THE POTENTIAL OF AMINE COPPER PRESERVATIVE SYSTEMS AS INDUSTRIAL PRESERVATIVES

By

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Summary – Several amine preservative systems have been developed and standardized and since 2002 one of the prime reasons has been to meet the market demands for alternatives previously dominated by CCA. The alternatives all centre on copper as their primary active ingredient but include inorganic or organic co-biocides instead of chromium or arsenic *(Freeman, McIntyre 2008).* These systems include alkaline copper quaternary (ACQ), copper azole (CA-B) and copper HDO (CX-A) and have registration in the USA and have been standardized in the American Wood-Preservers' Association (AWPA).

The focus of this paper is on ACQ and CA-B which are the only amine systems currently available and that have registration status with Health Canada's Pest Management Regulatory Agency (PMRA) as a heavy duty wood preservatives for use in the treatment of residential and non-industrial products only. Under current their current registrations, they cannot be used in the treatment of critical infrastructures such as bridges, pilings or other non-specified critical infrastructure applications either in Canada or as export products to other countries.

These same amine copper preservatives systems are available and are being used in Australia, Africa, New Zealand, Japan, United Kingdom, Europe and the United States of America as a heavy duty wood preservative in the treatment of lumber for residential as well as industrial uses. The purpose of this paper is to examine the opportunities or potential of amine copper preservatives as industrial preservatives in Canada.

Methodology – In developing this paper, it was important to know how and where amine copper preservative systems are being used and applied to lumber or timber.
To begin, Alkaline Copper Quat Type C (ACQ-C), Alkaline Copper Quat Type D (ACQ-D) and Copper Azole Type B (CA-B) are registered with Health Canada's PMRA, but in all cases these products have restricted uses under current regulations and are only allowed to for use as heavy duty wood preservatives in the treatment of non-industrial wood for above ground and ground contact in the following categories:

- Residential construction such decks, patios, fencing, play structures, siding, plywood, sill plate, and/or
- Recreational applications such as walkways, boardwalks, landscaping, docks, gazebos, and/or General Construction and commercial applications such as dimensional lumber, structural timbers, posts, decking, and/or
- Agriculture and Horticulture applications such as fencing, framing, building poles.

Furthermore, these preservative systems cannot under any circumstance be used in critical infrastructures such as bridges, pilings or other non-specified critical infrastructure applications.

A review of these same products in Australia, New Zealand, United Kingdom, Europe and our most important trading partner the United States of America reveals a different series of allowable use patterns.

In Australia, the Australian Pesticides & Veterinary Medicines Authority (APVMA), as well as New Zealand's Agricultural Compounds and Veterinary Medicines (ACVM) who for the most part follow the same regulatory processes rate these amine copper preservative systems by Hazard Class which allow, ACQ to be used under the following applications: Cladding, fascia, joinery, framing, decking, fence posts, retaining walls, posts, landscaping timbers, piling, house stumps, building poles and cooling tower fill.

Example: Fernz Timber Protection ACQ-D Label

Situation	**Softwoods**	**Hardwoods**	**Comments**
Hazard Level H1 (internal lyctus control		*0.17 % m/m*	Apply only using vacuum-pressure treatment in approved industrial facilities. For further information refer Australian Standard 1604-1997 "Timber – Preservative treated – Sawn & Round" or where applicable other local or state regulations
Hazard Level H2 (internal termite & borer control)		*0.35 % m/m*	
Hazard Level H3 (outside, above ground uses)	*0.35 % m/m*	*0.39 % m/m*	
Hazard Level H4 (outside, in-ground uses)	*0.89% m/m*	*0.98 % m/m*	
Hazard Level H5 (outside, in-ground contact or in fresh water. Critical structural end use.)	*1.41% m/m*	*1.69 % m/m*	

Similarly, Copper Azole is registered in Australia and New Zealand for the following applications: Exterior non-structural building components, cladding fascia, joinery, structural applications, decking, fence posts, landscaping timbers, house piles and poles, Line poles, crib walling or other engineered earth retaining structures.

The only noticeable difference between the two systems is that Copper azole can be used for H5 softwood only and ACQ can be used for H5 softwood and hardwood. Copper azole data for H5 hardwood is currently with APVMA and is anticipating Standardization in November 2010.

Example: Koppers Arch Wood Protection – Tanalith E

Situation	Pest	Minimum Retention Rates and Use Rates	Crictical Comments
Softwood timber poles, posts and sawn timber; plyboard, beams and other softwood timber components	Powder post beetles (Family Lyctidae), Furniture Beetles (Family Anobiidae) Termites including Drywood (Cryptotermes), Subterranean (Coptotermes & Schedorhinotermes) and Giant termites (Mastotermes). Protection from fungal decay	**H3** situations (outside above ground uses). 0.22% m/m elemental copper 0.0088% m/m tebuconazole (7.03 L/M³)	Apply only using vacuum pressure treatment in approved industrial facilities
		H4 situations (outside in ground uses). 0.40% m/m elemental copper 0.016% m/m tebuconazole (12.79 L/M³)	
		H5 situations (outside in ground with or in fresh water). 0.40% m/m elemental copper 0.016% m/m tebuconazole (12.79 L/M³)	
Hardwood timber poles, posts and sawn timber, plyboard, beams and other hardwood timber components		**H3** situations (outside above ground uses). 0.27% m/m elemental copper 0.011% m/m tebuconazole (16.10 L/M³)	
		H4 situations (outside in ground uses). 0.499% m/m elemental copper 0.020% m/m tebuconazole (29.74 L/M³)	
		H5 situations (outside in ground with or in fresh water). **Pending**	

Registration – Standards Process

To register a product with the APVMA takes 18-24 months for a new product, and approx. 6-12 months for a modification to a current product. This same process in New Zealand takes about 3-6 months for a new product.

Once a product is registered with the APVMA the next step is to apply for Standardization - AS1604 (though most do both APVMA and AS1604, etc. at the same time), and then request changes subsequent to the registration. The Standards process is similar in many ways to the process used in Canada and the USA where committees are made up of general interest groups, industry, academia, as well as consultants in the industry. It is the role of the committee to review the data as well as provide research data for the new product (test specimens – decay and termite) and approve the new preservative or a modification of use (i.e. hazard class or active level or hardwood/softwood use, etc.) The product and class use is approved by this committee. In summary, Australia and New Zealand allow ACQ and Copper Azole to be used in any hazard class, apart from Marine (H6).

In the UK and Europe, ACQ formulations as well as copper azole (Tanalith E) are approved for use as directed under the Control of Pesticides Regulations (COPR) by the UK Health and Safety Executive and the biocides contained in these products are supported under the Biocidal Products Directive. Allowable applications include:

Building: structural elements and general timbers in domestic, commercial and public buildings, such wall frames, sole plates, beams, joists, subfloors, roof timbers, external joinery, battens, cladding and roof shingles.

Garden & Landscaping: Decking systems, pergolas, gazebos, bridges, summer houses, soil retaining walls, timbers around fish ponds (but not in direct contact with the water), playground equipment, lawn edging, fencing, picnic benches and tables, way signs and litter bins.

Agricultural & Horticultural: Earth retaining vegetable beds, fruit tree stakes, hop poles, vine stakes.

Enclosures, Fencing: Natural round, machine turned and square sawn fence posts, rails, droppers, gates and gate posts, stiles and highway, farm and security fencing.

Transport: Floors and other timbers for railway and road vehicles, container floors and linings, packing cases, cable drums and hatch covers**:** (Australian Quarantine Regulations).

Engineering: Transmission poles, railway sleepers, decking, shells, gantries, bridges and bridge decks, handrails, cable ducting and sound barriers.

The application of these products is further defined in use classes are defined in BS EN 335-1 but can be summarized as follows:
Use Class 1 – internal building timbers – no risk of wetting
Use Class 2 – internal building timbers – risk of wetting
Use Class 3.1 – external timbers used above ground contact and coated
Use Class 3.2 – external timbers used above ground and uncoated
Use Class 4 – external timbers used in ground or fresh water contact.

In the USA, the Environmental Protection Agency (EPA) regulates these products and while each product varies slightly, essentially the allowable uses are consistent.

Allowable applications for ACQ, include: lumber, timbers, landscape ties, fence posts, building and utility poles, land, freshwater and marine pilings, sea walls, decking, wood shingles, and other wood structures. A review of AWPA Standards shows that ACQ has been Standardized for use in Use Categories UC1, Above Ground, interior construction, dry; UC2, Above Ground, interior construction, damp; UC3A, Above Ground, exterior, coated and rapid water run-off; UC3B, Above Ground, exterior, exposed or poor water run-off; UC4A,B &C, Ground Contact or Fresh Water and there are a number of critical use applications included in these particular Use Categories. Some of the allowable products include: Lumber and plywood for Permanent Wood Foundations, Lumber, Timbers for Bridges, Structural Members, Decking, Cribbing, Culverts, Lumber and Timbers used in Cooling Towers, Round Timber piling, Wood Composites, Sawn

Crossarms for critical uses, Shakes and Shingles, Wood for Highway Construction, Wood Used on Farms, Brine Storage Buildings, Round poles and posts used in building construction, Utility Poles, Round Timber Piling, Plywood, Glue-laminated members (laminations treated prior to gluing), Parallel Strand-lumber,

Similarly, Copper Azole is registered for treatment of millwork, shingles & shakes, siding, plywood, structural lumber, fences posts, building and utility poles, land and freshwater piling, composites, and other wood products that are used in above-ground, ground contact and fresh water as well as in salt water splash (marine) decking applications. A review of AWPA Standards shows that ACQ has been Standardized for use in Use Categories UC1, Above Ground, interior construction, dry; UC2, Above Ground, interior construction, damp; UC3A, Above Ground, exterior, coated and rapid water run-off; UC3B, Above Ground, exterior, exposed or poor water run-off; UC4A,B &C, Ground Contact or Fresh Water and there are a number of critical use applications included in these particular Use Categories. Some of the allowable products include: Lumber and plywood for Permanent Wood Foundations, Lumber, Timbers for Bridges, Structural Members, Decking, Cribbing, Culverts, Lumber and Timbers used in Cooling Towers, Round Timber piling, Wood Composites, Sawn Crossarms for critical uses, Shakes and Shingles, Wood for Highway Construction, Wood Used on Farms, Brine Storage Buildings, Round poles and posts used in building construction, Utility Poles, Round Timber Piling, Plywood, Glue-laminated members (laminations treated prior to gluing), Parallel Strand-lumber,

Registration – Standards Process

To register a product with the United States Environmental Protection Agency (EPA) takes up to 18 months for a new product, and approx. 3-6 months for a modification to a current product. The primary Standards-writing body for wood preservation in the United States in the American Wood-Preservers' Association that is made up of individuals with various areas of interest including consumers, users, government, academia, specifiers and producers who meet on a regular basis to develop and maintain these Standards for preservatives, treatment, testing methods, quality control and inspection of treated wood products. AWPA relies on the expertise of and information voluntarily developed by technically qualified members. AWPA Standards help ensure that treated wood products perform satisfactorily for their intended uses.

Why are these products not used in Canada for industrial applications? This is a question that is asked frequently and some of the factors may be:

Differences between CCA Alternatives?

From an end-use basis, there is little difference between CCA and alternatives ACQ or CA-B.
The appearance, strength properties, and handling characteristics are very similar to those of CCA. The alternatives are slightly more expensive, however, with the treated wood costing from 10% to 30% more than CCA-treated wood. The alternatives also tend to be somewhat more corrosive to metal fasteners than is CCA. Hot-dipped galvanized or stainless steel fasteners should be used when building with wood treated with CCA alternatives. (Lebow 2004).

Environmental concerns with CCA alternatives

Environmental and health concerns have been raised over the use of CCA-treated wood. It is likely that CCA alternatives will circumvent some of these concerns simply because they do not

contain arsenic. Because they have been developed relatively recently and/or have been used infrequently, only limited research has been conducted on their potential leaching and environmental impact. Much available data have been obtained using small samples that accelerate leaching and allow more rapid comparisons between preservative formulations. Although useful as a comparative tool, leaching rates derived from small samples should not be directly extrapolated to commodity size material. (Lebow 2004)

Efficacy Concerns

"As alternatives to CCA, ACZA, creosote or PCP wood preservatives, there are other chemical wood preservatives registered in Canada. These include alkaline copper quaternary (ACQ), copper azole (CA-B) zinc naphthenate, copper naphthenate and copper-8-quinolinoate. However, many of these preservatives are not suitable for uses for which CCA and other heavy duty preservatives are registered. Certain of these preservatives either are not effective enough for long-term protection or critical infrastructures, such as bridges and utility poles, or do not have performance data of sufficiently long period with Canadian species, under Canadian conditions, to support these uses." *(PVRD2010-03 PMRA publication, Proposed Re-evaluation Decision, Heavy Duty Wood Preservatives: Creosote, Pentachlorophenol, Chromated Copper Arsenate (CCA) and Ammoniacal Copper Zinc Arsenate (ACZA).*

Future

The Canadian treated wood industry has undergone a major transition since 2002 and both ACQ and CA-B have played major roles as replacements for CCA in residential applications. Unfortunately, the same cannot be said with respect to the industrial market products for domestic use or as export products and the industry needs to find a way to expand these opportunities or be faced with the use of non-wood alternatives for a number of critical infrastructures which will preclude the use of wood preservatives. For example concrete and steel are alternative materials for utility poles and despite the environmental and economic considerations regarding the use of these materials over that of treated wood they are being specified because of perceived environmental concerns with having to use CCA rather than ACQ or CA-B.

Conclusion

The wood preservation industry in Canada needs to find a way to continue to work collaboratively with PMRA to develop a model that will allow for improved timelines in the registration process and put more reliance on our standards writing body to qualify the various preservative systems in terms of performance data. Members of the Canadian Standards Association's Wood Preservation Committee have some of the best knowledge and qualifications in the world in terms a suitability and performance of wood preservatives.