Wood Preservation in the US Millwork Industry

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Good Morning Everyone! I am very proud to be invited to address this fine group of wood treating professionals – additionally; this is my first "international" speaking engagement. I very much enjoy visiting our neighbors in Canada –, as your cities are models of grace, integrity, and good planning. The AWPA had a productive and enjoyable meeting in Victoria, British Columbia in September. What a wonderful place that is to visit!

Well, I'm here today to talk about windows and doors – the U.S. millwork industry. And what an interesting industry it is. The company I work for – Andersen Windows was incorporated as a lumber company in Hudson Wisconsin in 1903.

Hans Andersen, the founder started standardizing the window industry in 1905 by producing standard size window frames that could be bundled individually and shipped to a job site. At that time the sash were all custom built on the job. About 1915, the company was moved across the St Croix River on the ice, and relocated in Bayport, Minnesota where the main plant is still located today.

Hans Andersen and his two sons Fred and Herb worked hard building a distribution system for the frame business. The books from back then indicated that they could produce those window frames for about $.50 each. The business grew rapidly and by 1908 annual frame production reached about 82,000 units. In contrast, today the Andersen Bayport facility can produce 82,000 windows and doors in a little more than 2 days. Hans Andersen could never have conceived of the size of the current U.S. window market.

Let's take a look at some market information as shown in **Figure 1** – U.S. demand for windows. Total U.S. Dollar demand for windows is expected to increase 3.4 percent per year – yet demand for wood windows is expected to increase only 1.9 percent per year. What is happening to our share of the market? It seems that the traditional wood window market that has been so consistent for so many years is being eroded by other types of windows. What's the problem? Is it the deterioration of wood windows that has reduced the demand?

Actually, we find that the majority of the market has shifted its demand to lower cost window units that have some degree of energy efficiency – that has translated into hollow vinyl windows. Consumers will continue to use wood windows particularly in high-end applications based on their superior appearance and premium appeal. It behooves us in the wood or clad wood window business to do our very best at designing and producing very durable, energy efficient windows to serve the global market. That, of course, must include effective wood preservation.

So, when did millwork wood preservation actually get started? As I indicated before, the U.S. millwork industry got started in the upper middle region of the country where there was a supply of native Eastern White Pine (Pinus strobus), and along rivers that could be used for log transportation.

This happened in the early 1900's. By the late 1920's the pine supply was already being decimated by cutting and white pine blister rust. White pine blister rust was brought in from Europe around the turn of the century. White pine was somewhat naturally resistant to decay, so it made an excellent millwork substrate, but the dwindling supply forced the millwork people to look for another source of lumber. That source turned out to be Ponderosa pine from the Pacific Northwest. With this change, also came the concept of treating the material with chemicals for decay resistance.

So, in the 1930's, the leading millwork companies started immersion treatment of their components for decay resistance and water repellency. It's not clear what the initial preservatives were. I've heard beta napthol might have been the chemical of choice. But the history is quite clear about the old standby that was developed and implemented in about 1938.

Pentachlorophenol (**Figure 2**) is the chemical that has served the preservation industry so very well. Typical formulations of penta millwork solutions of the 1940 - 1970'S looked like that shown in **Figure 3.**

These simple, slow drying formulations served the industry well until about the 1970's. At that time, the demand for windows and doors generated growing pains in the industry, and for the first time, reformulation had to be considered to reduce the drying time and increase manufacturing output.

Concurrent to this change, the market was also demanding more primed and finished windows and doors, so "cleaner", lower solids formulations that were compatible with coatings systems were necessary. An example of a faster drying formulation that was developed and used in conjunction with finishing systems is shown in **Figure 4**.

In the U.S., pentachlorophenol was still being used after 40 years because of its incredible track record of performance. The industry was very hesitant about moving away from penta.

Well, sometime around 1985, the situation for penta began to change. Penta came under pressure from the U.S. Environmental Protection Agency for health and hazardous waste concerns. My company, Andersen, took an early lead lead to change away from penta containing formulations in 1986. Working with our supplier, we reviewed the field exposure data from two non-penta formulations from the 1980's that had the following make-up, shown in **Figure 5.**

We (Andersen) decided to make the move to IPBC as our preservative chemistry, and apparently we made the right decision because it is the dominant preservative in the U.S.

millwork industry today. We made the change to IPBC solutions in 1986 with no problems. No odor issues, no industrial hygiene issues and no hazardous waste issues since IPBC is classified as a non- hazardous material – another real benefit.

IPBC is a very effective against stain and decay organisms, but has no insecticidal activity. As the millwork market became more global, it became obvious that we needed to provide protection from insects – mainly termites (**Figure 6**). For that reason, many millwork producers fortify their formulations with a small addition of chlorpyrifos – a safe and effective insecticide. Chloropyrifos is the active ingredient in DURSBAN, which is a widely used household and agricultural insecticide.

The late 1980's also brought other changes to our industry. The environmental age was well under way, and pollution prevention directives were forcing change away from toxic and hazardous materials in manufacturing. Again, companies like mine wanted to lead the way. In 1988, we worked closely with our suppliers on the development of an effective waterbased water repellent preservative formulation. Utilizing the technology of microemulsions, we succeeded. Of course, implementing these new formulations in production was no picnic; we had to change everything. We could no longer dip batch loads of pine parts in a vat for 3 minutes. We had to invest in new treating equipment that was incorporated into the milling workcenters, so that the parts are treated individually in-line, and are immersed for just enough time to allow an adequate amount of preservative to penetrate into the outer 9 mm of the end grain. After the treating process, the parts are forced air dried to minimize the swelling and grain raising effect. Notice, I said minimize – we have not been able to incorporate waterbase treating on any finished or highly visible parts that have to be finished after installation. The grain raising hasn't allowed that.

The waterbased preservation process has been the biggest technological change that we have had to absorb in the past several years. The benefits of this difficult change are reduced fire hazards, lower air emissions, and much lower employee exposure to hazardous chemicals in the workplace.

So to recap, lets review the important changes in millwork preservation in recent history: (**Figure 7**). Since the 1980's. Along with the new formulation technologies, it was imperative to change away from the 3 minute batch immersion process to new methods of treatment (**Figure 8**). Even in today's products that often are clad with durable polymeric materials, it is most important to effectively preserve the wood materials in windows and doors.

Now lets turn our attention to the history of the Association that has served the window and door industry in the United States (**Figure 9**). The roots of the window and door association started back in the 1920's. Back then, the millwork manufacturers would get together to exchange information in group meetings that were called "clubs".

There was a frame club and a hardwood door club, and others. In 1927 the newly formed National Door Manufacturers Association held an annual meeting and functioning committees were started (**Figure 10**). The Association's most important functions began in 1930 when

industry standards were initiated. Standards have been developed and maintained through the years for all operational and performance aspects of wood windows and doors, including their effective preservative treatment.

The preservative treating standard for the millwork industry is the NWWDA IS-4. With all of the technology and treating methods changes that have been happening in the past decade, it became obvious that the industry standard had to be changed to keep up with technology. Historically, the IS-4 standard has been a process oriented, proscriptive standard, dictating immersion times and required concentrations of preservatives. The dictates of this standard became hard to live with for flexible and creative manufacturers. Fortunately, an opportunity arose when the other wood preserving association in North America, the AWPA, started recognized the importance of the non-pressure sector of the American wood preservation industry and formed the N committees for various industry groups (**Figure 11).** This newly formed section of the AWPA gave us the opportunity to develop a totally new non-pressure treating standard for millwork. In 1996, the first standard published by the N- Committees was the N-1 standard for the non-pressure treatment of millwork.

The new N-1 standard is results oriented rather that proscriptive as to how you treat the material. The new standard says, in effect: treat the material in any way that you wish, but the concentration of preservative at a specified depth must effectively inhibit decay. The industry group feels that we have developed a good contemporary standard that will carry us into the future of new methods and chemistry. Currently, the NWWDA treatings and coatings subcommittee is "harmonizing" the IS-4 standard to be compatible with the AWPA N-1 standard. With harmonized standards, we feel that the AWPA and the NWWDA will allow the U.S. millwork industry the flexibility to produce high quality, long lasting wood based products that the demanding global market is seeking.

As a final point of information, I want to show you some of the other chemistries being considered as millwork preservatives (**Figure 12).**

Thank you again for this opportunity to present this information.

US Window and Door Market Information Demand

Material	*1995*	*1996*	*1997*
Clad	12.2	14.0	11.9
Wood	6.3	3.7	4.4
Vinyl	16.3	20.9	22.7
Aluminum	18.3	18.8	16.7
Total (Units in Millions)	53.1	57.4	55.8

Figure 1

Pentachlorophenol

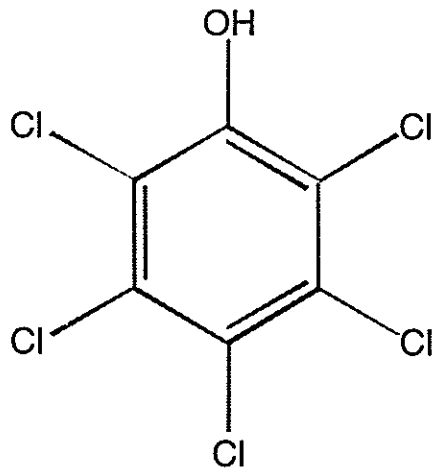

Figure 2

Typical Millwork Water Repellent Preservative Formula From the 1940's to the 1970's

Pentachlorophenol- - - - - - - - - - - 5%

Resins, waxes, oils- - - - - - 2% - 5%

Fuel oil or mineral spirits - - - - 90%

Figure 3

Cleaner Faster Drying Formulations From the 1970's

Pentachlorophenol - - - - - - - - - - 2%

Tributyltin - - - - - - - - - - - - - - - - 0.3%

Resins, waxes, oils - - - - - - 3% - 4%

Naphtha solvent - - - - - - 94% - 95%

Figure 4

Non-penta Wood Treating Formulae - 1980's

Bis-Tributyltin Oxide - - - - - - - - - - 0.75%
Resins, Waxes, Drying Oils- - - - - -4% - 5%
Solvent Carrier - - - - - - - - - - - - - - - 95%

Iodo-2 Propanyl Butyl Carbamate - - 0. 5%
Resins, Waxes, Drying Oils- - - - - 4% - 5%
Solvent Carrier- - - - - - - - - - - - - - - -95%

Figure 5

Insecticide - Termite Additive

0.1% chloropyrifos

O,o-diethyl O - (3,5,6 - trichloro - 2 pyridyl) phosphorothioate

Dursban

Figure 6

New Technologies in Preservative Formulations Since the Mid-80's

- Development of Waterbased Versions of IPBC Formulations
- Addition of Insecticidal Ingredients - (Chlorpyrifos 0.1%)

Figure 7

Modern Methods of Treating Millwork

- Conveyorized vertical floodcoater (15 second immersion)
- Horizontal in-line treater (15 second immersion)
- In-line vacuum coaters (?? seconds)

Figure 8

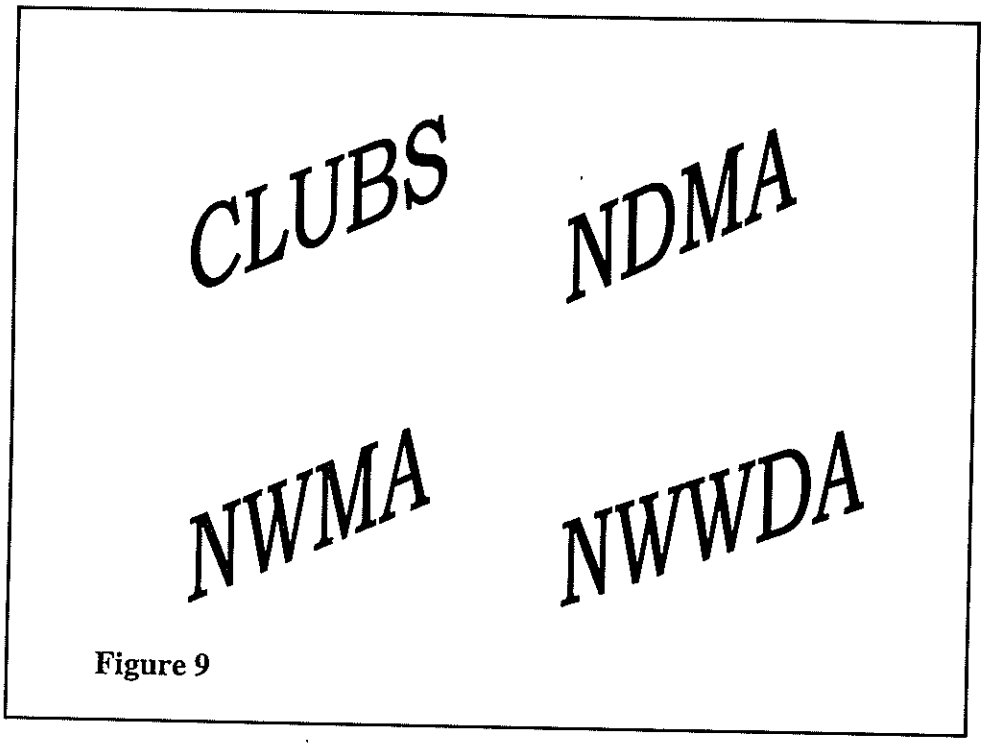

Figure 9

History of the Association

- The Association become incorporated under Illinois State law in 1933.
- Preservative treating standards were established in 1938.
- The name was changed to National Woodwork Manufacturers Association in 1949.
- The name was changed to National Wood Window and Door Association in 1985.

Figure 10

AWPA Non-pressure Committee Organization

N - 1 Non-Pressure Coordination Committee

N - 2 Non-Pressure Preservatives Subcommittee

N - 3 Millwork and Manufactured Wood Products Subcommittee

N - 4 Unseasoned Lumber, Logs & Timbers Subcommittee

N - 5 Composite Wood Products Subcommittee

N - 6 Finishes and Coatings Subcommittee

N - 7 Remedial Treatments Subcommittee

Figure 11

Other Active Ingredients Being Used

- Propiconazole
- Tebuconazole
- TCMTB - 2 - (thioyanomethylthio) Benzothiazole
- Copper - 8 - Quinolinolate

Figure 12