International Wood Treatment Trends and Issues

Alan Preston
Apterus Consulting

What’s changed and how will this impact the industry?
Topics discussed

- Industry characteristics
- Government funding and research changes
- Changes in scientific community
- Changes in biocide availability
- Wood substrate opportunities

Industry characteristics

- Industrial products
  - Poles (utilities and construction)
  - Piles (utilities and construction)
  - Sleepers, ties, etc
- Construction products
  - Framing
  - Deck structures and decking
  - Joinery (millwork)
  - Fences (posts and boards)
  - Garden furniture or structures
Industry Characteristics

- Basic chemical supplier/manufacturer
- Preservative formulator/supplier
- Wood treater
- Retailer
- Consumer

• Highly competitive in all sectors (chemicals, treating, and retail)
• Generally low margin in commodity construction-related businesses
• Moderate margins with industrial products
• Higher margins in specialty products
• Costs of failure in treatment disproportionately high relative to profits throughout value chain
When things go wrong in protecting wood products they really go wrong

- AAC treatment NZ $12 M
- OSB siding – untreated US $500 M
- Leaky buildings – untreated NZ $12+ B

High risk – low reward industry

- “A high risk with a low reward project is a foolish enterprise” – Futura LLC
- That’s where the wood preservation industry is today, or is headed that way
- Low returns on our products
- Decreasing retentions coupled with decreasing performance characteristics
- Declining quality assurance programs
Fundamental flaw in PTW

A key factor globally driving the viability of the wood preservation industry model

- Most industries sell **materials** as entities with an overall emphasis on the product performance
- The PTW industry sells “treated wood”, with an implied baseline price for the timber and then an adder for the cost of treatment
- Until a marketable “materials” approach is taken, our industry will fail to achieve financial stability, let alone future growing viability

WP Scientist community - 1981

Scientists employed in wood protection research*

- Australia ~ 20
- New Zealand ~ 6
- United Kingdom ~ 15
- Sweden ~ 10

*Number of wood preservation scientists employed in universities, or government or quasi-governmental institutions
WP Scientist community - 2012

Scientists employed in wood protection research*

- Australia ~ 2
- New Zealand ~ 2
- United Kingdom ~ 5
- Sweden ~ 10

*Number of wood preservation scientists employed in universities, or government or quasi-governmental institutions

Fungicides available for WP - 1980

- Around 40
Fungicides available for WP - 2012

- Around 10

Regions with significant governmental funding for WP - 1980

- New Zealand
- Australia
- Scandinavia
- Europe
- South Africa
- Canada
- United States
Regions with significant governmental funding for WP - 2012

- Europe (including Scandinavia)
- China

European R&D focus

- Wood modification without biocides
- Thermal modification of wood
Why does any of this matter, and should we care?
Current industry research

- Much of the development on-going in WP chemical suppliers is targeted at providing treatments at lower cost than existing, with dubious potential impact on performance
- The rise of the “consultant class” rather than employed scientist class (in both not for profit and industry) is distorting performance issues further
Profitability – does it matter?

• Yes, of course, from both short term and long term industry viability perspectives
• If there is not suitable profitability throughout the value chain then reinvestment in the future declines
• We’re all in this together, and ultimately the profitability of the industry is driven by providing the consumer with the products that satisfies their various product attribute needs
• In the appearance sector, we fail, and, we should not allow that to spread to the structural sector

Preservative retentions

• Changes first seen in Europe in the early 1990s
• Move from field-based retention setting, to EN113 lab test and EN599 basis led to rapid decline in approved retention levels
• Move mirrored in the US in the last decade with the ICC-ES system providing an alternative to the AWPA Standards
As Robin Wakeling has said based on his extensive field testing PhD research:

“Even against copper-tolerant fungi, the most effective biocide is copper itself through the use of increasing Cu retention”

In other words, the secondary biocide helps but does not carry the load – lowering preservative retentions will have direct consequences on performance.
Test methodology

- Not just an abstract thing relevant only to scientists
- For ground contact applications putting wood samples in the ground is the best way to test
- For above ground applications the situation is much more complex
- The afore-mentioned AAC failure in NZ was due entirely to the lack of understanding of the value of field tests at that time for above ground situations

Test methodology

- Now there are a range of different methods that each teach different things
- The judicious use of these various methods coupled with the use of accelerated test site locations based on Climate Indices provides industry with expeditious solutions
- Different methods teach likelihood of outcomes for different products, including worst case scenarios
So what about the future?

- New insecticides will become available
- Nicitinoids will come under increasing attack because of bee colony collapse, real or not
- New fungicides will be few and far between
- New fungicides will have even narrower spectra of activity, counter to the needs of wood preservation
- Copper will remain the backbone of ground contact
- Above ground will be more complicated

So what about the future?

- Decreasing retentions and uneven treatments of softwood sapwood will lead to increasing product failures
- More targeted treatments will lead to better product performance in some characteristics but will be more subject to treatment failures
- These treatment issues will cause more product performance failures
Where are the opportunities?

There is room for all to benefit

<table>
<thead>
<tr>
<th>Product</th>
<th>Price $/lineal foot (300mm)(USD)</th>
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</thead>
<tbody>
<tr>
<td>Redwood (Con Heart) (2x6)</td>
<td>1.50</td>
</tr>
<tr>
<td>Hardwood (1x6)</td>
<td>2.19</td>
</tr>
<tr>
<td>Trex (Accents) (5/4 x 6)</td>
<td>2.49</td>
</tr>
<tr>
<td>Trex (Transcend) (5/4 x 6)</td>
<td>2.89</td>
</tr>
<tr>
<td>Trex (Transcend Tropics) (5/4 x 6)</td>
<td>3.29</td>
</tr>
<tr>
<td>Dreamdex (5/4 x 6) (MF modified radiata)</td>
<td>3.69</td>
</tr>
<tr>
<td>Treated lumber (2 x 6)</td>
<td>0.95</td>
</tr>
</tbody>
</table>
What is good enough?

- Depends on the commodity
- For Posts and other structural components, assured long term performance is probably “good enough”
- But, we have to be sure of the “assured long term performance” and how that is determined going forward
- For appearance products, consumers clearly see a different world now that WPC presents a view of superiority to PTW
- In that sector we have work to do and opportunities
Comments by treater/WPC manufacturer

- “My challenge is to make WPC look like wood, your challenge is to make treated wood behave like WPC during weathering in service”

How can industry help?

- By ensuring that governmental and not-for-profit funding is focused on a balanced approach to realistic goals and programs, including both short, medium and long term programs
- By encouraging the view that natural wood has, in lignin, an incredibly well-developed adhesive over the past billion years, and that we can overcome some of the drawbacks with intelligent development
Preservative Hierarchy

Options to achieve this

- Naturally durable and stable wood species = diminishing resource, 2nd growth has different properties
- Preservatives: little positive impact on wood appearance in service
- Water repellent treatments: can provide major improvements but formulations are preservative dependent and not true dimensional stabilization
- Thermal treatment: helps in some regard, negative in other factors
- Wood modification leading to dimensional stabilization: yes but technology needs to be robust commercially
Wood siding: an example

- Have been involved in developing and testing new treatments of radiata pine wood siding for ~7 years
- Used an adaptation of DeCosta’s (1969) above ground method with exposure in Hilo, HI
- Performance varies widely
- Borate treatment at failure after 7 years
- LOSP at 50% soundness after 7 years
- Appropriate water borne water protected organic systems still 99%+
Moral of the story

• Methodologies matter
• Test site locations matter
• Biocide type matters
• Moisture content of product in service matters
• In other words, wood preservation development is a multi-disciplinary subject that requires thought, teamwork and considerable effort!

Radiata pine treatment oddity

• Pinus radiata is known to be an extremely treatable species
• However, treatment flow is almost entirely in the radial direction (McQuire 1970)
• Tangential penetration is unusually low
• Does this impact performance during exposure, and can grain orientation be used to advantage?
Wood modification
industry structure issues

Current Industry Structure
Basic chemical supplier/manufacturer
  ↓
Preservative formulator/supplier
  ↓
Wood treater
  ↓
Retailer
  ↓
Consumer
Some wood modification structures

Basic chemical supplier/manufacturer

Retailer

Consumer

Wood species density and cost

In wood modification, very high % product usage means that wood species density has a major impact on final material cost

- radiata pine density 400-450 kg/m³
- SYP & Scots pine density 500-550 kg/m³

Around 20% more chemical needed for SYP & Scots pine than for radiata pine, clearly a significant on-going opportunity
Wood resource issues

• For appearance products consumers prefer no knots – i.e. clear wood or finger-jointed
• Radiata pine clear wood (pruned trees) a preferred substrate
• Where is all the radiata pine going to come from, especially the clear material?

Softwood alternatives

<table>
<thead>
<tr>
<th>Location</th>
<th>Species</th>
<th>MAI</th>
<th>Rot.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costa Rica</td>
<td>P. caribaea</td>
<td>572</td>
<td>8</td>
</tr>
<tr>
<td>Brazil</td>
<td>P. caribaea</td>
<td>386</td>
<td>16</td>
</tr>
<tr>
<td>South Africa</td>
<td>P. taeda</td>
<td>523</td>
<td>22</td>
</tr>
<tr>
<td>Brazil</td>
<td>P. taeda</td>
<td>442</td>
<td>8</td>
</tr>
</tbody>
</table>

But knowledge of and the practice of pruning and utilization of clear wood from these pines remains poorly developed.
Chemical modification

- Have studied several options
- Performance generally meets expectations at the required wt/wt add-on
- Add-on requirements vary between modification chemicals – as expected
- Treatments can provide excellent wood product stability in exposures – i.e. true wood stabilization
- Can impart significant surface UV protection

Chemical modification criteria
(as I see it)

- the most appropriate technologies will be water-based
- the technologies should be compatible with current treatment plants for large scale commercial success
- the cost of modified treated wood should be competitive with WPC and naturally durable wood such as redwood
Marine applications

• Initially the marine wood piling was based on naturally durable species such as Syncarpia (turpentine wood)
• Such materials are of diminished availability
• Creosote successful in cooler waters
• CCA widely used
• Copper amine systems have too high Cu losses

Marine applications

• While initial costs are high, wood modification has significant potential for treatment of wood for marine applications
• Chemical loss into the environment likely to be very low, i.e. good eco-tox properties
• Limited historic data shows excellent performance in marine tests
Genetic modification for durability

- Wood modification has taken 70 years to achieve modest moves to commercialization
- Genetic modification of trees to impart durability is in infancy, if at all
- Imparting durability to sapwood as well as heartwood in plantation species is an interesting challenge
- NZ and Australia should find the political and financial vision to fund and carry out the research needed as part of forestry science development

Things I have left out

- CCA
- PCP
- LOSP
Conclusions

• These are not great days in world view of commodity timber (lumber) treatment
• Margins are low, and competitiveness is high
• Cooperation is scraping the bottom
• Scientific involvement in WP has declined with retirements and a lack of will for multi-disciplinary approaches moving forward
• The movement from CCA in lumber treatments in some countries has led to a declining in treating quality

Conclusions

• However, opportunities abound
• But it will take industry will to develop products that meet the needs of the final users and provide a return to profitability throughout the value chain
• To do otherwise will see the industry shrink into low value commodity irrelevance
• Marketing of materials rather than selling PTW
• Radiata pine has much potential in the future of wood treatment & modification throughout the world, it’s time to think about how to best maximize this locally for export potentials with appropriate treatments