Structural Plywood and Veneer-Based Composites

A Wood-Based Composites I/UCRC Short Course

In collaboration with the *Oregon Wood Innovation Center (OWIC)*

March 27-28, 2019 (INFO FROM 2019 WORKSHOP)

Location: Oregon State University
Department of Wood Science & Engineering
107 Richardson Hall
Corvallis, Oregon

What you will learn:
What is the state-of-the art in today's structural plywood and laminated veneer lumber (LVL) plant? How can today's technology help me produce a quality product that meets my customer's needs? Can basic wood science knowledge help me better understand my manufacturing process and product performance? Why is it so important to pay attention to water in wood throughout the manufacturing process? The North American structural plywood industry was started by a group of hard-working, fearless entrepreneurs in 1905, and has evolved to include LVL and related engineered products; staples of today's residential construction industry. This course will mix basic wood material and adhesive science with a practical look at how veneer-based wood products are manufactured. Included are hands-on activities, and an introduction to lean manufacturing and its use in the industry. Rounding out the agenda will be daily panel discussions, allowing participants to have their questions answered by industry pioneers, suppliers and academic instructors.

During the course, you will learn about the:

- History and current state of the industry and its products,
- Basic structure and properties of wood, including anatomy and mechanical properties,
- Production of veneer from roundwood,
- Interaction of wood and water throughout the manufacturing process, including veneer drying,
- Adhesives used to produce today's veneer-based wood composites,
- Lay-up and pressing, quality control, and testing of plywood and LVL products,
- Implementation of lean manufacturing processes in your plant,
- Alignment of product standards to regulations and performance-in-use, and
- Quality considerations throughout the manufacturing process.

This two-day event will provide a comprehensive look at the basics of producing high-quality structural plywood and LVL. Industry professionals will introduce processes, equipment and technology used in manufacturing. University instructors will build upon this information with relatable knowledge about wood material science, adhesives, the basics of mechanical testing and lean manufacturing. Upon completion of the course, participants will have a comprehensive understanding of key manufacturing processes and be better prepared to analyze problems through improved knowledge and troubleshooting skills. Hands-on activities and an evening reception will give participants an opportunity to connect with other industry professionals and instructors.

Who Should Attend:

- Persons who wish to learn about the manufacture of structural plywood and veneer-based products.
- Manufacturing team members who would benefit from basic knowledge of wood material science, adhesive science and product testing in their professional roles.
- Suppliers who wish to broaden their knowledge of the overall industry, including manufacturing processes and associated quality implications.
- Individuals who wish to sharpen their knowledge of the state-of-the art in processing equipment and continuous improvement practices.

There are no prerequisites. Target audience includes producers and suppliers that are new to the industry. Experienced professionals will also benefit through networking and exposure to state-of-the-art in equipment and practices.

Agenda:

DAY ONE:

7:30 a.m.	First van departs from Courtyard Corvallis lobby entrance for Richardson Hall. Returns as needed.
7:40 a.m.	Registration and Refreshments (107 Richardson Hall)
8:00 a.m.	**Welcome and Introductions** (Scott Leavengood, OSU) (10 minutes)
8:10 a.m.	**Veneer-Based Products: History and State-of-the Art** (Dick Baldwin) (35 minutes) • History of the plywood and LVL industries • Current capacities for structural plywood and LVL industries ✓ Definition and explanation of how capacities are determined for plywood and LVL (i.e.: 3/8-inch basis for plywood) • Overview of manufacturing processes (flow charts or video, very high level) • Five major industry challenges • A look at the future of plywood and LVL
8:45 a.m.	**Participant Introductions, Complete "One Pressing Question" forms** (15 minutes) • Participants complete and submit forms found in meeting books (Caudill and Leavengood)
9:00 a.m.	**Wood Tech 101** (Fred Kamke, OSU) (45 minutes) • Macroscopic features of wood • Rotary-cut veneer • Structure of softwoods and hardwoods • Density and specific gravity (SG)
9:45 a.m.	**Break** (20 minutes)
10:05 a.m.	**Wood-Moisture Relations and Log Conditioning** (Leavengood) (40 lecture + 15 minutes for exercise) • Water in wood • Moisture content (MC):

- ✓ Green-basis and oven-dry basis
- ✓ Measuring MC

- Relationship between moisture content, humidity and temperature
- Shrinking and swelling
- Green log pre-conditioning
- "Quality Considerations"
- Exercise: Measuring moisture content, density and specific gravity, Part 1 (Leavengood and Kamke)

11:00 a.m. **Debarking to Lathe Operations – Spindle Drive Lathe** (Mike Don, Timber Products Company) (35 minutes)

- Overview of log preparation
- How the spindle drive lathe functions
- The peeling process: lathe set-up and operation
- Block scanning and diameter optimization
- Lathe knives (honing and setup for optimal peel)
- Overview of care and maintenance
- "Quality Considerations", including smoothness of peel, tightness of back, thickness uniformity, minimizing humping and splitting (flatness).

11:35 p.m. **Lathe Operations – Circumferential Drive Lathe – to Green Stacking** (Anna McCann, Meinan Machinery) (30 minutes)

- The circumferentially driven lathe
- Knife grinding technology and strategies
- Clipping, stacking and composing
- "Quality Considerations" for veneer peeling and sorting & stacking

12:05 p.m. Lunch

1:00 p.m. **Fundamentals of Wood Drying** (Kamke) (20 minutes)

- Basics of wood drying, with special consideration to drying veneer
- "Quality Considerations" (to include surface inactivation, influence of wood species, thickness & width of veneer, and veneer quality)

1:20 p.m. **Veneer Drying** (Mike Crondahl, WESTMILL Industries) (30 minutes)

- History and types of veneer dryers – jet, longitudinal, etc.
- Overview of drying process – infeed, airflow & turbulence, material movement through dryer, exhaust
- Dryer controls for optimal drying performance
- Heating sources – operation and pros & cons
- "Quality Considerations" (proper sealing, temperature vs. retention time, airflow, controlling relative humidity, and innovations for improved quality)

1:50 p.m. Break

2:05 p.m. **Wood Tech 101 (continued):** Using a hand lens, looking at wood through microscopes (45 minutes) (Kamke, with help from Leavengood)

- A 10x look at wood species common to the industry (each participant receives a hand lens)
- Microscope images of commonly used or "structurally unique" woods at different magnifications
- Images of pits, longitudinal tracheids, cross-field pitting.
- Images of veneer glue lines

2:50 p.m. **Introduction to Lean Manufacturing in Plywood & Veneer-Based Products** (Urs Buehlmann, Virginia Tech) (30 minutes)

- Defining Lean; a look at lean safety
- Total Productive Maintenance (TPM)
- Six Sigma – A quality control tool
- What might the future hold?
- "Quality Considerations"

3:20 p.m. **Current Market Trends and Alignment of Product Use/Regulations with Standards** (Steve Zylkowski, APA-The Engineered Wood Association) (30 minutes)

- Overview of products and current market trends
  - ✓ Products: plywood panels, LVL, LSL, I-Beams, rim board, headers, scaffold planks, concrete forms
  - ✓ Market trends: plywood and LVL
- Overview of standards:
  - ✓ Structural plywood standards – PS1 and PS2
  - ✓ Structural composite lumber, including LVL – ASTM D5456
- Actual vs. nominal dimensions

3:50 p.m. **PANEL #1: Industry Pioneers and Wood Basics, Green End Thru Drying, Product Markets and Standards, Lean Basics**
Facilitator: Scott Leavengood

4:50 p.m. Day One Wrap up, Review of evening and Day Two activities (Caudill)

5:00 p.m. Day One, Adjourn
Van transports folks back to Courtyard Corvallis, returns as needed

5:30 p.m. **Networking Reception** for Participants and Instructors (Courtyard Corvallis, 90 minutes)
Sponsored by:
APA – The Engineered Wood Association
Dieffenbacher
Meinan Machinery
Metriguard Technologies, a Raute Group
PRE-TEC, a division of Willamette Valley Company
Spartek Industries
Timber Products Company
WESTMILL Industries

DAY TWO:

7:30 a.m. Van Transports Participants from Courtyard Corvallis to Richardson Hall

7:40 a.m. Refreshments and Social Time (107 Richardson Hall)

8:00 a.m. Recap of Day One (Leavengood)

8:10 a.m. **Wood Adhesives for Veneer-Based Composites** (Bruce Broline, OSU) (60 minutes)

- Resin Basics – purpose, function, performance and cost
- Phenol-formaldehyde resins:
  - ✓ Formulation, manufacture and quality control
  - ✓ Additives
  - ✓ VOCs
  - ✓ Optimizing performance
  - ✓ "Quality Considerations"
- Resin use in plywood and LVL manufacture
  - ✓ The glue mix
  - ✓ Adhesive application methods
  - ✓ "Quality Considerations" - adhesive-related manufacturing variables affecting product quality
- Other resin options

9:10 a.m. **Layup, Pressing and Material Handling** (Corey Farrens, Spartek Industries) (40 minutes)

- Layup strategies for engineered wood products
- Press technology – multi-opening, single-opening, and vertical
- Innovations in technology and controls
- Billet stacking dilemmas and strategies
- "Quality Considerations" from layup to finished product

9:50 a.m. **The Continuous Press** (Hauke Jeske, Dieffenbacher)(25 minutes)

- The continuous press
- Press controls and pressing strategies – continuous presses
- "Quality Considerations" for the continuous press and pressing strategies

10:15 a.m. Break

10:35 a.m. **An Introduction to Wood Mechanics and Testing** (Ari Sinha, OSU) (45 minutes)

- A review of actual vs. nominal dimensions (in collaboration with prior description during APA lecture – APA to introduce, Ari to revisit)
- The Basics – compression, tension, torque, etc.
- Basic failure modes in wood, wood composites
- Stress-strain, MOE and MOR
- Tension test for finger-jointed lumber
- "Quality Considerations" (SG, moisture and temperature effects, test machine and test speed issues)

Technology and Innovation

11:20 a.m. **In-Line Quality Control: Structural and Visual Veneer Grading** (Todd Kurle, Metriguard)(25 minutes)

- Structural veneer grading technology. What determines the strength of wood?
  - ✓ Determining a mill's UPT/sound velocity grade, it's correlation to MOE
  - ✓ Determining a mill's MOE grade. How do we calculate "E"?
- Visual veneer grading technology
  - ✓ Identifying defects and geometric features
- Putting it all together and "Quality Consideration"

11:45 a.m. Exercise: Measuring moisture content, density and specific gravity, Part 2 (Leavengood and Kamke)

11:55 a.m. Lunch

- Complete MC, density and SG measurements, Part 2 during lunch break

Technology and Innovation (continued)

1:15 p.m. **Robotics and Automation for Improved Quality and Productivity** (Steve Raye, PRE-TEC) (25 minutes)

- Robotics and the Manufacturing Landscape
- Automation: Goals and Benefits; Addressing Concerns
- Process of Automation and the "Seven Sins"
- Implementation and "Quality Considerations"
- Examples of Robotic Automation in the Wood Industry

1:40 p.m. **Continuous Improvement: A Case Study** (25 minutes) (Buehlmann, VT)

- Dryer efficiency study at Weyerhaeuser's Buckhannon, WV plant.

2:05 p.m. **The BLAST GAME: "Lean in Action"**
Facilitators: Scott Leavengood, Urs Buehlmann

4:00 p.m. **PANEL #2: Adhesives, Layup and Pressing, Basic Wood Mechanics, Continuous Improvement, Technology and Innovation**
Facilitator: Fred Kamke

4:50 p.m. Other Continuing Ed Offerings and the WBC I/UCRC (Kamke)
Course Evaluation and Wrap-up, Adjourn (Leavengood)
Van returns participants to Courtyard Corvallis as needed.
Optional: Tour of WS&E Department (sign up on Day 1; PPE required)

About the Instructors:

Richard (Dick) Baldwin, a native of Oregon, draws upon five decades and more of plywood experience as an hourly worker, industrial engineer, supervisor, and senior operating officer within the global plywood industry. Dr. Baldwin holds a B.S in Operations Management from the University of Oregon, an M.S. in Forestry from Stephen F. Austin State University, and a PhD in Public Affairs from the University of Texas at Dallas.

Bruce Broline has a PhD in physical organic chemistry and over 20 years' experience in the development of formaldehyde-based resins for the construction industry. He is a courtesy professor in the Department of Wood Science and Engineering at Oregon State University where he developed a distance-learning course entitled *Practical Wood Adhesives Technology*.

Urs Buehlmann is Professor in the Department of Sustainable Biomaterials at Virginia Tech, specializing in manufacturing systems engineering with a focus on continuous improvement (Lean). He has worked with numerous clients implementing Lean, including engineered wood products manufacturers.

Mike Crondahl is Owner/President of WESTMILL INDUSTRIES, a 44-year old company specializing in veneer drying technology. During 29 years with WESTMILL, Mike has helped secure multiple dryer-related patents, and is a recognized leader among North America's most knowledgeable and experienced veneer drying specialists.

Michael Don is Mill Manager for Timber Products Company in Yreka, California; the primary supplier of softwood veneer to Timber Product's plywood operations. With over 27 years of manufacturing experience in the veneer and plywood industry, Mike is an expert in the operation of conventional, spindle-driven lathes. He is also a proud alumnus of Oregon State University.

Corey Farrens is Business Development Manager for Spartek Industries in Portland, Oregon. With 30 years' experience in engineering and business development, he helps wood products manufacturers throughout the world meet their business goals with operational problem solving and solutions.

Fred Kamke is Professor and JELD-WEN Chair of Wood-based Composites Science in the Department of Wood Science and Engineering at Oregon State University. He is the Co-Director of the Wood-Based Composites Center. Dr. Kamke specializes in composite manufacture, resin penetration and distribution, and wood and water relationships.

Todd Kurle is Vice President of Sales for Metriguard Technologies, a Raute Group company located in Pullman, WA. Todd has been with Metriguard for 13 years, representing its complete line of production-line equipment and off-line QC products for lumber and panel-based products worldwide.

Scott Leavengood is Associate Professor and Director of the Oregon Wood Innovation Center (OWIC) in the Department of Wood Science and Engineering at Oregon State University. Dr. Leavengood specializes in wood science, quality and process control, and hardwood plywood manufacturing.

Anna McCann is President of Merritt Machinery, LLC in Lockport, NY. She has over 30 years of experience as a supplier to the veneer and plywood industry, and is the U.S. representative of Meinan Machinery in Nagoya, Japan.

Steve Raye is National Sales Manager of PRE-TEC, a division of Willamette Valley Company in Eugene, Oregon. He has over 25 years' experience designing and implementing automated manufacturing systems for the metals and wood products industries. Mr. Raye's specialty is helping manufacturers successfully align their business objectives with automation solutions.

Ari Sinha is Associate Professor in the Department of Wood Science & Engineering at Oregon State University. He specializes in timber mechanics and structural engineering.

Steve Zylkowski received his MS degree in Wood Science from OSU. He is the Director of Quality Services at APA and has been involved in testing, standards development, certification and regulatory issues impacting the wood industry.

Cost:

The cost for the two-day short course is $750.00 per person. Members of the Wood-Based Composites I/UCRC are eligible for a reduced fee of $600.00 (contact course registrar, Shannon Murray, at shannon.murray@oregonstate.edu for the discount code). The registration fee includes workshop materials consisting of a color notebook and hand lens, as well as lunch and refreshments during the class. An evening reception on Wednesday, March 27 is also included. Participants are strongly encouraged to add a signed copy of Dick Baldwin's 2016 book, ***Plywood and Veneer-Based Products*** to their registration for the reduced price of $38.00 (softcover) or $60.00 (hardcover). Dr. Baldwin's book is a must-have reference for anyone manufacturing veneer-based products. Books will also be available for purchase on-site, though the discount may not apply.

Travel Information and Lodging:

You are responsible for making your own lodging reservations. A block of rooms has been reserved at the new Courtyard Corvallis, 400 SW 1st Street, Corvallis, Oregon (https://www.marriott.com/hotels/travel/eugco-courtyard-corvallis/) at a discounted rate of $149.00 per night, single or double occupancy. Reservations can be made by calling 541-753-0199 or toll-free at 888-236-2427. Be sure to ask for the "The Structural Plywood & Veneer-Based Composites" room block. Reservations must be made **on or before Tuesday, March 5, 2019**. Rooms will be released to the public at this time and the special rate will no longer be offered.

Use the Portland (PDX) or Eugene (EUG), Oregon airport if air travel is required. If you prefer not to rent a car, shuttle service is available between PDX and Corvallis from the Oregon Express Shuttle. The cost for a round-trip ticket is approximately $60 per person. From EUG, shuttle service is available from Omni Shuttle, and offers discounts for multiple travelers. Both services will bring you directly to the Courtyard Corvallis. Hotel parking and internet access are free to registered guests. Van transportation to and from the short course, as well as walking directions, will be provided.

Short course participants driving to Corvallis for the event are invited to park in the hotel parking garage (complimentary) and use the shuttle to get to/from campus. Alternately, campus parking passes can be purchased online, in advance, through the OSU Parking Office Visitor's page, at a cost of $10 per day for the lot adjacent to Richardson Hall (Zone B). To purchase a parking pass the day of the event, use on-campus pay stations located throughout campus.

An evening reception, hosted by the course's vendor-speakers, will be held at the Courtyard Corvallis on Tuesday evening, March 27. Again, garage parking at the hotel is free for all participants.

For More Information:

Contact Linda Caudill, Managing Director, Wood-Based Composites Center, at 540-231-7092 or by email at lcaudill@vt.edu.

To Register:

Registration is available until space is sold out or until **Tuesday, March 5, 2019**. Register on-line through the WBC website (http://www.wbc.vt.edu) or OWIC website (http://owic.oregonstate.edu). Direct registration is also available using this link. Direct any questions to Shannon Murray, Program Coordinator for the College of Forestry Continuing and Professional Education at shannon.murray@oregonstate.edu or 541-737-3740.

Updated: 2/7/2019 (LCC, SL, SM)