Volume 11 • Issue 4

Forest Products Laboratory's

Newsline

2012 FALL

Recyclable, Compostable Stamps that Last "Forever"

FPL and the U.S. Postal Service Build on Their 20-Year Partnership

By Rebecca Wallace, Public Affairs Specialist

Do you remember the last time you licked a stamp? Maybe not, and for good reason: 20 years have passed since the U.S. Postal Service (USPS) first started transitioning from "lickable" stamps to the peel-and-stick squares we use today, called "pressure-sensitive adhesive" stamps by those in the know.

FPL worked closely with the USPS throughout that transition, and in the two decades that have followed, to continuously improve stamps.

The earliest cooperative research between FPL and the USPS focused on developing pressure-sensitive adhesives that didn't gum up the equipment used to recycle paper. By developing an adhesive that was compatible with the recycling process, an additional 20 million tons of waste paper can be recycled each year.

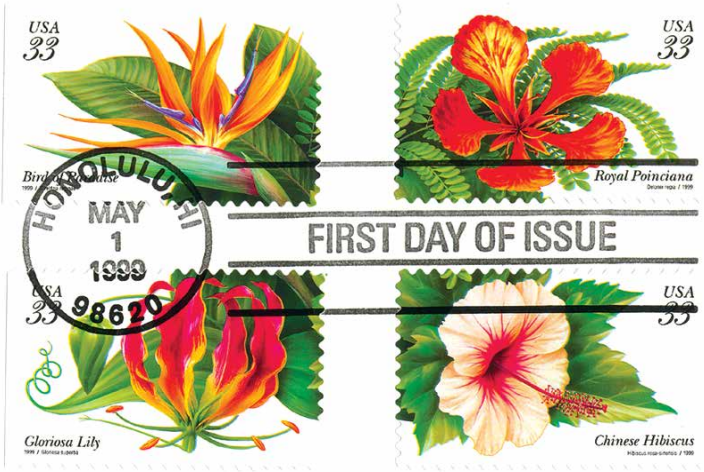
This research project ended up reaching beyond just stamps, according to Carl Houtman, a chemical engineer at FPL. "Advancements made with the Postal Service work were of interest to the entire label industry," explained Houtman. "The Tag and Label Manufacturer's Institute has adopted the same standards as the USPS, so labels can now be certified as recycling compatible."

Today's work with the USPS is two-fold: improving stamp performance continues to be a priority, as well as reducing the environmental impact of stamp materials.

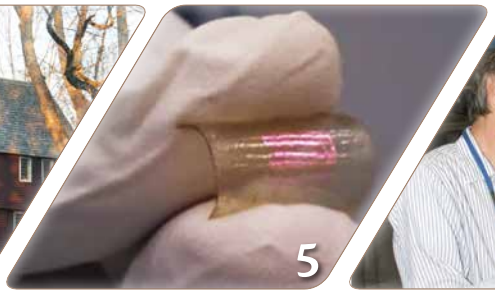
The introduction of the Forever Stamp has kept researchers busy developing improved performance and accelerated aging tests to ensure that the stamps indeed remain useful, if not forever, at least close enough to qualify for the name.

– Continued on page 7 –

Forever Stamps have kept FPL researchers busy ensuring stamps remain useful, if not forever, at least close enough to qualify for the name.



Recycling-compatible stamp using FPL-developed pressure-sensitive adhesives.



In this issue

Stamps that Last "Forever" 1
Upcoming Events 2
Build Green: Wood Can Last for Centuries 3
U.S. Patent Issued for FPL Fiberboard Panel 4
Flexible Electronics Using Nanocellulose 5
USDA Secretary Tom Vilsack Tours FPL 6
Scientist Profile: Steve Kalinosky 8
Wood Wise 9
The Nanocellulose Pilot Plant 10
Wood You Believe? 11

Visit our website
www.fpl.fs.fed.us

NewsLine Team

Douglas Clawson
Jim Anderson
Tivoli Gough
Bill Ireland
Rajinder Lal
Steve Schmieding
James T. Spartz
Rebecca Wallace
Madelon Wise

Published quarterly by USDA Forest Service Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53726–2398. Articles may be reprinted provided credit is given to the Forest Products Laboratory and NewsLine. To receive this newsletter electronically or to be removed from our mailing list, call Forest Products Laboratory at (608) 231–9200.

The use of trade or firm names in this publication is for reader information and does not imply endorsement by the United States Department of Agriculture (USDA) of any product or service.

The USDA prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720–2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250–9410, or call (800) 795–3272 (voice) or (202) 720–6382 (TDD). USDA is an equal opportunity provider and employer.

Upcoming Events

Second National Covered Bridge Conference

June 5–8, 2013, Dayton, Ohio

The Federal Highway Administration's National Historic Covered Bridge Preservation Program (NHCBP) will be sponsoring the Second National Historic Covered Bridge Conference in Dayton, Ohio, June 5-8, 2013. Co-Sponsored by the National Park Service's Historic American Engineering Record and the U.S. Forest Service, Forest Products Laboratory, this event will be held ten years after the First National Covered Bridge conference in Burlington, Vermont.

The second national conference will follow up on several themes: Reviewing several of the NHCBP-funded research and rehabilitation projects, best practices for rehabilitation, and the Burlington Charter for the Preservation of Covered Bridges.

For more conference information, visit http://woodcenter.org/2013-national-covered-bridge-conference/.

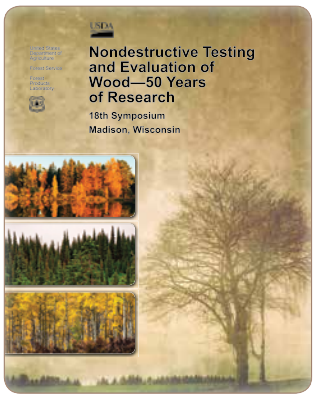
2013 International Conference on Timber Bridges

September 30–October 3, 2013, Las Vegas, Nevada

The main objective of this conference is to showcase and discuss state-of-the-art timber bridge technology. The mission of the National Center for Wood Transportation Structures (NCWTS) is to bring together academia, government, and industry to efficiently complete research, demonstration, and education that result in durable, cost-effective wood transportation structures to improve the transportation infrastructure of America and the world.

The NCWTS is a center at the Institute for Transportation at Iowa State University and is maintained in partnership with the U.S. Forest Service, Forest Products Laboratory, the Federal Highway Administration, and the National Park Service.

For more conference information, visit http://woodcenter.org/.



18th International Nondestructive Testing and Evaluation of Wood Symposium

September 24–27, 2013, Madison, Wisconsin

The 18th International Nondestructive Testing and Evaluation of Wood Symposium is a forum for those involved in nondestructive testing and evaluation of wood, and wood-based materials and products. It will bring together the international nondestructive testing and evaluation research community, users of various nondestructive testing technologies, equipment development and manufacturing professionals, representatives from various government agencies, and other groups to share research findings and new nondestructive testing products and technologies.

For more conference information, visit http://www.forestprod.org/symposium2013/

Build Green: Wood Can Last for Centuries

By Madelon Wise, Technical Publications Editor

Why do some homes built of wood last for centuries while others develop decay soon after construction?

A recent report, *Build Green: Wood Can Last for Centuries*, by FPL researchers Carol Clausen and Sam Glass, answers this question and more. First written by R.C. De Groot in 1976, the original publication (*Your Wood Can Last for Centuries*) has been nearly as enduring as wood can be.

According to co-author Sam Glass, the updated report gives "useful information on the fundamentals of wood durability and decay, some of the most common ways that buildings get wet, and how to prevent moisture problems through good design and construction." In cases where it's not feasible to keep wood dry, the report recommends using naturally durable wood species or preservative-treated wood. The report also links the reader to further technical information, such as the *Wood Handbook: Wood as an Engineering Material.*

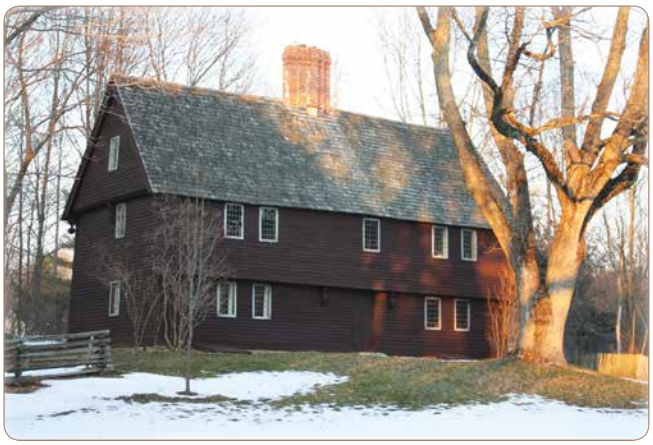
Build Green states that "Efficient use of wood as a green building material promotes healthy forests that, in turn, clean the air of greenhouse gases and purify drinking water" and "...also reduces the effects of climate change by storing carbon for as long as the home exists, so the longer the service life, the greater the benefit."

Photos in the report illustrate that wood buildings can last for centuries. Glass states that "most of the photos and examples are from the United States. If you go to

Carol Clausen, USDA FS-FPL

The Carson Mansion in Eureka, California, built in 1884, is just one example of Victorian structures constructed during the late 19th century that are still in service.

National Park Service



The Parson Capen House was built in 1683 in Topsfield, Massachusetts. Building design and construction detail are fundamental features that have contributed to over three centuries of service by this house.

What Can Be Done to Promote Long Service Life from Wood?

1. *Recognize the conditions that present a decay hazard for wood.*
2. *When new construction is planned, protect wood from moisture and decay hazard by proper design.*
3. *For above-ground uses where wood cannot be protected from excessive moisture, use decay-resistant wood, preferably preservative-treated.*
4. *Where wood in permanent structures is in contact with soil, use preservative-treated wood that is approved for ground contact.*
5. *When decay is detected, take corrective action to locate and stop the source of moisture, otherwise decay will only get worse!*
6. *Contact professionals for additional advice and assistance.*

For more on decay, see "Wood Wise", page 9.

– Continued on page 4 –

Continued from page 3 – **Build Green: Wood Can Last for Centuries**

Scandinavia or Japan, you can find wood structures that are a thousand years old. There is a history of using wood for a much longer period of time outside the United States."

But because wood is a biological material, when it is misused, it succumbs to the same biological processes that decompose dead trees in the forest: insects, rot by fungi, or both.

Glass stresses the desirability of wood as a green building material because "it is renewable, economical, versatile, and easy to work with, and it sequesters carbon over its service life." In a recent press release, USDA Secretary Vilsack urged that "wood should factor as a primary building material in green building."

In keeping with the Forest Service mission, Glass stresses that "sustainable forest management and wise utilization go hand in hand. Making good efficient use of wood is important for reducing susceptibility to forest fire and mitigating climate change."

To view the complete *Build Green: Wood Can Last for Centuries* publication please visit our website: www.fpl.fs.fed.us/products/publications/specific_pub.php?posting_id=61119&header_id=p

Tivoli Gough, USDA FS-FPL

Three zones of decay hazard in the United States.

Carol Clausen, USDA FS-FPL

A high-decay hazard can be artificially created when wood siding is repeatedly wetted by a lawn sprinkler, faucet, or vegetation that is planted too close.

U.S. Patent Issued for FPL-Developed Fiberboard Panel

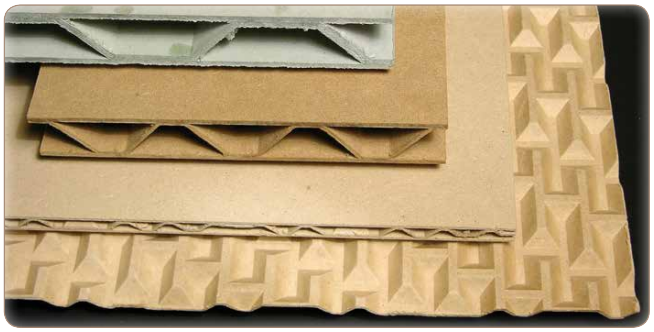
Steve Schmieding, USDA FS-FPL

John Hunt, FPL Research General Engineer

A U.S. Patent was issued on October 30, 2012, for the development of an engineered molded fiberboard panel product. This invention uses a broad spectrum of raw materials such as wood and plant fibers and recycled materials such as paper, agriculture waste, corrugated cardboard, and newspaper to form a sheet using wet process manufacturing methods. The panels are then cut in specific locations and then bonded together or laminated to produce novel architectural, furniture, or packaging applications. The result is a three-dimensional, light-weight, flexible material that is strong, durable, and environmentally friendly.

This patented invention was jointly engineered by FPL Research General Engineer John Hunt in collaboration with Noble Environmental Technologies (NET) under a Cooperative Research and Development Agreement. NET has exclusively licensed the worldwide rights for this patent and is actively commercializing it. Production engineering has started at FPL under the pilot plant authority, which is the first use of this legal authority within the Forest Service.

Steve Schmieding, USDA FS-FPL



Engineered molded fiberboard panels are light-weight, strong, durable, and environmentally friendly.

Creating Flexible Electronics Using Nanocellulose

By Rebecca Wallace, Public Affairs Specialist

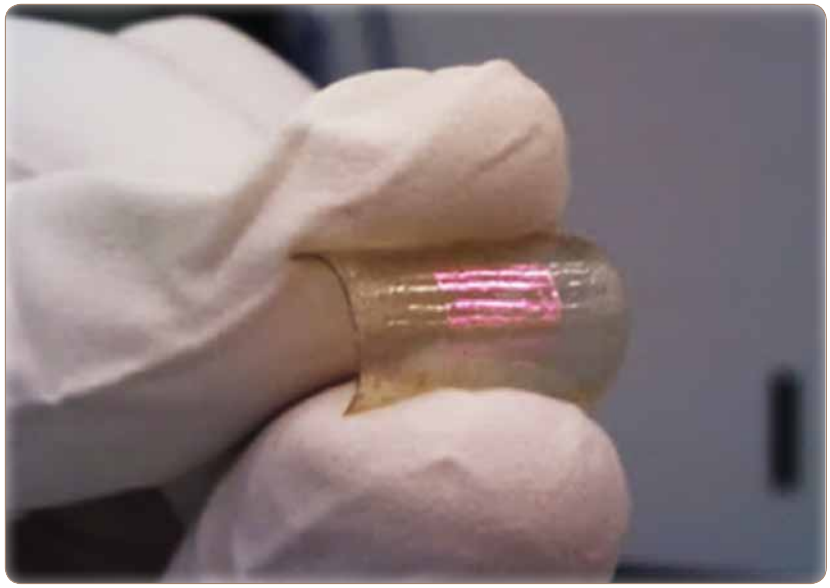
Not long ago it would have been hard to imagine throngs of people walking around with tiny computers in their pockets, able to communicate with someone around the globe instantly, just by tapping a screen. Imagining where these amazing technologies are headed next can be equally difficult.

Ron Sabo, a research materials engineer at FPL, and his partners at the University of Wisconsin (UW) have a few ideas, and they're looking to wood to make them happen—wood at the nanoscale, that is. "So far, most electronics are rigid and have glass coverings," Sabo says. "There is interest in advancing electronics by making them flexible, and we're finding nanocellulose could help make that happen."

Nanocellulose is simply wood broken down to the nanoscale. (A nanometer is approximately one-millionth the thickness of a U.S. dime.) At the nanoscale, wood is incredibly strong, lightweight, and transparent, all attributes that could enhance electronics. Flexible electronics present a wide range of possible applications, including displays, smart cards, solar cells, radio frequency tags, medical implants, and wearable computers.

Research and development have been ongoing in this arena, but some challenges have come up along the way. "The materials used to create these products must not only perform as intended," explains Sabo, "but also hold up to harsh production processes that can include drastic changes in temperature and being washed in acid."

Jung-Hun Seo, University of Wisconsin-Madison



Above and below: Nanocellulose film samples created at the Forest Products Laboratory.

Ron Sabo, USDA-FS FPL

> *"There is interest in advancing electronics by making them flexible, and we're finding nanocellulose could help make that happen."*

High-speed flexible electronics are created by building a circuit on a very thin silicone membrane and then transferring it to a flexible substrate. Most research has used plastic as the substrate, but plastics can have drawbacks; namely, the large degree to which they expand and contract with changes in temperature. Sabo, along with UW researchers Jung-Hun Seo and Zhenqiang Ma, are studying nanocellulose composites substrates as an alternative to plastic and were recently able to successfully demonstrate the technology.

"We found several benefits to using nanocellulose composites in flexible electronics," said Sabo. "When heated, cellulose does not expand as dramatically as plastics do, and it is also a renewable resource, which is important considering how prolific electronic devices have become."

According to a U.S. Environmental Protection Agency report, in the United States alone, 129 million mobile devices were disposed of in 2009, and less than 12 million of those were

– Continued on page 7 –

USDA Secretary Tom Vilsack Tours the Forest Products Laboratory

By James T. Spartz, Public Affairs Specialist

Led by Acting Director Michael Rains, the Forest Products Laboratory (FPL) recently welcomed USDA Secretary Tom Vilsack for a tour through its unique set of research facilities. Basic and applied research at FPL supports a number of USDA and Forest Service objectives, including forest management and restoration, the wise use of forest resources, job creation, and expanding economic opportunities through public–private partnerships.

Throughout his tour, Secretary Vilsack talked with Lab leadership about FPL's diverse research efforts. Project leaders used the opportunity to field questions from the Secretary and explain work ranging from wood preservation and durability to advances in "green" building strategies and technology, use of beetle-killed trees, work on historic timber bridges, and advances in nanocellulose-related materials.

Steve Schmieding, USDA FS-FPL

FPL Leadership provided a summary of recent accomplishments to Secretary Vilsack and staff.

Steve Schmieding, USDA FS-FPL

Supervisory Engineer Bob Ross discusses recent FPL research on a 2,500-year-old wooden mummy coffin.

Steve Schmieding, USDA FS-FPL

Supervisory Microbiologist Carol Clausen briefs Secretary Vilsack on FPL's Moisture Test Facility.

In FPL's unique weather-testing facility, project leader Carol Clausen described how wall assemblies can be tested for a range of harsh conditions, from heavy rain and extreme heat to high humidity and strong winds. "Developing durable building materials for green construction is a win-win situation for the Nation's forests and the American people," Clausen told Vilsack. "Utilizing beetle-killed trees creates value-added products, improves forest health, reduces the wildfire threat, and creates jobs."

In the Engineering Mechanics and Remote Sensing Laboratory, project leader Bob Ross brought out the big gun, an air-powered debris launcher used to develop protective safe rooms in hurricane- and tornado-prone areas. The Secretary watched as this unique air cannon blasted an eight-foot 2 by 4 board into a test wall of cross-laminated material at over 100 miles per hour.

> *"Utilizing beetle-killed trees creates value-added products, improves forest health, reduces the wildfire threat, and creates jobs."*

In the world-renowned nanocellulose pilot plant, project leader Alan Rudie guided the Secretary through some of FPL's most advanced equipment. Very strong and extremely versatile, nanocellulose materials can be used for a variety of applications including ballistic glass; small, powerful transistors; and heat-resistant additives for concrete, among many other uses.

Zhiyong Cai, project leader for FPL's Engineered Composite Science unit, demonstrated uses for cellulose nanofibrils

– Continued on next page –

material in biodegradable electronic parts, high-performance insulation aerogel material, and regenerated cellulose braided reinforced fabric.

"The Secretary was very interested in nanotechnology applications in forest products research," said Cai. "He was impressed with the impact that cellulose nanomaterial could bring to not only the forest products industry, but also electronics and other industries."

To view more photos of the Secretary's visit, including a slow-motion video of the hurricane-force 2 by 4 hitting a cross-laminated wall assembly, check out our website at www.fpl.fs.fed.us.

Steve Schmieding, USDA FS-FPL

Supervisory Research Chemist Alan Rudie tours Secretary Vilsack through FPL's new Nanocellulose Pilot Plant and shows nanocellulose samples.

Continued from page 1 – **Recyclable, Compostable Stamps That Last "Forever"**

FPL Research Materials Engineer John Considine conducts accelerated aging tests using a chamber and meteorological data from various locations in the United States. Considine can subject stamps to rapid cycles of heat and humidity, mimicking conditions the stamps might have to tolerate in the real world.

> *"Advancements made with the Postal Service work were of interest to the entire label industry,"*

Houtman's work, on the other hand, focuses on developing new pressure-sensitive adhesives that are environmentally friendly by looking at three key areas in the lifecycle of the product.

"We're developing adhesives that are made from renewable resources," Houtman says. "Additionally, we want the materials to be compatible with the recycling process and also biodegradable if they are thrown away."

Houtman is also developing experimental methods for determining the biodegradation rate of new materials. Currently, test samples are placed in a sludge inoculum that contains organisms that degrade, or "eat," the sample. The biodegradation rate can then be determined by measuring how much oxygen is consumed during the process.

Research and development will continue as FPL and the USPS work together to build on the successes of the past 20 years. And while stamps aren't something most of us give much thought to, perhaps next time you use one you'll at least be grateful that you don't have to lick it.

Continued from page 5 – **Flexible Electronics Using Nanocellulose**

recycled. Electronic waste is a serious environmental concern that the use of biodegradable materials such as cellulose nanofibers can help address.

Sabo's research is ongoing as the team works to refine the technology. They have improved upon their earliest work by coating the nanocellulose composite with a thin layer of epoxy on each side. The epoxy provided protection and created a smoother surface, improving the transfer of the circuit. Further research will focus on continuing to improve the composite material and testing to ensure the products developed will perform well under real-world conditions.

So are we looking at a future where televisions are high-tech wallpaper and tablet computers roll up and fit in your back pocket? Such developments are not out of reach, and wood could help us get there.

"Using cellulose nanofibers as a sustainable component for high-speed flexible electronics is extremely promising," says Sabo.

Scientist Profile: Steve Kalinosky

By James T. Spartz, Public Affairs Specialist

Steve Kalinosky is FPL's new supervisory general engineer in the Engineering Mechanics and Remote Sensing Laboratory (EMRSL). Having worked as the project engineer in Research Facilities Engineering (RFE) for eight years, Steve has worked on a variety of large-scale projects and gotten to know the FPL campus from an inside-out perspective. Steve responds to questions from NewsLine about his past work, present challenges, and future goals.

Briefly, please tell us a little about your background training and experience.

My education is in civil engineering, but I've had to learn a lot about mechanical systems, electrical engineering, plumbing design, laboratory design, and energy management for the project engineer position I just left within RFE. My experience is primarily in construction project management and facilities engineering, but I've also been a design engineer. I worked for the U.S. Navy, a private construction contractor, the Federal Highway Administration, and the U.S. Fish and Wildlife Service before coming to FPL in 2004.

What challenges and opportunities do you anticipate as supervisor of the EMRSL?

The most immediate challenge is my own learning curve. I need to learn a lot very quickly about the details of our equipment and other resources and how we execute our testing. We have a very capable group in EMRSL that will continue doing an excellent job of supporting the Lab's research work units for their materials and structural research needs while I catch up.

Another challenge I foresee is one we all face—shrinking budgets. We have a lot of expensive equipment that is costly to maintain. We need to be creative in how we fund replacement, calibration, and maintenance of that equipment because we don't have a budget large enough to fund those items on a regular, recurring basis. That could mean new collaboration with private industry or other government agencies to conduct their materials testing, changing the way we charge our cooperators for those services, a combination of the two, or some other model.

You oversaw much of the logistical effort in constructing the new Centennial Research Facility at FPL. How does this intricate knowledge benefit you now?

Rebecca Wallace, USDA FS-FPL

Steve Kalinosky, heads up FPL's Engineering Mechanics and Remote Sensing Laboratory.

I think the piece of my involvement that will benefit me in EMRSL is in knowing the exact parameters to which the space was constructed and having watched it being built. For example, we routinely tell tour groups that the strong floor is constructed with 336 tie-downs embedded in the 3-foot thick concrete, with a metal frame and layers of rebar in both directions at the top and bottom of the slab. But, I saw this being constructed and I have the pictures. I know exactly where that steel is, how big it is, and that everything was installed per the exacting standards we established up front.

What are likely trajectories for future work in the EMRSL?

EMRSL does not determine the program of work. We collaborate with and support the Research Work Units in executing the program they establish, so I can't really say where EMRSL is heading. Certainly there will be changes in the technology we use to perform our work and we will embrace those technologies if they suit our purposes. There is also the possibility of executing materials research work with other government agencies or for private organizations using a private–public partnership model.

What interests you about the EMRSL and why did you pursue the Group Leader position?

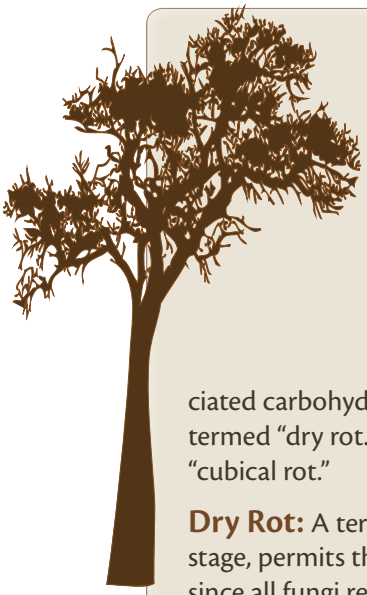
I've just finished eight years of running at an extremely quick pace, manipulating significant budgets to accomplish some very large, high-visibility projects. Although there is still a lot to accomplish, budgets are down and the large projects are drying up. There was still a lot of work for me to do in RFE. All the up-front planning for projects, reporting to the Washington Office, energy management, and

other tasks I performed must still be done, and I would have had plenty to occupy my time. But, the EMRSL job presents me an opportunity to learn something new and replace that big-project intensity to which I'd become accustomed. I was also attracted to this opportunity to work more directly in support of the scientific and engineering discovery conducted at the Lab. In my roles as a construction project manager, facilities engineer, and designer I've often worked with buildings codes and material standards. I'm excited about the direct impact we have on those construction industry tools, as EMRSL executes mechanical and materials testing of wood products in support of the FPL scientists.

Steve Schmieding, USDA FS-FPL

FPL employees set up an experiment on the strong floor in the Engineering Mechanics and Remote Sensing Laboratory.

Wood Wise—*Terms from the World of Wood*



Under proper conditions, wood will give centuries of service. However, under conditions that permit the development of wood-degrading organisms, protection must be provided during processing, merchandising, and use. The organisms that can degrade wood are principally fungi, insects, bacteria, and marine boreres. This *Wood Wise* series is dedicated specifically to decay, the decomposition of wood substances by fungi.

Advanced (Typical) Decay: The older stage of decay in which the destruction is readily recognized because the wood has become punky, soft and spongy, stringy, ringshaked, pitted, or crumbly. Decided discoloration or bleaching of the rotted wood is often apparent.

Brown Rot: In wood, any decay in which the attack concentrates on the cellulose and associated carbohydrates rather than on the lignin, producing a light to dark brown friable residue—hence loosely termed "dry rot." An advanced stage where the wood splits along rectangular planes, in shrinking, is termed "cubical rot."

Dry Rot: A term loosely applied to any dry, crumbly rot but especially to that which, when in an advanced stage, permits the wood to be crushed easily to a dry powder. The term is actually a misnomer for any decay, since all fungi require considerable moisture for growth.

Incipient Decay: The early stage of decay that has not proceeded far enough to soften or otherwise perceptibly impair the hardness of the wood. It is usually accompanied by a slight discoloration or bleaching of the wood.

Heart Rot: Any rot characteristically confined to the heartwood. It generally originates in the living tree.

Pocket Rot: Advanced decay that appears in the form of a hole or pocket, usually surrounded by apparently sound wood.

Soft Rot: A special type of decay developing under very wet conditions (as in cooling towers and boat timbers) in the outer wood layers, caused by cellulose-destroying microfungi that attack the secondary cell walls and not the intercellular layer.

White-Rot: In wood, any decay or rot attacking both the cellulose and the lignin, producing a generally whitish residue that may be spongy or stringy rot, or occur as pocket rot.

From the Wood Handbook: Wood as an Engineering Material, FPL–GTR–190
Available: http://www.fpl.fs.fed.us/woodhandbook

The Nanocellulose Pilot Plant—A "Game Changer" in the News

By James T. Spartz, Public Affairs Specialist

FPL's new nanocellulose pilot plant has garnered significant notice in the local and international press since its summer opening. A live report by Madison's NBC affiliate claimed the pilot plant "a game changer" at the facility's grand opening in mid-July and media interest picked up steadily from there. A popular story on the USDA Blog in early August 2012 highlighted the $1.7 million pilot plant as the first of its kind in the United States, situating FPL as the leading producer of domestic, renewable, forest-based nanomaterials.

Steve Schmieding, USDA FS-FPL

Left: FPL's new nanocellulose pilot plant.

Nanotechnology is a booming field of science working with materials ranging in size from 1 to 100 nanometers in at least one dimension. A nanometer is roughly one-millionth the thickness of an American dime or about 80,000 times thinner than a typical human hair. Materials at this minute scale have unique properties not found at the "human" scale. The FPL pilot plant can produce semicommercial-scale batches of cellulose nanofibrils and cellulose nanocrystals from renewable wood-based sources.

Reaching roughly 40 million listeners worldwide in late August, the British Broadcasting Corporation (BBC) featured an interview with FPL Supervisory Research Chemist Alan Rudie. After an overview by Rudie the BBC reporter asked, "Is there nothing nanocellulose can't do?" The future of nanocellulose is, indeed, wide open.

Cellulosic nanomaterials have unique photonic and piezoelectric properties, are stronger than Kevlar™ fiber, and

The nanocellulose pilot plant has garnered significant notice in the local and international press since its summer opening.

provide high strength and high stiffness with low weight. Potential applications for these nanomaterials include use in structural components, building materials and composites, high-strength paper and packaging, and biodegradable electronics. These attributes have attracted the interest of the Department of Defense for use in lightweight armor and ballistic glass as well as companies in the automotive, aerospace, consumer products, electronics, and medical device industries. All these industries see massive economic potential for these innovative wood-derived materials.

New Scientist magazine featured FPL and nanocrystalline cellulose, or what it calls "the hottest new material in town," in its August issue. Aiming to contextualize science and social issues, the *New Scientist* piece "Why Wood Pulp is the World's New Wonder Material," helped to introduce the FPL's nanocellulose pilot plant to an audience of international business decision-makers and technology aficionados.

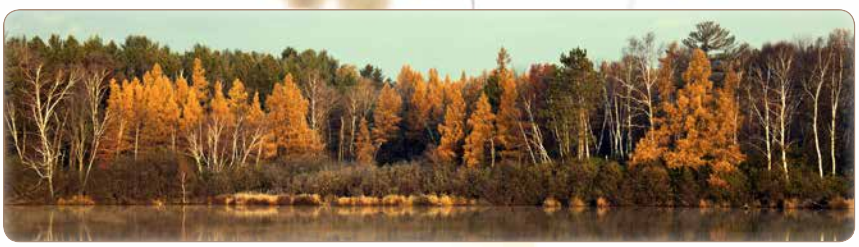
In mid-September, an Australian radio program focused on rural issues, ABC Rural's The Country Hour, also interviewed Alan Rudie about the new pilot plant. The Australian ABC is the Down Under equivalent of National Public Radio in the United States. Though The Country Hour reported that nanocellulose "is simply wood that has been carefully smashed to pieces, and then reformed into neatly woven "nano scale fibers," this description is only partially true.

Cellulose nanofibril (CNF) materials are produced using mechanical means, a highly refined version of being "smashed to pieces." CNFs are also known as nanfibrillated cellulose. The other main type of cellulosic nanomaterials being produced at the FPL, cellulose nanocrystals (CNC), are rod-like or whisker-shaped structures produced through chemical means such as acid hydrolysis.

The FPL nanocellulose pilot plant has made a splash across the internet on industry and government sites as well as technology and business sites like Slashdot, Gizmag, Teru Talk, and Bloomberg Businessweek. Regionally, around FPL's home-base in Madison, Wisconsin, the Milwaukee Journal Sentinel, Wisconsin State Journal, Madison's In Business magazine, and the Wisconsin Technology Council have also featured articles on this world-renowned nanocellulose pilot plant.

Wood You Believe?

http://www.shutterstock.com



- Have you raked leaves this fall season? A mature, healthy tree can have around 200,000 leaves! During 60 years of life, such a tree would grow and shed around 3,600 pounds of leaves, returning about 70% of their nutrients to the soil.

  Source: http://www.wisconsincountyforests.com/

- Less daylight and cool fall temperatures result in less production of green pigment (chlorophyll). Consequently, other leaf pigments like yellow (xanthophyll), orange (carotene), and red (anthocyanin) become more prominent. The intensity of color in a leaf depends on the amount of sugar stored in the leaf and the amount of autumn sunlight it gets. Brown pigment (tannin) remains after all other pigments have disappeared.

  Source: http://www.wisconsincountyforests.com/

USDA Newsline

Published quarterly by
USDA Forest Service
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53726-2398
www.fpl.fs.fed.us

FIRST CLASS PRSRT
U.S. POSTAGE PAID
MADISON, WI
PERMIT NO. 168

RETURN SERVICE
REQUESTED

In this issue

Newsline

Recyclable, Compostable Stamps that Last "Forever": FPL and the U.S. Postal Service Build on Their 20-Year Partnership 1
Upcoming Events 2
Build Green: Wood Can Last for Centuries 3
U.S. Patent Issued for FPL-Developed Fiberboard Panel 4
Creating Flexible Electronics Using Nanocellulose 5
USDA Secretary Tom Vilsack Tours the Forest Products Laboratory 6
Scientist Profile: Steve Kalinosky 8
Wood Wise—Terms from the World of Wood 9
The Nanocellulose Pilot Plant—A "Game Changer" in the News 10
Wood You Believe? 11