THE CONTROLLED TREATMENT OF EXTERNAL JOINERY

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SUMMARY

The paper describes the need for organic solvent wood preservatives (LOSP's) to complement creosote and CCA's, and reviews the evolution of LOSP treatments from the simple immersion process to the more controllable and sophisticated double vacuum plants.

LOSP treatments have three distinct market niches, firstly for moulded components such as joinery; secondly where dimensional tolerances are important e.g. trussed rafters; and thirdly where speed of treatment is important.

LOSP formulations are versatile in enabling other added value components to be incorporated into the formulations apart from the biocides. Double vacuum treatment is a flexible process which enables a variety of specifications to be met. Finally double vacuum process controls and the enclosed treatment process enable LOSP's to be used safely and promote wood preservation as an environment conservation industry.

BACKGROUND TO ORGANIC SOLVENT PRESERVATIVES

The treatment of timber with creosote and heavy-duty waterborne (W.B.) preservatives such as copper/chrome/arsenates (CCA) is long established and well-known in most parts of the world, and these preservatives are used to protect timber in all conditions from attack by decay fungi and wood destroying insect larvae or termites.

These two preservatives are usually applied to timber by vacuum and pressure techniques designed to give deep penetration of the chemicals so that when the timber is exposed to natural weather extremes of alternating cold, hot, dry and wet conditions the checks or cracks which develop do not expose untreated wood. Therefore these preservatives are well suited to severe exposure conditions such as soil or water contact.

For timber in buildings other properties of a wood preservative become important which may restrict the use of creosote or waterborne preservatives. For instance, creosote is not normally used to preserve joinery or other timber associated with domestic dwellings because of its strong smell, particularly when freshly treated and also because of the difficulty in painting over creosoted timber. Waterborne preservatives would be acceptable in these conditions although there are practical problems arising from the fact that timber swells when it absorbs water. Thus, window joinery, assembed from precisely machined timber profiles would not retain its dimensional tolerances during treatment of these profiles. In addition, even if the dimensions returned to their original limits after redrying, the surface condition of the timber would be rough owing to grain raising and probably would require sanding before any decorative finish was applied.

Another practical problem with water based treatments for building components is that these components are frequently produced on a production line where speed of manufacture and delivery to site are important. With water based treatments a conventional treatment schedule will impregnate a large quantity of water into the timber which requires a considerable time to evaporate before further processing can take place. Unless stocks of dried, treated timber are available such delays are inconvenient or unacceptable.

A third type of preservative was developed to meet the special set of circumstances where there is a requirement to treat timber for use in buildings and where it is important that the dimensions of the timber do not change during the treatment process, or where production schedules dictate that a rapid treatment and subsequent processing are required. The preservative is based on light petroleum solvent, which does not cause the wood to swell, having a boiling range usually within the limits 150°C and 200°C and a flash point of greater than 35°C. The active ingredients are dissolved in the solvent and can include insecticides and fungicides. In addition non-pesticidal components may be incorporated such as water repellent waxes and resins, and pigments or dyes to give colour to the treated wood. After treatment the solvent evaporates leaving behind the active components. These formulations, now frequently referred to as light organic solvent preservatives (LOSP's), are used to treat timber in its fully machined state for use in various parts of buildings, not in ground contact. The timber will normally be sheltered from the range of weather extremes either by other components of the building e.g. roof overhangs, or a decorative paint or stain finish.

LOSP's are not used in situations where protection against severe weather conditions is required such as ground or water contact. The movement of timber in buildings is less than for timber fully exposed to the range of weather conditions and this means that it is unlikely that deep checks will form in the wood in service. It is therefore not necessary to have the same depth of treatment that is required for timbers which are used in exposed situations. It is merely necessary to achieve an "envelope" treatment or a protection of the outer surface, to a depth which ensures that decay fungi, insect larvae or termites cannot penetrate. Because of this the treatment schedules normally used for application of LOSP's are much milder than the high pressure schedules adopted for creosote and CCA's. They range from simple dipping techniques to the more sophisticated double vacuum and vacuum low pressure methods. So far test methods have not been fully developed which will give information on the optimum depth of penetration of a preservative in these exposive situations. Therefore the choice of treatment schedule and hence the standard of treatment given is very much a matter of individual assessment of the risk involved and penetration required. This has led to many different standards of treatment to be specified in different countries.

THE DEVELOPMENT OF DOUBLE VACUUM TREATMENTS

LOSP products were first used in the USA 50 years ago when a formulation of 5% pentachlorophenol in petroleum spirit was used for application, by dipping, to fully machined window components, usually of Southern Yellow Pine, a highly permeable and non durable species. This method of treatment is still used today.

In the UK and other countries of Northern Europe the traditional building timber in the first half of this century was *Pinus sylvestris* heartwood which has adequate natural durability when used for window joinery. The trees, when cut down, were mature and it was economically possible to discard the small proportion of perishable sapwood so that only the more durable heartwood was used for construction. In these circumstances preservation was not necessary. In the 1950's in the UK the picture began to change. Younger trees were required to be felled, the proportion of sapwood was therefore greater and economic considerations required that this sapwood was also utilised. In addition, building techniques altered and these two changes resulted in a dramatic deterioration in the performance of wooden window joinery. This created the need for some preservative treatment. Attention turned to the LOSP based formulations and the experience of North America. At first, in the UK, simple deluging or spraying was adopted, then dipping for one minute and later three minutes.

In the mid 1960's the preservation industry felt the need to be able to exercise more control during the application of these types of preservatives so that particular absorptions and penetration of fluid could be obtained. Also it was shown that the penetration achieved by a 3 minute dip of *Pinus sylvestris* was lower than that achieved in Southern Yellow Pine. Interest turned to vacuum impregnation techniques which had been investigated, originally in the USA in 1959. These showed that the use of such methods can result in increased efficiency and they are also more hygienic than the simple dipping or deluging processes because of the reduced quantity of fluid on the surface of the wood at the end of the treatment process. Although the idea was not developed in the USA interest was created and maintained in the UK.

The aim of the work in the U.K. was to develop controlled processes, for the important timber species used in the U.K., which could provide a particular quality of treatment in terms of preservative absorption and/or depth of penetration, and in addition would produce timber which was touch dry at the end of the process. For commodities such as joinery the treated wood also was required to be compatible with standard glues and paints.

The outcome of the work was the double vacuum process for the treatment of pine species and the vacuum low pressure process for the treatment of spruce. The stages of the processes can be summarised as follows:

> An initial vacuum is applied to timber in the treatment vessel. The severity of this vacuum depends on the timber species being treated and the hazard to which the treated timber will be exposed.
>
> When the desired vacuum conditions have been achieved the vessel is flooded with preservative while still maintaining the vacuum.
>
> The system is then vented to atmosphere and the vacuum consequently reduced giving a relative pressure acting on the timber.
>
> This pressure (either atmospheric pressure or a small positive pressure depending on timber species being treated) is maintained for a pre-determined time, known as the "hold period".
>
> The preservative is then returned to the storage tank and a final vacuum applied and maintained usually for 20 minutes.
>
> The system is then finally vented to atmospheric pressure which forces preservative at the surface into the timber. The timber is then removed from the treatment vessel in a 'surface dry' condition.

We can identify five variables which can be used to control the absorption of solution and depth of penetration:

i) The degree of the initial vacuum.

ii) The pressure applied to the preservative fluid.

iii) The duration of the "hold period".

iv) The degree of the final vacuum.

v) The duration of the final vacuum.

To illustrate the use of these variables Figure 1 shows in graphic form the stages of the cycles used in the British Standards for the treatment of *Pinus sylvestris* (a permeable softwood) and *Picea sp* (an impermeable softwood).

TREATMENT SPECIFICATIONS

As mentioned above the definition of standard of treatment to be achieved is a matter of individual assessment of the risk rather than being determined by laboratory or field tests. Unlike timber in the ground there is no certainty or predictability that timber above ground will be attacked by wood destroying fungi or insects. Such attack will be determined by the climatic conditions and also influenced by the type of building, standards of maintenance and decoration given to the timber component. These will all affect the time of onset and rate of attack, and local treatment specifications should be based on these factors.

It is not the intention of this paper to discuss treatment specifications in detail but it is useful to record that a wide range of specifications exists, even for apparently similar commodities and it is difficult for different individuals or specifying authorities to come to a common agreement. For instance window joinery treatment specifications in the U.K. assume lateral preservative penetration of 3mm. In Scandinavia the requirements have recently been reduced from 10mm to 5mm whereas in New Zealand a penetration zone of 20mm is required.

The absolute requirement of any preservative is that a toxic loading be applied to the wood to an adequate depth. The difficult question for LOSP treatment of timber above the ground is, "what is an adequate depth?" Development of suitable field tests is required, which examines the treatment process as well as the preservative, to provide an objective answer to this question.

TREATED COMMODITIES

In general, throughout the world, the main commodity treated with LOSP's is window joinery although other commodities are also important in particular regions.

LOSP treatments in Canada and the USA are largely confined to window joinery (millwork) and the immersion process is still predominantly used for treatment of permeable pine species.

In the U.K. LOSP treatment has made a most important contribution to saving the window joinery industry for timber, certainly as far as windows in new buildings is concerned. In the 1960's there was widespread rapid decay of joinery in new buildings within a very few years. This has largely been eliminated by adoption of a minimum treatment requrement, by the National House Building Council (NHBC) of a 3 minute immersion for pine but more commonly by a double vacuum schedule. There are now at least 500 Double Vacuum Plants in operation in the U.K.

In mainland Europe window joinery in the northern countries is usually produced from *Pinus sylvestris* and is treated with LOSP to higher retentions and deeper penetrations than in U.K. In southern countries the use of hardwoods is more common and, in general, no or little treatment is given. In these countries the climatic conditions do not promote decay as vigorously as in the cooler, wetter regions.

In Australia the wooden window joinery producers have been successful in reversing a trend towards the use of aluminium windows through a combination of astute marketing, highlighting the aesthetic appeal of wood, particularly hardwoods and cedar, coupled with LOSP preservation giving confidence in the durability of timber.

Although this paper is specifically concerned with joinery treatments this section on treated commodities would not be complete without a brief reference to components, other than joinery, which lend themselves to LOSP treatment rather than creosote or CCA.

In New Zealand LOSP treatments have found a market niche for the treatment of finger jointed Radiata pine for house siding because the LOSP fits more efficiently into the production flow line than the traditional CCA as the following comparison shows.

SEQUENCE FOR CCA TREATMENT

green sawn timber
↓
dry
↓
CCA treat
↓
redry
↓
profile
↓
finger joint and glue
↓
cut to length

SEQUENCE FOR LOSP TREATMENT

green sawn timber
↓
dry
↓
profile
↓
finger joint and glue
↓
cut to length
↓
LOSP treat

The advantages of LOSP over CCA in this case are:-

1) eliminates one drying process

2) faster production

3) ensures that there are no untreated exposed surfaces.

4) no treated wood waste is produced. Such waste is both economically illogical and increasingly will create a disposal difficulty.

The benefits of speed of production of components using LOSP treatment are mainly responsible for the increased demand for LOSP in U.K. in the past few years. Housing components such as trussed rafters and exterior wall frames of timber frame houses are now generally treated with LOSP rather than CCA because the treatment can be given to the component immediately before final assembly with minimal delay after treatment before delivery to site. LOSP treatment is much more appropriate to efficient production lines than W/B preservatives.

TECHNICAL AND FUTURE DEVELOPMENT

In this final section I would like to highlight particular features of wood preservation, relevant to LOSP's, which are important for the future.

- predictive testing and specification of treatment

A feature of the commercial LOSP treatments, has been the lack of objectivity in deciding what should be an appropriate depth of preservative penetration for timber not in ground contact but exposed to a variable risk of fungal or insect attack. There is a plethora of laboratory tests, based on small blocks, to determine toxic loading requirements in the treated timber. Only recently has attention been directed to testing the efficacy of the treatment process itself. The so called "L" joint" test, which simulates a lower joint of a window frame, is being evaluated around the world by the International Research Group (IRG) for wood preservation and is starting to produce useful results. It is likely that this test will become part of an approval system in Europe in due course. It is essential that tests based on the commodity and typical exposure conditions be developed to supplement the laboratory block testing if we are to achieve realism in specifications.

- non biocidal components of LOSP's

So far this paper has concentrated only on the wood preservative aspects of LOSP's. The white spirit base of LOSP's is also a suitable vehicle for introducing other materials into the timber. For instance various resins and coloured molecules can be incorporated and these can provide considerable added value to the treated component e.g.

- to provide a degree of dimensional stability to improve the performance of subsequently applied paint systems

- to enable paint primer resins to be impregnated into the timber to reduce costs of painting

- to increase aesthetic appeal of treated timber at the point of sale

As in the case of biological testing, where it is difficult to establish objectively what depth of penetration is required, it is also difficult to predict the performance of the non biocidal components from laboratory data. An interesting example of this is Spain where LOSP treatment by double vacuum is carried out on hardwood flooring particularly to protect against insects. An added benefit, which emanates from the customer's experience of the product rather than from laboratory generated data, is an improved dimensional stability to the changing relative humidity conditions.

- **environment**

Possibly the biggest problem for our industry in general, not just LOSP, is its image in an increasingly environmentally aware world. In this regard the preservation industry at large has singularly failed to project itself as the conservation industry which it undoubtedly is.

By preserving timber we are conserving forests, by preventing unnecessary deterioration, and adding value to a natural product.

Unfortunately we have to use pesticides to protect the timber and the public image of our industry is more associated with this rather than the conservation aspect.

The future of our industry in large measure is in our hands. The trend of legislation is to restrict access of people to pesticides and prevent environmental contamination.

In the D.I.Y. field there will be increasing difficulty to justify the use of wood preservatives. It involves the use of pesticides and solvents by untrained people where the control which can be exercised is either minimal or unpredictable. In addition the efficacy of a D.I.Y. treatment is not great.

The case for industrial pretreatment is sound. It allows pesticides to be handled in closed systems, and fail-safe devices are technically feasible to prevent accidents and spillage. The users of treatment plants must recognise their responsibility in using pesticides safely, and having adequate training for personnel involved with handling preservatives. We may need to change active ingredients. If so we need confidence that these will perform in the wood as well as the present well established biocides.

This presents a great challenge to the industrial competitors in the industry. If we adopt new pesticides and then advertise that we are more environmentally friendly than our competitors then I believe we will destroy ourselves. There is no way that using new formulations will alter the hygienic practices which are necessary in handling pesticides. There is no such thing as a safe pesticide; only safe ways of using them.

What our industry has to do is to ensure that our treatment plants provide good quality treatment and are designed to prevent pollution of the environment by accidental spillage. We must also do more, by collective action, to promote wood preservation as an environment conservation industry.

F.W.Brooks
28.9.1989

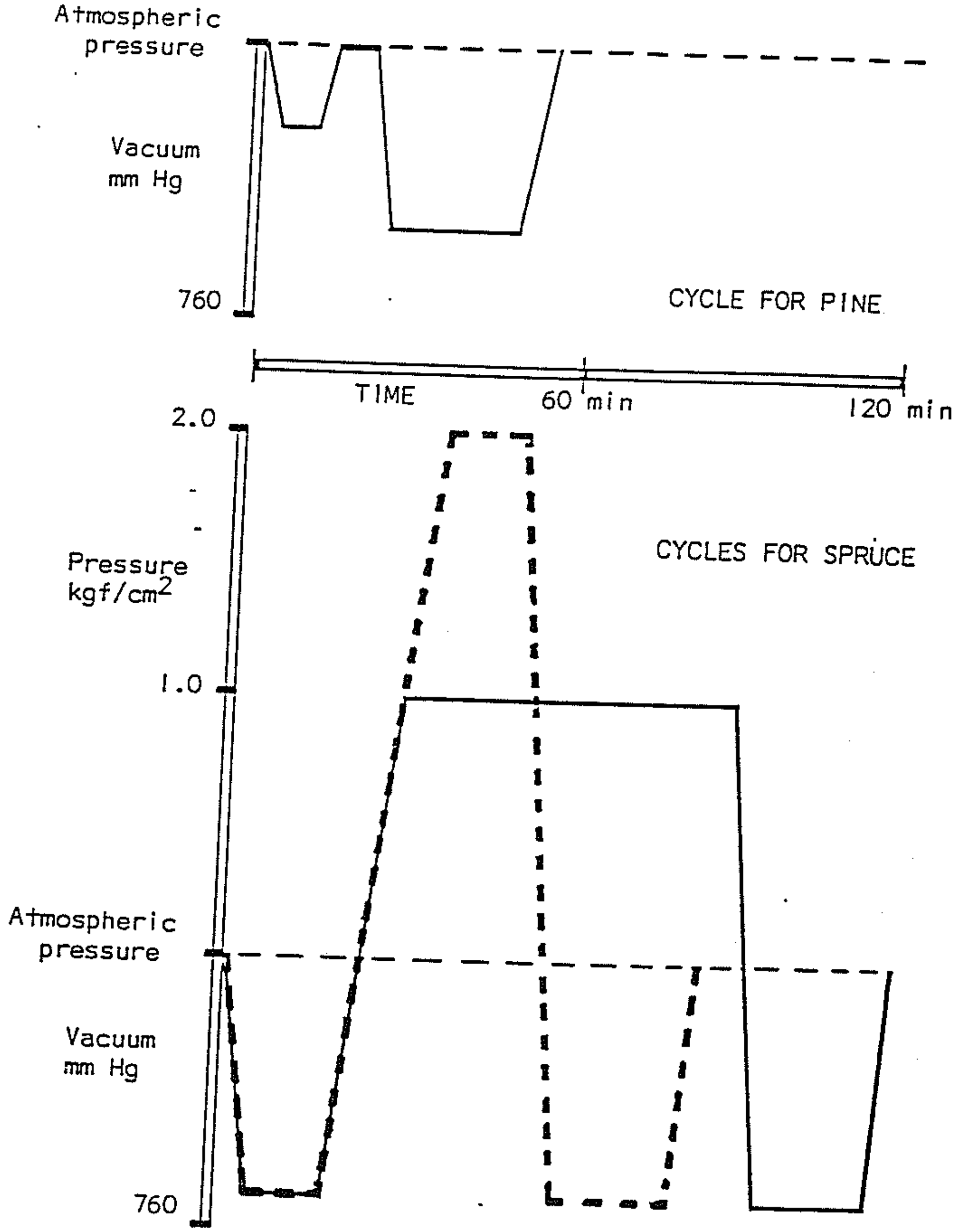

FIGURE 1. Treatment cycles defined in British Standards for the treatment of Pine and Spruce with organic solvent preservatives

An organizational meeting was held in Vancouver in November, 1989, following the day's proceedings of the C.W.P.A. annual conference. The attached list shows the members who attended the meeting or who agreed to serve on the committee.

Briefly, it was agreed to pursue the preservation of millwork as a starting point, and to concentrate upon millwork standards, procedures and chemicals used in Canada at the present time. Preserved millwork is virtually 100% doors and window frames. Accordingly some idea of the market is needed to obtain the Canadian perspective on the industry. Ron Bobker will contact the Canadian Window and Door Manufacturers' Association to obtain figures for the new construction and replacement markets for wooden door and window frames. Andrew Hobbs agreed to contact G. N. Rosenberg of Forintek, to get the background of the "technical mission" to the U.K. and Scandinavia in the fall of 1986 by some members of the C.W.D.M.A., C.O.F.I. and other interested bodies. The mission went specifically to investigate the status of double vacuum treatment of millwork in those countries, and concluded that double vacuum was not appropriate in Canada at present because (i) lumber used here has a high proportion of sapwood, and (ii) Canadian frame built houses have the roofs installed before windows are put in (so the latter are protected from the weather) and Canadian windows are designed for efficient water shedding.

Bill Goodwine agreed to obtain U.S. standards - those put out by A.W.P.A. and N.W.M.A. (These have now been obtained). Frank Brooks agreed to obtain British standards, and Lissi Jeppesen agreed to obtain Scandinavian standards (in English if possible). Ron Bobker will also contact Agriculture Canada and attempt to get a list of all chemicals that have been approved or registered for use in this country.

As far as an immediate objective for the technical committee, this should be to obtain credentials on the C.S.A. A440 committee, and with other interested parties, e.g. C.W.D.M.A. There are wide discrepancies on standards and much controversy as to methods for preserving wood. Possibly the technical committee should try to develop a consensus position. For example: although most window and door frames in manufactured in this country are sold unpainted, some manufacturers are factory applying high performance coatings. Should there be two standards, one for factory coated wood, and one for wood that is field painted or stained? Testing methods should also be reviewed. The L-joint test seems to be the standard in as much it simulates a window exposed to exterior conditions; however, are there any tests which simulate wood exposed to warm humid air on one side, and sub-zero air on the other (the typical condition in a Canadian home in winter)?

C.W.P.A. TECHNICAL COMMITTEE REPORT

There is probably enough material available to keep the technical committee busy full time for several years. However as this is not possible, limited achievable objectives will have to be set up. The committee is not exclusive, so any member of C.W.P.A. who feels he/she has something to contribute is welcome to join. Meetings will be held twice a year, once at the time of the annual meeting, and once in the spring. Two spring meetings will take place, one in Toronto and one in Vancouver, which implies western and eastern divisions. Hopefully overseas members will communicate by mail.

Wishing all members of the technical committee and C.W.P.A. all of the best for the holiday season, and for health and success in the coming decade,

Ron Bobker, Chairman

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INTERNATIONAL MARKET POTENTIAL FOR TREATED WOOD PRODUCTS FROM B.C.

Robert Zwick, P.Eng.
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During the 1980's, one can confidently say that the wood industry in B.C. had gone through a massive restructuring. The economic recession during the early part of the decade forced lumber manufacturers to take a serious reassessment at how and where profitability could return in manufacturing wood. One consensus has been to get closer to the customer, and manufacture wood products more suitable to the direct end-user.

What we once sent to Japan and Europe as large, 8" thick flawless and clear cants, are now sending items such as "Hashira", "Kamoi", German window stock, and sauna boards. B.C. sawmills are now starting to make the right sizes, lengths, grain orientation, moisture content, and grade. A lot of this value-added material is coming from remanufacturing, which COFI members play a key role in.

In my few trips to Japan and Europe, I was particularly surprised by the consumption of treated wood. In Japan, it was especially interesting to see that practically all the structural wood components on the first floor were pressure treated! Yet we do very little of the wood treating here. I feel the custom wood treating industry is at its infancy in B.C. (much like the custom remanufacturer was 10 years ago). If we can competitively do more wood treating here (and there is no reason why we can't), it could also lessen the burden of kiln drying all our products going to Japan.

The B.C. remanufacturing industry is now maturing to the point where they now have their own producer's association which is similar to, and affiliated with, the Council of Forest Industries of B.C. They are known as the B.C. Wood Specialties Group (BCWSG), and comprises of over 30 wood remanufacturing companies located from the coast and interior of B.C. It is my opinion that wood treating opportunities truly lies within the framework of remanufacturing, and with the BCWSG.

COFI has offices located in many of the major countries of the world where our wood products go. I asked our people what the approximate size of the treated wood markets were in their countries, and quite frankly, it generated a lot of interest. Very little work has been done to establish the size of these markets, and to effectively promote B.C. treated wood internationally.

Therefore, what you have in this paper, is probably one of the few sources of market information on treated wood from an international perspective. I must caution you that these are only rough estimates, since the material had to be compiled from a wide range of different sources. I have simplified the presentation of the statistics through use of bar graphs, and they are included with this paper.

The next question is, how can we begin to treat more wood for our international markets? I think this market can be developed and approached in three ways:

(1) Become familiar with what the requirements are for the export market. For example; Germany has very strict regulations for CCA treated wood products, and yet other countries continue to pressure treat with pentachlorophenols.

(2) Identify B.C. manufacturers who are "close to their customer"; where they process wood in B.C. that probably only requires the pressure treatment of wood and the foreign end-user could then have all their needs satisfied.

(3) Inform the lumber producers on the capabilities of the domestic wood treating industry.

Item number one above would probably be a task the wood preservers will have to do on their own - educating themselves on international standards for preserving wood. My discussions with some of the Canadian research experts reveal that they are completely familiar with wood treating codes and standards from other countries. The other two items is something the Canadian Wood Preservation Association can do in conjunction with the major lumber producers associations in Canada.

As stated previously, this should probably be considered a remanufacturing opportunity, and certainly the B.C. Wood Specialties Group would be an ideal organization to contact. The wood preserver will be able to quickly find out who the secondary manufacturers are, and the myriad of wood products that are being produced which are truly for the end-user.

The CWPA can also improve their association profile. For instance, a contact address or person is not even listed in the Canadian Wood Council directory which identifies key people and organizations in the wood products industry. In addition, I found it extremely difficult to find the CWPA annual meeting notice in the "conventional" sources of information for the wood producer. The CWPA will have to at least convey the message as to where they "hang their hat".

Finally, associations such as COFI and BCWSG can assist the CWPA in identifying who the key contacts are amongst the wood producers. It will be these key market development people who will be receptive in undertaking a program to pressure treat their wood products. The consideration of pressure treating wood (and initially as a remanufacturing opportunity) for export markets is something that should benefit all B.C. wood producers.