



# Kiln Clinic

April 7-8, 2010 – Keene, NH

Question: Questions listed on the following pages are as posed by people attending the meeting.

Responses are a summary of comments from those attending the meeting including industry, academic, and research personnel.



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Question: Kiln drying 101 for dummies, specifically reading and using dry kiln schedules, setting up wet-bulb sensor, etc.

- Dry and wet-bulb temperatures are controlled separately
- Dry and wet bulb temperature settings are taken from drying schedules that can be obtained from a number of sources such as US FPL Dry Kiln Operator's Manual and Jim Catterick's book on white pine.
- Wet bulb is simply another way of measuring relative humidity
- The wet-bulb sensor needs to be kept wet by a fresh water supply that keeps the surface wet. Best if water flow is fast enough to keep wick wet but slow enough to prevent splashing of water onto it. Best if water is close to the same temperature as the kiln. Slow flow will help ensure that the water is heated prior to reaching the wet bulb box.
- Ideally need about 600 fpm of airflow over the WB sensor in order to get the correct WB reading. Therefore it is important to ensure that the WB sensor is located in an area where it will receive full, unrestricted airflow.
- One suggestions of using a larger water reservoir with a float control to keep water in kiln longer to achieve the temperature.
- Check on wet bulb operation by removing wick and comparing to DB temperature
- When WB wick is on WB temperature will always be less than the DB



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## Question: Sticker stain in hard maple?

- Consider using Breeze-dried (or similar) stickers
- Achieve a 10 deg. Depression as fast as you can
- Wet stickers will contribute to stain
- Risers need to be dry and profiled
- The stain is caused by oxidation in the wood when MC is elevated
- Wetter spots in wood could contribute to stain
- Keeping temperature low and still trying to attain the required WB depression
- Good airflow required in addition to the above i.e. 600 fpm
- If you don't see surface checking, you are probably drying too slow. Could try drying faster i.e. add more vents
- Reversing the fans frequently will help alleviate stain i.e. every 2 hours
- Wet bulb depression is the priority. If you need to operate at a lower temperature then do so.
- Wetting of stickered packages will contribute to sticker stain
- Watered logs will be wetter due to no drying
- Get airflow over material as soon as possible.
- Localized airflow issues could cause stain



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## Question: How do you reduce cup when drying thicker White woods?

- Small radius on growth rings will contribute to cupping. Boards from smaller logs or from close the centre of the log will cup more.
- Applying weight will help minimize cupping
- Over-drying will make cupping worse
- Lumber size is important. Thick and thin lumber piled together will contribute to more cupping.
- Top restraint will help reduce severity of cupping. Need considerable weight to prevent warp in hardwoods. 8-inches thick of concrete is approximately 100 lbs./sq.ft.



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## Question: Vacuum kiln drying for white lumber?

- How do vacuum kilns help keep white woods white? Fast drying, reduced oxygen (vacuum kiln has very little oxygen present)
- A color contrast issue can arise if mixing conventionally dried wood with vacuum dried wood.
- Operating temperatures are lower which helps keep wood brighter
- When operating a vacuum kiln it is difficult to access the kiln in order to use traditional samples. One solution: They can be fitted with wireless probes.
- With RFV and platen dryers the load is solid stacked and therefore no potential for sticker stain.



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## Question: Heat treating for insects

- 133 deg. F. (56° C) for 30 minutes is internationally accepted standard based on pinewood nematode and monochamus beetle
- Recent work has shown that higher temperature is required for emerald ash borer (refer to presentation by Scott Meyers on tomorrow's program)
- Refer to schedule in US FPL Dry Kiln Operator's Manual for schedule suggested for killing powder post beetle.



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Question: General question on new technologies in drying but focused on Greenstone system?

- Greenstone is based on a Japanese biological drying technology
- Equipment is now being manufactured in NJ
- Claims include less energy and better quality
- Up to 20 Mbf capacity
- <http://www.greenstone.com>
- They will have portable unit on a trailer for demonstration



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## Question: Equalizing/drying to address a wide range of MC

- Good sampling required to get a good picture of initial and final MC
- For white pine, virtually half of the drying cycle becomes an equalization treatment to eliminate wets
- Another way of dealing with wets is to pull them after initial drying and re-dry them
- Ramping temperature slowly helps maintain the EMC in the kiln thereby avoiding the creation of a large depression
- Conditions for equalization are established based on the final desire MC for the material
- Specific procedures and conditions required for equalization are present in kiln operator manuals





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## Question: Use of variable speed drives on kiln fans i.e. white pine

- For white pine 600 to 800 fpm is ideal. Can slow the fans as the MC drops.
- Variable frequency drives (VFDs) (variable speed drives) can help reduce peak load.
- Electrical utilities will often help defray cost
- At 80% of fan speed you will use about ½ the power.
- Fan performance related to fan speed and fan pitch
- VFD may cause harmonic issues which could cause problems with the utility. Should investigate this before committing to an application.
- TDAL is a good indicator of whether or not you can reduce airflow i.e. high TDAL indicates that you should still have a high airflow. Reduce airflow as TDAL diminishes.
- Need to consider if your kilns are good candidates for VFD. Need to have a good higher airflow before you can consider reducing it at any stage of drying
- If you have good airflow, you can consider dropping it as the wood gets drier. This is usually once it reaches the fibre saturation point (25 – 30% MC).
- If you do not have good airflow you can look at taking measures to improve it including:
  - Improve airflow by improving baffling
  - Blocking the bunk spaces can also improve airflow
- One participant reported that (due to fan dynamics) small reductions in fan speed may not even affect airflow but would still achieve some energy savings.



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## Question: Drying white pine timbers – airflow requirements

- High airflow still important to prevent staining issues from blue-stain and brown stain
- Lateral spacing between timbers will expose more wood surface and help speed up drying and reduce stain potential
- Thicker stickers can also be used to improve airflow. This is important both in the air-drying yard as well as the kiln. Thicker stickers not only improve the movement of air (speed) through the pile but also the total volume of air.



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## Question: To water hard maple logs or not vs. end coating the logs

- Watering maple presents high potential for stain if not done properly
- Processing logs quickly helps
- If logs are watered, need to ensure good coverage by sprinklers
- End coating done primarily to prevent end checking but reducing the air contact with log ends can also reduce chemical (oxidative) discolorations



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## Question: Pros and cons of using a traditional wet bulb vs. a wafer vs. an electronic sensor

- Options for humidity measurement and control in a kiln include wafers, electronic wet bulbs (RH sensors), and traditional wet-bulb sensors
- Electronic WB sensors are available but can be problematic i.e. calibration issues, contamination. More difficult to tell if they are operating correctly
- Wafers also prone to contamination
- The EMC wafer system does not rely on airflow whereas a traditional wet-bulb is affected by low airflow.
- Need to change wafers regularly, clean the contacts, check the conductivity
- Anyone can easily check the operation of a wet-bulb sensor. One way is to remove wick and compare reading to the DB.
- If you are trying to check EMC conditions in an area with low airflow you can use a sling psychrometer.
- In storage or wood processing areas you can also get a good measure of the EMC by cutting thin wood wafers and leaving them exposed to the environment until they stabilize. Thin wafers will stabilize quickly. Can also use this system to double check on EMC in the kiln if it is operating at a constant DB/WB setting long enough.



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## Question: What are the possible causes and cures for bow in a package of lumber

- Can be related to differences in lumber thickness between board ends and centre of the boards. Even a few thousandths of an inch difference can accumulate through a pile and create a bowed effect.
- It was reported that equipment problems or feed rates in the sawmill could be causing the sawing equipment to “pinch in” near the board ends, creating slightly thinner lumber. Should test green lumber thickness to see if this is the problem and then work with sawmill personnel to try to address it.
- Possible that board ends may be also be a little drier and therefore have shrunk a little more than the rest of the board.



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## Question: Drying 5/4 white pine – general advice

- As with any white pine it is important to achieve a fast initial drying rate. This is achieved by getting a high initial wet-bulb depression and ensuring good airflow.
- Schedules are generally the same as for 4/4 material and call for an initial depression of 15° to reduce chances of stain
- Schedules and procedures are detailed in Jim Catterick's book on drying white pine



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## Question: What are the causes and cures for mechanical bruising of hard maple?

- Sudden impact of green material (logs or lumber) can cause stain that becomes apparent after drying and surfacing
- It was report that Rosser head debarkers can be a cause of this problem. Use of ring debarkers eliminated most of the bruising
- Can also control by switching to softer materials for rollers and avoiding impact situations for green lumber with equipment.
- Speculation that bruising may be damaging the cells and therefore water does not leave as quickly. As with other types of stain this would link it with slow drying.



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## Question: Suppliers of 4 ¼ square birch

- Steinway looking for a supplier of 4 ¼ inch square birch. If you can help, contact them





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## Question: Timers for Lignomat fan reversal – how to set them?

- Dip switches are present on the panel for different aspects of control i.e. start-up, fan reversal, etc. Each one operates differently depending on specifications.
- Could check with manufacturer of switches to determine how they operate
- Need to consider how they are wired in the control

\*\*\*\*\* Bill can you recollect any more for this one??? \*\*\*\*\*



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Question: Heat recovery and attaining temperatures for heat treatment

\*\*\*\*\* Bill any recollection on what, if anything, we discussed on this one? \*\*\*\*\*



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## Question: Fixed orifice traps vs. float and thermostatic?

- On-going debate over which trap type works best for a dry-kiln application.
- Fixed orifice have less maintenance
- Fixed orifice design relies on a continual flow of some steam through the trap. This contributes to increased steam consumption.
- Fixed orifice are less problematic with freezing
- Fixed orifice work better in a constant load setting. A kiln is not a very constant load. Therefore, this type of trap could be undersized and not able to keep up to the load at the start of drying or over-sized, and therefore over capacity, for much of the drying time.
- Bucket traps require more maintenance.



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Question: Heat treating and drying firewood. How dry is it after 24 hours?

- What is dry for firewood?
- Agreed by all that this is very client specific
- Some may be looking to dry only the outer shell to avoid stain and mold issues
- Drying is usually combined with heat treatment to kill any pests (in particular insects) that might be present.
- Heat treatment times are not long enough to completely dry the material but do achieve some drying.
- Heat treatment is more efficient if conducted at high humidity whereas drying (of firewood) is best done at very low humidity to promote rapid drying. If wet-bulb temperature is below target wood temperature the heat treatment process will take longer.



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**Question: Pre-surfacing oak prior to drying. Is it cost effective?**

- Get more lumber in the kiln i.e. about 7% after pre-surfacing and removing about 1/32
- Eliminates thick and thin issues
- Reduces drying time. i.e. about 3 days on 4/4 red oak
- Disadvantages, need to dedicate a planer to pre-surfacing and then you have wet shavings to deal with
- Reduced surface checking is possible because damaged fibers from sawing have been removed.
- It was pointed out that with new sawing technology, accurately cut wood from a bandsaw is very close to pre-surfaced. Green lumber sizes are smaller now than they were in the past.



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## Question: Steam humidification vs. cold water. Advantage and disadvantages.

- Goal is to achieve a certain EMC
- Potential problems with both
- Water sprays need to consider
  - as fine a mist as possible
  - cleaning and maintenance of nozzles
  - higher pressure works best, generally 800 to 1000 psi or higher
  - Need to locate nozzles far enough away from walls and equipment to avoid droplets from forming and draining away before it is evaporated
- Steam sprays
  - Steam cannot be at a high pressure as it will be too hot and will drive up the DB temperature
  - Even at low pressure, the steam needs to be saturated, otherwise it drive up the DB temperature
- Advice with cool water to use it at higher temperatures to avoid condensation issues
- Corrosion issues can develop if excessive spraying (steam or water) occurs and comes into contact with corrosion prone materials, especially any that may be at or below the dewpoint.



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## Question: Software to calculate true drying cost

- We anticipate having a presentation at the fall meeting on identifying and tracking drying costs.