



Biological Systems Engineering

Engineering Update

Winter 2007

BSE Named a University Exemplary Department!

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*Visit BSE Specialists
in Seitz Hall*

Engineering Update

Biological Systems Engineering
December 2007



VirginiaTech
Invent the Future

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

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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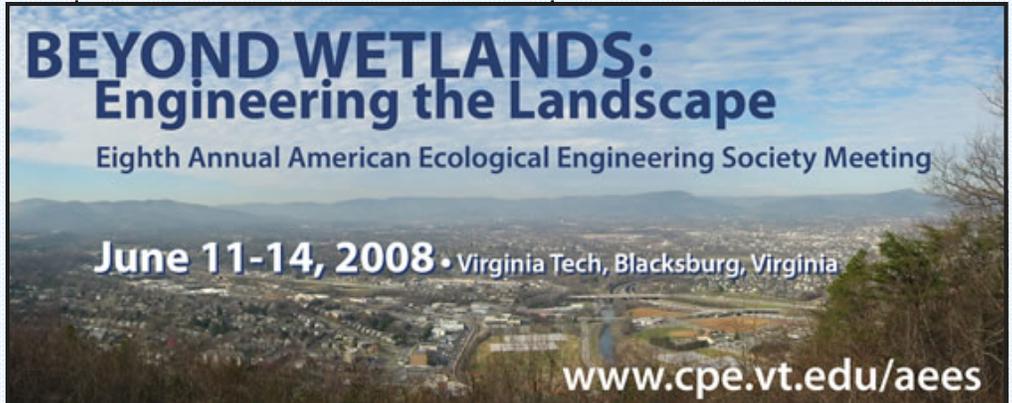
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VIRGINIA STATE UNIVERSITY

Beyond Wetlands: Engineering the Landscape
8th Annual American Ecological Engineering Society Meeting
2nd Annual Virginia Stream Alliance Workshop
June 11-14, 2008 (Workshops on June 9-10)
Virginia Tech Campus, Blacksburg, VA

The American Ecological Engineering Society (AEES) works to promote the protection and development of sustainable ecosystems that integrate human society with the natural environment for the benefit of both.



You are invited to participate in the Eighth Annual American Ecological Society Meeting at Virginia Tech on June 11-14, 2008, by submitting an abstract for an oral or poster presentation. Abstracts are due December 15 via our web-based abstract submittal system at: <http://www2.opd.outreach.vt.edu:8080/abstracts/VT/AEES2008>.

Paper topics related to the conference theme may include: Landscape Design (regional planning, watershed management, Stream Restoration/Design (floodplain and channel), Urban System Design (low impact development technologies, green infrastructure design, restoration

of ecological services in urban systems), Ecological Remediation/Treatment Systems (phytoremediation, wetland design) and Teaching and Professional Development.

The meeting includes a combination of workshops (June 9-10), plenary sessions, concurrent sessions, and breakout sessions over a six-day period.

Conference participants will include: environmental and ecological scientists and engineers; landscape architects; policy makers and planners; federal, tribal, state, and local government agency personnel; and private interests, environmental consultants, environ-

mental interest groups, and students.

More information about the meeting and the Second Annual Virginia Stream Alliance Workshop on June 9-10 will soon be available at <http://www.cpe.vt.edu/aees/>.

For further information about abstracts, the conference, or opportunities for sponsorship, please contact:

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Restoring Streams



Restoring streams (VT Front Page): Virginia Secretary of Natural Resources Preston Bryant (right)

learns about the Stroubles Creek restoration project from Virginia Tech BSE professors Tess Wynn and Cully Hession.

The Virginia Department of Conservation and Recreation awarded a grant to the faculty team, which also includes Gene Yagow of BSE, to restore 1.8 miles of Stroubles Creek, a New River tributary, downstream of the VT

Duck Pond. The restoration effort is part of a watershed management plan developed by local citizens, Virginia Tech, and the Town of Blacksburg, to reduce sediment pollution and improve aquatic habitat within Stroubles Creek.

Improved land-use management within the New River Watershed is crucial for the protection and preservation of this important natural resource.

Safety Tips, Kits Prepare Drivers for Winter

Safety needs to be a driver's main priority when traveling this winter.

Pay attention to weather forecasts before leaving home

and if dangerous weather is imminent, consider delaying or canceling travel plans. Travelers should share their plans with family members or friends who can notify authorities if they don't arrive on time. Also, let contacts know if plans change.

Even prepared drivers can have mishaps. Travelers that do become stranded should follow these safety tips:

- Don't run the engine or use the heater if the vehicle is resting at a steep angle, fac-



ing downward or has snow and ice around the exhaust outlet. Use extreme caution if the vehicle rests under an overpass or in a low area.

- Bundle up and stay with the vehicle. Blowing snow can be disorienting and cold temperatures, through hypothermia, can sap a person's strength.
- Use the vehicle engine and heater sparingly to conserve fuel. Run the engine often enough so it starts easily to prevent running down the battery.
- Avoid using the vehicle's

electrical accessories if possible. Use parking lights instead of headlights to warn approaching drivers.

- If more than one person is stranded

in the vehicle, only one should sleep at a time.

- Don't forget to pack a survival kit before traveling with blankets and thermal protection for head, hand and feet. Include enough high energy, non-perishable food, such as candy bars, for each passenger.
- Keep water inside the car to prevent it from freezing and a flashlight with extra batteries. Cell phones are helpful, but should not substitute for survival kits.

(adapted by Bobby Grisso)

Clean, winterize farm equipment to extend its life

It appears most of us finally have the crops out of the field for another season. It has been a difficult thing to harvest alfalfa, corn, peanuts, cotton, and soybeans while dodging storms in recent weeks. Though we have lost some feed quality to storms this season, we must gratefully admit that the harvest has been bounteous. Most hay barns are full of forage and the corn silage bunkers are stacked higher than typical.

Though most of us are ready to park our farm equipment for a few months, we must remember that spring will be here quickly and the equipment must be ready to go. The care we provide our machinery, such as proper cleaning, maintenance and storage not only increases equipment reliability and performance, it can also improve resale value. Farmers who properly winterize farm equipment now will be rewarded with a reduction in start-up time next spring.

The following winter storage suggestions come from various Extension bulletins, but should never supersede the recommendations found in equipment operator's manuals.

Be sure to change the oil and perform regular service. The hot, dry weather we have recently experienced makes oil changes necessary. Clean engine oil will reduce internal engine corrosion during storage. Clean or replace air filters, replace fuel filters and lubricate bearings and joints to maximize the life and efficiency of your machinery. Check antifreeze for correct freezing temperature. Remember that anti-

freeze, like engine oil, has a lifespan. Merely adding more coolant may not be enough to fully protect your investment.

Inflate tires to recommended pressure to reduce sidewall damage. Before storing tillage implements remove soil and apply appropriate rust preventive material, then store with soil engaging components raised or on blocks to prevent rust. Hydraulic cylinders should not be stored fully extended. If temperatures increase, hydraulic oil will be confined and high pressure may cause damage to the hydraulic system.

All planters, drills, air seeders and combines need to be cleaned out. Be sure all grain and plant material left in the grain tank and augers is removed. This will reduce rusting and make it less attractive to mice and other pests. It is sometimes possible to remove more than a bushel of grain even after a combine seems to be clean. Trapped grain attracts rodents, who often then make a meal of electrical wiring, leading to short circuits or other electrical problems.

Reduce tension on belts to reduce stretch and increase belt life. Be sure to follow storage instructions in the operator's manual for removing seed plates and other components to relieve pressure on seals, brushes, and seed plates. This will minimize warping and misshaped air seals and seed plates. Remove soil from all furrow openers to reduce rust and improve performance next season.

Balers need to have any partial bales and all plant material removed to minimize rusting. Follow the opera-

tor's manual for instructions on reducing pressure on baler belts or other components. Compressed air is a great way to clean hard to reach places and may be a better choice than water. When water is needed to clean surfaces, use only moderate pressure and mild soap.

Cleaning farm equipment with a power washer is great for removing dust and soil. Be careful, however, and avoid direct contact with seals when using high-pressure washers. Use compressed air after washing to help dry surfaces, and operate machinery for 10 to 20 minutes to help shed excess water from hard to reach places. Repaint worn surfaces with spray paint to protect from corrosion.

Proper battery storage can protect batteries from deterioration. Even a small current drain can eventually discharge batteries and cause them to freeze in cold weather. Consider removing batteries to convenient storage where they can receive a periodic charge. Clean all connections and coat terminals with a thin layer of grease to prevent corrosion.

Where possible, store equipment in a building. If a building is not available, at least cover equipment with a well secured tarp. This will always improve equipment performance and resale value.

(See: Five Strategies for Extending Machinery Life — VCE Publication 442-451. <http://www.ext.vt.edu/pubs/bse/442-451/442-451.pdf>)

Jumping a Dead Tractor Battery

The battery converts chemical energy to electrical energy. For a battery to operate properly, it must have the plates and electrolyte in proper proportions and the elements must be clean both inside and outside the battery case.

Temperature can influence a battery and that is the reason most batteries fail during winter conditions. In cold temperature, the battery capacity for cranking is smaller and the engine has more friction to overcome to be cranked. For example, a battery has only 65 per cent of its cranking power at 32 degrees F as it does at 80 degrees F; and only 40 per cent at zero degrees F. At the same time the engine is 165% harder to turn over and start at 32 degrees than at 80 degrees F.

Follow manufacturer's directions for "jump" start of engines with aid of extra battery. Operator must be in the operator's seat when jump-starting an engine so that the tractor will be under control when the engine starts. Jump-starting should be a two-person operation.

Be careful when jumping a dead tractor battery it is a big deal so take your time and think before 'jumping'. Make sure all electrical connections, switches and accessories are turned off and make sure the last connection

and the last disconnection is at some point away from the battery. Use the order for connecting jumper cables:

- Identify the POSITIVE (red) end of one of the jumper cable clamps - attach it to the POSITIVE (+) terminal of the dead battery.
- Attach the other POSITIVE cable clamp on the other end of the jumper cable to the good battery's POSITIVE post or terminal.
- Attach the NEGATIVE (black) jumper cable clamp nearest the good battery to the good battery's NEGATIVE (-) post or terminal.
- Attach the remaining NEGATIVE jumper cable clamp to a good engine ground point on the dead battery's vehicle away from the dead battery.

Never reverse the connections and never charge or jump a frozen battery; it can explode.

Allow a period for the battery to recharge and now with the dead vehicle in park and transmission disengaged turn the switch and start the dead engine.

After the dead vehicle has started remove the jumper cable in reverse order. Allow the vehicle to charge the battery before operating under a load.

Never jump-start a tractor by

touching the cables to the starter motor. The tractor can suddenly lurch forward and crush you.

Lead-acid batteries produce flammable explosive gases. Keep arcs, sparks, flames and lighted tobacco away. The sulfuric acid within a battery can damage eye and skin on contact. Always wear a face shield to avoid acid in eyes.

If further work is needed on the electrical system, disconnect the battery by removing the ground terminal first. Never work on the electrical system of any equipment unless you are thoroughly familiar with the system details.

If using a battery charger to recharge a dead battery, ALWAYS hook the charger leads to the battery BEFORE plugging the charger into the AC current - with the charger unplugged, there is little chance of a spark if you hook the leads to the proper polarity.

Then, ALWAYS unplug the charger from the AC wall socket BEFORE removing the leads from the charged battery - again avoid a spark while removing the leads - and please, wear eye protection when using that battery charger!

(adapted by Bobby Grisso)

Creating Biomass Appeal

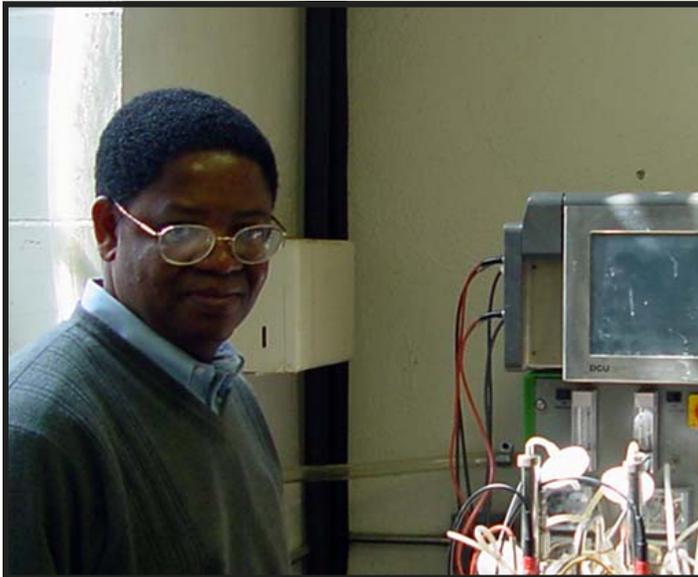
Here's a solution to high gas prices for you: Fire up the grill, cook hamburgers and hot dogs for your friends and neighbors, then collect the leftover grease and put it in your gas tank.

While greatly oversimplified, that scenario is not as bizarre as it sounds. The BSE Department wants to make it a semi-reality—only with a production facility and refinery.

Dr. Foster Agblevor, an expert in thermochemical biomass conversion and rapid characterization of biomass feedstocks, made news by developing manufacturing processes that could extract specific chemicals from cotton residue to make ethanol and the sugar xylitol.

"Our work shows a manufacturing process for extracting both products simultaneously from the cotton residue," he explained. "In the future, it is possible that a manufacturing company operating in Southside Virginia could produce both the ethanol and the xylitol products."

Foster, believes fuels origi-



nating from biomass could play a key role in Virginia's future.

"What we are trying to do is reduce dependency on foreign sources of energy. We can make bio-ethanol. We can also make bio-oils," he said. "You can use all kinds of feedstocks, residues and wastes. We are now looking into even using poultry litter."

Foster pointed out that the litter potentially can be converted into bio-oils, gas and fertilizer via pyrolysis, or chemical change brought about by the action of heat. The technology can be used to dispose of poultry litter and simultaneously produce high-value products and fuels.

"Producing bio-oil from litter creates a fuel while at the

same time dismissing excess nutrients in the ground. We capture the excess nutrients in a slow-release fertilizer."

Foster noted that Southside Virginia in particular could benefit from the conversion of biomass into biofuel.

"In Southside Virginia, we are looking into bio-energy options to replace tobacco," he explained. "We are encouraging the growth of switchgrass and hybrid poplars in particular, so that we can make bio-oils from them."

To prove the effectiveness of those fuels, VT is working with private nursery and greenhouse owners in the region to heat their facilities via bio-oils. The structures typically are heated with propane, the cost of which is "astronomical," Foster said. Heating via biomass is expected to prove more economical while giving the university an opportunity to effectively demonstrate the technology.

(Modified from Mark Cramer, Farm Bureau News, February 2006)

Greenhouse Heating System Checkup

A preseason heating system checkup for a greenhouse can prevent big problems - and big expenses - this winter.

Heating season is just around the corner. It's the perfect time to get out and make sure your heating system is ready for the next few months. A bit of routine maintenance will ensure your plants will have the warmth they need, when they need it.



The National Greenhouse Manufacturers Association offers heating guidelines (you can download a copy at www.ngma.com/downloads.htm).

- Check equipment for physical damage. Check the sheet metal, fans and air movers, wiring, fuel piping and vent system.
- Check for the cleanliness of the equipment's heat exchanger and burner. Vacuum out the heat exchangers and verify the unit

- fires properly and cleanly.
- Check the vent system.
- Check to make sure no obstructions block the air intake or air discharge of the equipment.
- Check lubrication of the motors on fans and pumps. With the power off, check to see that the motor shafts turn freely.
- Check the belt tension.
- Check the heat exchanger of the equipment for any signs of cracks or corro-

- sion.
- Check the heat exchanger of the equipment for signs of overheating.
- Inspect the burner for general cleanliness.
- Check the control wiring to make sure the connections are tight.
- Check to make sure the manual valves are opened.
- If your greenhouse has an alarm system, make sure it is operational.

Heating Guidelines: www.ngma.com/downloads.htm

Sprayer setup keys soybean rust control

Drought and extreme heat in the lower Southeast has slowed movement of soybean rust into the Carolinas and Virginia. However, as growers in the Delta and lower Midwest will attest, rust spores can move quickly as a recent find in other states.

Research at The Ohio State University, showed that growers can significantly improve fungicide application and by doing so — soybean rust control — by using proper spray equipment and application techniques.

Research indicates medium spray volume, rather than fine or coarse provides better droplet penetration into the soybean canopy. Though labels on most fungicides used for soybean rust suggest a 200-350 micron, or fine to medium spray volume, the optimum for rust control is probably closer to the bottom, or about 250 microns, than to the top end of the recommendation.

Using air assisted sprayers, regardless of cone type, generally provides better canopy penetration and plant coverage than conventional sprayers.

When using sprayers without air assisted application, a mechanical canopy opener or rigid bar that bends the top of the canopy ahead of the spray boom improves fungicide penetration to the middle and lower leaves of the soybean plant.

However, when using conventional sprayers, a flat cone spray pattern performs better than hollow cone spray patterns. When air assisted sprayers were used, there was little difference in performance of the two spray patterns, according to the researcher.

Timing, or more precisely the growth pattern and stage of the soybean plant, also effects fungicide application efficiency, regardless of spray delivery system used.

When spraying a fungicide for soybean rust control, good coverage on the lower and middle leaves is critical, because these are the most likely spots on the plant for the disease to form. Applying fungicides to shorter, low density plants will provide better results, again regardless of the spray system used.

While a single flat fan provides better spray coverage and disposition than cone or dual fan nozzles in tall, dense plant canopies, most of the late planted beans will not have this type growth habit, so the more popular nozzles and spray patterns should provide adequate coverage.

If plants get taller and vegetative growth is denser, research consistently shows a twin flow pattern nozzle, such as the conventional Twin-Jet nozzle, did not perform as well as a single flat fan nozzle.

When using a conventional boom sprayer, a flat fan nozzle provides a single spray flow pattern that will likely work better than cone nozzle or a twin pattern flat-fan nozzle.

Research from various locations clearly indicates an air-assisted sprayer is the best equipment option available to achieve the best coverage of soybeans with a fungicide. Unfortunately, a commercial-scale sprayer with the air assistance may add from \$10,000 to \$15,000 to the price tag of the equipment. However, this one-time cost may well outweigh the income lost due to soybean rust in one growing season.

Most important application factor is spray volume. At least 15 GPA and preferably 20 GPA of spray volume are needed for ground applications. At least 5 GPA are needed for aerial applications.

This volume will be needed to penetrate and thoroughly cover all leaf surfaces in the soybean canopy.

Next in order of importance is the drop-

let size. A medium droplet size (200 to 300 microns) is required to penetrate the canopy and adequately cover the leaf surfaces. Fine to very fine droplets, like those produced from hollow cone nozzles, will not penetrate the canopy and are prone to drift.

Large droplets will not give adequate coverage, may bounce off leaves, and because the total number of droplets is less, are more likely to miss the target and land on the ground.

Pressure can be an issue, especially if coarse droplet nozzles, such as those used for herbicide application are used. If these low drift, coarse droplet nozzles are used, higher pressure may reduce droplet size into the medium size range, though this is not guaranteed.

Two families of fungicides are currently used for soybean rust management in the U.S. — triazoles and strobilurins. Use rate for triazole products on the market range from 3-8 ounces per acre. Use rate for strobilurins is 6-15 ounces per acre. Combination of the two families in such products as Quilt and Stratego is still in the 5-10 ounce per acre range.

The triazoles tend to move better within the soybean plant and generally provide better curative results, while the strobilurins have longer residual activity within the plant and are generally better as a preventative.

Used together, both families of chemicals provide optimum protection, but all share one common factor — ultra-low rates of active ingredient per acre.

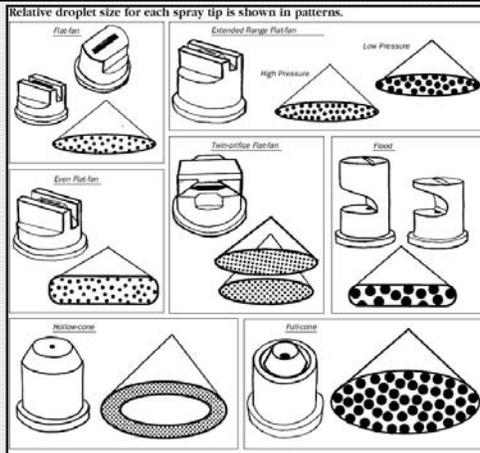
The cost of these highly efficient fungicides, plus their ultra-low volume make it essential for soybean growers to apply them correctly and at the right stage of soybean growth for optimum profitability.

(Modified from SE Farm Press)

Droplet Chart / Selection Guide

When choosing nozzles/ droplet sizes for spray applications, applicators must consider both coverage needed and drift potential. As a rule, smaller droplets provide better coverage...but larger droplets are less likely to drift.

Nozzle selection and application pressure govern droplet size, which in turn affect system output (application rate), target deposition, uniformity, efficacy, and the risk of drift. Off-target movement in the form of spray drift is a major concern because it diverts the chemical from the intended target, reduces efficacy, and deposits pesticide where it is not needed or wanted. When



a pesticide drifts, it may cause both environmental and economic damage, including exposure to people and property, injury to susceptible vegetation, harm to wildlife, deposition of illegal residues on crops, and contamination of water supplies.

In some cases, increased

droplet size may reduce efficacy because fine or very fine droplets (if applied uniformly) provide the best coverage. However, small, lightweight droplets may not penetrate plant canopies. Droplets produced by air-induction/ venturi nozzles may break vs. bounce when they hit the target, hence providing better coverage than droplet size rating alone would indicate. In many cases, choosing a nozzle/droplet size for a job is a "tradeoff" between good coverage and drift potential. So... what's an applicator to do?! Many labels provide specific recommendations regarding nozzle selection and sprayer configuration. However, in the absence of such guidance, the chart list below may serve as a starting point. (draft from Pat Hipkins, PAT)

Application	Droplet Category*	Approximate VMD Range**
Fungicide		
foliar protective or curative	Medium (M)	226 - 325
Insecticide		
foliar contact or stomach poison	Medium (M)	226 - 325
foliar systemic	Coarse (C)	326 - 400
soil-applied systemic	Coarse (C), Very Coarse (VC), or Extremely Coarse (XC)	326 - 400; 401 - 500; > 500
Herbicide		
foliar/postemergent contact	Medium (M)	226 - 325
foliar/postemergent systemic	Coarse (C)	326 - 400
soil-applied/preemergent systemic	Coarse (C), Very Coarse (VC), or Extremely Coarse (XC)	326 - 400; 401 - 500; > 500

* ASABE Standard 572; ** VMD = Volume Mean Diameter; 50% of the spray volume are larger droplets and 50% of the volume are made up of smaller droplets.

Student Design Projects

Six design projects, team members and faculty advisors for the 2006-07 academic year are as follows:

- Reducing Urban Stormwater Impacts within the Stroubles Creek Watershed (Advisor: Dr. Tess Wynn) Team: Catie Morin and Kathy DeBusk.
- Design of a Bioreactor for Refolding of Recombinant Human Lysozyme Expressed as Inclusion Bodies in *E. coli* (Advisor: Dr. Mike Zhang) Team: Matt Bernetich, Stephen Nimitz, and Andrew Frock.

- Design of Satellite Lignocelluloses Biorefineries Based on Switchgrass for Production of Cellulosic Ethanol and Bio-based Materials (Advisor: Dr. Percival Zhang) Team: Derek Grysko, Carolyn Hey, Alison Roma, and Shannon Reeves.
- Paint Bank Fish Hatchery Raceway Residue Management (Advisors: Drs. Jactone Arogo and Zhiyou Wen) Team: Aaron Bowman, Christopher Hickey, Justin Summers, and Sarah Walker.
- Development of a Food Composting Plant at Virginia Tech (Advisors: Drs.

Julia Fan and John Cundiff) Team: Kara Ford and Ryan Insley.

- Extraction of Phenolic Compounds from Peanut Skins (Advisor: Dr. Kumar Malikarjuna) Team: Ben Johnson and Stephen Park.

An executive summary of the results of these projects can be viewed at: http://www.bse.vt.edu/06/UG/SD_06-07.php

If you have ideas for a design project, please develop a brief description of the proposed project and send to: rgrisso@vt.edu.

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>

Heavy machinery on wet soils

Heavy machinery on wet soils is a sure prescription for compaction. But there are three ways to minimize the compaction: Look at axle loads, properly inflate tires of field equipment and control field traffic.

Heavy axle loads and wet soil conditions will increase the depth of compaction in the soil profile. Tracks and duals have better flotation than single tires. If you can equip your combine or grain carts with either of these choices it will increase flotation and allow the combine a few extra passes before it gets

stuck. To help minimize the compaction due to the weight of the combine, unload the combine on the headlands or unload the combine more frequently.

Check your **tire inflation pressure** before using any equipment in the field. Not only does this help reduce soil compaction, it also improves tractor efficiency. Studies have shown that given the same axle load, inflation of the tires (psi) will determine the depth and severity of the compaction. Check with your tire manufacturer or search the Web for

proper tire size and inflation rate for the carrying capacity of your equipment.

The theory behind **controlled traffic** is that 80% of the compaction happens on the first pass, so use this to your advantage. While it may take awhile to replace equipment that will use the same wheel tracks, there is one piece of equipment that should receive special attention: the grain cart. The grain cart has the highest potential to compact the soil due to the large carrying capacity (up past 1,000 bu.) and a single axle on which to carry that weight.



Tameshia Ballard (left) and Kumar

Transform Peanut Skins

Mallikarjuna are working to find the best ways to transform peanut skins into nutraceuticals such as an antioxidant extract.

Learn more about peanut skin anti-

oxidant research from the Oct. 23, 2007, WVTF national public radio feature "Plans for peanut skins underway" at http://www.wvtf.org/news_and_notes/audio/tp_pnut_10-23-07.mp3

Aerate stored grain to control temperature

Corn is a perishable commodity with a limited shelf life that depends on the moisture content and temperature of the grain. Special attention needs to be paid to the grain temperature in storage, especially with higher moisture contents, drought damaged grain, or low test weights. The harvested corn needs to be cooled as quickly as possible to reduce biological activity within the grain mass. In addition, insect activity is greatly reduced when grain temperatures are below 50° F.

Aeration is required for temperature management in all stored grains, regardless of moisture content. The average temperature of the grain mass should be kept within 10 degrees of the average ambient air temperature. This minimizes moisture migration within the grain mass, reducing the chances of condensation and spoilage.

When holding corn above 16% moisture content, continuous aeration is required, especially when the temperature is above 50°F. The temperature of the corn mass will not remain constant because biological activity of the corn releases heat that increases corn temperature. The higher corn temperature, in turn, increases biological activity, which can rapidly lead to corn deterioration. Aeration systems are needed to offset this temperature rise and to adjust the corn temperature to ambient temperatures. Without aeration, wet corn cannot be held.

Estimated shelf life

Successfully holding wet corn requires an understanding of aeration systems and the effects of corn moisture, temperature, and damage levels on shelf life of the corn. Use

the table to estimate the shelf life of aerated corn based on the moisture content and temperature of the corn. The shelf life data are not valid for corn held without aeration. Un-aerated corn may deteriorate three times faster than indicated in the table.

The shelf lives given in this table represent the lengths of time that good quality, aerated shelled corn can be stored before losing one-half percent of dry matter at various temperatures and moisture contents. With this amount of dry matter decomposition, it is assumed that the corn loses some quality, but maintains its market grade. Deterioration rates also depend on kernel damage from harvest and previous mold or insect damage. These storage times may be optimistic if excessive damage exists.

Aeration systems

A well-designed aeration system is necessary to safely hold wet corn for even short periods of time. Adequate air-flow within the corn mass is essential to carry away heat generated by mold and corn respiration. This

is particularly important when holding corn with shelf lives of less than 30 days (in yellow).

Research has shown that corn in this condition needs to be cooled within one or two days after being placed in the bin to avoid significant mold damage. This rapid cooling rate can be achieved only in bins with fully perforated floors and fans capable of delivering airflow rates of at least 0.33 to 0.5 cfm/bu. Airflow rates of 0.1 to 0.2 cfm/bu normally used for aerating dry corn (corn with less than 16% moisture content) are not adequate to safely hold corn with less than 30 days of shelf life. Airflows higher than aeration rates (about 1.5 to 2 cfm/bu) can be used for natural air drying to reduce the moisture content of the stored grain.

Dry corn aeration systems can be used to hold lower moisture corn for extended periods of time. Generally, longer term wet corn storage is possible only if corn temperatures are maintained below 50°F. While continuous fan operation is preferred, it is not always required to maintain cool corn temperatures and control mold activity. Once corn is cooled below 35° F, respiration of corn and molds is slowed and the fan needs to be operated only enough to ensure that temperatures remain at that level.

Shelf life (days) for aerated, shelled corn

Corn Temp. degrees °F	Corn Moisture Content (Wet Basis)							
	16%	18%	20%	22%	24%	26%	28%	30%
30	939	648	321	190	127	94	74	61
35	626	432	214	126	85	62	49	40
40	418	288	142	84	56	41	32	27
45	279	192	95	56	37	27	21	18
50	186	128	63	37	25	18	14	12
55	123	85	42	25	16	12	9	8
60	81	56	28	17	11	8	7	5
65	61	42	21	13	8	6	5	4
70	45	31	16	9	6	5	4	3
75	33	23	12	7	5	4	3	2

Numbers in green shade are safe conditions for storage. Numbers in yellow shaded areas are areas of concern and require frequent monitoring, inspection and continuous aeration.

Do not expect to dry corn in a system designed to temporarily hold wet corn, or even in a normal aeration system. Continuous aeration will dry corn very little during the fall and winter. With 0.1 or 0.2 cfm/bu, there is not enough airflow to change the moisture content more than 1 percentage point. With these low airflow rates, drying times are so extended that some of the corn usually goes out of condition before drying is complete. The best chances for success are with systems designed for airflow rates of at least 1.0 cfm/bu and filled with corn no wetter than 18% moisture content. For this situation, drying can be successfully completed if the fan is run continuously until the corn is dried.

Tips on How to Keep Hydraulic Systems Up and Running

The selection and maintenance of hydraulic hose components on agricultural and construction mobile equipment can spell the difference between productivity and costly downtime, especially when the work site is miles away from the nearest parts distributor or repair shop.

1. Identify hydraulic leakage. Machine operators need to be aware that although the appearance of dirt on hoses and fittings is an obvious indication of hydraulic leakage, leaks often send fluid onto other equipment surfaces and must be traced to their source.

2. Look for abrasions. A frequent cause of leakage in hydraulic hoses for agricultural and heavy construction equipment is abrasions resulting from cuts, friction caused by other moving parts, or from mechanical impacts.

3. Follow proper assembly procedures. Another cause of leaks can be the improper assembly of replacement hoses, which can occur when mating surfaces on couplings are incompatible, when couplings are improperly at-

tached to the hose, or when the hose assembly is installed incorrectly. Eighty percent of all hydraulic component failures are due to fluid contamination.

4. Allow for a margin of safety. Check individual hose



specification tables for outer diameters in suppliers' catalogs. The inside hose diameter must be capable of handling the required fluid flow rate without generating backpressure. When choosing hose to transmit fluid under pressure, it's best to allow a generous margin of safety.

5. Establish correct hose length. Too long an assembly can lead to the hose being severed or pinched in the moving components of the equipment. If the replacement hose assembly is too short, pressure may cause

the hose to contract and place excessive stress (tug) at the coupling.

6. Consider temperature requirements. Exposure to continuous high temperatures can lead to hoses losing their flexibility. When hoses are exposed to high external and internal temperatures concurrently, there will be a considerable reduction in hose service life.

7. Choose the right connections. Permanent and reusable fittings are common in agricultural and construction equipment. Permanent fittings provide greater performance capability and durability, plus the availability of inexpensive crimpers increases their ease of use.

8. Don't mix and match fittings. Engineers recommend against using couplings from one manufacturer and hoses from a different manufacturer interchangeably. The proliferation of thread ends from around the world in recent years has dramatically increased the possibility of mismatching threads and seats on various couplings.

(Continued on page 13)

Keep Hydraulic Systems Up and Running (cont.)

(Continued from page 12)

9. Follow proper installation procedures. Improper installation of replacement assemblies is another prime cause of leaks in hydraulic hose assemblies. One common installation error results from twisting

hoses as they are being tightened. The use of two wrenches (one on the hex nut and one on the stem nut) while tightening the swivel fittings will help prevent twisting.

10. Be prepared. Being miles from the nearest distributor

may require keeping an inventory of hydraulic hoses and fittings on hand, along with a crimper, to minimize downtime.

Adopted from Fluid Power Product Application Department, Gates Corporation, Fluid Power Journal, Off-Highway Directory 2007

How To Increase Accountability: Proven Ways

The leader's job is to ensure every member of the team wins, and winning is defined as meeting the organization's top objectives. One of the best ways to help people win is to establish an accountability-based culture focused on producing results, not activities.

Step 1: Establish the organization's top three objectives. This means the significant few, not the important many. Once identified, objectives must be clear, concise, measurable and obtainable.

Step 2: Assign each team member his or her respective objectives. Remember, when combined, they must allow the organization to achieve its top objectives. In other words, the sum of the parts must be equal to or greater than the whole.

Step 3: Ask each team member what he or she needs to win. Remove the roadblocks that stand in the way. Have each team member identify a maximum of three things they need to accomplish each objective.

Step 4: Agree on what the leader will do to help. Meet with each team member to clarify the roadblocks and agree on what's needed to win and who will be responsible for making it happen. Being responsible to people means helping them get what they need to win.

Step 5: Follow up. Focus on what will be done to achieve green status, when it will be achieved and any help that's needed.

Step 6: Share lessons

learned. Discuss lessons learned, identify critical roadblocks and make specific offers to help any team member behind plan.

Step 7: Reward results. When objectives are achieved, ensure that rewards are disproportionate and highly visible.

Effective communication drives results. This means being direct and forthright with people in every conversation, letting them know where they stand, what's needed from them, and when it is needed.

By holding others accountable, you are teaching them to accept responsibility. Remember, making and meeting commitments is one of the best ways to build trust.

Adapted from Fluid Power Journal, September/October 2007

Comply with the Youth Labor Law

Helping Farmers, Ranchers, Youth and Educators Comply with the Youth Labor Law...

Youth ages 14 and 15 can be employed in agriculture for work not classified as hazardous, as long as the work does

not interfere with school and appropriate wages are paid. A new brochure, published by Purdue University Extension, explains the tasks that can be performed and those that cannot or that may require special training. The brochure

is very helpful in explaining Hazardous Work requirements for youth. The brochure itself can be downloaded from https://www.ydae.purdue.edu/tractor/HOSTA_poster.pdf. The main site for this topic is www.agsafety4youth.info.

Bullies in the workplace

There are many names for it: bullying, incivility, disrespect, psychological abuse and emotional harassment. No matter what it's called, the results are the same - time lost from work, unhappy employees, medical claims, legal fees, and ultimately, dissatisfied customers. The cost, both financial and in quality of life, is enormous.

Workplace bullying is on the rise, yet despite the prevalence of bullying and its damaging impact, organizational responses are spotty, at best, according to the Crisis Prevention Institute (CPI), the world's leader in crisis preparedness and intervention. Organizations need better ways to identify bullying and better tools to address the problem.

A recent research study from the National Institute for Occupational Health and Safety (NIOHS) found 24.5 percent of surveyed companies reported incidents of bullying during the preceding year. In most incidents (55.2 percent), the victim is an employee, although customers (10.5 percent) and supervisors (7 percent) are frequently victims as well. As of 2004, an average of 33,000 employees are assaulted at work and 17 employees are murdered at work each week.

According to a survey conducted by the U.S. Department of Labor Bureau of Labor Statistics regarding workplace violence prevention, in 2005: Nearly 5% of the 7.1 million private industry business establishments in the US had an incident of workplace violence within the 12 months prior to completing a new survey on workplace violence prevention. Although about a third of these establishments reported that the incident had a negative impact on their workforce, the great majority of these establishments did not change their workplace violence prevention procedures after the incident; almost 9% of these estab-

lishments had no program or policy addressing workplace violence."

Bullying is defined as any negative behavior that demonstrates a lack of regard for other workers, including harassment, incivility, teasing, gossiping, purposely withholding business information, overruling decisions without a rationale, sabotaging team efforts, demeaning others and verbal intimidation.

Managers might ignore incivility in the workplace because they discount their importance as 'personal matters, but research has clearly demonstrated that when targets believe someone at work has treated them disrespectfully, half will lose work time worrying about future interactions with the instigator, and half will contemplate changing jobs to avoid a recurrence. Most will tell friends, family and colleagues about how badly they have been treated, and some targets of bullying will leave the company.

To help managers differentiate between ordinary disagreements and bullying, CPI uses five parameters: the actions 1) are pervasive and ongoing; 2) involve a power advantage; 3) lack consent of the victim; 4) involve intent to harm or control; and 5) are tolerated by the organization's culture.

Ongoing training is a vital element in establishing a culture that builds and sustains a respectful and safe workplace. Often, improving individual competencies such as conflict resolution, negotiation, dealing with difficult people, stress management, listening and coaching can curtail incivility. Expertise developed through such skills can yield additional positive impact in enhanced day-to-day

dealings with coworkers and customers, as well as improved performance.

Is your company at risk for workplace violence?

CPI has developed an audit tool to track information immediately and also over time. An audit can help companies organize their policies to promote values and clarify expectations for all employees, by using the categories of respect, service and safety. Promoting a workplace culture that conveys expectations relating to respectful interactions, quality service and safety can help prevent emergency situations that arise from incivility, aggression, and violence. This audit is available at no cost at www.preparetraining.com/.

Behavioral signals can provide awareness regarding someone's intentions. Pay attention to cues that may indicate distress or discontent.

Some behavioral signals to consider and explore in preventive efforts may include:

- Significant changes in someone's "normal" behavior or routines.
- Sudden changes in expression, physical activity or posture.
- Dramatic increase or change in voice volume or tone.
- Expressions that communicate extreme anger or distress.
- Communications of despair and hopelessness.
- Body posture that is intimidating or threatening.
- Verbal threats.

www.preparetraining.com/

Tips for newsletter writers

Good newsletter writers keep their audience firmly in mind, remembering readers:

1. are impatient, busy people who want to receive Information quickly;
2. are most interested in "what's in it for them."

A myriad of messages bombard people. If we don't provide the most interesting and accessible information possible, our readers may pass us by.

So. How do we do that?

The *Seven Cs* can help. The *Seven Cs* guideline is the invention of Don Ranley, a journalism professor at the University of Missouri, Columbia School of Journalism.

1) **Correct.** *Nothing* damages credibility faster than incorrect information. Are all the figures in a table correct? Did any numbers get transposed? Is anything left out?

Check the facts. Again.

Next, work on spelling and grammar. They, too, affect credibility. People may wonder, "how can I trust what

they say when they can't even spell it right?"

Proofread, proofread, proofread.

Because a fresh eye helps, ask a colleague or co-worker to proofread as well.

2) **Be consistent.** Consistency matters in both quality and style. Writing down everything that pertains to your newsletter's layout and style helps maintain consistency.

For example, note how wide your newsletter columns are, what space you allow between columns, what your margins are, the typefaces and sizes you use for body type, headlines, subheads, outlines, etc. Are your columns justified or ragged right? Do certain articles always run in the same place?

Note these specifics. Do you spell the month out when you use a date (January 12), or abbreviate (Jan. 12)? Do you follow the Associated Press stylebook? Do you use drop caps? If so, when? Do you spell out numbers below 10 and use Arabic numerals for those above? Where do

you place page numbers? Are they Arabic or Roman numerals?

The more style notes you have in writing and follow, the more consistent your newsletter can be, no matter who is doing it.

3) **Clarity.** Be clear. Our facts can be perfectly correct, but if they aren't clearly presented and understandable, so what? Active voice is one tool to help achieve clear and dynamic writing.

Consider these sentences:
Passive: This theory is in complete contradiction with an earlier one.

Active: This theory completely contradicts an earlier one.

Passive: Improvement in quality was seen.

Active: Quality improved.

Note: active voice sentences often are shorter, as well as stronger and clearer.

Dropping jargon in favor of simple words also improves clarity.

4) **Concise.** Concise writing saves impatient, hurried reader's time. It takes time and dedication to be concise,

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Tips for newsletter writers (cont.)

(Continued from page 15)

because writing tight is a learn-by-doing craft.

Many of us, in a hurry, write long because we haven't the time to edit our work and find the precise words we need.

Strong verbs help make language concise; usually the shorter the word, the stronger it is.

On the left are words many people consider short; on the right are even shorter, stronger verbs:

<i>inform,</i>	<i>tell;</i>
<i>reduce,</i>	<i>cut;</i>
<i>attempt,</i>	<i>try;</i>
<i>indicate,</i>	<i>show;</i>
<i>modify,</i>	<i>change.</i>

5) **Coherent.** If our writing is not coherent, it doesn't matter how correct we are. No one will know.

Does the writing tie together? Is language consistent throughout? Do associated thoughts follow each other, or is one thought in the first paragraph and its companion thought six paragraphs below?

Do the transitions work? Will readers get lost or will they easily find their way through the article?

6) **Complete.** It seems obvious, but - is everything there? In a story on garden planting, for example, are the steps complete, clear and concise? If the story is about an upcoming meeting, are the time, place and date listed? Is there enough information to make it clear why anyone would want to attend? Does it include any information about fees?

7) **Creative.** Creativity is the hardest to define. Creativity

means different things to different people. Making something more real, more immediate and more interesting to the people we're writing for is creative.

Okay. So. We've got a story that's correct, consistent, clear, coherent, concise, complete and creative. What now?

Cut by one-third.

WHAT? Yes. The one-third guide depends on the article's length to start with, but remember - newsletters are geared toward busy people who want lots of information quickly.

Too-long articles can prompt readers to think, "I'll read that later, when I have time." Consider your own life. When is there time? For many of us read now or read never, so - cut.



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Three keys to beat procrastination ... today!

"I'll do it tomorrow."

"There's really no rush to get this done, so it can wait another week."

"This task isn't that important anyway; it'll get done when I find the time."

All these statements are signs of procrastination. How many do you find yourself muttering on a regular basis?

While everyone procrastinates a task from time to time - whether it's completing a work project or cleaning the garage - too much procrastination in your life can derail even the best-laid plans.

Procrastination occurs for a number of reasons and in varying degrees. The most prevalent reasons for procrastination are: 1) unanswered questions about the task; 2) unresolved fears about doing the task; 3) insufficient motivation to take on something new. All of these reasons are internal, and really have nothing to do with the task itself; they all relate to something the person has to resolve within him or herself.

So if you have a few unfinished projects looming over your head and you can't seem to muster the initiative to get them done, put the following procrastination-busting tips into play today.

1. Find your passion. If you're passionate about something, you don't need an outside motivator to get it done, nor do you fear the task or have unresolved questions about it. So, the big question is, how do you find your passion? There are actually two routes to take for identifying your passion: 1) Either it's some aspect of the work you already do, or 2) It's something close to your heart. Keep in mind that for either of these options, your passion doesn't have to be something you're good at; it just has to be something meaningful to you - something that gets you excited to get out of bed in the morning. Once you can unlock the passion for something, you'll find the procrastination disappears. But, what if you're stuck in a situation or job you're not passionate about but fear leaving

due to financial or other constraints? How can you beat procrastination under those circumstances? Always remember ... life is too short to be in a situation you don't like. First consider talking to your supervisor about new opportunities you can take on within your current position. Chances are, you once found passion in your current job, but maybe your responsibilities have become mundane or repetitive and you have lost some of that passion. Taking on new responsibilities will rejuvenate the passion you once felt. Also, you could consider making a lateral move to remain loyal to your current company, but take on whole new challenges.

Granted, finances may be a consideration as well. If that's the case for you, then start looking for reasons why you are in that job or situation to begin with. Something drew you to that position initially. Find out that reason and you may be able to uncover some aspect of your current situation that you are passionate about and that can motivate you to achieve greater goals.

2. Choose a motivational buddy or dream team. Often, other people can motivate you to keep going when you're suffering from procrastination. Your buddy or team can consist of anyone, such as a spouse, co-worker, boss or sibling, as long as the people you choose will truly hold you accountable for taking (or not taking) action. Make sure you choose people you feel comfortable talking to about your goals and aspirations. Detail to your team exactly what you want to do and why, as well as how you plan to accomplish the goal. Then, make sure your team can monitor what you're doing on a regular basis.

Think of this approach like having a workout buddy. Even though you want to go to the gym three times a week and workout for 45 minutes, sometimes you need another person to keep you on track and to make sure you actually show up at the gym at 6 a.m. The same holds true for other goals in your life. So, assemble your dream team and keep them apprised of your progress. With a little help from outsiders, you can beat procrastination and reach new heights of success.

3. Get moving. Newton's Law of Motion states that objects in motion will stay in motion. That's why you have to do something, no matter how small, to get going toward your goal and beat procrastination. Every one of us is full of potential energy - energy that has not yet started in motion. But once some sort of motion starts, it will keep going. There-

fore, you have to take some step, even a small one sometimes, to start the momentum. Once you do, continuing the activity will be a lot easier.

Have you ever wondered why the most successful people in the world seem to grow even more successful with each passing year? It's because they don't stop once they've started. They use the momentum and energy they've accumulated to reach even higher levels of success. They get the cycle going and they don't let it stop.

For example, if you have to write a report for work and keep procrastinating the project, tell yourself that all you have to do is write one paragraph or even just a couple of sentences. Those initial words you write will give you the momentum to keep going, and before you know it you'll be "in the groove" and will have the entire report done.

Often, small steps are the best way to complete a task and end procrastination. Consider the Great Wall of China. It's the largest man-made structure on the planet and an amazing sight to behold. Most people automatically assume that the wall was built using large stones or boulders. In fact, the wall is constructed with many small bricks, not large stones. Life is the same way. Successful people are simply the right combination of small bricks. Therefore, if you can focus on the little things rather than on accomplishing the most major things all in one shot, you'll eventually have something quite magnificent to behold. Greatness always starts with the little things, and action of any sort will always stop procrastination in its tracks.

Take action today!

Procrastination is a deadly killer of dreams, of goals, of careers, and of life's happiness. Don't allow procrastination to hold you back any longer. By finding your passion, enlisting the help of others and taking small action steps, you can overcome procrastination and achieve your full potential. So make the decision today to get out and do something. And remember ... nothing meaningful ever happens by accident.

(Douglas Vermeeren, Issue: 11/2007)

Ergonomic Guidelines for Manual Material Handling

CAL/OSHA released a new guideline that addresses the ever-present ergonomics concern of manual material handling. This guideline was created in partnership with the Material Handling Industry of America (MHIA) and a key product council of the MHIA, the Ergonomic Assist Systems and Equipment (EASE) council, CNA Insurance Companies and the National Institute for Occupational Safety and Health (NIOSH). That is a lot of acronyms for one paragraph, but the important point to recognize is that a lot of experts from around the country came together to develop a simple, functional guideline to help industry deal with a very common problem.

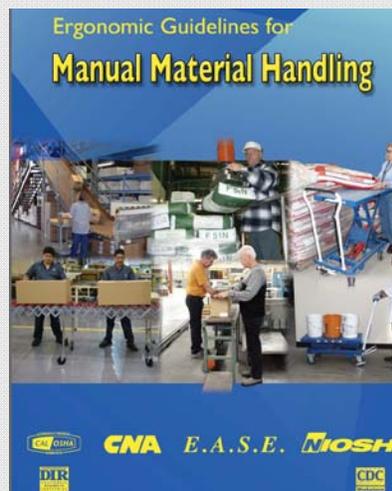
The booklet is written for managers and supervisors in industries that involve the manual handling of containers. It offers suggestions to improve the handling of rectangular, square and cylindrical containers, sacks and bags.

The guideline is laid out in four distinct areas starting with a presentation of background information, and then delving into the core of the document, which are solutions for material handling. One of the factors about

this guideline that addresses the functional needs of an organization is that it provides solutions that may still involve manually handling of materials and suggestions for mechanical assists to further reduce the potential risk of the task. The resources section provides references, links and risk evaluation tools to help the company decide which solution approach is necessary for any given situation.

The actual sections of the guideline are laid out as follows:

"Improving Manual Material Handling in Your Workplace" lists the benefits of improving your work tasks. It also contains information on risk factors, types of ergonomic improvements and effective training and sets out a four-step proactive action plan. The plan helps you identify problems, set priorities,



make changes and follow up.

Sections 1 and 2 of **"Improvement Options"** provide ways to improve lifting, lowering, filling, emptying or carrying tasks by changing work practices and/or the use of equipment. Guidelines for safer work practices also are included.

Section 3 of **"Improvement Options"** provides ideas for using equipment instead of manually handling individual containers. Guidelines for safer equipment use also are included.

For more help, the **"Resources"** section contains additional information on administrative improvements, work assessment tools and comprehensive analysis methods. This section also includes an improvement evaluation tool and a list of professional and trade organizations related to material handling.

To gain a more thorough understanding of this document, the first step is to obtain a free copy of the guideline and review the content. You can use the following links and download a PDF copy of the guideline:

NIOSH: <http://www.cdc.gov/niosh/docs/2007-131/>

Visit our website:

<http://www.bse.vt.edu>

