TREATMENT INNOVATIONS
TIMTECH CHEMICALS
CRC WOOD INNOVATIONS

INNOVATION

• Oxford Australian Dictionary:
  – “Bring in new methods-ideas”
  – “Make changes”

BUT--- there needs to be a reason
Why Innovate?

- Quality
- Safety
- Economy
- Legislation
- Speed
- Convenience
- Profit

What has been innovative in timber preservation over the past 50 years?
- Steaming leading to APM OPM
- LOSP
- Boron, alternative processes
- Low uptake processes
- Plant automation
- Untreated framing
- Treated framing

CCA

SCIENCES

VERSUS

EMOTION
STANDARDS

• Historically some overkill for end purpose

• Conversely some undertreatment
  – NZ - Leaky buildings
  – Australia – termites
  – Treated failures

• Must be maintained

RETENTION & PENETRATION

• Retention
  – Some forgiveness

• Penetration
  – No penetration, no protection
WHERE TO NOW?

• INNOVATION
  – *Must be driven by economics*
  – *Not scientists (with due respect)*
  – *To create PROFIT!!*

CRC for Wood Innovation

• Based at University of Melbourne
• Five research providers
• FWPRDC
• Two industry organisations
• Four industry partners
MICROWAVE TECHNOLOGY

- Wood Drying
- Pre-conditioning for treatment
- Creating “novel” material
- Wood bending
COSTS OF MICROWAVING

- Capital: $0.5-2.0 million
- Power use 70-170 kWhrs/m3
- At 12 cents per kWhr =
  - Less than $10 per m3 to
  - A little over $20 per m3
ACAWP

- Dedicated research facility
- Owned by CRC
- Microwave generators and applicators
- Treatment plants

MICROWAVE PROCESSING
PRIOR TO TREATMENT

- Enables full penetration
  – *Radiata corewood*
  – *Roundwood*
  – *Hardwoods*
  – “Untreatable” species, d. fir
TREATMENT VARIABLES

- Pre-treatment
- Plant
- Process
- Preservative
PLANT

- Striving for “in-line” treatment
- Spray or dip
- Vacuum/pressure
- Smaller
- Faster
PROCESS

- Speed
- Minimal uptake
- Controlled uptake
- Adaptable
- Achieve the standard
CCA FIXATION

- CCA treat hot wood
- Dry to touch after treatment
- Roundwood or sawn
- No sludge
- “Fixed” within few hours of treatment

PRESERVATIVE

- Existing formulations
- Solvent or water based
- New actives
- Physical protection
**IMPEDEMENTS TO INNOVATION**

- Registration through ERMA/APVMA
- Health and safety issues
- Efficacy testing
- Increasing costs of oil chemicals
- Costs of metals
INNOVATION IN WOOD PRESERVATION

INTRODUCTION

“innovate -bring in new methods, ideas
-make changes”

Oxford Australian Dictionary

Note that there is no mention of progress or improvement, so one can be innovative but go backwards.
The trick is to be innovative and make progress!

There are a number of reasons to be innovative, amongst them the more obvious for a member of the timber preservation industry, are:

Quality       Safety       Economy       Legislation
Ease of operation       Speed

And dare I say it?       Profit

Historically, the timber preservation industry have hardly been leading lights in the innovation stakes.

Let us take a quick look at what has actually changed over the last fifty years in our industry.

- Steaming wood to pre-condition it for treatment
- With it, the APM and OPM and subsequently the Q process
- Introduction of LOSP preservatives and their processes
- Change to CCA from “B type” to “C type”
- Change from Boron diffusion to other methods of Boron use
- Reduction in uptakes of LOSP preservatives from 70 down to 30 litres per cubic metre
- The “Dry” and other lower uptake water-borne processes
- Increasing amount of treatment plant automation
- NZ acceptance of untreated framing
- NZ reintroduction of requirement for framing to be treated
- Australian banning of chemical ground treatments under houses
- Moves towards acceptance of envelope type treatments

It's not really an impressive list of achievements, most of them being alterations and changes made to previously used methods.
We still use CCA in plants which are basically the same as they were in the 1950s. Sure there are some alternative chemicals used now, and the position is changing, but the majority of treatment is still good old CCA. Generally the plants are tidier than they used to be and environmental controls and health and safety issues are much better controlled, but I seriously question whether we are actually treating to a better standard than back then.

Now I’m not going to go near the argument as to whether CCA should be continued, phased out, banned or whatever. It’s an argument which can not be won by offering science, as it’s driven purely by emotions and politics. All I will say is that we have to try to be one step ahead of the knockers and the politicians and come up with innovative answers to ensure the survival of the preservation industry.
TREATMENT STANDARDS

There can be little argument to the suggestion that in days gone by, a lot of wood was over-treated for its intended purpose. However, there is also plenty of evidence to suggest that a lot has been undertreated for its intended use. The leaky building syndrome in New Zealand and the termite destruction of untreated framing in Australia are two vivid examples.

With such a variable and imprecise substance as wood, and with such a wide range of conditions in which that wood is expected to perform, there are always going to be the odd examples of pieces that for one reason or another have failed in service, even though they appear to have been adequately treated for the hazard they are exposed to.

Ignoring these examples and ignoring the use of untreated wood in potentially hazardous situations, the consideration I want to address is that of how we can innovate without compromising the standards the public expects.

I was brought up in the old school where the minimum standard for any treatment was full sapwood penetration. That way, even if through the law of distribution, there were some areas which had lower than average loadings of chemical, at least they had some protection.

Not wishing to pick an argument, I implore the industry to take extreme caution when “innovating” by using systems which can not provide full sapwood penetration. I fully understand that new dip and spray systems are tested extensively, but please let us not put the industry in the position of having to fight for credibility after yet another “treated timber fails” disaster.
WHERE TO NOW?

There are a number of issues relating to timber preservation which confront the industry now which have to be addressed if timber is to hold or even, hopefully expand its position in the market. The main one is that of economics. In order to survive, we have to do things smarter. We need to save on costs, increase productivity, all the same old criteria. How can we change the way timber preservation fits into the general process, in order to make it more economic? How can we add more cost benefit to the end product?

The obvious answer is to do it in-line, and clearly the spray and dip systems referred to earlier are ways of achieving this. Are there other ways we can make the end product more economic to produce?

The move to LOSP treatment was driven by overall economics rather than simply by considering the cost of treatment. LOSP treating is far more expensive than say CCA treating, but the market demand for dry finished product, meant that the additional cost was offset by the absence of a redrying process. So we have to be looking at what other properties we can give to the finished product and at what overall cost do those benefits come? For example, can we add colour, hardness, fire-retardancy and other beneficial properties at a relatively small incremental cost to give added value to the whole process?

In order to get more specific in this discussion, I now need to concentrate on what TimTech is doing in the development and "innovation" arena. I do this not to advertise but rather to set out what we see as the major priorities in the future. Other companies have their own lines of research and innovation. I am not suggesting anyone is right or wrong in this, but inevitably, different people see different paths to achieving expansion of the preservation industry.

What is important is ensuring a continuing role for timber into the future.
CRC FOR WOOD INOVATION

Most of you will have heard Professor Peter Vinden talk of the CRC and the work it has been doing, in particular with microwaves. Peter is the head of research for the CRC and of course is proud of what the organization has achieved in the research field.

However, research organizations are ultimately judged by the amount of their research which becomes a commercial reality.

Timtech became members of the CRC a little more than two years ago, firstly because we were not big enough to be able to have our own research facility, and secondly because we felt we could actively help the CRC to take some of their technologies to market.

Many times I have heard the comments about research work, and in particular the CRC work, such as “We’ve heard all that before, but when is something actually going to happen?”

Well, I can tell you it is happening, and on a number of fronts.

MICROWAVE TECHNOLOGY

The CRC was originally established based around the technology of microwave processing of wood. Much of the know-how came from eastern Europe and Russia. The concept was hardly new, with reports of work done with microwave and radio-frequency processing of wood going back to the 1940s, but the work done by the group has moved the science to the next step.

A range of large microwave processing units has been set up at the Australian Centre for Advanced Wood Processing, ACAWP, at Creswick in Victoria. This facility is owned and operated by the CRC.

Timbers up to 300mm square and roundwood up to 300mm diameter can be processed in a totally enclosed and safe unit where the timber is passed through an microwave applicator which is powered by three 100kW microwave generators. This compares with the home microwave power of say 800 watts.

The science is that the microwaves transfer energy into the wood, thereby heating it up very quickly, which in turn gives properties to the wood:

- Whilst still very hot and with moisture still in it, the wood becomes pliable and can be bent into different shapes
- The heat causes the moisture in the wood to boil which leads to the formation of micro-voids in the wood structure. These are small enough not to cause structural damage and strength loss, but large and numerous enough to enable the easy passage of moisture and liquid through the wood.
- Extensive microwave application causes the wood to become almost sponge-like, such that it expands beyond its original size and shape.
So, by controlled application, the wood can be made more permeable which leads to two major advantages:

1. The moisture in the wood can now be more easily removed
2. Treatment solution can be more easily impregnated into the wood.

So where does this lead to from a commercial point of view?

WOOD BENDING

On the bending front, a joint venture company has been formed between the CRC and Black Forest Timbers in Woodend in Victoria, to install and operate a microwave and bending facility to produce shaped furniture and joinery components. The driving force behind this is Diane Tregoning, a leading and well known figure in the timber industry in Australia. The first products are expected to roll out of the new plant by the middle of next year.

WOOD DRYING

The principle of accelerating the drying of hardwood has been well established by the CRC, but to go the next step to practical application, an industry group has been established in Australia to confirm the parameters for the accelerated drying of a range of commercially used hardwood species. Such timbers are traditionally very slow and difficult to dry, but by microwaving first, the drying process can be considerable speeded up. Other properties such as reduced internal checking and degrade are also being quantified in an extensive testing programme.

PRE-CONDITIONING FOR TREATMENT

In many respects, microwaving is similar to steaming in that it can take green wood and make it ready for treating in a short time, although in the case of microwaving it is merely a matter of seconds. Any timber, from the easy to treat radiata sapwood, the hard to penetrate radiata heartwood, normally impossible to treat hardwood corewood, species such as Douglas Fir, Scots Pine and many others have all been processed and then treated, giving full penetration of preservative throughout the piece. Work over the past twelve months has been concentrated on defining the parameters for the whole range of species and sizes so that full economic models can be established. A number of full scale and diverse applications are currently being costed with a view to the first one being up and running within the next nine to twelve months. This will of course be in conjunction with a treatment plant.
In summary, the advantages that microwaving offers over steaming or kiln drying are:

- Speed of process
- In-line
- Better quality of treatment
- Possible reduction of stresses in the wood

What about the costs?
Well the capital cost is not cheap. Depending on the dimensions of the wood being processed and the volumes, the capital cost of a microwave processing line is anything from $500,000 up to $2 million, but given the current cost of kilns and steaming plants with boilers, this is not out of the ball-park. The operating costs again vary with the dimensions and the type of wood, but for example with radiata corewood, the power use is about 70kWhrs per cubic meter, which at say 12 cents per kWhr, gives a power cost of less than $10 per cubic metre, far less than kilns and steaming, unless using wood-waste to produce the energy. Roundwood, because of the high percentage of high moisture sapwood requires more energy, perhaps twice as much to achieve the same end.

TREATMENT PLANT AND PROCESSES

Given that microwave processing can be carried out directly in-line, after a peeler in the case of roundwood or a saw in the case of lumber, the next step was to try to come up with a progressive plant and associated processes which will allow the timber to be treated in-line. This of course is applicable to timber no matter where it comes from in the process, whether it be coming straight off a planer, or being de-filleted from a kiln. It certainly doesn’t have to be straight after microwaving.

Unfortunately this is where commercial sensitivities come into play.

I can say that a pilot plant has been built and operated which gives effectively, an in-line treatment process, but actually taking small batches and treating them very quickly. The innovative science is in the processes used which ensure full compliance with the appropriate standards, either NZS3640 in New Zealand or AS1604 in Australia. Most work to date has been on achieving H1, 2 and 3, but some work has also been done to prove the applicability to H4 and above.

A number of commercial treatment plant installations for wood preservation are being discussed at the present time, some involving microwave and treatment operations, others just treatment
PRESERVATIVE FORMULATIONS

Whilst most of us know that CCA is very safe, we are also realists and accept that despite our best efforts, will one day be outlawed. We have to prepare ourselves for this event, which, because it is politically driven, could occur very swiftly. Already, the Tanalith Es and the ACQs are well accepted, but they both contain copper which itself is on the agenda in some parts of the world. My advice tells me that there is a distinct possibility that copper-containing preservatives may well be banned in the next five years in Europe.

The timber preservation market worldwide is just not big enough for any company to come up with new actives developed solely for that market. The costs of all the environmental, health and safety testing which is required to get approvals is simply too extensive and too costly to justify it. Therefore if we are going to see new actives in our industry, they are going to come, most likely, from the agricultural chemicals industry or the like. This is certainly the case with the azoles, developed by Jansen and Bayer for the agchem industry. The relatively small amount of additional groundwork was then done to get acceptance in the timber treatment industry. Prior to their introduction, the LOSP treatment market was being supplied with chemicals that have been around for many years; copper naphthenate and organo-tin as fungicides, both of which have their drawbacks, and permethrin as an insecticide. Permethrin is still used but alternatives are also being introduced.

Where there are greater possibilities of progress being made in formulations is in the carriers being used and in greater emphasis being put into the physical protection of the wood. If the moisture can be prevented from entering the wood by protecting it with resins, for example, then decay will not occur. I can see a day coming, although I doubt that I’ll be actively involved in the industry by then, when wood preservatives don’t contain any chemical “actives” but all the protection is physical. Wood modification techniques, resin technology, surface activation technology and a whole range of other so-called innovative technologies are all driving in that direction.

Whatever it is, let us try to ensure that it makes the “preserved” wood, a quality and long lasting product.