



Biological Systems Engineering

Engineering Update Summer 2008

BSE Named a University Exemplary Department!

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in Seitz Hall*

Engineering Update



Biological Systems Engineering
June 2008

To: ANR Agents, Extension District Directors, and Extension Program Directors

Dear Co-Workers: Engineering Update is a joint effort of Biological Systems Engineering and other interested agents. Subject matter areas include timely information on water quality, natural resource management, TMDL, air emissions, animal waste management, machinery management, precision farming, application technology, farm safety, energy, engineering education, and technology. Please use this information in your on-going Extension programs and circulate to all Extension staff. Engineering Update is electronically accessible via the VCE Intranet World Wide Web site (*at <http://www.ext.vt.edu/vce/anr/bse/index.html>*).



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Produced by Agriculture and Extension Communications, Virginia Tech

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Virginia Tech Scientists to Study Stream Restoration

Students and faculty members in BSE are developing methods to improve streams nationwide and train the next generation of environmental professionals while they work to reverse the effects of degradation on Stroubles Creek, a small "headwater" stream that flows through Blacksburg.

Local citizens, the Town of Blacksburg, and VT researchers developed a watershed management plan for Stroubles Creek after routine environmental testing showed that the stream was in crisis.

"Monitoring by the Virginia Department of Environmental Quality showed that the benthic macroinvertebrates — the insects that live on the bottom of a stream and are good indicators of water quality — were suffering from water pollution," says Theresa "Tess" Wynn, assistant professor and a lead faculty member in VT's Stream and Wetland Ecological Engineering Team. "Because certain macroinvertebrates are particularly sensitive to pollution, you know you have a problem when those insects are not present."

According to the U.S. Environmental Protection Agency, more than 40 percent of assessed waters in the United States are impaired, mostly from non-point source pollution. Urbanization and agricultural production are contributing factors, both throughout the country and for Stroubles Creek.

BSE faculty conducted a study on Stroubles Creek to diagnose the source of its water-quality issues. His study, which determined that excess sediment from Blacksburg construction and the stream channel itself polluted the stream, produced a total maximum daily load (TMDL) for Stroubles Creek. That is, it specified the maximum amount of sediment the stream can tolerate without

violating state water-quality standards. Gene Yagow BSE research scientist led this study. Although this stream is fairly small, repairing it may have a big impact. Because streams flow into rivers and other large waterways, improving the small streams also improves entire watersheds. In fact, small "headwater" streams such as Stroubles Creek account for roughly 80 percent of the total stream length within a typical watershed.

Economic factors also supplement the environmental motives for this research. A 2005 study on U.S. stream restoration practices revealed that since the 1990s the country has spent an average of \$1 billion each year on stream restoration. Most of these restoration efforts involve expensive form-based design that frequently requires the entire stream channel be reshaped and held in place by large stone structures.



Multifaceted approach turns Stroubles Creek into an outdoor laboratory with the help of W. Cully Hession, BSE associate professor, and their students. Wynn is using a two-year grant from the Virginia Department of Conservation and Recreation to split a 1.3-mile section of the main channel and a tributary into three sections to examine the effectiveness of common approaches to stream restoration.

Each segment of the stream will undergo a different type of restoration: In the first segment, the researchers will prevent cattle from trampling the stream

bank, a major source of erosion if left unchecked over a long period of time. Researchers want to better understand the effect of livestock access on stream bank stability and stream health, as well as the benefits of simply removing livestock access to the stream channel.

Researchers are reshaping the stream bank and planting woody vegetation in the second segment. Hession has spent more than a decade studying the effects of trees on stream channels and has found that trees, unlike grasses, are ideal for healthy streams in the eastern United States. "Streamside forests are important for stream health," adds Hession. "Research shows that trees along streams provide many benefits, such as shading, food, improved habitat, and increased bank strength."

The third segment will undergo natural channel design, also called form-based design. The most expensive of the three approaches, this involves rebuilding the stream channel to re-create a functional floodplain and reduce shear stress on the stream bank during flooding.

Wynn and Hession will study changes in the channel form and health that result from the three stream restoration practices, with the goal of determining cost-effective ways of improving unhealthy streams. This three-pronged effort aims to reduce sediment, nitrogen, phosphorus, and bacteria from the Stroubles Creek Basin and to turn the stream into an outdoor laboratory and classroom.

Wynn and Hession can bring their students to learn about stream channel morphology and health but they also invite outside researchers and stakeholders to learn about stream restoration practices and their effectiveness.

Spotlight on Impact - (VT News 1-28-08)
http://www.vt.edu/spotlight/impact/2008-01-28_stream/2008-01-28_stream.html

Stream and Wetland Ecological Engineering Team: <http://twosweet.bse.vt.edu/>

New TMDL Newsletter Online

A new issue of the TMDL Newsletter is available online and includes articles on bacterial loading from wildlife populations, a TMDL planning, implementation and policy review article, workshops in South America delivered by a Center member, and information on an upcoming American Ecological Engineering Society annual meeting in June. In addition, an ongoing segment in the newsletter continues to detail recent publications, presentations, and TMDL study updates.

Access at: http://www.tmdl.bse.vt.edu/uploads/File/newsletters/At_the_Center_Volume_4_Issue_2.pdf

New TMDL Publications:
Benham, B.L, R.W. Zeckoski, and G. Yagow. 2008. Lessons Learned from TMDL Implementation Case Studies. *Water Practice*. 2(1).

Hall, K.M., R.W. Zeckoski, K.M. Brannan, and B.L. Benham. 2008. FTABLE Generation Method Effects on Instream Fecal Bacteria Concentrations Simulated with HSPF. *JAWRA*. 44(2):489-495.

Jesiek, J.B, B.L. Benham, D.J. Bosch, and K. Stephenson. 2007. Approaches to TMDL Planning and Implementation policy tools for implementation to

achieve water quality standards. *CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources*. 2(084).

Mishra, A., B.L. Benham, and S. Mostaghimi. 2008. Bacterial Transport from Agricultural Lands Fertilized with Animal Manure. *Water Air Soil Pollut.* 189:127-134.



Yagow, G. 2008. A Review of Channel Erosion Modeling Techniques for Watershed Applications. Presented at the 2008 Virginia Lakes and Watersheds Conference, March 9 -11, 2008. Richmond, Virginia.

The Center for TMDL and Watershed Studies:
<http://www.tmdl.bse.vt.edu/>

New Biomass Logistics Publications

1. Raula, P.R., R.D. Grisso and J.S. Cundiff. 2008. Cotton logistics as a model for a biomass transportation system. *Biomass & Bioenergy* 32(4):314-325 <http://dx.doi.org/10.1016/j.biombioe.2007.10.016>
2. Cundiff, J.S. and R.D. Grisso. 2008. Containerized handling to minimize hauling cost of herbaceous biomass. *Biomass & Bioenergy* 32(4): 308-313 <http://dx.doi.org/10.1016/j.biombioe.2007.10.009>
3. Raula, P.R., R.D. Grisso, and J.C. Cundiff. 2008. Comparison between two policy strategies for scheduling trucks in a biomass logistic system. *Bioresour. Technol.* 99(13):5710-5721 <http://dx.doi.org/10.1016/j.biortech.2007.10.044>

Dr. Wen's Byproducts Utilization

The US has been experiencing historic highs in energy prices and is now showing the desire to use greener fuels. Biodiesel as an alternative fuel has attracted increasing attention in recent years. While biodiesel production skyrockets, the market is being flooded with crude glycerol, a major byproduct from the biodiesel production process. Because this glycerol is expensive to purify for use in food, pharmaceutical, or cosmetics industries, biodiesel producers must seek alternative methods for its disposal.

Dr. Zhiyou Wen from BSE is working on converting this byproduct into high value products - omega-3 fats. While in general fats are regarded as a food group that most people try to avoid, some fats we simply cannot live without. Among them are the omega-3 fatty acids, including eicosapentaenic acid (EPA) and docosahexanoic acid (DHA).

Omega-3 fatty acids are commonly found in wild coldwater fish such

as cod, salmon, herring, mackerel, sturgeon, anchovies, and tuna with about 1.5 ounces of fish containing 1 gram of omega-3s. However, the typical American diet is often deficient in seafood and consequently even more deficient and disproportionately lacking in omega-3s. An alternative to eating fish is to take fish oil capsules that are widely available on grocery shelves. However, most people do not like the peculiar taste and fishy flavor of the fish oil. In addition to the omega-3s, though, fish oil also contains some unwanted saturated fatty acids which will offset the beneficial effects of omega-3s when

people eat the fish oil capsules.

Dr. Wen is currently developing a novel fermentation process using microalgae to produce these two important omega-3 fats. Currently, the application of using algae as omega-3 sources is limited by the high algae product cost. The algae used in Dr. Wen's work is capable of using glycerol for their growth, the algal growth was even better when biodiesel-derived crude glycerol was fed to the algae than when growing in glucose. In addition, the impurities contained in the crude glycerol, methanol and soap, may also be beneficial to the algae growth. This will not only avoid the complex the crude glycerol purification process, but also further increased the omega-3 yield. Wen's work has been supported by Virginia Agricultural Council, US Poultry and Egg Association, and is currently supported by Fats and Proteins Research Foundation, and Virginia Sea Grant.



<http://filebox.vt.edu/users/wenz/3-Research/Res%20-%20index.htm>

Private Water Supply Protection: Revitalizing the Virginia Household Water Quality Program

Ground water quality is a concern for all residents using private water supplies. The majority of households in 60 of Virginia's 95 counties rely on private water supply systems. In 52 counties, the number of households using private wells is increasing faster than the number of households connecting to public water supply systems. Unlike homes served by public water, private system owners are responsible for all aspects of their water systems, including routine maintenance, regular water testing, interpretation of test results, and addressing water quality or quantity problems. A lack of knowledge about private water supply management and water quality issues may lead to system neglect and the consumption of poor quality water.

Initially launched in 1989, the VCE Virginia Household Water Quality Program (VAHWQP) consisted of county-based household water sampling clinics, which included confidential water sample analysis followed by a meeting where citizens learned about proper water supply system care and maintenance, how to interpret

their sample analysis report, and, about potential water treatment options, if needed.

The VAHWQP has been dormant since 2003 due to budget reductions. A competitive grant awarded by the U.S. Department of Agriculture's Cooperative Research Education and Extension Service (USDA-CSREES) to Brian Benham is being used to revitalize the VAHWQP and to expand it to include the establishment of the Virginia Master Well Owner Network (VAMWON). Additional support is also being provided by VCE.

The VAMWON will be patterned after a similar, very successful master well owner volunteer network established in Pennsylvania. The VAMWON will consist of Virginia Cooperative Extension (VCE) agents and lay volunteers trained in the proper design, management, and maintenance of private water supply systems. As part of the VAHWQP revitalization process, VAMWON trained VCE agents will organize and conduct county-based drinking water clinics and serve as a

local resource for clientele with household water quality concerns. Trained VAMWON volunteers will reach out to private water system owners in a variety of ways, ranging from speaking to local community groups to peer-to-peer education of friends and neighbors. The VAMWON will strengthen the VAHWQP, enabling trained agents and volunteers to work together to inform Virginians dependent on private water systems (springs, wells, and cisterns) about water testing, water treatment, and system maintenance. Resources that are being created and updated to support the VAHWQP include revised VCE water quality publications, a website, and newsletter.

Erin James joined the BSE in March of 2008 (see "New BSE Faces") and will serve as VAHWQP coordinator.



Project outcomes specified in the USDA grant include conducting at least 18 county drinking water clinics over the three-year

(Continued on page 6)

Private Water Supply Protection: Revitalizing the Virginia Household Water Quality Program

(Continued from page 5)

grant period, which will involve collection and analysis of more than 5,400 household water samples and training of at least 70 VAMWON VCE agents and 240 screened VAMWON

volunteers. Creation of the VAMWON will enhance VCE's capacity to offer education and outreach to private water system owners in the future. The USDA-funded project includes a commitment to reach rural citizens characterized as members of underserved communities, such as impoverished, minority, disabled, and/or elderly persons.

Virginia Household Water Quality Program 2008 County-based Drinking Water Clinics		
County	Kickoff Meeting and Sample Collection	Sample Analysis Interpretation Meeting
Caroline	July	August
King George	July	August
Culpeper	September	November
Fauquier	September	November
Dinwiddie	November	December
Prince George	November	December

Six county-based drinking water clinics are scheduled for 2008 (see table above).

Scheduling for 2009 clinics will begin in October 2008.

A two-day Virginia Master Well Owner Network training for VCE agents will be held in October or November 2008 in the Charlottesville area.

Agents will be notified of the

specific date and location via VCE listserves. Registration will begin in July 2008.

For additional information about the Virginia Household Water Quality Program or the Virginia Master Well Owner Network, please contact Erin James at ejames@vt.edu or 540-231-9058.

NASS 2006 Farm & Ranch Safety Survey

The National Agricultural Statistics Service (NASS) released its 2006 survey of farm and ranch safety on January 17, 2008. Results were based on a random telephone survey of 25,000 farm operations, and it was conducted by NASS for the National Institute of Occupational Safety and Health (NIOSH). The study covered the period 9/2005-9/2006.

The study estimated that 60% of

tractors currently in use have roll-over protective structures (ROPS). The percentage varied by region from 65% in the South to 51% in the Northeast. It was estimated that there were 6700 roll-overs during the study period. Tractors without ROPS accounted for a disproportionate number, 63%, of the rollovers.

In other findings, high percentages of those surveyed indicated that shields were in place on implements, including balers and mowers. About 40,000 operators had manure pits, and a majority of operators had not

entered the pit during the study year. Only 35% of pits were equipped with power ventilation fans.

Other topics covered by the survey included ATVs, farm structures, underground power lines, augers and personal protective equipment.

<http://www.usda.gov/nass/PUBS/TODAYRPT/fmrhss08.pdf>



Automated Boom Section Control Saves

As applicators begin to think ways to improve their spraying methods, a new precision agriculture tool can help them get the most from inputs and save money on wasted seed and chemicals.

Automated section control is a global positioning system driven machine that can be added to farm machinery. It works with the farm implement's GPS and onboard computer to record field applications in the form of a real-time map.

If the tractor or sprayer goes over an area that has already

received an application, the device detects the overlap and shuts off individual sections or nozzles of the implement to prevent the unnecessary usage of additional seed or chemicals.

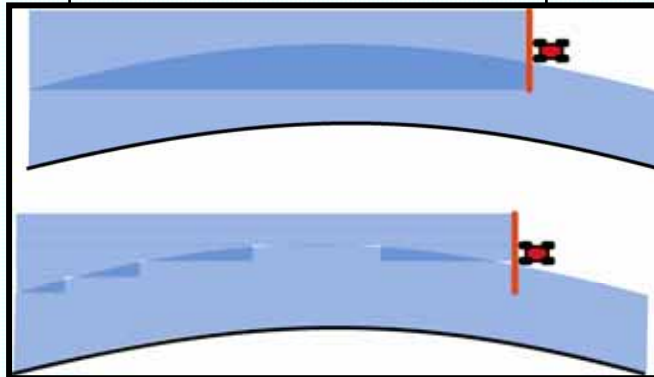
Spraying odd shaped fields, a lot of waterways, or obstructions in your

fields, the boom control can have to be a tremendous benefit.

Since an automated section control device requires a capital investment, applicators should weigh the cost of the machine against their potential savings on inputs before purchasing the equipment.

One of the farmers using the technology stated that he is probably looking at about a 15% savings in inputs just because of using this device.

(by R. Grisso)



Pointers for Purchasing Used Ag Equipment

"Not Everything Gets Better with Age" is the title of a recent article in Agricultural Safety and Health News from Penn State, which offers some good advice about what to look out for when purchasing used ag equipment. "When is a Bargain Not a Bargain" might have been another good title for this information.

While purchasing used equipment can save money, this equipment frequently has defects that will endanger the new owners, such as lack of signage, signals, seatbelts, and guards, among others. Other hazards are lurking beneath the surface, because even if all the parts are there, improper maintenance can make them weak and ineffective at a critical moment.

Read the complete story and build your own checklist for used equipment: <http://www.agsafety.psu.edu/newsletters/marapr08.pdf>

Other Resources:

<http://edis.ifas.ufl.edu/pdf/files/AE/AE18200.pdf>

<http://extension.usu.edu/files/publications/factsheet/FM-02.pdf>
<http://homestead.org/neilshelton/usedtractor/HowtoBuyaVeryUsedTractor.htm>
<http://www.extension.iastate.edu/AgDM/crops/pdf/a3-22.pdf>

(Adapted by R. Grisso)



College of Agricultural Sciences • Cooperative Extension

Agricultural Safety and Health News

Department of Agricultural and Biological Engineering Volume 19, Number 2 March/April 2008

Not Everything Gets Better with Age

Thinking about some brand new equipment for the farm? Or just new to you? A used tractor or other equipment is often a sensible route but not if it puts the operators at risk.

A University of Florida Safety News and Notes article <http://www.agsafety.psu.edu/snn/snn-02-02.htm> pointed out that in one research project in New York State that "over 97% of tractors and 85% of implements offered for sale through auctions had defects, lacking such essential safety equipment as slow-moving vehicle (SMV) emblems, ROPS, seat belts, lights, PTO master shields, starter solenoid covers, or steering components." Here are some issues to consider and suggestions if you are contemplating purchasing used equipment.

Dealers are an ideal place to begin, as they want to make sure that their customers

have important safety features such as a Roll-Over Protective Structure (ROPS) and shields. Many tractors manufactured in the 1970s can—and should—be retrofitted with a ROPS.

However, what about that beauty along the road with the "For Sale" sign or the tractor at the auction or the one being sold by the friend of a friend? Now you have your work cut out for you to make sure you are getting your money's worth in functioning, safe equipment. It might be immediately clear that the newly painted tractor with the tricycle tires is an injury incident waiting to happen but there might be less obvious issues with a not-so-old machine as well.

How a machine fairs the normal wear and tear of farm work is a consequence of the diligence of the previous owner(s) and operator(s). Lack of maintenance and not replacing or



Fuel Tank Security Tips

Thieves are turning their attention to aboveground petroleum tanks. With the price of gas and diesel fuel rising, some people are more apt to help themselves to your fuel tanks. When that happens, you're lucky if all you lose is the gas or diesel.

Sometimes thieves leave the power to the tank on, running valuable fuel onto the ground and contaminating soil. A new publication, "*Aboveground Petroleum Tanks*," is available in print and online versions. The publication

can help farmers select the correct tank for a farm, handle fuel spills and learn how to safeguard fuel tanks, among other topics.

By installing lights around the tank and installing locks on the tank, one can increase the security measures. At nighttime, turn the electricity off to the tank. Electrical circuits can be switched off from inside your barn or farm building. Farmers are encouraged to put tanks in locations that help protect groundwater in the event of a spill, and

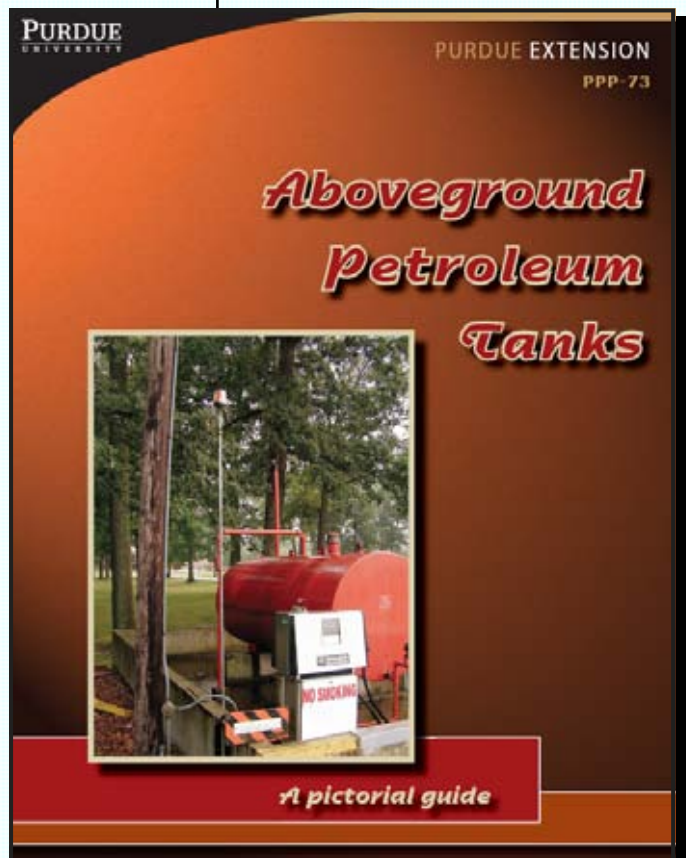
to prepare for an emergency before it happens. Most of

the insurance policies will not cover cleaning up contamination. So if fuel spilled, the cleanup comes out of the owner's pocket.

More than 230 photos in the 110-page booklet show examples of proper and improper fuel-tank practices. Known as Purdue Extension Publication PPP-73, it can be ordered for \$1 plus shipping and handling by calling the toll-free Purdue Extension hotline at 888-398-4636 or by emailing media.order@purdue.edu.

It also can be downloaded free at www.btny.purdue.edu/Pubs/PPP/PPP-73.pdf

(adapted by R. Grisso)



www.btny.purdue.edu/Pubs/PPP/PPP-73.pdf

Rural Road Safety is Everyone's Concern

As farmers across the country gear up, many of them will be traveling on rural roads and highways, often with large pieces of machinery. As the rural landscape shifts to include more non-farm drivers, it often becomes risky to travel with farm equipment. Impatient drivers, narrow roadways, over-sized equipment, and slower speeds often contribute to the risk.

A recent study about crashes between farm equipment and other vehicles was published in the *Journal of Rural Health* entitled, "Characteristics of crashes with farm equipment that increase potential for injury." The study's crash database identifies farm equipment. Most state crash reporting systems don't make this distinction.

The results show that crash fatality and injury rates are higher on rural roadways than other roadway type. Rural fatality rates are more than twice as high as urban rates for wide variety of injuries, including motor vehicle crashes.

Crash rate fatalities in the most rural counties are almost double the rate in urban counties, and they are more frequent, more severe, and more likely to result in death than urban crashes.

According to the article, Iowa has the highest rate of farm equipment crashes reported on public roads in the United States, with a rate of 10.7 crashes per 100,000 population per year. North Carolina has the second highest rate of 3.9 per 100,000 per year. Research on the fatality rates in crashes with farm vehicles/equipment indicates that 2

in every 100 crashes involving tractors and 1 in every 100 crashes involving other farm equipment leads to a fatality.

The rural roads themselves often contribute to the increased crashes and severe injuries. Paved rural roads typically have two narrow lanes. Gravel roadways do not necessarily have two fully functional lanes under all weather conditions and have even fewer safety features than paved rural roads.

Certain types of crashes, such as those involving motor vehicle collisions with farm vehicles and equipment, are unique to rural environments. These crashes most frequently involve slow-moving tractors.

The study included fatal, major, and minor driver injuries. Crashes that involved injuries only to passengers were excluded, and passenger injuries were not included. Restricting the data to only crashes resulting in at least 1 driver injury resulted in 825 crashes with 1,700 drivers.

Study results found that non-farm vehicle drivers were more than 5 times as

likely to be injured than the farm vehicle/equipment drivers. Crash characteristics increased the odds of injury for non-farm drivers included speeding, passing the farm vehicle, driving on a county road, front-impact collisions, and darkness, but ejection was the strongest injury predictor for the farm vehicle driver.

These findings suggest that farm vehicle/equipment crash prevention should be a priority for all rural road users.

ABSTRACT: *Context: Crash fatality and injury rates are higher on rural roadways than other roadway types. Although slow-moving farm vehicles and equipment are risk factors on rural roads, little is known about the characteristics of crashes with farm vehicles/equipment. Purpose: To describe crashes and injuries for the drivers of farm vehicles/equipment and non-farm vehicles involved in an injury crash. Passengers are not included in this analysis. Methods: Injury crashes were included that involved a farm vehicle/equipment and at least one non-farm vehicle reported in Iowa Department of Transportation crash data from 1995 to 2004. Odds ratios were calculated through logistic regression to identify increased odds for injury among drivers of non-farm vehicles and farm vehicles/equipment. We examined frequently occurring crash characteristics to identify crash scenarios leading to the highest odds for injury. Findings: Non-farm vehicle drivers were 5.23 times more likely to be injured than farm vehicle/equipment drivers (95% CI = 4.12–6.46). The absence of restraint use was a significant predictor of injury for both farm vehicle/equipment drivers (OR = 2.85; 95% CI = 1.14–7.13) and non-farm vehicle drivers (OR = 2.53; 95% CI = 1.54–4.15). Crash characteristics increasing the odds of injury for non-farm vehicle drivers included speeding, passing the farm vehicle/equipment, driving on a county road, having a frontal impact collision, and crashing in darkness. Ejection was the strongest predictor of injury for the farm vehicle/equipment driver. Conclusion: Non-farm vehicle drivers were much more likely to be injured than farm vehicle/equipment drivers, suggesting that farm vehicle/equipment crash prevention should be a priority for all rural road users. Prevention strategies that reduce motor vehicle speed, assist in safe passing, increase seat belt use, and increase conspicuousness of the farm vehicle/equipment are suggested.*

Anhydrous ammonia and propane cylinders

SAFETY ALERT

Consult the law of their individual jurisdictions for codes, standards and legal requirements applicable to them.

Caution! The brass valve in a propane cylinder will be damaged if it comes in contact with anhydrous ammonia. This deterioration will lead to cracking of the valve body or its components and can ultimately result in a violent, unexpected expulsion of the valve from the cylinder, causing personal injury or death.

Background

It has been observed that propane cylinders are being used in the manufacturing of Methamphetamines. This drug is commonly referred to as 'crank'. Manufacturers of this illegal substance are using propane cylinders for the storage and the use of anhydrous ammonia. These cylinders have been found in many states at cylinder exchange and refilling locations as well as in hotel rooms and mobile laboratories, where the manufacturing of

this illegal substance takes place.

As observed in the illustrations, a blue-green stain on any brass portion of a service valve is evidence that it may have been in contact with anhydrous ammonia. The pungent odor of ammonia on or near the cylinder is also an indication. If you suspect that a propane cylinder contains or has contained anhydrous ammonia, exercise extreme caution and restrict access to the area.



It can be dangerous to move the cylinder due to the unknown integrity of the cylinder's service valve. If you determine that it must be moved, keep in mind that hazards due to valve expulsion can be reduced by pointing the end of the container in which the valve is placed, away from your-

self and others and towards the most safe direction.

Immediately contact your Fire Department, Hazardous Materials Emergency Response Unit or the nearest office of the United States Department of Justice's Drug Enforcement Administration (DEA) for information on properly disposing of the cylinder. If these respondents are not sure what to do, for assistance call 1-800-728-2482, which is the contact number for an independent hazardous materials information resource.



Source: National Propane Gas Association <http://www.npga.org/i4a/pages/index.cfm?pageid=529>

PLANS

In response to numerous requests, building and facility plans are now available for download from the Virginia Cooperative Extension (VCE) Intranet. Plans are categorized under five main categories: Forage Storage and Feeding, Grain Handling and Feeding, Beef, Horse, and Sheep. You will need Adobe Acrobat to download these files. For the building and facility plans, as well as additional resources, please visit: <http://www.ext.vt.edu/vce/anr/bse/index.html>

Who discovered Gyre Island?

Hint: It wasn't Capt. James Cook

We're still not sure how Cook missed it. They say it's about twice the size of Texas, and just about half way between Hawaii and California. Captain Cook probably sailed right through this very area way back in 1779. Of course, back then there wasn't much to look at, you see, this is a new island – and, well it's not even really that much of an island. In fact, the question really isn't so much about who discovered it as it is who made it. You see, Gyre Island is made of plastic. It's plastic that you, me, and the rest of the world threw away, and as it turns out "away" looks a lot like Gyre Island.

Gyre Island is a swirling mass of plastic trash. A gyre is actually a large spinning region of water within our oceans. These vortexes are formed by air rising and moving across earth's surface from the warm equator toward the cooler poles. They estimate that about 80% of the plastic caught in this vortex was originally "thrown away" on land, and the remainder was disposed of at sea. This swirling plastic blob is comprised of old bottles, fishing lines, bags and other discarded plastics. However, since plastics photodegrade, a large percentage of this soup is made of very small plastic particles. Sea creatures often mistake these small plastic particles for phytoplankton, and ingest the plastic. Worse yet, these small plastic particles often become coated in persistent organic pollutants (e.g. DDT, PCBs, etc.) turning this into a toxic soup that has entered our food chain.

The U.S. EPA indicates that only about 4% of all plastics were recycled in 2003. Officials in the

recycling industry say that every bottle faces a moment of crisis after that last sip is swallowed. Will it be recycled? Thrown in the trash? Or, thrown out a window? Reused or sent away to the gyre?

With oil prices soaring well over \$130 a barrel, it makes economic sense to recycle these petroleum based plastics. Do you drink bottled water? That

empty bottle is worth about three times what it was just two years ago (currently at about 54¢ a pound). In addition to the environmental reasons to recycle, rising prices are providing an additional incentive.

Yet only 4% of plastics are recycled. The other 96% is sent "away", some goes to Gyre Island. What if some of these plastics had been built with a self-

destruct button in them? Where, once they'd served their initial purpose – BOOM, they actually went away and not just to somewhere else. Dr. Justin Barone is working on developing a new generation of bioplastics that are derived from naturally occurring biopolymers. At the end of their useful life these materials biodegrade as they are naturally metabolized by microorganisms.

Additionally, this summer, VCE will be exploring recycling opportunities within Virginia's fast growing nursery industry. A variety of plastics are used within this industry and seeking practical and sustainable options for these byproducts will help strengthen this important agricultural sector.

For information on recycling opportunities within the green industry please contact John Ignosh (jignosh@vt.edu), or for details on bioplastics please contact Dr. Justin Barone in BSE (jbarone@vt.edu).



Sea Turtle with Plastic Band

(Source: Segal, Our oceans are turning into plastic are we?) Available at this link:

[Best Life Plastic Article](#)

What About Using Ceiling Fans?

Can Ceiling Fans Lower My Utility Bill? Ceiling fans create a breeze, so room occupants feel cooler and more comfortable. With a ceiling fan running, you can raise the thermostat setting by 2 to 4 degrees during the cooling season with no reduction in comfort. Increasing the room temperature by even two degrees can cut your cooling costs 4 to 6 percent.

Will I Feel Less Comfortable When I Increase the Thermostat Setting? Probably not. Many people claim they don't even notice a difference in comfort.

Can I Use My Ceiling Fans Instead of My Air Conditioning? No, because ceiling fans do not lower humidity. Ceiling fans are best used in conjunction with air conditioning. Using them alone is advisable only when the relative humidity is less than 50%.

Should I Leave Ceiling Fans Running All the Time? No, because they cool people, not rooms. Ceiling fans are less costly than air conditioning, but they still use electricity. Running several fans 24 hours a day can add up quickly, especially if no one is home to benefit from them. Run a fan only when someone is in the room.

What Features Should I Look For? Correct sizing—choose a ceiling fan that fits the room (see table). Follow these guideline:

Motors—to ensure long life and quiet operation, purchase fans with motor housings constructed

with heavier materials such as die-cast metal. These models tend to have less vibration and provide better stability for down rods. Also look for models with heavy-duty windings, precision-engineered ball bearings, and shock-absorbent internal components.

Performance grade fans—designed for continuous, quiet operation—use larger, more powerful motors, and are generally the most expensive models. Medium grade models are designed to run 12 hours or less per day; and economy models, to run 8 hours or less per day, in rooms with 8-foot ceilings.

Motors come either with sealed and lubricated ball bearings—requiring little or no maintenance—or with bearings that operate in an oil bath, which will occasionally require adding oil.

3-speed motors are recommended for maximum comfort. Most fans—and all Energy Star® models—can reverse direction via a switch on the housing, so that they can move warm air (which rises up to the ceiling) down into the room during the winter.

Blades—should be sealed or finished to prevent moisture-caused damage such as warping, peeling, or tarnishing, especially if the fan will be used

in a high-humidity situation.

Sound—try the fan out in the store, using all settings, to determine if the sound is too noisy for you. If it is, try a different brand or a model with blades made of a different material.

Look for Energy Star® labeled ceiling fans—on average, these fans are 20% more efficient than standard ceiling fans.

Do Combination Fan/Lights Save Energy? Fan/light units labeled with the Energy Star® logo are about 50% more efficient than standard fan/light units—which can save you \$15–\$20 a year on utility bills (plus any heating/cooling savings gained by using the fan properly—see above).

Lights can also be purchased separately as an add-on to a ceiling fan. Most fans accept add-on light kits, though a number of them are only compatible within brands. Check the package for compatibility information.

Can I Use a Fan in Damp Areas? If you're installing a fan in a bathroom or other humid location, make sure it is UL-listed with a "damp" rating; and if mounting a fan where it will come into direct contact with water—such as a porch or patio—be sure it has a UL "wet" rating. These fans have features such as sealed or moisture-resistant motors, rust-resistant housings, stainless steel hardware, and all-weather blades.

(Adapted from NASULGC/DOE Building Science Community of Practice)

Room Dimensions	Suggested Fan Size
Up to 75 ft ²	29–36"
76–144 ft ²	36–42"
144–225 ft ²	44"
225–400 ft ²	50–54"

Newly Developed Publications

R.D. Grisso, S.C. Mariger, S.S. Wong, J.V. Perumpral, N.K. Christensen, R.L. Miller, and A.W. Sorenson. 2008. Depression as a risk factor for agricultural injuries. ASABE Paper and Presentation No. 084166. St. Joseph, MI :ASABE

Abstract. The agricultural industry has historically had one of the highest injury and mortality rates, and they have been on the rise during the past decade. Appropriate educational programs are essential to reverse this trend. To help extension educators and health care professionals with the development of such programs, a study dealing with health and safety concerns of farmers and farm workers in Virginia was initiated with multiple objectives.

One aspect of this broad study, the effect of depression on agricultural injury rate, is discussed in this paper. The population for this study included Virginia farmers currently cultivating 28 or more hectares, on a full or a part-time basis. Approximately 26,000 farms in Virginia met this criteria and a sample of 1,650 was randomly selected for the study. Owners or operators of these farms were asked to complete and return a survey mailed to them. Over 300 returned the completed survey.

Using the response from eight mental health related questions, 53 respondents were classified as "depressed." Seven of the 15 respondents on anti-depressant medi-

cations were also listed in the depressed group. Results of the analysis showed that the injury rate was significantly higher among farmers experiencing depression as compared to the rest. Educational programs for recognizing depression, prevention, and treatment may help reduce the agricultural related injury rates.

Read the whole article: http://filebox.vt.edu/users/rgrisso/Papers/084166_Depression.pdf

Grisso, R.D., R.K. Taylor, M. Hanna, and D.H. Vaughan. 2008. Machinery productivity estimates from seed tenders. ASABE Paper and Presentation No. 084086. St. Joseph, MI :ASABE

Abstract. Several methods and machines have been introduced during the last five years that can improve the timeliness and productivity of planting operations. Several manufacturers claim these devices can increase productivity by more than 50% over conventional methods.

This presentation provides a discussion and insights on the improvement of corn and soybean planting systems, while using a seed tender and other similar devices. A comparison between machine operations is analyzed with the assumptions made by these claims. While the claims may be valid, farm clientele deserve to know the conditions under which these improvements can be expected.

The results can assist farmers in evaluating how these purchases influence machine productivity, and how to identify potential operational areas that can improve their productivity with existing machinery systems. It also provides better estimates for parameters currently listed as ranges within the Agricultural Machinery Management Data (ASABE D497.5).

Read the whole article: http://filebox.vt.edu/users/rgrisso/Papers/084086_Seed_Tender.pdf

Grisso, R.D., D. Vaughan, and G. Roberson. Fuel prediction for specific tractor models. *Applied Engineering in Agriculture* (in press)

Abstract. Generalized models for fuel consumption are useful for budget and management scenarios, but may not have the ability to compare fuel consumption for several potential tractor configurations such as turbocharging and air densification models. The objective of this paper is to develop a method that uses the Nebraska Tractor Test Lab (NTTL) data for a specific tractor model to predict fuel consumption for full and partial loads and for reduced throttle conditions. Using these equations, the fuel savings can be predicted for different operating and loading conditions. This method is compared with the generalized model and actual NTTL fuel consumption data. The results showed that 88% of tractors had an improved prediction with the new methodology.

More Available Publications:

http://filebox.vt.edu/users/rgrisso/Grisso_pubs.htm

NEW BSE Faces

Dr. Durelle (Scotty) Scott will be joining our department in August as an assistant professor in Land and Water Resources Engineering with particular focus on in-stream processes and interactions.



Durelle graduated from the University of Colorado in 2001 in Civil and

Environmental Engineering. The primary focus of his dissertation was on diurnal metal cycling within streams affected by acid mine drainage, where he examined both the hydrologic and biogeochemical processes that alter metal transport. Following graduation, Durelle accepted a fellowship at Landcare Research in New Zealand where he worked on an interdisciplinary science team examining organic carbon export from the landscape through the river network to the ocean. This experience provided an opportunity to explore large spatial scales and long-term carbon fluxes, resulting in the development of a model that estimated the amount and hotspots of carbon yields across the landscape.

In 2003, Durelle returned to the US and received a National Research Council postdoctoral fellowship at the US Geological Survey in Reston, VA. Here, he worked at a range of spatial and temporal scales, with the primary focus on nitrogen retention within small and large river systems. In 2005, Durelle accepted a faculty position at the University of Nebraska - Lincoln. His research continues to explore hydrologic and biogeochemical processes across the

annual hydrograph, with projects ranging from glacial melt in Alaska to floodplain interactions in southeastern US. Durelle is excited to join the BSE department at VT, where there are excellent opportunities to work with other VT faculty in the department and across campus to examine interdisciplinary environmental problem related to both landuse and climate change.

Dr. David Sample will be joining our department in August as an assis-



tant professor in Land and Water Resources Engineering with particular focus on stormwa-

ter management. Dr. Sample will be located in Occoquan Laboratory in Northern Virginia. His responsibilities includes research and extension.

Dr. Sample received his BS and MS in Environmental Engineering from University of Florida and his PhD in Water Resources Engineering from University of Colorado. He has a total of 17 years of work experience. After completing his MS, Dr. Sample worked as an Environmental Engineer with US EPA and then as a consultant with GZA Environmental, Inc. From 1987-1997 he worked in variety of positions as Assistant County Engineer, County Engineer, City Engineer, and as a District Engineer in Georgia.

He is currently serving as the Atlanta Area Practice Leader in Water Resources for Brown and Caldwell, Inc. in Atlanta Georgia. Dr. Sample's research interest include integration of water conservation/irrigation

and stormwater quality management in support of low impact development; performance assessment and process modeling for the design of best management practices; integrated modeling/GIS systems for water resources management; and optimization of water resources systems design. Dr. Sample is an accomplished researcher who has published several peer-reviewed journal articles and book chapters and has made large number of presentations at various national and international conferences. He is a registered professional engineer in seven states. Dr. Sample's expertise greatly compliment those of our current faculty in Land and Water Resources Engineering.

Erin James joined the BSE department in March as an Extension Associate. She is working with Brian Benham to coordinate the USDA-CSREES funded Virginia Household



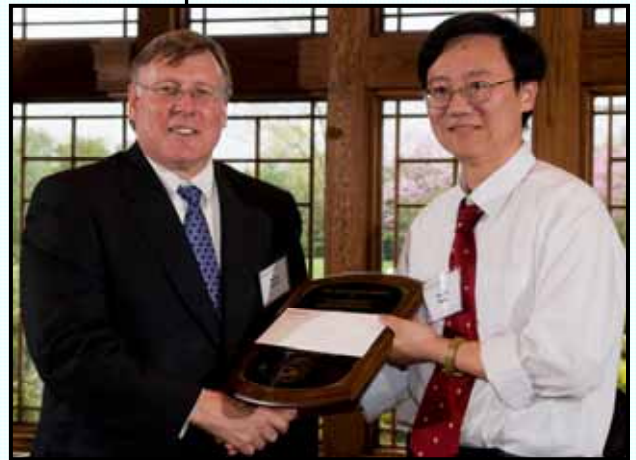
Water Quality Program. She will also work with Conrad Heatwole on an adaptive and community-based livestock exclusion pilot program.

Erin graduated from Virginia Tech with a BS in International Studies, and has a MS from Penn State University in Environmental Pollution Control and Rural Sociology. Her graduate research involved quantifying nutrient loads to surface waters from pastured cows and identifying factors influencing adoption of the Conservation Reserve Enhancement Program in the New York City Watershed. Before joining BSE, Erin was the Certification Director for Pennsylvania Certified Organic, a USDA-accredited organic certification agency. Erin is a Blacksburg native, and is enjoying living here again with her husband Doug and their daughter, Isla.

BSE Research Awardees

Foster Agblevor was recognized by the College of Engineering (COE) with the Outstanding Research Award. Foster concentrates on thermo-chemical biomass conversion and rapid characterization of biomass feed stocks. He has provided leadership to the bioprocess engineering group in BSE. Due to his leadership, VT is considered to be one of the leading institutions in the world in this field. His recent research efforts include development of pyrolysis process to convert poultry litter to bio-fuel or slow release fertilizer, and low temperature catalytic biomass gasification process to produce green diesel. Recently, he received \$1.3 million in funding from the National Fish and Wildlife Federation and Farm Pilots Projects Corporation and \$1.2 million from Virginia Tobacco Commission. Dr. Agblevor was also instrumental in the establishment of the Center for Biodesign Bioprocessing Center. The Center was awarded \$950,000 from Congress in 2007 and a similar amount is expected over the next 2-3 years.

Percival Zhang was recognized by the COE with the Outstanding Young Research Award. Percival joined VT in 2005 and within his short tenure, he has received \$1.7 million in external funding over the past two years in support of his research program. Dr. Zhang has published 13 peer-reviewed publications, three book chapters, and has filed for five patent disclosures. He serves on the editorial boards of prestigious journals of Process Biochemistry and Biotechnology for Biofuels. He has already experimentally validated the biological feasibility of consolidated bioprocess method for lowest-cost cellulosic ethanol production.



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