, which occurs naturally in petroleum. Commercial copper naphthenate is normally supplied as a 6% or an 8% copper concentrate which is diluted with a petroleum hydrocarbon to provide a 1-2% copper treating solution. Copper naphthenate is an EPA registered general use wood and fabric preservative that can be used with a high degree of safety. It is not considered a hazardous waste, it is non-corrosive, non-conductive, non-blooming, and it has low mammalian (e.g. human) toxicity.¹

Commercial pressure treaters dilute copper naphthenate with wood treating oil to obtain a 1-2% treating solution.² The exposure potential to the treating oil carrier from evaporation should be negligible with a low vapor pressure (less than 1 mmHg) and evaporation rate (0.02 compared to butyl acetate at 1.0).³

Copper naphthenate-treated wood has a low order of toxicity, and when it is discarded the treated wood is not a hazardous waste. Copper naphthenate products can be purchased at retail outlets and have a variety of uses as wood and textile preservatives. Copper naphthenate has been used safely in greenhouse applications.⁴ It is recommended for the treatment of beehives because it has not harmed bees or significantly affected the quality of honey produced.⁵ Copper naphthenate is approved as an over the counter topical treatment for treating horses and ponies for thrush at concentrations of 37.5%.⁶ Livestock exposed to copper naphthenate-treated shelters and water troughs exhibited no adverse health effects.⁷

The properties of copper and naphthenic acid provide insight into the overall risk profile of copper naphthenate. Elemental copper is an essential element for all known living organisms, including humans and other animals. Copper is normally kept in balance in the human body. Copper compounds are most commonly used in agriculture to treat plant diseases, like mildew, or for water treatment and as preservatives for wood, leather, and fabrics. Food naturally contains copper. You eat and drink about 1 milligram (1/1000 of a gram) of copper every day. Copper is necessary in your diet for good health.⁸ There is evidence that feeding extra copper and zinc may be beneficial to better bone quality in horses. Feeding 25 parts per million copper and 75 parts per million zinc may aid in preventing developmental orthopedic disease.⁹ Most copper compounds found in air, water, sediment, soil, and rock are so strongly attached to dust and dirt or imbedded in minerals that they cannot easily affect your health.¹⁰

Soil generally contains between 2 and 250 ppm copper. The Environmental Protection Agency (EPA) has determined that drinking water should not contain more than 1.3 ppm of copper.¹¹ Intentionally "high intakes" of copper can cause liver and kidney damage and even death. Copper is generally cleared from the body and is not known to cause cancer. There is no data indicating that copper can cause birth defects in humans.¹²

Naphthenic acid is a natural mixture of organic acids from petroleum refining. Studies indicate that naphthenic acid can probably cause irritation to the eyes and respiratory tract, and central nervous system depression at high concentrations. Contact with skin can cause slight to moderate irritation and possible severe dermatitis or irritation with prolonged or repeated contact.¹³

The acute oral toxicity of naphthenic acid is between 3 and 7 g/kg according to rodent studies. This correlates to a slightly toxic material. The dermal LD₅₀ for naphthenic acid is greater than 3.2 g/kg, which correlates to a moderately toxic material. Accumulation of naphthenic acid in the body is unlikely as it is probably excreted unchanged or broken down quickly in the body. Naphthenic acid does not have an established occupational airborne exposure limitation.¹⁴ Although toxic to fish, bacteria, and fungi, naphthenic acid is relatively non—toxic to birds and mammals.¹⁵

Copper naphthenate is not a restricted use pesticide. It is a general-use wood preservative. The EPA label for copper naphthenate products bears a “Warning” signal word, representing the moderately hazardous nature of the product.

Copper naphthenate is essentially insoluble in water and its leachability from wood is very low. Because it has a very low vapor pressure, evaporation from wood is inconsequential.¹⁶ There is practically no inhalation hazard from vapor. Any vapor inhalation hazard would be from the solvent carrier.¹⁷

The overall potential health effects of copper naphthenate to humans are extremely low. The oral toxicity or LD₅₀ (rats, lethal dose in 50% of the population tested) of an 8% copper naphthenate formulation according to laboratory testing is greater than 5 grams/kg. This means that it is slightly toxic if ingested. There are no occupational threshold limit values (airborne exposure limit) established for copper naphthenate. Exposure may cause minor inflammation to the skin and systemic toxicity resulting from absorption through the skin is unlikely. No fetotoxic or teratogenic potential has been indicated in animal studies.¹⁸

The diesel-like odor or musty smell of the naphthenic acid may be noticeable for a short period of time, although chemical concentrations in ambient settings should be negligible. Products formulated or repackaged from copper naphthenate must be labeled for “Exterior Use Only”.

Conclusion

Based on the information reviewed, it appears that copper naphthenate is one of the safer and more environmentally acceptable pesticide products in the marketplace today. No consequential short or long-term health effects are expected to occur from properly treated copper naphthenate wood in accordance with EPA labeled directions.

Thomas J. Leech, III, CHMM
Branch Manager
Memphis/North Mississippi Office

References

1. Grove, Scott L. Wood Technologist, Mooney Chemicals, Inc. *COPPER NAPH THENATE: An Alternative Wood Preservative*. Presented at the 41st Annual Meeting of the Forest Products Research Society. June 23, 1987.
2. Conversation with Wayne Keith. Ozark Timber Products. 5/27/98.
3. No. 1 Solvent, Material Safety Data Sheet. Lion Oil Company, El Dorado, AR. 12/17/97.
4. Emsweller, S.L., Lumsden, D.V., and Blew, J. O. *Tests Reveal that Copper Naphthenate and Celcure Prolong Life of Flats*. *The Florists Review* April 24, 1952.
5. Kalnins, M.A. and Erickson, E.H. *Extending the Life of Beehives With and Without Preservatives*. *American Bee Journal* 7, 1986: 488-91.
6. Maryland Small Ruminant Page, *Kopertox*. (at www.intercom.net/user/sschoen/footmed.html). 10/4/99.
7. Walters, C.S. *The Effects of Copper Naphthenate and Pentachlorophenol on Livestock*. Illinois Agricultural Experimental Station. *American Wood-Preservers' Association* 1952.
8. Agency for Toxic Substances and Disease Registry *Public Health Statement for Copper*. Internet site at atsdr.cdc.gov:8080/ToxProfiles/phs9008.html. 5/27/98.
9. Frederick Harper, Extension Horse Specialist, University of Tennessee, *The Great Balancing Act-Feeding Weanlings*. *The Horse Interactive* (at www.thehorse.com), 9/17/99.
10. Agency for Toxic Substances and Disease Registry
11. Agency for Toxic Substances and Disease Registry
12. Agency for Toxic Substances and Disease Registry
13. Canadian Centre for Occupational Health and Safety *CHEMINFO on Naphthenic Acid*, May 1998: Issue 98-2.
14. Canadian Centre for Occupational Health and Safety *CHEMINFO on Naphthenic Acid*, May 1998: Issue 98-2; and Exxon Biomedical Sciences, Inc., East Millstone, NJ, *Toxicity Statement: Naphthenic Acids*. 87MR 1239, 1987.
15. Brient, Jim, Naphthenic Acid Technology Manager, Merichem Company, Fax Transmittal with backup documentation, 9/28/99.
16. Grove, Scott L.
17. Canadian Centre for Occupational Health and Safety *CHEMINFO on Copper Naphthenate*, May 1998: Issue 98-2.
18. Canadian Centre for Occupational Health and Safety *CHEMINFO on Copper Naphthenate*, May 1998: Issue 98-2.

Background Information on Evaluator

Education: Associates Degree in Chemical Engineering Technology, State Technical Institute at Memphis; Bachelor of Technology, Concentration in Environmental Technology and Urban Systems, from Florida International University; and Master of Public Administration, Concentration in Health Care.

Certifications: Certified Hazardous Materials Manager, License No. 9398.

Work History: Over 20 years in the environmental, health and safety field, including government, private industry, and consulting. Over 10 years of experience working with wood treating chemical hazards as Principal Environmental Engineer and "product stewardship" consultant. Started up the Memphis, TN/North Mississippi Office of E. Roberts Alley & Associates, currently functioning as Branch Manager.

E. Roberts Alley & Associates, headquartered in Nashville, TN has been in the environmental engineering and consulting field for over 25 years.