In This Issue

- 2006 Legislative Session Begins
- Water Utility Staffing
- Jar Testing - How Well Do We Use It
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West Virginia Rural Water Association

Articles and Features

- President’s Message
- The Adventure at Boone-Raleigh PSD
- Source Water Protection Planning
- Safety Training
- EPA is Cleaning Up Vienna’s Groundwater
- 2006 Legislative Session Begins January 11, 2006
- Spotlight on the City of Spencer
- PSC Approves New Financial Tools
- Planning for Contamination Threats and Incidents
- Sharing Resources and Technical Expertise
- The S.O.U.R. Test
- Water Utility Staffing
- Work Ahead (Part 2)
- Mercer County Blazing the Trail
- Source Water Delineation in Karst Aquifers
- Blue-Green Algae (Cyanobacteria)
- To Be or Not to Be
- Diamonds in the Rough
- Computer Backup Options
- Wheels of Progress: Rotary Press Selection for Plum Island
- Tax Increment Financing
- Jar Testing - How Well Do We Use It
- Calculating Detention Time
- Training Calendar
- Membership Listings

West Virginia Rural Water Association is a non-profit organization of rural and small publicly owned water and wastewater systems. Our goal is to enhance the lives of West Virginians. Our efforts to achieve this goal are focused on providing training and technical assistance to the managers and operators of systems. We work with other non-profit organizations in representing the interests of public water and wastewater systems at both the local and national levels.

WVRWA is affiliated with the National Rural Water Association.
By Bonnie Serrett, WVRWA President

President’s Message
Looking Forward to 2006

As I sit here thinking about what a wonderful and productive year we have experienced and wondering what the New Year will bring, I know, as in the past, it will be a busy year filled with high expectations and promises. WVRWA is dedicated to delivering quality service to the citizens of WV by providing clean, safe drinking water for everyone. I would like to welcome aboard two new board members, Dave Wagner and Wayne Oates. Dave will be representing Region VI and Wayne will be representing Region II. Both of these men, I am sure, will be great additions to our board.

WVRWA is the leader in water and wastewater industries in WV and takes great pride in our working relationship with many agencies across the state as well as state legislators. WVRWA will continue to work with these agencies and legislators to ensure that everyone has the knowledge and support that is needed. The association will continue to provide training and technical assistance in the future to those in our industry who manage, operate and maintain our water and wastewater systems. A great addition to our training is our yearly training calendar that was sent out in November to all operators in WV listing the training that will be conducted in 2006. This is a great tool in scheduling your employees for training throughout the year.

Our continuous success will depend on dedicating the necessary time and energy to accomplish our goals. WVRWA has and will continue to address the needs of our member systems. WVRWA has a dedicated staff of fourteen employees and thirteen board members who are available to help whenever needed. If you have a comment or concern, please do not hesitate to contact our office or any board member.

May God bless you this coming year and Happy Holidays to all!
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People become really quite remarkable when they start thinking that they can do things. When they believe in themselves they have the first secret of success.”

As I recall, Will and I showed up at Boone-Raleigh to perform a filter assessment and develop a game plan for the results. After lowering the water level in the #2 filter, we found that the surface area of the anthracite looked more like the topography of Boone/ Raliegh Counties than that of a conventional filter. It was easy to determine the outcome of the project; the under drains had failed and needed replaced. In brief discussions with Chief Operator Chad Beller, the PSD had gotten costs in the past for renovation at the tune of $35,000. Will and I discussed our options and formulated some ballpark costs of our own ($5,000.00). We teamed up with Manager Bob Wiseman and decided that this project was do-able with PSD employees, Henry Aliff, Doug Cox, and Ted Carter.

Office Manager Inza Hapney coordinated an emergency PSD Board Meeting to obtain authorization for the project and the Board agreed. We now had a head of steam built up and the crew at Boone-Raleigh PSD wasted no time in removing the old filter media to uncover the deteriorated under drain that needed replaced. The heat and humidity were unbearable to exist in, not to mention removing all that media and gravel by hand. When Will and I returned for the redesign and fabrication phase of the project, we were able to inspect the old under drain and see where and what failed plus figure out how to build a new one!

While working through the sweat and back breaking efforts, the redesign and installation was fairly simple. We had evolved into a team that could not be defeated. The basics of the new under drain were set forth in a small technical session at the plant and everyone had positive input to insure the proper completion. We measured twice, cut once and laughed a little in between. Once we had the new under drain built and installed, we loaded our backs with bags and installed the gravel and media with an inspiring push for the finish. An end result was near and success was in the air for filter #2. It was like operating the “Two Minute Drill, and crossing the goal line to victory”.

We inventoried everything we did on the filter so that when we rebuild the next filter in a week, we would have the same enthusiasm as we experienced on the first! I think it’s only appropriate to express my thanks to the Board at Boone-Raleigh PSD, Carrie Lou Jarrel, Freddie Harless, and Betty Smith for giving us a chance to explore and conquer the unknown.

Accomplishments of this magnitude by a small number of employees with many other daily obligations will always be a tale for me to tell.
SOURCE WATER PROTECTION PLANNING

INTRODUCTION
In 1996, Congress amended the Safe Drinking Water Act to establish the national Source Water Assessment and Protection Program for public water supply systems. Every public water system is now required to have an assessment of their system completed. West Virginia Bureau for Public Health and the WV Rural Water Association (WVRWA) has been helping rural communities to develop Source Water Protection plans. WVRWA has been providing not only technical and educational assistance, but has been working with communities throughout the entire process of plan conception, development and implementation.

WVRWA has been preparing source water assessment and protection plans for areas that encompass 5-15 water sources (surface and groundwater) or entities including local, county, state or federal agencies.

STEPS FOR DEVELOPMENT OF SOURCE WATER PROTECTION PLAN:

The following steps are generally followed for developing a Source Water Protection Plan:

i. Forming a local team to help develop a Source Water Protection plan.

ii. Review of source water assessments in the select area, developing a comprehensive inventory of water sources, preparing map outlining the source water protection areas and identifying potential contaminants in source water assessment area is necessary.

iii. Developing management strategies to address the potential contamination sources identified in the Source Water Assessment;

iv. Developing contingency provisions for replacement/alternative water sources.

v. Implementing the management strategies.

vi. Review and revising the plan on a consistent and recurring basis.

STEP 1: FORMING A LOCAL TEAM TO HELP DEVELOP A SOURCE WATER PROTECTION PLAN.

The public water system should take the lead in identifying appropriate members for the local planning team. The main purpose of this team is to help develop strategies to effectively manage the potential contaminant sources identified in the Source Water Assessment.

Developing a Source Water Protection Plan without the participation of interested stakeholders in the community is not likely to be successful. Involving local stakeholders can be achieved by having a diverse planning committee, with members from the general public, industry, local and state government. At a minimum, the committee should include the public water supply manager, representatives of government bodies that have authority over land use in the protection area, owners/operators of businesses, farmers, developers within the protection area.

If some of the water issues in your community are potentially controversial, it may be better to include representatives of differing viewpoints in the planning process. If this is not done, perceptions that a particular agenda is being favored may develop, which could create problems with implementing the finalized plan.

STEP 2: REVIEW THE SOURCE WATER ASSESSMENT FOR YOUR AREA.

The WV Bureau for Public Health (WVBPH) has completed Source Water Assessments either in house or through technical consultants. These assessments include delineations of areas around wells and surface water intakes; inventories of potential contamination sources within the protection areas; and susceptibility analyses (i.e., risk assessments) for each system.

As per WV BPH all public water systems have been provided a copy of the assessment for their area. Although the source water assessments are intended to be as complete as possible, there may be some errors in well head protection areas and zone of concerns around streams and water storage structures; locations of potential contaminant sources may not have been identified. The WV Rural Water Association can work with public water systems to check items on these assessments, and make revisions or additions and updates as necessary. Part of this step in the process will include developing a comprehensive inventory of water sources for your area.
Step 3: Developing protective management strategies.

Based on the risk analysis of the potential contamination sources identified in the Source Water Assessment, the planning team develops management strategies that can effectively address each of the contaminant sources. Those identified as “high risk” are given priority.

Any one or combination of management strategies can be used to address the risks to the water supply identified in the assessment. These may include:

- Public involvement and education
- Contaminant source control strategies
- Contingency/emergency planning
- Source water monitoring
- Regulatory controls/local ordinances
- Conservation options

Public involvement and education is considered very important in protecting source waters (both in terms of quality and quantity). The actions of individuals can have some of the most dramatic consequences on a public water supply. WV Rural Water Association can help develop educational materials and presentations to include materials as inserts in water bills; signs along streets and highways indicating the presence of a protection area; posters in public places informing people about source water protection; public meetings; employee training on materials handling practices, emergency spill situations, etc; and presentations to businesses, community groups, schools and other organizations.

Contaminant source control strategies include options such as:

- Contaminant Source Prohibitions. Some types of potential contaminant sources (facilities, land use, specific chemicals, etc.) can be excluded from the protection area, usually through local zoning or ordinances, but also through purchase of land or development rights, or by obtaining an easement, deed restriction, or restrictive covenant.
- Contaminant Source Restrictions. Potential contaminant sources may be restricted within the protection area in amounts, locations, or through extra controls/monitoring.
- Design Standards. Specific design standards can be implemented for potential contamination sources such as overfill protection, leak detection systems, secondary containment systems, etc., through state regulation, building codes, local ordinances, or as voluntary measures.
- Best Management Practices. Examples include septic tank maintenance, proper storage of chemicals and fuels, low-impact development by land developers, and optimal fertilization and land management by farmers.
- Household hazardous waste collection. Communities can provide for periodic local drop-off locations for household hazardous waste that potentially could be disposed of improperly.

Source water monitoring, while not actually a preventative strategy, nevertheless provides information that may lead to actions to help protect the water supply. Sampling and analysis of the “raw” or “untreated” water can, for example, provide an early warning of contaminant plumes.

Regulatory controls/local ordinances provide statutory control methods for protecting source waters. Local governments are generally responsible for land use management, and state statutes empower local governments with certain authority to enforce local police and sanitary ordinances to promote public health, safety and general welfare. The regulatory controls/local ordinances include:

- Sanitary ordinances
- Zoning ordinances and source prohibitions
- Land use and Master Planning
- Special Use Permits
- Subdivision of land
- Parceling of land
- Business Process Reviews

Conservation options can have a profound impact in West Virginia, both in terms of current and future supplies of drinkable water. An effective management strategy could involve an educational campaign to spread awareness of the contribution conservation can make to future drinking water supplies.

Step 4: Developing contingency provisions for replacement/alternative water sources.

This is an important step in planning for the future. Changing regulations alone can “redefine” the number of water sources in a community. Many other factors can influence the amount of water that will be available long-term to a community.

Incorporating planning for future supplies into the Source Water Protection plan add to the plan’s usefulness.

Step 5: Implementing management strategies.

Without implementation, a source water protection plan is of little use. Thus, putting the plan into practice is a major step in producing a successful plan. The WV Rural Water Association’s Source Water Protection Specialist will be available to assist in implementing the plan by providing technical assistance, educational materials and activities, and other applicable assistance.

Step 6. Review and revising the source water plan on a consistent and recurring basis.

WV Rural Water Association will provide guidance for plan review and revision, and work with public water
systems to ensure that plans are periodically reviewed and updated on a consistent and recurring basis.

**Governmental Agencies involved in Source Water Protection**

**Environmental Protection Agency**

Source Water-Related websites:

General Information on Source Water: [http://www.epa.gov/OGWDW/protect/geninfo.html](http://www.epa.gov/OGWDW/protect/geninfo.html)

Source Water Protection at the Community Level: [http://www.epa.gov/safewater/protect/localact.html](http://www.epa.gov/safewater/protect/localact.html)

**Financial Assistance Tools:** [http://www.epa.gov/OGWDW/protect/financial.html](http://www.epa.gov/OGWDW/protect/financial.html)

**Local Government Resources:** [http://www.epa.gov/safewater/protect/localgov.html](http://www.epa.gov/safewater/protect/localgov.html)


WV Bureau for Public Health [http://www.wvdhr.org/bph](http://www.wvdhr.org/bph)

WV Office of Environmental Health Services [http://www.wvgs.wvnet.edu](http://www.wvgs.wvnet.edu)

WV Department of Environmental Protection

WV Division of Water and Waste management [http://www.wvdep.org/dwmm](http://www.wvdep.org/dwmm)

WV Division of Mining and Reclamation [http://www.wvdep.org/dmr](http://www.wvdep.org/dmr)

WV Office of Oil & Gas [http://www.wvdep.org/ooog](http://www.wvdep.org/ooog)

WV Geological and Economic Survey [http://www.wvgs.wvnet.edu](http://www.wvgs.wvnet.edu)

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Workplace safety is an ethical responsibility. Employers have a duty to do everything reasonable to protect their employees from accidents on the job. Safety training can serve to dramatically reduce or eliminate these preventable accidents.

Safety training is the attempt to inform employees of how to prevent and respond to work-related illness and injury. Safety training can take on a number of different appearances—from on-the-job safety equipment training to seminars to videos. Good safety training will inform employees of potential danger on the job and will teach and encourage safe work habits.

Safety training should be designed to fit the needs of the target audience. Rather than have a standard form of safety training, start with a few fundamentals and then deal with the risks specific to the particular employee. With this in mind, training can include some of the following:

- **Proper use of equipment:** Train employees on the correct use of any equipment they will be using. Follow that up with a quick observation of the employee using the equipment himself in order to ensure comprehension.
- **Appropriate storage and equipment and materials:** The third leading cause of injury is bodily reactions such as slipping and tripping. A large percentage of these accidents can be avoided by simply keeping walkways clear and work areas clean.
- **Handling of hazardous material:** Employees should be trained how to be confident and careful with such material.
- **Reporting procedures:** When employees notice an unsafe area or situation on the job, it is important that they know how to report it and have it corrected.
- **Responding to injuries on the job:** It is inevitable that some injuries will happen on the job. How should employees respond when they or someone else is injured on the job? To whom should they report the injury? If employees need basic first aid skills, include a first aid class as part of training.

There is no end to the possible topics of safety training. One common practice is to record injuries that have occurred at your workplace in the past year or two and tailor safety training to address those specific issues.

**Safety Videos available through the WVRWA Library are listed below:**

| VCR-001 Chlorine Safety Runtime 19:00 |
| VCR-002 Confined Spaces, Deadly Places Runtime 21:42 |
| VCR-003 Working in the Hazard Zone: Breathing Easy Runtime 19:00 |
| VCR-004 Confined Space Safety and Rescue Runtime 45:01 |
| VCR-005 Trenching and Excavation Safety Runtime 18:55 |
| VCR-006 Construction Shoring and Safety Runtime 19:22 |
| VCR-007 Cave-In Response Runtime 23:19 |
| VCR-008 Communicating with Irate Customers Runtime 14:22 |
| VCR-010 Life Saving Through Air Monitoring Runtime 11:53 |
| VCR-011 Chlorine Safety Runtime 11:33 |
| VCR-015 Survival By Permit Runtime 16:00 |
| VCR-016 Safety Bite Chlorine Safety Runtime 5:00 |
| VCR-018 Working in Confined Spaces Runtime 19:23 |
| VCR-021 Orientation to Laboratory Safety Runtime 11:00 |
| VCR-025 No Injury, No Accident Runtime 15:00 |
| VCR-026 Blindfold Effect: Driving Safely Runtime 20:00 |
| VCR-027 Close Calls: The Wake Up Call Runtime 17:00 |
| VCR-028 It Only Takes A Second Runtime 4:00 |
| VCR-029 Safety Bite: Trenching & Shoring Safety Runtime 6:14 |
| VCR-030 On The Road: The Lighter Side of Lifting/<TD><TR> |
| VCR-040 Computer Ergonomics Runtime 80:00 |
| VCR-053 Introduction to SCBA Runtime: 25:00 |
| VCR-073 Safety First: Water Utility Security |
| VCR-078 The Safe handling of Water Treatment Chemicals |
| VCR-087 SCBA Safety and Emergency Procedures: Bread and Butter Organizations |
| VCR-103 Defensive Driving Techniques |
| VCR-104 Real Accidents Real People |
| VCR-105 Emergency Planning |
| VCR-106 Chlorine Safety |
| VCR-107 Water and Sewer Treatment Plant Safety |
| VCR-108 Backhoe Safety and Operation |
| VCR-115 Back Safety: Lumbar Lock Presentation |

**References:** Free guide to workplace safety and safety training: coachbiz
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Take a firm approach to Public Law.
US EPA has spent some $8 million on a system to remove dry cleaning solvent from the aquifer in Vienna, WV. Having installed 130 air injection and vapor extraction wells in a 12-block area of town, EPA hopes to clean up the aquifer over the next decade.

EPA’s numerous treatment wells are interconnected by six miles of buried air lines to four separate treatment units where the solvent vapors are captured in large canister carbon filters. In addition, EPA has installed a single low volume groundwater well in a strategic location for extraction of highly contaminated groundwater. Water from this well is pumped through its own set of carbon filters.

The levels of solvent (tetrachloroethylene) in the city’s groundwater are up to one thousand times the drinking water standard and EPA’s goal is to clean the aquifer to better than the standard while preventing any of the contamination from reaching two of Vienna’s water supply wells.

EPA got involved because the solvent had caused the city to close six wells previously. Once an aquifer becomes contaminated and the contamination spreads, the consequences can be very costly.

Mark Your Calendar!

WV Rural Water Association Annual Canaan Valley Conference
September 10-13, 2006
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It’s hard to believe that a year has passed and its time for the legislative session to begin. West Virginia Rural Water Association (WVRWA) accomplished a lot during the 2005 session and 2006 promises the same results. As professionals, WVRWA has a responsibility to keep our voting member systems abreast of all legislative action that is taking place so that we all can make informed decisions that will affect our customers.

The legislative session will begin on Wednesday, January 11, 2006 and will continue until Saturday, March 11, 2006. WVRWA will be monitoring, on a daily basis, all activity that takes place at the Capitol and attending meetings in order to keep systems up-to-date on the latest bills being introduced. We will track each piece of legislation that affects water/wastewater systems and contact member systems if action needs to be taken.

Throughout the session, WVRWA will publish, via E-Brief, a weekly newsletter that will identify important pieces of legislation and any action that is needed. If you haven’t sent in your e-mail address to receive the E-Brief, please respond now so that you won’t miss out on this important communication avenue at debbiebritt@citynet.net. In addition, a Legislative Update will be sent to each voting member system listing all the bills that have been introduced up to that point that affect your system and your customers. When action needs to be taken immediately, a “Water Hammer” will be issued that pertains to a specific piece of legislation that needs immediate action. Each of these communication tools is an integral part of the legislative process and we are there to keep you informed.

The WVRWA Legislative Committee and myself will be working together to keep a watchful eye on activities taking place at the Capitol during this time. If, at any time, you need information about a particular bill, please do not hesitate to contact me. In the past, WVRWA has been recognized for our strength in numbers when a piece of legislation is introduced. Through our 285 voting members, we will be heard so don’t hesitate to contact me or our Legislative Committee regarding issues that arise throughout the session.

It’s been said that the best never rest and at West Virginia Rural Water Association we plan on staying busy. Listed below, for your information, is a list of your senators and delegates for 2006 and how they can be reached.

West Virginia Legislature 2006

<table>
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### 2006 SENATE MEMBERS LISTING (cont’d)

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### 2006 HOUSE OF DELEGATES LISTING

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Spotlight on the City of Spencer

When I was growing up in the City of Spencer, I really never gave any thought to where the drinking water came from or what process was involved in treating the water. I grew up on the outskirts of town and didn’t receive municipal water until my sophomore year in high school. It wasn’t until I treated water in the United States Marine Corps that I ever thought about the subject.

The City of Spencer has an excellent water system. The source of water is Charles Fork Lake located just off U.S. 36 south of Spencer. At one point, Spring Creek was the city’s source for their drinking water. The lake is approximately 5 miles from the water treatment plant. Utilizing Charles Fork Lake has allowed the city to greatly reduce their cost in chemicals used to treat the water because Charles Fork Lake has a fairly consistent turbidity.

It would be difficult for most individuals to locate the water treatment plant in Spencer. It is quite unique in the fact that it is located in one of the highest points in the city. This allows the city to utilize its storage reservoir to feed the main part of town by gravity. The water treatment plant is 1.0 million gallons per day that utilizes conventional treatment. The system uses a SCADA system to monitor and control all the water storage tanks.

The City of Spencer recently received a USDA RUS grant which allowed them to move a water line that was located in a slip located just off U.S. 33 west of Spencer. The town did all of the work internally which allowed Spencer to save money. The mayor, Terry Williams, attributes much of the city’s success to its professional employees. He admits that the city has become much more professional in their business practices in recent years.

Water plant manager Brent Wilson, oversees the water treatment plant and Mark Ray is the chief water plant operator. Jim Williams is the plant operator and Rob Miller is the distribution system manager. Working as a team is what allows the City of Spencer to utilize all assets that are available to them for their customers.

After all those years of not knowing where the water in the City of Spencer came from, I now realize where and how it is delivered to the customers of Spencer. It is a unique system that has some of the best employees anywhere. They are always working hard to ensure that the quality of the water delivered to the customers is the best possible. They quickly respond to customer requests of potential problems in the distribution system.

I am proud to say that I come from a fine small town like Spencer. I could not imagine a finer place to grow up. Everyone is friendly and quick to lend a helping hand when it is needed. The water system employees of the city of Spencer are just a part of a wonderful place located in central West Virginia. One thing is for sure. You always know that the City of Spencer’s drinking water supply is in very capable hands.

The City of Spencer has an excellent water system.
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T he range of options available to finance projects increased appreciably in 2005, as the Public Service Commission (PSC) of West Virginia approved impact fees, the reservation of capacity for private entities in exchange for contributions toward projects, and the implementation of a rate increase prior to completion of a project.

The PSC recognized the shrinking availability of grants and subsidized loans, and the need to find alternatives, in stating:

“. . .[t]he significant reduction of available federal grant and low interest debt dollars for water and sewer infrastructure presents significant challenges to the State, including how to extend needed water and sewer systems throughout the State as well as repair aging infrastructure. Alternative means of providing or promoting adequate water and sewer service are essential and must be explored.” General Order No. 195.50 (June 16, 2005).

The PSC delivered on its commitment to seeking alternatives by approving previously rejected financing and ratemaking concepts.

Impact Fees
Not surprisingly, the rapidly growing Eastern Panhandle served as the backdrop for the first ever PSC approved impact fees for public service districts. Some municipalities charge impact fees because municipalities can set rates without PSC approval (unless a petition for appeal of an ordinance increasing rates is filed with the PSC). In the 1990s, the PSC rejected impact fees sought by Union Williams and Warm Springs PSDs.

On March 28, 2005, in two separate orders, the PSC approved a $1,127 impact fee for Jefferson County PSD and a $1,581 impact fee for Berkeley County Public Service Sewer District. As the numbers indicate, these fees were set based upon recovery of specified costs, however the PSC undertook surprisingly little review of the bases for the amounts of these fees.

The Commission justified approval of the impact fees based upon rapid growth in the service areas of the utilities and an approaching exhaustion of capacity. The PSC limited the application of the fee to developers and to parcels located within a development or previously divided tract. The Commission was concerned that the fee would be unaffordable for existing homeowners, and that ordinary fill-in growth was not driving exhaustion of capacity. The fee was made due and payable at the time the developer receives a sewer commitment letter from the utility.

Reservation of Capacity
In another Jefferson County case, the Commission approved a reservation of capacity at a new wastewater treatment plant for the developer which will construct and donate the plant to the Jefferson County PSD. The developer, Old Standard L.L.C., filed a certificate application for a $1.5 million, 50,000 gallons per day membrane bio-reactor plant and a $1 million collection and transmission system. The developer intends to convey this system to the Jefferson County PSD for $1.00 after it is built. The Commission approved the developer’s request that 27,000 gpd of capacity be reserved for its residential subdivision for a three year period.

The reservation of capacity concept has the potential to bring private donations to fully or partially fund projects which might not otherwise get built, as the rates resulting from conventionally financed projects might cause a utility to decline to pursue the project.

Two Tier Rates
Typically, in conjunction with certificate projects, the PSC does not permit increased rates to go into effect until the project is completed and customers are receiving the benefits of the project. This creates a lag between when a lender requires payment and when the utility has increased revenues to pay the lender. If the lender on the project requires the utility to commence making payments of interest or principal and interest one month after closing and the commencement of construction, the Commission has traditionally required the utility to make these payments with capitalized interest. For example, if $100,000 will be due to the lender between the date of closing on proj-
ect financing and the date the project is complete, the Commission would require the utility to borrow an additional $100,000. This practice is known as capitalizing interest. Increasing the amount of borrowing obviously increases the amount of repayment, ultimately resulting in higher rates. The problem is exacerbated the higher the rate of interest on the loan.

In the City of Moundsville’s certificate application for a new water treatment plant and a related appeal of Moundsville’s ordinance increasing rates, the Commission authorized Moundsville to impose higher rates before the project was completed to cover the interim debt service. This saved Moundsville from borrowing an additional $1.7 million. A second rate increase will go into effect once the project is complete to cover increased operational costs.

Moundsville had a strong case to avoid capitalized interest. The project cost over $18,000,000, and each additional dollar borrowed carried a 6% interest rate. The project did not include any line extensions, creating a perfect match in terms of who pays and who benefits.

The Commission may not permit utilities to forego capitalized interest in other circumstances, but I encourage utilities to propose novel but sensible financing and ratemaking concepts to the Commission in filings. All of these new concepts were approved in particular factual circumstances. That is not to say that the concepts could not be approved in other contexts. For example, a utility which is in a generally slow growth county may be experiencing rapid localized growth which is exhausting capacity. An impact fee would be worth pursuing for that utility.

Separate Rates?
The next testing ground may be separate rates. In 1998, the Legislature amended W.Va. Code §24-2-2 to provide:

“Notwithstanding any other provision of this code to the contrary, rates are not discriminatory if, when considering the debt costs associated with a future water or sewer project which would not benefit existing customers, the Commission establishes rates which ensure that the future customers to be served by the new project are solely responsible for the debt costs associated with the project.”

To my knowledge, the Commission has never approved separate rates as contemplated by this subsection. If utilities had the ability to establish such separate rates, it would make many projects more politically palatable, thereby encouraging the extension of service. The Legislature obviously created this option with the expectation that the Commission would at some point use it.

The Commission has demonstrated a new openness to considering more flexible financing and ratemaking concepts. Utilities should not be bashful in requesting PSC approval of financial terms which make good business sense. In order to get such treatment, utilities need to ask for it, and demonstrate the reasonableness of the request.

James V. Kelsh is an attorney representing utilities, including the Jefferson County PSD and the City of Moundsville, before the Public Service Commission.
Planning for Contamination Threats and Incidents

The time is three in the morning and you just received a call from a well spoken, calm and educated sounding person that your water system has been contaminated. Do you know how to determine if the threat is possible? Do you know how to determine if the threat is credible? And what steps do you take to confirm the threat? These are difficult questions that take a lot of preparation and planning to answer.

The utility needs to incorporate the response and mitigation actions of an intentional or accidental contamination into their emergency response plans. Most utilities have an ERP that covers power failures, natural and manmade disasters and other events, but not many ERPs include how to respond to waterborne contaminants and an intentional threat of contamination.

There are many potential consequences of intentional contamination such as illness and death, public panic, reduced public confidence in the water supply, disruption in water system operations, damage to infrastructure, and the cost of recovery and remediation. Is it possible to intentionally contaminate a public water supply and cause serious results? “A general assessment of the threat of intentional contamination of drinking water indicates that it is possible to cause varying degrees of harm by contaminating a water system.” There are many types of contaminants that have the potential to produce widespread death or illness in the general population; some examples are pathogens, biotoxins, toxic chemicals, microbial contaminants, inorganic and organic chemicals and chemical weapons such as nerve agents and vesicants.

Is an intentional contamination event probable in my utility? Well, determining probability of a contamination event is difficult. Determination may be based on current intelligence and the history of threats and incidents. There has been a reported increase in the interest of various terrorist groups in Weapons of Mass Destruction (WMD) including biological and chemical contaminants. Some intelligence information indicates that terrorist organizations have considered water infrastructure as a possible target. Thus, the potential for such an incident does exist.

“I’m just a utility, why do I need to do anything at all?” Utilities play an essential role in providing safe and reliable drinking water. Both contamination threats and incidents deeply impact the public health mission of water utilities. The guiding principle is “Due Diligence”, what is a suitable and sensible response. Some response is warranted due to public health implications of contamination. Ultimately, the answer must be decided at the local level. (An important consideration is risk comfort level of local decision officials.)

Here are some EPA recommendations on how to prepare for a contamination incident or threat.
1. Know your system
2. Include intentional contamination scenarios in the ERP
3. Develop utility specific response guidelines
4. Establish a structure for Incident Command
5. Develop an information management strategy
6. Establish a communication and notification strategy
7. Conduct training and desktop/field exercises
8. Enhance physical security
9. Establish a baseline monitoring program
10. Utilize and understand on-line monitoring

Summary: As a utility, you cannot prepare for every type of threat or incident. But you can incorporate the concept of “Due Diligence” in responding to events in your system. You can train your employees to be vigilant and to make security a part of their everyday operation. Continue to look for ways to enhance physical security. This article has only scratched the surface on this topic. Next year I will be doing training classes on the USEPA Response Protocol Tool Box and a class on distribution system security. This training will help you to be better prepared to deal with a threat or incident. If you need any technical assistance training on security or assistance determining your vulnerabilities, please contact me at 1-800-339-453 or e-mail me at mhersman@citynet.net.
West Virginia, “The Mountain State” is, in my biased opinion, the most beautiful state in America. Our mountains, as spectacular as they may be, also present a significant obstacle with separation of communities. It is often a great task to get from one community to the next and each community is unique in many different ways. I find that neighbors do not often share their resources and expertise nor do they take the initiative to schedule time together and learn about what the other is doing.

I have encouraged our readers, in previous articles, to break old habits and start communicating with one another. Many of you will recall the consolidation studies conducted by the Public Service Commission in the 1980’s. Unpopular as they were with many of the Public Service Districts, it served as a catalyst in many of our counties that brought the districts together and work towards a common goal. Communicating and working together presents many opportunities to share manpower, equipment, save money, and become more efficient.

For example, lets say that you are considering abandoning your gas chlorinators in favor of liquid chlorine. Your neighbor may be doing so right now and they may have had some challenges that you may have to face as well. If you take the time to visit with your neighbor, you could avoid many of the same difficulties and possibly realize some cost savings by not having to reinvent the wheel twice. This could also lead in to cost savings for the purchase of the chlorine solution if you choose to purchase from the same supplier. With fuel costs such as they are it makes sense to think that a supplier would be willing to cut both systems a break since they are getting more bang for their buck as well.

Manpower is an area that many utilities are not taking advantage of when they could be working with their neighbor. Maybe you need extra help at the sewage treatment plant one or two days a week, but you can’t justify the expense of a full-time employee. What about your neighbor? Do they have someone that could work a couple of days a week? The South Putnam PSD and the Town of Eleanor recently entered into a contract where South Putnam PSD operates the Town’s lagoon. It has turned out to be a good situation for both utilities. The Town doesn’t have the expense of a full time operator and the District is able to realize savings on their employee costs. This is a perfect example of what you can accomplish just by sitting down and opening the lines of communication.

Many cities and towns across the state have employees that do double and triple duty between departments. It makes sense for utilities to do the same. A simple contract can clearly identify each parties responsibilities and how to get started. I hope that I have hit a nerve with some of our readers in order to make you think about all the different ways you can work together and accomplish more tomorrow than you are doing on your own today. If there is any way that I can be of assistance in helping you achieve your goal, please do not hesitate to contact me.
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The S.O.U.R. Test

The S.O.U.R Test (Specific Oxygen Uptake Rate Test) is a two-fold test that is used to indicate stability of sludge in order to meet the vector attraction reduction requirements of the Federal 503 sludge regulations. It is a simple test that uses the respiration of microorganisms. The more microorganisms or the healthier the microorganisms are in the sludge the more they respire or breathe. Conversely, the fewer microorganisms there are in the sludge or less healthy they are are the less they respire. The S.O.U.R. Test measures that respiration with the aid of a dissolved oxygen (D.O.) meter. A temperature-corrected result of 1.5 or less milligrams (mg) of oxygen per hour per mg (mg O₂/Hr/mg) of total solids means that the vector attraction reduction requirements of a stable sludge have been met and that the sludge may be land applied to an approved site.

The first part of the process is the oxygen uptake test, followed by the total solids test. Fortunately, both tests use the same sample for analysis. Several representative grab samples are taken from the digester or sludge holding tank by a core sampler and placed in a bucket or other large storage container. This composited sample is then aerated continually until the uptake test is run. The sample must be kept at the digester temperature for the duration of the test. Aeration may be accomplished by using a laboratory air pump and a weighted diffuser in the bottom of the storage container. The sludge sample is then taken into the laboratory for analysis. The steps for the oxygen uptake test are as follows:

- Pour the sludge sample into a 500 ml sample bottle, leaving an air space at the top of the bottle.
- Shake the capped sample for approximately 30 seconds to increase the dissolved oxygen further.
- When aeration is complete, place a magnetic stir bar in a clean 300 ml BOD bottle.
- Place the BOD bottle probe in the bottle, carefully, while avoiding entrapment of air.
- Turn on the magnetic stirrer.
- Wait for the D.O. reading to stabilize and write down the initial reading.
- After the initial reading, continue to write the readings at 1-minute intervals for 15 additional readings. (This will give you 15 minutes of D.O. depletion.)

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It is a simple test that uses the respiration of microorganisms.

To calculate the oxygen uptake rate, subtract the final D.O. reading from the initial D.O. reading to obtain the oxygen uptake rate in a 15-minute period. Multiply that reading by 4 to get the overall oxygen uptake rate per hour.

The total solids test is done using Standard Methods test 2540 B.

- Prepare a clean evaporating dish by placing in a muffle furnace at 550° C. for one hour, then cool in a dessicator, weigh, and store in the dessicator until ready for use.
- Shake thoroughly, the retained sample from the 500 ml sample bottle, used previously.
- Using a 100 ml graduated cylinder, measure 25 ml of the sample
Place the sample into an evaporating dish, and place in a drying oven at 103 to 105°C until dry (at least 1 hour).

Place the evaporating dish in the dessicator until cool and weigh. Repeat the process of heating in drying oven, cooling, and weighing until the weight change is less than 4% or 0.5 mg, whichever is less.

To calculate the total solids, subtract the weight of the initial empty evaporating dish from the dish with the dried sample. This will give you the total solids of the sample in mg. Divide the volume of the BOD bottle (300 ml) by the volume of the weighed sample (25 ml) to arrive at a multiplication factor. (300 ml ÷ 25 ml = 12) Multiply the weight (mg) of the 25 ml sample by the multiplication factor (12, in this example) to arrive at the total solids (mg) of the 300 ml sample. Below is an example of the calculations:

0.2144 mg (weight of 25 ml sample) x 12 = 2.5728 mg (weight of 300 ml dried sample or total solids)

Divide the oxygen uptake rate per hour by the weight of total solids in mg to arrive at the specific oxygen uptake rate.

\[
3.2 \text{mg O}_2/\text{Hr} \div 2.5728 \text{mg total solids} = 1.24 \text{ mg O}_2/\text{Hr/mg of total solids}
\]

When the oxygen uptake rate calculation is completed, a temperature correction must be applied to the result, if the digester temperature is between 10 and 30°C, unless the temperature is exactly 20°C. If the temperature is 20°C, no correction is necessary. The formula for temperature correction is as follows:

\[
\text{SOUR}_{20} = \text{SOUR}_7 \times \Theta^{(20-T)}
\]

where

\[
\Theta = 1.05 \text{ above } 20^\circ\text{C (68°F)} \\
= 1.07 \text{ below } 20^\circ\text{C (68°F)}
\]

In this case the digester temperature was 21.6°C. Therefore, substituting for the given and known information, we end up with the following formula:

\[
\text{SOUR}_{20} = \text{SOUR}_{21.6} \times 1.05^{(20-21.6)}
\]

\[
\text{SOUR}_{20} = 1.24 \times 0.92
\]

\[
\text{SOUR}_{20} = 1.14 \text{ mg O}_2/\text{Hr/mg of total solids after temperature correction.}
\]

Since the temperature-corrected S.O.U.R. is less than or equal to 1.5 mg O$_2$/Hr/mg of total solids, the vector attraction reduction requirements have been met, in this example, and the sludge can be applied to an approved land application site. Meeting this requirement can save a tremendous amount of time and money on lime addition that is used to stabilize the sludge. It is possible that some systems that have been on the borderline trying to meet the S.O.U.R. requirements may be able to meet them after temperature correction. Conversely, it is also possible that a temperature-corrected S.O.U.R. of over 1.5 mg O$_2$/Hr/mg of total solids would necessitate the use of another method to achieve the vector attraction reduction requirements. The easiest way to do the temperature correction is by using a computer. If anyone would like assistance in setting up a spreadsheet for this purpose, please feel free to call me.

---

“Life in the twentieth century is like a parachute jump; you have to get it right the first time.”

-Margaret Mead
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Thank You Letters

WVRWA

I would like to thank the WVRWA for selecting me as the “2005 Office Manager of the Year”. I was both humbled and greatly surprised by this honor. I apologize for not being present at the awards banquet. I was visiting my son at Fort Knox, Kentucky before he left on a 3 month training mission.

I know I speak for everyone at Hammond PSD when I say how much our district appreciates the WVRWA and all the help you have given us. Thanks again for the award and for your continued support.

Linda Lemasters
Hammond PSD

Dear WVRWA

On behalf of the Friendly PSD, let me assure you that this year’s conference was one of the best. I enjoyed the classes, the entertainment, but most of all the people. To Debbie and staff you are the greatest. To Bonnie and the board you deserve a trophy. To those who attended thanks for being one big family and to the vendors, we love the goodies.

These were all highlights that I’ve placed in my memory book, but my biggest thrill was seeing Clay Lutz. Clay is very special to us and I hope he knows we wish him well.

Susan Stoneking
Friendly PSD

Dear Mrs. Britt

I would like to take this opportunity to express South Putnam Public Service District’s support for the continuation of the Wastewater Technical Assistance and Training programs. The addition of Calvin Hatfield, Wastewater Technician has greatly enhanced the program with his expertise in Board/Management issues. Mr. Hatfield has benefited our District and North Putnam Public Service District by listening to our concerns and sharing his ideas.

Most importantly, Mr. Hatfield’s approach to providing assistance has been by providing us the information we need to help ourselves. Mr. Hatfield is always well informed with new information to benefit our industry and he approaches every situation with an open mind and fresh perspective.

It is our sincerest hope that the West Virginia Rural Water Association’s Wastewater Training and Technical Assistance programs will continue to assist wastewater systems throughout West Virginia and we truly appreciate the benefits we receive from having access to Mr. Hatfield’s knowledge. I have often heard it said that West Virginia Rural Water Association is the critical link between the industry and the introduction of new technology.

Sincerely
Michael W.McNulty
General Manager
South Putnam PSD
Dear Ms. Britt:

Over the last few years this utility has been visited by your staff member, a Mr. Jeff Martin. We have requested his support and the use of his equipment which is a camera suitable for viewing inside sewer piping and locating how these sewers run.

The sewer system under investigation is known as Camp Conley. Its exact origin is unknown, but is believed to date back to the 1920s. It was installed by the US Army to provide services to an army camp. After 20 plus years it was transferred to the local citizenry and that is when the problems began. Mapping was lost, or never transferred. It was not maintained. It was added to without thought about yearly operation and maintenance. Eventually, it became what it is today – bad.

We were forced to take it over in 1998 and have to adjust finances, establish O&M procedures and put in place a preventative maintenance program. Adjusting finances was not part of Jeff’s work. However, without his work we would be “nowhere” on the latter two. We had no mapping when we started, but now have a useful map with very few unknowns about infrastructure location. We had no way of identifying the condition of the infrastructure. Through use of the camera we have been able to determine what needs done to bring the system up to standard. And all of this at no charge to this utility! I have looked at the cost of purchasing this equipment, or contracting out these services and I know the value of what Jeff has done for us. As important has been Jeff’s professionalism when working with our staff. His experience at other entities has helped him with providing input related to trouble shooting our system. And personally he is always a pleasure to be around. Thanks much and kudos to WV Rural Water.

Randy Grinstead, Manager
Mason County PSD

2006 Consumer Confidence Report Workshop Locations

WVRWA has scheduled 5 CCR workshops for all public water systems. Pre-registration is required by calling (800) 339-4513 to select the location and date you wish to attend.

April 6, 2006  Community Building – Glen Dale, WV
April 12, 2006  City Hall – Nutter Fort, WV
April 25, 2006  Huttonsville PSD – Mill Creek, WV
May 2, 2006  WVRWA Office – Hurricane, WV
May 11, 2006  Public Library – Welch, WV
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The staffing function of a water utility includes the selection, placement, orientation, training, development, and compensation of employees. These activities are the responsibility of every water utilities administration. Although much help and support are usually provided by the utilities supervisors, which include the chief operator, the distribution supervisor and office manager depend on the position to be staffed. The supervisory staffing function also includes the evaluation and performance appraisal of employees according to their efforts and abilities. Further, supervisors play a role in determining how employees are to be rewarded on the basis of their work performance.

When staffing and organizing a water utility, the administration must acknowledge that their employees are the key ingredient of the drinking water system. Employees participate in the community daily, from operating the treatment plant to repairing lines or reading meters. The office staff answers phones, collection of payments and billing. Employees make numerous decisions daily from how to operate the treatment plant, repair water main breaks, or an office employee handling a consumer’s complaint. The administration should encourage employees to work as a team. The team approach encourages communication between departments and can induce better performance from all employees and generally tasks are accomplished in a timely manner. Staffing levels may depend on the age and complexity of the water system, maintenance needs, and miles of line and geological features of the system. The extent of automation and growth can influence the staffing levels of a utility. Many smaller utilities outsource services such as line repair and construction projects because of limited staffing and equipment to perform certain tasks. In all forms of business and industry, employers staff their organizations with skilled people and the water industry is no different. All water utilities that have a treatment plant need skilled, trained, licensed, and qualified operators to operate and maintain the treatment plant. The operator is the key to fulfilling the mission of the community in delivering safe drinking water. The chief operator is responsible for how the treatment plant is operated and maintained and is responsible for the training and supervision of all other operators. The administrative duties of the chief operator are rapidly increasing as more regulations that govern the treatment plant are being promulgated and proposed.

The utility also needs to be staffed with adequate back-up operators to cover shifts and to provide coverage for vacations, sick leave and for operators to attend training classes and, in many cases, cover for the chief operator so they can keep up with the administrative part of the job. All operators employed by the utility need to have the proper certification levels and training. Employers should encourage all employees to attend training and encourage them to achieve higher certification levels and they should be compensated accordingly. Essential operator qualities are concern for providing safe drinking water. They need to have knowledge of current drinking water regulations and of the entire system. The distribution system needs to be staffed with personnel that are knowledgeable of the system and are able to “fix things”. They need to understand the need for water quality and should be trained on proper operation and maintenance of the distribution system. Distribution system operators need to work well with and communicate with operators at the treatment facility to ensure uniform operation of the total system.

The office staff is the main link when it comes to the consumers. The office staff communicates directly with the consumers and is the middle link between the operations and distribution staff. Office staffing can require a wide range of responsibilities and multi-skill training because of the diversity that is needed to run an efficient office. Administration needs to adequately staff their utility to properly operate and maintain the system and to provide customer service. Inadequate staffing can create poor work performance and bad attitude from your employees and can compromise customer service.
## WVRWA Resource Library

For the past six years, the WVRWA Resource Library has proven to be an extremely popular service. Hard bound text books, workbooks, technical guides, informational pamphlets, operator exam study guides, and video tapes have all been shipped free to each corner of the state since the library was created. WVRWA regularly adds to the list of titles. Order forms can be faxed or mailed. Even more convenient is the online library materials request form which can be accessed through the WVRWA web site. Below is a listing of the available textbooks and workbooks from the WVRWA Resource Library.

### Water & Wastewater Textbooks and Workbooks

<table>
<thead>
<tr>
<th>Title</th>
<th>Publisher</th>
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<tbody>
<tr>
<td>HBW-001 Applied Math for Water</td>
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<td>HBW-002 Basic Math Concepts for Water &amp; Wastewater Operators</td>
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Give yourself a boost…

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As I dig back through my memory of the last magazine article, I have to apologize and clarify for the thought of not seeing proper road signs being placed before our water utility work zones. Let’s just say, “Water utilities, in general, have good practice in warning oncoming traffic. As part two continues, we are going to explore more of the WVDOH laws on traffic control.

Case 3: A two-lane, two-way or multilane, two-way traffic undivided, (daylight operation only). Where, at any time, any vehicle, equipment, workers or their activities will encroach in the centerline area.

The lanes on either side of the center work space should have a minimum width of 10 feet as measured form the near edge or outside edge of the paved shoulder. When no work is being performed, any unattended obstacle or excavation in the work area shall be protected by type I or type II barricades with flashing lights (type A). If it becomes necessary to operate one lane traffic, Case A6 shall apply. (see next drawing)

All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to the work area unless otherwise authorized by the Engineer. In urban areas, the distance of road signs may be decreased 200 feet to 350 feet.

Case A6: A two-lane, two-way traffic short-time operations (daylight operation only). Construction operations shall be confined to one traffic lane leaving the opposite lane open to traffic at least 500 ft. off both traffic lanes which shall be available for traffic movement at intervals not greater than 1000 ft. in length including both taper and work areas. The flaggers shall be in sight of each other or in direct communication at all times. All signs are to be removed at the completion of the day’s operations.

For multilane, divided roadways, the advance warning signs for traffic approaching from the opposite direction may be omitted if approved by the Engineer.

Table 2. Taper length criteria for work zones

<table>
<thead>
<tr>
<th>Type of taper</th>
<th>Taper length</th>
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<tbody>
<tr>
<td>Upstream tapers</td>
<td></td>
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<tr>
<td>Merging taper</td>
<td>L minimum</td>
</tr>
<tr>
<td>Shifting taper</td>
<td>1/2 L minimum</td>
</tr>
<tr>
<td>Shoulder taper</td>
<td>1/3 L minimum</td>
</tr>
<tr>
<td>Two-way traffic taper</td>
<td>100 feet maximum</td>
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</table>

Downstream tapers (use is optional)

<table>
<thead>
<tr>
<th>Speed</th>
<th>Formula</th>
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<tbody>
<tr>
<td>40 mph or less</td>
<td>L = ( \frac{W S^2}{60} )</td>
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<tr>
<td>45 mph or greater</td>
<td>L = W \times S</td>
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</tbody>
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*\( L \) = Taper length in feet.
\( W \) = Width of offset in feet.
\( S \) = Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph.
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Mercer County Blazing the Trail

In past articles, I have had the pleasure to tell our readers about the Mercer Public Utilities Group (MPUG). MPUG is made up of Mercer Counties publicly owned and operated water and sewer utilities that have formed an alliance to share information, provide support and technical expertise to one another. They have had tremendous success working together in the past and now they are blazing a new trail by working with the Mercer County Solid Waste Authority and the Mercer County Commission to begin moving into the future of reducing the amount of solid waste filling the Mercer County Landfill by 60 to 75% each year. They are researching the feasibility of combining wastewater treatment plant sludge and municipal solid waste to create an end product that could be returned back to the environment.

A project of this nature makes perfect sense, reducing the volume of solid waste filling our landfills and saving valuable green space for agricultural use should be a winning situation for all of us. Although West Virginia doesn’t currently have a facility in place to tackle such a mammoth undertaking, other communities in Tennessee, Georgia, Massachusetts, Florida, and Michigan do.

Many of today’s technologies available are patented by the Bedminster Corporation and incorporate the use of the proprietary Eweson “in-vessel composting system.” While others systems are being developed, the Mercer County group is looking at utilizing the same technology.

The Mercer County Project Team consists of the following individuals:

- Lyle Huntington
  Oakvale Road PSD
- Mike Saffel
  Princeton Sanitary Board
- Marty Mariotti
  Green Valley-Glenwood PSD
- Jerry Haynes
  Mercer County Landfill
  Mercer County Commissioners

As this project moves forward, all of West Virginia’s utilities will be watching and hoping for highly successful and economical results. As stated by one team member, “The changes made today will ultimately benefit our children and grandchildren of tomorrow.”

---

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Source Water Delineation in Karst Aquifers

The shallow subsurface areas of limestone are prone to formation of cavities or caverns called “karst” when surface water flows into, and the moving groundwater dissolves limestone, creating and enlarging cavities and caves and creating sinkholes.

In karst aquifers, under unconfined or poorly confined conditions, water flows and contaminant transport rates can be very high following a storm event. Solution enhancement of bedding plane joints and fractures creates large pathways and a conduit flow condition in karst aquifers. The flow velocities in karst aquifers having conduit flow can range over several orders of magnitude between high-flow and normal-flow conditions. The transport times across entire karst flow systems may be as short as hours to weeks, much briefer than in porous, granular aquifers. For this reason, these susceptible aquifers must be evaluated differently than the more common porous, granular aquifers and bed rock aquifer delineation methods.

A simple method used in source water delineation and common to aquifer delineation consists of establishing a base map for the area, indicating information on natural features of the area and location of public water supply wells and springs. Once a base map has been prepared, overlay maps are drawn up outlining drainage basins, wetlands, ground water resources, sewer service areas, zoning districts and land development maps. Drainage basins or catchment areas that collect water and transport transported into aquifer are determined by finding the highest elevation points on the topographic base map and connecting the high points by drawing boundary lines parallel to the surface contours. The resulting drainage area is the Source Water Delineated area (SWDA) and is generally larger than the SWDA determined by other methods or techniques.

Another method is based on hydro-geological information obtained from field investigations including well logs, test borings, well discharge records and water level fluctuations. The information so obtained can be used to evaluate aquifer’s characteristics including hydraulic conductivity and transmissivity. Water table maps can be constructed which help in understanding the ground water movement and wellhead delineation. In karst aquifers, tracing techniques consisting of injecting dyes or tracers into ground water system are used to understand groundwater movement and mapping of underground conduits. In tracer technique, the dye is introduced into a sinkhole or stream that flows into ground water suspected to flow to the supply source for which SWDA is being delineated. Water from the supply well or spring is then monitored and/or observed for a period of time that is adequate to reach the supply. Field identification of springs and sinkholes is critical in dye tracing. It is important to identify and “bug” numerous area springs to determine ground water flow, not just the well or spring of concern. If the tracer is detected in the supply, the source from which the tracer was injected becomes part of the SWPA. Fluorescent dyes (fluoroscein and rhodamine) are well suited for dye tracer studies by hydrologists. The tracer study helps refine the SWPA area determined from hydro geological mapping study indicated above.

In steeply dipping rocks of Valley and Ridge Province, the ground water flow has been observed to frequently flow along the strike (parallel to the long axis of the ridge) rather than along the dip (down slope) of the beds. At locations, where there is cross strike fracturing there can still be extensive cross-strike ground water flow.

Another method that has been used for determination of the SWPA area is calculating the Aquifer Recharge Area by using the formula: A= Q/R where A is the Area of Recharge in square feet, Q is the Withdrawal Rate of the Well or Spring discharge (cu.ft/year) and R is the Annual Recharge in feet per year. The Recharge Area in acres is obtained by dividing the recharge area in sq.feet by 43,560 sq.ft. For a PWS using a spring, the total discharge of the spring at high flow conditions should be considered rather the amount of water that the public water supply is withdrawing from the spring for its’ use. In the formula, the lowest annual recharge rate is recommended by USGS. The
Spring Discharge is determined during high base flow condition by measuring the velocity and area of water in the channel issuing from the spring and obtaining the discharge by multiplying the velocity by the cross sectional area. A commonly used approximation is that the average velocity for a vertical column of water in a stream is equal to 0.85 times the velocity at the surface and that the velocity should be measured over a length of channel approximately ten times the channel width and where multiple springs are in close proximity a combined discharge is recommended. The calculated recharge area by this method can be compared with SWDA delineation determined by hydro-geological mapping methods.
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Blue-Green Algae (Cyanobacteria)

What are blue-green algae?
Blue-green algae are not true algae. *Cyanobacteria* is the scientific name for blue-green algae or “pond scum.” The first recognized species were blue-green in color, which is how the algae got their name. These microscopic organisms are naturally present in lakes and streams. They usually are present in low numbers.

What are blooms?
Blue-green algae can become very abundant in warm, shallow, undisturbed surface water that receives a lot of sunlight. Under these favorable conditions the numbers of algae can increase dramatically and accumulate on the surface of lakes and ponds, to the point where they become easy to see. This condition is called a “bloom.”

Why do blooms sometimes appear overnight?
Even if you can’t see a cyanobacterial bloom floating on the surface of the water, that doesn’t mean one isn’t present in the water - the bloom could be suspended at various depths in the water where you can’t see it.

The depth at which cyanobacterial blooms float depends on a number of factors. The most important of these are light, phosphorus and nitrogen, which cyanobacteria need in order to survive. As the availability of these elements can change quickly with the time of day and the weather, most cyanobacteria have evolved to be able to control their buoyancy. By being able to sink and rise at will, they are able to move to where nutrient and light levels are at their highest.

In order to activate the mechanism that allows them to move, cyanobacteria need light. At night, when there is no light, cells are unable to adjust their buoyancy and often float to the surface, forming a surface scum. This scum literally appears overnight and lingers until the wind and waves scatter the cells throughout the water.

If a bloom is detected, how long will it last?
Fortunately, most blooms are short lived. An affected area will likely be safe again in anywhere from a few days to a week or two.

Are cyanobacteria a year-round problem in water supplies?
No most water supplies are unlikely to contain cyanobacteria during the winter.

References: *BC HealthFiles #47, June 1995.*

By Mary Hutson, H.E.L.P. Training Specialist
To protect your system, order your warning signs today by calling WVRWA at 1-800-339-4513.
Shakespeare wasn’t a favorite of mine, but the phrase from Hamlet “to be or not to be, that is the question” does create some thoughts for the water professional. Joel Sommer Littauer, a writer, interprets that the answer eludes Hamlet throughout the play, perhaps because it is the wrong question. Hamlet is alive, and to be alive means “to do”, not merely to be. It is his inability to “do”, his tendency to reflect rather than to act, which poisons Hamlet’s resolve and causes his tragic death.

We, as water professionals, must understand that since we are alive, we must be ready “to do” rather than “to be”. The sense of reflecting the “I should have…or I could have…” could be our poison, which means we must “take action”, no matter what the cost. To make a mistake is okay if you have learned from it. Winston Churchill said, “All men make mistakes, but only wise men learn from their mistakes.”

Back in June, I attended NRWA In-Service training and was ousted with curiosity at a 7:30 a.m. Opening Session with Rhett Laubach, a speaker who proclaimed everyone was a leader, he set out to prove it. He had a lot of enthusiasm for such an early morning task and not much time to achieve his goal, but it was just what the doctor ordered. I think he dwelled on what Thomas Bennet once said, “Having once decided to achieve a certain task, achieve it at all costs of tedium and distaste. The gain in self confidence of having accomplished a tiresome labor is immense.” He proved himself during his 30 minutes of bouncing around the room from tabletop to tabletop, gaining confidence with every word, motivating me and others in the room. I couldn’t wait to hear more!

I made my way to his class, not caring what the topic was, as I figured if he was able to continue with the same level of enthusiasm I was feeding off of at 7:30 AM, why miss out. Rhett’s program overview was “life as a torchbearer” and how to become one. An individual torchbearer can light the way for a team of people. He then went over the three defining principles of being a torchbearer: 1) Focus by having a burning passion for results of your work; 2) Having enthusiasm for sharing the good news; and 3) Having the desire to fulfill your role. During class, we separated into small groups and worked to define what we believed leadership meant. When our small groups become one, it was surprising to find we had a lot of similarities. Rhett wanted to ensure we had a passion for results of the work we did, an enthusiasm for sharing the good news and we had a desire to fulfill our role during the class.

My directive for you is to step up to the plate and swing away. Don’t just get up in the morning and go through the motions of work. Remember that famous quote, “Don’t confuse motion with progress. A rocking horse keeps moving, but does not make any progress.” Take action when you walk into the water plant to provide quality water or when you’re heading into the field to repair a line break, efficiently and properly enabling you to be the provider of quality service to your customers. John F. Kennedy once said, “There are costs and risks to a program of action, but they are far less than the long-range risks and costs of comfortable inaction.”

Prepare yourself each day for success. As Albert Schweitzer said, “Success is not the key to happiness. Happiness is the key to success. If you love what you are doing, you will be successful.” Our roles have been described or perceived by some as not important, but they are wrong. I read in the paper in July of 2005 an article written by WV Senator Robert C. Byrd, which he stated “Modern technology can speed information across the world in a fraction of a second. People travel from one continent to another in a matter of hours. The advancements will only continue to amaze. Unfortunately, there are still people in our country whose community infrastructure has barely entered the 20th Century, let alone the 21st... Clean water is basic to the health and prosperity of all citizens.”

We must all rise to the words of the Senator and make sure quality water is available to everyone. Albert Einstein said, “In the middle of difficulty lies opportunity.” The opportunity is ours to make the difference; difficulty has been our middle name forever, and success is right around the corner!
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While researching groundwater supplies in Monroe County, I discovered a piece of trivia in Peterstown. According to an historical marker, a rather large alluvial diamond was discovered along Rich Creek. This is very odd, as there are no known sources of loose diamond gravels in West Virginia.

As I researched groundwater in Monroe County, I found that many of the larger springs in the county are located near a major fault zone, the St Clair Thrust Fault, along the base of Peters Mountain. These large springs tend to issue from caverns in the Ordovician Age Beekmantown Dolomite, which the fault cuts through.

I also found in my literature searches that the Beekmantown Dolomite contains within it what Geologists call an “unconformity”. This is an erosional surface created during ancient Ordovician time. I imagined alluvial diamonds being washed along an ancient Beekmantown shoreline, buried for an eternity at the unconformity, thrust upward by the St Clair fault and released back to the present day surface by another round of erosion.

My alluvial diamond theory may be no more than a fleeting daydream, but there are real diamonds in the rough in Monroe County. These are the numerous springs, some of which have been used as sources of public water supplies and aquaculture ponds. Other springs are as yet “unused”, except as headwaters of high quality streams.

Water from these springs is generally of very good quality. For example, Red Sulphur PSD, which uses one of these springs near Peterstown as its primary source, won the taste testing contest at WVRWA’s 20th Annual Conference. I’d like mine “on the rocks”.

Figure 1. Diamonds in the Rough
The West Virginia Rural Water Association offer’s the following products and others for sale on its web site. If you have any questions or would like to place an order, please do so on the Web at www.wvrwa.org or by calling us directly at (304) 562-8585.

www.wvrwa.org
Computer Backup Options

Computer data is one of your most valuable assets; unfortunately, it’s also one of the most fragile. Most of us know that we’re supposed to back up our data, but how many of us bother to do it? It takes time and discipline to follow a regular backup schedule, and it’s easy to tell yourself that nothing bad is likely to happen. No one really believes that a disaster will ever strike them.

Backing up your system’s computers is absolutely essential -- if you lose computer data, you could spend countless hours retrieving data that could have been prevented. But there’s more than one way to back up your data, depending on your system’s budget, the number of computers that require backup and whether or not you use a network. Here are a few of the backup options available:

1. **Use recordable media.** Once upon a time, you could back up your entire computer on a few floppy disks or Zip disks. Those days are now long past -- but now we have CD-R and DVD-R media. CD-Rs can hold up to 700MB of data, and double-layer DVD-Rs can hold up to 8.5GB. Depending on the size of your hard drive, though, you may end up spending lots of time burning multiple disks to safeguard your data.

2. **Get a second hard disk.** You can install a drive that’s just as big as your existing hard disk and then copy, or “mirror,” all of the data on the second drive. Hard disk prices have dropped considerably, and mirroring a disk makes it easy to replace lost data. But keeping all of your backup data on the same system leaves it vulnerable to the same problems that might affect your primary hard disk.

3. **Use an online backup service.** These services allow you to upload your data over the Internet to remote servers -- if you need to restore lost data; you simply log on to the backup service and download your files. Internet backup services offer several benefits: They’re cheap, easy to use and very reliable. But Internet backups can be slow, and you’ll need Internet access to retrieve your backup files. You should never rely only on Internet backups; if the company storing your data goes out of business, your data might vanish too.

4. **Use a software backup program.** A backup utility, like Norton Ghost or the backup utility that comes bundled in Windows XP, can take the headache out of backing up your data. It’s not meant to replace any of the three methods above; rather, it just automates the backup process. You tell it when and where, and the program can automatically back up your data to the location of your choice.

**What’s Better: Local or Network Backups?**

If your system uses a network, you’ll have to decide whether to back up all of your computers over the network or back up each computer separately. In most cases, you should back up all of the computers on a network along with your file servers; that way, you can purchase a single high-end backup system for your whole network. It’s much more expensive to buy a separate backup unit for each computer. It’s also a waste of time to lug a portable backup drive from one computer to another when you don’t have to.
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Leo B. Hill
Wheels of Progress: Rotary Press Selection for Plum Island

John K. (Jake) Earle, P.E., is a wastewater plant engineer with the Charleston (S.C.) Commissioners of Public Works, assigned to the city’s Plum Island Facility. He is a member of the Water Environment Federation and the Water Environment Association of South Carolina.

The Commissioners of Public Works (CPW) of the City of Charleston, South Carolina, is an agency responsible for providing sewer service and wastewater treatment for Charleston and parts of the surrounding area. The majority of this treatment effort is accomplished at the 36-million-gallons-per-day (MGD) Plum Island Facility adjacent to Charleston Harbor. The Plum Island Facility historically managed treatment residuals on-site using a five-hearth incinerator built in 1969 as part of the original primary-treatment-only plant. Dewatering was initially accomplished with vacuum filters.

In 1984 the plant was modified to incorporate secondary (activated sludge) treatment of the primary effluent, and belt filter presses were installed to dewater the combined primary and waste activated sludge. With the advent of more stringent regulations (including the Federal 503 Rules), the CPW decommissioned the incinerator in 1993 and began hauling dewatered residuals to a landfill approximately 45 miles away.

In 2000 the CPW commissioned a study of long-term biosolids management options with the goal of developing a cost-effective, reliable residuals management program that would minimize environmental and community impacts. This study concluded that with proper consideration of all factors affecting the Plum Island facility, a new thermal oxidation process was the option best suited to meet the CPW’s long-term needs (Malcolm Pirnie, unpublished).

A decision was made to replace the belt presses with high cake-solids dewatering equipment. In August 2002 an evaluated bid process was used to select a centrifuge for installation at Plum Island. The selection process included consideration of capital cost, physical configuration to fit into the existing sludge building, and base of installed units. The result of this process was selection and purchase of a Westfalia Model 635 centrifuge and initiation of a project to install it in a new structure outside of the present residuals processing building in support of replacing the belt presses.

After this process had begun, the CPW’s wastewater engineers and operators became aware of the rotary press after noting that Fournier Industries had been awarded the Water Environment Federation’s Innovative Technology award for 2002. After extensive evaluation, the rotary press was selected for installation at Plum Island to replace the belt presses. The centrifuge installation continued and both dewatering technologies will be used.

Methodology

Pilot studies were used to compare centrifugation of the Plum Island facility residuals with dewatering by the rotary press. Field inspections were made by site visits where centrifuges and rotary presses were installed and in operation. Cost assessments focused on differences in polymer and power cost.

Results

The Plum Island Facility treatment residuals historically have been determined to be approximately 60 percent primary and 40 percent waste activated sludge.

Centrifuge Trials

Three centrifuge manufacturers—Alfa Laval Sharples, Humboldt, and Andritz-Ruthner—were selected for pilot testing to dewater the Plum Island plant residuals over a one-year period from May 1998 through May 1999. The intent of the pilot testing included verifying the feasibility and effectiveness for dewatering Plum Island sludge, and generating potential design data for a full-scale centrifuge installation (Hazen & Sawyer, May 1999).

Each manufacturer provided a trailer-mounted centrifuge dewatering unit with polymer mixing and feed equipment, sludge feed pump, and discharge conveyor. Due to the constraints of mounting a unit for mobility, all of the units tested were smaller than the ones proposed for ultimate installation. A summary of the pilot test results is shown in Table 1, and a compilation of the required 19 runs is shown in Table 2.

Rotary Press Trial

Over a two-week period from February 6 to March 5, 2003, trials were conducted of the Fournier Rotary
Table 1 – Plum Island Centrifuge Trial Summary

<table>
<thead>
<tr>
<th>Shapells</th>
<th>Humboldt</th>
<th>Andritz</th>
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<tbody>
<tr>
<td>Polymers</td>
<td>Cake</td>
<td>Recovery</td>
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Table 2 – Plum Island Centrifuge Trial Data

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Table 3 – Plum Island Rotary Press Trial Results

Press for dewatering of both Plum Island and Daniel Island residuals. The trial equipment was trailer mounted, complete with a control room and testing lab. All equipment used was professionally installed and in extremely good working order. The same PLC-based controls were used as in full-scale installations. The drive unit for the press was full-size, exactly as in full-scale installation. Three configurations of dewatering channel were installed on the output shaft of the drive unit for testing various sludges, and each channel was full-sized. Scale-up for a plant installation consists only of installing additional channels. Due to this configuration, there was a high degree of confidence in the pilot test results, since the pilot equipment exactly represented what would ultimately be installed in the dewatering facility.

For the Plum Island residuals, the rotary press generated sludge cake during 30 separate runs as shown in Table 3. All of these were successful at generating dry sludge cake (average 25.5 percent), with good solids capture (average 98.2 percent) and low polymer consumption (avg. 10.5 lb/ton).

### Site Visits

Four sites were visited to observe operational centrifuge installations and obtain feedback from operation and maintenance personnel, as well as managers. The sites featured centrifuges from four different manufacturers and ranged in age from two to eight years of operating experience. A total of five sites were visited with operational rotary presses.

### General Observations

At each site visited, an attempt was made to solicit objective opinions in the form of informal discussions of all aspects of the centrifuges or rotary presses. Opinions were taken from all available personnel, including operators, maintainers, and managers. Ease of operation and maintenance were key subjects. Rotary presses were noted to be easy to maintain, whereas there were numerous comments to indicate that centrifuges were more maintenance intensive. The rotary press units were significantly quieter than centrifuges. Odors were fairly low in most facilities.

### Discussion

#### Rotary Press Operating Principle

The rotary press technology was devised by a Canadian government agency in 1992 and was licensed to Fournier Industries for marketing and further development (McKay and Fournier, 2002). Because of the sound of its name, the rotary press
is sometimes confused with a screw press when in fact it operates quite differently. Another misconception is that the dewatering channels on the rotary press somehow incorporate a converging or narrowing channel. The following explanation attempts to provide a more accurate understanding of how this equipment works.

The principle of operation is relatively simple. After dosing with polymer to promote flocculation (typical of dewatering processes), sludge is pumped into a hollow cavity between porous screens as shown in Figure 2. Free water (filtrate) passes through the screens and a cake begins to form inside the cavity. The screens are in constant, slow rotation and are able to “grip” the dry cake near the outlet, extruding it continuously through a pressure-controlled port. A septum separates the inlet side of the cavity from the outlet.

Specific features that give the Fournier Rotary Press its performance characteristics include the stainless steel chrome plated screens and a robust, force-multiplying gearbox. These make it possible to produce a dry cake with reduced power consumption and low wear on machine parts.

**Centrifuge Operating Principle**

While centrifuges are common, having been used in wastewater treatment since the 1930s (U.S. EPA, 2000), for the sake of completion, a brief discussion of the operating principle will be made. Solid-bowl centrifuges operate as continuous feed units, which remove solids by a scroll conveyor and discharge liquid over a weir (U.S. EPA, 2000). The solid bowl, into which is inserted the spiral conveyor (See Figure 3), is rotated together with the conveyor at high speeds. These two combined units are often called the rotating assembly.

Higher specific-gravity material (i.e., solids) is displaced to the bowl periphery by centrifugal forces. The bowl is conical shaped on one end, corresponding to the tapered end of the scroll. As feed is continuously added, the thinner liquid above the solids (centrate) flows over a circular weir partially covering the end of the bowl away from the conical end. A slight differential in speed is created by “slowing down” the scroll portion of the rotating assembly, and the resulting motion of the scroll against the outer wall of the bowl forces the solids to the cone-shaped end, up the slope, and out of the ponded centrate, then out of the bowl where they are able to fall by gravity.

**Comparison Chart of Centrifuge and Rotary Press Features**

Based on observations, the rotary press can be compared to the centrifuge on a number of points. Table 4 lists the advantages and disadvantages of centrifugation as described in the U.S. EPA Technology Fact Sheet on Centrifuge Thickening and Dewatering. Corresponding to each point are observations made of the rotary press during the evaluation period. The author’s comments on the EPA centrifuge points are in italics.

**Comparison Chart of Centrifuge and Rotary Press Features**

<table>
<thead>
<tr>
<th>Centrifuge Advantages (EPA, 2000)</th>
<th>Rotary Press Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. May offer lower overall operation and maintenance costs and can outperform conventional belt filter presses.</td>
<td>A. Outperforms belt filter presses based on pilot results. Low operation and maintenance costs.</td>
</tr>
<tr>
<td>Require a small amount of floor space relative to their capacity.</td>
<td>A. Largest rotary press units are compact and can be configured to fit irregular spaces.</td>
</tr>
<tr>
<td>Require minimal operator attention when operations are stable.</td>
<td>A. Require very little operator attention.</td>
</tr>
<tr>
<td>Operators have low exposure to pathogens, aerosols, hydrogen sulfide or other odors.</td>
<td>A. Very low human exposure to pathogens, aerosols, hydrogen sulfide or other gases.</td>
</tr>
<tr>
<td>Are easy to clean.</td>
<td>A. Internal cleaning cycle can be automated. Manual cleaning cycle easy to initiate.</td>
</tr>
<tr>
<td>Can handle higher than design loading and the percent solids recovery can usually be maintained with the addition of a higher polymer dosage. Can handle higher than design flow rate and maintain efficiency.</td>
<td>D. Can be operated at higher throughput than design but cake solids may be reduced. Increased polymer does not overcome reduced cake solids.</td>
</tr>
<tr>
<td>Major maintenance items can be easily removed and replaced. Repair work is easily performed by the manufacturer.</td>
<td>A. Major maintenance items can be easily removed and replaced in the field by plant maintenance personnel. Special training not required.</td>
</tr>
<tr>
<td>Centrifuge Disadvantages (EPA, 2000)</td>
<td></td>
</tr>
<tr>
<td>Have high power consumption and are fairly noisy.</td>
<td>A. Low power consumption (20 HP for largest unit). Very quiet.</td>
</tr>
<tr>
<td>Experience operating the equipment is required to optimize performance.</td>
<td>A. Optimum settings are determined at startup and programmed into controls. Operation is easy to understand. Optimization of polymer dose can be programmed into controls.</td>
</tr>
<tr>
<td>Performance is difficult to monitor because the operator’s view of centrifuge and feed is obstructed. This can be remedied by design.</td>
<td>A. Floculated feed can be observed in sight tube. Centrate samples are easy to obtain. Note: These features could be provided on a centrifuge design.</td>
</tr>
<tr>
<td>Special structural considerations must be taken into account. As with any piece of high speed rotary equipment, the base must be stationary and level due to dynamic loading.</td>
<td>A. Special structural considerations are not needed. Essentially there are no live floor loads as the equipment operates at 0.6 to 2.6 rpm.</td>
</tr>
<tr>
<td>Spare parts are expensive and internal parts are subject to abrasive wear.</td>
<td>A. Wear items are inexpensive. Internal parts are less subject to wear because of low speeds, and sludge movement across major components is minimal (metal screen “grip” cake).</td>
</tr>
<tr>
<td>Start-up and shutdown may take an hour to gradually bring the centrifuge up to speed and slow it down to clean out prior to shut down. New designs can incorporate automatic start and shutdown cycles.</td>
<td>A. Star-up and shutdown is short duration. Periodic, short wash cycles are programmed into normal operation.</td>
</tr>
</tbody>
</table>

![Image](image-url)
was 25.3 percent, which compares closely to the rotary press average cake solids of 25.5 percent. Accordingly, the average results obtained from the rotary press trial is used for further comparison, including a throughput of 1,108 dry pounds per hour (See Table 3).

The Westfalia Model 635 centrifuge being installed at Plum Island has not yet been started up; therefore, design criteria are used to estimate expected throughput. All of the centrifuges used in the pilot tests were smaller; therefore, the feed rates were less than the design values of the Model 635. The design feed rate range is 67-150 gallons per minute (gpm) at feed solids concentrations from 2.2-4.8 percent.

Since centrifuges normally are operated at less than maximum rated capacity to reduce polymer consumption (EPA, 2000), it is assumed that two-thirds of the max feed rate, or 100 gpm, will be the normal feed rate. Applying this to the average feed solids concentration from the rotary press trial of 3.4 percent and the 95.3 percent average recovery from centrifuge trials gives the following hourly throughput, once up to operating speed and conditions:

\[100 \text{ gal/min} \times 8.34 \times 1.005 \times 0.034 \times 0.935 \times 60 \text{min/hr} = 1630 \text{ dry pounds/hour}\]

Note: Specific gravity of sludge assumed to be 1.005 as used here and in rotary press data calculations (Metcalf & Eddy, 1991)

**Automation**

Centrifuges can be fully automated, but starting the bowl and putting feed into the machine are usually performed manually (U.S. EPA, 2000). The parameters typically adjusted during operation are feed rate, polymer dosage, and scroll differential speed (GEA Westfalia, unpublished). All of these values are typically monitored on control screens, along with the resulting change in torque.

Centrifuges are subject to vibration, which must be monitored with sensors. Non-uniform feed solids can cause vibration due to an imbalance of material in the bowl. Wear of mechanical parts can cause excessive vibration. Controls for the centrifuge will shut the unit down if an out-of-specification vibration is observed. While remote starting and stopping of a centrifuge is certainly possible, this was not observed at any installations.

The rotary press operates at a constant pressure in the cake formation zone (See Figure 2). A pressure sensor feeds a signal that is used by the controls to speed up or slow down the feed pump to maintain the desired pressure. The rotational speed of the screens can be varied, and a resulting change in pressure near the cake outlet can be observed.

Polymer dosage can be varied at specified intervals and the effect observed on the outlet pressure and the torque. This can be done manually or programmed into the controls. Overall, the controls for the rotary press are very adaptable to automation, as observed at most of the installations. The units can

![Figure 1 – Cutaway View of a Rotary Press Channel](image1)

![Figure 2 – Cutaway View of Typical Centrifuge](image2)

![Figure 3 – Projected Plum Island Residuals Production](image3)
be remotely started and stopped, as observed at one installation.

**Plum Island Solids Production**

Figure 4 shows Plum Island solids production since detailed records of landfill receipts began being recorded. Samples of cake for each trailer load of residuals are analyzed for total solids and an average number applied to the recorded weight to determine the total mass of dry solids. Regression analysis was applied to this data to project solids production estimates for the next few years. For cost estimates, an average of the projected production from 2003 through 2007 is used, or 4,464 dry tons per year.

**Polymer Consumption**

Centrifugation subjects flocculated sludge to high G forces and “plowing” action as the scroll moves solids to the discharge end of the bowl. Centrifuges are generally noted to require more polymer per pound of dry solids processed. This dosage increases as throughput increases to maintain capture efficiency (U.S. EPA, 2000). The centrifuge trials for Plum Island resulted in average polymer usage of 22.7 pounds per dry ton.

By comparison, the rotary press process appears to be much more gentle to the flocculated sludge. This is seen in the lower polymer usage observed in the Plum Island trials of 10.5 pounds per dry ton (Table 3). Discussions with operating personnel and the technician operating the mobile unit indicate that a wide range of polymers gives good dewatering results with the rotary press. This supports use of polymer trials to determine a cost-effective polymer selection.

Applying a budget estimate polymer cost of $1.87 per dry-equivalent pound to the estimated annual sludge production at Plum Island of 4,464 dry tons results in a significant anticipated annual cost savings as follows:

\[(22.7 - 10.5) \text{ lbs/dry ton} \times 4464 \text{ tons} \times \$1.87 = \$101,842 \text{ (say \$102,000 for comparison)}\]

**Power Consumption**

In the near term, until a thermal process is implemented, the operating schedule for first the centrifuge, then the rotary press is assumed to be similar to the current belt press schedule. This follows a weekly pattern corresponding to landfill operating schedules. Once the units are started, they run more-or-less continuously until the weekly production of residuals is processed. If two weeks per year are allotted for more extensive maintenance, this results in 50 weekly periods requiring processing of:

\[4,464 / 50 = 89.3 \text{ dry tons per week.}\]

For the centrifuge, using the 1,630 dry pounds/hour determined previously, the weekly hours of processing time are determined as follows:

\[89.3 \text{ dry tons per wk} \times 2000 \text{ lb per ton} / 1630 \text{ lb per hr} = 109.57 \text{ say 110 hr per week}\]

For the rotary press, using the 1,108 dry pounds/hour determined previously, the weekly hours of processing time are determined as follows:

\[89.3 \text{ dry tons per wk} \times 2000 \text{ lb per ton} / 1108 \text{ lb per hr} = 161 \text{ hours}\]

From these calculations, it is estimated that using the rotary press to dewater the Plum Island residuals will result in savings of approximately $24,000 per year. Two rotary presses will be installed to provide redundancy and excess capacity to perform routine and major maintenance. Once the rotary presses are installed, the centrifuge will be maintained as supplemental solids processing capacity.

**Total Polymer and Power Cost Savings**

Total cost savings of approximately $125,000 per year are expected for operation of the rotary press at Plum Island, based on reduced power and polymer consumption. Other factors that will determine annual operation and maintenance cost differences are operator time required and maintenance time and material. These costs will be collected over time for further comparisons of operating experience using the centrifuge and the rotary press at Plum Island.

**Conclusions**

The rotary press was selected for retrofitting into the residuals dewater-
ing building at the Plum Island facility to replace the belt presses. Automation, extended hours of operation, and low operator attention are expected to offset throughput differences. The modular nature of the rotary press and the ability to fit it into irregular spaces make it ideal for this application and will result in significant construction cost savings. Quietness of operation, effective containment of odor and the demonstrated suitability for automation and unattended operation were key factors in the decision, as was ease of maintenance.

Installation of a backup/standby centrifuge will continue as planned. This combination of advanced equipment will provide a unique opportunity for detailed comparison of associated costs over time. Savings of at least $125,000 are expected annually.

The normal operation will be to use the rotary presses for daily residuals processing. The centrifuge will be useful in the event the rotary press operation is interrupted for any reason, and the higher throughput of the centrifuge will enable accelerated processing of backlogged residuals.

The centrifuge will be operated on a planned schedule to maintain its operational effectiveness. Reducing the run time will spread maintenance costs out over a much longer period. Operating the centrifuge at off-peak hours will minimize the power cost impact. Polymer trials and other optimization means will be investigated to keep polymer costs as low as possible.


Malcolm Pirnie *Plum Island WWTP Biosolids Disposal Plan*, November, 2000 document 4006-001


Hazen and Sawyer *Plum Island Wastewater Treatment Plant Centrifuge Pilot Testing Summary Report*, May 1999

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Like most people, we were a little skeptical of the idea that we could somehow use a tool called Tax Increment Financing (TIF) to build water and sewer projects in West Virginia. However, by the time you begin reading this article, South Putnam PSD will have the majority of its first TIF project completed. What is TIF? TIF is a unique funding mechanism created by the West Virginia Legislature to be used by all county commissions and Class I and II municipalities in West Virginia. There is one caveat for municipalities, whereas they must work through their respective county commissions. How does TIF work? After a development or redevelopment district is established, the county assessor certifies the based assessed value. This based assessed value is the value of all real and tangible personal property with a tax situs in the district on July 1 of the year prior to the establishment of the district.

Each year, the county assessor will certify the current assessed value of the property in the TIF district. The difference between the amount of regular levy property taxes on the current assessed value and the amount of regular levy property taxes on the base assessed value is the tax increment. For example, take a TIF Base Rate of the following levy rates:

County Current Expense $54.00 cents/$100
School Current $81.92 cents/$100
State General $1.00 cents/$100
Total $136.92

The TIF would take $136.92 cents per $100 of new development. The state would subsidize $81.92 cents per $100 back to the school system which is 60% of the TIF base rate. In this example, the county would be funding 40% of the TIF District.

The South Putnam PSD has partnered with the Putnam County Commission to fund a $2 million sewer line rehabilitation project. The District was faced with replacing 12,500 ft of sewer line ranging from 15-inch diameter to 24-inch diameter. The lines in need of repair pass through several subdivisions and the only golf course in Teays Valley. It soon became evident that replacement was out of the question if the District intended to keep the project affordable. Therefore, they hired Howard K. Bell Consulting Engineers to evaluate the technical feasibility of installing cured in-place pipe (CIPP). After extensive modeling, the engineers recommended the District move forward with the CIPP which will increase the capacity even though the original diameter of the pipe is reduced and the roughness of the pipe is decreased which will allow for greater flow in both dry and wet conditions. The CIPP process will help restore the structural integrity of the existing pipe and minimize future degradation.

By Calvin Hatfield, Management Support Technician
I came across the following article on the internet and it reminded me that we do not use jar testing enough, and when we do, we don’t use it as we should. Most often jar testing is used only if visible conditions change or if we change treatment chemicals. Most operators in the state are working with less than optimum treatment conditions. They will lack mixing, flocculation, settling time, or a combination of these. This is a condition we have to change if we can, but more often than not, we must accept the treatment mechanics that we have. This is where the conscientious operator will ask the question “How can I make the plant work better?” Jar testing is a valuable tool we should use more often, but we must be sure that the data we receive is as accurate as we can. We have to insure that the test conditions match the actual treatment conditions as closely as we can. To do this, we have to look very closely at our treatment plants various components. Do you have static mixers? Do you have mechanical flocculators? What are the settling conditions in your sedimentation basin? Maybe you don’t have a sedimentation basin. What about a pre-sed tank or basin. Do you treat prior to the pre-sed? All of these need to be examined to mimic your plant in the jar tests to allow you to get pertinent data.

After you have answered these questions and decided how to imitate the conditions you have, you need to do the test itself. When you have your results, try the doses you have determined and see how closely the end result of your treatment plant matches the test data. If they don’t match, maybe you need to look at the answers again. Perhaps you overlooked something or your ways to mimic your plant were not accurate. Possibly some short circuiting in one or more of your processes occurred. Maybe something happened as simple as using the wrong speed on the mixer at the wrong time. You have to make these observances and adjustments as needed.

If you can develop a jar test that gives results comparable to those you see leaving your plant, then you can use it to maximize your chemical doses. This can save you money on several different ways. You may use fewer chemicals or get longer filter runs. You may save money on utilities and man hours by pumping more water in the same amount of time. You should get better quality water which makes it easier to meet the ever tighter regulations. All of these are good things to remember and something we should work towards.
Jar Test Procedure:
The jar test procedure involves the following steps:

1. Fill the jar testing apparatus containers with sample water. One container will be used as a control while the other 5 containers can be adjusted depending on what conditions are being tested. For example, the pH of the jars can be adjusted or variations of coagulant dosages can be added to determine optimum operating conditions.

2. Add the coagulant to each container and stir at approximately 100 rpm for 1 minute. The rapid mix stage helps to disperse the coagulant throughout each container. Coagulants are chemical additions, such as metallic salts, which help cause smaller aggregates to form larger particles.

3. Reduce the stirring speed to 25 to 35 rpm and continue mixing for 5 to 20 minutes. This slower mixing speed helps promote floc formation by enhancing particle collisions which lead to larger flocs. These speeds are slow enough to prevent sheering of the floc due to turbulence caused by stirring to fast.

4. Turn off the mixers and allow the containers to settle for 30 to 45 minutes. Then measure the final turbidity in each container. The final turbidity can be evaluated roughly by sight or more accurately using a nephelometer.

Jar Test Example:
The following results were achieved after a series of jar test on two sample waters, A and B, were treated with two different coagulants, alum and ferric chloride, at varying doses.

Conclusion:
Jar testing is an experimental method where optimal conditions are determined empirically rather than theoretically. Jar test are meant to mimic the conditions and processes that take place in the clarification portion of water and wastewater treatment plants. The values that are obtained through the experiment are correlated and adjusted in order to account for the actual treatment system.

http://ewr.cee.vt.edu/environmental/teach/wtprimer/jartest/jartest.html
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Calculating Detention Time

Often when a water plant operator thinks of detention time, he/she thinks they automatically have the proper amount. That is not always the case. The Environmental Protection Agency has set forth rules and regulations that determine if a water treatment plant has enough detention time. In this article, I will discuss what some of those rules are and how to calculate the detention time in your specific treatment plant. The question remains, “Will you have the proper amount?”

The Interim Enhanced Surface Water Treatment Rule (IESWR) requires systems to use disinfection benchmarking to determine whether there may be a significant reduction in microbial inactivation as a result of modifying disinfection practices to meet the Stage 1 Disinfection Byproducts Rule Maximum Contaminant Levels for Total Trihalomethanes and Halo Acetic Acids. Surface Water systems are required to develop a benchmark based on *Giardia* inactivation if they are planning to significantly alter their disinfection practices. Determine the benchmark as follows:

- If data collected is only available for one year, then the lowest month becomes the critical period or benchmark.
- If data is available for previous years, then systems must calculate their benchmarks using the lowest average month for each 12 month period. If a system has 4 years of data collected, then they would calculate their benchmark as follows:
  
  \[
  \text{Benchmark} = \frac{\text{Lowest Average Month} + \text{Lowest Average Month} + \text{Lowest Average Month}}{3}
  \]

It is important for a system to remember that if they are thinking of changing their disinfectant or their injection point, they should contact their state engineer to see if they still are able to meet their CT time. When Total Trihalomethanes and Halo Acetic Acids were going to become a factor for many small systems in the state of West Virginia, many systems decided to drastically reduce or totally eliminate their pre-chlorination in their water treatment plant. This was decided to decrease the formation of TTHM’s and HAA5’s. Reducing the pre-chlorine residual is one thing, but totally eliminating the addition of chlorine is a totally different matter. Remember, if you totally eliminate chlorine, or in some instances reduce chlorine, it may be difficult for your system to maintain the required .2 mg/l residual that is required out in the distribution system. I said it earlier and I’ll say it again, if you are going to change anything about your disinfection techniques, contact your state district engineer.

All chemicals that are added to water to disinfect or coagulate need a certain amount of time to react with things in the water. It is easy to calculate the detention time in for all or just part of your treatment system. Here is a simple way to reach those numbers that you need:

- Calculate the amount of water flowing in gallons per minute (gpm) after the injection point of the chemical added.
- Calculate the volume of water that is in a certain area (Length * Width * Height) if it is a square or rectangular basin (3.1416 * Height) if it is a circular tank
- Multiply the volume by 7.48 to obtain the amount of water in gallons
- Divide the gallons by the flow rate (gpm). This is your detention time in minutes.

If anyone needs help determining their detention time, don’t hesitate to call West Virginia Rural Water at 1-800-339-4513. We are always there to help.
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## January, February, March 2006

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<table>
<thead>
<tr>
<th>CLASS</th>
<th>DATE</th>
<th>LOCATION</th>
<th>CEH CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding Regulations &amp; Math Review</td>
<td>January 5, 2006</td>
<td>Martinsburg</td>
<td>6</td>
</tr>
<tr>
<td>Understanding Regulations &amp; Math Review</td>
<td>January 11, 2006</td>
<td>Ravenswood</td>
<td>6</td>
</tr>
<tr>
<td>Understanding Regulations &amp; Math Review</td>
<td>February 8, 2006</td>
<td>Hurricane</td>
<td>6</td>
</tr>
<tr>
<td>Distribution System Practices &amp; Procedures</td>
<td>February 15, 2006</td>
<td>Beckley</td>
<td>6</td>
</tr>
<tr>
<td>Distribution System Practices &amp; Procedures</td>
<td>March 15, 2006</td>
<td>Moorefield</td>
<td>6</td>
</tr>
<tr>
<td>Distribution System Security</td>
<td>March 22, 2006</td>
<td>Charleston EXPO</td>
<td>3</td>
</tr>
<tr>
<td>Understanding Regulations &amp; Math Review</td>
<td>March 29, 2006</td>
<td>Weirton</td>
<td>6</td>
</tr>
</tbody>
</table>

### H.E.L.P. TRAINING CLASSES

<table>
<thead>
<tr>
<th>CLASS</th>
<th>DATE</th>
<th>LOCATION</th>
<th>CEH CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basics of Being a Chief Operator</td>
<td>January 10, 2006</td>
<td>Hurricane</td>
<td>6</td>
</tr>
<tr>
<td>Ethical Considerations for Chief Operators</td>
<td>January 11, 2006</td>
<td>Hurricane</td>
<td>6</td>
</tr>
<tr>
<td>Beginning Word</td>
<td>January 17, 2006</td>
<td>Scott Depot</td>
<td>6</td>
</tr>
<tr>
<td>Advanced Excel</td>
<td>January 18, 2006</td>
<td>Scott Depot</td>
<td>6</td>
</tr>
<tr>
<td>Class I Certification</td>
<td>January 24-25, 2006</td>
<td>Moundsville</td>
<td>12</td>
</tr>
<tr>
<td>Fluoride Certification</td>
<td>January 26, 2006</td>
<td>Moundsville</td>
<td>6</td>
</tr>
<tr>
<td>Standard Operating Procedures/PM</td>
<td>February 7, 2006</td>
<td>Clarksburg</td>
<td>6</td>
</tr>
<tr>
<td>Chemical Feed Pumps &amp; Dosages</td>
<td>February 8, 2006</td>
<td>Clarksburg</td>
<td>6</td>
</tr>
<tr>
<td>Standard Operating Procedures/PM</td>
<td>February 14, 2006</td>
<td>Moundsville</td>
<td>6</td>
</tr>
<tr>
<td>Basic Math</td>
<td>February 15, 2006</td>
<td>Moundsville</td>
<td>6</td>
</tr>
<tr>
<td>Class ID Certification</td>
<td>February 16, 2006</td>
<td>Moundsville</td>
<td>6</td>
</tr>
<tr>
<td>Class I Certification</td>
<td>February 21-22, 2006</td>
<td>Moundsville</td>
<td>12</td>
</tr>
<tr>
<td>Standard Operating Procedures/PM</td>
<td>March 7, 2006</td>
<td>Weirton</td>
<td>6</td>
</tr>
<tr>
<td>Chemical Feed Pumps &amp; Dosages</td>
<td>March 8, 2006</td>
<td>Weirton</td>
<td>6</td>
</tr>
<tr>
<td>Class ID Certification</td>
<td>March 9, 2006</td>
<td>Weirton</td>
<td>6</td>
</tr>
<tr>
<td>Valve Location/System Design</td>
<td>March 14, 2006</td>
<td>Pt. Pleasant</td>
<td>6</td>
</tr>
<tr>
<td>Chemical Feed Pumps &amp; Dosages</td>
<td>March 16, 2006</td>
<td>Beckley</td>
<td>6</td>
</tr>
<tr>
<td>Implementing a QC/QA Plan</td>
<td>March 23, 2006</td>
<td>Charleston EXPO</td>
<td>3</td>
</tr>
<tr>
<td>Drinking Water Lab Procedures</td>
<td>March 27-31, 2006</td>
<td>Hedgesville</td>
<td>30</td>
</tr>
</tbody>
</table>

### WASTEWATER TRAINING CLASSES

<table>
<thead>
<tr>
<th>CLASS</th>
<th>DATE</th>
<th>LOCATION</th>
<th>CEH CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Math for WW Operators</td>
<td>January 12, 2006</td>
<td>Hurricane</td>
<td>5</td>
</tr>
<tr>
<td>WW Sampling &amp; Monitoring Procedures</td>
<td>February 9, 2006</td>
<td>Vienna</td>
<td>5</td>
</tr>
<tr>
<td>Wastewater System Design</td>
<td>March 9, 2006</td>
<td>Buckhannon</td>
<td>5</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>VOTING MEMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrian PSD</td>
</tr>
<tr>
<td>Albright Water Works</td>
</tr>
<tr>
<td>Alderson</td>
</tr>
<tr>
<td>Alpine Lake Public Utilities</td>
</tr>
<tr>
<td>Ammoores PSD</td>
</tr>
<tr>
<td>Arbuckle PSD</td>
</tr>
<tr>
<td>Armstrong PSD</td>
</tr>
<tr>
<td>Arthurdale Water</td>
</tr>
<tr>
<td>Athens</td>
</tr>
<tr>
<td>Belington</td>
</tr>
<tr>
<td>Bellwood Community</td>
</tr>
<tr>
<td>Belmont</td>
</tr>
<tr>
<td>Benwood</td>
</tr>
<tr>
<td>Berkeley County PSD</td>
</tr>
<tr>
<td>Berkeley Springs Water</td>
</tr>
<tr>
<td>Beverly</td>
</tr>
<tr>
<td>Big Bend PSD</td>
</tr>
<tr>
<td>Bingamon PSD</td>
</tr>
<tr>
<td>Birch River PSD</td>
</tr>
<tr>
<td>Bluewell PSD</td>
</tr>
<tr>
<td>Bolar PSD</td>
</tr>
<tr>
<td>Boone County PSD</td>
</tr>
<tr>
<td>Boone Raleigh PSD</td>
</tr>
<tr>
<td>Bradley PSD</td>
</tr>
<tr>
<td>Bradshaw</td>
</tr>
<tr>
<td>Bramwell</td>
</tr>
<tr>
<td>Branchland-Midkiff PSD</td>
</tr>
<tr>
<td>Bridgeport</td>
</tr>
<tr>
<td>Brooke County PSD</td>
</tr>
<tr>
<td>Bruceton Mills</td>
</tr>
<tr>
<td>Buckhannon</td>
</tr>
<tr>
<td>Buffalo Creek PSD</td>
</tr>
<tr>
<td>Burnsville</td>
</tr>
<tr>
<td>Cairo</td>
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**WVRWA Associate Members - Winter, 2005**

### ACCOUNTING/FINANCIAL

* Bassett & Lowe  
  1156 South Main Street  
  Milton, WV 25541  
  Phone: (304) 743-5573  
  See Our Ad Page 54

* Ferris Baker Watts  
  100 Laidley Tower  
  Charleston, WV 25301  
  Phone: (304) 345-3439  
  See Our Ad Page 63

* Griffith & Associates, CPA’s  
  905 Little Coal River Road  
  Alum Creek, WV 25003  
  Phone: (304) 756-3600  
  See Our Ad Page 42

* Ross, Sinclaire & Associates  
  400 Democrat Drive  
  Frankford, Ky 40601  
  Phone: (502) 695-7353  
  See Our Ad Page 31

### INSURANCE

** Bill Bailey Insurance Agency, Inc.  
 P.O. Box 246  
 Williamstown, WV 26187  
 Phone: (304) 375-4900  
 See Our Ad Page 3

### ATTORNEYS

* Bailey & Wyant, PLLC  
  P.O. Box 3710  
  Charleston, WV 25337  
  Phone: (304) 345-4222  
  See Our Ad Page 54

* Bowles Rice McDavid Graff & Love, LLP  
  P.O. Box 1386  
  Charleston, WV 25325  
  Phone: (304) 347-1100

* Daniels Law Firm PLLC  
  P.O. Box 1433  
  Charleston, WV 25325  
  Phone: (304) 342-6666  
  See Our Ad Page 61

* Goodwin & Goodwin  
  300 Summers Street  
  Charleston, WV 25301  
  Phone: (304) 346-7000  
  See Our Ad Page 71

* James V. Kelsh, Esquire  
  P.O. Box 3713  
  Charleston, WV 25337  
  Phone: (304) 343-1654  
  See Our Ad Page 48

* Hoy Shingleton  
  1446-24 Edwin Miller Blvd.  
  Martinsburg, WV 25401  
  Phone: (304) 262-4773  
  See Our Ad Page 28

* Robert R. Rodecker  
  P.O. Box 3713  
  Charleston, WV 25337  
  Phone: (304) 343-1654  
  See Our Ad Page 17

### CONSULTANTS

* AE Associates, Ltd.  
  P.O. Box 607  
  Charleston, WV 25322  
  Phone: (304) 346-0505  
  See Our Ad Page 5

* Alpha Associates, Inc.  
  535 West King Street  
  Martinsburg, WV 25401  
  Phone: (877) 264-0051  
  See Our Ad Page 54

* Anderson & Associates, Inc.  
  100 Armdore Street  
  Blacksburg, VA 24060  
  Phone: (800) 763-5596  
  See Our Ad Page 8

* Backflow Consulting Services  
  P.O. Box 127  
  Dunbar, WV 25064  
  Phone: (304) 768-0021  
  See Our Ad Page 5

* Boyles & Hildreth  
  P.O. Box 614  
  Spencer, WV 25276  
  Phone: (304) 927-4974  
  See Our Ad Page 28

* Burgess & Niple, Inc.  
  1124 Smith Street, Suite 105  
  Charleston, WV 25301  
  Phone: (304) 342-0000  
  See Our Ad Page 54

* Cerrone & Associates, Inc.  
  401 Main Street  
  Wheeling, WV 26003  
  Phone: (304) 232-5550  
  See Our Ad Page 43

* Chaplin Technical Group  
  200 Sixth Avenue  
  St. Albans, WV 25177  
  Phone: (304) 727-5501  
  See Our Ad Page 12

* Dunn Engineers, Inc.  
  400 South Ruffner Road  
  Charleston, WV 25314  
  Phone: (304) 342-3436  
  See Our Ad Page 20

* E.L. Robinson Engr. Co.  
  5088 Washington St., West  
  Charleston, WV 25313  
  Phone: (304) 776-7473  
  See Our Ad Page 26

* Geary Associates  
  106 North Main Street  
  Petersburg, WV 26847  
  Phone: (304) 257-2022  
  See Our Ad Page 41

* GAI Consultants  
  3412 Chesterfield Ave.  
  Charleston, WV 25304-2997  
  Phone: (304) 926-8100  
  See Our Ad Page 17

* Ghosh Engineers, Inc.  
  723 Kanawha Blvd., East  
  Charleston, WV 25301  
  Phone: (304) 343-5300  
  See Our Ad Page 28

* Gilson Engineering  
  505 Capitol Street  
  Charleston, WV 25301  
  Phone: (304) 342-0012  
  See Our Ad Page 20

* Greenhorne & O’Mara  
  12 Moran Circle  
  Fairmont, WV 26554  
  Phone: (304) 367-9401  
  See Our Ad Page 20

* Gwin, Dobson & Foreman, Inc.  
  3121 Fairway Drive, Suite B  
  Altoona, PA 16602-4475  
  Phone: (814) 943-5214  
  See Our Ad Page 47

* HNTB  
  #3 Mission Way  
  Scott Depot, WV 25560  
  Phone: (304) 757-0888  
  See Our Ad Page 41

* Hornor Brothers Engineers  
  P.O. Box 386  
  Clarksburg, WV 26302  
  Phone: (304) 624-6445  
  See Our Ad Page 70

* Howard K. Bell  
  Scott Depot, WV 25560  
  Phone: (304) 757-8031  
  See Our Ad Page 28

* Huntley, Nyce & Associates  
  319 Lutz Ave.  
  Martinsburg, WV 25401  
  Phone: (319) 260-1290  
  See Our Ad Page 17

* Kappe Associates, Inc.  
  4268 Northern Pike  
  Monroeville, PA 15146-2733  
  Phone: (412) 393-9303  
  See Our Ad Page 19

* L. A. Gates Company  
  P.O. Drawer AF  
  Beckley, WV 25802  
  Phone: (304) 356-1464  
  See Our Ad Page 66

* MS Consultants  
  206 Capitol Street  
  Charleston, WV 25301  
  Phone: (304) 346-1211  
  See Our Ad Page 48

* Pentree, Inc.  
  P.O. Box 1309  
  Princeton, WV 24740  
  Phone: (304) 431-7800  
  See Our Ad Page 45

* Potesta & Associates, Inc.  
  2300 MacCorkle Avenue, S.E.  
  Charleston, WV 25304  
  Phone: (304) 342-1400  
  See Our Ad Page 17

* Rummel, Klepper & Kahl, LLP  
  One Grand Central Park, Suite 2040  
  Keyser, WV 26726  
  Phone: (304) 788-3370  
  See Our Ad Page 54

* S & S Engineers, Inc.  
  501 Eagle Mountain Road  
  Charleston, WV 25311  
  Phone: (304) 342-7168  
  See Our Ad Page 63

* Stafford Consultants, Inc.  
  P.O. Box 5849  
  Princeton, WV 24740  
  Phone: (304) 425-9555  
  See Our Ad Page 5

* Terradon Corporation  
  P.O. Box 519  
  Nitro, WV 25143  
  Phone: (304) 755-8291  
  See Our Ad Page 5

* Thrasher Engineering, Inc.  
  P.O. Box 1532  
  Nitro, WV 25143  
  Phone: (304) 755-8291  
  See Our Ad Page 21

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**Associate Member**  •  **Sponsoring Associate Member**  
**Sustaining Associate Member**
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<td>*Triad Engineering</td>
<td>(304) 755-0721</td>
<td>4980 Teays Valley Road, St. Albans, WV 25177</td>
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<tr>
<td>*VIEW Engineering</td>
<td>(304) 267-9759</td>
<td>300 Foxcroft Avenue, Suite 301, Martinsburg, WV 25401</td>
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<td>**Welding, Inc.</td>
<td>(304) 346-0763</td>
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<td>**AMR, Inc.</td>
<td>(304) 986-3368</td>
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<td>**American Water Services</td>
<td>(800) 999-3484</td>
<td>7241 Peppermill Parkway, North Charleston, SC 29418</td>
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<td>**American Development Corp.</td>
<td>(888) 542-8561</td>
<td>1830 Pulaski Hwy., P.O. Box 620, Fayetteville, TN 37334</td>
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<tr>
<td>**American Flow Control</td>
<td>(412) 851-1230</td>
<td>2581 Washington Road, Suite 220-222, Pittsburgh, PA 15241</td>
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<tr>
<td>**American Leak Detection of WV</td>
<td>(800) 939-2777</td>
<td>P.O. Box 228, Mannington, WV 26582</td>
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<tr>
<td>**Analabs, Inc.</td>
<td>(304) 255-4821</td>
<td>P.O. Box 962, Beckley, WV 25802-0962</td>
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<td>**Appalachian Software, Inc.</td>
<td>(304) 776-4889</td>
<td>P.O. Box 549, Gap, PA 15727</td>
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<td>**BFMC, Inc.</td>
<td>(724) 941-5386</td>
<td>132 Sherwood Dr., Suite 101, McMurray, PA 15317</td>
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<td>**BissNuss, Inc.</td>
<td>(330) 533-5531</td>
<td>Olde Courthouse Bldg., Suite 210, Canfield, OH 44406</td>
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<td>**Brenntag Mid-South, Inc.</td>
<td>(304) 727-4379</td>
<td>319 1st Street, North St. Albans, WV 25177</td>
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<td>**Bristol Babcock</td>
<td>(800) 945-2262</td>
<td>1100 Buckingham St., Watertown, CT 06795</td>
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<td>**C.I. Thornburg Co., Inc.</td>
<td>(800) 999-3484</td>
<td>4034 Altizer Avenue, Huntington, WV 25705</td>
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<tr>
<td>**Control Equipment Co.</td>
<td>(800) 572-3220</td>
<td>P.O. Box 1207, Salem, VA 24153</td>
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<tr>
<td>**D&amp;S Contractors</td>
<td>(304) 344-2223</td>
<td>P.O. Box 625, Benedum Airport Ind. Park, Beaver, WV 26330</td>
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<td>**Dutchland, Inc.</td>
<td>(727) 928-1712</td>
<td>P.O. Box 549, Gap, PA 15727</td>
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<td>**Eagle Research Corporation</td>
<td>(304) 757-6565</td>
<td>4237 State Rt. 34, Hurricane, WV 25526</td>
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<td>**Eastern Tank &amp; Utility Series, Inc.</td>
<td>(800) 455-6754</td>
<td>145 Krit Lane, Princeton, WV 24740</td>
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<tr>
<td>**Fisher Research Laboratory</td>
<td>(724) 941-5386</td>
<td>132 Sherwood Dr., Suite 101, McMurray, PA 15317</td>
</tr>
<tr>
<td>**Greentree Applied Systems, Inc.</td>
<td>(304) 455-6754</td>
<td>145 Krit Lane, Princeton, WV 24740</td>
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<tr>
<td>**HACHI Company</td>
<td>(304) 727-4224</td>
<td>P.O. Box 9694, Columbus, OH 43209</td>
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<td>**ISG Weirton, Inc.</td>
<td>(304) 725-2202</td>
<td>P.O. Box 1220, Morgantown, WV 26508</td>
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<td>**KCI Technologies</td>
<td>(304) 252-2202</td>
<td>P.O. Box 783, Morgantown, WV 26508</td>
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<td>**Leo Equipment</td>
<td>(703) 506-9515</td>
<td>8620 Westwood Center Drive, Vienna, VA 22182</td>
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<td>**Ford Meter Box Company</td>
<td>(703) 768-0886</td>
<td>4821 McChung Street, South Charleston, WV 25309</td>
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<td>**Hughes Supply</td>
<td>(703) 797-2658</td>
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<td>**Industrial Electric Corp.</td>
<td>(703) 832-2581</td>
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<td>4821 McChung Street, South Charleston, WV 25309</td>
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South Charleston, WV 25303
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See Our Ad Page 66

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11548 Cotton Road
Meadville, PA 16335
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**Mountaineer Computer Systems**
P.O. Box 982
Lewisburg, WV 24901
Phone: (304) 392-5018
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**M.S. Jacobs & Associates, Inc.**
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Phone: (304) 343-8906
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**Mueller Company**
4119 Whitford Circle #408
Glen Allen, WV 23060
Phone: (304) 527-0286
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**Natgun Corporation**
3960 Brown Park Dr., Suite B
Hilliard, OH 43026
Phone: (614) 777-9834
See Our Ad Page 13

**National Road Utility Supply, Inc.**
P.O. Box A
Valley Grove, WV 26060
Phone: (304) 547-0101
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**Neptune Technology Group**
1600 Alabama Highway 229
Tallassee, AL 36078
Phone: (803) 243-0421
See Our Ad Page 63

**Packaged Systems, Inc.**
P.O. Box 13399
Sissonville, WV 25360
Phone: (304) 984-3333
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**Panhandle Pipe & Supply, Inc.**
P.O. Box 764
Martinsburg, WV 25402
Phone: (304) 263-6986
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**Patriot Services, Inc.**
HC 63, Box 57
Red House, WV 25168
Phone: (304) 856-4495
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**Pittsburg Tank & Tower Co.**
P.O. Box 913
Henderson, KY 42419-0913
Phone: (270) 826-9000
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**John P. Place, Inc.**
90 Clairmont Boulevard
Pittsburgh, PA 15236
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** Reynolds, Inc.**
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**Ramco Industries**
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Midlothian, VA 23112
Phone: (800) 258-7448
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**Sal Chemical Co., Inc.**
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**Schenstedt Instrument Co.**
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Kearneysville, WV 25430
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**Service Pump & Supply Co.**
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**Severn Trent Services**
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Alsip, IL 60803
Phone: (708) 768-6544
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**Sherwin Williams**
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Little Hoskins, OH 45742
Phone: (304) 377-1189
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**Southeastern Equipment Co., Inc.**
P.O. Box 536
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Phone: (740) 432-6303

**Southern Corrosion, Inc.**
738 Thelma Rd.
Roanoke, NC 27870
Phone: (304) 535-1777
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**S. R. Harper, Inc.**
448 Munntown Road
Eighty Four, PA 15330
Phone: (724) 942-9520
See Our Ad Page 43

**State Equipment Inc.**
P.O. Box 3939
Charleston, WV 25339
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**Tepco Equipment Co., Inc.**
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Phone: (304) 558-3637
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**Water Development Authority**
180 Association Drive
Charleston, WV 25311
Phone: (304) 558-3612
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**W.C. Weil Company**
P.O. Box 7144
Charleston, WV 25326-0144
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**W.C. Weil Water Technology Inc.**
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