This manual is designed for operators taking the Water Distribution (WD) certification course and exam. This manual directly references the *Water Distribution System Operation and Maintenance Fifth Edition* prepared by California State University, Sacramento College of Engineering and Computer Science Office of Water Programs.

This tool, along with your operating experience and review of the Office of Water Programs California State University Sacramento manuals, will help you prepare for the certification exam. Prior review of this manual does not eliminate the need for prospective operators to attend the required WD training course.

If you are already a Class I –IV public water system (PWS) operator, you are not required to also hold a WD certification. Instead, you may take this course for continued education and learning (CEH2008-052 for 23 hours).

With the great diversity and dynamics present in the water treatment industry, it is important for operators to be resourceful – at least know enough to ask the right questions to the right people.

---

**Disclaimer**

All reasonable precautions have been taken in the preparation of this document, including both technical and non-technical proofing. The West Virginia Department of Health and Human Resources and West Virginia Environmental Training Center and all staff assume no responsibility for any errors or omissions.

Should the summarized information in this document be inconsistent with a governing rule or statute, the language of the rule or statute shall prevail.

Reference herein to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the West Virginia Department of Health and Human Resources and West Virginia Environmental Training Center.
This manual and course was developed in cooperation with:

**West Virginia Environmental Training Center**
HC 88, Box 21
Ripley, West Virginia 25271
(304) 372-7878
www.wvetc.org

WVETC was established in 1983 under the administration of the West Virginia Department of Education (WVDE). Federal grant funds were obtained from the USEPA to construct and equip the facility for the purpose of providing training to wastewater and water plant operators. Continued operation is overseen by the WVDE through Regional Education Service Agency (RESA) V.

**Operator Training Committee of Ohio, Inc.**
3972 Indianola Avenue  Columbus Ohio 43214
(614) 268-6826
www.ohiowater.org/OTCO

Since 1964 OTCO has focused primarily on the needs of operators. We accomplish our objective by working with United States Environmental Protection Agency, Ohio Environmental Protection Agency, Ohio Department of Health and non-profit environmental organizations such as American Water Works Association, Rural Water Association, and Rural Community Assistance Programs.

&

Gary A. Espenschied, Principal Author and Experienced Instructor for both WVETC and OTCO.
<table>
<thead>
<tr>
<th>Section 1: West Virginia Drinking Water Program</th>
<th>Page 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 2: The Supply and the Operator</td>
<td>Page 8</td>
</tr>
<tr>
<td>Section 3: Basic Math Concepts for the Operator</td>
<td>Page 21</td>
</tr>
<tr>
<td>Section 4: Solving Distribution Math Problems</td>
<td>Page 32</td>
</tr>
<tr>
<td>Section 5: Storage Facilities</td>
<td>Page 41</td>
</tr>
<tr>
<td>Section 6: Distribution System Facilities</td>
<td>Page 46</td>
</tr>
<tr>
<td>Section 7: Water Quality Considerations in Distribution Systems</td>
<td>Page 53</td>
</tr>
<tr>
<td>Section 8: Operation and Maintenance</td>
<td>Page 56</td>
</tr>
<tr>
<td>Section 9: Sampling</td>
<td>Page 62</td>
</tr>
<tr>
<td>Section 10: Disinfection</td>
<td>Page 80</td>
</tr>
<tr>
<td>Section 11: Safety</td>
<td>Page 86</td>
</tr>
<tr>
<td>Section 12: Water Security</td>
<td>Page 91</td>
</tr>
<tr>
<td>Section 13: Administration</td>
<td>Page 100</td>
</tr>
<tr>
<td>Additional Information:</td>
<td></td>
</tr>
<tr>
<td>• Reference List</td>
<td>Page 104</td>
</tr>
<tr>
<td>• Boil Water Notices</td>
<td>Page 105</td>
</tr>
<tr>
<td>• United States, 1992–2001</td>
<td>Page 106</td>
</tr>
<tr>
<td>• DOH contact information</td>
<td>Page 108</td>
</tr>
<tr>
<td>Regulations:</td>
<td></td>
</tr>
<tr>
<td>• Title 64, Legislative Rule, Bureau for Public Health, Series 3, Public Water Systems.</td>
<td>Page 109</td>
</tr>
<tr>
<td>• Title 157 Legislative Rule, Series 5, Traffic and Safety Rules.</td>
<td>Page 117</td>
</tr>
<tr>
<td>• Title 64, Legislative Rule, Bureau for Public Health, Series 4, Public Water Systems Operator Regulations.</td>
<td>Page 132</td>
</tr>
<tr>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Title 150, Legislative Rule, Series 7, Rules For The Government Of Water Utilities</td>
<td>140</td>
</tr>
<tr>
<td>Title 64, Legislative Rule, Bureau for Public Health, Series 15, Cross-Connection Control and Backflow Prevention</td>
<td>191</td>
</tr>
<tr>
<td>Title 64, Legislative Rule, Bureau for Public Health, Series 25, Certification of Backflow Prevention Assembly Testers</td>
<td>197</td>
</tr>
<tr>
<td>Title 64, Legislative Rule, Series 61, Public Water Systems Capacity Development</td>
<td>201</td>
</tr>
<tr>
<td>Title 64, Legislative Rule, Series 77, Public Water Systems Design Standards</td>
<td>207</td>
</tr>
</tbody>
</table>
SECTON 1: WEST VIRGINIA DRINKING WATER REGULATIONS

West Virginia has received approval from EPA to have primacy authority for enforcing public drinking water regulations at the state level. In other words, OEHS ensures all federal and state drinking water requirements are met. These state regulations can be accessed online at the West Virginia Legislature web site at www.legis.state.wv.us/. The OEHS Environmental Engineering Division (EED) Director, Walter Ivey, oversees several programs that make up the WV drinking water program. The following programs function as the multiple barrier approach in West Virginia:

- The Source Water Assessment & Wellhead Protection (SWAP) Program’s mission is to assess, preserve, and protect the state's source waters which are used to supply water for the state's PWSs.
- The Certification & Training (C&T) Program provides training and/or testing to PWS operators, wastewater treatment works operators, backflow prevention assembly installers/testers, water well drillers, and monitoring well drillers to administer certifications.
- The Infrastructure & Capacity Development (I&CD) Program helps drinking water systems improve their finances, management, infrastructure, and operations so they can provide safe drinking water consistently, reliably, and cost-effectively.
- The Compliance & Enforcement (C&E) Program determines whether a PWS is in compliance with all state rules and federal regulations pertaining to the SDWA. Such determination is based on results of the chemical/contaminant monitoring required for each PWS. If a system is out of compliance, a violation is then issued requiring the PWS to do public notification activities to inform the public there was a problem, what happened, and what they are doing to fix it.
- Data Management enters all data received from the Monthly Operational Reports (MORs), bacteriological reports, and chemical reports into a specialized database called Safe Drinking Water Information System (SDWIS). Each PWS monitors and samples their water for various chemicals and contaminants that have the potential to be a public health risk.

All of the WV drinking water program is based in the OEHS central office located at 1 Davis Square, Suite 200 in Charleston, WV 25301. The OEHS central office phone number is (304) 558-2981 and fax number is (304) 558-0139. The OEHS website is http://www.wvdhhr.org/oehs/eed OEHS also has 5 district offices to provide technical and administrative support locally to PWSs across the state:

- Wheeling District Office (304) 238-1145
- Philippi District Office (304) 457-2296
- Kearneysville District Office (304) 725-0348
- Beckley District Office (304) 256-6666
- St. Albans District Office (304) 722-0611
The OEHS not only enforces drinking water standards, such as those in the SDWA, but it is also responsible for establishing and enforcing standards and regulations for water system design, construction, operation and maintenance, well construction and placement, pumps, treatment processes, chemical addition, well abandonment, lab certification, and wellhead protection. To ensure water systems meet these state requirements, water system owners are responsible for obtaining plan approvals from the OEHS for well construction, pump installation, well rehabilitation, chemical addition to water, water treatment, and new system capacity. Plan approvals help ensure that water suppliers provide a safe and dependable supply of water to their customers.

OEHS personnel enforce compliance with all appropriate codes and regulations by performing periodic on-site inspections of each system. These inspections are called sanitary surveys and their frequency depends upon the size and classification of the water system. During the sanitary survey, the OEHS representative will review the system’s compliance and monitoring records and inspect the water system facilities. Following the inspection, the system owner will receive a written report listing any deficiencies or violations found. A PWS must respond within 45 days and establish time frames to correct the problem(s).
The water supply is a very important part of the water distribution system. As an operator, you need to know where your system derives its supply. The two types of water sources are surface and groundwater sources. Surface water comes from natural water sources such as lakes, rivers, streams, or man-made reservoirs. Ground water, also referred to as well water, is drawn from below the ground surface. Both sources are usually transferred to a water plant through transmission lines. After the water is treated, it is usually sent on to the distribution system.

Water distribution systems consist of pipes, valves, service lines, meters, pumping stations, storage facilities, pressure tanks, and fire hydrants.

Once the distribution system is engineered, designed and built, it is the operator's responsibility to see that these facilities store, transport, and distribute quality water to the consumer as was intended. The typical duties of the water distribution operator may include:

- Excavate trenches, install shoring
- Maintain pipes, valves, pumps and equipment
- Tap and install connections into main lines
- Read water meters
- Operate and maintain well pumps
- Detect and correct hazardous atmospheres
- Be part of a cross connection control program
- Read and update maps and records
- Communicate with the public
- Troubleshoot complaints
- Develop and follow safety rules

The performance of the operator's job is critical for safe and continuous operation of the water system. As an operator, you should always be alert to any potential problems. Preventive maintenance and careful observations can prevent many problems from occurring to the water system. Anticipate problems and deal with them before they happen or before they become major problems.
PUBLIC WATER SYSTEMS

Title 64 Legislative Rule Series 3 Public Water Systems (64CSR3) establishes State standards and procedures for public water systems (PWSs). Title 64 Legislative Rule Series 77 Public Water Systems Design Standards (64CSR77) provides the regulation of public water supplies to promote and protect the public health by having the public served safe and potable water. Title 64 Legislative Rule Series 4 Public Water Systems (64CSR4) governs the examination and certification of operators of PWSs. 64CSR4 also includes classification of PWSs and requirements of PWS owners.

The classification of PWS has recently been changed from a point rating table to a descriptive definition based on source, population served, and treatment requirements. In general, the system complexity will continue to determine the required operator classification. All PWS will be reviewed as part of the sanitary survey conducted by District Office staff. This timeframe enables existing staff to reevaluate each system. Exceptions to this schedule will be made if requested in writing or if other problems arise. If reclassification occurs, systems must communicate with OEHS to ensure proper operator coverage. OEHS recommends operators at systems likely to change to start training and working towards the appropriate classification.

Class 1D

All transient non-community water systems that have ground water only as a source, and do not use gaseous chlorine or chlorine dioxide as a means of disinfection, and do not treat for the removal of nitrate or nitrite, or both. Ground water sources that use gaseous chlorine, chlorine dioxide as a means of disinfection or have treatment for removal of nitrate or nitrite, or both, are considered a Class I public water system.

Class WD

A public water system that obtains all of its water from another public water system, and is not owned or operated by the supplying public water system. The system does not have any other source of water other than water from the supplying public water system. A WD system may apply chorine for supplemental disinfection.

Class I

Community and non-transient non-community public water systems that use ground water only, serve a population of less than 10,000 (including consecutive connection population), and do not treat for a primary contaminant.

Class II

All public water systems that use a surface source or a ground water under the direct influence of a surface water source, serve a population of less than 10,000 (including consecutive connection population), and do not have any additional treatment units within the treatment plant for identified primary contaminants in the source water. Treatment installed for removal of Cryptosporidium is considered an additional treatment unit. Class II also includes all public water systems that use ground water only, serve less than 10,000 population, use at least
one radial water collector well as a source, or treat for at least one primary contaminant identified in the source water, or both.

Class III
All public water systems that use surface or a ground water under the direct influence of a surface water source, serve a population of at least 10,000 (including consecutive connection population), and do not have any additional treatment plant for identified primary contaminants in the source water. Class III also includes all public water systems that use ground water only, serve a population of at least 10,000 and use at least one radial water collector well as a source.

Class IV
A public water system that uses a surface or a ground water under the direct influence of a surface water source and serves a population of at least 20,000 (including consecutive connection population).
OPERATOR CERTIFICATION

Operator certification helps protect human health and the environment by establishing minimum professional standards for the operation and maintenance of PWSs. In 1999, EPA issued operator certification program guidelines specifying minimum standards for certification and recertification of the operators of community and nontransient noncommunity PWSs. While the specific requirements vary from state to state, the goal of all operator certification programs is to ensure that skilled professionals are overseeing the treatment and distribution of safe drinking water. Operator certification is an important step in promoting compliance with the SDWA.

The West Virginia Operator Certification Program was approved by EPA on February 20, 2002. West Virginia requires all public water systems to have a certified operator to effectively operate the system. Certified operators play a crucial role in protecting the health and welfare of West Virginia citizens, which can be jeopardized if persons not properly qualified are allowed to operate water supply systems. There are many disease-causing organisms and chemicals that may enter a system through the source water or through problems in the distribution system. Most contaminants cannot be seen or smelled, so proper system maintenance and monitoring is required to ensure the protection of public health. Water users expect a safe and adequate water supply and rely on the system operator to notify them if problems occur.

OEHS recently reviewed and revised 64CSR4, which became effective April 18, 2007. The new regulation is an amendment to the existing PWS operator rule (July 1, 2002) intended to increase clarity and maintain compliance with changes in federal rules and requirements. Periodic rule review and revision enable West Virginia to retain primary enforcement for the Safe Drinking Water Act. Without the PWS operator regulations administered by the operator certification program, one of the important barriers to preventing contamination of PWS’ has been compromised.

The need for responsible water system operators is enormous. Competent water system operations require someone with skill, knowledge and experience in operating, maintaining and troubleshooting water sources, treatment and distribution systems. Even if the operator will not be the one to repair or replace broken equipment, he/she must be able to recognize potential problems and take action to have problems corrected. Any individual making process control/system integrity decisions about water quality or quantity must be certified.

West Virginia’s Operator Certification Program:
• Provides applications and informational resources to prospective operators;
• Administers the examination process;
• Evaluates applicant experience and education;
• Evaluates training for continuing education;
• Tracks continuing education obtained by each operator; and,
• Ensures compliance with all applicable state and federal laws.
To become a certified operator, an individual must:
1. Submit an application;
2. Attend any required training courses;
3. Pass a written examination specific for the size and type of system to be operated;
4. Meet minimum experience and education requirements; and,

Maintaining certification requires:
1. Applying for new renewal by submitting an application every 2 years;
2. Documented attendance at sufficient OEHS-approved continuing education courses (CEHs); and,
3. Continued employment as an operator in a WV public water system.

Continuing Education Hours
Our understanding of drinking water quality and chemical and biological contaminants in water is changing almost daily. Similarly, better laboratory methods to find small amounts of chemicals, and improvements in diagnosing and tracking disease, more clearly define water that is truly safe to consume. Along with increased knowledge of health threats, which may be in drinking water, we have also increased our ability to prevent their occurrence, and to detect and remove them. Special sample collection methods, monitoring schedules and treatment options exist for a variety of possible contaminants. All certified operators, as well as system owners and managers, have a responsibility to keep up with changes in monitoring and reporting requirements. Also, it is important you are aware of new information on water quality and treatment and they maintain a basic level of knowledge.

West Virginia requires all certified operators, except 1Ds, to obtain continuing education hours (CEHs). Continuing education is essential to keeping up to date with water supply, treatment, maintenance, and monitoring information. The amount of continuing education that must be obtained depends on your certification classification.

- Operators-in-Training (OITs) and Water Distribution (WD) operators are required to obtain 6 CEHs every 2 years.
- Class I operators are required to obtain 12 CEHs every 2 years.
- Classes II-IV are required to obtain 24 CEHs every 2 years.

Operators are required to notify the OEHS in the event they are no longer the operator for a specific system. This is to emphasize the importance of having a certified operator at all times. A 30 day advance notice is required for voluntary terminations. Please complete and submit form ES-74 at least 30 days prior to quitting to stay in compliance with operator requirements and keep your certification. If you are fired, contact Certification & Training so they are aware your employment status has changed and provided them with your new or anticipated employment information.

Certification is personal. Each individual operator is responsible for keeping his/her certification current and ensuring all requirements are met. Please contact the Certification and Training Section at (304) 558-2981 or WVRWA at (304) 201-1689 if you have any
questions concerning your responsibilities as a certified public water system operator in West Virginia. The Certification and Training Section currently oversees information on more than 2,400 certified water operators (as of June 2008) in addition to wastewater operators, backflow prevention & assembly inspector testers, water well drillers, and monitoring well driller training in West Virginia. It is essential we work together and openly communicate.

**Responsibilities of the Public Water System and OEHS**
The public water system owner and operator, along with OEHS, work together to make sure that safe drinking water is provided to water system users and that all regulatory requirements are met. Providing safe drinking water requires a team effort from systems, operators, and OEHS.

**Responsibilities of the Owner and Operator**
The owner of a public water system is responsible for meeting all of the legal requirements that apply to the water supply. An operator is a person who conducts day-to-day operational and technical activities related to the operation of a water supply. Although the owner may designate an operator, the owner is ultimately responsible for providing safe drinking water and meeting regulatory requirements. It is important that both the owner and operator work together to ensure that the water system provides safe drinking water and meets all applicable requirements. **The ultimate goal for both the owner and operator is to provide safe drinking water to the public.**

A certified operator shall:
- Notify the Commissioner at least thirty (30) days prior to voluntarily terminating employment with a public water system in a manner and form approved by the Commissioner (EW-74);
- Obtain the necessary amount of CEHs and retain documentation of attendance required for his or her renewal application;
- Ensure that the renewal applications are submitted at least thirty (30) days before the required date and no earlier than sixty (60) days prior to expiration, in a manner and form approved by the Commissioner;
- Have the original personal certification card issued by the Commissioner upon his or her person at all times the operator is operating the public water system; and,
- Not work in a public water system under the certification of another; only the person whose name appears on the operator certification is certified by that document.
WATER DISTRIBUTION CERTIFICATION

US Environmental Protection Agency (EPA) guidelines require all PWS operating personnel making process control/system integrity decisions about water quality or quantity that affect public health be done under the direction of a qualified, certified operator. This potential exists in both the treatment facility and distribution system. Therefore, a Water Distribution (WD) operator certification has been added.

Some water utilities have “split” responsibilities, where the water treatment plant may be under the direction of a certified PWS operator but the distribution system is not. This is no longer allowable under 64CSR4. The WD certification will allow two “chief operators” to be assigned under the above scenario and still meet the federal guidelines. Although a WD system is defined as a PWS that obtains all of its water from another PWS (also known as a purchase system), and is not owned or operated by the supplying PWS, an individual working in the distribution portion of any PWS must hold a WD or higher certification to ensure properly certified operator coverage.

Since WD operators collect water quality samples at the distribution system but not provide any treatment, much of the current Class I (and higher) operator certification training is not needed for distribution only systems or related work. Development of a WD training course and exam where only distribution activities are taught and tested, will eliminate the problem of a person having to study unneeded and unnecessary material in order to proficiently perform their job functions.

WD certification requires:

- a completed EW-102C application;
- a high school diploma or equivalent;
- attendance at a WD training course approved by OEHS;
- 70% on the WD certification exam;
- 1,000 hours of experience at a WD or higher classification PWS; and,
- 6 continuing education hours (CEHs) for renewal every 2 years.

All of these new requirements for WD operator certification are based on current EPA guidelines related to operator education, examination, experience, and continued training. Any current 1D operator may apply to be reclassified as a WD operator by passing the WD exam and meeting the minimum educational and experience requirements within 2 years from the effective date of the new rule (by April 18, 2009). Any operator collecting samples at a WD or higher system must hold a 1D or higher certification. This provision was added to give existing WD operators a chance to upgrade without going through the Operator-in-Training (OIT) process.

Prior to April 18, 2007, all water operator certifications were sequential – in other words, they built upon each other with no dual certifications allowed. With the new WD certification, Class I-IV certified operator may choose to be WD certified in addition to their higher classifications, however, it is not required. If both certifications are held, all requirements for both must be met in accordance with 64CSR4. For example, a Class IV operator who wants to be additionally certified as a WD must complete a total of 30 CEHs every 2 years. The Water Distribution Operator Certification Course is approved for 23
CEHs (CEH2008-052) so it may be taken for continued learning purposes instead
certification if the individual chooses.
OPERATOR FORMS

Remember all forms must be complete, legible, signed and dated, and timely with all required documents attached (copy of diploma, CEH certificates, etc.) for processing. Also remember to use the most current version of each form. All forms are available on the OEHS website at http://www.wvdhhr.org/oehs/eed/swap/training&certification/forms.asp or by phone request from the Certification and Training Program at (304) 558-2981.

EW-74 Voluntary Resignation: Use this form when voluntarily terminating employment to ensure proper notification.

EW-75 Application for Certification as a Backflow Prevention Assembly Inspector/Testor (BPAIT): Use this form when applying for initial, reinstatement, or renewal of BPAIT certification.

EW-102C Application for WD and Class I-IV Certification and Examination: Use this form when applying for examination or certification as a WD or Class I-IV operator.

EW-102D Application for Renewal of WD and Class I-IV Certification: Use this form for renewal of WD or Class I-IV operator certifications.

EW-102E Operator-In-Training Certification (OIT): Use this form when applying for initial certification or renewal of OIT certification. OIT renewal requires 6 CEHs and taking the WD or Class I Exam.

EW-102F 1D Application: Use this form when applying for examination, initial certification or renewal of 1D operator certification.

EW-104 Public Water System Personnel Status Report: All PWS’ must submit this form by July 15th every year to facilitate accurate information on all certified personnel currently employed.

EW-107 Certified Operator Requirement Waiver: Use this form when applying for a certified operator requirement waiver, in accordance with 64CSR4 5.1.g and h.

EW-108 Reciprocity Application: Use this form when you are certified by another jurisdiction outside of WV and seeking certification as a WV PWS operator to document your competency (64CSR4 8.1).

EW-111 Public Water System Employee Status Changes: Use this form to ensure reporting within 10 days of any employment status change (except termination) of PWS certified operators for compliance with 64CSR4 Section 5.1.d. Terminations of certified operators must be reported to OEHS within 24 hours (64CSR4 5.1.e).
OPERATOR CERTIFICATION CHECKLIST

Since certified operators are a key component of any water system, it is important to understand what all goes into becoming a certified water operator. The Certification and Training Program is commonly asked how quickly an individual can become a certified water operator. The summary below was comprised to address this good question in writing. Feel free to use it as a checklist in the future.

1D Water Operator:
- employed with a PWS;
- completed EW-102F, which includes proof of 8th grade completion;
- attended 1-day OEHS course; and,
- passed the 1D certification exam with a 70% or higher.

Water Operator-in-Training (OIT):
- employed with a PWS; and,
- completed EW-102E, which includes proof of high school or GED diploma and PWS Chief Operator signing-off on responsibility for individual’s training experience.

Water Distribution (WD) Operator:
- employed with a PWS;
- completed EW-102C;
- attended OEHS-approved week long WD training course;
- passed WD certification exam with a 70% or higher; and,
- documented proof of 1,000 hours (~6 months full-time) OIT or PWS certified experience at a WD or higher PWS.

Note: Until April 18, 2009, current 1D operators employed in a WD or higher classification PWS may apply to be reclassified as a WD operator by passing the exam and meeting the minimum educational and experience requirements.

Class I Water Operator:
- employed with a PWS;
- completed EW-102C;
- attended OEHS-approved week long Class I training course;
- passed Class I certification exam with a 70% or higher; and,
- documented proof of 2,000 hours (~1 year full-time) OIT or PWS experience.

Note: Experience gained in WD or 1D counts for no more than 600 hours.

Class II Water Operator:
- employed with a PWS;
- completed EW-102C;
- attended OEHS-approved week long Class II training course;
- passed Class II certification exam with a 70% or higher; and,
- documented proof of 6,000 hours (~3 years full-time) PWS experience with 2,000 of those at a Class I or higher PWS.

Note: Can substitute up to half of the required experience (~1.5 years full-time or 3,000 hours) with OEHS approved education continuing education units (CEUs), but still will need 3,000 hours (~1.5 years full-time) experience minimum. A CEU is 10 CEHs or any higher education approved by OEHS. C&T reviews each
course for relevancy and assigns CEUs on a case-by-case basis. The rules specify courses relevant to water treatment will count 100% towards CEUs. However, a course not directly related will receive 50% credit towards CEUs. Thus, a 3 credit hour Music Appreciation course taken at WVU will only be granted 1.5 CEUs. Also, keep in mind you cannot use your education for both minimum education requirements and experience substitution. Therefore, a person with a 4-year degree would be well advised to consider NOT using their degree for experience substitution if they plan to eventually become a Class III or IV operator.

Note: 1,000 hours experience (or approved alternative) in a surface source water treatment plant prior to being allowed to operate unsupervised in a Class II or III surface water source water treatment plant.

Class III Water Operator:
- employed with a PWS;
- completed EW-102C;
- passed Class III certification exam with a 70% or higher;
- documented proof of 10,000 hours (~5 years full-time) PWS experience with 2,000 of those at a Class II or higher PWS; and,

Note: Can substitute up to half of required experience (5,000 hours or ~2.5 years full-time) with OEHS approved education (CEUs), but will still need 5,000 hours (~2.5 years full-time) experience minimum.
- documented completion of 90 CEUs.

Note: Can substitute all required education (up to 90 CEUs) with 4,000 hours (~2 years full-time) experience.

Class IV Water Operator:
- employed with a PWS;
- completed EW-102C;
- passed Class IV certification exam with a 70% or higher;
- documented proof of 12,000 hours (~6 years full-time) PWS experience with 2,000 of those at a Class III or higher PWS; and,

Note: Can substitute up to half of required experience (3 years full-time or 6,000 hours) with OEHS approved education (CEUs), but will still need 6,000 hours (~3 years full-time) experience minimum.
- documented completion of 180 CEUs.

Note: Can substitute up to half of the required education (90 CEUs) with 2 years full-time or 4,000 hours experience but would still need 90 CEUs.

Applying the above information, the fastest an individual without prior certification or higher education beyond high school/GED could become a Class IV water operator is with 6 years full-time experience and 180 CEUs. Keep in mind, all operator certification requirements are based on federal and state regulations to ultimately protect public health. Each certified PWS operator is responsible in providing adequate supply of safe, potable drinking water to consumers who are confident their water is safe to drink. It is essential these operators not only achieve these minimum requirements for certification but continue to gain knowledge and acknowledge the public health foundation of their career choice in the drinking water industry. Please contact the Certification and Training Program at any time to discuss any aspect of the operator certification program at 304-558-2981.
Section 2 Homework

1. What are the two types of water sources?

2. List five typical duties of the water distribution operator.

3. Name four key components of a water distribution system.

4. What is the most common means of disinfecting drinking water used to protect the health of the public?

5. Most accidents result from what?

6. Why must reliable and adequate records be kept for the operation of the distribution system?
7. Isolation valves are used in the distribution system to do what?

8. How can the distribution operator help an engineer improve or expand on the current distribution system?

9. Why does surface water require treatment?

10. What does it take to become a water distribution operator?
SECTION 3: BASIC MATH CONCEPTS FOR THE OPERATOR

Setting Up and Solving Math Problems

There are two types of math the distribution system operator will use:

- Theoretical Math
- Applied Math

Theoretical Math: This is the math concept involving fractions, percents, decimals, volumes, areas, etc. These are known as the tools of math.

Applied Math: This is the math concept applied in solving practical problems. You will be successful in solving applied math calculations by approaching every problem with a strategy that leads to the answer.

Basic Strategy: Solving Math Problems

**Step 1** Determine the type of problem. What type of problem is it? (Disregard all numbers.) Many types of problems could be used in the Water Distribution field such as detention times, chemical dosages, loading rates, etc. Recognizing the type of problem is the very first step in solving the problem.

**Step 2** What formula (if any) will be used with Step 1 above? Also, diagrams, charts, tables, etc. are used frequently in determining the answer to many problems.

**Step 3** Convert to similar terms and units. What information is required to solve the problem? It is common to have the problem contain information that is not required to solve the equation. Conversion of terms may also be needed to solve the problem. (Example: 7.48 gallons of water = 1 cubic foot of water or 7.48 gallons = 1 ft$^3$).

**Step 4** Determine the final answer to the problem. The equation has been selected, the formula has been selected, and the units or terms have been established. Simply fill in the equation and solve the problem.

**Step 5** Make sure your answer makes sense. You have worked through the problem and have an answer. Ask yourself, “Does this answer make sense?” Plug your answer into the equation. The problem could possibly be worked backwards.

* Always take your time when solving problems *
Conversion Factors and Formulas

The following conversion factors and formulas must be learned and memorized. It may be a good idea to study three or four each day until you have learned and memorized them all.

1. 1 pound per square inch (1 psi) = 2.31 feet (ft) of water
2. 1 foot (ft) of water = 0.433 pounds per square inch (psi)
3. 1 cubic foot (ft³) of water = 7.48 gallons (gal)
4. 1 gallon of water = 8.34 pounds (lbs)
5. 1 grain per gallon (gpg) = 17.1 milligrams per liter (mg/L)
6. 1 horsepower (HP) = 746 watts
7. \( \pi \) = 3.14
8. square feet = sq. ft. = \( \text{ft}^2 \)
9. cubic feet = cu. ft. = \( \text{ft}^3 \)

**Formulas**

**Chemical Dosage:**

\[
pounds (lbs)/day = \text{million gallons per day (MGD)} \times 8.34 \text{ lbs/gal} \times \text{mg/L}
\]

or

\[
\text{lbs/day} = \text{MGD} \times 8.34 \text{ lbs/gal} \times \text{mg/L}
\]

\[
\text{lbs/day} = \frac{\text{MGD} \times 8.34 \text{ lbs/gal} \times \text{mg/L}}{ \text{percent of available chemical} }
\]

**Temperature Conversion:**

\( ^\circ \text{Celsius (C)} \) to \( ^\circ \text{Fahrenheit (F)} \)

\[ ^\circ \text{Celsius} \times 1.8 + 32 = ^\circ \text{Fahrenheit} \]

\[ \frac{^\circ \text{Fahrenheit} - 32}{1.8} = ^\circ \text{Celsius} \]

**Electrical:**

\[ \text{amperes (amps)} \times \text{volts (v)} = \text{watts (w)} \]
Detention Time:

\[
\text{Detention Time} = \frac{\text{Volume}}{\text{Flow Rate}}
\]

Geometry

A = Area

C = Circumference

L = Length

W = Width

H = Height

\(\pi = 3.14\)

r = Radius

D = Diameter

V = Volume

B = Base

Rectangle:

\[
A = L \times W \quad V = L \times W \times H
\]

Circle:

\[
C = \pi \times D \quad A = \pi (r)^2 \quad \text{or} \quad A = 0.785 \times (D)^2
\]

\[
D = 2 \times r
\]
Flow:

Q = Flow rate is expressed in: cu. ft. per minute (ft³/min).

V = Velocity is expressed in: feet per minute (ft/min).

A = Area is expressed in: square feet (ft²).

\[ Q = A \times V \quad \text{or} \quad \frac{Q}{V} = A \quad \frac{Q}{A} = V \]

\[ \text{ft}^3/\text{min} \times 7.48 \text{ gal/ft}^3 = \text{gal/min} \]

\[ \text{ft}^3/\text{hr} \times 7.48 \text{ gal/ft}^3 = \text{gal/hr} \]

1 MGD = 1.55 ft³/sec

Area Units:

Areas are measured in two dimensions or in square units. The most common unit used by a distribution operator is square feet (ft²).

Rectangle:

The area of a rectangle is equal to its length multiplied by its width.

Example: Find the area of a rectangle if the length is 8 feet and its width is 3 feet.

Area, ft² = Length x width

Area = 8 feet x 3 feet

Area = 24 ft²
Circle:

The area of a circle can be written: \( \pi r^2 \).

Since the diameter of any circle is equal to twice the radius, the formula for the area of circle can also be written as follows:

\[
A = \pi r^2 = \pi \times \frac{r \times r}{2} = \frac{\pi D}{2} \times \frac{D}{2} = \frac{\pi D^2}{4} = \frac{3.14 D^2}{4} = 0.785 \times (D^2)
\]

Example: Find the area of a circle that has a diameter of 20 feet.

Area, \( ft^2 \) = (0.785) (Diameter, \( ft \))^2

Area = (0.785) (20 \( ft \))^2

Area = (0.785) (20 \( ft \times 20 \( ft \))

Area = (0.785) (400 \( ft^2 \))

Area = 314 \( ft^2 \)

or using the formula \( \pi r^2 \) can also be used as follows:

Area, \( ft^2 \) = \( \pi \) (Radius, \( ft \))^2

Area = 3.14 (10 \( ft \))^2

Area = 3.14 (10 \( ft \times 10 \( ft \))

Area = 3.14 (100 \( ft^2 \))

Area = 314 \( ft^2 \)

Volume Units:

Volumes are measured in three dimensions or in cubic units. The most common unit used by a distribution operator is measured in cubic feet (\( ft^3 \)).
**Rectangle:**

The volume of a rectangle is equal to its length multiplied by its width multiplied by its height.

\[
\text{Volume, ft}^3 = \text{length, ft} \times \text{width, ft} \times \text{height, ft}
\]

Example: the length of a box is 3 feet, the width is 6 feet, and the height is 30 inches. Find its volume in cubic feet (ft\(^3\)).

\[
\text{Volume} = 3 \text{ ft} \times 6 \text{ ft} \times \frac{30 \text{ inches}}{12 \text{ inches/ft}}
\]

Volume = 3 ft \times 6 ft \times 2.5 ft.

Volume = 45 ft\(^3\)

**Cylinder:**

The volume of a cylinder is equal to the area of the base multiplied by the height.

\[
V = \pi r^2(h)
\]

Example: A tank has a diameter of 50 feet and a depth of 18 feet. Find the volume in cubic feet (ft\(^3\)).

\[
\text{Volume, ft}^3 = 0.785 \times (\text{Diameter, ft})^2 \times \text{Height, ft}
\]

Volume = 0.785 \times (50 \text{ ft} \times 50 \text{ ft}) \times 18 \text{ ft}

Volume = 0.785 \times (2,500 \text{ ft}^2) \times 18 \text{ ft}

Volume = 35,325 \text{ ft}^3
CONVERSION FACTORS

<table>
<thead>
<tr>
<th>Conversion</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 foot = 12 inches</td>
<td></td>
</tr>
<tr>
<td>1 inch = 2.54 cm</td>
<td></td>
</tr>
<tr>
<td>1 gallon = 8 pints</td>
<td></td>
</tr>
<tr>
<td>1 gallon = 3.785 l</td>
<td></td>
</tr>
<tr>
<td>1 liter = 1,000 ml</td>
<td></td>
</tr>
<tr>
<td>1 cubic foot = 7.48 gallons</td>
<td></td>
</tr>
<tr>
<td>1 cfs = 448 gpm</td>
<td></td>
</tr>
<tr>
<td>1 gpm = 1,440 gpd</td>
<td></td>
</tr>
<tr>
<td>1 MGD = 1.55 cfs</td>
<td></td>
</tr>
<tr>
<td>1 psi = 2.31 feet</td>
<td></td>
</tr>
<tr>
<td>1 foot = 0.433 psi</td>
<td></td>
</tr>
<tr>
<td>( \pi ) = 3.14</td>
<td></td>
</tr>
</tbody>
</table>

TEMPERATURE

Fahrenheit (\( ^\circ F \)) = (1.8 \times ^\circ C) + 32
Celsius (\( ^\circ C \)) = 0.56 \times (\( ^\circ F \) - 32)

CIRCUMFERENCE, AREA & VOLUME

Circumference (C, ft) = 3.14 \times diameter (D, ft)
Area of a rectangle (A, sq ft) = (length, ft) \times (width, ft)
Area of a circle (A, sq ft) = 0.785 \times (diameter, ft)^2
Area of a circle (A, sq ft) = 3.14 \times (radius, ft)^2
Volume of a rectangle (V, cu ft) = (length, ft) \times (width, ft) \times (height, ft)
Volume of a rectangle (V, gal) = (length, ft) \times (width, ft) \times (height, ft) \times 7.48 gal/cu ft
Volume of a cylinder (V, cu ft) = 0.785 \times (diameter, ft)^2 \times (height, ft)
Volume of a cylinder (V, gal) = 0.785 \times (diameter, ft)^2 \times (height, ft) \times 7.48 gal/cu ft

CHLORINATION

Chlorine dose (mg/L) = chlorine demand (mg/L) + chlorine residual (mg/L)
Total chlorine residual (mg/L) = free chlorine residual (mg/L) + combined chlorine residual (mg/L)

POUNDS, DOSAGE & FLOW

Dose (mg/L) = Feed (lbs/day) \div (8.34 lbs/gal) \div \text{flow (MGD)}
Flow (MGD) = Feed (lbs/day) \div \text{dose (mg/L)} \div (8.34 lbs/gal)
Feed (lbs/day) = \text{dose (mg/L) \times \text{flow (MGD) \times \text{8.34 lbs/gal}}}
Feed (lbs/day) = \text{dose (mg/L) \times \text{flow (MGD) \times \text{8.34 lbs/gal} \div \% purity (decimal)}}
FLOW

Flow (Q, gpm) = volume (V, gal) ÷ time (t, min.)
Flow (Q, gps) = velocity (v, fps) x area (A, sq ft) x (7.48 gal/cu ft)
Flow (Q, cfs) = velocity (v, fps) x area (A, sq ft)

DETENTION TIME

Detention time (DT, min) = volume (V, gal) ÷ flow (Q, gpm)

PERCENT

Percent (%) = part ÷ whole x 100
Part = whole x percent ÷ 100

FLUORIDATION

Fluoride Feed Rate (lbs/day) = \( \frac{\text{Dose (mg/L) } \times \text{ Capacity (MGD) } \times (8.34 \text{ lbs/gal})}{\text{Available Fluoride Ion (AFI) } \times \text{ chemical purity (decimal)}} \)

Fluoride Feed Rate (gpd) = \( \frac{\text{Dose (mg/L) } \times \text{ Capacity (gpd)}}{18,000 \text{ mg/L}} \)

Dose (mg/L) = \( \frac{\text{Fluoride Feed rate (lbs/day) } \times \text{ Available Fluoride Ion (AFI) } \times \text{ chemical purity (decimal)}}{\text{Capacity (MGD) } \times (8.34 \text{ lbs/gal})} \)

Dose (mg/L) = \( \frac{\text{Solution fed (gal) } \times 18,000 \text{ mg/L}}{\text{Capacity (gpd)}} \)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Formula</th>
<th>Available Fluoride Ion (AFI) Concentration</th>
<th>Chemical Purity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Fluoride</td>
<td>NaF</td>
<td>0.453</td>
<td>98%</td>
</tr>
<tr>
<td>Sodium Fluorosilicate</td>
<td>Na₂SiF₆</td>
<td>0.607</td>
<td>98%</td>
</tr>
<tr>
<td>Fluorosilic Acid</td>
<td>H₂SiF₆</td>
<td>0.792</td>
<td>23%</td>
</tr>
</tbody>
</table>

MISC

Potassium Permanganate dose (mg/L) = \( 1 (\text{Iron concentration mg/L}) + 2 (\text{Manganese concentration mg/L}) \)

Alkalinity = \( \frac{\text{mL of H₂SO₄} \times 1,000}{\text{mL of sample}} \)

Hardness = \( \frac{\text{mL of EDTA} \times 1,000}{\text{mL of sample}} \)
Chemical Feed Setting (mL/min) = \( \frac{\text{Flow, MGD}(\text{Alum Dose, mg/L})(3.785\text{L/gal})(1,000,000\text{ gal/MG})}{(\text{Liquid Alum, mg/mL})(24\text{ hr/day})(60\text{ min/hr})} \)

Calibration of a Dry Chemical Feeder (lbs/day) = \( \frac{\text{Chemical Applied, lbs}}{\text{Length of Application, day}} \)

Calibration of Solution
Chemical Feeder (lbs/day) = \( \frac{\text{Chem Conc, mg/L}(\text{Vol pumped, mL})(1,440\text{ min/day})}{(\text{Time pumped, min})(1,000\text{ mL/L})(1,000\text{ mg/g})(454\text{ g/lb})} \)

Filtration Rate (gpm/sq ft) = \( \frac{\text{Flow, gpm}}{\text{Surface area, sq ft}} \)

Unit Filter Rate Volume (UFRV) = (Filtration Rate, gpm/sq ft)(Filter Run, hr)(60 min/hr)

Backwash Water, gal = (Backwash Flow, gpm)(Backwash Time, min)

Backwash, % = \( \frac{(\text{Backwash Water, gal})(100\%)}{(\text{Water Filtered, gal})} \)

\[ \text{pH}_s = A + B + \log(Ca^{2+}) + \log(Alk) \]

Langlier Index = \( \text{pH} - \text{pH}_s \)

Polymer, lbs = \( \frac{(\text{Polymer Solution, gal})(8.34\text{ lbs/gal})(\text{Polymer, %})(\text{Sp Gr})}{100\%} \)

Hypochlorite Flow, gpd = \( \frac{(\text{Container area, sq ft})(\text{Drop, ft})(7.48\text{ gal/cu ft})(24\text{ hr/day})}{(\text{Time, hr})} \)

Feed Rate, gal/day = \( \frac{(\text{Feed Rate, lbs/day})(\text{Feed Dose, mg/L})}{\text{Feed Solution, mg/L}} \)

Feed Rate, lbs/day = \( \frac{\text{Feeder Setting, lbs/day}}{24\text{ hr/day}} \)

\[ \text{CT, mg/L-min} = \frac{(\text{Vol, gal})(T_{10})}{\text{Flow, gpm}}(\text{Free Chlorine Residual, mg/L}) \]

Free Chlorine Residual, mg/L = \( \frac{(\text{CT, mg/L-min})}{T_{10s\ min}} \)
Section 3 Homework

1. What are the two basic types of math involved when setting up and solving math problems?

2. Math concepts such as fractions, percents, decimals, areas, volumes, etc. are known as ____________ math.

3. What is the definition of applied math?

4. When applying the "basic strategy" in solving math problems, name two steps that are used.

5. \( \pi \) or \( (\pi) \) =

6. 7.48 gallons of water = ___________ ft\(^3\)

7. 1 psi = ____________ feet

8. 1 gallon of water = _____________ lbs

9. The correct formula for changing \( ^\circ \)Fahrenheit to \( ^\circ \)Celsius is:
   
   A. \( ^\circ F - 32 \times 1.8 = ^\circ C \) 
   
   B. \( \frac{^\circ F - 32}{1.8} = ^\circ C \) 
   
   C. \( 1.8 + 32 = ^\circ C \) 
   
   D. \( \frac{32 \times 1.8}{^\circ F} = ^\circ C \)
10. In the chemical dosage formula, the MGD stands for what?

11. $746 \text{ watts} = \underline{\quad} \text{ HP}$

12. $\text{Amps x Volts} = \underline{\quad} \text{ .}$

13. When finding detention time, the volume is divided by the $\underline{\quad} \text{ .}$

14. When finding the area of a circle, you square the $\underline{\quad} \text{ , then multiply by 3.14.}$

15. In the flow/pressure problems:
   
   the Q stands for $\underline{\quad}$,
   
   the V stands for $\underline{\quad}$, and
   
   the A stands for $\underline{\quad}$.

16. $\text{ft}^3/\text{min} \times 7.48 \text{ gal/ft}^3 = \underline{\quad}$

17. $\text{ft}^3/\text{hr} \times 7.48 \text{ gal/ft}^3 = \underline{\quad}$
SECTION 4: SOLVING DISTRIBUTION MATH PROBLEMS
A hand-held non-programmable calculator with a square root key is necessary for solving.

Solving the problems - What is the unknown value X?

Addition and Subtraction

1. When solving for the unknown value X involving addition or subtraction, there are two objectives.
   
   a) X can be a positive or negative number, and
   
   b) X must stand alone on one side of the equation.

2. The terms must be moved from one side of the equation to the other by changing the sign of the term moved from negative to positive or positive to negative.

Illustration III - 1

10.2 = X + 6.2

Whatever is done to one side of the equation must be done to the other side.

In order to get X by itself, 6.2 must be moved to the left side of the equation.

10.2 = X + 6.2

10.2 - 6.2 = X + 6.2 - 6.2  Note: This operation cancels out the 6.2 on the right side of the equation leaving (X) by itself.

10.2 - 6.2 = X

X=4  Check work: 10.2 = 6.2 + 4  ✓
**Multiplication and Division**

When solving for the unknown value \(X\) involving multiplication or division, there are two objectives:

a) \(X\) must be in the top of the fraction. This is called the numerator. The bottom of the fraction is known as the denominator.

b) \(X\) must stand alone on one side of the equation.

Many water distribution calculations involve multiplication and/or division terms. For these, one rule must be followed. Move the terms diagonally from one side of the equation to the other.

**Illustration III - 2**

\[
\begin{array}{c}
\frac{3}{4} = \frac{4}{3} \\
\end{array}
\]

**Illustration III - 3**

Try a problem. Solve for the unknown \(X\) using the basic steps.

\[
840 = \frac{X}{60}
\]

\(X\) is in the numerator. This satisfies the first objective. Now leave \(X\) where it is and move all the other numbers from the right side or \(X\) side of the equation to the left side.

\[
60 \times \frac{840}{1} = \frac{X}{60} \times 60
\]

Now you can calculate \((X)\)

\[
60 \times 840 = X
\]

\[
50,400 = X
\]
**What does (X)² stand for?**

This stands for the unit or X multiplied by itself such as:

If X = 2 then: \( X^2 = 2^2 \)

(2 multiplied by 2 equals 4)

\( X^2 \) known as the exponent of the power. This is called squaring the number. Sometimes in a problem, such as finding the area of a circle, you may have an unknown in the equation that is squared. When this happens, you must find the opposite of the square, which is the square root.

When solving problems involving squared terms: First follow the same procedure as before. Move the terms so that X is the numerator, (the top number), and X is alone.

**Illustration III - 4**

Once \( X^2 \) is the numerator and stands alone, then take the square root of both sides of the equation. The square root is symbolized by the \( \sqrt{\cdot} \) character.

Let's say \( X^2 = 13,225 \) sq. ft. (ft²)

\[ \sqrt{X^2} = \sqrt{13,225} \]

The square root of \( X^2 \) is always \( X \).

Use your calculator to obtain the square root function. Enter 13,225 on your calculator, then hit the square root button on the calculator. The answer will appear.

\[ X = 115 \]
1. If not, then move the X term to the numerator using the diagonal move. (See Illustration III – 2.)

Double check: Is X alone on one side Advanced Problems - Solving for X

When solving for X in multiplication and division as well as addition and subtraction, use the following ideas:

2. Simplify the problem
   a) Complete all multiplication and division from left to right.
   b) Complete all addition and subtraction from left to right.

3. The X term must be the numerator of the equation?

Illustration III - 5

Solving the advanced problem

Find X

\[
\frac{(6 + X)}{4} (2)(60) = 600
\]

1. Simplify your terms: \((2)(60) = 120\)

\[
\frac{(6 + X)}{4} (120) = 600
\]
2. X is the numerator. We want X to stand alone. 6 is part of X by the addition sign (temporary). Take the 4 and 120 away from X, using the diagonal principle.

\[
\frac{6+X}{4} \cdot \frac{120}{120} = \frac{600}{120}
\]

\[
\frac{6+X}{4} = 5
\]

\[
\frac{(6+X) \cdot 4}{4} = 5 \cdot 4
\]

\[
6 + X = 20
\]

\[
X = 20 - 6 = 14
\]

3. Simplify the right side.

\[
\frac{(600)(4)}{120} = \frac{2400}{120} = 20
\]

4. Finish the problem by having X alone

\[
X = 20 - 6
\]

\[
X = 14
\]
Section 4 Homework

Use your calculator.

1. \(44 = X + 36\)  
   \(X = \)

2. \(320 = \frac{X}{40}\)  
   \(X = \)

3. \(36.2 + X = 440\)  
   \(X = \)

4. \(\frac{X}{440} = 3,520\)  
   \(X = \)

5. \(X^2 = 7,744 \text{ sq ft}\)  
   \(X = \)

6. \(\frac{(15)(2)(4 + X)}{4} = 45\)  
   \(X = \)
7. What is the area in square feet of a circle that has a 6-inch diameter?

8. What is the length in feet of a rectangle that has a 396 sq. in. area and its width is 18 inches?

9. A circle is 16 feet in diameter. What is its area in ft²?

10. How many cubic feet of water are there in 374 gallons?

11. What is the weight of 200 gallons of water?

12. What is the volume in ft³ of a clearwell 200 feet long, 50 feet deep and 24 feet wide?

13. What is the volume in ft³ of a 20-foot section of pipe that has a diameter of 2 feet?

14. 166 lbs of water = _________________ gallons.
15. 22,200 gallons of water = _________________ lbs.

16. 60° F = _________________ °C

17. How many gallons of water does it take to fill a 24-inch water line that is 2,220 feet long?

18. Calculate the volume of water in ft³ that is contained in a rectangular water storage tank 40 feet long, 15 feet wide, and has a water depth of 8 feet.

19. How many gallons of water are in the tank in question 19?

20. What does the water weigh in pounds in question 20?

21. A pressure test gauge indicates a reading of 60 psi. What is the pressure head in feet?
22. Using the equation $Q = A \times V$, solve the following problem. If the velocity in a 12 inch main is 1.25 feet per second, how many gallons per minute are flowing through it?
The main purpose of a water storage facility is to provide a sufficient amount of water to average or equalize the demand on the water supply system. The storage facility is also expected to help maintain adequate pressure throughout the entire system. The storage facility should be able to provide water for *average and *peak demands.

*Average Demand* - The total demand for water during a period of time divided by the number of days in that period.

*Peak Demand* - The highest instantaneous flow rate during a given time period.

The selection and type of storage tank depends on the system's individual needs and the type of terrain where it is to be installed. Any major system changes, such as bigger main lines or more customers, can change the storage requirements.

Instrumentation operates the water supply system by measuring the system pressures and water levels in the storage tanks. Pumps are automatically started and stopped by controls based on measurements of the instruments.

The main function of a storage reservoir is to take care of daily demands, especially peak demands. Operators should know the level in a storage tank each morning so that the system's demand will be met throughout the day. These levels or depths of water can be measured by the use of electronics, floats, and ultrasonic signals. Pressure switches, differential-pressure altitude valves, and solid-state electronic sensors control the water flow into the tank.

Water utilities may often have more than one type of storage facility. Elevated tanks, ground level storage tanks, clearwells, standpipes, and hydro-pneumatic or pressure tanks can be used. The requirements for the specific types of storage facilities will depend upon a system's individual needs. To select the suitable type of storage facility, the answers to the following questions must be known:

1. What is the maximum daily use?
2. What is the maximum hourly use?
3. What type of pressure will the facility be required to provide and maintain throughout the system?
4. What size will be necessary to fulfill the requirements for emergencies such as fire flow?

Inspection and maintenance records should be kept for all storage tanks. The exterior of the tanks should be inspected frequently. All overflow and air vents should be checked to ensure that all are screened to prevent entry of birds and/or other animals. Air vents are an important part of the storage tank. If air cannot enter to replace the water being drawn out, a
vacuum could occur in the tank causing damage or collapse of the tank. The interior of the tank should be inspected every three to five years, depending on local conditions. Three types of inspections can be made:

1. A visual inspection, which is made from the roof hatch with the water lowered to approximately half full or less;

2. A detailed inspection, accomplished by completely draining the tank, washing it out, and then inspecting the interior walls; or

3. A detailed inspection using divers and video cameras and then cleaning the tank by a vacuum type method.
Section 5 Homework

1. What is the main purpose of a water storage facility?

2. What is average demand?

3. What is peak demand?

4. List four types of storage facilities.

5. What is the purpose of a surge tank?

6. What is the purpose of booster pumps?

7. What is the main purpose of an elevated tank?
8. How can the operator minimize ice formations in the water storage tank?

9. List three steps that should be followed when draining a storage facility for complete cleaning and inspection.

10. Before entering an empty water storage tank for inspection, the tank’s atmosphere should be tested for what?

11. Calculate the volume of water in cubic feet in a rectangular storage tank 40 feet long, 20 feet wide, and the water is 10 feet deep.

12. How many gallons of water are in a circular water storage tank 30 feet in diameter and the water's depth is 18 feet?

13. How many lbs of sodium hypochlorite solution (10 percent available chlorine) would need to be added to 500 gallons of water to produce a 100 mg/L chlorine solution?
14. How many pounds of water are in a tank that contains 900 gallons of water?

15. A water storage tank contains 1,200 cubic feet of water. How many gallons of water are in the tank?
As we discussed in Section 2 of this manual, a water distribution system consists of pipes, valves, fire hydrants, meters, pumping stations, storage facilities and other appurtenances.

The two major hydraulic concerns placed on the distribution system are: will water flow, and in what direction? Water pressure is also a concern. Water should generally be delivered to the customer with a static pressure of 30 pounds per square inch (psi). An absolute minimum of 20 psi is required. Plumbing fixtures may be damaged when pressures exceed 100 psi.

Continuous positive pressure is necessary to prevent the creation of a vacuum effect on the water supply mainline. These vacuums can also cause the entrance of toxic and other undesirable substances into the water.

Avoid dead-end water mains whenever possible in your system. If you do have dead-end mains, make sure a fire hydrant, flushing valve, or blow-off is at the end of the line for periodic flushing. The minimum line size used when installing fire hydrants is 6 inches in diameter.

Take a closer look at some of the components that make up the distribution system.

**Pipes**

Many different types of material are used for water mains. Ductile iron, steel, plastic, and reinforced concrete are available. Service pipe, which is the pipeline extending from the main line to the building being served, is made of copper, plastic, steel, iron, or brass.

All pipes have a roughness that resists water flow and causes a drop in pressure under flowing conditions. The roughness is indicated by a factor called a C Factor. The higher the C Factor…the smoother the inside of the pipe. New plastic pipe would have a very high C Factor. Old steel pipe may have a low C Factor because of the corrosion that has occurred in the pipe.

**Valves**

Valves have many uses in a water distribution system. They can shut off, turn on, regulate flow of water, reduce pressure, provide vacuum and air relief, prevent backflow, and blow off or drain water from parts of the system. The most common types of valves encountered by the distribution operator are ball, diaphragm, plug, check, butterfly, globe, and gate.

**Fire Hydrants**

The two types of hydrants used are known as the wet barrel and dry barrel hydrants. Wet barrel hydrants have their operating valve located at the outlet and can only be used in areas where winters are mild and freezing is not likely. Dry barrel hydrants have the operating valve located at the bottom which makes it possible to drain the water from the hydrant and prevent damage caused by freezing.
Hydrants are used to fight fires, flushing pipelines, and at times for construction purposes. Generally, they are made up of four parts: the inlet pipe connection from the water main, the main valve, the barrel, and the head.

**Meters**

The primary and most common use of a water meter is to measure and display the amount of water passing through it. A metered water system is one in which meters are used at all strategic points: on main lines, reservoir outlets, pump stations, connections to other utility systems, and at each customer’s service. By installing a meter to each service line the utility can charge the customer for the exact amount of water used.

Meters can also serve in many other ways. They can be used to accurately blend waters of different qualities so that the mix in the reservoirs is of the same constant quality. Chemical dosages can also be measured by metering.

Small flow meters (displacement type) consist of nutating disc and piston types. Large flow meters (velocity type) consist of turbine, propeller, venturi, magnetic, and insertion types. Combination meters (known as compound type) are used to measure both high and low flows. Compound meters are generally used in hospitals, hotels, schools, factories, apartment buildings, commercial properties, and office buildings. They are best suited for locations with widely varying flows where accurate low flow measurement is needed. However, where the majority of flows are moderate to high, a turbine meter is generally used.

The most common meter is the water service meter, which is a displacement type meter. The basic requirements of an acceptable meter installation as recommended by the American Water Works Association (AWWA) are (1) that it be leak-tight, (2) that it provide an upstream shutoff valve of high quality and low pressure loss, (3) that it position the meter in a horizontal plane for optimum performance, (4) that it be reasonably accessible for inspection and service, (5) that it provide for easy reading either directly or with a remote-reading device, (6) that it be protected against frost, (7) that it not be an obstacle or hazard to the customer or public safety.

Meters can be installed outside or inside buildings. When the meter is installed outside, a meter box should be used. The meter box may be made of concrete, plastic, or cast iron. Meters installed inside need to be located at the point where the service line enters the building. In both types of installations, a copper meter yoke, which connects rigidly and permanently to the inlet and outlet pipes at the points where the meter is connected can be used. This ensures proper spacing and alignment of the meter, cushions the meter against strains and stresses in the piping, and provides pipe support and electrical continuity if the meter is removed.
**Pipe Installation**

Before excavating, all buried water, sewer, power, gas, telephone, cable TV lines, as well as storm drains in the work area need to be located. A "call before you dig" or "one-call" number such as Miss Utility should be called prior to any digging or drilling underground. Miss Utility can be reached at 1-800-245-4848.

All pipes should be handled carefully when loading, transporting, and unloading. Always check for damage when the pipe arrives at the job site and place as near as possible to the point of installation.

Of special concern when installing a water line is the separation between it and any sanitary sewer lines. If the water main becomes depressurized (which could be caused by a leak), and there is no pressure (negative pressure), contaminants in the saturated soil could enter the water line. Therefore, adequate separation between the two lines is needed to prevent the possible entrance of sewage into the water main. Water mains parallel to sanitary sewers should be installed at least 10 feet horizontally edge to edge away from the sewers. Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer.

The trench should be no more than 1-2 feet wider than the outside diameter of the pipe. Excavated soil should be piled on the side of trench between the trench and the traffic and far enough away (2-5 feet) so the workers can walk between the trench and the excavated material.

All trenches 5 feet in depth and deeper must be cut to the angle of repose. The angle of repose is the angle at which the trench wall should be excavated to prevent cave-ins (unless shoring is used). The angle varies depending on the type of earth material being excavated. If shoring is used, then the law and codes of the Occupational Safety and Health Administration (OSHA) inspects the working conditions for men and women. OSHA's mission is to save lives, prevent injuries, and protect the health of workers. OSHA is administered by the federal government and can be reached at 1-800-321-OSHA or at the website www.osha.gov.

Regardless of what type of hazard exists, OSHA requires that a "competent person" must be on the job site and in charge at all times. OSHA defines a "competent person" as a person capable of identifying existing predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate the hazards. This employee has received the appropriate training to be called competent.

In trenches more than 4 feet deep, use a standard stairway, ladder, or ramp securely fastened in place at a protected location where people are working. Ladders must be located within 25 feet of any person in the trench. Again, a "competent person" must inspect the trench for any hazardous conditions.
Section 6 Homework

1. What does the water distribution system consist of?

2. What is the system’s purpose?

3. Why is positive pressure needed in the distribution system?

4. A dead-end water main can cause what kind of problems in the system?

5. List three types of material used for water mains.

6. List two types of material used for service lines.

7. What are two advantages of plastic pipe?
8. What are the most common joints used when installing ductile iron pipe?

9. Water mains installed parallel to sanitary sewer lines should be at least ________ feet apart.

10. How do you determine the depth of a trench to install new main lines?

11. All trenches at or deeper than _____ feet must be properly shored or cut to angle of repose.

12. List five types of valves used in the water system.

13. List a function that an air relief valve serves.

14. Where are altitude valves mainly used?
15. What are some advantages of the gate valve?

16. Fire hydrants should not be more than _____ feet apart. Why?

17. List the two types of fire hydrants that are used in a distribution system.

18. A residential water meter is what type?

19. Large-flow meters are also known as what type?

20. When would you use a compound meter?

21. A device installed on the service connection directly downstream from the meter to prevent backflow is called ____________________ ____________________ ____________________.
22. What is the head in feet if the water distribution system reads 40 psi?

23. A water storage tank contains 40 feet of water. What is the pressure at the bottom of the tank in psi?

24. If you have 75 feet of pressure head, what is the pressure in psi?

25. What is the most positive mechanical means of backflow prevention?
The quality of water received in the distribution system depends on the quality of the source water and the type of treatment used. The source of the water must be protected against pollution or contamination. Any type of contamination or pollution may result in delivery of an unknown quality or dangerous water to the distribution system. The primary responsibility of the treatment plant is to produce potable water. If a water treatment plant is not operated effectively and reliably, the water entering the distribution system could be unsafe for human consumption.

Many conditions exist that may result in degradation of water quality in the distribution system. Cross-connections, corrosion, biological growth, and dead end water mains are a few examples that may affect the water quality.

Water quality monitoring of the distribution system is important to identify when and where water quality changes occur in the system. Routine monitoring consists of collecting samples at remote locations in the system and testing for chlorine residual and coliforms. The minimum number of samples per month to be taken is based on the population served.

As a distribution operator, you can maintain water quality in the distribution system by developing and implementing an effective operation and maintenance program. Critical elements of an effective operation and maintenance program include:

- A comprehensive system surveillance and monitoring program;
- Institution of a biofilm control program;
- Development and implementation of a unidirectional flushing program;
- Regular inspection and maintenance of storage tanks along with the assurance there is adequate turnover of water in the tank;
- Monitoring of main line repairs and replacement programs, especially disinfection procedures;
- A comprehensive backflow program must be implemented;
- Elimination of as many dead ends as possible;
- Institution of an annual cleaning and lining program;
- Development and maintenance of a corrosion control program; and
- Development of a value exercise program to ensure proper setting and operation of valves.
Section 7 Homework

1. What is the definition of potable water?

2. As the water temperature increases, chemical reactions will _____________________.

3. What physical qualities of water are important to the consumer?

4. What is the most frequent reported cause of waterborne disease outbreaks in the United States?

5. What are the two types of backflow that can occur through cross-connections?

6. What could cause “milky water” to appear in the system?

7. When flushing or flow testing a fire hydrant, what might the consumer experience?

8. Estimate the water flow rate in cubic feet per second in a canal 6 feet wide when the water is 3 feet deep and the water velocity is 4 feet per second.
9. What is the flow velocity in feet per second in a 14-inch diameter pipe when the flow rate is two cubic feet per second?

10. What is the flow rate in a 12-inch diameter pipe in cubic feet per second when the flow velocity is 2.2 feet per second?

11. The velocity in a 36-inch main is 2.5 feet per second. How many gallons are flowing through it per minute?
The water supplier’s managers and operators have the legal responsibility for delivering safe water to their customers. This is largely done through the conscientious operation and maintenance of the system facilities.

Both preventive and corrective maintenance are necessary in the operation of a distribution system. Preventive maintenance is that which is specifically scheduled while corrective maintenance is not scheduled but is done when a problem must be corrected to continue satisfactory operation.

**Pipe Maintenance**

The type of maintenance performed by the operator on water mains includes repairing leaks and breaks, flushing, cleaning, disinfecting and relining. Locating and repairing leaks will help to reduce operating and maintenance costs.

**Valves**

Operators should know exactly where to go to shut off any valve at any time in case of an emergency. Having a good map of all system valves is important in assuring proper line isolation during a repair or maintenance. All valves should be regularly operated and inspected.

**Fire Hydrants**

Inspection and maintenance of fire hydrants should be conducted twice a year. Usually these operations are done in the spring and fall; however, each hydrant should be inspected after each use.

Fire hydrants are one of the few parts of a water distribution system visible to the public so keeping them well maintained is very important.

Hydrants are often used for fighting fires to help save lives and property. In addition to fire fighting, hydrants can be used to clean out the distribution pipelines by flushing out any impurities or sediment that may be present in the pipes. Start to flush near or at the source of the supply and work outward into the distribution system. This is referred to as unidirectional flushing.

**Water Meters**

The primary function of a meter is to measure and display the amount of water passing through it. Meter registers may be mechanically or magnetically driven. Like any other mechanical device, meters need regular servicing to maintain their efficiency. Proper testing of the meters is very important. Small meters should be tested once every five to ten years and large meters every one to four years. New meters should also be tested before installation.

Every operator who may have to read a meter should have a thorough understanding of how to do it correctly. There is a wide variety of meter reading systems used. Visual reading of the dial, digital readouts, radio handhelds, fixed network, mobile and telephone systems can be used.

**The Operator and the Customer**

Everything an operator does from meter reading, installing pipelines, repairing lines, and flushing hydrants to answering consumer complaints should always be performed in a professional manner. The system operator is often the most visible of the employees and at such times can be considered as being in the front line of public relations.
**Monitoring Program**
Federal and State regulations require monitoring water within the distribution system under three specific rules. Two of the rules we have already discussed in Chapter VI - chlorine residuals and coliform monitoring. The third rule, Lead and Copper general requirements are also required.

**Emergency Planning**
Each community water system shall prepare and maintain a written contingency plan relating to disasters such as earthquakes, floods, hurricanes, vandalism and even war. Normally, this type of plan does not include an “everyday” routine disruption of service. The utility should have a separate plan that outlines what must be done when a routine problem such as the following occur:

- A chlorinator or treatment unit fails,
- A water main breaks,
- Test results show a positive bacteriological test,
- A pump or motor burns out,
- Extended electrical power interruption occurs.

Operators must recognize that these types of problems can also result from a disaster. During a disaster, many routine problems may occur resulting in a major problem.
Name: ___________________________________________     Date:_____/_____/_____

Section 8 Homework

1. Water suppliers meet their legal responsibility to deliver safe water to the customer through what means?

2. What is the objective of distribution system maintenance?

3. How often should the interior of each storage tank be inspected?

4. When should air relief valves be inspected?

5. Federal and State regulations require monitoring water within the distribution system under what four specific rules?

6. When should new packing rings be installed?

7. What is the minimum flushing velocity required when cleaning water mains?
8. What is the factor or value used to indicate the smoothness of the interior of a pipe known as?

9. Hydraulic gradient tests are used for what purpose?

10. How could a frozen water main be thawed?

11. Freezing problems occur more frequently in what type of lines? Why?

12. When thawing pipe using electrical thawing methods, what precaution should be taken?

13. How often should fire hydrants be inspected?

14. How is the register of a water meter driven?
15. Why are coupons inserted in water mains?

16. What does SCADA stand for?

17. What are the three common forms of chlorine available for disinfecting a water main?

18. What is the flow from a pipe in gallons per minute (gpm) if a 500 gallon tank fills in 40 minutes and 30 seconds?

19. A water meter is tested. The meter reads 200 gallons. The actual flow into a tank is known to be 220 gallons. What is the accuracy as a percentage of the meter?

20. A pump is producing 150 gpm. How long (in hours) will it take to fill a 50,000 gallon storage tank?

21. How many cubic yards of soil must be excavated for a trench that needs to be 3 feet wide, 1,000 feet long and 5 feet deep?
22. What is the horsepower of a pump that must lift water 90 feet when the flow is 120 gpm?

23. Determine the amount of liquid chlorine required in pounds for a dosage of 50 mg/l in a 525,000-gallon elevated storage tank.

24. A new 12-inch water main is installed. It is 2,000 feet in length. If you desire to disinfect the main with 50 mg/l of chlorine using 70% HTH, how many pounds will you need?

25. Water velocity in two 4-inch pipes is 4 feet per second. What size pipe will carry about the same amount of water if the velocity is reduced to 2 feet per second?
SECTION 9: SAMPLING

Importance of Good Sampling Procedures
The importance of obtaining samples by proper methodology cannot be emphasized enough. Proper sampling is a vital part of protecting the water supply. Without proper sampling techniques the laboratory data obtained from tests conducted on those samples are meaningless, and more importantly, any maintenance of the water supply based on that data could result in situations which would endanger human health.

Representative Sampling
Remember; with sampling a small quantity of water is being used to evaluate a great quantity of water. Every precaution must be taken to ensure that the small quantity is a good representative sample of the greater quantity. A representative sample is a sample portion of material or water that is as nearly identical in content and consistency as possible to that in the larger body of material or water being sampled.

Grab Sampling
A grab sample is a single water sample collected at no specific time. A grab sample only represents the characteristics of that particular sample at that particular time. There may be times when a grab sample is preferred over a composite sample. These situations may include the following:
- The water to be sampled does not flow continuously;
- The characteristics of the water are relatively constant; and
- The water needs to be tested for water quality indicators that may change with time, such as dissolved gases, coliform bacteria, residual chlorine, temperature and pH.

Composite Sampling
A composite sample is a collection of individual samples obtained at regular intervals over a 24-hour period. The combined sample (the composite sample) forms a single larger representative sample and is analyzed to determine the average conditions during the sampling period. If the individual samples are combined in proportion to the rate of flow when the sample was collected, then it is called a flow proportional composite sample.

Sampling Locations
Sampling location usually depends on the type of system and the analyses required. The sampling locations to be used and the rationale behind selecting the sites are to be presented in a sample-site plan, which is to be submitted to the State for approval.

Water Taps
To collect samples from taps connected to water mains the service line must be flushed for a brief period of time before collecting the sample. The following precautions should be taken:
- Do not take samples from drinking fountains, restrooms, or taps with aerators.
- Do not take samples from taps surrounded by excess foliage such as leaves or flowers.
• Do not take samples from taps that are dirty, corroded, or are leaking.
• Never collect a sample from a hose or other attachment fastened to a faucet.
• Care should be taken that the person collecting the sample does not touch the faucet in any way that could contaminate the sample.

Sometimes, as in the collection of samples for lead and copper testing, a ‘first draw’ or ‘first flush’ sample will be required. For this, the water needs to stand in the pipes undisturbed for at least six hours before the sample is drawn. No water is flushed from the faucet before the sample is collected. Usually, this sample will be taken first thing in the morning before any water has been used.

**Distribution Systems**
The most representative samples of the water supply would be taken from the water main before any branching off occurs. Analyses of water main samples can be compared to analyses of tap samples to help pin point a possible problem for instance.

Sampling points should be selected so that the pathway of water from the source to the endpoint will be represented. Ideal sampling locations are those that provide a short, direct connection with the main and are made of corrosion-resistant material. Not just any faucet will do, and fire hydrants are not acceptable due to how they are constructed and their infrequent use. Allow the water line to flush long enough to replace the water in the lines twice. About 5 minutes is usually sufficient. Do not turn the faucet on wide open to make flushing quicker as this will stir up any deposits in the lines.

**Sampling Containers, Preservation and Holding Times**
The type of container used for collecting a sample depends on what tests need to be conducted on that collected sample. The Code of Federal Regulations, Protection of Environment, CFR 40, Part 136.3 contains a complete list of analyses that can be conducted along with information on approved sample containers, volume required, preservatives and maximum holding time between sampling and analysis.

The container must be clean and will usually be supplied by the laboratory performing the analysis. The container must be clearly labeled and at a minimum contain the following information:

• PWS ID Number
• Sample location
• Sample date
• Time of collection (exact time)
• Name of collector
**BASIC SAMPLING PROCEDURES**

**Basic Sampling Procedures**
The way you collect, store and transport your drinking water test sample affects the accuracy of your test results. Improper handling may show signs of drinking water contamination where it may not truly exist. Operator certification is required for any individual collecting samples for compliance. The certified laboratory you have hired will give you detailed instructions for handling a drinking water test sample, including:

- Collection procedures;
- Containers to use, including those supplied by the laboratory;
- Labeling of samples;
- Completion and chain of custody forms;
- Transportation of samples; and
- Time periods for delivery of samples.

Carefully follow the instructions from the laboratory to ensure accurate results.

**Location of sampling points**
One objective of sampling is to assess the quality of the water supplied by the water purveyor and the point of use, so that samples of both should be taken. Any significant difference between the two has important implications for remedial strategies.

Samples must be taken from locations that are representative of the water source, treatment plant, storage facilities, distribution network, points at which water is delivered to the consumer, and points of use. In selecting sampling points, each locality should be considered individually; however, the following general criteria are usually applicable:

- Sampling points should be selected such that the samples taken are representative of the different sources from which water is obtained by the public or enters the system.
- These points should include those that yield samples representative of the conditions at the most unfavorable sources or places in the supply system, particularly points of possible contamination such as unprotected sources, loops, reservoirs, low-pressure zones, ends of the system, etc.
- Sampling points should be uniformly distributed throughout a piped distribution system, taking population distribution into account; the number of sampling points should be proportional to the number of links or branches.
- The points chosen should generally yield samples that are representative of the system as a whole and of its main components.
- Sampling points should be located in such a way that water can be sampled from reserve tanks and reservoirs, etc.
- In systems with more than one water source, the locations of the sampling points should take into account the number of inhabitants served by each source.
- There should be at least one sampling point directly after the clean-water outlet from each treatment plant.

**Analytical quality assurance and quality control**
Standard methods for drinking-water analysis should be tested under local conditions for accuracy and precision, agreed at national level, and applied universally by both water-supply and regulatory
agencies. However, the use of standard methods does not in itself ensure that reliable and accurate results will be obtained.

In the context of analytical work, the terms quality assurance and quality control are often treated as synonymous. In fact, they are different concepts. Analytical quality control is the generation of data for the purpose of assessing and monitoring how good an analytical method is and how well it is operating. This is normally described in terms of within-day and day-to-day precision.

Analytical quality assurance, by contrast, comprises all the steps taken by a laboratory to assure those who receive the data that the laboratory is producing valid results. Quality assurance thus encompasses analytical quality control but also includes many other aspects such as proving that the individuals who carried out an analysis were competent to do so, and ensuring that the laboratory has established and documented analytical methods, equipment calibration procedures, management lines of responsibility, systems for data retrieval, sample handling procedures, certification, and so on.

Field Analysis and Field Instruments
All field instruments should be calibrated according to the manufacturer’s instructions prior to field use and documented in a calibration notebook to be kept with the instrument. Operation of field equipment varies depending on the manufacturer. Care must be taken to assure that each instrument is functioning properly and calibrated according to any calibration schedule.

Field measurements should be made in accordance with equipment manufacturer’s instructions and at appropriate times and locations so that valid information is obtained.

Chain of Custody Procedure
Procedures for Chain of Custody (COC) require maintenance of permanent records for all sample handling and shipment. COC procedures must be used to ensure sample integrity as well as legal and technically defensible data.

Any samples collected must be submitted with a COC form and a signed affidavit. The lab has stated that one COC form per shipping container (ice chest) is sufficient. The COC form must have each analysis request checked and show a range of collection times.

The sample should be kept in view or in locked storage until custody is relinquished to the shipper and formal documentation of the transfer is completed. The person collecting a sample will start the COC procedure.

In completing the tag, care should be taken to insure that all necessary information is correct and legibly written on the tag with a black waterproof ink pen. The use of a fine point pen is discouraged because of possible problems in making legible photostatic copies.

Shipping of Samples
The water system is responsible for shipment of all routine samples to the laboratories so that analyses can be conducted in accordance with EPA methods. Each sample must be accompanied by a COC form.

When a sample is shipped to the laboratory, it must be packaged in a proper shipping container to avoid leakage and/or breakage. The laboratory must be able to associate each container in the ice chest with a COC form.
COC forms or other documents should be shipped inside the ice chest and must be placed in a plastic bag to prevent water damage. A good method is to use a zip-lock bag taped to the inside of the ice chest lid. All shipping boxes must be taped closed with shipping tape, strapping tape or fiber plastic tape, etc.

The complete address of the sender and the receiving laboratory must legibly appear on each container. When sent by U.S. Mail, register the package with a return receipt requested. When sent by a shipping service, obtain a copy of the bill of lading. Post office receipts and bills of lading may be used as part of the COC documentation.

Certified laboratories must conduct analyses within the prescribed holding times in order to produce valid compliance results. An even flow of samples must be maintained into the labs throughout each sampling period so as to assure that the laboratory capacity is not exceeded. This will require that the Contractor and each shipper carefully plan and coordinate the collection and shipment of samples. Samples must be shipped on a routine daily basis.

It is far better to spend extra funds on ice and shipping costs than to have an entire shipment of samples rejected at the lab because of the failure to meet temperature requirements due to ice melt.

**How to store your sample and send it to the laboratory**

- **Submit your drinking water test sample to the certified laboratory as quickly as possible after collection.** To give the most accurate results, testing for bacteria must begin within 30 hours of collecting the drinking water sample. Be sure to obtain clear instructions from the laboratory regarding sample submission drop-off time.
- **Refrigerate samples until ready for shipping.**
- **Ship your sample bottles or containers to the laboratory in coolers, or in foam pack containers, with ice or ice packs.** Don’t pack the bottles with loose ice as this may contaminate the sample. If you only have loose ice, encase the sample/container in waterproof packaging or a sealed container. Be sure it is well protected from other samples that you may be sending to the laboratory at the same time (e.g. sewage samples).
- **Don’t allow samples to freeze.** In winter, you may want to take advantage of heated shipping offered by some courier companies.
- **Package the completed COC form, provided by the certified laboratory, with the collected sample.** If sending it inside the cooler containing the sample, ensure that the form is enclosed inside a waterproof package (e.g., a new zip-lock bag).

**Safety for Laboratory Personnel**

The safety of staff undertaking analytical procedures, both in the field and in the laboratory, is of the greatest importance. All staff should be trained in safety procedures relevant to their work. In the laboratory, individual staff members should be authorized to undertake procedures involving risk of any type only after appropriate training; unauthorized staff should not be allowed to undertake analyses.

All laboratories should formulate and implement a safety policy that should cover cleaning, disinfection, and the containment of hazardous substances. Safety equipment such as fire extinguishers, safety glasses, and first-aid kits should be suitably located, and readily available; they should be routinely checked and all staff should be trained in their use.
**Sampling Safety - Preservation Chemicals**

Acids of various types are the most common sample preservation materials that may pose a risk or hazard. Preservation chemicals must be handled with care and all appropriate safety procedures followed. You may feel that safety precautions are a burden; however, no amount of compensation can replace an eye or other body part damaged by acid. Material Safety Data Sheets are available wherever chemicals are stored.

It is your responsibility to use appropriate eye, hand, and clothing protection.

Also, if you are shipping samples that you know or suspect as a health hazard, include a warning note or letter in an appropriate location on the shipping container to minimize laboratory personnel exposure to an unknown health hazard.
**Procedure for Measuring pH**

Presently, pH measurements are part of routine tests done to check potable water quality. pH can be measured in several ways, of which 2 are widely used. One, simple and often precise enough, is the use of colorimetric (spectroscopic) methods. Second, more costly and more demanding in terms of procedure that have to be used, but giving much more precise results - is a potentiometric method with usage of pH electrodes and pH meters. pH measurements should be reported to +/- 0.1 units.

**Colorimetric Method**

The colorimetric method uses a sulfonphthalein indicator (Phenol Red) to determine pH based on color intensity of the chemical reaction. Phenol Red has a working range of pH 6.8 (yellow) to 8.2 (red). This is an indicator test, using a comparator. This test is the quickest and simplest method for testing pH. With this test, the reagent is added to a sample of water, coloring it red. The strength of color is measured against standard colors to determine the pH concentration. The stronger the color, the higher the concentration of pH in the water. Several kits for analyzing the pH in water are available commercially. The kits are small and portable.

1. Analyze samples for chlorine immediately after collection.
2. Fill a sample cell with 10 mL of sample (the blank).
3. Place the blank in the cell holder. Tightly cover the sample cell with the instrument cap.
4. Zero the instrument.
5. Fill another cell with 10 mL of sample.
6. Using a disposable dropper, add 1 mL of Phenol Red Indicator Solution to the cell (the prepared sample). Cap the sample cell and invert twice to mix.
7. Place the prepared sample into the cell holder. Tightly cover the sample cell with the instrument cap.
8. Analyze the results.


**Potentiometric Method**

Depending on the pH meter and the electrode used, procedures can look slightly different, but in most cases pH measurement procedures will be at least very similar. First of all - remember, that the electrode should be always immersed. Thus between pH measurements it should be put into a beaker with pH buffer (preferably 7.0) or - much better - KCl solution (0.1M to 1M). Don't worry that you will destroy the electrode moving it between solutions. It can easily survive minute in the air, but don't let it dry. Second, equally important thing is - the electrode is very fragile, and thus you should treat your electrode with care.

Ensure that pH meter is on. If you want high precision of measurements it is better to let the pH meter to warm up to ensure it will not drift later. Before every single pH measurement, or before any series of uses, you must calibrate (standardize) the pH electrode. To calibrate the electrode you need at least two solutions (buffers) of known pH values which should bracket the pH of the sample. The most commonly used commercially available calibration buffers have pH of 4.01, 7.00 and 10.00. Rinse the electrode with distilled water from a wash bottle into an empty beaker before immersing it into new solution. You should do it every time electrode is moved from one solution to other to minimize contamination. Check if the working part of the electrode is completely immersed in the buffer. Take care to not hit bottom of the baker with the electrode. Wait for the reading to stabilize (it takes seconds usually, up to a minute sometimes). After calibration you are ready to measure pH.
Rinse the electrode with distilled water and submerge it in the tested solution. Read the result and write it down in your lab notebook. Rinse the electrode and move it to the storage beaker.

Please remember, that above outline is very general. Different pH meters may require slightly different operating procedures. You should consult the manufacturer’s manual to be sure how to proceed and how to maintain the electrode.
**Procedure for Testing Total Chlorine Residual (using DPD Method)**

The method recommended for the analysis of chlorine residual in drinking water employs $N,N$-diethyl-$p$-phenylenediamine, more commonly referred to as DPD. This is an indicator test, using a comparator. This test is the quickest and simplest method for testing chlorine residual. With this test, the reagent is added to a sample of water, coloring it red. The strength of color is measured against standard colors to determine the chlorine concentration. The stronger the color, the higher the concentration of chlorine in the water. Several kits for analyzing the chlorine residual in water are available commercially. The kits are small and portable.

**Sample Collection, Storage and Preservation**

1. Analyze samples for chlorine immediately after collection.
2. Free chlorine is a strong oxidizing agent and it is unstable in natural waters. It reacts rapidly with various inorganic compounds and more slowly oxidizes organic compounds.
3. Many factors, including reactant concentrations, sunlight, pH, temperature, and salinity influence decomposition of free chlorine in water.
4. Avoid plastic containers since these may have a large chlorine demand.
5. Pretreat glass sample containers to remove any chlorine demand by soaking in a dilute bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse thoroughly with deionized or distilled water.
6. If sample containers are rinsed thoroughly with deionized or distilled water after use, only occasional pre-treatment is necessary.
7. Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere.
8. It is best to use separate, dedicated sample cells for free and total chlorine determinations.
9. A common error in testing for chlorine is not obtaining a representative sample.
10. If sampling from a tap, let the water flow for at least 5 minutes to ensure a representative sample.
11. Let the container overflow with the sample several times, then cap the sample containers so there is no headspace (air) above the sample.
12. If sampling with a sample cell, rinse the cell several times with the sample, the carefully fill to the 10-mL mark.
13. Perform the chlorine analysis immediately.
14. After adding reagent to the sample cell, a pink color will develop if free chlorine is present.
15. If the test overranges, dilute the sample with a known volume of high quality, chlorine demand-free water and repeat the test. Some loss of chlorine may occur due to the dilution. Multiply the result by the dilution factor.
16. Wipe the outside of sample cells before each insertion into the instrument cell holder. Use a damp towel followed by a dry one to remove fingerprints or other marks.
17. Place the sample cell into the cell holder.
18. Fill a second round cell with 10 mL of sample.
19. Add the contents of one DPD Total Chlorine Powder Pillow to the sample cell. (This is the prepared sample).
20. Swirl the sample cell for 20 seconds to mix.
21. **Wait 3 minutes** after adding the reagent and place the prepared sample into the cell holder.
22. Compare results.

Procedure for Sampling Fluoride

Water system personnel must monitor daily fluoride levels in the water distribution system daily (including weekend days). Samples that reflect the actual level of fluoride in the water system should be taken at points throughout the distribution. The sites where samples are taken should be rotated daily.

At least once a month, the public water system must submit a sample of drinking water to the commissioner or to a certified laboratory for fluoride analysis. The plant’s and the state laboratory split sample results and the plant's self monitoring form averages must also correlate.

Sampling Procedure

1. Collect sample at a representative sample point in the distribution system.
2. Remove any screen, hoses and aerators from end of faucet.
3. Run COLD water for 3 to 5 minutes to make sure water has not been sitting for a long time in pipes or tanks and is fresh from the well.
4. Turn water down so it does not splash.
5. Uncap bottle and fill to shoulder with water. Screw the cap on tightly.
6. Fill out the required information on Chain of Custody form. **SIGN THE FORM!** The sample will not be processed unless the form has a signature! Also, it is always a good idea to include your printed name next to your signature. In most cases, signature alone cannot identify an individual.
7. Return bottle with completed paperwork to lab.
8. **SAMPLE MUST ARRIVE AT LAB WITHIN 28 DAYS OF COLLECTION!**
Bacteriological Sampling Suggestions

General Procedures –

1. Use only sterile bottles furnished by the State or County Health Department. These sample bottles have shelf life of 6 months, after which they must be returned to the Office of Laboratory Services for reprocessing.

2. **Do Not Touch** the inside of the sample bottle or cap.

3. Do not collect samples from a storage tank, leaky faucet, aerators, or “purifiers”.

4. Allow cold water to run 5 minutes to clean service line before sampling.

5. **Do Not Rinse Out The Bottle.**

6. Reduce water flow and fill bottle to the shoulder, leaving about 1 inch air space at the top to facilitate mixing. Samples can be rejected at the laboratory for insufficient air space.

7. Replace the sample bottle cap securely.

If tap cleanliness is questionable –

1. Apply a solution of sodium hypochlorite (100 mg NaOCl/L) to faucet before sampling.

2. Let water run an additional 2-3 minutes.

Sampling from a mixing faucet –

1. Remove faucet attachments, such as a screen or splashguard.

2. Run hot water for 2 minutes.

3. Run cold water for 2-3 minutes.

Sampling from a river, stream, lake or reservoir –

1. Hold bottle near its base in the hand and plunging it, neck downward, below the surface.

2. Turn bottle until neck points slightly upward and mouth is directed toward the current. If there is not current, as in the case of a reservoir, create a current artificially by pushing bottle forward horizontally in a direction away from the hand.
Procedure for Bacteriological Sampling

Collecting the Sample
1. Use only sterile sample bottle furnished by State or County Health Departments. These sample bottles have 6 month shelf life after which they must be returned to the Office of Laboratory Services for reprocessing.
2. Do not touch the inside of the sample bottle or cap or otherwise contaminate outfit.
3. Do not collect from a storage tank, leaky faucet, aerators, or “purifiers”.
4. Allow water to run 5 minutes to clean service line before sampling.
5. Do not overflow or rinse sample bottle.
6. Fill sample bottle to the shoulder leaving about a 1-inch air space at the top.
7. Replace the sample bottle cap securely.

Completing the Sample History – Report Form
1. Complete all of the following information IN INK – make sure that all copies are legible.
2. Provide the following information:
   a. County of water sample origin.
   b. Public Supply (PWS) ID Number and name of water supply.
   c. Who is to be charged for the sample examination?
   d. Collector’s name, title, certification number, organization, and telephone number.
   e. To whom the final report of examination is to be mailed? (DO NOT WRITE “SAME AS ABOVE” – This information appears in a window envelope.)
3. Complete the following sample collection data:
   a. Sample type – Repeat samples and replacement samples must have the complete lab number of the previous sample that they are a repeat/replacement for. (Repeat samples are for samples that were previously positive, replacements samples are for samples that were previously unsatisfactory, laboratory accident or invalid.
   b. Date and Time of sample collection. COLLECTOR MUST INITIAL THE FORM.
   c. Give a specific description or location of the sampling point.
   d. Is the water supply chlorinated? Chlorine residual.
   e. pH
   f. How the sample is to be transported to the laboratory and the transportation condition.

Mailing – Delivery to Laboratory
Samples must be sent or brought for receipt to the laboratory in time for examination during the following hours (South Charleston Laboratory: 8:00 am to 4:30 pm, Monday thru Friday. Kearneysville Laboratory: 8:00 am to 4:00 pm, Monday thru Wednesday and 8:00 am to 12:00 pm, Thursday) and within 30 hours of collection. Check departure schedule of mail or delivery service from your area and plan for collections to be readied for shipment at that time. Make sure postage is affixed to outer mailer.

ALL FIVE COPIES OF THE COMPLETED HISTORY FORM MUST BE ENCLOSED WITH THE SAMPLE.

SAMPLING CONTAINERS ARE THE PROPERTY OF THE STATE AND THEIR USE IS RESTRICTED ONLY FOR THE COLLECTIONS BY STATE AGENCIES OR THOSE DULY AUTHORIZED BY THE STATE.
Procedure for Sampling Total Nitrates

Total Nitrates Sampling Supplies
Before you begin sampling, it is important to have all of your supplies on hand. Here is a list of the suggested supplies you may need:

- Cooler for shipping and storage of your sample while in transit between collection point and lab.
- Bagged Ice for your shipping cooler.
- PVC or unsupported Neoprene gloves which are necessary to keep your hands safe from sample container preservative chemicals.
- Safety Goggles which are necessary to keep your hands and eyes safe from sample container preservative chemicals.
- Sample Container
- Lab slips, labels, and markers for sample container identification

Additional Recommended Items
- Paper towels for drying off the outside of your sample container after sampling.
- Plastic storage baggies for ice and sample container
- Sampling Containers
  - Although different sizes and types of sample containers can be used for Nitrate sampling, most laboratories supply 80mL sample bottles with concentrated Sulfuric Acid as a preservative
- As a general rule, proper washing of hands is highly recommended for the sample collector.
- Also, food, drink, and even 2nd hand cigarette smoke should never come into contact with the sample or its containers. These foreign objects have been suspected of causing false results in samples, so be sure to practice good clean sample collection procedures.
- Do not sample with any containers that appear to have been tampered with since this may cause an undesirable sample result.
- The laboratory that supplies the sampling containers may provide instruction with the kit for the type of monitoring being performed. Be sure to refer to those instructions when provided.

Important Safety Precautions
Safety goggles and gloves must be worn. Wash hands before and after sampling.

Sampling Procedures
Sample containers may contain liquid preservatives. Liquid preservatives will cause burns. If it comes into contact with the skin or eyes, flush with liberal amounts of water and seek immediate medical attention.

1. Select a state approved sampling location if any have been designated. If none have been designated, contact your state or tribal drinking water program office. For a surface water system, the plant effluent tap might be an appropriate sampling location. For a well discharging directly into a distribution system (entry point to the distribution system or EPTDS), a tap on the well’s discharge piping after any treatment may be appropriate.

2. If possible, use a non-swivel faucet and remove all attachments, including any aerators, strainers
and hoses. It is normally recommended not to take a sample at that location if all attachments cannot be removed because they may alter the sample results.

3. Turn on the water tap and run the water until the temperature has stabilized (use a thermometer if possible). This typically takes 2 to 3 minutes. Then reduce the flow so that the stream is approximately ¼ inch in diameter. Do not change the flow rate until after sampling is completed.

4. While the water is running for those 2-3 minutes, completely fill out the labels and lab slip. Be sure to clearly identify the system information, like the public water system identification number, exact sample location, date and time of collection, and the sampler’s name.

5. If the sample collection point has a specific coded identification, include it on the label and sample submission form. Be sure to attach the label prior to sampling. A wet sample container may not allow the label to properly adhere.

6. Hold bottle at an angle and carefully fill it to its shoulder. Do not touch the interior of the bottle or the underside of the cap. Do not allow the bottle to touch the faucet, or allow water to splash up onto the faucet.

7. The sample container should be tightly capped.

8. Blot the sample container with a paper towel to dry it off.

9. It is recommended that you place the sample in a sealable plastic bag before shipping in a closed chest or box.

10. Since ice is sometimes recommended for use in shipping, it is recommended that it be bagged separately to eliminate any contamination of the sample.

11. Samples must be delivered to the analytical laboratory within 3 days for proper testing.

RECOMMENDED:
Taping of the chest prior to shipping is also recommended since the container could be mistakenly opened during shipment.

Also be sure to tape the sample forms and any other sample documentation either inside or the outside of the lid.

If the laboratory has any additional recommendations or requirements, they should be read and followed closely.

If you have any additional questions, please contact your state or tribal drinking water program office for assistance.

Following the proper drinking water sample collection procedures can lead to peace of mind, knowing that the test results truly represent the quality of water your customers are drinking.
Procedure for Sampling Lead and Copper

1. **Sample must be first-draw after water has been motionless in the plumbing for a minimum of 6 hours.** An exception to the first-draw requirement can be granted to non-transient non-community systems that operate 24 hours per day. They must document that they are 24-hour operations and indicate the approximate length of time the water was motionless before sample was collected.

2. Samples must be from cold, untreated water taps in the kitchen or bathroom of residential buildings. Non-residential building samples must be collected from taps where water is typically drawn for consumption. Taps connected to a softener or other point-of-use-device may not be used.

3. Sample must be acidified immediately after collection. If not, the sample has to stand in the original bottle for 28 hours after acidification.

4. Label bottles and fill out laboratory request forms completely.

5. Be sure to take the required number of samples for your system. Refer to page 28 or the *EPA Lead and Copper Rule: A Quick Reference Guide* to determine your system’s sampling requirements and the 90th percentile.
Procedure for Sampling Disinfection Byproducts

TTHM/HAA5 Sampling Supplies:
Before you begin sampling, it is important to have all of your supplies on hand. Here is a list of the suggested supplies you may need:
- Cooler for shipping and storage of your sample while in transit between collection point and lab.
- Bagged ice for your shipping cooler.
- PVC or unsupported Neoprene gloves which are necessary to keep your hands safe from sample container preservative chemicals.
- Safety goggles which are necessary to keep your hands and eyes safe from sample container preservative chemicals.
- Sample container.
- Lab slips, labels, and markers for sample container identification.

Additional Recommended Items:
- Paper towels for drying off the outside of your sample container after sampling.
- Plastic storage baggies for ice and sample container.
- For this sampling method, the laboratory normally sends either 2, 40 or 2, 60 milliliter glass vial containers. Some labs may provide ampules with acid for pH adjustment which is not covered in this presentation.
- Obtain specific instructions from the laboratory at the time empty containers are received.

As a general rule, proper washing of hands is highly recommended for the sample collector.

Also, food, drink, and even 2nd hand cigarette smoke should never come into contact with the sample or its containers. These foreign objects have been suspected of causing false results in samples, so be sure to practice good clean sample collection procedures.

Do not sample with any containers that appear to have been tampered with since this may cause an undesirable sample result.

Procedures
The laboratory that supplies the sampling containers may provide instruction with the kit for the type of monitoring being performed. Be sure to refer to those instructions when provided.
IMPORTANT: The laboratory supplying the sample containers may send trip blanks, sometimes called field reagent blanks, along with the sample containers. Trip blanks consist of sample containers filled at the laboratory, that must remain sealed and must be shipped back to the lab. This is done to check if samples were contaminated during shipment.

Important Safety Precautions
Safety goggles and gloves must be worn. Wash hands before and after sampling.
Caution-Hazard
Sample containers may contain liquid preservatives. Liquid preservatives will cause burns. If it comes into contact with the skin or eyes, flush with liberal amounts of water and seek immediate medical attention.

Sampling Procedure
1. Select a state approved sampling location. Normally, this type of sample is collected at various locations throughout the distribution system.

2. If possible, use a non-swivel faucet and remove all attachments, including any aerators, strainers and hoses. It is normally recommended not to take a sample at that location if all attachments cannot be removed because they may alter the sample results.

3. Turn on the water tap and run the water until the temperature has stabilized (use a thermometer if possible). This typically takes 2 to 3 minutes. Then reduce the flow so that the stream is approximately ¼ inch in diameter. Do not change the flow rate until after sampling is completed.

4. While the water is running for those 2-3 minutes, completely fill out the labels and lab slip. Be sure to clearly identify the system information, like the public water system identification number, exact sample location, date and time of collection, and the sampler’s name.

5. If the sample collection point has a specific coded identification, include it on the label and sample submission form. Be sure to attach the label prior to sampling. A wet sample container may not allow the label to properly adhere.

6. Remove the cap from the vial, keeping the vial upright to prevent spilling any preservatives. Do not put the cap face down or put it in your pocket. Do not allow the inside of the cap or the bottle threads to be touched by any object.

7. Hold the vial at an angle pointing away from your face and carefully fill it until it is completely full. Be careful not to rinse out the preservatives. If acid has been added to the vial by the laboratory, it will mix rapidly with the water and may splatter a bit.

8. Carefully complete filling the vial by putting water inside the cap and transferring it one drop at a time to the vial until completely full.

9. Screw the cap on the bottle being sure not to overtighten the cap.

10. Invert the bottle 2 or 3 times and check for air bubbles. If any are present, add additional water-just a drop or 2- seal and check again.

11. Remember that each “sample” consists of 2 to 3 filled vials. Repeat the previous steps to fill additional vials for each sample.

12. Complete all necessary forms supplied by the laboratory with the appropriate information. In many states, the same form that is filled out here will be used to report the analytical results. Also, you may need to complete a chain of custody form, if required.
13. Place the samples in a cooler. The trip blanks should still be in the cooler. Keep the samples at 2 degrees to 6 degrees C (36 degrees to 43 degrees Fahrenheit) and keep them away from direct light or gasoline and solvent vapors. Pack the samples in a cooler with Ice. As a tip, it might be a good idea to bag up the sample and the ice separately in the cooler. This will help prevent leakage or contamination of the sample from the ice.

14. Deliver the samples to the laboratory or ship the samples by an overnight courier. This will ensure prompt testing for the most accurate results. It is recommended that all samples be received by the laboratory within 7 days.

15. If the laboratory has any additional recommendations or requirements, they should be read and followed closely.

If you have any additional questions, please contact OEHS at 304-558-2981 for assistance.

Following the proper drinking water sample collection procedures can lead to peace of mind, knowing that the test results truly represent the quality of water your customers are drinking.
One of the processes in the treatment of drinking water is known as disinfection. “Safe” water is water that can be consumed without menace to one’s health.

Water in nature is never pure. It always contains dissolved gases and mineral matter in solution or suspension.

Chlorine is the most commonly used disinfectant in the United States. Chlorine is a greenish-yellow gas with a penetrating and distinctive odor. The gas is two and one half times heavier than air.

Chlorine is delivered for use by chlorinators in 100-pound cylinders, one-ton tanks, or chlorine tank cars in sizes from 16 to 90 tons. These cylinders are mainly made of seamless carbon steel. A fusible plug is placed in the valve below the valve seat of the tank. The plug is a safety device. At temperatures of 158 to 165°F, the fuse plug will melt because the pressure in the tank increases with temperature.

Drawn out of a tank, chlorine is applied to the water as either a gas or a liquid. Liquid chlorine is concentrated and heavier than gas chlorine. As a liquid, chlorine can be withdrawn from a cylinder at a much faster rate than a gas. The liquid is piped to an evaporator where it is converted into gas for injection.

Due to safety, most facilities using liquid chlorine use it in gaseous form using vacuum in the feed line so if a leak were to occur, the line would suck air in, not let chlorine out to the atmosphere.

Chlorine is also available in a dry form known as calcium hypochlorite or in a solution form known as sodium hypochlorite. Hypochlorites are applied by mechanical feeds or in a solution by hypochlorinators.

When chlorine is added to water containing organic and inorganic materials, the chlorine will combine with these materials and form chlorine compounds. If chlorine continues to be added, a point will be reached where the reaction with organic and inorganic materials stops. At this point, you have satisfied what is known as the chlorine demand.

The chemical reactions between chlorine and these organic and inorganic substances produce chlorine compounds. The total of the compounds with disinfecting properties plus any remaining free (uncombined) chlorine is known as the chlorine residual. The presence of this measurable chlorine residual is what indicates to the operator that all possible chemical reactions have taken place and that there is still sufficient available residual chlorine to inactivate or kill the microorganisms present in the water supply.

By adding together the amount of chlorine needed to satisfy the chlorine demand and the amount of chlorine residual, you have the chlorine dose. This is the amount of chlorine you will have to add to the water to disinfect it.

\[
\begin{align*}
\text{Chlorine Dose, mg/L} &= \text{Chlorine Demand, mg/l} + \text{Chlorine Residual, mg/L} \\
\text{Chlorine Demand, mg/L} &= \text{Chlorine Dose, mg/l} - \text{Chlorine Residual, mg/L} \\
\text{Chlorine Residual, mg/L} &= \text{Combined Chlorine Forms, mg/L} + \text{Free Chlorine, mg/L}
\end{align*}
\]

In West Virginia the standard test method used to measure chlorine residual is the DPD test.

“Residual disinfectant concentrations for free chlorine and combined chlorine may also be measured by using DPD colorimetric test kits. A DPD colorimetric test kit acceptable to the director is one that uses electronic measurement of the color development. It shall also have a digital display of the result. DPD colorimetric test kits with an analog display are not acceptable for use. An acceptable DPD colorimetric test kit shall have a method detection limit of 0.1 mg/l. A written protocol for quantitative dilution of samples shall be kept on file. This protocol shall be approved by the director before a colorimeter is approved for use for determining compliance with the MRDL for total chlorine.”
Every person working with chlorine should know the proper ways to handle it. Chlorine is a hazardous chemical and must be handled with respect. Concentrations of chlorine gas in excess of 1,000 parts per million (1.0% by volume in air) may be fatal after a few breaths.

Every employee should be trained in the use of self-contained breathing apparatus (SCBA), and should know what to do in case of emergencies. Wear an SCBA that protects your face, nose, and eyes. Protective clothing for working in an atmosphere that contains chlorine includes disposable rain suits with hoods to protect your body, head, limbs, and rubber boots to protect your feet.
Section 10 Homework

1. Drinking water standards are established by what agency?

2. What is the definition of pathogenic organisms?

3. What is the definition of coliform?

4. How does the temperature of the water affect the disinfection process?

5. Define disinfection.

6. How is the chlorine dosage determined?
7. Chlorine gas tends to do what to the pH of the water?

8. What are the three forms of chlorine used for the disinfection of water?

9. What are the two major types of chlorine feeders?

10. When should you read the level of a hypochlorite solution tank?

11. What should be worn when attempting to locate and/or repair a chlorine gas leak?

12. How frequently should residual chlorine measurements of treated water be taken on smaller water systems?

13. What would be the chlorine dosage if the chlorine demand is 2.2 mg/L and the residual is 0.3 mg/L?
14. How many pounds of 60% HTH are needed to chlorinate 20,000 feet of a 24-inch water main at a dosage of 40 mg/L of chlorine?

15. A new 12-inch water main is installed, and it is 12,000 feet in length. If you desire to disinfect the main with 50 mg/L of chlorine of 70% HTH, how many pounds will you need?

16. A water treatment plant treats 1,350,000 gallons of water per day. If it is desired to dose the water with 1.8 mg/L of chlorine, how many pounds per day are needed? The chlorine demand is 1.2 and the residual is 0.6 mg/L.

17. How many gallons of hypochlorite would be pumped by a hypochlorinator if the hypochlorite solution is in a container with a diameter of 48 inches and the hypochlorite level drops 30 inches during a specific period of time?

18. Determine the pounds of liquid chlorine required for a dosage of 100 mg/L in a water tank that is 50 feet in diameter and 25 feet to the top of the overflow. Assume the tank is \( \frac{1}{2} \) full of water.
19. What type of maintenance is usually required on a hypochlorinator?

20. What are the two most common water quality tests run on samples of water from a water supply system?
Safety is a program for everyone. Accidents do not just happen. They are caused. Safety authorities say that nine out of every ten injuries are the result of unsafe acts of either the person injured or someone else. The following is a list of some principle reasons for unsafe acts.

**Haste:** When we rush too fast; Someone who works too fast to think about what they are doing may take a dangerous shortcut.

**Indifference:** Someone who knows better but does not care. They disregard the instructions and/or rules.

**Ignorance:** Lacks experience or training or submits to a condition that prevents the recognition of a hazard.

**Poor work habits:** Some people either do not learn the correct way of doing things or they develop a wrong way.

**Laziness:** Affects the safety of the job because safety requires effort.

**Temper:** Someone’s thinking is interfered. Impatience and/or anger cause accidents.

**Poor physical condition:** Ignoring your bodily needs in regard to rest, exercise, and diet lessons your endurance and alertness, which could cause an accident.

Safe procedures must be used by the operator at all times. Working in a ditch, driving a vehicle, using a caustic chemical, working around electrical equipment, and many other conditions require the operator to follow safety procedures.

Many state and federal agencies are involved in ensuring safe work conditions. The one law that has the greatest impact has been the Occupational Safety and Health Act of 1970 (OSHA). This legislation affects more than 75,000,000 employees and has been the basis for most of the current state laws. Managers and supervisors must understand the OSHA Act and furnish each operator with the rules of conduct in order to comply with occupational safety and health standards.
**Electrical**

When working around electrical equipment, a basic lockout/tag out procedure set forth by OSHA should be followed. This procedure requires the following to be performed:

1. Notify all affected employees that a lockout or tagged system is going to be utilized and the reason why. The authorized employee shall know the type and magnitude of energy that the equipment utilizes and shall understand the hazard.

2. If the equipment is operating, shut it down by the normal stopping procedure.

3. Operate the switch, valve or other energy isolating device(s) so that the equipment is isolated from its energy source(s).

4. Lock out or tag out the energy-isolating device with assigned individual lock or tag.

5. After ensuring that no personnel are exposed, check to ensure the energy source is disconnected. Do this by pushing a button or other normal operating control to make certain the equipment will not operate. Return operating controls to the “Off” position after the test!

6. The equipment is now locked out or tagged out and work on the equipment may begin.

7. After the work on the equipment is complete, all tools have been removed, guards have been reinstalled, and employees are in the clear, remove all lock out and tag out devices. Only the employee who placed the lock out/tag out device shall remove it. Operate energy isolating devices to restore energy to the equipment.

8. Notify affected employees that the lock out or tag out device(s) have been removed before starting the equipment.

**Traffic Control**

At any time traffic may be affected, appropriate authorities must be notified. These could be state, county, or local depending on whether it is a state, county, or local street.

In West Virginia, traffic control related to the construction or maintenance of a utility is the responsibility of that utility. Specifications for traffic control devices and their arrangements have been established in accordance with Title 157 Legislative Rule, Department Of Transportation, Division Of Highways, Series 5, Traffic and Safety Rules.
Section 11 Homework

1. What are two very important aspects of a safety program?

2. What tasks should be performed before leaving the maintenance yard or shop?

3. What is the water distribution operator’s responsibility for safety?

4. Before taking an atmospheric testing device out to the job site, what should be done to the device?

5. A mixture of gas in air is considered hazardous at what level?

6. When working on electrical motors, what precautions should the operator take?

7. List some locations in your water utility where it may be necessary to monitor the atmosphere before entering.
8. Before performing any type of repair or maintenance on a pump and/or equipment, what steps should be taken?

9. What is a sanitary seal on a water well used for?

10. What is the purpose of traffic control?

11. Most traffic control zones can be divided into what five specific areas?

12. When installing braces or screw jacks in a trench, in what order should they be placed?

13. In excavation of a trench, when is shoring required?

14. Ladders should extend how many feet above an excavated trench?
15. When climbing fixed ladders, what are the two types of safety devices used by the operator?

16. Federal regulations regarding confined spaces identify both __________________ confined spaces and __________________ confined spaces.

17. All persons entering a tank for any reason must wear a __________________________.

18. If noises cannot be controlled within acceptable limits, the operator must be provided with __________________________, __________________________, and/or __________________________.

19. Does a confined space permit have to be renewed each time an operator leaves and re-enters the confined space?

20. The acronym MSDS stands for what?
SECTION 12: WATER SECURITY

Security practices should be incorporated into a utility's every day business functions. Activities such as fence cutting and lock picking, often dismissed as harmless, may be indications of more serious threats to a water or wastewater system. Utilities must be prepared to respond to this type of threat, as well as a wide range of other emergencies, including natural disasters. Improved security preparations provide for a more effective and efficient response.

Water and wastewater utilities are responsible for taking action to protect their infrastructure. The federal government and EPA are helping utilities to accomplish these actions by providing tools, trainings, and technical assistance.

Several resources designed specifically to help small drinking water and wastewater utilities better protect their systems are available through this site.

BIOTERRORISM ACT - On June 12, 2002, President Bush signed into law the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL 107-188, referred to as the Bioterrorism Act). In the Bioterrorism Act, Congress recognizes the need for drinking water systems to undertake a more comprehensive view of water safety and security. The Act amends the SDWA and specifies actions CWSs and the EPA must take to improve the security of the Nation's drinking water infrastructure.

The Bioterrorism Act defines small community drinking water systems as those serving a population of more than 3,300 but less than 50,000. If a community drinking water system serves more than 3,300 people, that utility must:

- Conduct a vulnerability assessment
- Certify to EPA that the assessment has been completed
- Send a copy of the assessment results to EPA
- Certify that the system has an emergency response plan.

VULNERABILITY ASSESSMENTS - Vulnerability assessments help water systems evaluate susceptibility to potential threats and identify corrective actions that can reduce or mitigate the risk of serious consequences from adversarial actions (e.g., vandalism, insider sabotage, terrorist attack, etc.). Such an assessment for a water system takes into account the vulnerability of the water supply (both ground and surface water), transmission, treatment, and distribution systems. It also considers risks posed to the surrounding community related to attacks on the water system. An effective vulnerability assessment serves as a guide to the water utility by providing a prioritized plan for security upgrades, modifications of operational procedures, and/or policy changes to mitigate the risks and vulnerabilities to the utility’s critical assets. The vulnerability assessment provides a framework for developing risk reduction options and associated costs. Water systems should review their vulnerability assessments periodically to account for changing threats or additions to the system to ensure that security objectives are being met. Preferably, a vulnerability assessment is "performance-based," meaning that it evaluates the risk to the water system based on the effectiveness (performance) of existing and planned measures to counteract adversarial actions. The following are common elements of vulnerability assessments. These elements are conceptual in nature and not intended to serve as a detailed methodology:
1. Characterization of the water system, including its mission and objectives;
2. Identification and prioritization of adverse consequences to avoid;
3. Determination of critical assets that might be subject to malevolent acts that could result in undesired consequences;
4. Assessment of the likelihood (qualitative probability) of such malevolent acts from adversaries;
5. Evaluation of existing countermeasures; and
6. Analysis of current risk and development of a prioritized plan for risk reduction.

The vulnerability assessment process will range in complexity based on the design and operation of the water system itself. The nature and extent of the vulnerability assessment will differ among systems based on a number of factors, including system size, potential population affected, source water, treatment complexity, system infrastructure and other factors. Security and safety evaluations also vary based on knowledge and types of threats, available security technologies, and applicable local, state and federal regulations.

EMERGENCY RESPONSE PLANS - An Emergency Response Plan (ERP) is a documented plan that describes the actions that a CWS would take in response to various major events. A major event refers to:

- Credible threats, indications of terrorism, or acts of terrorism;
- Major disasters or emergencies such as hurricanes, tornadoes, storms, earthquakes, fires, flood, or explosion regardless of cause; and
- Catastrophic incidents that leave extraordinary levels of mass casualties, damage, and disruption severely affecting the population, infrastructure, environment, economy, and government functions.

Protecting public health is the primary goal of community drinking water systems, and having an up-to-date and workable ERP helps achieve this goal in any crisis situation. The Bioterrorism Act amends the SDWA by adding, among other requirements, section 1433. Section 1433(b) requires community water systems serving populations greater than 3,300 to either prepare or revise an ERP that incorporates the results of its Vulnerability Assessment (VA). The ERP must include “plans, procedures, and identification of equipment that can be implemented or utilized in the event of a terrorist or other intentional attack” on the CWS. The ERP also must include “actions, procedures, and identification of equipment which can obviate or significantly lessen the impact of terrorist attacks or other intentional actions on the public health and the safety and supply of drinking water provided to communities and individuals.”
Core elements form the basis, or foundation, for responding to any major event. EPA has identified 8 core elements common to an ERP that you should plan to utilize or bring to bear during water emergencies:

1. System Specific Information;
2. CWS Roles and Responsibilities;
4. Personnel Safety;
5. Identification of Alternate Water Sources;
6. Replacement Equipment and Chemical Supplies;
7. Property Protection; and
8. Water Sampling and Monitoring

Your ERP may contain sensitive information, so you should consider steps you need to take to ensure the security of your ERP. Sensitive information should be placed in appendices, or in sections that are not readily available to unauthorized personnel. The ERP, however, should be easily accessible to authorized personnel and should be easily identifiable during a major event. Steps taken to limit access by unauthorized persons should consider local and state Freedom of Information Act (FOIA) laws. Alternatively, you can opt to make your ERP general in nature so that everyone can use it and not include specific information about system vulnerabilities. A secure copy of your ERP should be maintained in an off-premises location in the event that your primary copy cannot be accessed.

CONTINGENCY PLANNING
Contingency planning is an essential facet of utility management and one that is often overlooked. Although utilities in various locations will be vulnerable to somewhat different kinds of natural disasters, the effects of these disasters in many cases will be quite similar. As a first step toward an effective contingency plan, each utility should make an assessment of its own vulnerability and then develop and implement a compressive plan of action.
What is an Emergency?
An emergency is an unplanned event which disrupts or impacts your water system.

What Causes an Emergency?
- Cross-connections
- Mis-communication
- Unspecified Responsibilities
- Equipment Failure
- Safety Violations
- Inadequate Maintenance
- Accidents
- Natural Disasters
- Acts of Vandalism or Terrorism
- Insufficient or Contaminated Source Water

How Can You Minimize the Impact of an Emergency?
Quick, responsible action is necessary during an emergency. Developing and implementing a written emergency plan and procedures, along with having trained personnel, will help your water system achieve this goal. This guide offers information which can be used to create such a plan for your system.

Guidelines to Determine Impact of an Emergency:

**LEVEL 1—NORMAL**
Trouble that can be handled routinely, including normal operator activity.

**LEVEL 2—ALERT (Minor Emergency)**
Trouble which can be handled by the system with oversight and guidance from OEHS and/or Rural Water Association. This could be an early sign to indicate that a system or part of a system could be lost.

**LEVEL 3—Major Emergency**
Problem(s) that are somewhat beyond the capability of system personnel and association capabilities. May require a declaration of emergency in order to authorize shortcut procedures. Would require mobilizing all system personnel who might seek help through activating mutual aid agreements or contacts. This level of emergency leaves no doubt that outside help is required because of a serious threat to the facilities of a system and the public health.
LEVEL 4—PROBLEMS CLEARLY AND IMMEDIATELY BEYOND THE CAPABILITY OF THE UTILITY
Recovery time will exceed one week. Cost will be great and large amounts of mutual aid will be required. A request for a declaration of emergency will be required. This level would normally affect many different services that may be lifelines to a water and/or wastewater system. Natural or man-made disasters at this level will cause both disruption over a large area of service and a severe health risk to the public.

HOMELAND SECURITY ADVISORY SYSTEM

Threat Condition Levels
The Homeland Security Advisory System consists of five Threat Condition Levels, each identified by a brief description and corresponding color. From lowest to highest, they are as follows:

LOW = GREEN
GUARDED = BLUE
ELEVATED = YELLOW
HIGH = ORANGE
SEVERE = RED

The higher the Threat Condition, the greater the risk of a terrorist attack. (Risk includes both the probability and severity of such an event.) The EPA has created a series of suggested preventive measures for water systems to use at each of these levels.
EIGHT COMPONENTS OF EMERGENCY RESPONSE PLANS
(Suggested by the EPA)

1) System Specific Information
   • PWSID Number
   • System Name
   • Physical Address
   • Phone Numbers, etc.

2) Water System Responsibilities
   • Designate an Emergency Response Lead (ERL)
   • Name an alternate ERL
   • ERL’s should be individuals who can be on call 24/7
   • Maintain contact information for ERL’s

3) Communication Procedures
   • Details WHO, WHAT, and WHEN for distributing information
   • Communicates with both internal and external customers
   • Special plans for contacting various contingencies (first responders, hospitals, schools, etc.)

4) Personnel Safety
   • Shelter in place procedures
   • Evacuation of employee procedures
   • Other actions to ensure safety of water system personnel during emergencies

5) Identify Alternate Water Sources
   • List other water utilities or agencies which could be utilized in emergencies

6) Replacement Equipment and Chemical Supplies
   • Sources for replacing equipment damaged as a result of emergency situation
   • Sources of chemical supplies

7) Property Protection
   • Measures taken to protect water system physical facilities

8) Water Sampling/Monitoring
   • Listing of companies and facilities which can provide sampling and monitoring
WHAT SHOULD YOU DO IF…
- A threat is made against your water system?
- There is suspicious activity at your facilities?
- An intrusion or act of vandalism has occurred at your system?

IMMEDIATELY

1) CALL 911
If your area does not have 911 service, then contact your local law enforcement agency

2) CALL WV WATCH: 1-866-989-2824
This number will connect you with the WV State Police

3) CALL THE OEHS DISTRICT OFFICE SERVING YOUR AREA
See Phone Numbers below. Ask to speak directly to a district office Representative

OFFICE OF ENVIRONMENTAL HEALTH SERVICES
District Offices/Counties Served

Beckley (District 1) Phone: (304) 256-6666
COUNTIES SERVICED: Fayette, Greenbrier, McDowell, Mercer, Monroe, Nicholas, Raleigh, Summers, Wyoming

St. Albans (District 2) Phone: (304) 722-0611
COUNTIES SERVICED: Boone, Cabell, Calhoun, Clay, Jackson, Kanawha, Lincoln, Logan, Mason, Mingo, Putnam, Roane, Wayne, Wirt

Kearneysville (District 4) Phone: (304) 725-9453
COUNTIES SERVICED: Berkeley, Grant, Hampshire, Hardy, Jefferson, Mineral, Morgan, Pendleton

Wheeling (District 5) Phone: (304) 238-1145
COUNTIES SERVICED: Brooke, Doddridge, Hancock, Marshall, Ohio, Pleasants, Ritchie, Tyler, Wetzel, Wood

Philippi (District 6) Phone: (304) 457-2296
COUNTIES SERVICED: Barbour, Braxton, Gilmer, Harrison, Lewis, Marion, Monongalia, Pocahontas, Preston, Randolph, Taylor, Tucker, Upshur, Webster

Charleston (Central Office) Phone: (304) 558-2981
THREAT AWARENESS

What Is A Threat?
A threat is any event which could result in contamination of your water system or cause a loss of water volume or pressure.

Types of Threats
- Intentional Acts from an EXTERNAL source (Example: Activist groups, Criminals, Cults, Domestic or International Terrorist Groups, Vandals)
- Intentional Acts from an INTERNAL source (Example: Disgruntled present or former employee of a system)
- Natural Disaster (Example: Acts of God or Nature, such as a flood)
- Unintentional Acts/Accidents/Incidents (NON-DELIBERATE acts due to such causes as equipment failure, human error, or other unplanned acts)

How Can A Threat Be Communicated?
- E-Mail (Example: Virus which can damage system)
- Fax
- In-Person (Example: A disgruntled employee threatens to damage a treatment plant)
- Phone (Example: Bomb threat)
- Suspicious openings or evidence of tampering involving structures such as manhole covers, buildings, or other equipment.

How Can I Increase Awareness?
- Encourage customers to communicate with you and your staff as to how they can be involved in protecting their water system.
- Work with the public and other local agencies such as law enforcement or citizens/neighborhood watch groups.
- Watch for suspicious activity involving system facilities, personnel, or vehicles.

Examples of Suspicious Activity
- Unidentified or unmarked vehicles (cars, trucks, etc.) parked or left near waterways or facilities for no apparent reason.
- Unidentified persons photographing or videotaping water system facilities, structures, equipment, dams, etc.
- People atop water tanks or climbing or cutting a utility fence.
- Unknown persons hanging around locks or gates.
IF YOU SUSPECT A THREAT, IMMEDIATELY:

1. CALL 911
   If you do not have 911 in your area, call your local law enforcement agency.

2. CALL WV WATCH
   1-866-989-2824 (WV State Police)

3. CALL THE OEHS DISTRICT OFFICE SERVING YOUR AREA
   Ask to speak directly to a District Office Representative.
The management of a public water distribution system, large or small, is a complex and challenging job. The functions of the manager are similar to the ones performed by a CEO (Chief Executive Officer) of any big company. These functions include planning, organizing, staffing, directing, and controlling. In some small communities, the manager may be the only one who has these responsibilities and the community depends on the manager to handle everything.

**Planning**
A very large portion of a manager’s typical workday will be spent planning activities for the upcoming days ahead. Planning is one of the most important functions of the manager and may be one of the most difficult. Planning must take place before any of the other management functions can occur.

**Organizing**
All water distribution systems should have a written organizational plan and written policies. The purpose of the organizational plan is to show who reports to whom and to identify the lines of authority. For the manager, good organization means that employees are ready to accept responsibility and have the power and resources to make sure that the job gets done.

**Staffing**
The distribution system manager is also responsible for staffing. This includes hiring new employees, training employees, and evaluating job performances.

**Directing**
This also includes teaching, guiding, motivating, and supervising the water distribution system operators and staff members. Direction includes issuing orders and instructions so that activities are performed safely and properly.

**Controlling**
Controlling involves taking the steps which are necessary to ensure that essential activities are performed so that objectives will be completed as planned. Controlling also means being sure that progress is being made towards objectives and taking any corrective action. The manager is directly involved in controlling the distribution system to ensure safe water is being distributed to the customer.

To this point, we have talked about the manager’s functions. But what qualities does the manager need to fulfill those functions? A key ingredient is communication. Good communication is an essential part of being a good manager. Both written and oral communication skills are needed to effectively organize and direct the operation of a water distribution system. Communication is a two-part process: information must be given and it must be understood. Good listening skills are also important in communicating with someone. Remember, people need to communicate in order to accomplish any task large or small.
Section 13 Homework

1. What are the main functions of a water distribution manager?

2. In what type of community does the manager usually handle everything?

3. Distribution system planning must include whom?

4. What is the purpose of an organizational plan?

5. What are the two personnel management concepts a manager should always keep in mind?

6. When should a new employee’s safety training program begin?

7. What kind of communication skills are needed by a manager?
8. How is a water distribution system agency’s operating ratio calculated?

9. What are the three most common types of maintenance?

10. What does “SCADA” stand for?

11. What does a “SCADA” system do?

12. What can be caused by a cross-connection?

13. What is the first step toward an effective contingency plan for emergencies?

14. What does OSHA stand for?

15. Who enforces the OSHA requirements?

17. Define “unaccounted for water.”

18. How could a water distribution agency finance long-term projects?

19. Who is responsible for the implementation of a cross-connection control program?

20. If you, as an operator, are unsure of how to perform a job, what should you do?
ADDITIONAL INFORMATION:
REFERENCE LIST

1. Water Distribution System Operation and Maintenance Fifth Edition prepared by California State University, Sacramento College of Engineering and Computer Science Office of Water Programs.

2. Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report, April 23, 2004


4. Safe Drinking Water Act and all current Rules and Regulations from www.epa.gov/safewater

5. West Virginia Secretary of State Code of State Rules www.wvsos.com/csr


10. National Environmental Services Center www.nesc.wvu.edu

11. West Virginia Environmental Training Center www.wvetc.org

12. West Virginia Rural Water Association www.wvrwa.org

13. Sacramento State Office of Water Programs www.owp.csus.edu
BOIL WATER NOTICES

Water treatment professionals must regard public health protection as the highest priority. Although every water treatment plant operator strives to produce high quality water, if a test result or a condition exists that may threaten public health, a boil water notice (BWN) must be considered.

Therefore, water professionals must develop BWN criteria and action plans before there is a problem, not during a crisis. BWNs require a considerable amount of thought if they are to be carried out in timely fashion. One of the most important aspects of BWN’s is determining what circumstances will trigger the event, a few examples are:

- A violation of the total coliform rule;
- Loss of disinfection residuals at the point of entry;
- High filter effluent turbidities;
- Loss of pressure in the distribution system;
- Cross-connection/backflow incidents;
- Major water main breaks; or,
- Breaches in the integrity of water storage facilities.

There is no single perfect action plan for all utilities: each must be tailored to the specific system and situation. It is essential that plant staff focus on the challenge of fixing the problem that prompted the BWA thus protecting public health. Text of the public notification regulation can be found in the EPA Public Notification Handbook, on the OEHS website or by contacting your OEHS district office engineer.

Professional judgment and discretion are necessary in making decisions on the issuance of a notice. The water supplier is advised to consult with the local primacy agency to discuss the criteria for issuing public notices or BWNs. These discussions should include the actual wording and conditions for issuing the advisory.

Once the criteria to issue a BWN have been met, prompt action is necessary. Failure to issue a timely BWN could lead to serious public health, financial, and public relations consequences. Customer confidence may be eroded or elevated depending on the timeliness and accuracy of the information they require. BWNs erode public confidence if they are not issued in time or issued too often.

On July 8, 1998, OEHS Environmental Health Procedures Manual Memorandum DW-23 addressed Boil Water Orders at PWSs. Recently, DW-23 was reviewed and revised to improve consistent, proper handling of situations requiring boil water orders. Be sure to obtain a copy of the new DW-23 when it becomes final.
Workers' Memorial Day, April 28, 2004

On April 28, Workers' Memorial Day, the United States will join the international labor community in remembering those workers who have died or been injured on the job. On an average day in the United States, as a result of work-related injuries or illnesses, nearly 11,000 workers are treated in emergency departments, and approximately 200 of these workers are hospitalized (1). An estimated 7,000 private-sector workers require time away from their jobs (2), 15 workers die from their injuries (3), and 134 die from work-related diseases (4). The emotional, economic, and social costs of these injuries and illnesses are immense. In 2001, workers' compensation costs for employers alone totaled $64 billion (5).

Workers' Memorial Day also will commemorate the 33rd anniversary of the signing of the U.S. Occupational Safety and Health Act, which created the National Institute for Occupational Safety and Health within CDC and the Occupational Safety and Health Administration within the U.S. Department of Labor to lead the effort to create safer workplaces. Additional information about workplace safety is available at http://www.cdc.gov/niosh/ homepages.html or telephone, 800-355-4674.

References


Fatalities associated with trench collapses and other excavation hazards continue to occur despite Occupational Safety and Health Administration (OSHA) standards that specify safe work practices to reduce such hazards to workers (1). To assess the hazards of trenching and excavation work in the United States, CDC reviewed data from national occupational fatality records and investigatory reports of fatal injuries. This report summarizes the results of that analysis, which indicated that 76% of the deaths were caused by cave-ins and 47% of the deaths occurred among employees of companies with ≤10 workers. Employers can reduce the risk for future deaths by adhering to OSHA standards and by using education and training resources on safe excavation and trenching practices offered by the National Institute for Occupational Safety and Health (NIOSH), OSHA, and labor and trade organizations.

CDC reviewed data for 1992–2001 (the most recent data available to CDC) from the Census of Fatal Occupational Injuries (CFOI) maintained by the Bureau of Labor Statistics (BLS) and reviewed reports from the NIOSH Fatality

INSIDE
314 Carbon Monoxide Poisonings Resulting from Open Air Exposures to Operating Motorboats — Lake Havasu City, Arizona, 2003
321 Nosocomial Transmission of Mycobacterium tuberculosis Found Through Screening for Severe Acute Respiratory Syndrome — Taipei, Taiwan, 2003
322 Vancomycin-Resistant Staphylococcus aureus — New York, 2004
323 Update: Multistate Investigation of Measles Among Adoptees from China — April 16, 2004
324 Notice to Readers
<table>
<thead>
<tr>
<th>DISTRICT</th>
<th>ADDRESS TO</th>
<th>LOCATION</th>
<th>TELEPHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>District Engineer, W. VA. DOH</td>
<td>Charleston, West Virginia 25301</td>
<td>558-3001</td>
</tr>
<tr>
<td>Two</td>
<td>District Engineer, W. VA. DOH</td>
<td>Huntington, West Virginia 25704</td>
<td>528-5625</td>
</tr>
<tr>
<td>Three</td>
<td>District Engineer, W. VA. DOH</td>
<td>Parkersburg, West Virginia 26102</td>
<td>420-4645</td>
</tr>
<tr>
<td>Four</td>
<td>District Engineer, W. VA. DOH</td>
<td>Clarksburg, West Virginia 26302</td>
<td>842-1550</td>
</tr>
<tr>
<td>Five</td>
<td>District Engineer, W. VA. DOH</td>
<td>Burlington, West Virginia 26710</td>
<td>289-3521</td>
</tr>
<tr>
<td>Six</td>
<td>District Engineer, W. VA. DOH</td>
<td>Moundsville, West Virginia 26041</td>
<td>843-4008</td>
</tr>
<tr>
<td>Seven</td>
<td>District Engineer, W. VA. DOH</td>
<td>Weston, West Virginia 26452</td>
<td>269-0414</td>
</tr>
<tr>
<td>Eight</td>
<td>District Engineer, W. VA. DOH</td>
<td>Elkins, West Virginia 26241</td>
<td>637-0220</td>
</tr>
<tr>
<td>Nine</td>
<td>District Engineer, W. VA. DOH</td>
<td>Lewisburg, West Virginia 24901</td>
<td>647-7450</td>
</tr>
<tr>
<td>Ten</td>
<td>District Engineer, W. VA. DOH</td>
<td>Princeton, West Virginia 24740</td>
<td>487-5228</td>
</tr>
</tbody>
</table>
64-3-1. General.

1.1. Scope. -- This legislative rule establishes State standards and procedures and adopts national drinking water standards for public water systems. It establishes standards for the production and distribution of bottled drinking water, and also adopts federal standards for the certification of laboratories performing analyses of drinking water. This rule should be read in conjunction with W. Va. Code 16-1-9 and 16-1-9a. The W. Va. Code is available in public libraries and on the Legislature’s web page, http://www.legis.state.wv.us


1.5. Amendment of Former Regulations. -- This rule amends Public Water Systems, West Virginia Administrative Rules, Division of Health, 64CSR3, 2002.

64-3-2. Application and Enforcement.

2.1. Application. -- This rule applies to public drinking water systems, to bottled water treatment plants and distributors, and to laboratories desiring certification to perform analytic tests of drinking water.

2.2. Enforcement. -- This rule is enforced by the commissioner of the Bureau for Public Health or his or her designee.

64-3-3. Definitions.

3.1. Bottled Water. -- Water that is intended for human consumption and is sealed in bottles or other containers with no added ingredients except that it may contain safe and suitable antimicrobial agents, and includes bottled mineral waters.

3.2. Bottled Water Distributor. -- A person who buys and sells bottled water on a wholesale basis.

3.3. Commissioner -- Commissioner of the bureau for public health or his or her designee.

3.4. Community Water System. -- A public water system which serves at least fifteen (15) service connections used by year-round residents or regularly serves at least twenty-five (25) year-round residents.

3.5. Non-Community Water System. -- Any public water system that is not a community water system.

3.6. Person. -- An individual, partnership, association, syndicate, company, firm, trust, corporation, government corporation, institution, department, division, bureau, agency, federal agency or any other entity recognized by law.

3.7. Public Water System
3.7.a. A public water system is any water supply or system that regularly supplies or offers to supply water for human consumption through pipes or other constructed conveyances, if serving at least an average of twenty-five (25) individuals per day for at least sixty (60) days per year, or which has at least fifteen (15) service connections, and shall include: (1) Any collection, treatment, storage, and distribution facilities under the control of the owner or operator of the system and used primarily in connection with the system; and (2) Any collection or pretreatment storage facilities not under such control which are used primarily in connection with the system. A public water system does not include a system which meets all of the following conditions: (1) Which consists only of distribution and storage facilities (and does not have any collection and treatment facilities); (2) Which obtains all of its water from, but is not owned or operated by a public water system that otherwise meets the definition; (3) Which does not sell water to any person; and (4) Which is not a carrier conveying passengers in interstate commerce.

3.8. Sanitary Survey. -- An on-site review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of the source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water, as described in the federal regulations adopted in this rule.

64-3-4. Public Water System Construction, Alteration or Renovation; Standards; Exceptions.

4.1. No person shall construct, alter, renovate or award a contract for any construction, alteration or renovation of a public water system without obtaining a permit from the commissioner.

4.2. Application for a permit to construct, alter or renovate shall be made to the commissioner on forms prescribed by the commissioner at least forty-five (45) days prior to the date on which approval by the commissioner is desired. The application shall be accompanied by an engineering report, maps, and detailed plans and specifications of the proposed construction, alteration or renovation prepared by or under the direction of a registered professional engineer.

4.3. The commissioner may revoke a permit to construct, alter or renovate for failure of the public water system to comply with this rule.

4.4. A permit to construct, alter or renovate is valid for two (2) years from the date of issuance.

4.5. The public water system shall be constructed, altered or renovated in accordance with the plans and specifications approved by the commissioner in accordance with the Division of Health rule, “Public Water System Design Standards,” 64 CSR 77.

4.6. To the extent practical, all new or expanded facilities shall be located outside the one-hundred year (100) flood plain.

4.7. The commissioner may issue an order requiring a change in the source of the water supply for the system or in the manner of collection, treatment, storage, or distribution before delivery to the consumer as may be necessary to safeguard the public health.

4.8. A permit to construct, alter or renovate is not required for any minor addition to, or alteration or renovation of an existing public water system which will not significantly affect the quality or quantity of the water supply service rendered. The work shall be done in accordance with the provisions of the Division of Health rule, “Public Water System Design Standards,” 64 CSR 77.

4.9. A public water system shall submit a written description of the proposed additions, alterations or renovations to the commissioner no less than ten (10) working days prior to implementing the additions, alterations or renovations under this provision. The commissioner shall notify the system whether or not the
proposed additions, alterations or renovations qualify under this provision within five (5) days of receipt of the description.

4.10. All public water supply systems using a raw water source which is open to the atmosphere or subject to surface runoff shall, at a minimum, provide filtration treatment.

64-3-5. Permit to Operate a Public Water System.

5.1. A public water system shall be operated in accordance with this rule and the federal regulations adopted in this rule.

5.2. The commissioner may develop a program for the issuance of a permit to operate a public water system. The permit is renewable annually and may be revoked for failure to comply with the requirements of this rule or the federal standards adopted in this rule. The commissioner shall administer the permit program uniformly and shall not grant a permit until after he or she has completed a sanitary survey.

5.3. In the event of a proposed change in the ownership of a public water system, the new owner shall submit a written application to the commissioner at least fifteen (15) days before the proposed change to transfer the permit to operate.

5.4. The current permit to operate shall be posted in a conspicuous place at the public water system's treatment plant or main office.

64-3-6. Inspections and Sanitary Surveys of Public Water Systems.

6.1. The commissioner shall inspect public water systems and conduct sanitary surveys in accordance with the federal regulations adopted in this rule.

6.2. The commissioner has the right of access to all parts of a public water system. The public water system shall furnish the commissioner access to all information and records required to be kept by this rule and the federal regulations adopted in this rule.

64-3-7. Public Water System Disinfection Requirements.

7.1. Disinfection with chlorine, chlorine dioxide, chloramine or ozone is required of all public water systems, provided the requirements of Subsection 7.6 of this section are met.

7.2. The disinfectant shall be applied during treatment at a point before entering the distribution system which will provide effective contact time.

7.3. The minimum chlorine contact time for groundwater systems not influenced by surface waters is thirty (30) minutes from the point of application to the point of delivery to the first consumer or as stipulated in the Division of Health rule, “Public Water System Design Standards”, 64 CSR 77. At the end of the chlorine contact time, minimum free chlorine residuals shall comply with the requirements of Table 64-3A at the end of this rule. For these systems, the amount of residual disinfectant in the drinking water at the treatment plant and in the distribution system shall be determined at least once per day, or more often if considered necessary by the commissioner.

7.4. Surface water systems and groundwater systems under the direct influence of surface waters shall meet the disinfection requirements of the federal regulations adopted in this rule.

7.5. Chlorine residual testing equipment shall enable measurement of free and total chlorine residuals to the nearest 0.2 milligrams per liter in the range of 0.0 milligrams per liter to 2.0 milligrams per liter.
7.6. For all public water systems, at least 0.2 milligrams per liter of total chlorine residual shall be maintained throughout the distribution system at all times.

7.7. The commissioner may authorize variances in the chlorine disinfection parameters specified in this section.

64-3-8. Public Water System Fluoridation.

8.1. Average concentrations of fluoride present in the drinking water of a public water system, which artificially adjusts fluoride concentrations, shall be no less than the minimum and no higher than the maximum concentrations shown in Table 64-3B at the end of this rule.

8.2. The drinking water of fluoridated or defluoridated public water systems shall be monitored once per day for fluoride concentration. Records of the monitoring shall be maintained in accordance with Sections 9 and 10 of this rule.

8.3. At least once a month, the public water system shall submit a sample of drinking water to the commissioner or to a certified laboratory for fluoride analysis.


9.1. A public water system shall retain records of microbiological, turbidity, radiological and chemical analyses, or a summary of the records, at a convenient location on or near the premises of the public water system. The public water system shall keep turbidity, radiological and chemical analytical records for ten (10) years; they shall keep control test, microbiological and operational records for five (5) years. The commissioner shall certify a laboratory to conduct all tests and analyses required by this rule or the federal regulations adopted in this rule, with the exception of on-site water system operational tests.

9.2. The records shall include the date, place and time of sampling; the name of the person who collected the sample; identification as to whether it was a routine distribution system sample, resample, raw or drinking water sample, or other special purpose sample; the date of the analysis; the laboratory and person responsible for performing the analysis; the analytical technique or method used for microbiological testing; and the results of the analysis.

9.3. A public water system shall keep records of action taken to correct violations of this rule or the federal regulations adopted in this rule for three (3) years after the corrective action is completed.

9.4. A public water system shall keep copies of written reports relating to sanitary surveys of the system for ten (10) years.

9.5. A public water system shall keep records concerning a variance or exemption from this rule or the federal regulations adopted in this rule for at least five (5) years following the expiration of the variance or exemption.

64-3-10. Adoption of Federal Regulations.

10.1. The following federal regulations promulgated and published as final rules prior to adoption of this rule are hereby adopted by reference:


10.1.b. National Primary Drinking Water Regulations Implementation, 40 CFR 142.20(b), 142.21; 142.62, 142.63, 142.64 and 142.65, and

10.2. The commissioner shall use the provisions of 40 CFR 142.20(b), as adopted in this rule as applicable in granting exemptions.

10.3. In the event of a conflict between a federal standard adopted in this rule and a state standard adopted in this rule, the more stringent standard applies, except as stated in Subsection 8.5 of this rule.

10.4. These regulations can be viewed on the internet at <www.epa.gov/safewater/regs>. Copies of these regulations are available in hard copy from:

U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103

64-3-11. Bottled Water Treatment Plants and Distributors.

11.1. No person shall operate a bottled water treatment plant in this State without first receiving from the commissioner a permit to bottle and distribute water.

11.2. No person shall distribute bottled water in this State without first receiving from the commissioner a permit to distribute bottled water.

11.3. Application for a permit to bottle and distribute water shall be made to the commissioner on forms prescribed by the commissioner. Four (4) sets of completed applications, and plans and specifications for the treatment plant shall be submitted to the commissioner for approval at least forty-five (45) days prior to the date on which a permit from the commissioner is desired.

11.4. The source of the water to be bottled and the bottled water shall comply with Beverages, 21 CFR, 165 final regulations promulgated and published as final rules prior to the adoption of this rule, with the exception of Sections 165.3(b), 165.110(a)(2)(ii) and 165.110(b)(2).

11.4.a. The name of the water from a subsurface saturated zone that is under a pressure equal to or greater than atmospheric pressure is “ground water”. Ground water found to be under the direct influence of surface water as defined in 40 CFR 141.2, as adopted by this rule, shall be treated by a method approved by the commissioner.

11.4.b. The bottler shall conduct microbiological monitoring not less than weekly on the finished product. The bottler shall determine microbiological acceptability in accordance with 40 CFR 141.63, as adopted by this rule.

11.5. A bottled water treatment plant shall be operated in accordance with the provisions of the federal standards, Current Good Manufacturing Practice in Manufacturing, Packaging or Holding Human Food, 21 CFR Part 110, and Processing and Bottling of Bottled Drinking Water, 21 CFR 129, final regulations promulgated and published as a final rule prior to the adoption of this rule.

11.6. The commissioner shall inspect each in-state bottled water treatment plant every twelve (12) months or as he or she otherwise determines.

11.7. An out-of-state bottled water treatment plant desiring to distribute bottled water in West Virginia shall apply for a permit to bottle and distribute bottled water on forms approved by the commissioner. Four (4) copies of all materials shall be submitted. The out-of-state treatment plant shall comply with the requirements of this rule and the federal regulations adopted in this rule for in-state bottled water treatment plants. Subsequent to the initial evaluation, monitoring of the treatment plant by the regulatory agency of the state in
which the treatment plant is located is considered acceptable for the purposes of this rule. The out-of-state treatment plant shall notify the commissioner of any corrective action it is required to take by its state regulatory authority and shall notify the commissioner of any change in ownership or in the event that it closes.

11.8. A person wishing to distribute bottled water in the State who does not operate a bottled water treatment plant shall apply for a permit to distribute bottled water on a form approved by the commissioner. The applicant shall identify the location of the plants from which the bottled water is obtained and any distributor other than the bottled water plant from which the bottled water is obtained and shall provide other information required by the commissioner. The commissioner shall grant a permit to distribute bottled water if the bottled water complies with the requirements of this rule.

11.9. The commissioner may revoke a permit for failure to comply with provisions of this rule.

64-3-12. Public Water System Reporting Requirements.

12.1. Unless otherwise specified in this rule or the federal regulations adopted in this rule, a public water system shall report to the commissioner the results of any test, measurement or analysis required to be made by this rule or the federal regulations adopted in this rule within forty (40) days of the system's receipt of the test, measurement or analysis.

12.2. If a public water system fails to comply with this rule or the federal regulations adopted in this rule, it shall be reported to the commissioner within forty-eight (48) hours of the discovery of the violation.

12.3. Analytical results of tests performed by the laboratory of the bureau for public health are not required to be reported.

12.4. A public water system shall submit a written summary of the public water system operation, test data, and other information as may be required by the commissioner to the commissioner at least once per month. The commissioner may require more frequent reports in cases where there are public health concerns.

12.5. All reports and summaries required by this rule or federal regulations adopted in this rule shall be submitted in a manner or form approved by the commissioner.

12.6. A public water system shall distribute a public notice for any failure to comply with this rule or the federal regulations adopted in this rule. The content, distribution, recordkeeping, and reporting of the public notification shall be performed in a time and manner as specified in the federal rules adopted, by reference, in this rule.

64-3-13. Certification of Laboratories to Conduct Drinking Water Tests.

13.1. All laboratories providing drinking water testing results for purposes of this rule or the federal regulations adopted in this rule shall be certified by the commissioner or by the Federal Environmental Protection Agency.

13.2. A certified laboratory shall:

prior to the adoption of this rule; or any other accreditation determined to be equivalent by the commissioner; or

13.2.b. Comply with the requirements of this rule and hold a certificate of recognition from the National Environmental Laboratory Accreditation Program (NELAP) for the analysis of drinking water.

13.3. An in-state laboratory shall submit an application form when seeking initial approval at least sixty (60) days prior to the date certification is desired.

13.4. A laboratory located outside the boundaries of this state shall be certified by the commissioner if:

13.4.a. It has been certified by the federal Environmental Protection Agency; or

13.4.b. It has been certified by a program for the certification of laboratories equivalent to the program of this state as determined by the commissioner. If the program of the state in which the laboratory is located is not judged equivalent, the laboratory may request an on-site evaluation and full certification review by the commissioner.

13.5. An out-of-state laboratory shall submit an application form when seeking initial approval and shall include with its application evidence of compliance with Subsection 13.4.a. or 13.4.b. of this section. The out-of-state laboratory shall notify the commissioner immediately of any change in its certification status under Subsection 13.4.a. or 13.4.b. of this rule.

13.6. The commissioner shall conduct on-site inspections of in-state laboratories to determine compliance with this rule and the federal standards adopted in this rule initially prior to certification, and at least every three (3) years thereafter. The division has the right of entry upon proper identification at any time considered necessary during operating hours in order to conduct the inspections.

13.7. The commissioner shall issue certificates of approval upon initial approval and shall renew the certificates on an annual basis thereafter pursuant to the conditions listed in this rule. Certificates issued shall contain the name and location of the laboratory, a laboratory code number, the name of the laboratory director and the date of expiration of the certificate.

13.8. Certified laboratories shall notify the commissioner when there is a change in ownership, laboratory director, technical personnel or location of the laboratory.


64-3-14. Penalties.

Any person who violates any provision of this rule or orders issued under this rule is subject to injunction, criminal prosecution, and criminal, civil and administrative fines, all as provided in W. Va. Code 16-1-9, 16-1-9a, 16-1-17 and 16-1-18.
64-3-15. Administrative Due Process.

Those persons adversely affected by the enforcement of this rule desiring a contested case hearing to determine any rights, duties, interests or privileges shall do so in accordance with the Division of Health rule, “Rules and Procedures for Contested Case Hearings and Declaratory Rulings,” 64CSR1.

### TABLE 64-3A.
Minimum Levels of Free Chlorine Residual at Various Water Sample pH Levels

<table>
<thead>
<tr>
<th>pH VALUE</th>
<th>FREE CHLORINE RESIDUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 7.0</td>
<td>0.4 mg/l</td>
</tr>
<tr>
<td>7.1 to 8.0</td>
<td>0.6 mg/l</td>
</tr>
<tr>
<td>8.1 to 9.0</td>
<td>1.0 mg/l</td>
</tr>
</tbody>
</table>

### TABLE 64-3B.
Average Acceptable Range of Fluoride Concentration at Various Annual Average Maximum Daily Air Temperatures

<table>
<thead>
<tr>
<th>ANNUAL AVERAGE MAXIMUM DAILY AIR TEMPERATURE</th>
<th>FLUORIDE CONCENTRATION IN MILLIGRAMS PER LITER</th>
</tr>
</thead>
<tbody>
<tr>
<td>53.8 -- 58.3 °F</td>
<td>Lower 0.8</td>
</tr>
<tr>
<td>12.1 -- 14.6 °C</td>
<td></td>
</tr>
<tr>
<td>58.4 -- 63.8 °F</td>
<td>Lower 0.8</td>
</tr>
<tr>
<td>14.7 -- 17.7 °C</td>
<td></td>
</tr>
<tr>
<td>63.9 -- 70.6 °F</td>
<td>Lower 0.7</td>
</tr>
<tr>
<td>17.7 -- 21.4 °C</td>
<td></td>
</tr>
</tbody>
</table>

1.1. Scope. -- This Legislative rule establishes general rules for the control of traffic and the promotion of safety on the public highways.

1.2. Authority. -- This rule is issued under the authority of W. Va. Code 17-2A-8 and 12 and 17C-17, et seq.

1.3. Filing Date. -- April 2, 2008.

1.4. Effective Date. -- April 2, 2008.


2.1. "Holiday Weekend" means any weekend containing a national holiday on either Friday, Saturday, Sunday or Monday.

2.2. "Lighting Device" means any head lamp, auxiliary or fog lamp, signal lamp, clearance lamp, reflector lamp, identification lamp, or any lighted lamp or illuminating device designed or sold to be installed upon a motor vehicle.

2.3. "Safety Glass" means any product composed of glass, manufactured, fabricated, or treated to prevent shattering and flying of the glass when struck or broken, or such other or similar product as may be approved by the Commissioner.

2.4. "Seat Belt" means a restraining device bolted to the interior frame or body of an automobile which when buckled will prevent a passenger from seat ejection due to crash, collision, sudden stop, or other propulsive cause.

2.5. "Stud" means a pin type device prepared for installation in the tread design of a motor vehicle tire. It shall consist of a tungsten carbide core bonded to an outer casing or shell of plastic, aluminum or steel.

2.6. "Studded tire" means pneumatic tires with metal studs protruding from the tread for the purpose of providing improved traction on snow and ice covered roadways.


157-5-4. Speed Controls.

4.1. Commissioner's Order. Whenever the Commissioner of Highways has, pursuant to the provisions of W. Va. Code 17C-6, et seq., established a speed zone or designated a maximum or minimum speed limit, the Commissioner of Highways shall enter an order to such effect in the Commissioner's Order Book, in the manner provided in Section 2, Regulations Pertaining to Particular Functions of the Commissioner of Highways, 157CSR1. Such order shall set forth the reasons for establishing such speed zone or maximum or minimum speed limit, and whether the same shall be effective at all times or during the hours of daylight or darkness, or at such other times as the Commissioner of Highways may determine. The order shall designate the county route and mileposts in which the speed zone or limit is established and shall accurately describe the intersection, highway or part of highway, or bridge approach, to which the speed zone or limit shall apply. The description and designation shall be in non-technical terms of reference insofar as possible. All references in the order to the boundary of the speed zone shall be in terms of reference that may be readily ascertained by an examination of any affected road or bridge.

4.2. Erection of Signs Before Speed Limit Effective. No speed limit is effective until appropriate signs giving notice thereof are erected at the beginning point of the speed zone designating the zone and the speed limit to be observed in that zone, and until appropriate signs are erected indicating the end of the speed zone, which signs shall also indicate such different speed limit as may then be observed.

157-5-5. Traffic Regulation by Local Authorities.

5.1. Procedure for Establishment of Local Traffic Regulations. Whenever local authorities desire to alter a speed zone upon a state highway or extension of a state highway in a municipality, they shall set forth the reasons for the alteration, the speed limits to be observed, and the times the speed limits are effective, and a designation and description of the state highway or extension of the state highway in the municipality to which the speed limit or traffic regulation is to be applicable. The local authority shall send a written request to the Commissioner of Highways, and the speed zone or limit established by local authorities is not effective until approved by the Commissioner of Highways by order entered in his or her Order Book in the same manner as provided in Section 4, of this rule. Appropriate signs giving notice of the speed zone or limit so established shall be erected. Approved signs shall be erected, altered or removed only by Division forces.


6.1. Specifications. All signs relating to traffic controls, weight limitations, civil defense, safety, and other matters pertaining to use of road rights of way, which are erected or placed upon or near any state highway, bridge, or street, by the Commissioner of Highways, or any local authority, pursuant to any requirement of law or any rule issued by the Commissioner of Highways, or pursuant to any order entered by the Commissioner of Highways, shall conform in size, shape, color, form, and specifications to those contained in the Manual on Uniform Traffic Control Devices for Streets and Highways, described in Subsection 3.1, of this rule.

157-5-7. Lighting Devices; Safety Glass; Seat Belts.
7.1. General. The purpose of this rule is to establish the procedure which shall be followed when any type, brand or make of lighting device, safety glass, or seat belt is submitted to the Commissioner of Highways for his or her approval; and for the issuance of a Certificate of Approval; and for the revocation of the Certificate of Approval where prescribed standards are not met.

7.2. General Conditions for Issuance of Certificate of Approval.

7.2.a. All lighting devices shall conform to the current standards and specifications of the S.A.E. (Society of Automobile Engineers) Handbook applicable to the equipment.

7.2.b. All safety glass shall conform to the current standards and specifications of the American Standard Safety Code for "Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways".

7.2.c. All seat belts shall conform to the current standards and specifications of the Society of Automotive Engineers prescribed for such equipment.

7.2.d. All lighting devices, safety glass, and seat belts shall be marked for easy identification.

7.2.e. All markings on lighting devices, safety glass, and seat belts shall be identical with the markings shown on the application for their approval.

7.2.f. All lighting devices, safety glass, and seat belts, sold or used must conform identically with the equipment of such nature for which a Certificate of Approval has been issued.

7.2.g. The issuance of a Certificate of Approval by the Commissioner of Highways shall not constitute an endorsement of the use of any lighting device or type of safety glass, or seat belt, in a manner contrary to the laws of the State of West Virginia.

7.3. Application for Certificate of Approval.

7.3.a. Each application for approval of a type, brand or make of lighting device, safety glass, or seat belt, shall be made in duplicate on forms furnished by the Commissioner of Highways and both copies shall be submitted to the Director of the Materials Control, Soils and Testing Division, West Virginia Department of Transportation, Division of Highways, 190 Dry Branch Road, Charleston, West Virginia 25306.

7.3.b. The applicant's duly authorized representative will sign both copies of the application.

7.3.c. The applicant will submit a separate application for each type, brand or make of lighting device, safety glass, or seat belt.

7.3.d. The applicant will submit a report from an independent testing laboratory approved by the Society of Automotive Engineers with each application of a type, brand or make of lighting device, safety glass, or seat belt. The report must show compliance with the standards and specifications described in Subsection 7.2, of this rule.

7.4. Approval by Commissioner of Highways. - The Commissioner of Highways upon approving a type, brand or make of lighting device, safety glass, or seat belt shall issue to the applicant a Certificate of Approval, together with any instructions determined by him or her.

7.5. Revocation of Certificate of Approval.

7.5.a. When the Commissioner of Highways has reason to believe that an approved type, brand or
make of lighting device, safety glass, or seat belt does not comply with the provisions of W. Va. Code 17C-15, et seq., or meet the requirements of this rule, he or she may after giving thirty (30) days' notice to the person holding the Certificate of Approval, conduct a hearing upon the question of failure of compliance. The hearing shall be conducted in accordance with the rules relating to hearings before the Commissioner, as set forth in Section 3, Regulations Pertaining to Particular Functions of the Commissioner of Highways, 157CSR1.

7.5.b. After the hearing, the Commissioner of Highways shall make a finding as to whether a failure of compliance exists, and if it is his or her determination that a failure of compliance does exist, he or she shall promptly notify the person holding the Certificate of Approval of the failure of compliance.

7.5.c. If at the expiration of ninety (90) days after the giving of the notice the person holding the Certificate of Approval has failed to satisfy the Commissioner of Highways that the lighting device, or type of safety glass, or seat belt, as thereafter to be commercially sold, does comply with the provisions of W. Va. Code 17C-15, et seq., or meet the requirements of this rule, the Commissioner of Highways shall suspend or revoke the Certificate of Approval issued until and unless the lighting device, safety glass, or seat belt is resubmitted to and retested by an authorized testing agency and is found to meet and satisfy the requirements of W. Va. Code 17C-15, et seq., and the provisions of this rule, and the Commissioner of Highways may in addition require that any and all lighting devices, safety glass and seat belts required by law to be installed and sold since the notification following the hearing be replaced with equipment of such kind that fully complies with the requirements of W. Va. Code 17C-15, et seq., and this rule.

7.5.d. The Commissioner of Highways may at the time of the retest purchase in the open market and submit to a testing agency any type, brand or make of lighting device, safety glass, or seat belt, as found at the hearing not to be in compliance with provisions of W. Va. Code 17C-15, et seq., or the requirements of this rule, and if the test discloses that any such equipment fails to comply with the code provisions, or meet the requirements, he or she may refuse to renew the Certificate of Approval.


8.1. General. Pursuant to authority vested in him or her by law, the Commissioner of Highways may, in his or her discretion, upon application in writing and good cause being shown therefore, issue a special permit authorizing the applicant to operate or move upon, along, over, or across the highways of this state, a vehicle or combination of vehicles of a size, weight, or load exceeding the maximums specified by law.

8.2. Basis for Granting or Denying Special Permits. In considering applications for special permits, primary consideration will be given to the protection and safety of the traveling public and the probable effects the issuance of the permits will have upon the state road system. The Commissioner will not grant permits for extra dimensional vehicles which will endanger other vehicles, or are likely to cause damage to bridges, municipal facilities, utility facilities, traffic signals, signs, or devices, or roadway structures of whatsoever kind or nature, or for overweight vehicles or loads which are likely to cause damage to any roads or roadway structures.

8.3. Officials Authorized to Issue Special Permits. Special Permits may be issued by the Commissioner of Highways, the Maintenance Division and such other personnel as may be authorized by the Commissioner of Highways.

8.3.a. Permits Issued Solely by the Maintenance Division. Blanket permits, and special permits for mobile homes, and special permits for seagoing containerized cargo, will be issued only by the Maintenance Division.

8.4. General Conditions for Issuance of Special Permits. Whenever a special permit is issued, the Commissioner of Highways, or his or her duly authorized representative, may impose any reasonable conditions or restrictions, which may be considered proper or necessary, such as establishing seasonal or other
time limitations within which the vehicles described in the permit may be operated on or across the highways specified, requiring the trip to be made over routes other than the route applied for, or otherwise limiting or prescribing conditions of operation of the vehicle or vehicles, when necessary to insure against damage to road foundations, surface, bridges, municipal or utility facilities, traffic signals, signs, or devices, or roadway structures of any kind or nature, and may require such condition, bond or security as may be considered necessary to compensate for any injury to such foundation, surface, bridge, etc. The following conditions, however, are applicable to all special permits issued by the Commissioner of Highways.

8.4.a. Permit must be Carried with Vehicle. Every permit shall be carried in the vehicle or combination of vehicles to which it refers and shall be available for inspection by any police officer or authorized agent of the Commissioner of Highways granting the permit, no person shall violate any of the terms or conditions of the special permit.

8.4.b. Permits Nontransferable. A special single trip permit is valid only for the vehicle or combination of vehicles described upon the face of the application and permit. No single trip permit is transferable to another vehicle or combination of vehicles.

8.4.c. Maximums not to be Exceeded. The maximum size limitations and the maximum axle, axle combinations and vehicle weights authorized by a permit shall not be exceeded.

8.4.d. Excesses to be Kept to a Minimum. Property transported under a permit shall be loaded to reduce to a minimum the excess over statutory size or gross weight limitations, and an oversize vehicle used for transporting loads under a permit shall be reduced to statutory size limitations if practicable when being operated without load. The load shall be properly secured and fastened to the transporting vehicle.

8.4.e. Notice to Owners of Overhead Structures. When a vehicle or load under a permit is in excess of the statutory height limitation, the person granted the permit shall give adequate notice to owners of overhead wires, cables, or other facilities which may be affected by the transportation authorized by the permit.

8.4.f. Vertical Clearance; Effect of Permit. Nothing contained in this rule shall be construed to require the state, any state agency, any utility, or any municipality, to provide sufficient vertical clearance to permit the operation of any vehicle or vehicles or to make any changes in or about existing structures now crossing the streets, roads and other public thoroughfares of the State of West Virginia.

8.4.g. Particular Regulations; Effect of Permit. No permit shall be considered to set aside any rules limiting loads because of local conditions including bridges and highways posted for load limits, seasonal weight restrictions, or under construction.

8.4.h. Permit not a Guarantee. The granting of a permit shall not be considered as a guarantee of the sufficiency of any highway or structure for vehicular movement.

8.4.i. Statutes, Ordinances, Rules and Effect of Permit. The holder of a permit shall not be relieved of compliance with the provisions of any statute, ordinance, or rule of any state agency or subdivision of the state, except to the extent that the statute, ordinance, or rule is modified by the conditions of the permit.

8.4.j. Limitations on Movement Under Permit.

8.4.j.1. Vehicles under special permit with loads 14 feet or less in width may not be moved on holiday weekends or legal holidays.

8.4.j.2. As a general rule, vehicles under special permit with loads wider than 14 feet may not be moved on Saturdays, Sundays, or legal holidays (except as otherwise provided in Section 8.13.d.2 of this rule.
8.4.j.3. No over dimensional or overweight loads may be moved when road conditions are hazardous due to ice or snow, or when driving conditions are rendered dangerous by reason of fog, snow, excessive rain, etc.

8.4.j.4. Overweight permits shall not, as a general rule, be issued for routes upon which temporary loading restrictions have been imposed.

8.4.k. Police Escort. All persons moving houses or other similar structures shall make arrangements with the appropriate law enforcement agency for police escort to accompany the movement. The applicant for a special permit, as provided in Subdivision 8.6.c. of this rule, shall furnish the Commissioner, or his or her duly authorized representative, a verification of the police escort arrangement with the application for the special permit.

8.4.l. Safety Regulations. Where a special permit requires the use of an escort vehicle or vehicles, the escort vehicle shall conform to the provisions of Subsection 8.14 of this rule.

8.4.m. False Information; Penalty. False information, or erroneous information, given in the application or the omission of information from the application, or failure to comply with the conditions of a permit, is just cause for the summary suspension of the permit, upon notice given orally or in writing, and for the suspension of the permit, upon notice in writing, of other permits held by the permittee. The length of the suspension and other matters pertaining to the suspension or revocation of a permit shall be determined by the issuing authority, which may conduct a hearing upon request of the person granted the permit subsequent to the suspension of a permit. Suspended and revoked permits shall be returned to the issuing authority.

8.5. Excessive Loads. The Maintenance Division, after approval by the District Engineer, may issue a special single trip permit for the movement of exceptionally heavy or large equipment such as transformers or compressor station machinery which cannot be disassembled. The permit may be issued only if the following requirements are fulfilled:

8.5.a. bridges must be reinforced at the applicant's expense and in accordance with instructions of the District Engineer;

8.5.b. a professional charge in order to determine the feasibility of any movement of extremely heavy equipment may be levied before an analysis is undertaken; and

8.5.c. a bond may be required in an amount prescribed by the District Engineer, to cover the cost of repairing all possible damage to bridges and/or roads.

8.6. Procedure for Issuance of Special Permits.

8.6.a. Applications; Forms. An application for a special permit shall be in writing. The application shall be made on a form approved by the Commissioner of Highways and directed to any officer duly authorized by the Commissioner of Highways to issue special permits.

8.6.b. Information Required. The application for a special permit shall specifically set forth the following information:

8.6.b.1. A detailed description of the vehicle and its registration and a detailed description of the proposed load including the manufacturer's name and model number of any equipment being transported. For cargo bearing vehicles, the application shall show the gross load and licensed gross vehicle weight; and

8.6.b.2. the particular portion of the highway or the specific point of crossing of the highway for
which the permit to operate is requested.

8.6.c. Applications for House Moving. Applications for house moving shall be made at least ten days in advance of the move on the regular permit application form supplied by the Commissioner. The applicant shall furnish verification to the Commissioner of Highways, or his or her duly authorized representative, that a law enforcement agency will provide a police escort to accompany the movement of the house, or other similar structure.

8.6.d. Applications Made at District Offices. Applications made at District Offices for a special single trip hauling permit shall be made on the forms approved by the Commissioner and shall include all required information.

8.6.e. Penalty for Erroneous Information. In the event of omissions or errors in submitted information, the permit may be considered invalid, thereby making the owner, lessee, or borrower of the vehicle subject to a fine for exceeding the legal size and weight limitation.

8.6.f. Permit Cost. Special Permits for single trips will be issued at a basic fee of $20.00 covering any oversize dimension. In addition to the basic fee, an overweight fee of $.04 per ton mile will be assessed. Annual Blanket Permits for continuous movement of oversized loads only will be issued at a basic fee of $200.00. Annual Blanket Permits for continuous movement of oversize and overweight loads will be issued at a fee of $500.00. Annual Blanket Permits for the movement of Mobile Homes that are no more than 14’ wide will be issued at a fee of $200.00. Annual Blanket Permits for the movement of seagoing containerized cargo will be issued at a fee of $150.00 for the first 15 permits and $15.00 for each additional permit.

8.7. Other Application. Any person who applies for and receives and accepts a permit by any telecommunication device does upon acceptance agree that he or she is familiar with all Statutes and Rules and Regulations of the State relating to excess size and weight and agrees to be bound thereby.

8.8. License Requirements. As a general rule a special permit for excess size and weight will not be issued to a vehicle which is not registered and licensed as required by the laws of the State of West Virginia.

8.8.a. Vehicles not Required to be Licensed. Vehicles which are not required to be registered and licensed by the laws of the State of West Virginia shall, nevertheless, obtain a special permit for all operations where the legal limitations for size and weight will be exceeded.

8.8.b. Licensed and Unlicensed out of State Vehicles. If the state of domicile or origin does not require a vehicle used in interstate commerce to be registered or licensed, the vehicle shall not be required to be registered or licensed before issuance of a special permit by the Commissioner of Highways for movements through the state. If the special equipment is worked within the state, a license is required before the permit will be issued.

8.9. Movement of Contractor's Equipment and Materials; Commercial Haulers.

8.9.a. Contractor's Equipment. A special permit for excess size and weight shall be obtained by a contractor who moves equipment and materials to a West Virginia Division of Highways project or from one project to another project.

8.9.b. Commercial Haulers on Road Projects. Commercial haulers transporting materials to projects under contract for the West Virginia Division of Highways, a political subdivision of the state, or the federal government shall obtain special permits for excess size and weight.

8.10. State and Federal Government Vehicle. A special permit for excess size and weight shall be obtained for the movement of overweight or over dimensional vehicles where both the vehicle and the load are wholly owned by the federal government, the state, or a political subdivision of the state.
8.11. Movement Involving More Than One District. In the event the movement of a vehicle involves more than one District, the permit shall not be issued until the District Engineer or the delegated representative of each District involved approves in advance each permit and the advance approval is received by the District Office in which the permit is being issued.

8.12. Single Trip Permits over Routes Designated for Loading Restrictions. Except in case of an emergency, overweight permits shall not be issued via routes where temporary loading restrictions, or embargoes have been designated by Commissioner's Order.


8.13.a. Authority of the West Virginia Commissioner of Highways to Issue Permits for the Movement of Vehicles in Excess of the Statutory Limits. Pursuant to the provisions of W. Va. Code 17C-17-11, as amended, the Commissioner of Highways may, in the exercise of his or her discretion and upon application duly made, issue a special permit authorizing the applicant to move or operate a licensed mobile home or house trailer which exceeds the length, width or height restrictions along, upon, over, and across the highways of this State.

8.13.b. Legal Dimensions. A mobile home or house trailer, including its towing vehicle, whose overall dimensions do not exceed the statutory limits in this rule may be operated over West Virginia highways without a special permit.

COMBINATION LENGTH: 55 FEET
60 FEET
(DESIGNATED HIGHWAY)

MOBILE HOME LENGTH: NO REGULATION

WIDTH: 8 FEET
8 FEET 6 INCHES
(DESIGNATED HIGHWAY)

HEIGHT: 13 FEET 6 INCHES

8.13.c. Permit Information.

8.13.c.1. A permit to move a mobile home over legal dimensions may be obtained at the West Virginia Division of Highways, Central Vehicular Permit Section, Maintenance Division, State Capitol, Building 5, Charleston, West Virginia, 25305, (Telephone (304) 558-3736).

8.13.c.2. Maximum over dimension permit limitations:

COMBINATION LENGTH: 110 FEET
MOBILE HOME LENGTH: 80 FEET
WIDTH: 16 FEET
HEIGHT: 15 FEET 6 INCHES

8.13.c.3. A permit may be obtained in person or by letter, telephone/telecommunication, electronic means (email), or by any other means acceptable to the Commissioner of Highways. The following information must be furnished with permit application: name, address, and telephone number of applicant; driver's name and address; a description of the mobile home, including its make, year, model, serial number, license number, overall length, width, and height; a description of the towing vehicle, including its capacity, make, year, model, and license number; the name and address of the insurance company and the expiration
date of insurance; and a description of the routes to be traveled. Upon the expiration of insurance, all permits and coupons will be canceled.

8.13.c.4. The cost of all oversize mobile home permits shall be in accordance with existing West Virginia statutes.

8.13.d. Travel Regulations.

8.13.d.1. Travel shall be only over routes designated in the permit. Proof of possession of a permit in the form of coupons, facsimile, original permit, or telegram, whichever is used, shall be taped to the left rear of the Mobile Home approximately five (5) feet above the ground and shall not be protected by material; provided, however, that the master permit and the copy of the coupon must be carried in the tow truck at all times and shall be available for inspection by any duly authorized person.

8.13.d.2. All movements by permit must be made between sunrise and sunset. The movement of mobile homes greater than 14' wide will be restricted to travel Monday through Thursday and until 3:00 P. M. Friday. The movement of mobile homes 14' wide or less and subject to a permit will be restricted to travel Monday through Friday and until 12:00 Noon Saturday. Exceptions to the travel time restrictions may be considered on a per case basis. Approved exceptions will be noted on the permit.

8.13.d.3. All other limitations and restrictions on movements of mobile homes concerning the number of trips and the establishment of seasonal or other time limitations within which the mobile homes may be operated on or across West Virginia State highways shall be prescribed by the Commissioner of Highways in accordance with the circumstances of each individual permit as authorized by the provisions of W. Va. Code 17C-17-11(c), as amended.

8.13.d.4. Manufacturers and distribution and sales organizations of mobile homes up to 14'-6" wide shall make application to the above-mentioned Permit Section to determine a possible route for delivery of mobile homes to the point of destination.

8.13.d.5. The movement of mobile homes in excess of 14'-6" is restricted to 24' wide pavement on multi-lane highways with a minimum total clear roadway width of 28' except as noted in Section 8.13.d.6 of this rule.

8.13.d.6. Manufacturers and distribution and sales organizations of mobile homes in excess of 14'-6" wide shall make written application to the Permit Section to determine possible routing other than that permitted in Section 8.13.d.5 of this rule for delivery to the point of destination. The written application shall also include a statement that the applicant will be responsible for all costs incurred by the District Engineer or his or her designee in determining the feasibility of the routing, either approved or unapproved.

8.13.d.7. Permits in advance are legal for TEN DAYS when validated.

8.13.d.8. Notwithstanding the issuance of a permit, mobile homes of greater than legal dimension shall not be moved at any time when driving conditions are hazardous due to disturbance of road surfaces and/or visibility by natural phenomena such as snow, ice, fog, excessive rain, etc.

8.13.e. Manufacturing Regulations.

8.13.e.1. All mobile homes shall be equipped with brakes adequate to control the movement of and to stop and hold the vehicle. The brakes shall be designed so that they can be conveniently applied by the driver of the towing vehicle, and the brake shall be designed and connected so that in case of an accidental breakaway of the towed mobile home the brakes are automatically applied.

8.13.e.2. Provisions in this section shall not apply to any manufactured home built to conform to
8.13.f. Safety Regulations.

8.13.f.1. A permit applicant shall maintain and operate all equipment covered by permit in accordance with all applicable laws of the State of West Virginia.

8.13.f.2. On all two-lane highways, mobile homes up to and including 12' wide shall have an escort vehicle at the front of the towing vehicle. On expressways and/or Interstate highways, units in excess of 12' wide shall have an escort vehicle at the rear. On multi-lane highways having pavement widths of at least 24', mobile homes in excess of 14'-6" shall have one escort in front and two escorts at the rear. All other highways will require escort vehicles at the front and at the rear for mobile homes over 12' wide.

8.13.f.3. The towing vehicle must be marked at the appropriate location with a sign containing the message, "OVERSIZE LOAD". The sign must be at least 18" high, at least 6' but not over 8' long; and the height of the black letters shall be 10" capital letters on yellow background. However, approved color combination or wording of other states will be permitted, when the trip originates outside West Virginia. These signs shall also be placed to the rear of the mobile home and shall be mounted so that the bottom of the sign shall not be less than 6' above the roadway. The signs may be removable devices made of durable material. "OVERSIZE LOAD" signs shall be removed or covered when not required.

8.13.f.4. The towing vehicle and mobile home shall be flagged both front and rear with six (6) red flags not less than 16" square and made of plastic or cloth which shall be placed as follows:

8.13.f.4.A. One at each end of the front bumper of the towing vehicle and one on each corner of the mobile home roof at the ends, both towing and trailing.

8.13.f.5. The towing vehicle shall be equipped with 4-way amber flashing light spaced not less than 6' above the roadway. All running lights must be burning while on the highway.

8.13.f.6. Towing, and escort vehicles shall have 2-way radio communications.

8.13.f.7. When one-way or narrow bridges or restrictive structures are encountered, the driver of the front escort vehicle shall, if oncoming traffic is present, act as a flagger at the end of the structure to insure the safe passage of the mobile home and traffic over or through the constricted area.

8.13.f.8. The tow bar must be located in such a position that the center of the socket of the coupler shall not be less than 20" from the ground.

8.13.f.9. The towing vehicle of all mobile homes must be of a capacity of at least 1-ton or greater and must be equipped with dual drive wheels.

8.13.f.10. Movers of all mobile homes that will require parking restrictions or impede the normal flow of traffic in any way through a municipality shall notify the local authorities prior to movement. Municipalities may require police escort.

8.13.f.11. The towing vehicle on mobile homes shall be equipped with safety chains and brake load devices of sufficient strength to hold all weights being towed.

8.13.f.12. All towing vehicles moving mobile homes of greater than legal dimensions shall stop at all truck weighing stations, either platform or portable, and submit the combination of vehicles to any inspection considered to be necessary to determine if they are in compliance with this rule and applicable highway laws.

8.13.f.13. The maximum speed of vehicles towing mobile homes is the posted speed limit, but not
to exceed 50 miles per hour. Regardless, the driver of the vehicle towing the mobile home must operate the vehicle at a safe, reasonable speed for the conditions.

8.13.f.14. When a mobile home permit requires the use of an escort vehicle, the escort vehicle or vehicles shall conform to the provisions in Subsection 8.14, of this rule.

8.13.f.15. A multiple trip permit may be issued at the discretion of the Commissioner of Highways for the operation of mobile homes with widths not exceeding 16' and not exceeding the gross weight limit as set forth in W. Va. Code 17C-17-9, as amended.

8.13.f.16. Insurance. No permit will be issued unless there is submitted with the application a certificate from any reputable and solvent insurance company providing liability insurance in the amount of $100,000 for each person, $300,000 for each accident, and property damage insurance in the amount of $50,000. The certificate must be signed by a West Virginia Resident Agent pursuant to W. Va. Code 33-12-7.

8.13.f.17. Exemption from Liability for Damages. The applicant shall save harmless the Commissioner of Highways and any and all officers, agents, and employees of the Division of Highways from any and all claims for damages that may arise as a result of operations pursuant to any permit, and shall, as well, make full restitution to the Division of Highways for any damage to its property as a result of the operations.

8.13.g. Additional Restrictions. The Division of Highways reserves the right to place such additional restrictions and exceptions on the movement of mobile homes of greater than legal dimensions as may be considered necessary. Any restrictions imposed by the issuing agency will be recorded on the face of the permit. The Division of Highways reserves the right to deny any permit within its exercise of this discretion and in the event of violation of State laws or any provisions of this rule, the permit may be cancelled.

8.14. Escort Vehicles. The applicant for any special permit or any mobile home permit is responsible for the conditions and requirements for any front or rear escort vehicle as follows:

8.14.a. The escort vehicle must weigh more than 2,000 pounds and have a manufacturer's gross weight rating less than 26,001 pounds and must be properly licensed.

8.14.b. Identification signs or placards showing the name of the company or the owner or driver of the escort vehicle shall be displayed on the escort vehicle in a conspicuous place on both the right and left sides. The signs or placards shall be at least 8" x 12" and shall also contain the telephone number of the owner or driver plainly legible and visible to the motoring public.

8.14.c. All escort vehicles must be equipped with either a rotating or strobe amber yellow plastic, acrylic or glass covered flashing light which:

8.14.c.1. is visible from at least 500 feet; and

8.14.c.2. has a horizontal placement which is visible from all directions 360 degrees.

8.14.d. Escort vehicles shall display bumper mounted or roof mounted yellow 5' x 12" signs reading "OVERSIZE LOAD" with black letters 10 inches high, 1-1/2 inch wide brush stroke, which must be visible from front or rear;

8.14.e. Two flags, red or safety orange, a minimum of 18" square in size, shall be mounted at a 40 to 70 degree angle on the escort vehicle's roof rack or flags may be mounted on all four corners of the vehicle.

8.14.f. All for-hire escort vehicles shall contain the following miscellaneous equipment:
8.14.f.1. a CB radio, or any other two way communication device with the permitted load;

8.14.f.2. two 5 lbs. fire extinguishers (type A-B-C);

8.14.f.3. a sign with a handle with the word "STOP" on one side and "SLOW" on the other of not less than “18” in diameter with 6" letters suitable for directing traffic;

8.14.f.4. a safety orange vest, shirt or jacket (which must be worn by an operator directing traffic);

8.14.f.5. a red hand-held flag (18" in size);

8.14.f.6. 2 oversized load banners (Yellow with black lettering); and

8.14.f.7. three reflecting triangles or 24” traffic cones.

8.14.g. Nothing in this subsection prevents motor carriers of property from providing their own escort services related to their vehicle load transportation with their own drivers and equipment, provided the public safety requirements of this subsection are fulfilled relating to the escort vehicle.


9. Increase of Weight, Height, and Length Limitations Upon State Highways by Commissioner of Highways. Pursuant to the provisions of W. Va. Code 17C-17-11a and 11b, whenever in the opinion of the Commissioner of Highways, the design, construction and safety of any highway or portion thereof are such that the gross weight limitations prescribed by W. Va. Code 17C-17-4, can be increased without undue damage to the highway, or without undue risk of damage to the highway, or to bridges, municipal or utility facilities, traffic signs and signals, or roadway structures of other kind of nature, the Commissioner of Highways may, by order, increase the gross weight, height or length limits of vehicles which may be operated upon the highway or portion thereof and may establish the limitations which are applicable, subject, however, to the maximum limitations imposed by W. Va. Code 17C-17-11a and 11b.

9.1.a. Commissioner's Order for Increase of Weight, Height and Length Limitations. Whenever the Commissioner of Highways increases the limits under this subsection he or she shall enter an order to that effect in the Commissioner's Order Book, as provided in Section 2, Regulations Pertaining to Particular Functions of the Commissioner of Highways, 157CSR1. The order shall set forth the reasons for his or her decision and shall designate and accurately describe the highway or portion thereof, to which the increase in weight, height or length limits is applicable.

9.2. Restrictions Upon Right to use Highways by Commissioner of Highways. Pursuant to the provisions of W. Va. Code 17C-17-12, and subject to the restrictions contained in W. Va. Code 17C-17-12, the Commissioner of Highways may prohibit the operation of vehicles, or any class of vehicles, upon any state highway, or impose restrictions as to the weight of vehicles to be operated on the highways, whenever the state highway by reason of deterioration, rain, snow or other climatic conditions will be seriously damaged or destroyed unless the use of vehicles is prohibited or the permissible weights reduced, and the Commissioner of Highways may prohibit the operation of trucks or other commercial vehicles, or may impose limitations as to the weight on designated state highways.

9.2.a. Commissioner's Order. Whenever the Commissioner of Highways prohibits the operation of vehicles upon any state highway or imposes weight restrictions as provided in this subsection, the Commissioner of Highways shall enter an order to such effect in the Commissioner's Order Book, as provided in Section 2, Regulations Pertaining to Particular Functions of the Commissioner of Highways, 157CSR1. The order shall set forth the reasons for the prohibitions or limits and shall designate the road district and accurately
describe the state highway or portion thereof, upon which the prohibitions or limitations are applicable.

9.2.b. Signs. The order of the Commissioner of Highways imposing prohibitions or weight restrictions is not effective until appropriate signs giving notice of the prohibitions or restrictions are erected and maintained at each end of that portion of any highway thereby affected. All signs shall comply with the specifications described in Section 3 of this rule.

9.3. Structurally Unsafe Bridges. The Commissioner of Highways shall inspect all bridges upon state roads and if any bridge is found to be structurally unsafe, the Commissioner of Highways shall promptly condemn, close, and repair the bridge. Except in the case of emergency, the Commissioner of Highways' determination to condemn and close any structurally unsafe bridge upon a state road shall be manifested by an order duly entered in the Commissioner's Order Book as provided in Section 2, Regulations Pertaining to Particular Functions of the Commissioner of Highways, 157CSR1. The order shall set forth the reasons for condemning and closing the bridge and shall designate and accurately describe the county route and milepost upon which the bridge is located. Appropriate signs shall comply with the provisions of Section 3 of this rule.

9.3.a. Emergencies. In case of an emergency, all District Engineers or any other authorized personnel of the Commissioner of Highways' office have authority to condemn and close an unsafe bridge prior to the entry of an order by the Commissioner of Highways. In such event an order shall be entered as provided in this subsection as soon as possible after the closing of the bridge. Appropriate signs must be erected by Highways personnel, as provided in this subsection.

9.4. Transportation of Explosives. Any person operating any vehicle transporting any explosives as cargo or part of cargo upon a highway shall at all times comply with the following regulations:

9.4.a. Signs on Vehicle. Any vehicle transporting explosives shall be marked on the front, both sides, and the rear with the word "EXPLOSIVES" in letters not less than 8 inches in height and colors contrasting with the background; or there shall be displayed on the rear of the vehicle in a conspicuous place a red flag not less than 24 inches square with the word "DANGER" in white letters 6 inches in height.

9.4.b. Fire Extinguishers. Every vehicle shall be equipped with not less than two fire extinguishers filled and ready for immediate use, and placed at a convenient point on the vehicle used.

9.4.c. Blasting Caps; Containers. Blasting caps and electric blasting caps shall not be transported in the same vehicle with other explosives, unless packed in shipping containers conforming to Interstate Commerce Commission specifications.

9.4.d. Spark of Flame Producing Items Prohibited. No sparking metal tool or other loose piece of sparking metal, oils, matches, firearms, acids, inflammable substances, or similar material shall be carried on vehicles transporting explosives.

9.4.e. Overloading Prohibited. Vehicles transporting explosives shall not be overloaded, and in no case shall the explosives containers be piled higher than the sides of the truck body. Any vehicle with an open body shall carry a tarpaulin to cover the explosives containers.

9.4.f. Vehicle; Mechanical Condition. All vehicles when used for transporting explosives shall be inspected to determine that; the brakes and steering mechanism are in effective working condition; the electric wiring is well insulated and firmly secured; the body and chassis are clean and free from accumulations of oil and grease; the fuel tank and feed line are secure and have no leaks; two suitable fire extinguishers in working order are placed at a convenient point on the vehicle; and, in general, that the vehicle is in proper condition for safe transportation of explosives. The floors of all vehicles shall be tight. Any exposed metal on the inside of the body that might come into contact with any package of explosives shall be covered or protected with wood or other nonmetallic material.
9.4.g. Trailers. No explosives shall be transported in any form of pole-type trailer, nor shall any trailer be attached to a vehicle hauling explosives.

9.4.h. Vehicle Operator; Speed and Operating Prohibitions. Vehicles transporting explosives shall be driven only by authorized persons not addicted to the use of, or under the influence of, intoxicants or narcotics. Vehicle speed shall not exceed 35 miles per hour. Motor vehicles shall not coast or free-wheel at any time. Vehicles containing explosives shall not be taken inside a garage for repairs or other purposes. Insofar as possible, explosives shall be transported on streets or highways only during daylight hours.

9.4.i. Avoiding Public. Motor vehicles transporting explosives shall avoid, so far as practicable, driving into or through congested thoroughfares, places where crowds are assembled, streetcar tracks, tunnels, viaducts and dangerous railroad crossings. So far as practicable, this shall be accomplished by prearrangement.

9.4.j. Railroad Crossings. Vehicles transporting explosives shall come to a full stop before crossing any railroad track or main highway, and then proceed with caution, and conform to all other traffic safety measures.

9.4.k. Passengers. Passengers or other unauthorized persons shall not ride on a vehicle transporting explosives. Smoking or carrying of matches and smokers' articles is not permitted on or around a vehicle transporting explosives.

9.4.l. Unattended Vehicles. Vehicles transporting explosives shall not be left unattended at any time except while making actual deliveries, and then the utmost effort shall be made to prevent the vehicle from running away by carefully setting the brakes, blocking the wheels, or taking other precautions.

9.4.m. Careful Handling. Packages or containers of explosives shall not be thrown or purposely dropped while being loaded or unloaded or otherwise handled, but they shall be carefully deposited and stored or placed in such manner as to prevent the packages or containers from sliding or falling or being otherwise displaced.

9.4.n. Unloading at Rear of Vehicle. Explosives cases or containers shall not be left immediately back of the exhaust tailpipe of automotive equipment during loading or unloading. Motors of vehicles transporting explosives shall be stopped before loading or unloading the explosives.

9.4.o. Storage of Explosives During Unloading. Motor vehicles shall not be unloaded if explosives already unloaded have not been safely stored.

9.5. Transportation of Compressed Gas Containers. No person shall operate an open motor vehicle upon a highway while transporting, as a cargo or part of a cargo, any container of compressed gas designed to receive a valve protection cap, where such container is unsecured, uncapped, or has a gauge attached.

9.5.a. The following are exempt from this requirement as long as the container is safely secured and as long as this exemption does not conflict with any other local, state or federal requirements:

9.5.a.1. propane gas containers for household use;

9.5.a.2. personal oxygen containers for medical use, and;

9.5.a.3. any compressed gas containers in a fully enclosed part of the motor vehicle.

157-5-10. Studded Tires.

10.1. General. This rule, relating to the design, construction and use of studded tires, is promulgated by the Commissioner of Highways pursuant to the authority specifically delegated to him or her in the premises by

10.2. Design and Construction Standards and Specifications. All studded tires sold in this State or offered for sale in this State, shall comply with the following design and construction standards and specifications.

10.2.a. There shall be a minimum of one-eighth inch of rubber between the base of the stud and the body of the tire;

10.2.b. the tungsten tip of the stud shall project no more than seven-sixty-fourths of an inch from the surface of the tire;

10.2.c. the diameter of the stud, inclusive of the stud casing, shall not exceed three-eighths of an inch;

10.2.d. the contact area of the total number of studs shall not exceed three per centum of the total contact area of the tire;

10.2.e. in the interest of highway maintenance studs shall not be installed in tires which are operational with a recommended air pressure greater than forty pounds per square inch;

10.2.f. The studs shall be firmly and securely seated in the tire, which may be tested by applying a tensile force to each of five studs selected at random. The load shall be applied in the direction of minimum extraction force, and the load required to remove each stud shall be in excess of thirty pounds; and

10.2.g. failure to comply with the provisions of this subsection is a violation of the provisions of W. Va. Code 17C-15-37, and subject to the penal sanctions imposed by W. Va. Code 17C-18-1.

10.3. Use of Studded Tires. No studded tires shall be used on the highways of the State except during the period November 1st to April 15th in any calendar year.
64-4-1. General.

1.1. Scope. -- This legislative rule governs the examination and certification of operators of public water systems. The W. Va. Code is available in public libraries and on the Legislature’s web page, http://www.legis.state.wv.us/.


1.3. Filing Date. -- April 18, 2007.

1.4. Effective Date. -- April 18, 2007.

1.5. Repeal and Replacement of Former Rules. -- This legislative rule repeals and replaces Bureau for Public Health rule 64CSR4, Public Water Systems Operator Regulations, effective July 1, 2002.

64-4-2. Application and Enforcement.

2.1. Application. -- This rule applies to owners, certified operators, and operators-in-training (OITs) of a public water system and to applicants for certification.

2.2. Enforcement. -- This rule is enforced by the Commissioner of the Bureau for Public Health or his or her designee.

64-4-3. Definitions.

3.1. 1D Operator. -- An individual holding a valid West Virginia public water system certification issued by the Commissioner, who has met the education and experience requirements outlined in Table 64-Ba of this rule. Personnel employed in a Class WD or higher public water system that collect samples or collect water quality data from the distribution system shall hold a Class 1D or higher operator certification.

3.2. Adequate. -- A sufficient amount the Commissioner determines, considering hours of operation of the treatment plant, treatment complexity, distribution extent, source of water, and other factors.

3.3. Certified Operator. -- An individual holding a valid West Virginia public water system certification in accordance with Section 6 of this rule.

3.4. Chief Operator. -- The certified operator whom the owner designates who is responsible for managing the daily operational activities of an entire public water system or a water treatment facility, or a distribution system in a manner that ensures meeting state and federal safe drinking water rules and regulations.

3.5. Class I Operator. -- An individual holding a valid Class I West Virginia public water system certification issued by the Commissioner in accordance with Section 6 of this rule.

3.6. Class II Operator. -- An individual holding a valid Class II West Virginia public water system certification issued by the Commissioner in accordance with Section 6 of this rule.
3.7. **Class III Operator.** -- An individual holding a valid Class III West Virginia public water system certification issued by the Commissioner in accordance with Section 6 of this rule.

3.8. **Class IV Operator.** -- An individual holding a valid Class IV West Virginia public water system certification issued by the Commissioner in accordance with Section 6 of this rule.

3.9. **Commissioner.** -- Commissioner of the West Virginia Bureau for Public Health or his or her designee.

3.10. **Community Water System.** -- A public water system that serves at least fifteen (15) service connections used by year round residents or regularly serves at least twenty-five (25) year round residents.

3.11. **Consecutive System.** -- A public water system that receives some or all of its finished water from one or more other public water systems.

3.12. **Continuing Education Hour (CEH).** -- One (1) hour of participation in an organized continuing education experience under responsible sponsorship approved by the Commissioner for renewal of a public water system operator certification.

3.13. **Continuing Education Unit.** -- Ten (10) CEHs.

3.14. **Course of Study.** -- A series of continuing education courses, approved by the Commissioner, required as one way to qualify for a higher certification level.

3.15. **Day.** -- A standard work day of the Bureau for Public Health, unless specified otherwise.

3.16. **Distribution System.** -- Facilities downstream of the water treatment plant used to convey water for human consumption and which may include storage tanks, disinfection mechanisms, pumps, valves, hydrants, meters, and other appurtenances.

3.17. **Drinking Water.** -- Water produced by a public water system that conforms to the requirements of the Division of Health rule, "Public Water Systems," 64CSR3.

3.18. **Experience.** -- Hands-on work performing certified operator duties at a public water system.

3.19. **Ground Water.** -- A source of water not considered a surface or a ground water under the direct influence of surface water source.

3.19. **Non-Transient Non-Community Water System.** -- A public water system that is not a community water system and that regularly serves at least twenty-five (25) of the same persons over six (6) months per year.

3.20. **Operating Shift.** -- That period of time during which operator decisions that affect public health are necessary for proper operation of the public water system.

3.21. **Operate.** -- To perform the practical work and apply the technical knowledge and operational skills in the treatment, testing, and distribution of drinking water.

3.22. **Operator-in-Training (OIT).** -- An individual who holds a valid operator-in-training certificate issued by the Commissioner, and who is training under the responsibility of the chief operator at a public water system while completing the educational or experience requirements to become a Class I or WD operator.

3.23. **Owner.** -- The person that is legally responsible for the operation of a public water system.
3.24. **Person.** -- An individual, partnership, association, syndicate, company, firm, trust, corporation, government corporation, institution, department, division, bureau, agency, federal agency, or any other entity recognized by law.

3.25. **Present.** -- To be readily available to perform tasks at the water treatment plant.

3.26. **Primary Contaminant.** -- Any contaminant (other than microbiological) that has a maximum contaminant level in accordance with the Division of Health rule, “Public Water Systems,” 64CSR3.

3.27. **Public Water System.** -- Any water supply or system that regularly supplies or offers to supply water for human consumption through pipes or other constructed conveyances, if serving at least an average of twenty-five (25) individuals per day for at least sixty (60) days per year, or which has at least fifteen (15) service connections, and shall include: (1) Any collection, treatment, storage, and distribution facilities under the control of the owner or operator of the system which are used primarily in connection with the system; and (2) Any collection or pretreatment storage facilities not under such control which are used primarily in connection with the system. A public water system does not include a system which meets all of the following conditions: (1) Consists only of distribution and storage facilities (and does not have any collection and treatment facilities); (2) Obtains all of its water from, but is not owned or operated by a public water system that otherwise meets the definition; (3) Does not sell water to any person; and (4) Is not a carrier conveying passengers in interstate commerce.

3.28. **Public Water System Operator Certification.** -- Authority the Commissioner issues granting an individual permission to operate a public water system in accordance with this rule.

3.29. **Radial Water Collector Well.** -- A well that has radial well screens installed to increase the potential amount of water produced.

3.30. **Surface and Ground Water Under the Direct Influence of Surface Water.** -- A source that has been determined to be open to the atmosphere or subject to surface water runoff.

3.31. **Transient Non-Community Water System.** -- A public water system that is not a community water system that does not regularly serve at least twenty-five (25) of the same persons over six (6) months per year.

3.32. **WD Operator.** -- A water operator certified at the WD level that may only operate within the water distribution system or conduct distribution system related functions at a Class I or higher public water system.

3.33. **Water Treatment Plant.** -- A facility to process and treat water for distribution to consumers in accordance with the Division of Health rule, “Public Water Systems,” 64CSR3.

**64-4-4. Classification of Public Water Systems.**

4.1. A public water system is classified on the basis of the complexity of water treatment processes.

4.1.a. **Class 1D:** All transient non-community water systems that have ground water only as a source, and do not use gaseous chlorine or chlorine dioxide as a means of disinfection, and do not treat for the removal of nitrate or nitrite, or both. Ground water sources that use gaseous chlorine, chlorine dioxide as a means of disinfection or have treatment for removal of nitrate or nitrite, or both, are considered a Class I public water system.

4.1.b. **Class WD:** A public water system that obtains all of its water from another public water
system, and is not owned or operated by the supplying public water system. The system does not have any other source of water other than water from the supplying public water system. A WD system may apply chorine for supplemental disinfection.

4.1.c. Class I: Community and non-transient non-community public water systems that use ground water only, serve a population of less than 10,000 (including consecutive connection population), and do not treat for a primary contaminant.

4.1.d. Class II: All public water systems that use a surface source or a ground water under the direct influence of a surface water source, serve a population of less than 10,000 (including consecutive connection population), and do not have any additional treatment units within the treatment plant for identified primary contaminants in the source water. Treatment installed for removal of Cryptosporidium is considered an additional treatment unit. Class II also includes all public water systems that use ground water only, serve less than 10,000 population, use at least one radial water collector well as a source, or treat for at least one primary contaminant identified in the source water, or both.

4.1.e. Class III: All public water systems that use surface or a ground water under the direct influence of a surface water source, serve a population of at least 10,000 (including consecutive connection population), and do not have any additional treatment plant for identified primary contaminants in the source water. Class III also includes all public water systems that use ground water only, serve a population of at least 10,000 and use at least one radial water collector well as a source.

4.1.f. Class IV: A public water system that uses a surface or a ground water under the direct influence of a surface water source and serves a population of at least 20,000 (including consecutive connection population).

**64-4-5. Required Personnel and Conditions of Employment.**

5.1. The owners of public water systems shall:

5.1.a. Employ a Chief Operator with a certification equal to or higher than the system classification and an adequate number of certified operators to operate the system;

5.1.b. Not employ more OITs than the number of employed certified operators, unless written permission is granted by the Commissioner;

5.1.c. Apply to the Commissioner for OIT Certification, on behalf of OIT applicants, within thirty (30) days of their hire at the public water system. Experience gained for certification starts only upon the issued date of the OIT certificate;

5.1.d. Notify the Commissioner within ten (10) days, in a manner and form approved by the Commissioner, of any employment status changes, except termination, of the system’s certified operators, OITs, and intended certified operators and OITs, including their reassignment;

5.1.e. Notify the Commissioner within twenty-four (24) hours if a certified operator or OIT terminates employment for any reason;

5.1.f. Renew the OIT Certification every two (2) years or until all requirements for Class I certification are met. Submit the renewal application at least thirty (30) days prior to expiration date, in a manner and form approved by the Commissioner. The OIT shall attempt to pass the Class I or WD examination at least once during each two (2) year renewal;

5.1.g. Require in the case of Class II, III, and IV public water systems, that a certified operator

135
with certification equal to or greater than the system classification, be present at all times when the plant is operational, unless the Commissioner grants a written exception to this requirement in response to a written request by the owner of the public water system.

5.1.h. Require in the case of Class III and IV public water systems, that a certified operator with certification no lower than one (1) class below the system classification, be present at all times when the plant is operational.

5.1.i. Submit a personnel status report by July 15 every year. The report is to be in a manner and form approved by the Commissioner and required information includes, at a minimum: a list of all certified operators, the operator in charge of each shift (if applicable), the Chief Operator, and any OIT’s currently employed; and

5.1.j. Post a copy of the current certification of all certified operators employed at the public water system and a copy of the certified operators' renewal card, if applicable, in a conspicuous location in the water treatment plant, or, if there is no water treatment plant, the office of the public water system.

5.2. A certified operator shall:

5.2.a. Notify the Commissioner at least thirty (30) days prior to voluntarily terminating employment with a public water system in a manner and form approved by the Commissioner;

5.2.b. Obtain the necessary amount of CEHs and retain documentation of attendance required for his or her renewal application;

5.2.c. Ensure that the renewal applications are submitted at least thirty (30) days before the required date and no earlier than sixty (60) days prior to expiration, in a manner and form approved by the Commissioner; and

5.2.d. Have the original personal certification card issued by the Commissioner upon his or her person at all times the operator is operating the public water system.

5.2.e. Not work in a public water system under the certification of another; only the person whose name appears on the operator certification is certified by that document.

64-4-6. Qualifications for Certification.

6.1. Certification of a public water system operator is based on education, a passing grade on the applicable certification examination, and experience as a certified operator or OIT at a public water system. An applicant shall obtain certification for each Class level in sequence, except for Class 1D certification. A person with a 1D certification shall begin with an application for an OIT, if he or she wishes to operate in a higher classification system.

6.1.a Operators with a current 1D certification upon the effective date of this rule, currently employed in a WD system or employed in a higher classification system performing work only in the distribution system, may apply to the Commissioner to be reclassified as a WD certified operator by passing the WD certification examination and meeting the minimum educational and experience requirements. This provision expires two (2) years from the effective date of this rule. Applicants shall meet all requirements for WD certification two (2) years after the effective date of this rule. A WD certified operator may operate in a WD system or make operating decisions in the distribution system of a higher classification system. Personnel employed in a Class WD or higher public water system to collect samples from the distribution system shall hold a Class 1D or higher operator certification.
6.2. The education and experience requirements are listed as follows:

6.2.a. The requirements for the various certifications are in Table 64-4A of this rule; and

6.2.b. The number of CEUs credited for courses and operating experience, are in Table 64-4B of this rule.

6.3. Experience substitution for education is as follows:

6.3.a. An applicant for certification in Classes III and IV may substitute a maximum of two (2) years prior experience as a certified operator for the educational requirements on a year for year basis; and

6.3.b. An applicant using experience as a substitute for the educational requirement cannot simultaneously use that same experience to satisfy the experience requirement.

6.4. Education substitution for experience is as follows:

6.4.a. An applicant for certification in Classes II, III, and IV may substitute a maximum of three (3) years of education beyond high school on a year for year basis for required experience, not to exceed fifty percent (50%) of the total required experience; and

6.4.b. An applicant using education as a substitution for the experience requirement cannot simultaneously use that education to satisfy the education requirement.

6.5. An applicant for operator certification shall submit an application for examination in a form and manner approved by the Commissioner with proof of education and, if required, separate proof of work experience.

6.6. The Commissioner shall schedule examinations for the applicants and notify them before the examination date. An applicant is required to demonstrate a passing grade of 70% on the applicable certification examination. An applicant who fails an examination shall wait a minimum of sixty (60) days before applying for re-examination. The results of certification examinations are valid for two (2) years. If the applicant has not met the requirements for education, or experience, or both within those two (2) years, the applicant must reapply for examination.

6.7. A person newly designated by the owner as the Chief Operator or a person working as the only certified operator at that facility, shall attend a course approved by the Bureau for Public Health for training as a Chief Operator at the next available class, unless waived in writing by the Commissioner. Current Chief Operators shall attend a course approved by the Bureau for Public Health for training as a Chief Operator within two (2) years of the effective date of this rule. A certified operator in a system with one (1) certified operator is automatically designated as the Chief Operator. Attendance of the designated course is also applicable for CEH credit for the renewal cycle. Class 1D systems are exempt from the requirements of this subsection.

64-4-7. Certification Expiration, Renewal, Re-certification, Suspension and Revocation.

7.1. Certified operator and OIT certifications expire two (2) years from the date of issuance.

7.2. Applicants for renewal shall submit documentation that they are employed by a public water system and have successfully completed the minimum number of CEHs. No CEHs are required for Class 1D renewal. CEHs cannot be repeated in two (2) concurrent renewal periods. Operators may not carry over additional CEHs completed during the two (2) year period to satisfy the CEH requirements for the next certification renewal period. The Commissioner may grant extensions upon written request by the applicant.
7.2.a. OIT: minimum of six (6) CEHs required for renewal.

7.2.b. WD: minimum of six (6) CEHs required for renewal.

7.2.c. Class I: minimum of twelve (12) CEHs required for renewal.


7.3. The Commissioner may specify certain courses an operator must attend in order to qualify for renewal.

7.4. A formerly certified applicant seeking re-certification at his or her last certification level shall pass a certification examination at his or her last certification level if he or she has not been actively engaged in public water system operations for a one (1) year period.

7.5. Suspension and Revocation of Certification.

7.5.a. The Commissioner may suspend or revoke the certification of an operator if the operator:

7.5.a.1. Fraudulently obtained certification;

7.5.a.2. Performed the duties of an operator in a grossly negligent or incompetent manner;

7.5.a.3. Knowingly or negligently submitted misleading, inaccurate, or false reports to the Commissioner;

7.5.a.4. Violated, or caused to be violated, any portion of the Division of Health rule, “Public Water Systems,” 64CSR3 or the Division of Health rule, “Cross-Connection Control and Backflow Prevention,” 64CSR15; or

7.5.a.5. Failed to notify the Commissioner of voluntary termination of employment in accordance with subdivision 5.2.a. of this rule, even though the failure shall not subject the certified operator to the penalties of Section 10 of this rule.

7.5.b. The Commissioner shall notify the certified operator and the employer via certified mail of a proposed suspension or revocation. The notification shall set forth the action proposed, the effective date, the reason, and the length of time of the proposed action.

7.5.c. The suspension of an operator’s certification is effective for an initial period of not more than one (1) year, during which time the certification is not valid. Revocation of an operator’s certification is for a period of not less than one (1) year. After the period of ineligibility (caused by the revocation) has expired, the formerly certified operator may apply for examination for certification at the former certification classification held by the operator, and shall obtain the CEHs required for that certification level, as if the revocation had not occurred.

64-4-8. Certification from Another Jurisdiction.

8.1. The Commissioner may grant certification to a public water system operator certified by another jurisdiction, if the applicant:

8.1.a. Submits a completed application in a manner and form approved by the Commissioner;
8.1.b. Meets the educational and work experience requirements of this rule; and

8.1.c. Passes a West Virginia certification examination equivalent to the certification level of
The other jurisdiction, as determined by the Commissioner.

64-4-9. Advisory Board.

9.1. The Commissioner may establish an advisory board and designate the chairman of the board.

9.2. The advisory board membership shall consist of, but not necessarily be limited to, the following
members: five (5) certified public water system operators, with one (1) from each classification, except 1D, and
a person designated by the Commissioner.

9.3. The Commissioner shall assign the duties of the advisory board.

64-4-10. Compliance and Penalties.

10.1. A person subject to the provisions of this rule shall comply fully with them and shall not direct or
assist another person to violate this rule.

10.2. A person who violates any provision of this rule or any rules or orders of the Division of Health
is guilty of a misdemeanor and shall, upon conviction, be punished by a fine of not more than five hundred
dollars ($500), as provided under W.Va. Code 16-1-18. Each day there is a failure to comply with a provision
of this rule may be a separate offense.

64-4-11. Administrative Due Process.

11.1. Those persons adversely affected by the enforcement of this rule may request a contested case
hearing in accordance with the Division of Health rule, “Rules of Procedures for Contested Case Hearings and
Declaratory Rulings,” 64CSR1.
150-7-1. General.

1.1. Scope -- These rules govern the operation and service of water utilities subject to the jurisdiction of the Public Service Commission pursuant to W. Va.Code 24-2-1.


1.4. Effective Date -- October 24, 2003.

1.5. General.

1.5.a. This rulemaking repeals the Commission’s current Rules and Regulations for the Government of Public Service Districts, 150 CSR 17, and incorporates portions of those rules within these Water Rules. Portions of Series 17 will be incorporated into the Commission’s Rules for the Government of Sewer Utilities, 150 CSR 5, by separate proceeding.

1.5.b. These rules are intended to insure adequate service to the public, to provide standards for uniform and fair charges and requirements by the utilities and their customers, and to establish the rights and responsibilities of both utilities and customers.

1.5.c. The adoption of these rules in no way precludes the Commission from altering or amending them in whole or in part, or from requiring any other or additional service, equipment, facility, or standard either upon complaint or upon its own motion, or upon the application of any utility.

1.5.d. These rules shall not relieve in any way a utility from any of its duties under the laws of this State.

1.6. Application of rules.

1.6.a. These rules apply to all public utilities as defined in Rule 1.7.

1.6.b. If hardship results from the application of any Water Rule or if unusual difficulty is involved in immediately complying with any rule, application may be made to the Commission for the modification of the rule or for temporary or permanent exemption from its provisions: Provided, that no application for modification or exemption will be considered by the Commission unless there is submitted therewith a full and complete justification for such action.

1.7. Definitions.
1.7.a. "Applicant" -- A person, firm, corporation, municipality, public service district or any other entity that applies for water service.

1.7.b. Billing Related Dates --

1. "Bill due date" -- The date when the utility mails the bill.

2. "Latest pay date" -- The last date, which shall be no sooner than the 20th day following the date the utility mails the bill, that the bill may be paid without incurring a late payment penalty. Such date must be stated on the face of the bill.

3. "Delinquent bill" -- Any bill issued by a public service district that has not been paid within twenty (20) days of the bill due date; or any bill issued by a water utility that is not a public service district within thirty (30) days of the bill due date. Such date must be stated on the face of the bill.

1.7.c. "Commercial Service" -- Means service to each separate business enterprise, occupation or institution occupying for its exclusive use any unit or units of space as an entire building, entire floor, suite of rooms or a single room, and using water for such incidental use as the schedule of rates applicable to the particular installation may permit. Commercial service shall apply to all stores, offices, hotels, wholesale houses, garages, display windows, signs, theaters, barber and beauty shops, churches, opera houses, auditoriums, lodge halls, school houses, banks, bakeries and any other space occupied for commercial purposes. Any rooming house, lodging house, resort, inn or tavern renting more than four (4) rooms to strangers or transients without any previous agreement for accommodation or as to the duration of stay shall be classed as a hotel and as such it comes under the commercial classification.

1.7.d. "Commission" -- Whenever in these rules the words "Commission" or "Public Service Commission" occur, such word or words shall, unless a different intent clearly appears from the context, be taken to mean the Public Service Commission of West Virginia.

1.7.e. "Customer" -- Shall mean and include any such person, firm, corporation, municipality, public service district or any other entity who purchases a product or services of any utility and shall include any such person, firm, corporation, municipality, public service district or any other entity who purchases such services or product for resale.

1.7.f. "Customer's Service Pipe" -- Shall be that portion of the service pipe from the point of service to the structure or premises supplied, installed at the cost and expense of the customer.

1.7.g. "Distribution Main" -- Means water pipe owned, operated, or maintained by the utility located in a public right-of-way, street, alley, or private right-of-way, which is used for the purpose of distribution of water from which utility service pipes extend to make service connections with customers. Any water pipe extending through a utility right-of-way across private property shall be a distribution main. Costs to install a distribution main across private property are subject to the cost-sharing provisions of Rule 5.5.

1.7.h. "Governmental Unit" -- Any municipality or other political sub-division or agency of the State of W. Va. or the Federal Government.

1.7.i. "Moratorium" -- A condition imposed on a utility by the Commission prohibiting service connections and/or reactivation of service for an entire system, or a portion thereof.

1.7.j. "Payment" -- Payment is made by cash, check, credit card, debit card, or voucher accepted by the utility.

1.7.k. "Point of service" -- Means the utility's pipe and appurtenances which connect any utility service pipe with the inlet connection of a customer's service pipe at the customer's property line, or elsewhere on the customer’s property if provided for in a user’s agreement. The utility shall own and maintain all
facilities located between the point of service and the main.

1.7.l. "Private Fire Service Connection" -- Is one to which is attached fixtures from which water is taken in whole or in part for the extinguishment of fire.

1.7.m. "Public Utility" -- Except where a different meaning clearly appears from the context, the word or words "utility" or "public utility" when used in these rules shall mean and include any person or persons, or association of persons, however associated, whether incorporated or not, including municipalities, engaged in the business of producing, furnishing, transporting, distributing or selling water for any purpose which is now or may hereafter be held to be a public service.

1.7.n. “Residential Service” -- Means service to a householder or a tenant, living in a separate house or separate apartment in an apartment building, using water for general household service. Should the owner of a multiple apartment building undertake to furnish water to his tenants as a part of their monthly rent, then such service shall be classed as “Commercial.” However, a close branch of a householder’s family living with the householder and using the same water facilities, shall not be classified as an additional service or as “Commercial.” In cases where a householder or tenant devotes some portion of the occupied building to commercial use and uses the remainder as a residence then the predominate use of water shall constitute the basis for classification as either residential or commercial.

1.7.o. "Standard Distribution Pressure" -- Shall be the distribution pressure established by the utility under the requirements of Rule 5.8.

1.7.p. "Temporary Service Connection" -- One which is installed for the temporary use of water; provided that the customer's premises is located on a lot having a curb line abutting on that part of a street or public right-of-way in which there is located a utility distribution main extending along the total frontage of the lot on said street or right-of-way, unless otherwise agreed to by the utility.

1.7.q. "Unaccounted for Water" -- The volume of water introduced into the distribution system less all metered usage and all known non-metered usage which can be estimated with reasonable accuracy.

1.7.r. "Utility Service Pipe" -- Shall mean that portion of the service pipe between the distribution main and the curb cock or the inlet connection of the coppersetter at or near the customer’s property line or point of service, installed at the cost and expense of the utility, regardless of the side of the road on which the customer is located in reference to the main line.

150-7-2. Records, Reports and Other Information to be Supplied to the Commission.

2.1. Records and reports.

2.1.a. Preservation of records -- All records required by these rules shall be preserved by the utility in the manner prescribed by the Commission.

2.1.b. Location of records

1. Such records shall be kept at the office or offices of the utility in West Virginia, and shall be open at all reasonable hours for examination by the Commission or its duly authorized representative.

2. If kept outside the State, such records shall be brought to the utility’s office in West Virginia upon request of the Commission, or the utility may be required to pay the reasonable traveling expenses of Commission employees assigned to examine the records.
2.1.c. Reports to Commission -- Upon Commission request, a utility shall furnish to the Commission the results of any test or tests required to be made, or the information contained in any records required to be kept by the utility, or any further information in its possession, respecting its rates, charges, or practices, without formal order of the Commission requiring the release of such information.

2.2. Filing of rate schedules.

2.2.a. Tariffs containing rates and rules of each utility shall be filed in the manner prescribed by the Commission in "Rules and Regulations for the Government and Filing of Tariffs" (Tariff Rules) effective as amended or modified by the Commission.

2.2.b. Municipal rates -- Rates for municipal water and combined water and sewer utilities shall be adopted, and tariffs shall be filed, in accordance with the Commission’s “Rule for the Government and Filing of Tariffs,” 150CSR2, effective as amended or modified by the Commission.

2.3. Utility's special rules.

2.3.a. A utility desiring to establish any rule(s), supplementing the rules of the Commission shall first make application to the Commission for authority to establish such a rule(s), clearly stating the reasons for the rule(s).

2.3.b. On and after ninety (90) days from the effective date of these Rules, any utility's special rules and regulations now on file with the Commission which conflict with these rules, will become null and void, unless they have been ratified and approved by the Commission.

2.3.c. Exemption -- A customer who has complied with the rules of the Commission shall not be denied service for failure to comply with the rules of the utility that have not been approved by the Commission.

2.4. Financial and statistical report.

2.4.a. Every utility shall file annually a financial and statistical report upon forms to be furnished by the Commission. The report shall be based upon the accounts set up in conformity with Rule 2.5. The report shall be filed on or before three (3) months following the end of the utility’s fiscal year or on such date as the Commission may direct.

2.4.b. Upon written request and for good cause shown, the Commission may approve or disapprove, through its Executive Secretary, by letter, a reasonable extension of time to file the financial and statistical report. Such application is to be made before the expiration of the time for filing the report.

2.4.c. Each utility shall file, yearly as of July 1 for the preceding July 1 through June 30, water statistical reports upon forms to be furnished by the Commission. The report shall be filed on or before three (3) months following the end of the utility’s fiscal year or on such date as the Commission may direct.

2.5. Uniform system of accounts.

All water utilities shall maintain their accounts and records in compliance with the Uniform System of Accounts as promulgated in 1973 by the National Association of Regulatory Utility Commissioners for Class A and B Water Utilities and Class C and D Water Utilities.

Observance of the system of accounts applicable to the water utility by appropriate class is obligatory upon all persons having direct charge of the books and accounts of the utility. For the purpose of securing uniformity in the applications of this system all questions of doubtful interpretation of accounting rules are to be submitted to the Commission for consideration and decision.
The classification of water utilities for purposes of keeping accounts in accordance with the Uniform System of Accounts shall be as follows:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Revenue Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$800,000 or more</td>
</tr>
<tr>
<td>B</td>
<td>400,000 - 799,999</td>
</tr>
<tr>
<td>C</td>
<td>100,000 - 399,999</td>
</tr>
<tr>
<td>D</td>
<td>less than 100,000</td>
</tr>
</tbody>
</table>

2.6. Maps and records.

2.6.a. Each utility shall keep on file suitable maps, plans and records showing the entire layout of every pumping station, filter plant, reservoir, transmission and distribution system, with the location, size and capacity of each plant, size of each transmission and distribution line, fire hydrant, valve and customer's service, reservoirs, tanks and other facilities used in the production and delivery of water.

2.6.b. In the case of new construction or property acquired from others, the additions to such maps and records should be made by the end of the next calendar year following the year in which the construction is done or property acquired. All drawings shall have the scale clearly shown and be of sufficient detail to accurately depict the project or property.

2.6.c. In general, where present maps of existing facilities are not entirely up to date, special surveys to locate any plant or facilities will not be required immediately, but maps must be updated as prescribed by the Commission.

2.7. Management audits.

2.7.a. Scope -- To establish a procedure for examination of management practices and policies to determine whether the utility being audited is operating with efficiency and utilizing sound management practices. The purpose of a management audit is to disclose operating areas that are efficient or inefficient, to identify areas for improvement, and to form recommendations for changes. The results of a management audit and the response of the utility to the recommendations and implementation plans developed pursuant to a management audit may be a factor in determining just and reasonable rates, as set out herein.

2.7.b. Types of management audits -- The following types of management audit, which vary in scope, may be directed and used by the Commission:

1. Comprehensive -- An investigation characterized by an extensive, detailed analysis of a utility's management and operations.

2. Reconnaissance -- A broad review, similar in scope to a comprehensive audit, but in less detail. The objective of this type of audit is to identify specific areas for more intensive investigation based upon the magnitude of the problem identified or the potential benefits to be derived.

3. Focused -- An in-depth investigation of one or several specific areas of a utility's management and operations.

2.7.c. Frequency -- The Commission shall order a management audit of any utility under its jurisdiction whenever the Commission deems it necessary to investigate the operational efficiency of the utility. Such factors as the cost of the management audit and the potential benefits of such audit may be taken into consideration. The Commission may accept or request a management audit performed under the rules of another jurisdiction in satisfaction of this rule when that audit is of the scope contemplated by the Commission, conforms to the standards herein set forth and covers the utility's service functions in its W. Va. jurisdiction.
2.7.d. Conduct and control --

1. The Commission may choose to have the audit performed by its Staff or contracted to a qualified outside auditing firm. In the latter case, the Commission may supervise the selection process. If the management audit is to be conducted by an auditing firm, the Commission's order initiating the audit shall include provision for the development of the request for proposal (RFP), the consultant selection process and Staff's assistance and supervision during the audit.

2. The Commission may impose eligibility restrictions upon contractors relating to past, current and post-audit relationships with the utility.

3. The utility is expected to cooperate to the fullest extent with the performer of a Commission ordered management audit. A responsible employee shall be appointed by the utility as its management audit coordinator, who shall be responsible to assist in the efficient performance of the management audit.

2.7.e. Costs -- It shall be the responsibility of the audited utility to pay for a contracted audit. The Commission shall include the reasonable cost of conducting the contracted management audit in the cost of service of the utility. The Commission may allow such costs to be recovered in the utility's next general rate case following completion of the audit, or the Commission may order such costs to be amortized over a reasonable period of years, considering the impact of these costs on both the utility and its customers.

2.7.f. Implementation of recommendations --

1. Draft report.

   A. Upon completion of the audit a draft report shall be submitted to the utility for comments.

   B. The auditor and Company representatives shall conduct a draft review meeting subsequent to the distribution of the draft review report.

2. Final report.

   A. A final report shall be submitted to the Commission no later than thirty (30) days after the submission of the draft report to the utility.

   B. Within thirty (30) days of the final submission of the management audit report, the utility shall file a document detailing its position on each audit recommendation. This document must state which recommendations are acceptable to the utility and the nature of the utility's disagreement with any recommendations.

3. The Commission may, after hearing, issue an order prescribing the recommendations which should be adopted by the utility.

4. The utility shall file detailed implementation plans for the Commission's review and approval within the time specified in the Commission's order prescribing which recommendations the utility should adopt. The utility shall not deviate from an approved implementation plan without prior notice to the Commission which specifically states the utility's reasons for departing from the approved plan.

5. At the direction of the Commission, a follow-up audit may be performed to review the progress of the utility in implementing the approved plans and the results of previously performed management audits.
6. A management audit report and implementation plan adopted pursuant thereto and any follow-up audit may be used by parties in a general rate case subsequent to the management audit. Such audits and implementation plans may be a factor in the determination of just and reasonable rates if introduced as an exhibit and subjected to normal due process procedures.

7. The Commission may grant an extension of the time limits established in this section upon a showing of good cause for such extension.

150-7-3. Meter Requirements.

3.1. Utility to provide meters -- Unless otherwise authorized by the Commission, each utility shall provide and install at its own expense (except as provided in Rule 5.2) and shall continue to own, maintain, and operate all equipment necessary for the regulation and measurement of water, in accordance with tariff or contract provisions, to its customers. Where additional meters are requested by the customer and are furnished by the utility for the convenience of the customer, a charge for such meters shall be made. All meters used in serving resale customer(s) shall be owned and operated by the utility providing service to the bulk or resale customer.

3.2. Location of meters.

3.2.a. Accessibility -- In the interest of safety and convenience to the customer, and as a measure of economical operation to the utility, it is required that all meters should be located at or near the property line: Provided that when such location is impractical meters shall be placed outside of the customer's building as near as possible to where the "Point of Service" joins the "Customer's Service Pipe": Provided, further, if neither of the foregoing requirements can be complied with on account of physical, economic, or climatic conditions, the meter may be placed within the building, preferably in the cellar, and when so placed within the building, the meter shall be so located that it will be easily accessible for reading, maintenance and protected from freezing and mechanical damage.

3.2.b. Meter grouping -- When a number of meters are grouped, every meter shall be tagged so as to indicate the particular customer served by it.

3.2.c. Remote meters -- When a meter is located inside a home or building, the utility may install a remote register or dial on the exterior of a home or building accessible for meter reading. The remote counter reading shall be compared to the actual meter register reading not less than once every six (6) months.

3.2.d. Meter setting installation -- Meter settings shall be installed in accordance with drawings submitted and approved by the Commission under Rule 5.2.i.

3.3. Prohibitions on master metering.

3.3.1. Reserved.

3.3.2. Mobile home parks.

For mobile home parks constructed on or after the effective date of these rules, each mobile home in a mobile home park shall be individually metered with taps installed at the lot line of each mobile home. The lot owner shall be responsible for payment of any applicable tap fees. All utility easements and mains constructed
within the mobile home park will become the property of the utility by agreement between the (i) owner of the mobile home park or the lot owner, whichever is applicable, and (ii) the utility. The agreement must be approved by order of the Commission prior to construction of any main. Lines extending from the mobile home to the tap will be considered customer service lines and maintenance of those lines will be the responsibility of the applicable lot owner.

150-7-4. Customer Relations.


4.1.a. Information as to service -- Each utility shall, upon request, give its customers such information and assistance as is reasonable, in order that customers may enjoy safe and efficient service.

4.1.b. Explanation of meter readings -- Each utility shall adopt some means of informing its customers as to the method of reading meters, either by a printed description on its bills, or by a notice to the effect that the method will be explained at the office of the utility upon request. It is recommended that an exhibition meter be kept on display in each sales office maintained by a utility.

4.1.c. Explanation of rates -- It shall be the duty of the utility to explain to the customer at the beginning of service, or whenever the customer shall request the utility to do so, the utility's rates applicable to the type of service furnished to the customer and all other classes of customers, and to assist him in obtaining the best rate for his service requirements. The responsibility for the selection, however, rests with the applicant. In the event the customer's use of service changes such that a rate schedule other than the one initially selected becomes favorable, the responsibility for requesting a change in rate schedule, consistent with the provisions of the service agreement, shall rest with the customer. The utility shall, on its periodic statements, annually inform its customers that, if they so request, it shall supply them with a copy of the utility's rate or rates applicable to the type of service to be furnished to all classes of customers with a concise written explanation of the rates, and an identification of any classes of customer for whom rates are not summarized.


1. Every utility shall maintain in its office for inspection by the public the following:

   A. A copy of the rates and rules of the utility, and of forms of contracts and applications applicable to the territory served from that office.

   B. A copy of the Public Service Commission Law of this State.

   C. A copy of these rules.

2. A suitable placard, in large type, shall be exhibited in a conspicuous location, giving information to customers that a copy of the law, the rules of the Public Service Commission and the schedule of rates are kept for their inspection.

3. Once a year, or as often as a utility changes collection agents, each utility shall publicize by newspaper or bill insert to its customers its collection agents to whom customers may deliver payment of water bills.

4.1.e. Applications for water service.

1. All applicants desiring water service may be required to make written application at the office of the utility on printed forms provided there for, setting forth in said application all purposes for which water will be used upon their premises. The utility may require the applicant to provide identification at the time of application for service. All applicants for service shall be required to designate on every application for service whether the applicant is a tenant or an owner of the premises to be served. If the applicant is a tenant, he shall state the name and address of the owner or owners of the premises to be served.
2. Any change in the identity of the contracting customer at a premises will require a new application for water, and the utility may, after reasonable notice, discontinue water service until such new application has been made and accepted, but the former customer shall remain liable for water furnished to said premises until he has given notice in writing to the utility to discontinue water service. In the event the customer of record has died or has become incapable of being responsible for water service, that individual’s spouse may become the customer of record without being required to complete a new application for water service, or paying a new deposit.

3. Except as provided in Rule 4.8.c.2., no charge will be made for turning on the water to new customers or current customers transferring service to a new location during regular working hours.

4. Accepted applications for water to be supplied to any premises shall constitute a right to the customer to take and receive a supply of water for said premises for the purposes specified in such application; (i.e. Residential, Commercial, and Industrial) subject only to the fulfillment of the conditions of these rules by the customer.

5. In the event that a public service district providing sewer service owns and operates facilities within the same service territory as the publicly or privately owned water utility, city, incorporated town, other municipal corporation or other public service district providing water service to the area, then an application shall not be complete until such time as the applicant provides a receipt from the sewer public service district showing that, where the applicant is legally required to do so, proper application for sewer service has been made and a security deposit paid thereto. Upon receipt of said proof from the applicant, or upon a showing that the applicant is not legally required to apply for sewer service or pay a security deposit, the water utility shall notify the sewer public service district, in writing, the date upon which water service is scheduled to be turned on to the applicant. Said written notification to the sewer public service district shall be made within five (5) working days of the date that the application for water service is deemed complete.

4.1.f. Special applications to a utility for water service.

1. Water for building, construction or other temporary purposes must be specifically applied for with the utility.

2. Connections for private fire service must be specifically applied for with the utility.

3. Where water is desired for only a short period of time, and not continuously throughout the year, such as for vacation homes or cottages, building purposes, street paving, cleaning property, filling tanks or other short-term uses, an application shall be made to the utility as set forth in Rule 4.1.e., and payment made in accordance with the applicable schedule of rates and charges, in which case a suitable deposit shall be made.

4. Whenever a street service connection is made to the mains for temporary service or for temporary private fire service, the applicant shall bear the entire cost and expense of labor and material for tapping the main and installing the service pipe and meter and its removal, if required.

4.1.g. Private fire protection service --

1. The applicant shall furnish the utility with one set of complete drawings prior to the completion of the tap, showing the pipes, valves, hydrants, tanks, openings, and appurtenances contemplated in the application. Such sketch must also show any other water supply system, pipelines and appurtenances existing on the premises. There shall be no connection between such other supply and pipes connected to the utility's mains unless protected by a backflow prevention device approved by the utility, or the Bureau for Public Health.

2. The utility shall not approve an application for private fire protection service unless the utility
determines that its system provides an adequate size water main with sufficient water volume and pressure.

3. The customer shall obtain in advance the approval of the utility for any change, alteration or addition in the fixtures, openings and uses specified in the application. The customer shall make its fire protection facilities available to the utility at all reasonable times.

4. The utility shall determine the size and location of any connections made to its distribution mains for private fire protection service, and will, at the cost and expense of the customer, make the connection to its mains and install the service connection from the distribution main to a point at or near the property line.

5. The extent of the rights of the private fire protection service customer is to receive, but only at times of fire on his premises, the available water supply. The utility shall not be considered an insurer of property or persons, or to have undertaken to extinguish fire or to protect any persons or property against loss or damage by fire or otherwise, and shall be free and exempt from any and all claims for damages on account of injury to property or persons by reason of fire, water, failure to supply water or pressure, or for any other cause whatsoever.

6. Unless otherwise provided in a written agreement between the applicant and the utility, service lines for private fire protection service shall be distinct and separate from the regular or general water service line. A private fire service connection is furnished for the sole purpose of supplying water for the extinguishment of fires, and the use of water from such a connection for any other purpose is absolutely forbidden.

7. Where the applicant and the utility have entered into a written agreement that one service pipe be used for both general and fire purposes, the entire service pipe on the applicant’s premises will be installed and maintained by and at the cost and expense of the applicant as if it were solely a private fire protection service line. The utility may set minimum construction standards and specifications for the applicant’s portion of the dual purpose service pipe, and may require that its construction be subject to inspection by the utility. Maintenance of the service line, from the main to the property line, will be the responsibility of the utility.

At the building to be served, the common service pipe shall separate into two service pipes. One for private fire protection and the other for general water service. The utility will, at its cost and expense, install and maintain a water meter of appropriate size on the general water service pipe and the necessary piping and fitting for the meter setting. All dual purpose service lines must comply with all applicable Bureau for Public Health standards and regulations.

The utility will charge the applicant for general water service based on the consumption through and size of the water meter installed, in accordance with its schedule of rates for general water service. The utility shall, subject to Commission approval, charge the applicant for private fire protection service in accordance with its schedule of rates for such service.

8. A gate valve and box, or a post indicator controlling the entire supply shall be placed at the curb or property line of the street in which the main is located or at such other points as may be approved by the utility, and shall be furnished and installed by and at the expense of the customer, and if required by the utility, said valve shall be installed in a valve pit or vault which shall also be furnished and installed at the expense of the customer.

9. Service lines supplying fire sprinkler systems only, must be protected by a minimum of two approved check valves. One of these check valves may be the alarm check provided as part of the sprinkler system. The other may be a detector check, double check valve assembly, or an approved single check valve. Specific requirements and/or installation procedures are governed by the Bureau for Public Health.
10. Under no circumstances will anti-freeze be permitted in the sprinkling systems unless a reduced pressure zone backflow preventer, approved by the utility or the Bureau for Public Health, is provided at the point of connection in the anti-freeze system.

11. The entire private fire service system on the customer's premises shall be installed and maintained by and at the expense of customer and shall be subject to the inspection, test and approval of the utility before the service is made effective, and at such times thereafter as the utility deems necessary or appropriate.

12. Hydrants and other fixtures connected with a private fire service system may be sealed by the utility, and such seals may be broken only in case of fire or as specially permitted by the utility, and the customer shall immediately notify the utility of the breaking of any such seal.

13. Whenever a fire service system is to be tested, the customer shall notify the utility of the proposed test, designate the day and hour when same is to be made, so that, if desired, the utility may have an inspector present during the test.

4.1.h. Public fire service.

1. Any governmental unit located in the utility's service area by ordinance of its Council or by resolution of its Board of County Commissioners shall have the right to order the installation of additional fire hydrants on existing utility owned mains having an internal diameter of six (6) inches or larger and the utility will install such hydrants at its own cost and expense; provided the estimated gross receipts from such proposed new fire hydrant rentals shall equal or exceed twelve percent (12%) annually of the cost of said installations.

2. Where pipeline installations are required to carry out an order of any governmental unit located in the utility's service area to install fire hydrants, or where existing utility owned mains, in the opinion of the utility, are inadequate to provide fire flows to such hydrants, and when any governmental unit located in the utility's service area orders the installation of a water main of adequate size to provide such flows to the hydrant or hydrants so ordered, the utility will install such mains and hydrants at its own cost and expense; provided that the utility shall not be required to make extensions of said water mains unless the estimated gross receipts from private consumers and from such proposed new fire hydrant rentals shall equal or exceed twelve percent (12%) annually of the cost of such extensions.

3. Non-emergency use of a fire hydrant is prohibited unless there has been made advance notification of such proposed use by the user to the utility, and the utility has provided prior written approval of such use to the user. The utility shall charge its tariff rate for domestic water usage for all non-emergency fire hydrant water usage.

4.2. Customer deposits.

4.2.a. Security deposits --

1. Security deposits for utilities other than public service districts -- A utility, other than a public service district may require the applicant or customer to make a deposit with it initially, and from time to time, to secure the payment of water service rates and charges. Such deposit shall not be more than one-twelfth (1/12) of the annual estimated charge for residential service or one-sixth (1/6) of the annual estimated charge for all other service. The utility shall not be bound to supply water until these conditions are fulfilled and it may terminate water service if the security or increased security is not given when required. After the customer has paid bills for service for twelve (12) consecutive months without a delinquency, the utility shall promptly and automatically refund the deposit plus accrued interest. Calculation of the above twelve (12) months’ period shall commence from the first regular payment or following the payment of a delinquent bill or bills. Interest at
the rate as determined in accordance with Rule 4.2.a.7., shall be paid from the date of deposit until the date of the refund of the security deposit. The utility shall have a reasonable time, not to exceed thirty (30) days, to read and remove meters and to ascertain that the obligations of the customer have been fully performed before being required to return any deposit in the case where there has not been an automatic refund.

2. Security deposits for public service districts -- All new applicants for residential or other water service from a public service district shall make a deposit of (i) a minimum of fifty dollars ($50.00), or (ii) two-twelfths (2/12) of the annual estimated charge for water service, whichever is greater, with the district to secure the payment of water service rates and charges. The district shall not be bound to supply water until this condition is fulfilled. In any case where a deposit is forfeited to pay service rates and charges which were delinquent at the time of disconnection or termination of service, no reconnection or reinstatement of service may be made by the district until another deposit as described above has been remitted to the district.

3. Return of deposit to customers who are not tenants -- After a customer who is not a tenant has paid bills for service for twelve (12) consecutive months without a delinquency the utility shall promptly and automatically refund the deposit plus accrued interest. Calculation of the above twelve (12) months’ period shall commence from the first regular payment or following the payment of a delinquent bill or bills.

4. Return of deposit by district to a customer who is a tenant -- A district is not required to return a deposit to a customer who is a tenant until the time the tenant discontinues service with the district. After a customer who is a tenant discontinues service with the district, the utility shall promptly and automatically refund the deposit plus accrued interest.

5. Interest at the rate as determined in accordance with Rule 4.2.a.8. shall be paid from the date of deposit until the date of the refund of the security deposit. All customer security deposits shall be placed in an interest bearing account at a local federally insured financial institution. The district shall have a reasonable time, not to exceed thirty (30) days, to read and remove meters and to ascertain that the obligations of the customer have been fully performed before being required to return any deposit in the case where there has not been an automatic refund.

6. Rule 4.2.a.5 requires public service districts to segregate deposits into interest bearing accounts. Upon proper showing by complaint or otherwise, the Commission may require any other utility to likewise segregate customer deposits.

7. The interest rate to be paid by all water utilities other than public service districts shall be determined as follows. The rate which utilities shall be required to pay shall be the average of the one-year United States Treasury Bill rates for October, November and December of the preceding calendar year. By January 15 of each year, Staff of the Commission shall make the necessary calculations and file with the Commission its calculations. The Commission will issue an order setting the rate to be paid by the utilities until the next annual Commission order. The simple interest shall be paid at the date of discontinuance of service or at the end of the deposit period.

8. The interest rate to be paid by public service districts shall be determined as follows. The Staff of the Commission shall determine a rate which a typical small investor could receive at federally insured banks in W. Va. in the last quarter of each calendar year. The Staff shall by January 15 of each year report to the Commission its rate with supporting information. The Commission will issue an order setting the rate to be paid until the next annual Commission order. The simple interest shall be paid at the date of discontinuance of service or at the end of the deposit period.

9. A current customer of a public service district who requests service at another location within the jurisdiction of the district and who has made payment of bills for the previous twelve (12) months without a delinquency is not required to pay a deposit for service at the new location because that customer is not a new applicant for service under W. Va. Code 16-13A-9. The preceding sentence shall not apply to multiple service locations. Multiple service locations shall require multiple deposits. In the event the customer of record has died or has become incapable of being responsible for water service, that individual’s spouse may become the customer of record without being required to complete a new application for water service, or paying a new
10. All new applicants for residential or other service from a combined water and sewer public service district shall deposit (i) a minimum of fifty dollars ($50.00), or (ii) two-twelfths (2/12) of the annual estimated charge for water service, whichever is greater, for each of the services to be rendered.

11. Record of deposit -- Each utility holding a cash deposit shall keep a record showing: (i) the name and current address of each depositor; (ii) the amount and date of the deposit; (iii) each transaction concerning the deposit.

12. The receipt -- Concurrently with receiving a cash deposit, the utility shall deliver to the applicant for service or the customer, a receipt showing: (i) the date thereof, (ii) the name of the applicant or customer and the address of the premises to be served or served, (iii) the service to be furnished or furnished, and (iv) the amount of the deposit and the fact that interest will be paid at a Commission determined rate. Each utility shall provide automatic means to refund the deposit of a customer, when he is so entitled, if the original receipt cannot be produced. A receipt of proof or payment will not be necessary under the provisions for an automatic refund.

13. Unclaimed deposits -- Should a utility have retained, through no fault of its own, deposits made by customers to whom service has been discontinued during any calendar year, it shall, on or before the first day of March, in each year, mail to the customer's last known address a check as refund of the deposit plus accrued interest, or at the utility's option, publish a list of such depositors, in a newspaper published and of general circulation in each of the counties in which it operates and in which the deposits were made, showing as of the thirty-first (31st) day of December immediately preceding, the amount of each such deposit, together with the interest due thereon, and notifying depositors listed therein that their deposits, together with accrued interest, are being held to their credit and will be returned upon request. The utility shall not be liable for any interest on such deposit after publication of such lists. Upon the completion of the above procedure, the utility shall follow the provisions of the Uniform Unclaimed Property Act, codified at W. Va. Code 36-8-1, with regard to the disposition of any unclaimed deposit.

14. Provided that this rule shall not affect residential customer security deposits required by a utility prior to the passage of W. Va. Code 24-3-8 on March 12, 1983.

15. All utilities that collect security deposits must do so in a nondiscriminatory manner.

4.2.b. Guarantee agreement --

1. A utility, other than a public service district, may accept, in lieu of the cash deposit, a guaranty agreement signed by a financially responsible guarantor, whereby payment of a specified sum, not exceeding the cash deposit aforesaid, is guaranteed. The guarantor may, upon request, receive copies of disconnection notices sent to the customer whose account has been guaranteed: Provided that the limitations herein fixed upon the terms of a guaranty agreement shall not apply to industrial customers.

2. A guaranty agreement shall terminate after the customer has satisfactorily paid bills for twelve (12) consecutive months, or when the customer gives notice to the utility of discontinuance of service at the location covered by the guaranty agreement, or six (6) months after discontinuance of service where no notice was given, or at the guarantor's request upon thirty (30) days' written notice to the utility. Upon termination of a guaranty agreement, or whenever the utility deems the same insufficient as to amount of surety, a cash deposit or a new or additional guaranty may be required upon reasonable written notice to the customer.
3. Application in case of receiver or trustee -- The aforesaid provisions shall apply in the case of a receiver or trustee operating a business, under court order that requires utility service.

4.3. Billing information.

4.3.a. Bills shall be rendered periodically, and they shall show the readings of the meter at the beginning and end of the period for which the bill is rendered, the date of the meter readings, the number of cubic feet or gallons of water supplied, and the authorized rate. If the utility must, for any reason, render an estimated bill, the bill shall be clearly marked as an estimated bill. All bills shall state "This utility is regulated by the Public Service Commission of West Virginia" and "Rates available upon request."

4.3.b. First and last bills, monthly or quarterly, for water service rendered for periods of five (5) days more or five (5) days less than the normal billing period will be computed in accordance with the rate applicable to that service, by the amount of water blocks, and the minimum charge as set forth in that rate will be prorated on the basis of the number of days in the period in question, to the total number of days in the normal period.

4.3.c. Utilities desiring to adopt mechanical billing of such nature as to render compliance with all the terms of Rule 4.3.b. impractical, may make application to the Commission for relief from part of these terms. After consideration of the reasons given when asking for relief, the Commission may allow the omission of part of these requirements.

4.3.d. On all bills which include charges for items other than authorized water charges, the other factors used in computing the bill shall be clearly stated so that the amount may be readily verified from the information appearing upon the bill.

4.3.e. Each bill shall bear upon its face the latest pay date and the date it shall be a delinquent bill if not paid. On all current usage billings not paid by the latest pay date, ten percent (10%) will be added to the net current amount unpaid. This delayed payment penalty is not interest and is to be collected only once for each bill where it is appropriate.

4.4. Adjustment of bills.

4.4.a. Fast meters -- If, upon test of any meter, the meter is found to have an average error of more than two percent (2%) fast, the utility shall refund to the customer the overcharge, based upon the corrected meter reading for a period equal to one-half (½) the time elapsed since the last previous test, but not to exceed six (6) months. If it can be shown that the error was due to some cause, the date of which can be fixed, the overcharge shall be computed back to but not beyond such date. If the meter has not been tested in accordance with Rule 6.4, the period for which it has been in service beyond the regular test period shall be added to the six (6) months in computing the refund.

4.4.b. Dead meters -- If a meter is found not to register, or that remote metering equipment has failed, for any period, the utility shall compute the water used by taking the average of the water used for the meter-reading period preceding and the meter-reading period following the date when the meter was found to be dead, which amount shall be assumed to be the amount of water used by the customer during the billing period in which the meter was found dead. Exceptions will be made to this rule in case the facts clearly show that the
above method does not give the correct consumption for the period. A utility may backbill the customer for the
difference between the amount previously billed and the customer’s estimated usage for a maximum of three
(3) months preceding the date the dead meter is repaired or replaced. The utility should fix or replace dead or
malfunctioning meters within thirty (30) days of the utility’s discovery that a meter is dead or malfunctioning.

4.4.c. Leaks on the customer’s side of the meter --

1. Each utility shall develop and implement a written policy concerning the adjustment of
customer bills where the bill reflects unusual usage which can be attributed to leakage on the customer’s side
of the meter. Leaking commodes, dripping facets, malfunctioning appliances and similar situations shall not
constitute leaks which entitle the customer to a recalculated bill. The policy shall be maintained in the utility’s
office for inspection by the public and shall be applied in a non-discriminatory manner to all customers. The
reasonableness of the utility’s policy or practice with respect to a policy shall be subject to Commission review
in a formal complaint proceeding.

2. The policy shall provide for a recalculated bill to reflect the utility’s incremental cost of treating
or purchasing the water, as contained in the utility’s tariff, for all amounts above the customer’s historic usage.
Historic usage shall be defined as the average usage of the preceding twelve (12) months, or actual period of
service if less than twelve (12) months. If using the historic usage would result in an unreasonable calculation,
adjustments may be made. If such adjustments are made, the utility should advise its customer that a dispute
regarding such adjustments may be taken to the Commission in the form of an informal complaint.

3. As an alternative to using the incremental cost of treating or purchasing the water, the utility
may, at its option, use an adjustment which allows it to recover the Commission’s estimate of "typical
incremental" cost per thousand gallons of water on usage above the historic usage. The Commission shall from
time to time establish its estimate of "typical incremental cost" by order.

4. However, in future rate cases the utility’s incremental cost of treating or purchasing the water
shall be determined and the rate placed in an appropriate tariff as the leak adjustment rate. After a rate has been
determined in a rate case, the utility shall not have the option to use the Commission’s estimate of "typical
incremental cost" found in 4.4.c.3.

5. The water utility shall, after determining that a leak adjustment must be made, notify the sewer
utility of the amount of the adjustment in gallons and the reason for making the adjustment.

4.5. Complaints.

4.5.a. Investigation of complaints -- Each utility shall make a full and prompt investigation of all
complaints made to it by its customers, either directly or through the Commission. In the event that the
complaint is not adjusted, the utility shall notify the customer that he may file an informal or formal complaint
with the Commission.

4.5.b. Records of complaints -- The utility shall keep a record of all complaints received, which record
shall show the name and address of the complainant, the date and character of the complaint, and the
adjustment or disposal made thereof.

4.5.c. Disposition of records -- Records of complaints shall not be destroyed until a summary has been
prepared for permanent record, showing the character of complaints made, the number of each type received in
each month, and the disposition of the complaints.

4.6. Disputed bills.
4.6.a. In the event of a dispute between the customer and the utility respecting any bill, the utility shall conduct an investigation and report the result thereof to the customer. In the event that the complaint is not resolved, the utility shall, before service is discontinued, notify the customer that he may file an informal or formal complaint with the Commission.

4.7. Customer discontinuance of service.

4.7.a. Any customer requesting service to be discontinued shall give notice thereof to the utility, during regular business hours. Unless a different period shall be mutually agreed upon by written contract, service will be discontinued by the end of the next business day. Until the utility shall have such notice, the customer may be held responsible for all service rendered.


4.8.a. Notice of discontinuance --

1. Service shall actually be discontinued no sooner than ten (10) days following the date that a utility has mailed to a customer a statement that water bills are delinquent.

2. Where conditions hazardous to life or property are found to exist on the customer's premises, or where the utility's regulating, measuring or distribution equipment or facilities have been tampered with, the water may be shut off without notice in advance.

3. Where written notice is required it must be sent first class mail, address service requested. Written notice shall comply with Water Form No. 1, attached to these rules. The written notice shall become void if the utility has not discontinued service within thirty (30) days of the date indicated on the notice for termination.

4. Prior to disconnecting water service for non-payment of sewer bill, the water utility shall make at least two (2) attempts to notify the customer through personal contact. First the water utility shall either telephone or visit the customer at least twenty-four (24) hours prior to a scheduled disconnection. Second, the water utility shall knock on the customer’s door immediately prior to a disconnection. The inability to make personal contact shall not prevent the water utility from terminating service.

5. Service shall not be discontinued on a Saturday, Sunday, any day that is a federal or state holiday, a day on which the utility’s business office is not open to accept payment, or on the day before such days, unless an emergency exists.

6. All disconnections shall be performed between the hours of 8 a.m. and 4 p.m.

7. The utility shall accept payment at the customer's premises in lieu of discontinuing service for either a delinquent water or sewer bill. The payment must be for the entire amount of the delinquency to prevent termination. However, a utility may refuse payment by check if the customer has, during the previous twelve (12) months, attempted to make payment by a check subsequently returned by the bank for insufficient funds.

8. If a customer has received notice of a scheduled termination, and, to avoid such termination, makes payment by check which is subsequently dishonored by the bank, the utility may then terminate service only after it has mailed notice, by first class mail, to the customer at least five (5) calendar days, excluding state or federal holidays, prior to termination; provided that at the option of the utility, either personal contact or telephone contact may be substituted for contact by first class mail.

9. If a landlord of a single-unit dwelling or a master-metered mobile home park, apartment building, motel, hotel or other multiple or single-unit dwelling is responsible for payment of a utility bill,
written notice of termination in the form of Water Form No. 2 shall be placed at a location readily available for public inspection on the premises at least five (5) days prior to the scheduled termination of service to that mobile home park, apartment building, motel, hotel or other multiple or single-unit dwelling. If the billing address for any single unit service is different than the service location, a written notice in the form of Water Form No. 2 shall be delivered or posted at a visible location on the premises where the service is to be terminated at least five (5) days prior to the scheduled termination. This notice shall inform the occupant(s) of the date on or after which termination of service will occur and shall state the steps the occupant(s) can take to avoid termination of service.

10. A water customer who has been notified that water service is to be terminated for non-payment of water bills shall be given the opportunity to enter into a deferred payment agreement: Provided, that the customer has demonstrated an ability to pay but only in installments. The customer shall be informed at the time a disconnect notice is issued of the availability of a reasonable payment plan.

A. The details of the deferred payment agreement are to be negotiated between the utility and the customer and may consider several factors, including, but not limited to the following: amount of the delinquency; ability of the customer to pay; payment history; time the delinquency has been outstanding; reasons why the delinquency has been outstanding; and any other relevant factors.

B. The deferred payment agreement shall include language informing the customer of the right to challenge the reasonableness of the proposed payments to the Commission.

C. During the challenge, the utility may not terminate service: provided that the current bill must be paid by the customer on time and in full in order to protect his rights under this rule.

D. Once a deferred payment agreement has been established, the customer must pay the current bill on time and in full and make timely payments in accordance with the deferred payment agreement.

E. If the customer's financial condition significantly changes and the existing payment agreement results in hardship, the utility shall renegotiate the payment agreement, consistent with the provisions of Rule 4.8.a.10.A. The customer shall provide documentation in support of his claim that his financial condition has changed. During the renegotiation period the customer must continue to pay the current bill on time and in full and make some payment on the delinquency.

F. If the deferred payment is not received in accordance with the terms of the agreement or the payment is made with a check subsequently dishonored by the bank, the utility may terminate service only after it has mailed written notice, by first class mail, to the customer at least five (5) calendar days, excluding state or federal holidays, prior to termination: provided that at the option of the utility, either personal contact or telephone contact with the customer may be substituted for contact by first class mail. If the customer makes the delinquent payment within that notice period, service shall not be terminated. However, if the customer has, during the previous twelve (12) months, attempted to make payment by a check which was subsequently dishonored by the bank the utility may refuse the customer’s check and immediately terminate service without additional notice.

11. In the case of a sewer utility requesting termination of water service for non-payment of sewer service, the sewer utility shall provide the customer written notice complying with Sewer Form No. 1, ten (10) days before the effective termination that the sewer utility will request termination of water service by the water utility if payment is not made in full or a payment schedule is not established as provided by Sewer Rule 4.8.a.10. The written notice must be sent first class mail, address service requested. This notice shall contain a provision notifying the customer that in the event water is terminated the customer will be responsible for and required to pay the fees charged to the sewer utility by the water utility.
12. A sewer utility requesting termination of water service for non-payment of sewer bills shall provide the water utility with a copy of the notice to the customer required by Sewer Rule 4.8.a.1.

13. A sewer utility will provide the water utility with a written request for termination of water service for non-payment at least twenty-four (24) hours before the end of the ten (10) day notice period to the customer.

4.8.b. Once a disconnected customer has paid his delinquency in full, or the utility has agreed to enter into a deferred payment agreement with the customer, and all disconnect and/or reconnect fees have been paid, the utility shall reconnect the customer’s water service as soon as possible but no later than twenty-four (24) hours from the time the customer pays all disconnect and reconnect fees.

4.8.c. Charge for reconnection

1. Whenever the supply of water is turned off for violation of rules, non-payment of bills, or fraudulent use of water, the utility may make a charge as set forth in its tariff for reestablishment of service.

2. If service is discontinued at the request of the customer, the utility may refuse service to such customer, at the same premises, if requested within eight (8) months of the date service was discontinued, unless the customer shall first pay the reconnection charge set forth in the utility’s tariff.

4.8.d. The utility shall not refuse, deny, or discontinue service to an applicant or present customer due to a delinquency in payment for service by a previous occupant of the premises to be served unless such applicant or present customer and such previous occupant are members of the same household and were members of the same household at the time the delinquent bill was incurred.

4.8.e. Combined water and sewer public service districts -- Any public service district providing water and sewer service to its customers shall have the right to terminate water service for delinquency in payment of either water or sewer bills; provided that proper notice is given and procedures followed as set out in these Rules.

4.8.f. Inter-utility Agreements regarding discontinuance of water service for non-payment of sewer bills.

1. In the event that any utility, (whether public, private, city, incorporated town, municipal corporation or public service district) owns and operates either water facilities or sewer facilities, and a separate utility owns and operates the other kind of facilities, either water or sewer, then the two utilities shall covenant and contract with each other to shut off and discontinue the supplying of water service for the non-payment of sewer service fees and charges; provided that proper notice is given and procedures are followed as set forth in Rules 4.8.a.1. through 4.8.a.13.

2. Municipal sewer -- When sewer facilities are municipally owned and water facilities are not, the municipality providing sewer service may require the water utility to discontinue water service to any customer who is delinquent in the payment of sewer service rates and charges to the municipality. The water utility shall discontinue water service upon demand of the municipality for this purpose; however, prior to discontinuance of any water service, the municipality shall contract with the water utility which contract shall provide that the municipality shall reimburse the water utility for all costs and expenses incurred in both the termination of water service to the delinquent sewer customer and the subsequent resumption of water service to such customer. The contract shall provide for reasonable methods and assurances so that the water utility will be
protected and held harmless from claims and damages when water service is discontinued in error or in violation of the rights of the customer through the fault of the municipal sewer utility.

3. The inter-utility agreement should contain specific provisions regarding responsibilities of notice of termination, termination, reconnection, and reasonable fees based on fair and reasonable compensation.

4. Any inter-utility agreements pursuant to Rule 4.8.f.2. shall be submitted to the Commission for approval prior to any termination of water service for non-payment of sewer bills under such agreements.

5. A water utility that has terminated or reconnected service for non-payment of sewer bills or that has made a visit to the customer’s premises to terminate service, may charge the sewer utility a fee pursuant to Rule 4.8.c. The sewer utility may include this charge in the billing to the delinquent customer; provided that such charge is included in the sewer utility’s approved tariff.

4.8.g. A sewer customer who has been notified that water service is to be terminated for non-payment of sewer bills shall be given the opportunity to enter into a deferred payment on the same terms and conditions set forth in Rule 4.8.a.10.

4.9. Refusal to serve applicant.

4.9.a. Non-compliance with rules -- Any utility may decline to serve an applicant until he has complied with these rules and the Commission approved utility’s rules set forth in a Commission approved tariff governing water service.

4.9.b. Applicant's facilities inadequate -- The utility may refuse to serve an applicant if, in its judgment, the applicant's installation of piping equipment is regarded as hazardous or of such character that satisfactory service cannot be provided.

4.9.c. A bill which has been found to be contractually uncollectible by a court or could reasonably be found to be uncollectible by reason of an applicable statute of limitations shall not be used by a utility to deny or discontinue service.

4.9.d. Applicant's recourse -- In the event that the utility shall refuse to serve an applicant under the provisions of this rule, the utility must inform the applicant that the question may be submitted to the Commission for decision.

4.9.e. In the case of the establishment of a new utility and/or extensions, the utility has received applications for service and has accepted the tap-fee for same; the utility will immediately upon receiving bids for such installation determine the feasibility of serving the areas in question and immediately advise the applicants. In the event an area is deemed infeasible to serve, the tap-fee deposit will be returned to the applicant immediately.

It is suggested the utility design its application form to reflect the above procedures.

4.10. Change in character of service -- When a substantial change is made by a utility in water pressure, or other conditions affecting the efficiency of operation or adjustment of appliances, the utility shall inspect and readjust the appliances of all customers in the district affected, if necessary, without charge. Where circumstances require, the utility shall furnish and install suitable pressure regulating devices.

4.11. Access to property.
4.11.a. The utility shall at all reasonable times have access to meters, service connections and other property owned by it on customer's premises, for the purpose of maintenance and operation. Neglect or refusal on the part of customers to provide reasonable access to meters, service connections and other property owned by the utility for the above purposes shall be deemed to be sufficient cause for discontinuance of service.

4.11.b. Identification for employees -- Every employee, whose duties regularly require him to enter the homes of customers, shall wear a distinguishing uniform or insignia, identifying him as an employee of the utility and shall carry on his person an identification card which will identify him as an employee of the utility, containing a photograph of said employee. The identification card shall contain the telephone number of the utility as well as other pertinent information necessary to identify the employee. All other employees, whose duties require occasional entry into the homes or premises of customers, shall carry an identification card containing information as herein required.


4.12.a. Records of interruptions -- Each utility shall keep a record of all interruptions of service affecting its entire system or major divisions thereof, including a statement of the time, duration, and cause of the interruptions.

4.12.b. Notification to customer -- Every customer affected shall be notified in advance of contemplated work which will result in an interruption of service.

4.12.c. Curtailment or restriction service policy -- Each utility shall file with the Commission for any contemplated curtailment or restriction policy to any customers, prior to such curtailment or restriction policy being put into effect. The following information shall be supplied:

1. Reason for curtailment or restriction of service.
2. Date curtailment or restriction policy requested to begin.
3. Duration of policy and projected correction programs with time parameters for completion.

4.13. Moratoria

4.13.a. Conditions -- The Commission may impose a moratorium on a system, either entire or apportioned, whenever sufficient evidence exists that the existing facilities are operating in excess of design capacity, that the system capacity necessary for future demand does not exist, or when an increase in customers will result in the degradation of service to existing customers.

4.13.b. Petition -- A utility, Commission Staff, or governmental entity may petition the Commission in writing for the imposition of a moratorium on a system. The petition should include evidence of the existence of conditions outlined in Rule 4.13.a. If the utility is the petitioner, it must state the utility's plan to remediate those conditions.

4.13.c. Imposition by state agency other than the Commission -- A utility must immediately notify the Commission in writing if a State agency other than the Commission imposes a moratorium on the utility’s system.

4.13.d. Public notification of petition -- A party petitioning for a moratorium shall notify the public that such request is being made, through a Class II legal advertisement in the form of Water Form No. 3, "Public Notice of Filing of a Petition for Imposition of a Moratorium" attached to these Rules, published no later than fifteen (15) calendar days from the date such request is made to the Commission. The notification
shall clearly state which areas of the utility's system are affected, and that interested parties may submit comments to the Commission for consideration.

4.13.e. Exemptions -- Any prospective customer or group of prospective customers may apply to the Commission for an exemption from an existing moratorium. Such requests shall be made in writing by the prospective customer(s) to the Commission, and shall include justification for the proposed exemption.

4.13.f. Refusal of Service -- A utility may not deny service to a prospective customer on grounds of a moratorium until the Commission has imposed a moratorium. Any utility denying service to a prospective customer or group of customers due to a moratorium shall notify, in writing, all applicants for service of their right to file with the Commission a request for exemption from the moratorium.

4.13.g. Improvements to System -- A utility upon which a moratorium is imposed shall continue to seek improvements to its system necessary to lift the moratorium. The Commission may, at its discretion, require the utility to submit reports outlining all progress made toward system improvements.


4.14.a. Authority -- Upon giving notice to the Commission and the general public, any water utility declaring a temporary shortage of water, and that it is necessary for the health and welfare of the utility's customers to restrict the consumption and use of the existing water supply, shall be authorized to enforce the following Local Water Rationing Plan ("Plan") to restrict use of water to human consumption and for sanitary purposes. If a utility wishes to adopt a water rationing plan different from the following Local Water Rationing Plan, it may petition the Commission for permission to do so.


1. “Emergency service area” -- the area or areas within which the utility has declared a state of drought and water shortage emergency.

2. “Excess use” -- the usage of water by a water customer in excess of the water allotment provided under the Local Water Rationing Plan for that customer, over any applicable period.

3. “Service area” -- the territory and the customers serviced by the utility.

4. “Service interruption” -- the temporary suspension of water supply, or reduction of pressures below that required for adequate supply, to any customer, portion of a water supply system or an entire system.

4.14.c. Purpose -- This Plan is intended to establish measures for essential conservation of water resources, and to provide for equitable distribution of limited water supplies, to balance demand and available supplies and to assure that sufficient water is available to preserve public health and safety within an emergency service area.

4.14.d. Scope -- This Plan shall apply to all water uses within a utility’s emergency service area including uses by customers of wholesale customers of the utility.


1. It is imperative that water customers within an emergency service area reduce water use in order to extend existing water supplies, and to assure that sufficient water is available to preserve the public health and sanitation, and provide fire protection service and electric power generation.

2. This Plan requires equitable reductions in water usage, and for equal sacrifice on the part of
each water customer, insofar as such restrictions do not interfere with the public health, adequate fire protection and the generation of electric power. The success of this Plan depends on the cooperation of all water customers in the emergency service area.

4.14.f. Measures to implement the water rationing plan -- Each water supply purveyor, including resellers, within the emergency service area, will develop and adopt necessary and appropriate measures to assure compliance with requirements of this Plan.

4.14.g. Prohibiting non-essential water uses -- The following water uses are non-essential and are prohibited within an emergency service area:

1. Watering of outside shrubbery, trees, lawns, grass, plants or any other vegetation, except from a watering can or other container not exceeding three (3) gallon capacity. This limitation shall not apply to vegetable gardens, greenhouse or nursery stocks and newly established lawns or sod less than five (5) weeks old, which may be watered in the minimum amount required to preserve plant life before 8:00 a.m. or after 6:00 p.m.

2. The watering of golf course fairways.

3. The washing of automobiles, trucks, trailers or any other type of mobile equipment except in vehicle wash facilities operating with a water recycling system with a prominently displayed sign in public viewing so stating, or from a bucket or other container not exceeding three (3) gallons.

4. The washing of streets, driveways, parking lots, service station aprons, office buildings, exteriors of homes or apartments or other outdoor surfaces.

5. The serving of water in restaurants, clubs or eating places unless specifically requested by the individual.

6. Ornamental water use, including but not limited to fountains, artificial waterfalls and reflecting pools.

7. The use of water for flushing sewers or hydrants by municipalities or any public or private individual or entity except as deemed necessary in the interest of public health or safety by the utility.

8. The use of fire hydrants by fire companies for testing fire apparatus and for fire department drills except as deemed necessary in the interest of public safety and specifically approved by the municipal governing body.

9. The use of fire hydrants by municipal road departments, contractors and all others, except as necessary for fire fighting or protection purposes.

10. The filling of swimming or watering pools requiring more than five (5) gallons of water, or the refilling of swimming or wading pools which were drained after the effective date of the order, except that pools may be filled to a level of two (2) feet below normal, or as necessary to protect the structure from hydrostatic damage, as to pools constructed or contracted for on or after the date of the final order.

4.14.h. Recourse -- Any person aggrieved by a utility’s decision relating to these rules may file a complaint with the Commission.
4.14.i. Penalties. -- Any person who violates the provisions of this Plan, who fails to carry out duties and responsibilities imposed by this Plan or who impedes or interferes with any action undertaken or ordered pursuant to this Plan, shall be subject to the following penalties:

1. For the first excess use, the utility shall issue a warning of possible discontinuation of service.

2. For the second or subsequent excess use, the utility may interrupt or shut off service to the customer without notice, or the utility may add a surcharge of ten percent (10%) to the end user’s monthly bill for the month of the infraction.

4.14.j. Effective period -- This Plan shall remain in effect until terminated by action of the utility declaring an end to the emergency condition or until terminated by order of the Commission, whichever comes first.

4.14.k. Effective date -- This Plan shall take effect immediately upon adoption by the utility.

4.15. Resale of water.

Water furnished on approved rates or contracts by a public utility shall not be resold or caused to be resold by any customer unless the said customer is engaged in the business of distributing water as a public utility.

150-7-5. Utility Facilities; Service Pipes; Extension of System.

5.1. Adequacy of facilities.

5.1.a. Construction and maintenance of plant -- Each utility shall at all times construct and maintain its entire plant and system in such condition that it will furnish safe, adequate and continuous service.

5.1.b. Inspection of plant -- Each utility shall inspect its plant and facilities in such manner and with such frequency as is necessary to insure a reasonably complete knowledge as to their conditions and adequacy at all times. Such inspections must comply with the requirements of the legally applicable Minimum Federal Safety Standards (Federal Occupational Health and Safety Administration) and the standards of the Bureau for Public Health and the Department of Environmental Protection (as applicable).

5.1.c. Records of conditions -- Records necessary for the proper maintenance of the system and in accordance with the Bureau for Public Health and the Department of Environmental Protection (as applicable), and the Minimum Federal Safety Standards shall be kept of the conditions found. In special cases, a more complete record may be specified by the Commission.

5.1.d. Records of operation -- Each utility shall keep a record of the operation of its plant, which, so far as practical, shall show sufficient details of plant operation as is necessary to substantially reproduce the daily history of its operation. The records shall also be maintained in accordance with the requirements of the Minimum Federal Safety Standards and Bureau for Public Health and Department of Environmental Protection (as applicable).

5.1.e. Reports to Commission -- Each utility shall, upon request of the Commission, file with the Commission a statement regarding the condition and adequacy of its plant, equipment, and facilities, and of its operations and service in such form as the Commission may require.

5.1.f. Bureau for Public Health Standards -- All extensions, service connections and modifications to the utility's plant must meet applicable design standards established by the West Virginia State Bureau for Public Health in addition to these rules.
5.1.g. Dead ends. -- "Dead ends" in the utility’s distribution mains should be avoided so far as possible. If such "Dead ends" exist the utility shall provide facilities for flushing.

5.2. Utility Service Pipe.

5.2.a. Where the service pipe is required for the immediate and continuous use for general service to premises abutting the public street or right-of-way in which mains are located, the utility will furnish, install, and maintain the utility service pipe and appurtenances between the main in the street up to the customer’s point of service at or near 90 degrees to the main. Provided, all such utility service pipes and appurtenances shall be installed only by the utility unless by prior written agreement.

5.2.b. The utility shall determine the location of the utility service pipe.

5.2.c. The utility will specify the size, kind, quality and location of all materials used in the utility service pipe.

5.2.d. The utility shall install and maintain, at its own cost and expense, all of the utility service pipe regardless of the side of the road on which the customer is located in reference to the main line. The utility shall designate the point of service on the customer’s side of the road.

5.2.e. The utility shall not make any charge for furnishing and installing any permanent service connection, meter or other appliance necessary to deliver and measure the water furnished unless the utility has prior approval of the Commission to charge a tap fee and the same is set forth in the utility’s tariff on file with the Commission.

5.2.f. The utility's service pipe shall remain under the utility’s sole control and jurisdiction.

5.2.g. The customer shall not attach any fixtures to, or make any branches in, the utility service pipe between the point of service and the distribution main. Violation of this rule may result in termination of service pursuant to these rules.

5.2.h. Temporary service connections for construction or other temporary purposes or connections for private fire service shall be installed by the utility at the cost of the applicant.

5.2.i. Each water utility shall adopt standard methods of meter installations where practicable. Such methods shall be set out with a written description and drawings to provide a clear understanding of the requirements; all of which shall be submitted to the Commission.

5.3. Customer Service Pipe.

5.3.a. No customer, plumber, company owner or any agent shall connect to the utility’s main or to any utility service pipe, or extend the pipes there from to any premises for the purpose of securing water service, until application has been made therefore to the utility as provided in these rules and permission for doing so has been granted by the utility in writing.

5.3.b. Once an application for service has been granted, the customer shall install and maintain the customer service pipe.

5.3.c. The utility’s authorized employee shall inform the customer of the location of the point of service. The customer shall install the customer service pipe to the point of service after which the utility will install the utility service pipe from the distribution main to the point of service.

5.3.d. The customer shall also install and properly maintain in good working condition a stop and waste cock of a type approved by the utility on the customer's service pipe immediately inside the foundation wall in a readily accessible location and in a place protected from the possibility of freezing and so placed that it will shut off and drain all plumbing within any and all buildings in the premises.
5.3.e. Where the utility's service pipe is already installed to the point of service, the customer shall connect with the utility service pipe as installed.

5.3.f. The customer's service pipe shall be installed in a workmanlike manner, shall conform to all reasonable rules and regulations of the utility, and shall be maintained by the customer at his own expense.

5.3.g. The utility will specify the size, kind, quality and location of all materials used in the customer's service pipe and the customer shall comply with those specifications.

5.3.h. A customer must maintain his service pipe in good condition and free from all leaks and defects, at the customer's cost and expense. A customer’s failure to comply with this rule may result in termination of service pursuant to these Rules.

5.3.i. The customer's service pipe shall: be laid below the frost line at all points; be placed on firm and continuous earth so as to give unyielding and permanent support; and be installed in a trench at least two (2) feet in a horizontal direction from any other trench wherein gas pipe, sewer pipe, or other facilities, public or private, are or are to be installed.

5.3.j. Except in the case of long-service lines, a customer’s service pipe shall not pass through or across any premises or property other than that to be served, nor across any portion of the property that could practicably be sold separately from the immediate premises served, and no water pipes or plumbing in any premises shall be extended there from to adjacent or other premises.

5.3.k. The customer's service pipe and all connections and fixtures attached thereto shall be subject to the inspection of the utility before the water will be turned on, and all premises receiving a supply of water and all service pipes, meters and fixtures, including any and all fixtures within the said premises, shall at all reasonable hours be subject to inspection by any duly authorized employees of the utility.

5.3.l. The utility shall make changes and bear the full costs of changes in the customer's service pipe or meter location required due to changes in grade, relocation of mains, and other causes not related to the customer. The customer shall bear the full costs of changes in service pipe or meter location desired by the customer for his or her convenience.

5.3.m. The customer shall not attach any fixtures to, or make any branches in, the customer service pipe between the point of service and the premises served. Violation of this rule may result in termination of service pursuant to Rule 4.8.

5.3.n. There shall be no more than one (1) customer service pipe required to serve a single premises and each premises shall be supplied through an independent customer service pipe, unless otherwise approved by the utility in writing.

5.4. Long service lines.

5.4.a. To assure the orderly development of its system, and to provide adequate service to its customers, the utility should ordinarily provide water service only at the property line of the customer requesting service, and in those instances where the utility's service does not extend to the customer's property line, an extension should be made by the utility in accordance with Rule 5.5. of these rules. In unusual and exceptional cases where the property line of the customer requesting service is an excessive distance from the existing main of the utility, and the cost to be borne by the prospective customer under Rule 5.5. is prohibitive, and there is no reasonable prospect of further growth and development in the area, or for any one of the above reasons, the utility may serve the customer by installing a meter in the utility's right-of-way at its main nearest the customer's property, and connecting the meter to the customer's privately owned service line. The customer shall extend his customer service line to an existing distribution main of the utility and shall be solely
responsible for service beyond the meter.

5.4.b. If a road crossing is necessary to serve the customer, the utility shall install that portion of the line crossing under the road and shall locate the meter on the customer’s side of the road; provided that the utility’s distribution main lies within or adjacent to the existing road right-of-way. The customer shall be required to provide evidence to the utility that proper easements or rights-of-way have been obtained. Standards of service received by the customer shall be determined at the metering point. The customer shall not permit others to connect to the customer’s water lines or receive water service from the customer’s privately owned service line. In the event the utility's main is later extended to the customer's property line under Rule 5.5., the customer shall discontinue the use of his privately owned service line and shall pay all costs and charges authorized by the rules of the Commission and the rules and tariffs of the utility for water service from such extension, the same as if the customer had not previously laid and received service through a private service line. The provisions of this rule shall apply to all persons now or hereafter receiving water service through a privately owned service line extending from the utility's main to the property to be served.

5.5. Extension of mains to serve new customer(s) and customers currently served under Rule 5.4.

5.5.a. A water utility, whether publicly or privately owned, is under a public service obligation to extend its mains, and its plant and facilities to serve new customers within its service area who may apply for service.

5.5.b. Extensions shall be made in all cases in which the public convenience and necessity require the service, construction problems are not unusual or burdensome, and the extensions appear to be economically feasible.

5.5.c. For any proposed extension of mains, a reasonable relationship should exist between the per customer investment to serve new customers and the per customer investment to serve existing customers.

5.5.d. Every effort shall be made by a utility to install its distribution main in the public road right-of-way or in a utility right-of-way abutting the public road right-of-way.

5.5.e. Extensions for general water service --

1. The utility will respond to all inquiries regarding new water service, whether oral or written, by explaining all available options for obtaining service under these rules.

2. The utility will, upon written request for service in the form of Water Form No. 4, by a prospective customer or group of prospective customers located in the same neighborhood, or a customer currently served under Rule 5.4., determine the necessary size of main required to give service and make an estimate of the cost of providing the requested service, using the form of Water Form No. 5, including pipe, valves, fittings, necessary materials, permits, costs incurred by the utility when the utility externally contracts for the construction of the extension, or internal labor costs, provided such internal or external costs are not recovered in existing rates, and other applicable related costs. When a road crossing(s) is(are) necessary to serve the customer(s) requesting service, the cost estimate shall not include costs attributable to extending the main across the first road (closest to the already existing main), but shall include the costs of installing the main across a second and any subsequent road(s). The written estimate calculated using Water Form No. 5, shall be provided to the customer in the form of Water Form No. 6, no more than forty-five (45) days from the receipt by the utility of the written request for service. The written estimate shall include an estimated construction start date and an estimated time of construction. If the prospective customer believes that any part of the estimate is unreasonable, the customer is free to pursue an informal request for assistance from the Commission staff or to file a formal complaint with the Commission. Further, the utility and the customer shall execute a Main Line Extension Agreement. Commission Staff may be consulted to provide assistance and sample forms. The agreement must include as an attachment a copy of this extension rule. The utility shall keep an executed copy of their agreement for at least six (6) years. The length of the extension required shall be
that length required to extend from the new proposed service area to the nearest point of connection to the
utility system having sufficient excess capacity to provide service at maximum demand.

2. Unless service is to be provided by a long service line pursuant to Rule 5.4., whenever the
utility is required to extend service from an existing distribution main to property that does not immediately
abut the utility’s right-of-way or the public road that contains the distribution main, the extension shall be
considered a main extension and cost responsibility shall be determined under this Rule 5.5.e.

3. Where the cost of the extension does not exceed the estimated total net revenue, as calculated
below from hydrants and prospective customers whose service pipes will immediately be connected directly to
the extension and from whom the utility has received applications for service upon forms provided by the
utility for this purpose, the utility will install, at its own cost and expense, the necessary extension; provided
that the patronage or demand will be of such permanency as to warrant the capital expenditure involved.

   A. Net revenue shall be gross revenue minus the excess usage leak adjustment rate approved
   for the utility, and with this difference further reduced for any revenue based taxes.

   B. Revenue shall be based on 4,500 gallons per month per residential unit, unless
   circumstances of the applicant show this would result in significant error. For non-residential units, annual
   revenue shall be based on typical consumption for comparable units published by the American Water Works
   Association.

   C. Estimated total net revenue for private, for profit, utilities will be initially calculated as six
   (6) times estimated net annual revenue. Each such utility shall file for a line extension multiplier within twelve
   (12) months of the effective date of these rules.

   D. The utility-specific line extension multiplier for private, for-profit, utilities shall be based
   on one (1) divided by the utility’s net fixed charge rate. The net fixed charge rate shall equal the total of the
   utility’s weighted cost of capital, applicable income tax rates, and the Commission approved depreciation
   accrual rate.

   E. Estimated total net revenue for associations, municipal, and public service district utilities
   will be calculated as five (5) times estimated net annual revenue. If the excess leak adjustment calculated for
   the utility fails to include all of the incremental costs of serving a new customer that should properly be netted
   out from the total revenues of the utility, the utility may apply to the Commission for a determination of the
   proper amount to be deducted from gross revenues to arrive at an appropriate determination of net revenue.

5.5.f. Extensions beyond the limit of utility-financed extensions of general water service and public
fire service.

   If the estimated cost of the proposed extension required in order to furnish general water service
exceeds the utility's estimate of total net revenue as determined by Rule 5.5.e.4., such extension shall be made
if the applicant or the applicant's authorized agent contracts for such extension and deposits in advance with
the utility the estimated cost of the extension over and above the limit of the utility-funded portion of the
extension. The utility shall not pay nor be liable for any interest on such cash deposits. The utility shall make
the extension after receiving the cash deposit. The utility shall, for each bona fide new customer who, within a
period of ten (10) years from the making of such extension, directly connects to the extension between its
original beginning and the original terminus, refund to the original depositor(s), an amount equal to the
estimated total net revenue of the new customer as determined by Rule 5.5.e.4., but in no event shall the
aggregate refund made to the depositor(s) exceed the original deposit. Provided that associations, public
service districts and municipal water utilities may elect to refund the estimated amount over a period of five (5)
years equal to the utility’s line extension multiplier as defined in Rule 5.5.e.4.D. making payments no less
frequently than every six (6) months.
5.5.g. Alternate depositor-financed extension plan.

1. Qualifying utilities -- The above requirements notwithstanding, the utility may decline to finance the portion of a requested extension that would be utility-funded if it can demonstrate that it has no prospect of any reasonable internal or external financing through commercial loans, grants, or through an installment arrangement with an entity installing the extension or providing the necessary materials.

   A. If the utility declines to finance the portion of a requested extension that would be the financial responsibility of the utility, the utility shall file for a waiver of the extension rule within sixty (60) days of the written request.

   B. Before filing for a waiver, the utility must first make an estimate of the extension costs.

   C. A request for a waiver by a utility shall be accompanied by supporting documentation justifying its request.

   D. If the Commission finds that the utility has reasonably declined to finance the portion of the requested extension that would otherwise be utility-funded, the Commission shall authorize the use of the alternate depositor-financed extension plan as described below.

2. Description of alternate depositor-financed extension plan — Under the alternate depositor-financed extension plan, the utility shall make the extension after:

   A. receiving a cash deposit equal to the full amount of the extension cost; and

   B. agreeing to give the depositor(s), who is a customer, a monthly bill credit totaling one hundred percent (100%) of the actual net bill(s) from the date service is initiated and until the total credits given equal the estimated total net revenue as defined in Rule 5.5.e.4. and

   C. agreeing to refund to the original depositor(s) an amount equal to the estimated total net revenue as defined in Rule 5.5.e.4. of each bona fide customer, other than the depositor(s), who, within a period of ten (10) years from the construction of the extension, directly connects to the extension between its original beginning and the original terminus. The refund may be spread out over a five (5) year period with the utility making payments no less frequently than every six (6) months. Such refunds shall continue until the total refunds given equal the estimated total net revenue as defined in Rule 5.5.e.4.

3. In no event shall the total refund made to the depositor(s) under Rule 5.5.g. exceed the original deposit of the depositor(s).

4. The utility shall not pay nor be liable for any interest on the cash deposits associated with line extensions.

5.5.h. General Provisions

1. Should the actual cost of the extension be less than the estimated cost, the utility will refund the difference as soon as the actual cost has been ascertained, but in no event longer than ninety (90) days after completion of construction of the extension. When the actual cost of the extension exceeds the estimated cost, then the utility will bill the depositor for the difference between the estimated and the actual cost. No interest will be paid by the utility on the applicant's payment or on any balance to be refunded.

2. In estimating the cost of an extension, the estimate shall be based on the diameter of the pipe to be used; provided that the estimated cost to the customer or customers shall not be based on a pipe diameter greater than the diameter of the main from which the extension is to be made, unless actual consumption
estimated for the proposed customer or customers requires a larger pipe.

3. Extensions made under this rule shall be and remain the property of the utility.

4. The utility reserves the right to further extend its distribution mains from and beyond the extension made under this rule, and the depositor or the depositor's agent paying for an extension shall not be entitled to any refund for the attaching of customers to such further extension or branch mains.

5. In determining the length of water line to be installed in an urban area when land is subdivided into lots, the main, or water line (if installed by an entity other than a utility), shall be extended to fully cover the frontage of the property, and if the last lot to be served is a corner lot the terminal point of the extension made hereunder shall be located so that the water line ties in with the intersecting street; and further; provided that if there is no main located in the intersecting street, the terminal point of the extension shall be located at the nearest street line of the intersecting street. In rural areas or open land areas, the extension required will be that length necessary to adequately serve the applicant.

6. Before water lines will be laid in any new subdivision, the road surface shall be brought to the established sub-grade as determined by the agency having jurisdiction.

7. This rule shall not be construed as prohibiting the utility from entering into an agreement with a customer that complies with the Commission approved checklist attached hereto as Water Form No. 6, providing an alternate plan for a main extension. Commission Staff may be consulted to provide assistance and sample forms. In providing an alternate plan for main extensions a utility may not discriminate between customers whose service requirements are similar. The agreement shall be filed with and approved by the Commission prior to implementation or execution of the agreement by any of the parties. The agreement shall include the name, address and phone number of the parties to the agreement. The agreement shall also include a provision explaining why the utility is not funding the extension. The agreement must attach a copy of this Rule 5.5., and a statement signed by the prospective customer that he has reviewed and understands the provisions of Rule 5.5.g. which entitle a customer to refunds and that he knowingly waives such rights, if applicable. Failure to obtain Commission approval will result in the loss of the right to obtain reimbursement from the utility. If an entity other than the utility constructs the extension, upon completion of construction and proper utility inspection of the extension, the utility shall initiate service only after proper transfer of title to all facilities including property, plant and rights-of-way incidental to the furnishing of utility service.

8. Contract for service -- The utility shall not be required to make free extensions or refunds as described in this rule unless those to be served by such extension shall guarantee to the utility that they will take water service at their premises within thirty (30) days after water is turned into the main or as otherwise mutually agreed in a user’s agreement.

9. Construction conditions -- Construction of line extensions, as provided in this rule, will be undertaken promptly after all applications have been completed, necessary right-of-way agreements or rights of entry have been delivered to the utility, and all prospective customers have signed contracts.


   A. If the construction of an extension involves the acquisition of a private right-of-way, then the prospective customer shall attempt to secure the right-of-way and deliver it to the utility free of cost before construction of the extension is started.

   B. If, however, it is not reasonably possible for the prospective customer or customers to secure the right-of-way, and the construction of an extension involves the utility's incurring expense for right-of-way easements, either by purchase or condemnation, such costs shall be added to the total cost of the extension.

168
C. As a condition to obtaining a main extension, any property owner or developer shall grant the utility the necessary easements to allow the utility to make future extensions into unserved areas. The granting of the necessary easements shall be made without the utility being required to pay additional consideration for the additional easements to the property owner or developer. If the property owner or developer is unwilling to grant the additional easements, the utility shall not be required to extend its main to serve the property owner or developer.

11. Upon the proper filing of a Tariff Rule 42A, 42T, or 19A rate case by the utility, the utility may seek an impact fee to be assessed against customers.

5.6. Unaccounted for water.

Each utility shall determine either by actual measurement or by estimate the amount of "Unaccounted for Water" as defined in 1.7.q. of these Rules in each division of its system and report, separately, to the Commission in its annual report. Said report shall contain the proposed remedial actions to be taken if unaccounted for water is in excess of fifteen percent (15%) of the gross production on an annual basis. A utility may seek assistance from the Commission regarding remediation of unaccounted for water in excess of fifteen percent (15%).

5.7. Cross connections and back flow prevention regulations.

See West Virginia Bureau for Public Health Bulletin EW-113 Effective April 1, 1976.

5.8. Standard pressure.

5.8.a. Each customer shall be deemed to receive a “standard pressure” within the Commission’s established minimum and maximum pressure limits. When possible, such “standard pressure” shall be calculated as the static pressure based on the difference in elevation between the base of the storage tank and meter box or point of service. Where this method of calculating a customer’s “standard pressure” is not practical, the actual engineering design of the system or common engineering methods shall be used to determine the “standard pressure” at the point of service. Pressure fluctuations shall not vary more than fifty percent (50%) above nor fifty percent (50%) below such “standard pressure” during normal operating conditions. Pressure variations outside the limits specified will not be considered a violation of this rule if they are infrequent and arise from unusual or extraordinary conditions, or arise from the operation of the customer’s equipment. This rule shall be interpreted to permit a different “standard pressure” calculation for each customer due to varying elevations.

5.8.b. Each utility should establish an elevation in each pressure district above which it cannot provide the minimum pressure required by this rule. This elevation shall be displayed in a prominent place in the public offices of the utility. The utility may furnish new service to customers above this elevation if the customer is fully advised of the conditions under which average service may be expected, and the customer’s agreement is secured in writing. The utility may require in the agreement that its terms shall be binding on future customers served at the same location under similar circumstances; provided that the agreement be recorded with the appropriate county clerk. This waiver shall not prevent the Commission from requiring a better service when, upon investigation, it appears that improvements should be made.

5.8.c. No change shall be made by a utility in the standard pressure or pressures adopted for its customers without the approval of the Commission.

5.8.d. A customer's pressure shall be no less than twenty (20) p.s.i. at peak demand on system or thirty (30) p.s.i. static pressure at the terminus of the utility's service line (meter box or curb box) unless the customer has waived this requirement. For all new customers desiring service on and after the effective date of these rules, a customer’s pressure shall be no greater than one hundred thirty-five (135) p.s.i. unless the customer has waived this requirement. The utility shall keep on file all the aforesaid waivers, in accordance with Rule 2.1.
5.9. Quality of water.

5.9.a. Purity -- All water furnished by a utility for domestic use, shall be pure, wholesome, potable and in no way dangerous to the health of the consumer.

5.9.b. Health Department -- Every water utility shall comply with the rules of the Bureau for Public Health governing purity of water, testing of water, operation of filter plants and such other rules they may prescribe, pursuant to law, having as their ultimate end the purity of water.

150-7-6. Inspections and Tests.

6.1. Meter testing facilities and equipment.

6.1.a. Testing facilities -- Each utility shall provide or have access to such laboratory meter-testing facilities as may be necessary to make the tests required by these rules or other orders of the Commission. The facilities so provided shall be subject to the approval of the Commission, and shall be available at all times for inspection or use by any member or authorized representative of the Commission.

6.1.b. Tests required; Reports to Commission -- Each utility shall, as a minimum requirement, conduct the tests required by these rules with such frequency, and in such manner, and at such places as provided herein or as may be approved or ordered by the Commission. Each utility shall make yearly reports, in accordance with the requirements of the Commission, on Water Form No. 8, of meter tests, number of customers and amount of refunds. These reports must be filed not later than thirty (30) days after the expiration of the period covered by the reports.

6.1.c. General testing equipment -- Each utility furnishing metered water service shall own and maintain the equipment necessary to accurately test all types and sizes of meters employed for the measurement of water unless the utility has made arrangements to have such testing done in a shop or laboratory containing equipment acceptable to the Commission. The utility shall promptly report in writing to the Commission all alterations or repairs to meter testing equipment, which might affect the accuracy or method of operation of such equipment.

1. The utility shall hold for all testing instruments and other equipment, a certificate signed by a proper authority giving the date when the instrument was last certified and adjusted, and certificates, when superseded, shall be kept on file in the office of the utility.

2. Shop testing equipment -- Testing equipment shall consist of calibrated tanks large enough to hold the equivalent volume needed to move the test dial one or more complete revolutions. It is recommended that the calibrated tanks hold not less than the quantity needed to test meters in accordance with the test requirements of the American Water Works Association (AWWA) found in the Water Meters Section of Manual M6, Denver (1986). The equipment shall be provided with the proper valves, gauges, and flow devices so constructed that the flow rate can be determined in gallons per minute and an accurate check can be made of the pressure on the intake side of the meter.

3. Field testing equipment "Prover Meter" -- Testing equipment shall consist of a calibrated meter(s) provided with the proper discharge valves and gauges so constructed that the flow can be adjusted on the outlet side of the prover meter. Said equipment shall be tested and calibrated against a certified calibrated tank not less than once each year, or more frequently if circumstances warrant, and a record of such test shall accompany the field test equipment when in use. It is recommended that the test record be plotted as an accuracy curve in graph form so that operating error may be determined easily. The error of the prover meter shall be applied as a correction factor when computing final accuracy of meters tested in place by using the following formula:

\[
\text{TESTED METER ACCURACY} = \frac{MV}{PV} \times PA
\]
where: MV = volume recorded on meter tested  
PV = volume recorded on prover meter  
PA = accuracy of prover meter at tested flow rate (in %).

6.2. Tagging, sealing and capping meters.

6.2.a. Tagging meters -- A record of each meter shall be maintained showing the type, brand, serial number, registration reading, test date, flow rates, and test results. This record, which may be kept on paper or electronically, shall be maintained after installation of the meter and for so long as the meter remains in service.

6.2.b. Sealing meters -- All meters in which the accuracy can be adjusted or which could otherwise be easily altered or tampered with shall be sealed at the time of the test by the metertester performing the test. Pulse generator remote type meters shall have the remote counter sealed.

6.2.c. Capping meters -- All meters must have caps placed on the inlet and outlet ports when removed from service and awaiting testing. All meters that have been tested and sealed or are ready for installation must be capped when sealed and kept capped until installed.

6.3. Accuracy requirements for water meters.

6.3.a. Installation accuracy -- Before being installed for the use of any customer a water meter, whether new, repaired, or removed from service for any cause, shall be in good order and shall be adjusted or repaired to be as nearly correct as is commercially practical. However, a manufacturer's certified test may be accepted in lieu of utilities' test of new meters of the positive displacement type.

6.3.b. Whenever, on installation, periodic or any other test, a meter is found to exceed a limit of two percent (2%) fast or slow, it must be adjusted so as to register as nearly one-hundred percent (100%) as is commercially practicable. For displacement, multi-jet, propeller, and turbine meters, the normal test-flow-percent accuracy shall be the average of the accuracy results at the intermediate and maximum test-flow rates. For compound and fire-service meters, the normal test-flow-percent accuracy shall be the average of the accuracy results at the maximum test-flow rate of the main line meter and the intermediate and maximum test-flow rates of the bypass meter.

6.3.c. After all necessary repairs, adjustments and final tests have been made so that the meter registers accurately, such meter shall be sealed. It is recommended that all meters of the disc or displacement type, two inch (2") or less in size, be tested before being installed on the premises of any customer.

6.3.d. Meters of the turbine type, two inch (2") and larger, shall always be tested after installation. The meter installations shall be installed with a "Test Tee" and valve for use in testing.

6.3.e. Meters of the turbine type can be tested and calibrated more accurately in place. The accuracy of turbine meters is affected by changes in distribution of velocities through the meter. Such variation of velocity may occur to an appreciable degree through change of nature of inlet piping.

All tests to determine the accuracy of registration of any water meter shall be made with a Commission certified meter prover.

6.3.f. Meter Test Flow -- Flow rates shall be in accordance with "American Water Works Association" standards.

6.3.g. Tests -- How Made -- The testing procedures shall be in accordance with American Water Works Association standards.
6.4. Periodic test.

6.4.a. Meters shall be periodically tested as follows:

- 3/4" or less in size at least once every 10 years.
- 1" in size at least once every 7 years.
- 1-1/4", 1-1/2", 2" in size at least once every 5 years.
- 3" in size at least once every 3 years.
- 4" and larger in size at least once each year.

6.4.b. "Periodic test periods" for testing meters in the system of utilities supplying water of high turbidity, or of peculiar characteristics, will be determined by the Commission from time to time.

6.4.c. The time frame for periodic tests may be modified by the Commission from time to time upon the submission of evidence by the utility to substantiate any request for modification.

6.5. Request tests.

6.5.a. Action required -- If any customer shall request in writing to the utility a test of the accuracy of his or her meter, and the meter is not due for periodic testing, the utility shall notify the customer of the conditions under which the test will be made by the utility or by a referee. If the customer shall then request the utility to proceed with the test and remits an amount equal to the estimated cost incurred by the utility, but not less than ten dollars ($10), the utility shall make the test promptly. A report giving results of the test shall be made to the customer and the utility, and a complete record of the test shall be kept within the applicable Division of the Commission. If, when tested, the meter is found to be more than two percent (2%) in error, the amount advanced shall be promptly refunded to the customer. If the meter is not found to be more than two percent (2%) in error, the utility shall retain the amount advanced by the customer for the test.

6.5.b. Customer's privilege -- A customer may be present when the utility conducts the test on the customer’s meter or, if the customer desires, may send an expert or other representative appointed by the customer.

6.5.c. If the customer files a complaint with, or makes a request for assistance from, the Commission regarding the accuracy of his or her meter, the utility owning the meter shall be notified and shall have a representative present to remove the meter and assist a Commission inspector with the test. This test shall be made at the expense of the utility.

6.5.d. Report to customer -- A report giving the name of the customer requesting the test, the date of the request, the location of the premises where the meter had been installed, the type, make, size and serial number of the meter, the date of removal, the date tested, and the result of the test shall be supplied to such customer within ten (10) days after the completion of the test.

6.6. Metertesters.

6.6.a. Metertester required -- Every utility shall have in its employ or have access to the services of one or more competent metertesters whose duty it shall be to perform such tests as may be necessary to determine the accuracy of the utility's meters.

6.6.b. Certification of metertester -- A utility desiring to certify an employee as a metertester must secure a qualification card from the Commission in the form of Water Form No. 9; have same executed by the applicant and returned to the Commission; together with a certification by a responsible representative of the utility as to the facts contained on the card. The Commission will then schedule a certification test which will consist of a written examination and a demonstration test of the applicant's meter testing skills on certified testing equipment. If the applicant's qualifications are satisfactory, the Commission will then issue a card to the employee in the form of Water Form No. 10 authorizing the employee to test meters of the type and size shown.
6.6.c. Experience required -- No employee of a utility shall be authorized to test meters unless he or
she has had at least six (6) months' experience in a utility water-meter shop, or equivalent experience, part of
which time must have been spent working on the type meter for which authority to test has been requested. All
tests must be made by an authorized metertester.

6.6.d. Reports to Commission --

1. Each utility shall file on or before February 1st, each year, a list of the individuals in its employ
authorized to test meters.

2. The utility shall notify the Commission and shall take up and return the metertester’s card when
a certified metertester ceases to be in its employ.

150-7-7. Safety Requirements.

7.1. Accidents -- Every utility shall keep a record of every accidental happening in connection with the
operation of its plant, station, property, and equipment, whereby any person shall have been killed, or seriously
injured, or any property damaged or destroyed, with full statement of the cause of such accident, and the
precautions taken to prevent similar accidents in the future.

150-7-8. Creation or Alteration of Public Service Districts.

8.1. Creation or alteration of a public service district.

8.1.a. A county commission upon entering an order on its own motion, or upon receipt of a petition, or
upon receipt of a recommendation of the Commission, proposing the creation, expansion, merger,
consolidation, reduction or dissolution of a public service district pursuant to W. Va. Code 16-13A-2, shall:

1. At the same session, fix a date of hearing in the county which date shall be not more than forty
(40) days nor less than twenty (20) days from the date of the action;

2. Within ten (10) days, provide the Executive Secretary of the Commission with a copy of the
order or petition and notification of the time and place of the hearing to be held by the county commission;

3. If the territory proposed to be included is situated in more than one county, when fixing the date
of hearing, provide for notifying the county commission and clerk thereof of each of the other counties into
which the territory extends of the date so fixed;

4. Publish, at least ten (10) days prior to the hearing, a Class I legal advertisement meeting the
requirements stated in W. Va. Code 16-13A-2, giving notice of the hearing;

5. Post notice in at least five (5) conspicuous locations in the proposed public service district as
required by W. Va. Code 16-13A-2; and

6. File with the Executive Secretary of the Commission affidavits of publication pursuant to Rule
4. above, and affidavits of posting pursuant to Rule 5. above as soon as the same are available.

8.2. Notification to the Commission of county commission action.

8.2.a. If the county commission enters an order creating, enlarging, reducing, merging, dissolving, or
consolidating a public service district, the county commission shall, within ten (10) days of entering such order,
file a copy of such order with the Executive Secretary of the Commission. If the county commission declines to
enter such an order, the county commission shall, within ten (10) days of declining, file with the Executive
Secretary of the Commission notice that it has declined to enter any such order.
8.3. Commission hearing.

8.3.a. The Commission shall hold a hearing or hearings in each county affected by a county commission order(s) filed pursuant to Rule 8.1.a. and the Commission shall publish a Class I legal advertisement giving notice of such hearing or hearings.

8.4. Commission consideration of proposed creation or alteration.

8.4.a. After public comment and hearing the Commission shall, by order, approve, disapprove or modify a county commission order creating, expanding, merging, consolidating, reducing or dissolving a public service district. In deliberating on approval, modification or disapproval the Commission may consider, among other things:

1. the public convenience and necessity;
2. the economic feasibility, including sources of funding, costs and related benefits of the county commission's order;
3. the adequacy of facilities;
4. other facilities in the area; and
5. other possible alternatives.
NOTICE OF SCHEDULED TERMINATION OF SERVICE
AND CUSTOMER RIGHTS

We have scheduled your water service provided at (address) for termination on or after (date). This action has been taken for the following reason(s):

(Include reason and facts resulting in decision to terminate service).

If your service is terminated you may be subject to additional charges involving reconnect fees and deposit requirements in order to restore service.

(Include all applicable charges.)

YOU HAVE THE RIGHT TO CHALLENGE THE TERMINATION IF YOU BELIEVE ANY OF THE FOLLOWING CONDITIONS APPLY TO YOU:

1. Any portion of the bill is in dispute
2. You are being charged for service not received
3. The information above is incorrect
4. You are unable to pay the bill in accordance with the billing, and termination of service would be especially dangerous to the health or safety of a member of your household.
5. You are able to pay only installments

If the reason for your challenge is 1, 2 or 3 above, you will have to pay any amount not in dispute. If the reason for your challenge is 4 or 5, we will attempt to negotiate a deferred payment agreement with you.

YOU MUST NOTIFY US BEFORE THE DATE OF TERMINATION IN ORDER TO PROTECT YOUR RIGHTS UNDER THIS RULE:

(Provide instructions for contacting the appropriate utility personnel by telephone and mail, including business hours)

You should also inform us if you are 65 years or older, or regardless of age, if you are physically, mentally, or emotionally incapacitated.

Once you have notified us of your challenge, we will schedule a meeting at the business office nearest to your residence and try to resolve your problem. At your option, the discussion of your challenge may be made over the telephone. IF YOU ARE NOT SATISFIED WITH OUR DECISION AT THIS MEETING, YOU WILL HAVE SEVEN DAYS IN WHICH TO FILE A CHALLENGE WITH THE PUBLIC SERVICE COMMISSION OF WEST VIRGINIA. You will be required to pay your current bill while the challenge is pending. There is no charge associated with filing a challenge and you may do so without the assistance of an attorney.
To file a challenge with the PSC, you may call this toll free telephone number 1-800-642-8544 or write to this address:

    Utility Challenge
    Public Service Commission of West Virginia
    P. O. Box 812
    Charleston, W. Va. 25323

If you are in need of assistance to pay your bill, you should contact the following agencies: (List agencies in service area).

If you desire the assistance of a lawyer with regard to the scheduled termination and are unable to pay for legal counsel, contact one of the following low income legal assistance organizations: (List agencies in service area).
NOTICE OF SCHEDULED TERMINATION

We have scheduled water service provided at (address) for termination on or after (Date) because of your landlord’s delinquent water bill.

To notify the Public Service Commission, you may call this toll free telephone number, 1-800-642-8544, or write to this address:

Public Service Commission of West Virginia
P.O. Box 812
Charleston, WV 25323

If you desire the assistance of a lawyer with regard to the scheduled termination and are unable to pay for legal counsel, contact one of the following low income legal assistance organization: (List agencies in service area).
Water Form No. 3
(Water Rule 4.13.d.)

PUBLIC NOTICE OF FILING OF A PETITION
FOR THE IMPOSITION OF A MORATORIUM

Case No. 
NAME OF UTILITY ,
a public utility.

Petition for consent and approval for
the imposition of a moratorium on the
utility system.

PUBLIC NOTICE

On , the
(Date) (Name of Utility, Commission Staff, or governmental entity)
filed a petition with the Public Service Commission for approval of the imposition of a moratorium on

's
system serving '[name of utility] [water, sewer, or other]
system serving '. If approved, the moratorium would mean
that
(describe areas served)

no new customers could be served by the utility in these areas until the Commission lifts the moratorium.
The
(name of petitioner)
claims that the imposition of a moratorium is appropriate because
[describe reasons and describe any plans to alleviate the circumstances giving rise to the petition, and any
estimate of a date when it would be appropriate for the Commission to lift the moratorium.]

Any person wishing to protest, support, make comment, or request a public hearing about the proposed
moratorium should do so in writing. Written statements should be addressed to the Executive Secretary, Public
Service Commission, P.O. Box 812, Charleston, WV, 25323.

NAME OF UTILITY
Form of written request for service by a prospective customer or a group of prospective customers located in the same neighborhood

Water ( ) Water and Sewer ( )

Previous Customer ( ) If so, when
Name
Mailing address Phone
Property location
Rent ( ) Own ( ) Other
If rent: Property owners name
Property owner’s mailing address Phone
Type of service: Residential ( ) Number in household
Commercial ( ) Type
Industrial ( ) Type
Applicant’s place of employment
Employment address Phone
Name of spouse ________________________________

Spouse’s place of employment ________________________________

Spouse’s employment address Phone

I HEREBY AUTHORIZE SERVICE TO BE ESTABLISHED IN MY NAME AT THE ABOVE PROPERTY LOCATION AND AGREE TO PAY FOR SERVICE UNTIL DISCONTINUED BY MY REQUEST IN WRITING. I UNDERSTAND THAT THIS APPLICATION IS ACCEPTED SUBJECT TO THE AVAILABILITY OF SERVICE AT THIS LOCATION.

Applicant’s signature
Date
Utility representative Date
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Account No.</td>
</tr>
<tr>
<td>Applicant ID</td>
<td></td>
</tr>
<tr>
<td>Deposit amount</td>
<td>Tap fee amount</td>
</tr>
<tr>
<td>Meter Size</td>
<td>Meter No.</td>
</tr>
<tr>
<td>Meter Route</td>
<td>Meter reading</td>
</tr>
<tr>
<td>Date on</td>
<td>Date off</td>
</tr>
<tr>
<td>Customer request ( )</td>
<td>Termination ( )</td>
</tr>
</tbody>
</table>
Water Form No. 5,
(Water Rule 5.5.e.2.)

Form for use in determining cost estimate
to extend water service

Date
The following estimate is in response to a request to extend the Utility’s water facilities approximately
to serve a customer or customers who desire water service.

Cost Estimate

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>@ $</th>
<th>/foot = $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water line (inch PVC)</td>
<td>feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excavation/installation</td>
<td>feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials (fittings, valves, stone, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permits/rights-of-way (Health, Highways, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restoration (seeding, gravel, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Related cost (engineering, legal, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cost Share of Customers and Utility

A. Total estimated cost of extension $
B. Utility Share: (estimated total net revenue per customer calculated pursuant to Rule 5.5.e.4.)
\( \$ \text{ per customer} \times \text{customers} = \$
C. Customer share: estimated cost to be paid by customers (A-B) $ = $

Conditions

If the potential customers shall deposit with the Utility, in advance, the total sum of $ (customers share from “C” above), a tap fee of $ per customer, and a $ security deposit per customer, the Utility will apply for the necessary permit applications and begin construction as soon as possible.

If the actual cost to construct the extension is less than the estimated cost, the Utility will refund the difference to the original depositors. If the actual cost exceeds the estimated cost the Utility will bill the depositors for the difference.
The customers will be required to sign an application for service and/or a users agreement when the tap fees and deposits are made.

This main line extension estimate is made in accordance with Water Rule 5.5 of the Rules for the Government of Water Utilities.
Water Form No. 6
(Water Rule 5.5.e.2.)
Form of cost estimate to be provided to applicants for service

Dear Mr. Customer:

We have received a petition for a water main extension and have estimated the construction cost to extend the main to serve the properties of the ___(insert number) petitioners. This estimate is summarized below:

- Water feet at $ / foot
- Excavation/Installation feet at $ / foot
- Materials (fittings, valves, stone, etc.)
- Permits/Rights-of-way (Health, Highways, etc.)
- Restoration (seeding, gravel, etc.)
- Related Cost (engineering, legal, etc.)
- Total Estimated Extension Construction Cost
- Minus Utility’s Share (estimated total net revenue per customer pursuant to Water Rule 5.5.e.4.)
- Estimated Cost to be Paid by Customers
- Estimated Cost per Customer

When the “customer’s share” referenced above is deposited with the Utility, the Utility will apply for the necessary permit applications and begin construction as soon as possible. If the actual cost to construct the extension is less than the estimated cost, the Utility will refund the difference to the original depositors. If the actual cost exceeds the estimated cost, the Utility will bill the depositors for the difference. This difference must be settled before service can actually be connected.

All customers will be required to sign an extension agreement and an application for service and/or a users agreement and pay a tap fee of $, and a security deposit of $ prior to receiving service. The security deposit is refunded with interest following twelve consecutive months of full and timely payments for services rendered.

The estimated start date of construction is .
The estimated duration of construction is days.

Should you have any questions, you may contact Barbara Manager or John Foreman at between 9:00 a.m. and 4:00 p.m., Monday through Friday.

Sincerely,
Form of Commission Check-List for Alternate Main Extension Agreements

This form sets forth the minimum amount of information that should be included in a proposed alternate main extension agreement.

☐ 1. Name of developer, mobile home park owner or prospective customers(s).

☐ 2. General location or description of area to be served.

☐ 3. Indication that the developer, owner or prospective customer(s) has/have read Water Rule 5.5, Sewer Rule 5.3, or both in their entirety.

☐ 4. Indication that the developer, owner or prospective customer(s) understand(s) the Rules.

☐ 5. Having read and understood the Rules, the developer, owner or prospective customer(s) choose(s) to enter into the alternate main line extension agreement.

☐ 6. If the developer, owner or prospective customer(s) waive(s) reimbursement, the agreement should contain the waiver.

☐ 7. A copy of the applicable Rule(s) must be attached to the agreement.

☐ 8. A statement as to who will bear the cost of inspection, if any.

☐ 9. If the customer is to bear the cost of inspection, a statement of the maximum amount of the cost of inspection.

☐ 10. If the developer, owner or prospective customer(s) wish(es) to waive the right of receiving an estimate of the cost of the extension if constructed by the utility, a statement reflecting the waiver.

☐ 11. A statement as to the type of testing to be required.

☐ 12. A statement as to who will bear the cost of testing, if any.

☐ 13. If the customer is to bear the cost of the testing, a statement of the maximum amount of the cost of the testing.

☐ 14. A statement as to who will install the service connections.

☐ 15. If the developer, owner or prospective customer(s) is/are to install the service connections, a statement that the utility will not charge a tap fee.

☐ 16. A statement that the tap fee, if any to be charged, is the approved tap fee in the utility’s tariff.

☐ 17. A statement that the utility is to be indemnified and held harmless against any and all claims for injuries and/or damages which may arise from problems associated with the construction of the extension by the developer, owner or prospective customer(s).
18. A statement that the ownership of the extension will be conveyed to the utility prior to its connection to the utility’s system.

19. A statement indicating who will be responsible for preparing the plans for the extension.

20. If the developer, owner or prospective customer(s) is/are to be responsible for the preparation of the plan for the extension, a statement that the developer, owner or prospective customer(s) will provide plans to the Staff of the Public Service Commission if required.

21. The number of prospective customers to be served by the extension, the number of lots to be served, or some other general indication of the size of the area to be served by the extension.

22. If the initial cost estimate has not been waived, the estimate must be set forth in the agreement.

23. A warranty indicating that the developer, owner or prospective customers will warrant the system for a period of one year after completion of the construction, or after system is placed into service.

24. The agreement should not be executed before being sent to the Commission for approval.

25. A statement as to who will obtain and pay for necessary permits.

26. A statement as to who is responsible for the cost of the construction.

27. A statement as to who is responsible for the cost of the material.

28. A statement describing the extension, including length, diameter and any major components such as fire hydrants, etc.

NOTE: A paragraph such as “The Developer/Customer waives his rights under paragraph 5.3 or 5.5 of the Commission’s Rules” will not be acceptable as a catch-all for the requirements listed above. Each item must be addressed in the agreement.
WATER UTILITY REPORT
REPORT OF METERS, CUSTOMERS AND REFUNDS
TO THE
PUBLIC SERVICE COMMISSION OF WEST VIRGINIA
CHARLESTON

THIS REPORT TO BE MADE YEARLY

Name of Utility
Address
Names of Towns Covered by This Report
Period Covered by Previous Report to
Period Covered by This Report to

*Number of Old Meters from Service Tested During This Period Were:
  - More than 2% slow ____________
  - 1% to 2%, inclusive, slow ____________
  - less than 1% slow ____________
  - Total Slow ________________

  - More than 2% fast ____________
  - 1% to 2%, inclusive, fast ____________
  - less than 1% fast ____________
  - Total Fast ________________

**Number of New Meters, or Old Meters not from Service Tested During this Period
Total Meters Tested During this Period
Number of Tests Made at Customer’s Request as per This Report
Number of Tests Made at Commission’s Request as per This Report
Number of Meters Past Due for Test

<table>
<thead>
<tr>
<th>Metered Customers</th>
<th>Unmetered Customers</th>
<th>Total Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Residential Customers Served</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number Commercial Customers Served</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number Industrial Customers Served</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Residential, Commercial, Industrial Customers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number Public Fire Protection Customers Served</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Water Form No. 8
Number Private Fire
Protection Customers Served
TOTAL NUMBER OF CUSTOMERS
- ALL CLASSES

*Number of Refunds to be Made Account of Fast Meters Found During This Period

Total Amount of Refunds Account of Fast Meters Found During This Period

*Number of Customers to be Billed Account of Slow Meters Found During This Period

Total Amount to be Billed Account of Slow Meters Found During This Period

Report Covering Meter Tests Approved By:

Title

Report Covering Customers and Refunds Approved By:

Title

NOTES:

All spaces on this report MUST be filled in using “0” or the word “none” where applicable.

*Make special note if any Meters more than 2% fast or slow recorded above were used to measure service for company’s use, free customers, customers who had a minimum bill for the 3 months previous to date of test, or any other special condition.

**All new Meters must be tested and a record made of their condition before being installed, but a report of their present condition is not required.
QUALIFICATION CARD FOR WATER METERTESER

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employer</td>
<td>Shop Location</td>
<td>Title</td>
</tr>
</tbody>
</table>

GENERAL EXPERIENCE

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Company</th>
<th>Years</th>
</tr>
</thead>
</table>

*METER EXPERIENCE

<table>
<thead>
<tr>
<th>Type Meter</th>
<th>Nature of Work</th>
<th>Company</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disc or Displacement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compound</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Protection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Testing &amp; Repairing-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compound</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Protection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*State, under remarks, in detail the type or kind or work done on meters.

Should this application be approved, I will test all water meters in accordance with the Rules for the Government of Water Utilities of the Public Service Commission of West Virginia, and will not seal or approve for installation any meter that does not meet all of the requirements of the Rules for the Government of Water Utilities.

Signature
CERTIFICATE BY RESPONSIBLE REPRESENTATIVE OF THE UTILITY

I, ___________________________ of the ___________________________,

(Name) (Title)
certify that I have read the questions and answers on this (Water Company) card, relative to the experience of ___________________________,

(Name of Employer)
and that they are true and correct to the best of my knowledge and belief. I further certify that the above employee is competent to test and repair (Disc) (Current) (Compound) meters and will, faithfully and honestly discharge the duties of metertester.

Signature

======================================================================

TO BE FILED BY THE PUBLIC SERVICE COMMISSION

The above employee has been authorized to test Water Meters as shown below:

<table>
<thead>
<tr>
<th>Testing</th>
<th>Testing and Repairing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td></td>
</tr>
<tr>
<td>Compound</td>
<td></td>
</tr>
</tbody>
</table>

PSCWV Employee

date
WATER METERTESTER’S CARD

PUBLIC SERVICE COMMISSION OF WEST VIRGINIA
Charleston, West Virginia

No. Date

Name of Employee

is hereby authorized to test and repair the following type or types of water meters:

<table>
<thead>
<tr>
<th>Testing</th>
<th>Testing and Repairing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td></td>
</tr>
<tr>
<td>Compound</td>
<td></td>
</tr>
<tr>
<td>Utility</td>
<td></td>
</tr>
<tr>
<td>Shop Location</td>
<td></td>
</tr>
</tbody>
</table>

PSCWV Employee

(over)

(Back)

This card must be returned to the Public Service Commission of W. Va. by the

when leaves the employee of the

company or ceases to serve as metertester.
GENERAL INFORMATION: B

TITLE 64
LEGISLATIVE RULE
BUREAU FOR PUBLIC HEALTH

SERIES 15
CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION


1.1. Scope. -- This legislative rule governs cross-connection control and backflow prevention for public water systems. This rule should be read in conjunction with W. Va. Code 16-1-9, 16-1-9a, 16-1-17 and 16-1-18. The W. Va. Code is available in public libraries and on the Legislature’s web page: http://www.legis.state.wv.us/.


1.5. Repeal of former rule. -- This legislative rule repeals and replaces the Department of Health rule, “Cross-Connection and Backflow Prevention,” 64CSR15, effective April 1, 1976.


2.1. Application. -- This legislative rule applies to any owner, operator or customer of a public water system.

2.2. Enforcement. -- This rule is enforced by the Secretary of the Department of Health and Human Resources.


3.1. Air Gap Separation. -- A physical separation between the free-flowing discharge end of a water supply pipe and the flood level rim of a vessel open to the atmosphere having a minimum unobstructed vertical distance between the supply pipe equal to twice its inside diameter or one inch, whichever is greater.

3.2. Approved. -- Accepted by the Commissioner as being suitable for the proposed use.

3.3. Approved Backflow Prevention Assembly. -- A double check valve assembly, reduced pressure backflow prevention assembly, other devices or methods approved by the Commissioner for preventing backflow.

3.4. Auxiliary Water Supply. -- Any water source or system available within the building or premises other than the community public water system, including, but not limited to individual wells, springs and cisterns. A private water storage tank supplied by a community public water system is considered an auxiliary water supply unless its design meets the most current minimum design standards required for storage tanks for community public water systems, and the water contained in them is potable.

3.5. Backflow. -- The unintentional reversal of the normal direction of flow within a piping system.

3.6. Commissioner. -- The Commissioner of the Bureau for Public Health or his or her designee.
3.7. Cross-Connection. -- Any physical connection or other arrangement through which a backflow of liquids, gases or other substances into a public water system may occur.

3.8. Degree of Hazard. -- The potential risk to health and potential adverse effects upon the public water system based on the probability of backflow occurring and the type or nature of the contaminant.

3.9. Double Check Valve Assembly. -- An arrangement or device consisting of two (2) single independently acting watertight check valves with connections for testing the water-tightness of each check valve.

3.10. Flood Level Rim. -- The edge of the vessel or receptacle from which water overflows.

3.11. Health Hazard. -- Any condition, device or practice that in the judgment of the Commissioner creates or may create a danger to the health and well-being of the water customer.

3.12. Interchangeable Connection. -- An arrangement or device that allows the alternate but not simultaneous use of two (2) sources of water.

3.13. Low-Suction Pressure Cut-Off Controller. -- An arrangement or device designed to shut off a pump when the pressure at the suction side of the pump falls below a specified level.

3.14. Person. -- An individual, partnership, association, syndicate, company, firm, trust, corporation, government corporation, institution, department, division, bureau, agency, or any entity recognized by law.

3.15. Potable Water. -- Water free from impurities in amounts sufficient to cause disease or harmful physiological effects, with bacteriological, chemical, physical and radiological quality conforming to applicable regulations and standards of the bureau for public health.

3.16. Public Water System. -- A public water system is any water supply or system that regularly supplies or offers to supply water for human consumption through pipes or other constructed conveyances, if serving at least an average of twenty-five individuals per day for at least sixty days per year, or which has at least fifteen service connections, and shall include: (1) Any collection, treatment, storage, and distribution facilities under the control of the owner or operator of the system and used primarily in connection with the system; and (2) Any collection or pretreatment storage facilities not under such control which are used primarily in connection with the system. A public water system does not include a system which meets all of the following conditions: (1) Which consists only of distribution and storage facilities (and does not have any collection and treatment facilities); (2) Which obtains all of its water from, but is not owned or operated by a public water system that otherwise meets the definition; (3) Which does not sell water to any person; and (4) Which is not a carrier conveying passengers in interstate commerce.

3.17. Reduced Pressure Backflow Prevention Assembly. -- A device containing a minimum of two (2) independently acting check valves, an automatically operated pressure differential relief valve located between the two (2) check valves and watertight valves located at each end of the assembly, with connections for testing the operation of the device.

3.18. Severe Health Hazard. -- A hazard to the health of the user that could reasonably be expected to result in significant morbidity or death.

3.19. Unprotected Cross-Connection -- Any cross-connection with no approved backflow prevention assembly, air gap separation, double check valve assembly, or reduced pressure backflow prevention assembly installed.

3.20. Water Customer. -- The owner or person in charge of any building or premises supplied by or in any manner connected to a community public water system.
3.21. **Water Service Line.** -- A pipe or water line, with or without a meter and valves, through which the water customer conveys the water from the public water system to the initial point of use.

**64-15-4. Cross-Connections.**

4.1. No person shall install or maintain an unprotected cross-connection in a public water system.

4.2. The public water system shall not install a water service connection to any premises where a violation of Subsection 4.1 of this rule exists.

4.3. After giving written notice to the water customer with an opportunity for administrative due process, the public water system shall discontinue water service to any premises:

4.3.a. Where an unprotected cross-connection or unauthorized connection exists;

4.3.b. Where a required backflow prevention method has been removed or bypassed; or

4.3.c. When the public water system is denied entry to the water customer’s premises to confirm compliance with this rule.

4.4. When the public water system finds deficiencies in a water customer’s premises, as listed in Subsection 4.3 of this Section, the public water system shall:

4.4.a. Ensure that the public water system ceases water service to those premises until the deficiencies are corrected; and

4.4.b. Notifies the owner, person occupying or in charge of the premises of the findings and orders that the cross-connection be removed or that an approved backflow prevention method be installed prior to water service resuming.

**64-15-5. When Protection Is Required.**

5.1. Each water service line requires installation of an approved backflow prevention method when the public water system determines that either an actual or potential health hazard, or other degradation of the public water system, including the following, exists:

5.1.a. On premises that have unprotected internal cross-connections that the public water system determines are not correctable or that have intricate plumbing arrangements that make it impractical to determine whether unprotected cross-connections exist;

5.1.b. On premises where it is impossible or impractical to make a cross-connection survey because of security requirements or other prohibitions or restrictions;

5.1.c. On premises that have a repeated history of unprotected cross-connections; and

5.1.d. On others specified by the public water system.

5.2. Each water service line, including but not limited to, the following types of facilities, requires installation of an approved backflow prevention method, unless investigation by the public water system determines that no actual or potential health hazard, or other degradation of the public water system exists:
5.2.a. Hospitals, mortuaries, clinics, nursing homes, and animal hospitals;
5.2.b. Laboratories;
5.2.c. Sewage treatment plants, sewage pumping stations, and storm water pumping stations;
5.2.d. Chemical plants, dyeing plants, metal plating industries, and tanneries;
5.2.e. Petroleum processing or storage plants;
5.2.f. Slaughterhouses, poultry processing plants, and food or beverage processing plants;
5.2.g. Piers, docks, and waterfront facilities;
5.2.h. Photo development plants;
5.2.i. Car washes and laundromats;
5.2.j. Public swimming pools;
5.2.k. Farms when they use water for reasons other than household purposes; and
5.2.l. Other facilities specified by the community public water system.

64-15-6. Type of Protection and Circumstances When Protection Is Required.

6.1. The type of protection required under this rule depends on the degree of hazard that exists or may exist, as determined by the public water system and shall involve the installation of either:

6.1.a. An approved air gap separation when the public water system determines that contamination with substances could cause a severe health hazard;

6.1.b. An approved air gap separation or approved reduced pressure principle backflow prevention assembly when the public water system determines that contamination with substances could cause a health hazard; or

6.1.c. An approved double-check valve assembly, approved reduced pressure principal backflow prevention assembly, or an approved air gap separation when the public water system determines that contamination with substances could degrade the water quality of the public water system.

6.2. When the public water system does not approve any point of connection between a public water system and an auxiliary water supply, the water customer shall install an approved air gap separation or an approved interchangeable connection with a reduced backflow prevention assembly.

6.3. When a water customer installs a booster pump on the premises served by a public water system, or on the service line to the premises, the customer shall install a check valve on the discharge and a low-suction pressure cut-off controller designed to shut off the booster pump when the pressure in the service line on the suction side of the pump drops to twenty (20) pounds per square inch gauge or less.

6.4. On premises where backflow prevention assemblies are required by this rule, and the public interest requires continuous uninterrupted service, the water customer shall install two (2) approved backflow prevention assemblies in parallel and shall properly valve them to permit continuous operation, or service to the premises shall be from two separate water service lines each protected by an approved backflow prevention
6.5. Water customers that are open to the public shall be required to install internal backflow prevention methods as part of the public water system’s approved backflow prevention program in Section 8 of this rule.


7.1. The public water system shall approve installation of an approved backflow prevention assembly at a location and in a manner that best facilitates testing and servicing in accordance with the approved cross connection and backflow prevention program in Section 8.2. of this rule.

7.2. The water customer shall purchase, install, maintain and test any backflow prevention assembly according to this rule.

7.3. When any approved backflow prevention assembly is found to be defective, the water customer shall immediately notify the public water system of any defect and within ten (10) days shall repair, overhaul, replace, and test the assembly again at the water customer’s expense.


8.1. The water customer shall provide the public water system with all drawings, plans, specifications and other data related to the backflow prevention assemblies so that the public water system can ensure the water customer’s compliance with this rule.

8.2. The public water system shall establish a cross-connection and backflow prevention program approved by the Commissioner.

8.3. The water customer shall furnish information on water use practices for facilities within the water customer’s premises, including plumbing diagrams, drawings, or plans, at the request of the public water system.

8.4. The water customer on any premises that under this rule require the installation of backflow prevention assemblies, is responsible for getting the assemblies inspected and for the cost of the required inspections.

8.4.a. The water customer shall ensure that a person certified by the Commissioner as a certified backflow assembly tester inspects and tests the backflow prevention assemblies upon installation and at least every twelve (12) months after that; and

8.4.b. The certified backflow assembly tester shall provide records of all inspections and tests to the public water system within 15 days of the inspection or test.

8.5. The public water system shall maintain records of all inspections, surveys, tests and corrective actions taken, for a period of at least two (2) years and provide the information to the Commissioner upon request.

8.6. The public water system shall request permission from a potential water customer to inspect the premises and dwellings formerly served by individual wells when the public water system believes unprotected cross-connections may exist. If the potential water customer does not allow the inspection, the refusal will be grounds not to supply water service.

8.7. No provisions of this rule shall relieve the water customer of the responsibility for conducting surveys of water use practices on his or her premises to determine whether there are actual or potential unprotected cross-connections.

8.8. Requirements of this rule shall be in accordance with all applicable guidelines contained in the West


9.1. This rule is enforced under W. Va. Code 16-1-6, 16-1-9, 16-1-9a, 16-1-17, 16-1-18 and other applicable Code provisions.


10.1. Any person who violates any provision of this rule or orders issued under this rule is subject to injunction, criminal prosecution, and criminal, civil and administrative fines, all as provided in W. Va. Code 16-1-9, 16-1-9a, 16-1-17 and 16-1-18.


11.1. Those persons adversely affected by the enforcement of this rule may request a contested case hearing in accordance with the Division of Health rule, “Rules and Procedures for Contested Case Hearings and Declaratory Rules,” 64 CSR 1.
GENERAL INFORMATION:

TITLE 64
LEGISLATIVE RULE
BUREAU FOR PUBLIC HEALTH

SERIES 25
CERTIFICATION OF BACKFLOW PREVENTION
ASSEMBLY TESTERS


1.1. Scope. -- This legislative rule governs the examination and certification of backflow prevention assembly testers. The W. Va. Code is available in public libraries and on the Legislature’s web page: http://www.legis.state.wv.us/.


2.1. Application. -- This rule applies to certified backflow prevention assembly testers as defined in Section 3 of this rule.

2.2. Enforcement. -- This rule is enforced by the Commissioner of the Bureau for Public Health or his or her designee.


3.1. Applicant. -- An individual who has applied for certification as a backflow prevention assembly tester.

3.2. Approved. -- Accepted by the Commissioner.

3.3. Backflow Prevention Assembly Tester Certification. -- a written document issued by the Commissioner certifying an individual as a tester for backflow prevention assemblies.

3.4. Certified Backflow Prevention Assembly Tester. -- An individual who meets all of the requirements under this rule to be certified to inspect and test backflow prevention assemblies or methods.

3.5. Commissioner. -- Commissioner of the West Virginia Bureau for Public Health or his or her designee.

64-25-4. Qualifications for Certification.

4.1. Applicants for certification as a backflow prevention assembly tester shall:

4.1.a. Be a minimum of eighteen (18) years of age;

4.1.b. Have either a high school diploma or general education diploma (GED); and
4.1.c. Either:

4.1.c.1. Complete and pass all parts of an approved forty (40) hour course of instruction in theory, design, performance, testing and maintenance of backflow prevention assemblies; or

4.1.c.2. Meet re-certification, reinstatement or reciprocity requirements as provided in sections 7 or 8 of this rule.

64-25-5. Certification Application.

5.1. Application.

5.1.a. An applicant for certification as a backflow prevention assembly tester shall submit an application (Form EW-75, available from the Bureau for Public Health), proof of education and proof of completing an approved course of instruction as identified in Section 4 of this rule.

5.1.b. Any applicant who commits fraud or misrepresentation on the application will be permanently disqualified from consideration.


6.1. The Commissioner shall schedule the two part (written and performance) examination for those applicants who meet the requirements in Section 4 of this rule and shall notify the applicants at least fourteen (14) days before the scheduled examination date.

6.2. The examinations shall consist of a performance examination and a closed book written examination. Exceptions to the written part are:

6.2.a. An applicant may make written request to the director at least thirty (30) days before a scheduled examination date for an oral examination to be given instead of the written examination;

6.2.a.1. Before an oral examination will be given, an applicant shall obtain written approval from the Commissioner; and

6.2.a.2. The taking of an oral examination shall not affect the performance examination requirement.

6.2.b. All examinations shall be administered in English.

6.3. Examination grade.

6.3.a. An applicant’s certification status shall be determined by the examination grade.

6.3.b. To pass the examination, an applicant is required to make a minimum grade of seventy percent (70%) on the written examination, and must demonstrate competence to the Commissioner on the performance examination.

6.3.c. An applicant who does not receive a passing grade on the written or successfully complete the performance examination shall wait a minimum of sixty (60) days before applying for reexamination.

6.3.d. An applicant who fails an examination three (3) times shall wait a minimum of one (1) year before reexamination.
6.4. Ineligible Applicants:

6.4.a. The Commissioner shall declare the examination scores of any applicant who corrupts or attempts to corrupt the examination process invalid and shall declare the applicant ineligible for certification upon discovery of the applicant’s conduct.

6.4.b. Conduct resulting in invalidation of the examination includes:

6.4.b.1. Any action that violates the security of examination materials, such as removal of any examination materials from the examination room;

6.4.b.2. Communicating with any other examinee or permitting one’s answers to be copied by another examinee; or

6.4.b.3. Falsifying or misrepresenting information for admission to the examination, impersonating an examinee or having someone else take the licensing examination on one’s own behalf.


7.1. Expiration. Backflow prevention assembly tester certifications expire three (3) years after the date of issue.

7.2. For re-certification:

7.2.a. Backflow prevention assembly testers shall submit a written application (Form EW-75, available from the Bureau for Public Health) to the Commissioner at least thirty (30) days before and no more than ninety (90) days prior to expiration of current certification and the application shall include documentation, satisfactory to the Commissioner, that the applicant has sufficient experience or has attended one or more approved continuing education courses for backflow prevention assembly testers during the past three (3) years.

7.2.b. Testers who fail to submit an application for re-certification or submit an incomplete application within the time period stated in Subdivision 7.2.a. of this rule shall retake and pass both the written and performance examinations in accordance with Section 6 of this rule before the applicant will be re-certified.

7.3. Revocation or suspension. The Commissioner may revoke or suspend the certificate of any person who fraudulently obtains certification, or is found to have committed neglect, incompetency or misconduct in the performance of his or her duties as a backflow prevention assembly tester, including non-compliance with this rule. Any person whose certificate is suspended must cease any inspection and testing of backflow prevention assemblies until their certification is reinstated.

7.4. Reinstatement. The Commissioner may reinstate any person whose certification has been revoked upon being presented with satisfactory evidence that all deficiencies leading to the revocation have been corrected.

64-25-8. Reciprocity.
8.1. The Commissioner may grant West Virginia certification to a backflow prevention assembly tester certified by another jurisdiction, if written proof is presented to the Commissioner that:

8.1.a. The applicant has successfully passed a certification examination at least equivalent to that required under this rule;

8.1.b. The applicant has successfully completed a course of instruction at least equivalent to that required under this rule; and

8.1.c. The applicant meets the educational and age requirements of this rule.


9.1. A person subject to the provisions of this rule shall comply fully with them and shall not direct or assist another person to violate this rule.

9.2. A person who violates any provision of this rule is subject to the criminal penalties of West Virginia Code 16-1-18.

64-25-10. Administrative Due Process.

10.1. Those persons adversely affected by the enforcement of this rule may request a contested case hearing in accordance with the Division of Health rule, “Rules and Procedures for Contested Case Hearing and Declaratory Rulings,” 64CSR1.
64-61-1. General.

1.1. Scope. -- This legislative rule establishes state standards and procedures and adopts national safe drinking water standards for capacity development. The 1996 Safe Drinking Water Act amendments require states to ensure that all new community water systems and new nontransient noncommunity water systems demonstrate technical, managerial, and financial capacity to be able to comply with national drinking water regulations. Further, the Safe Drinking Water Act (SDWA) amendments require states to develop a strategy to address the capacity of all public water systems to include:

1.1.a. Determining which public water systems need help and in what order of priority;
1.1.b. Describing enhancers and inhibitors of developing capacity;
1.1.c. Determining a plan of action to help systems in need comply with the SDWA;
1.1.d. Establishing a baseline and measuring program; and
1.1.e. Identifying, in as much as possible, all persons who are interested in or involved with capacity development.

1.2. Authority. -- W. Va. Code 16-13C-2(b) and 16-1-7.

1.3. Filing Date. -- April 14, 1999.

1.4. Effective Date. -- May 14, 1999.

1.5. Administration. -- This rule is administered by the division of health of the department of health and human resources.1

1.6. References.

1.6.b. West Virginia Division of Health, Public Water Systems, 64CSR3.
1.6.c. West Virginia Division of Health, Drinking Water Treatment Revolving Fund, 64CSR49.

1The department of health and human resources (DHHR) was created by the Legislature’s reorganization of the executive branch of state government in 1989. The department of health was renamed the division of health and made a part of the DHHR (W. Va. Code 5F-1-1 et seq.). Administratively, within the DHHR, the bureau for public health through its commissioner carries out the public health function of the division of health.
1.6.e. West Virginia Division of Health, Water Well Regulations, 64CSR19.
1.6.f. West Virginia Division of Health, Water Well Design Standards, 64CSR46.
1.6.g. West Virginia Division of Health, Intended Use Plan for the West Virginia Drinking Water Treatment Revolving Fund.
1.6.h. West Virginia Division of Health, Design Standards for Public Water Supply System, 64CSR42.
1.6.i. West Virginia Division of Health, Mobile Home Parks, 64CSR40.

64-61-2. Application and Enforcement.

2.1. Application - This rule applies to all community water systems and nontransient noncommunity water systems as defined in Section 3 of this rule. This rule does not apply to private water wells. This rule does not require consumers serviced by private water wells to abandon their wells nor to connect to any new or existing public water system or community water system as defined in Section 3 of this rule.

2.2. Enforcement - This rule is enforced by the director of the division of health.

64-61-3. Definitions.

3.1. Capacity -- Capacity refers to a water system’s ability to consistently provide safe drinking water for its customers. A water system must have the technical abilities, managerial skills, and financial resources to meet state and federal drinking water regulations.

3.2. Capacity development -- A program and a tool which helps to ensure all community public water systems and nontransient noncommunity water systems demonstrate the technical, managerial, and financial capacity to comply with Safe Drinking Water Act requirements and to benefit their customers.

3.3. Community water system -- A public water system which serves at least fifteen (15) service connections used by year-round residents or regularly serves at least twenty-five (25) year-round residents.

3.4. Director -- The director of the division of health or his or her designees from the division who are charged with enforcement of this rule.

3.5. Existing public water system -- Any community water system or nontransient noncommunity water system which came into existence prior to October 1, 1999.

3.6. Financial capacity -- The financial resources of the water system, including but not limited to the revenue sufficiency, credit worthiness, and fiscal controls.

3.7. Managerial capacity -- The management structure of the water system, including but not limited to ownership accountability, staffing, organization, and effective external linkages.

3.8. New public water system -- Any community or nontransient noncommunity water system which comes into existence on or after October 1, 1999.
3.9. **Noncommunity water system** -- Any public water system that is not a community water system.

3.10. **Nontransient noncommunity water system** -- A public water system that is not a community water system and that regularly serves the same twenty-five (25) or more persons over six (6) months per year.

3.11. **Person** -- An individual, partnership, association, syndicate, company, firm, trust, corporation, county or municipal government, public or private institution, department, division, bureau, agency, federal agency, or any other entity recognized by law.

3.12. **Public water system** -- A system which provides water to the public for human consumption through pipes or other constructed conveyances, if the system has at least fifteen (15) service connections or regularly serves at least twenty-five (25) individuals.

3.12.a. Public water system includes:

   3.12.a.1. Any collection, treatment, storage, and distribution facilities under the control of the operator of a system and used primarily in connection with the system; and

   3.12.a.2. Any collection or pretreatment storage facilities not under the control of the operator of the system which are used primarily in connection with the system.

3.12.b. A public water system does not include a system which meets all of the following conditions:

   3.12.b.1. It consists only of distribution and storage facilities and does not have any collection and treatment facilities;

   3.12.b.2. It obtains all of its water from, but is not owned or operated by, a public water system which otherwise meets the definition;

   3.12.b.3. It does not sell water to any person; and

   3.12.b.4. It is not a carrier conveying passengers in interstate commerce.

3.13. **Safe Drinking Water Act** - A federal statute commonly known as the “Safe Drinking Water Act” - 42 USC 300f et seq.

3.14. **Sanitary Survey** -- An on-site review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of the source, design, facilities, equipment, operation and maintenance for producing and distributing drinking water, as described in the federal regulations adopted in this rule.

3.15. **Technical capacity** -- The physical infrastructure of the water system, including but not limited to the source water adequacy, the infrastructure adequacy (including wells, source water intakes, or both, treatment, storage, and distribution), and the ability of system personnel to implement the requisite technical knowledge.

---

**64-61-4. Capacity Development of New Public Water Systems.**

4.1. A person shall obtain a permit from the director before constructing or awarding a contract to
construct a public water system. A person shall obtain approval in writing from the director before establishing a public water system, and the system shall be installed or established in accordance with the plans, specifications and instructions issued by, or approved in writing by, the director.

4.2. A person seeking a permit to construct shall submit to the director an application in accordance with the rule referenced in subdivision 1.6.b. of this rule. The application shall include an engineering report which provides a detailed discussion of the proposed system’s capacity to operate, with an emphasis on financial capacity. The engineer, owner, or both shall provide proof to the director that the owner has the technical, managerial, and financial capacity to operate and maintain the new system. The director shall consult with the public service commission and the water development authority, as well as other affiliated agencies as necessary, concerning the financial and managerial capacity.

4.3. A permit to construct may be revoked by the director for failure of the public water system to comply with this rule.

4.4. The public water system shall be constructed in accordance with the plans and specifications approved by the director in accordance with the rule referenced in subdivision 1.6.h. of this rule.

4.5. The director may issue an order requiring a change in the source of the water supply for the system or in the manner of collection, treatment, storage, or distribution facilities of the system before delivery to the consumer, as may be necessary to safeguard the public health.

4.6. A new public water system shall not commence operation without written approval to proceed from the director.


5.1. The director may develop a program for the issuing of a permit to operate a public water system. The director may revoke a permit for failure of the permittee to comply with the requirements of this rule or the requirements of the rule Division of Health, Public Water Systems, 64CSR3. The director shall not issue a permit until he or she has reasonable assurance that the system has achieved or is actively pursuing the technical, managerial, and financial capacity needed to operate in accordance with this rule.

5.2. The capacity of a system shall be assessed using the following indicators:

5.2.a. Compliance data;

5.2.b. Construction permits;

5.2.c. Sanitary surveys;

5.2.d. Annual reports;

5.2.e. Water system plans or business plans;

5.2.f. Compliance reports;

5.2.g. Self-assessment/peer reviews;

5.2.h. Regional plans;

5.2.i. Criteria used by lenders;
5.2.j. Financial viability assessment methods;
5.2.k. Operator certification;
5.2.l. Financial and managerial training;
5.2.m. Permit application data;
5.2.n. Capital improvement plans;
5.2.o. Comprehensive performance evaluation;
5.2.p. Consumer complaint records;
5.2.q. State-wide studies of water quality or quantity;
5.2.r. State revolving fund loan application;
5.2.s. Budgeting worksheets;
5.2.t. Annual financial reports;
5.2.u. Source water assessment programs;
5.2.v. Water conservation plans;
5.2.w. Emergency response plans;
5.2.x. Certificates of convenience and necessity (CCN);
5.2.y. Review of audit reports;
5.2.z. Bond issue reviews;
5.2.aa. Rate reviews and approvals;
5.2.bb. Credit rating services;
5.2.cc. Financial assurance mechanisms;
5.2.dd. Consumer confidence reports; and
5.2.ee. Interviews with personnel familiar with the system.

5.3. A prospective new owner of a public water system shall submit to the director a written application to transfer the permit. The application shall be submitted at least fifteen (15) calendar days before the proposed change of ownership.

5.4. A public water system shall conspicuously post at its treatment plant a copy of the current permit to
operate. The original shall be kept on file and available to the director upon request.

64-61-6. Inspections and Sanitary Surveys of Public Water Systems.

6.1. Public water systems shall be inspected as scheduled by the director, and sanitary surveys shall be conducted by the director.

6.2. Surveys will be performed with in-depth emphasis on capacity development. As a minimum, inspectors shall evaluate the following:

6.2.a. The reliability of the system’s overall infrastructure, including source water protection, treatment, distribution system, and storage;

6.2.b. The treatment process schematic diagrams and determination of the appropriateness of the treatments given the sources used and raw water quality;

6.2.c. The distribution system maps and plan, including operation and maintenance schedules and procedures;

6.2.d. Pump operating condition, including the presence of reserve pumps;

6.2.e. The technical competence of the system operator;

6.2.f. Overall management and operations of the system;

6.2.g. Safety practices; and

6.2.h. Records and record keeping.

64-61-7. Penalties.

7.1. Penalties are as provided in W. Va. Code 16-1-18. In addition, the director may seek injunctive relief in the circuit court of the county in which all or part of the public water system is situated for threatened or continuing violations.


8.1. Those persons adversely affected by the enforcement of this rule desiring a contested case hearing to determine any rights, duties, interests, or privileges shall do so in a manner prescribed in the rule, Division of Health, Rules of Procedure for Contested Case Hearings and Declaratory Rulings, 64CSR1.
64-77-1. General.

1.1. Scope. -- The State of West Virginia provides for the regulation of public water supplies to promote and protect the public health by having the public served safe and potable water. The West Virginia Division of Health is empowered to adopt rules to implement the intent of the law.

1.1.a. This rule has been prepared to assist professional engineers responsible for the design and construction of public water supply systems. The design of these facilities shall not be limited by minimum requirements, but shall meet the needs of the particular situation. Nothing in this rule shall be construed as preventing the consulting engineer from recommending, or the West Virginia Division of Health, Environmental Engineering Division, from approving, more effective treatment where local conditions dictate such action.

1.1.b. The West Virginia Division of Health, Environmental Engineering Division will require, before approval can be granted, that the applicant or the applicants engineer submit reliable engineering data and a report if new or innovative technology is proposed. The Environmental Engineering Division may permit an experimental installation. The Environmental Engineering Division will require the experimental installation to be replaced by a conventional installation, if the experimental installation fails to produce satisfactory results, as determined by the Environmental Engineering Division.

The Recommended Standards for Water Works, 1992 Edition of the Great Lakes - Upper Mississippi River Boards of State Sanitary Engineers were used as a guide for this rule.


1.3. Filing Date. -- April 13, 2000.

1.4. Effective Date. -- July 1, 2000.

1.5. Repeal of former rule. -- This legislative rule repeals and replaces the interpretive rule of the Division of Health, Design Standards for Public Water Supply Systems, 64CSR42, filed October 30, 1969 and effective January 1, 1970.

64-77-2. Definitions.


2.2. ANSI. -- American National Standard Institute, 11 W. 42nd St. 13th Floor, New York, NY 10036, (212) 642-4900.


2.5. AWWA. -- American Water Works Association, 6666 West Quincy Ave., Denver, CO 80235, (303) 794-7711.

2.6. Chlorine Institute, Inc. -- a trade association of companies that are involved in the safe production, distribution and use of chlorine products. Their address is 2001 L Street, N.W., Suite 506, Washington, D.C. 20036

2.7. Community Water System. -- a public water system that pipes water for human consumption to at least 15 service connections used by year-round residents, or one that regularly serves at least 25 year-round residents (e.g., municipality, subdivision, mobile home park).

2.8. CT. -- C, residual disinfectant (mg/l) x T, contact time (min).

2.9. ISO. -- Insurance Service Office, 7 World Trade Center New York, NY 10048, (212) 898-6000.

2.10. MF. -- Membrane filter.

2.11. MPN. -- Most probable number.

2.12. NEC. -- National Electric Code, Quincy, MA 02269.

2.13. NGWA. -- National Ground Water Association, 601 Dempsey Road, Westerville, OH 43081-9895, (800) 551-7379.


2.15. Non-Community Non Transient Water System. -- a public water system that serves at least 25 of the same persons over six months per year (e.g., schools, factories, industrial parks, office buildings).

2.16. NSF. -- National Sanitary Foundation, 3475 Plymouth Rd., P.O. Box 130140, Ann Arbor, MI 48113-0140, (313) 922-6222.

2.17. NTU. -- Nephelometric turbidity units.


2.19. PVC. -- Polyvinyl chloride.

2.20. Standard Methods for the Examination of Water and Wastewater. -- A joint publication of the American Public Health Association, the AWWA and the Water Pollution Control Association.

2.21. Transient Water System. -- a public water system that serves at least 25 people (not the same people) at least 60 days a year (e.g., highway rest stops, motels, restaurants, parks).


2.23. WVDEP. -- West Virginia Division of Environmental Protection, 1201 Greenbrier St., Charleston, WV 25311, (304) 558-4086.
64-77-3. Submission of Plans.

3.1. General -- The applicant or the applicant’s engineer shall submit all reports, final plans and specifications, in the time frame noted in the Department of Health Rule, West Virginia Public Water System Rules, 64 CFR 3, prior to the date on which action by the Environmental Engineering Division is desired. For public water system wells, if emergency conditions prohibit meeting the permit application requirements, the applicant, the applicant’s engineer, or the West Virginia Certified Water Well Driller that drilled the well shall notify the Environmental Engineering Division by facsimile, E-mail, or telephone within five (5) calendar days after the emergency well is drilled. Emergency conditions exist when public water systems experience source water outages, low source water quantity due to drought or source water failure to produce enough water for daily demands, or existing source water sudden contamination by a regulated contaminant in which the maximum contaminant level is exceeded. For emergency wells, the applicant or the applicant’s engineer, shall submit the permit application within thirty (30) calendar days after the well is drilled. Emergency wells shall meet all of the requirements of this rule and shall be drilled by a West Virginia Certified Water Well Driller. Permits for construction, for waste discharges, for stream crossings, etc., may be required from other federal, state or local agencies. Preliminary plans and the engineer's report shall be submitted for review prior to the preparation of final plans. The Environmental Engineering Division shall issue a permit to construct only after review and approval of submitted final, complete detailed applications, plans and specifications.

3.1.a. The applicant shall submit four (4) complete sets of documents for a formal review by the Environmental Engineering Division. The documents shall include but not be limited to: application forms; a summary of the basis of design; operation requirements, where applicable; general layout; detailed plans; and specifications.

3.1.b. All installation and operations shall meet or exceed the relevant requirements of the national, state, local or trades, good practices, regulations and codes, whichever has jurisdiction.

3.2. Engineer's Report -- The engineer's report for public water systems improvements shall, where pertinent, present the following information:

3.2.a. General information, including a description of the existing public water systems and wastewater facilities; identification of the municipality or area served; and the name and mailing address of the owner or official custodian;

3.2.b. The extent of the public water system, including a description of the nature and extent of the area to be served; provisions for extending the public water system to include additional service areas; and an appraisal of the future requirements for service, including existing and potential industrial, commercial, institutional and other water supply needs;

3.2.c. List the alternate plans where two (2) or more solutions exist for providing public water supply facilities, each of which is feasible and practicable and give reasons for selecting the one (1) recommended, including financial considerations and a comparison of the minimum classifications of the public water system operators required for operation of each alternative facility;

3.2.d. Soil, groundwater conditions, and foundation problems, including a description of: the character of the soil through which water mains are to be laid; foundation conditions prevailing at sites of proposed structures, and the approximate elevation of ground water in relation to subsurface structures;

3.2.e. Water use data, including a description of the customer and population trends as indicated by available records, and the estimated population that will be served by the proposed water supply system or expanded system. Water use data shall also include present water consumption and the projected average and maximum daily demands, including fire flow demand; present and estimated yields of the sources of supply; unusual occurrences, and unaccounted for water;
3.2.f. Water distribution shall have normal, minimum and maximum pressures with and without fire flow at the beginning of the system, at the ends of the system and intermediate points throughout the system. Include supporting data used as basis for design;

3.2.g. Flow requirements, including hydraulic analyses based on flow demands and pressure requirements; and fire flows, when fire protection is provided, which meet the recommendations of the ISO or other similar agency for the service area involved;

3.2.h. Describe the existing wastewater system with special reference to its relationship to existing or proposed public water system structures that may affect the location and operation of the public water system, or that may affect the quality of the supply;

3.2.i. Describe the proposed source or sources of water supply to be developed, the reasons for their selection, and provide the following information:

3.2.i.1. Surface water sources, including hydrological data, stream flow and weather records; safe yield, including all factors that may affect it; and maximum flood flow, together with approval for safety features of the spillway and dam from the appropriate reviewing authority. Include a description of the watershed, noting any existing or potential sources of contamination (such as highways, railroads, chemical facilities, etc.) that may affect water quality, and data on the quality of the raw water with special reference to fluctuations in quality, changing meteorological conditions, regulated contaminant levels, etc.;

3.2.i.2. Groundwater sources, including sites considered; advantages of the site selected; elevations with respect to surroundings; probable character of formations through which the source is to be developed, and geologic conditions affecting the site, such as anticipated interference between proposed and existing wells;

3.2.i.3. A summary of source exploration, test well depth and the method of construction; placement of liners or screen; test pumping rates and their duration; water levels and specific yield; and water quality;

3.2.i.4. Sources of possible contamination such as sewers and sewerage facilities, highways, railroads, landfills, outcroppings of consolidated water-bearing formations, chemical facilities, waste disposal wells, etc.; and

3.2.i.5. A description and plat of the system's wellhead protection area and plan;

3.2.j. Summarize and establish the adequacy of proposed treatment processes and unit parameters for the treatment of the specific water under consideration. Alternative methods of water treatment and chemical use shall be considered as a means of reducing waste handling and disposal problems. Pilot studies shall be included, if applicable;

3.2.k. Discuss the various aspects of waste disposal from the water treatment plant, including volume, proposed treatment and points of discharge;

3.2.l. Provide supporting data justifying the use of automatic equipment, including the servicing and operator training to be provided. Manual override and redundancy shall be provided for any automatic controls;

3.2.m. Give personnel information including the required number of plant operators and relief plant operators, distribution system maintenance personnel, meter readers, and clerical personnel needed to provide adequate coverage;

3.2.n. Project sites, including the discussion of the various sites considered and advantages of the
recommended ones; the proximity of residences, industries, and other establishments, and any potential sources
of pollution that may influence the quality of the supply or interfere with effective operation of the public water
system, such as sewage absorption systems, septic tanks, privies, cesspools, sink holes, sanitary landfills, refuse
and garbage dumps, etc.;

3.2.o. Financing, including estimated cost of integral parts of the system; detailed estimated annual
cost of operation; and proposed methods to finance both capital charges and operating expenses; and

3.2.p. Summarize planning for future needs and services.

3.3. Plans. -- Plans for public water system improvements shall, where pertinent, provide the following:

3.3.a. A general layout which shall include: a suitable title; the name of the municipality, other entity
or person responsible for the water system; the area or institution to be served; the scale; the north point;
datums used; boundaries of the municipality or area to be served; date, name and address of the designing
engineer; the imprint of the professional engineer's seal or the conformance with engineering registration
requirements of West Virginia; legible prints suitable for reproduction; the location and size of existing and
proposed water mains; and the location and nature of existing public water system structures and
appurtenances affecting the proposed improvements, noted on one sheet;

3.3.b. Detailed plans which shall include:

3.3.b.1. Stream crossings, providing profiles with elevations of the stream bed and the normal and
extreme high and low water levels;

3.3.b.2. Profiles having a horizontal scale of not more than two hundred (200) feet to the inch and
a vertical scale of not more than ten (10) feet to the inch, with both scales clearly indicated. Profiles are not
required for water main construction, however, critical elevations (high points, low points, water tanks, booster
stations, etc.) are required;

3.3.b.3. The location and size of the property to be used for the groundwater development with
respect to known references such as roads, streams, section lines, or streets;

3.3.b.4. The topography and arrangement of present or planned wells or structures, with contour
intervals not greater than two (2) feet;

3.3.b.5. Elevations of the one hundred (100) year flood level, the floor of the structure, upper
terminal of protective casings and outside surrounding grade, using United States Coast and Geodetic Survey,
United States Geological Survey or equivalent elevations where applicable as reference;

3.3.b.6. Plat and profile drawings of well construction, showing the estimated diameter and depth
of drill holes, casing and liner diameters and depths, grouting depths, elevations and designation of geological
formations, water levels and other details to describe the proposed well completely;

3.3.b.7. The location of all existing and potential sources of pollution that may affect the water
source or underground treated water storage facilities;

3.3.b.8. The size, length, and identity of sewers, drains, and water mains, and their locations
relative to plant structures;

3.3.b.9. Schematic flow diagrams and hydraulic profiles showing the flow through various plant
units;

3.3.b.10. Piping in sufficient detail to show flow through the plant, including waste lines;

3.3.b.11. The locations of all chemical storage areas, feeding equipment and points of chemical
application;

3.3.b.12. All appurtenances, specific structures, equipment, water treatment plant waste disposal units and points of discharge having any relationship to the plans for water mains and public water system structures;

3.3.b.13. The locations of sanitary or other facilities, such as lavatories, showers, toilets, and lockers, when applicable or required by the Environmental Engineering Division;

3.3.b.14. The locations, dimensions, and elevations of all proposed plant facilities;

3.3.b.15. The locations of all sampling taps; and

3.3.b.16. An adequate description of any features not otherwise covered by the specifications;

3.3.c. Plan sheet sizes which are a minimum eighteen (18) inches by twenty-four (24) inches or a maximum twenty-four (24) inches by thirty-six (36) inches. The base mapping for water line construction shall accurately reflect the current surface features along the proposed water line routing; and

3.3.d. Aerial photo-enlargement plans which may be used for water line construction, provided the enlargement is done utilizing electronic media (for archival purposes).

3.4. Specifications -- The applicant or the applicant’s engineer shall supply complete, detailed technical specifications for the proposed project, including: pipe, valves and other building materials; a program for keeping existing public water system facilities in operation during construction of additional facilities so as to minimize interruption of service; laboratory facilities and equipment; the number and design of chemical feeding equipment; and materials or proprietary equipment for sanitary or other facilities including any necessary backflow or back-siphonage protection.

3.5. Design Criteria -- The applicant or the applicant’s engineer shall submit a summary of the complete design criteria for the proposed project, containing but not limited to the following: the long-term dependable yield of the source of supply; the reservoir surface area, volume, and a volume-versus-depth curve, if applicable. The summary shall include the area of watershed, if applicable; the estimated average and maximum day water demands for the design period; number of proposed services; fire fighting requirements; flash mix, flocculation and settling basin capacities; retention times; unit loadings; the filter area, proposed filtration rate, and filter media; the backwash rate; feeder capacities and ranges, and disinfection facilities and CT calculations, where applicable. The summary shall include special facilities such as aerators, corrosion control, softeners, fluoridation, iron and manganese removal, taste and odor control. Summary shall include design calculations, including head loss, distribution system analysis and pressures at all high and low points under all flow conditions (normal flow, maximum design flow and normal flow with fire flow).

3.6. Revisions to Approved Plans -- The applicant or the applicant’s engineer shall obtain approval from the Environmental Engineering Division before deviating from approved plans or specifications. Revised plans or specifications shall be submitted in time to permit the review and approval of the plans or specifications before any construction work, which will be affected by the changes, is begun.

3.7. Additional Information Required -- The Environmental Engineering Division may require additional information from the applicant that is not part of the construction drawings, such as proprietary technical data, copies of deeds, copies of contracts, etc.

64-77-4. General Design Considerations.

4.1. General -- The design of a public water system or treatment process encompasses a broad area and
thus, is dependent upon the type of system or process involved.

4.2. Design Basis -- The system including the water source, treatment facilities, operation and distribution system shall be designed for maximum day demand at the design year.

4.3. Plant Layout -- The public water system’s engineer of the plant shall consider: functional aspects of the plant layout, including provisions for future plant expansion; provisions for expansion of the plant waste treatment and disposal facilities, including filter backwash effluent; access roads; site grading; site drainage; walks; driveways; and chemical delivery and storage.

4.4. Building Layout -- The designer of the building shall provide for: adequate ventilation, lighting, heating and drainage; dehumidification equipment, if necessary; accessibility of equipment for operation, servicing, and removal; flexibility of operation; operator safety; and convenience of operation. The design of the building shall also provide for chemical storage and feed equipment in a separate room to reduce hazards and dust problems.

4.5. Location of Structures -- The applicant or the applicant’s engineer shall consult the West Virginia Division of Environmental Protection (WVDEP) regarding any structure that is located in such a way that normal or flood stream flows may be impeded. Where practical, all structures shall be located above the one hundred (100) year flood elevation or have adequate protection against one hundred (100) year floods. The U.S. Army Corps of Engineers may require permits.

4.6. Electrical Controls -- Main switch gear electrical controls shall be located above grade, in areas not subject to flooding.

4.7. Standby Power -- Standby power may be required by the Environmental Engineering Division so that water may be treated or pumped, or both, to the distribution system during power outages to meet the average day demand.

4.8. Shop Space and Storage -- Adequate facilities shall be included for shop space and storage consistent with the designed facilities.

4.9. Laboratory Facilities -- Each public water system shall have its own equipment and facilities for routine laboratory testing to ensure proper operation. Laboratory equipment selection shall be based on the characteristics of the raw water source and the complexity of the treatment process involved. Laboratory test kits that simplify procedures for making one or more tests may be acceptable. Necessary laboratory tests shall be performed by an operator or chemist qualified to perform the tests. Analyses conducted to determine compliance with drinking water regulations shall be performed in a laboratory certified by the United States Environmental Protection Agency or the West Virginia Office of Laboratory Services and shall be performed in accordance with “Standard Methods for the Examination of Water and Wastewater” or alternative methods approved by the Environmental Engineering Division. Persons designing and equipping laboratory facilities shall confer with the Environmental Engineering Division before beginning the preparation of plans or the purchase of equipment.

4.9.a. Laboratory testing equipment -- As a minimum, the following laboratory equipment shall be provided:

4.9.a.1. Surface water supplies shall have a nephelometric turbidimeter meeting the requirements of “Standard Methods for the Examination of Water and Wastewater”; 

4.9.a.2. Each surface water treatment plant utilizing flocculation and sedimentation, including those which lime softens, shall have a pH meter, jar test equipment, and titration equipment for both hardness and alkalinity;

4.9.a.3. Each community and non-community, non-transient public water system ion-exchange
softening plant, and lime softening plant treating only groundwater shall have a pH meter and titration equipment for both hardness and alkalinity;

4.9.a.4. Each green sand filter using potassium permanganate iron removal plant shall have test equipment capable of accurately measuring iron to a minimum of 0.1 milligrams per liter. Each green sand filter using potassium permanganate manganese removal plant shall have test equipment capable of accurately measuring manganese to a minimum of 0.05 milligrams per liter;

4.9.a.5. Public water systems shall have test equipment for determining both free and total chlorine residual by methods in “Standard Methods for the Examination of Water and Wastewater”;

4.9.a.6. Public water systems that fluoridate shall have test equipment for determining fluoride by methods in “Standard Methods for the Examination of Water and Wastewater”; and

4.9.a.7. Public water systems that feed polyphosphates shall have test equipment capable of accurately measuring phosphates from 0.1 to twenty (20) milligrams per liter.

4.9.b. Physical facilities -- Sufficient bench space, adequate ventilation, adequate lighting, storage room, laboratory sink, and auxiliary facilities shall be provided. Air conditioning may be necessary.

4.10. Monitoring Equipment -- Water treatment plants designed to serve three thousand three hundred (3300) people or more shall be provided with continuous monitoring equipment (including recorders) to monitor water being discharged to the distribution system as follows:

4.10.a. Plants treating surface water and plants using lime for softening shall have the capability to monitor and record free chlorine residual and shall consider having the capacity to monitor and record turbidity; and

4.10.b. Plants treating ground water using iron removal or ion exchange softening shall have the capability to monitor and record free chlorine residual.

4.11. Sample Taps -- Sample taps shall be provided so that water samples can be obtained from each raw water source and from appropriate locations in each process unit of the treatment system. Taps shall be consistent with sampling needs and shall not be of the petcock type. Taps used for obtaining samples for bacteriological analysis shall be of the smooth-nosed type without an interior or exterior aerator, or other type of appurtenance.

4.12. Facility Water Supply -- The facility water supply service line and the plant finished water sample tap shall be supplied from a source of finished water at a point where all chemicals have been thoroughly mixed, and the required disinfectant contact time has been achieved. There shall be no cross-connections between the facility water supply service line and any piping, troughs, tanks, or other treatment units containing wastewater, treatment chemicals, or raw or partially treated water.

4.13. Wall Castings -- Consideration shall be given to providing extra wall castings built into the structure to facilitate future uses whenever pipes pass through walls of concrete structures.

4.14. Meters -- All community and non-community, non-transient public water systems water plants shall have a means of metering the raw, finished, backwash and plant use water.

4.15. Piping Color Code -- To facilitate identification of piping in plants and pumping stations it is recommended that the color scheme in Table 64-77 A of this rule be used. In situations where two (2) colors do not have sufficient contrast to easily differentiate between them, a six (6) inch band of contrasting color shall be on one of the pipes at approximately thirty (30) inch intervals. The name of the liquid or gas shall also be on the pipe. In some cases it may be advantageous to provide arrows indicating the direction of flow.

4.16. Disinfection -- All wells, pipes, tanks, and equipment that can convey or store potable water shall be disinfected in accordance with current AWWA procedures. Plans or specifications shall outline the procedure and include the disinfectant dosage, contact time, and method of testing the results of the procedure.
4.17. Manuals and Parts Lists -- An operation and maintenance manual including a parts list and parts order form shall be supplied to the water works as part of any proprietary unit installed in the facility.

4.18. Operator Instruction -- Provisions shall be made for operator instruction at the start-up of a plant or pumping station following the manufacturers’ representatives trouble shooting.

4.19. Paints, Coatings, Sealers and Liners -- Paints, coatings, sealers and liners that contact raw, partially treated or potable water and are used in pipes, tanks or equipment that can transport or store water shall have third party certification of compliance with ANSI\NSF Standard 61: Drinking Water System Components - Health Effects.

4.20. Other Considerations -- Consideration shall be given to the design requirements of other federal state and local regulatory agencies for items such as safety requirements, special designs for the disabled, plumbing and electrical codes, construction in the flood plain, etc.

64-77-5. Source Development.

5.1. General. -- In selecting the source of water to be developed, the public water system or their engineer shall prove to the satisfaction of the Environmental Engineering Division that an adequate quantity of water will be available, and that the water that is to be delivered to the consumers will meet the current requirements of the rule of the Division of Health, Public Water Systems, 64CSR3, with respect to microbiological, physical, chemical and radiological qualities. Each water system shall take its raw water from the best available source that is economically reasonable and technically possible.

5.2. Surface Water System. -- A surface water source includes all tributary streams and drainage basins, natural lakes, artificial reservoirs or impoundments above the point of water system intake and ground water under the direct influence of surface water.

5.2.a. Quantity -- The quantity of water at the source: shall be adequate to meet the maximum projected water demand of the service area as shown by calculations based on the extreme drought of record; shall provide a reasonable surplus for anticipated growth; shall be adequate to compensate for all losses such as silting, evaporation, seepage, etc.; shall be adequate to provide ample water for other legal users of the source; shall not exceed a rate of withdrawal that is more than ten (10) percent of the minimum available flow in a stream; and shall provide minimum six (6) months storage based on average daily demand for all drainage basins, natural lakes and artificial reservoirs or impoundments.

5.2.b. Quality -- A sanitary survey and study shall be made of the factors, both natural and man made, that may affect the quality of the surface water. This survey and study shall include, but not be limited to: determining possible future uses of impoundments or reservoirs; determining the degree of control of water shed by the owner; assessing the degree of hazard to the supply by accidental spillage of materials that may be toxic, harmful or detrimental to treatment processes; obtaining samples over a sufficient period of time to assess the microbiological, physical, chemical and radiological characteristics of the water; assessing the capability of the proposed treatment process to reduce contaminants to applicable standards; and consideration of currents, wind and ice conditions, and the effect of confluent streams. The coliform group shall not exceed five thousand (5000) per one hundred (100) milliliters as a monthly average value (MPN or MF count), nor exceed this number in more than twenty per cent (20%) of the samples examined during any month, nor exceed twenty thousand (20,000) per one hundred (100) milliliters in more than five per cent (5%) of the samples.

5.2.c. Minimum Treatment -- The design of the water treatment plant shall consider the worst conditions that may exist during the life of the facility. The minimum treatment required shall be determined by the Environmental Engineering Division. Filtration preceded by pretreatment approved by the Environmental Engineering Division shall be provided for all surface waters.

5.2.d. Structures.
5.2.d.1. Design of intake structures shall provide for: withdrawal of water from more than one level if quality varies with depth; separate facilities for release of less desirable water held in storage; where frazil ice may be a problem, holding the velocity of flow into the intake structure to a minimum, generally not to exceed 0.5 feet per second; inspection manholes every one thousand (1000) feet for pipe sizes large enough to permit visual inspection; periodic cleaning of the inlet line; and adequate protection against rupture by dragging anchors, ice, etc. Ports shall be located above the bottom of the stream, lake or impoundment, but at sufficient depth to be kept submerged at low water levels. Where shore wells are not provided, a diversion device shall be capable of keeping large quantities of fish or debris from entering an intake structure and of controlling zebra mussels where applicable.

5.2.d.2. Shore wells shall: have motors and electrical controls located above grade and above the one hundred (100) year flood elevation; be accessible; be designed against flotation; be equipped with removable or traveling screens before the pump suction well; provide for introduction of a disinfectant or other chemicals in the raw water transmission main if necessary for quality control; have intake valves and provisions for backflushing or cleaning by a mechanical device and testing for leaks, where practical; have provisions for withstanding surges where necessary and include provisions for adequate ventilation for maintenance personnel.

5.2.d.3. An upground reservoir is a facility in which water is pumped during periods of good quality and high stream flow for future release to treatment facilities. Upground reservoirs shall be constructed to assure that: water quality is protected by controlling runoff into the reservoir; dikes are structurally sound and protected against wave action and erosion; intake structures and devices meet requirements of this section; point of influent flow is separated from the point of withdrawal; and separate pipes are provided for influent to and effluent from the reservoir.

5.2.e. Impoundments and reservoirs.

5.2.e.1. Site preparation shall provide, where applicable: for the removal of brush and trees to high water elevation; for protection from floods during construction; for the abandonment of all water wells that will be inundated, in accordance with requirements of the Environmental Engineering Division; and for the abandonment of all oil and gas wells in accordance with WVDEP oil and gas regulations.

5.2.e.2. Construction may require: approval from the WVDEP of the safety features for stability and spillway design; a permit from the WVDEP for controlling stream flow or installing a structure on the bed of a stream or interstate waterway; a withdrawal permit; and a U.S. Army Corps of Engineers permit.

5.3. Groundwater System -- A groundwater source includes all water obtained from drilled, bored or driven wells, infiltration lines, springs and approved mines.

5.3.a. Quantity.

5.3.a.1. Source Capacity -- The total developed groundwater source capacity shall equal or exceed the design maximum day demand. For systems serving five hundred (500) people or more, source capacity shall equal or exceed the design average day demand with the largest producing well out of service.

5.3.a.2. Number of Sources -- All community groundwater systems serving five hundred (500) or more people, shall provide a minimum of two (2) good sources of water, with sufficient capacity so that with the largest producing source out of service the remaining source or sources can produce sufficient quantity to produce average daily demands.

5.3.a.3. All public water systems shall provide standby power if the system is treating greater than
or equal to three (3) million gallons per day.

5.3.a.3.A. To ensure continuous service when the primary power has been interrupted, a power supply shall be provided through connection to at least two (2) independent public power sources, or portable or in-place auxiliary power.

5.3.a.3.B. When automatic pre-lubrication of pump bearings is necessary, and an auxiliary power supply is provided, the pre-lubrication line shall be provided with a valved bypass around the automatic control, or the automatic control shall be wired to the emergency power source.

5.3.b. Quality.

5.3.b.1. Microbiological Quality -- Public water systems shall provide for disinfection of every new, modified or reconditioned groundwater source prior to use in accordance with AWWA Standard C655. Public water systems shall submit, after disinfection, in accordance with AWWA Standard C654, one (1) or more special purpose water samples to a State certified water quality laboratory for microbiological analysis with results reported to the Environmental Engineering Division prior to placing the well into service.

5.3.b.2. Physical and Chemical Quality -- Public water systems shall have every new groundwater source examined for all regulated primary and secondary contaminants by tests of a representative sample in a State certified water quality laboratory for drinking water, with the results reported to the Environmental Engineering Division. Samples shall be collected at or near the conclusion of the test pumping procedure and examined as soon as practical. Field determinations of physical and chemical constituents or special sampling procedures may be required by the Environmental Engineering Division.

5.3.c. Location.

5.3.c.1. Public water systems or their engineer shall consult with the Environmental Engineering Division prior to design and construction regarding a proposed well location as it relates to required separation between existing and potential sources of contamination and groundwater development. The public water systems or their engineer shall provide a location map, a site map and an inventory of potential contamination activity sources within a two thousand (2000) foot radius of the proposed well location for community and non-community, non-transient public water systems and five hundred (500) foot radius of the proposed well location for transient public water systems. Under no circumstances shall the water well be located closer to sources of microbiological pollution or contamination than as provided in Table 64-77 B of this rule.

5.3.c.2. Continued Protection -- Public water systems shall provide continued protection of the well site from potential sources of contamination through the development of a wellhead protection program as approved by the Environmental Engineering Division. Fencing of the site may be required by the Environmental Engineering Division.

5.3.d. Testing and Records.

5.3.d.1. The public water system’s engineer or a West Virginia Certified Water Well Driller shall perform yield and drawdown tests on every production well after construction or subsequent treatment and prior to placement of the permanent pump; have the test methods clearly indicated in the project specifications; have a test pump capacity, at maximum anticipated drawdown, at least 1.5 times the quantity anticipated, and provide for continuous pumping for at least twenty-four (24) hours or until stabilized drawdown has continued for at least six (6) hours when test pumped at 1.5 times the design pumping rate for community and non-transient non-community public water supplies; and provide for continuous pumping for at least eight (8) hours for transient non-community public water supplies.

5.3.d.2. The public water system’s engineer or a West Virginia Certified Water Well Driller shall
provide the following data to the Environmental Engineering Division: test pump capacity-head characteristics; static water level; the depth of test pump setting; the time of starting and ending each test cycle.

5.3.d.3. The public water system’s engineer or a West Virginia Certified Water Well Driller shall provide recordings and graphic evaluation of the following at one hour intervals or less as may be required by the Environmental Engineering Division: pumping rate, pumping water level, drawdown, and water recovery rate and levels. The non-community transient water systems are not required to provide the graphic evaluation of pump test data.

5.3.d.4. The public water system’s engineer or a West Virginia Certified Water Well Driller shall determine the geological data from samples collected at five (5) foot intervals and at each pronounced change in formation; record the information and provide a report to the Environmental Engineering Division; and be supplemented with information on accurate records of drill hole diameters and depths, assembled order of size and length of casing and liners, grouting depths, formations penetrated, water levels, and location of any blast charges.

5.3.e. General Well Construction.

5.3.e.1. Wells shall be covered while unattended during construction. Drilling fluids and additives: shall not impart any toxic substances to the water or promote bacterial contamination; and shall have third party certification of conformance with ANSI/NSF Standard 60, Drinking Water Treatment Chemicals - Health Effects.

5.3.e.2. Minimum Protected Depths

5.3.e.2.A. Minimum protected depths of drilled wells shall provide watertight construction to the depth required by the Environmental Engineering Division to: exclude contamination; seal off formations that are, or may be, contaminated or yield undesirable water; and provide a minimum casing length as follows:

5.3.e.2.A.(a) ten (10) feet of casing in unconsolidated water bearing formations for wells that are thirty (30) feet deep or less if approved by the Environmental Engineering Division;

5.3.e.2.A.(b) twenty (20) feet of casing in unconsolidated water bearing formations for wells that are deeper than thirty (30) feet; or

5.3.e.2.A.(c) a minimum of twenty (20) feet of casing in bedrock wells with a minimum of five (5) feet of casing installed into unweathered bedrock. Unweathered bedrock is bedrock that is competent, hard, firmly-consolidated and unaltered by erosion or surficial weathering.

5.3.e.2.B. Other minimum protective depths of casing may be allowed upon the written approval of the Environmental Engineering Division in special circumstances (i.e., the well supplies a surface water treatment plant).

5.3.e.3. Temporary Steel Casing -- Temporary steel casing used for construction shall be capable of withstanding the structural load imposed during its installation and removal.

5.3.e.4. Permanent Steel Casing -- Permanent steel casing pipe shall: be new steel casing pipe meeting AWWA Standard A-100, ASTM or API specifications for water well construction; have the minimum weights and thickness indicated in Table 64-77 D of this rule; have additional thickness and weight if minimum thickness is not considered sufficient to assure the reasonable life expectancy of a well; be capable of
withstanding forces to which it is subjected; be equipped with a commercial heat treated tempered drive shoe when driven; have full circumferential welds or threaded coupling joints for twelve (12) inch or less diameter wells. Wells with diameters larger than twelve (12) inch can use non-commercial materials for the drive shoes when driven and shall have full circumferential welds or threaded coupling joints;

5.3.e.5. Nonferrous Casing Materials -- Nonferrous material proposed as a well casing: shall be resistant to the corrosiveness of the water and to the stresses to which it will be subjected during installation, grouting and operation; and shall comply with ANSI/NSF Standard 61, Water System Components - Health Effects.

5.3.e.6. Plastic Well Casing -- Plastic well casings, liners, spline-lock mechanical joining systems, couplings and solvents shall be approved by the NSF Standard 14 and 61 and meet ASTM F 480. Temporary casing shall meet NSF Standard 61. Plastic well casing shall not be driven during the installation. Plastic well casing shall be installed in accordance with the manufacturer’s specifications. Evidence of compliance is the display of the NSF seal on each section of casing and liner. All plastic casing and liners shall have a wall thickness that will be of adequate thickness to prevent collapse due to hydrostatic pressure or temperature effects. The minimum wall thickness for plastic well casing shall have a standard dimension ratio (SDR) of 21 or heavier as governed by the ASTM F 480 standards. Plastic well liners shall meet a minimum SDR of 26.

5.3.e.7. Packers -- Packers shall be of material that will not impart taste, odor, toxic substance or bacterial contamination to the well water. Lead packers shall not be used.

5.3.e.8. Screens -- Screens shall: be constructed of materials resistant to damage by chemical action of groundwater or cleaning operations and have size of openings based on sieve analysis of formation or gravel pack materials; and have sufficient length and diameter to provide adequate specific capacity and low aperture entrance velocity. Usually the entrance velocity shall not exceed 0.1 feet per second. Screens shall be installed so that the pumping water level remains above the screen under all operating conditions. Where applicable, screens shall be designed and installed to permit removal or replacement without adversely affecting watertight construction of the well and be provided with a bottom plate or washdown bottom fitting of the same material as the screen. Only commercially manufactured screens designed for the intended purpose are permitted. Plastic well screens shall comply with the ANSI/NSF Standard 61 - Water System Components - Health Effects.

5.3.e.9. Grouting requirements.

5.3.e.9.A. The full length of the well casing shall be fully grouted from the lower terminus up to the ground surface, except as noted in paragraphs 5.3.e.9.A.1 through 5.3.e.9.A.3 of this section.

5.3.e.9.A.1. When drilling through caves, mines or other cavities, the lower portion of the casing shall be grouted in accordance with a method described in this section and a packer or similar bridging device may be used to permit grouting from the top of the cavity.

5.3.e.9.A.2. In unconsolidated aquifers (i.e., sand and gravel) above bedrock, the permanent casing shall be grouted.

5.3.e.9.A.3. In cases where a pitless adaptor is to be installed, upward grouting may terminate at the level of the pitless adapter.

5.3.e.9.B. Grout shall be neat cement, bentonite and cement mixtures, or bentonite. Other materials require the written approval of the Environmental Engineering Division. The neat cement, bentonite
and cement mixtures, and bentonite shall be mixed according to the manufacturer’s specifications. All drilling muds shall not be used for grouting. Water used shall be fresh (not saline) and uncontaminated. A neat cement grout shall consist of cement and water with not more than six (6) gallons of water per sack (ninety-four (94) pounds) of cement.

5.3.e.9.C. All public water system water wells shall be installed with an annular space seal between the casing and borehole, that hardens or forms a seal, to prevent the entrance of water from sources other than the aquifers selected.

5.3.e.9.C.1. When grouting below the water level, grout shall be installed by a positive displacement method, placed from the bottom up. Grout material shall be placed by a positive displacement such as pumping or forced injection by air or hydraulic pressure. Grout shall be injected in the annular space between the inner casing and either the outer casing or the borehole. In wells where the outer casing is left in place, a dry bentonite shall be used while driving the casing.

5.3.e.9.C.2. When grouting above the water level, the annular space shall be a minimum of 1.5 inches for grout and a positive displacement method, placed from the bottom up, is the preferred method for grouting. The gravity placement method maybe used for grouting not to exceed thirty (30) feet. Bentonite chips, pellets or granules with a diameter of 3/8 inches or less, or neat cement shall either be poured freely down the borehole or added through a tremie pipe to seal the annular space. As the bentonite material is poured into the hole, bridging may occur. A tamper or a weighted line may be necessary to tamp the bentonite material into place.

5.3.e.9.C.3. When underreaming is used to set permanent casing in unconsolidated materials, either a dry or wet bentonite slurry shall be used at the ground surface while the casing is being installed. Upon termination of casing in unweathered bedrock and removal of the underreamer, bentonite or neat cement shall be placed in the bottom of the casing by a positive displacement or gravity placement method before casing is set in bedrock. All other methods require the written approval of the Environmental Engineering Division.

5.3.e.9.C.4. If rapid loss of grout material occurs during emplacement, coarse fill material (e.g., sand, gravel, crushed stone or dry cement) may be used in the zones in which the loss is occurring. The remainder of the annular space shall be grouted as provided in this section.

5.3.e.9.C.5. If the annular space cannot be grouted in accordance with this section, alternative methods subject to prior written approval by the Environmental Engineering Division will be considered.

5.3.e.10. Upper Terminal Well Construction - Permanent casing for all groundwater sources shall project at least twelve (12) inches above the pumphouse floor or at least twelve (12) inches above the final ground surface. Where a well house is constructed, the floor surface shall be at least six (6) inches above the final ground elevation. Sites subject to flooding shall be provided with an earth mound to raise the pumphouse floor to an elevation at least two (2) feet above the highest known flood elevation, or other suitable protection as determined by the Environmental Engineering Division. The top of the well casing at sites subject to flooding shall terminate at least three (3) feet above the one hundred (100) year flood level or the highest known flood elevation, whichever is higher, or as the Environmental Engineering Division directs. If the three (3) feet above the one hundred (100) year flood elevation or the highest known flood elevation requirement is not practical, the well shall be protected from flood waters entering the well and contaminating the aquifer.

5.3.e.11. Development -- Every well shall be developed to remove the native silts and clays,
drilling mud or finer fraction of the gravel pack. Development shall continue until the maximum specific capacity is obtained from the completed well. Where chemical conditioning is required, the specifications shall include provisions for the method, equipment, chemicals, testing for residual chemicals, and disposal of waste and inhibitors. Where blasting procedures may be used, the specifications shall include the provisions for blasting and cleaning. Special attention shall be given to assure that the grouting and casing are not damaged by the blasting.

5.3.e.12. Capping Requirements -- All caps shall be Water Systems Council approved. All caps in the 100 year flood plain shall be water tight. All caps above the 100 year flood plain shall, as a minimum, be vector (insects, rodents, snakes, etc.) proof. At all times during the progress of work, the West Virginia Certified Water Well Driller shall provide protection to prevent tampering with the well or entrance of foreign materials.

5.3.e.13. Well Abandonment -- When a public water system water well is to be abandoned, the work is to be performed by a West Virginia Certified Water Well Driller. The preferred method of abandonment involves casing removal. The borehole shall be completely sealed to reduce concern about channeling in the annular space or inadequate seals between casing and grout. When the casing is removed and the borehole is unstable, grout shall be simultaneously emplaced as the casing is "pulled" to prevent collapse of the borehole and an inadequate seal; however, if the casing is left in place, the casing shall be completely pressure grouted to reduce the possibility of annular channeling. All pumps, wiring, pipes, valves, accessories and hardware shall be removed prior to abandonment. The requirements herein pertain to wells and test holes in consolidated and unconsolidated formations. Each well abandonment shall be considered as an individual problem. Methods and materials are to be selected only after careful consideration of casing material, casing condition, the diameter of the casing, quality and quantity of the original grout seal, the depth of the well, well plumbness, hydrogeologic setting, level of contamination and the zones where contamination occurs. All abandonment procedures shall prohibit groundwater contamination.

5.3.e.13.A. All wells shall be completely filled. The public water system’s engineer or a West Virginia Certified Water Well Driller shall provide procedures and quantities of material used for water well abandonment to the Environmental Engineering Division within thirty (30) days after abandonment.

5.3.e.13.B. Wells in Unconsolidated Formations -- In water-bearing formations consisting of coarse gravel, and when producing wells are located nearby, care shall be taken to select sealing materials that will not affect the producing wells. Concrete may be used if the producing wells can be shut down for a sufficient time to allow the concrete to set. Clean, disinfected sand or gravel may also be used as fill material at the water-bearing formation elevations. The remainder of the well, especially the upper portion, shall be filled with clay, concrete, grout, or neat cement to exclude surface water. The latter method, using clay as the upper sealing material, is especially applicable to larger than ten (10) inch diameter abandoned wells. In gravel-packed gravel-envelope, or other wells in which coarse material has been added around the inner casing to within twenty (20) to thirty (30) feet of the surface, sealing outside the casing is very important. Sometimes this sealing may require removal of the gravel or perforation of the casing.

5.3.e.13.C. Wells in Creviced Formations -- Abandoned wells that penetrate limestone or other creviced or channelized rock formations shall be filled with concrete, grout or neat cement to insure permanence of the seal. The use of clay or sand is not desirable because fine-grained fill material may be displaced by the flow of water through crevices of channels. Alternating layers of coarse stone and concrete may be used for fill material through the water producing horizon if limited vertical movement of water in the formation will not affect the quality or quantity in producing wells. Only concrete, neat cement or grout shall be used in this type of well. The portion of the well between a point ten (10) to twenty (20) feet below and a point ten (10) to twenty (20) feet above the creviced formation shall be sealed and a plug of sealing material formed above the creviced formation.

5.3.f. Source Types and Construction Methods - Special Conditions.
5.3.f.1. Radial Water Collector -- Locations of all caisson construction joints and porthole assemblies shall be indicated. The caisson wall shall be reinforced to withstand the forces to which it will be subjected. Radial collectors shall be in areas and at depths approved by the Environmental Engineering Division. Provisions shall be made to assure that radial collectors are horizontal. The top of the caisson shall be covered with a watertight floor or be above the 100 year flood elevation. All openings in the floor shall be curbed and protected from the entrance of foreign material. Commercially available watertight wall sleeves shall be used if the pump discharge piping is placed through the caisson walls.

5.3.f.2. Infiltration Lines -- Infiltration lines may be considered only where geological conditions preclude the possibility of developing an acceptable drilled well. The area around infiltration lines shall be under the control of the water purveyor for a distance acceptable to or required by the Environmental Engineering Division. Flow in the lines shall be by gravity to the collecting well.

5.3.f.3. Naturally Flowing Wells -- Flow from naturally flowing wells shall be controlled. Permanent casing and grout shall be provided. If erosion of the confining bed appears likely, special protective construction may be required by the Environmental Engineering Division.

5.3.f.4. Springs and Mine Openings -- Springs and mine openings, when used as a source point, shall be protected from the entry of surface water and foreign objects and shall be housed in a permanent structure.

5.3.g. Well Pumps, Discharge Piping and Appurtenances.

5.3.g.1. Line shaft pumps - Wells equipped with line shaft pumps shall: have the pump structure firmly connected to the casing or have the casing inserted into a recess extending at least one-half (1/2) inch into the pump base; have the pump foundation and base designed to prevent water from coming into contact with the joint.

5.3.g.2. Submersible pumps -- Where a submersible pump is used, the top of the casing shall be effectively sealed against the entrance of water under all conditions of vibration or movement of conductors or cables, and the electrical cable shall be firmly attached to the riser pipe at twenty (20) foot intervals or less.

5.3.g.3. Discharge piping -- The discharge piping shall: be designed so that the friction loss will be low; have control valves and appurtenances located above the pumphouse floor when an above-ground discharge is provided; be protected against the entrance of contamination; and be equipped with a check valve, a shutoff valve, a pressure gauge, a means of measuring flow, and a smooth nosed sampling tap located at a point where positive pressure is maintained. Where applicable, discharge piping shall be equipped with an air release-vacuum relief valve located upstream from the check valve, with exhaust/relief piping terminating in a down-turned position at least eighteen (18) inches above the floor and covered with a twenty-four (24) mesh corrosion resistant screen. Discharge piping: shall be valved to permit test pumping and control of each well; shall have all exposed piping, valves and appurtenances protected against physical damage and freezing; shall be properly anchored to prevent movement; and shall be protected against a surge or water hammer. The discharge piping shall be provided with a means of pumping the discharge directly to waste but shall not be directly connected to a sewer.

5.3.g.4. Pitless Well Units -- The Environmental Engineering Division shall be contacted by the public water system or their engineer for approval of specific applications of pitless units. Pitless units shall: be threaded or welded to the well casing; be of watertight construction throughout; be of materials and weight at least equivalent and compatible to the casing; have field connection to the lateral discharge from the pitless unit of threaded, flanged or mechanical joint connection; terminate at least twelve (12) inches above final ground elevation or three (3) feet above the one hundred (100) year flood level or as the Environmental Engineering Division directs. If the three (3) feet above the one hundred (100) year flood elevation
requirement is not practical, the well shall be protected from flood waters entering the well and contaminating the aquifer. The pitless unit installation shall consist of either a pitless well unit or pitless well adapter and well cap. The pitless unit shall be approved by the NWSC, NGWA or equivalent. If a field weld connection is made, the pitless well unit shall be specifically approved by the manufacturer for such welding. The only field welding permitted is that required to attach the pitless well unit and appurtenances to the casing.

5.3.g.4.A. The design of the pitless unit shall make provisions for: access to disinfect the well; a properly constructed casing vent meeting the requirements specified in this rule; facilities to measure water levels in the well; a cover at the upper terminus of the well that will prevent contamination; a contamination-proof entrance connection for electrical cable; and an inside diameter as great as that of the well casing, up to and including casing diameters of twelve (12) inches, to facilitate work and repair on the well, pump, or well screen. If the three (3) feet above the one hundred (100) year flood elevation requirement is not practical, the well shall be protected from flood waters entering the well and contaminating the aquifer.

5.3.g.5. Casing Vent -- The public water system or a West Virginia Certified Water Well Driller shall make provisions for venting the well casing to the atmosphere. The pipe connecting the casing to the vent shall be of adequate size to provide rapid venting of the casing. For installations in the 100 year flood plain, refer to paragraph 5.3.e.12 of this rule.

5.3.g.6. Water level measurement -- The public water system or a West Virginia Certified Water Well Driller shall make provisions for periodic measurement of water levels in the completed well for community and non-community, non-transient public water systems. Where pneumatic water level measuring equipment is used, the measurement shall be made using corrosion resistant materials attached firmly to the drop pipe or pump column and in such a manner as to prevent entrance of foreign materials.

5.3.g.7. Observation wells shall: be constructed in accordance with the requirements for permanent wells if they are to remain in service after completion of a water supply well; and be protected at the upper terminus to preclude entrance of foreign materials.

64-77-6. Treatment (General and Clarification).

6.1. General. -- The design of treatment processes and devices shall depend on evaluation of the nature and quality of the particular water to be treated, the desired quality of the finished water and the mode of operation planned. All treatment processes with only one (1) unit shall be capable of meeting the projected maximum daily demand in eight (8) hours of operation or less to provide "down time" for repairs and maintenance.

6.2. Clarification. -- Plants designed for processing surface water shall: provide a minimum of two (2) units each for rapid mix, flocculation and sedimentation unless otherwise approved by the Environmental Engineering Division; permit operation of the units either in series or parallel where softening is performed and shall permit series or parallel operation where plain clarification is performed; be constructed to permit units to be taken out of service without disrupting operation; be constructed with drains or pumps sized to allow dewatering in a reasonable period of time; provide multiple-stage treatment facilities when required by the Environmental Engineering Division; be started manually following a shutdown; and minimize hydraulic head losses between units to allow future changes in processes without the need for repumping. For ground water systems under the direct influence of surface water, the requirements in this subsection may be modified by the Environmental Engineering Division, depending on the raw water quality characteristics.

6.2.a. Rapid mix means the rapid dispersion of chemicals throughout the water to be treated, usually
by violent agitation. The engineer shall submit the design basis for the velocity gradient (G value) selected, considering the chemicals to be added, water temperature, color and other related water quality parameters.

6.2.a.1. Equipment -- Basins shall be equipped with mechanical mixing devices. Other arrangements, such as baffling, may be acceptable only under special conditions. Where mechanical mixing devices are utilized, duplicate units or spare mixing equipment shall be provided.

6.2.a.2. Design parameters -- The detention period for the mixing coagulants shall be in the range of ten (10) to thirty (30) seconds. The point of application of the coagulant shall be at the point of maximum mixing intensity. The physical configuration of the mixing basin shall be designed to eliminate vortexing. Rapid mix units shall be designed to allow a speed variation ratio throughout at a range of one (1) to three (3). The rapid mix and flocculation basin shall be as close together as possible. Static mixers shall be properly selected and approved by the Environmental Engineering Division.

6.2.b. Flocculation -- Flocculation means the agitation of the water at low velocities for long periods of time.

6.2.b.1. Basin design -- Inlet and outlet design shall prevent short-circuiting and destruction of floc. A drain or pumps, or both, shall be provided to handle dewatering and sludge removal.

6.2.b.2. Detention -- The flow-through velocity shall be not less than 0.5 nor greater than 1.5 feet per minute with a detention time for floc formation of at least thirty (30) minutes.

6.2.b.3. Equipment -- Agitators shall be driven by variable speed drives with the peripheral speed of paddles ranging from 0.5 to three (3.0) feet per second.

6.2.b.4. Piping -- Flocculation and sedimentation basins shall be as close together as possible. The velocity of flocculated water through pipes or conduits to settling basins shall be not less than 0.5 nor greater than 1.5 feet per second. Allowances shall be made to minimize turbulence at bends, elevation drops and changes in direction.

6.2.b.5. Superstructure -- The Environmental Engineering Division may require a superstructure over the flocculation basins.

6.2.c. Sedimentation -- Sedimentation shall follow flocculation. The detention time for effective clarification is dependent upon a number of factors related to basin design and the nature of the raw water. The following criteria apply to conventional sedimentation units:

6.2.c.1. Detention time -- A minimum of four (4) hours of settling time shall be provided. This may be reduced to two (2) hours for lime-soda softening facilities treating only groundwater. Reduced sedimentation time may also be approved by the Environmental Engineering Division when equivalent effective settling is demonstrated (i.e., tube settlers, lamella plates, etc.) but shall never be less than two (2) hours.

6.2.c.2. Inlet devices -- Inlets shall be designed to distribute the water equally and at uniform velocities. Open ports, submerged ports, and similar entrance arrangements are required. A baffle shall be constructed across the basin close to the inlet end and shall project several feet below the water surface to dissipate inlet velocities and provide uniform flows across the basin;

6.2.c.3. Outlet devices -- Outlet devices shall be designed to maintain velocities suitable for
settling in the basin and to minimize short-circuiting. The use of submerged orifices is recommended in order to provide a volume above the orifices for storage when there are fluctuations in flow;

6.2.c.4. Overflow rate -- The rate of flow over the outlet weir shall not exceed twenty thousand (20,000) gallons per day per foot of weir length. Where submerged orifices are used as an alternate for overflow weirs, they shall be not lower than three (3) feet below the flow line with flow rates equivalent to weir loadings;

6.2.c.5. Velocity -- The velocity through settling basins shall not exceed 0.5 feet per minute. The basins shall be designed to minimize short-circuiting. Fixed or adjustable baffles shall be provided as necessary to achieve the maximum potential for clarification;

6.2.c.6. Overflow -- An overflow weir (or pipe) shall be installed that will establish the maximum water level desired on top of the filters. It shall discharge by gravity with a free fall at a location where the discharge will be noted;

6.2.c.7. Superstructure -- The Environmental Engineering Division may require a public water system to build a superstructure over the sedimentation basins. The Environmental Engineering Division may allow a cover in lieu of a superstructure, if there is no mechanical equipment in the basins and if provisions are included for adequate monitoring under all expected weather conditions;

6.2.c.8. Sludge collection -- Mechanical sludge collection equipment shall be provided;

6.2.c.9. Drainage -- Basins shall be provided with a means for dewatering. Basin bottoms shall slope toward the drain not less than one (1) foot in twelve (12) feet where mechanical sludge collection equipment is not required;

6.2.c.10. Flushing lines -- Flushing lines or hydrants shall be provided and shall be equipped with backflow prevention devices acceptable to the Environmental Engineering Division;

6.2.c.11. Safety -- Permanent ladders or handholds shall be provided on the inside walls of basins. Guard rails shall be included;

6.2.c.12. Sludge removal -- Sludge removal design shall provide that sludge pipes shall be not less than three (3) inches in diameter and so arranged as to facilitate cleaning. The entrance to sludge withdrawal piping shall prevent clogging. The operator may observe and sample sludge being withdrawn from the unit; and

6.2.c.13. Sludge disposal -- Facilities shall be provided for the disposal of sludge.

6.2.d. Solids contact unit -- Combined softening and clarification units are generally acceptable for where water characteristics, especially temperature, do not fluctuate rapidly, flow rates are uniform and operation is continuous. The Environmental Engineering Division shall give specific approval to the public water system’s engineer before these units are considered as clarifiers without softening. The public water system’s engineer shall design clarifiers for the maximum uniform rate and shall be adjustable to changes in flow that are less than the design rate and for changes in water characteristics. The Environmental Engineering Division requires a minimum of two (2) units for surface water treatment, unless the public water system’s engineer provides justification for one (1) unit, that is acceptable by the Environmental Engineering Division.

6.2.d.1. Installation of equipment -- A representative of the manufacturer shall supervise the
installation of mechanical equipment, trouble shooting, problem solving times, and start-up and initial operation.

6.2.d.2. Operating equipment -- The following shall be provided for plant operation: a complete outfit of tools and accessories; trouble shooting and problem solving manuals; necessary laboratory equipment; and adequate piping with suitable sampling taps located to permit the collection of samples of water from critical portions of the units.

6.2.d.3. Chemical feed -- Chemicals shall be applied at such points and by such means as to insure satisfactory mixing of the chemicals with the water.

6.2.d.4. Mixing -- The Environmental Engineering Division may require a rapid mix device or chamber ahead of solids contact units to assure proper mixing of the chemicals applied. Mixing devices employed shall be constructed to provide mixing of the raw water with previously formed sludge particles, and prevent deposition of solids in the mixing zone.

6.2.d.5. Flocculation -- Flocculation equipment shall: be adjustable (speed or pitch, or both); provide for coagulation in a separate chamber or baffled zone within the unit; and provide the flocculation and mixing period to be not less than thirty (30) minutes.

6.2.d.6. Sludge concentrators -- The equipment shall provide either internal or external concentrators in order to obtain a concentrated sludge with a minimum of waste water. Large basins shall have at least two (2) sumps for collecting sludge with one (1) sump located in the central flocculation zone.

6.2.d.7. Sludge removal -- Sludge removal design shall provide that sludge pipes shall be not less than three (3) inches in diameter and so arranged as to facilitate cleaning. Entrance to sludge withdrawal piping shall prevent clogging. The design shall permit the operator to observe and sample sludge being withdrawn from the unit.

6.2.d.8. Cross-connections -- Blow-off outlets and drains shall terminate and discharge at places satisfactory to the Environmental Engineering Division. Cross-connection control shall be included for the potable water lines used to backflush sludge lines.

6.2.d.9. Detention period -- The detention time shall be based on the raw water characteristics and other local conditions that effect the operation of the unit. Based on design flow rates, the detention time shall be two (2) to four (4) hours for suspended solids contact clarifiers and softeners treating surface water and one (1) to two (2) hours for the suspended solids contact softeners treating only groundwater.

6.2.d.10. Suspended slurry concentrate -- Softening units shall be designed so that continuous slurry concentrates of one per cent (1%) or more, by weight, can be satisfactorily maintained.

6.2.d.11. Water losses -- Units shall be provided with suitable controls for sludge withdrawal. Total water losses shall not exceed five percent (5%) for clarifiers and three percent (3%) for softening units. The solids concentration of sludge bed to waste shall be three percent (3%) by weight for clarifiers and five percent (5%) by weight for softeners.

6.2.d.12. Weirs or orifices -- The units shall be equipped with either overflow weirs or orifices constructed so that water at the surface of the unit does not travel more than ten (10) feet horizontally to the collection trough. Weirs shall be adjustable and at least equivalent in length to the perimeter of the tank. Weir loading shall not exceed ten (10) gallons per minute per foot of weir length for units used for clarifiers and twenty (20) gallons per minute per foot of weir length for units used for softeners. Where orifices are used, the loading rates per foot of launder rates shall be equivalent to weir loadings. Either weirs or orifices shall produce uniform rising rates over the entire area of the tank.
6.2.d.13. Upflow rates -- The Environmental Engineering Division shall receive supporting data from the public water system’s engineer to justify rates exceeding the following: one (1) gallon per minute per square foot of area at the sludge separation line for units used for clarifiers; and 1.75 gallons per minute per square foot of area at the slurry separation line; for units used for softeners. If flow is subject to surges, an equalization tank shall be provided.

6.2.e. Tube or plate settlers -- Commercial settler units consisting of variously shaped tubes or plates that are installed in multiple layers and at an angle to the flow may be used for sedimentation following flocculation.

6.2.e.1. General criteria.

6.2.e.1.A. Inlet and outlet considerations -- The inlets and outlets shall be designed to maintain velocities suitable for settling in the basin and to minimize short-circuiting.

6.2.e.1.B. Drainage -- Drain piping from the settler units shall be sized to facilitate a quick flush of the settler units and to prevent flooding other portions of the plant.

6.2.e.1.C. Protection from freezing -- Although most units will be located within a plant, outdoor installations shall provide sufficient freeboard above the top of settlers to prevent freezing in the units. A cover or enclosure is strongly recommended.

6.2.e.1.D. Application rate for tube settlers -- A maximum rate of two (2) gallons per square foot per minute of cross-sectional area (based on twenty-four (24) inch long sixty (60) degree tubes or 39.5-inch long 7 1/2 degree tubes) is required, unless higher rates are successfully shown through pilot plant or in-plant demonstration studies.

6.2.e.1.E. Application rate for Lamellae plates -- A maximum forward design flow through the inclined plate settler is 0.5 gallons per minute per square foot of effective projected inclined plate surface area. Projected area is the total plate area multiplied by the cosine of the inclination angle. Effective settling surface area shall be a maximum of eighty percent (80%) of the total projected plate surface area installed.

6.2.e.1.F. Flushing lines -- Flushing lines shall be provided to facilitate maintenance and shall be properly protected against backflow or back siphonage.

6.2.f. Other settling/flocculation processes -- The Environmental Engineering Division may approve roughing filters, unconventional type flocculation and sedimentation on a case by case basis.

6.3. Filtration -- The application of any type of filter shall be supported by water quality data representing a reasonable period of time to characterize the variations in water quality. Experimental treatment studies may be required to demonstrate the applicability of the method of filtration proposed.

6.3.a. Rapid rate gravity filters.

6.3.a.1. Pretreatment -- The use of rapid rate gravity filters requires pretreatment. Pretreatment includes but is not limited to coagulation, flocculation, and sedimentation.

6.3.a.2. Rate of filtration -- The Environmental Engineering Division shall determine the rate of filtration through consideration of such factors as raw water quality, the degree of pretreatment provided, filter media, water quality control parameters, the competency of operation personnel, and other pertinent factors.
The maximum rate shall be two (2) gallons per minute per square foot of filter area for sand media, four (4) gallons per minute per square foot of filter area for dual media, and six (6) gallons per minute per square foot of filter for mixed media. In any case, the filter rate shall be proposed and justified by the designing engineer to the satisfaction of the Environmental Engineering Division prior to the preparation of final plans and specifications.

6.3.a.3. Number -- For groundwater plants producing 0.2 million gallons per day or more, two (2) filter units are required. For surface water plants, at least two (2) units are required. Where only two (2) units are provided, each shall be capable of meeting the plant design capacity (normally the projected maximum daily demand) at the approved filtration rate. Where more than two (2) filter units are provided, the filters shall be capable of meeting the plant design capacity at the approved filtration rate with one (1) filter removed from service. Where declining rate filtration is provided, the variable aspect of filtration rates and the number of filters shall be considered when determining the design capacity for the filters.

6.3.a.4. Structural details and hydraulics -- The filter structure shall be designed to provide for: vertical walls within the filter; no protrusion of the filter walls into the filter media; covering by superstructure; head room to permit normal inspection and operation; minimum depth of filter box of 8 1/2 feet; minimum water depth over the surface of the filter media of three (3) feet; trapped effluent to prevent backflow of air to the bottom of the filters; prevention of floor drainage to the filter with a minimum four (4) inch curb around the filter; prevention of flooding by providing overflow; maximum velocity of treated water in pipe and conduits to filters of two (2) feet per second; cleanouts and straight alignment for influent pipes or conduits where solids loading is heavy, or following lime-soda softening; washwater drain capacity to carry maximum flow; walkways around filters, to be not less than twenty-four (24) inches wide; safety handrails or walls around filter areas adjacent to normal walkways; and the prevention of cross connections and common walls between potable and non-potable water.

6.3.a.5. Washwater troughs -- Washwater troughs shall be constructed to have: the bottom elevation above the maximum level of expanded media during washing and the top elevation above the filter surface, not to exceed thirty (30) inches with a two (2) inch freeboard at the maximum rate of wash; the top edge level and all at the same elevation; spacing so that each trough serves the same number of square feet of filter area; and maximum horizontal travel of suspended particles to reach the trough not to exceed three (3) feet.

6.3.a.6. Filter -- The filter shall be constructed to provide the following characteristics: a total depth of not less than twenty-four (24) inches and generally not more than thirty (30) inches; and a minimum of twelve (12) inches of media with an effective size range no greater than 0.45 mm to 0.55 mm, and a specific gravity greater than other filtering materials within the filter.

6.3.a.7. Types of filter media.

6.3.a.7.A. Anthracite -- Clean crushed anthracite, or a combination of anthracite and other media may be considered on the basis of experimental data specific to the project, and it shall have: an effective size of 0.45 mm to 0.55 mm with uniformity coefficient not greater than 1.65 when used alone; an effective size of 0.8 mm to 1.2 mm with a uniformity coefficient not greater than 1.85 when used as a cap; and an effective maximum size of 0.8 mm for anthracite used as a single media on potable groundwater for iron and manganese removal only (effective sizes greater than 0.8 mm may be approved by the Environmental Engineering Division based upon on-site pilot plant studies).

6.3.a.7.B. Sand -- Sand shall be clean silica sand and have an effective size of 0.45 mm to 0.55 mm and a uniformity coefficient of not greater than 1.65.
6.3.a.7.C. Granular activated carbon (GAC) -- Granular activated carbon media may be considered. The design shall include the following: the media shall meet the basic specifications for filter media as given in this section except that larger size media may be allowed by the Environmental Engineering Division where full scale tests have demonstrated that treatment goals can be met under all conditions; there shall be provisions for a free chlorine residual and adequate contact time in the water following the filters and prior to distribution; there shall be means for periodic treatment of filter material for control of bacterial and other growth; and provisions shall be made for frequent replacement or regeneration if GAC is used for filtration.

6.3.a.7.D. Other Media -- The Environmental Engineering Division shall consider other media based on experimental data and operating experience.

6.3.a.7.E. Torpedo sand -- A three (3) inch layer of torpedo sand shall be used as a supporting media for filter sand, and shall have an effective size of 0.8 mm to 2.0 mm and a uniformity coefficient not greater than 1.7.

6.3.a.7.F. Gravel -- Gravel, when used as the supporting media, shall consist of hard, durable, rounded silica particles and shall not include flat or elongated particles. The coarsest gravel shall be approximately 2 1/2 inches in size when the gravel rests directly on the strainer system and shall extend above the top of the perforated laterals. Not less than four (4) layers of gravel shall be provided in accordance with the size and depth distribution when used with perforated laterals, as illustrated in Table 64-77 C of this rule. Reduction of gravel depths may be considered upon justification to the Environmental Engineering Division when proprietary filter bottoms are specified.

6.3.a.8. Filter bottoms and strainer systems -- Departures from the standards under this rule may be acceptable for high rate filters and proprietary bottoms. Porous plate bottoms shall not be used where iron or manganese may clog them or with waters softened by lime. The design of manifold-type collection systems shall minimize loss of head in the manifold and laterals and assure even distribution of washwater and even rate of filtration over the entire area of the filter. The ratio of the area of the final openings of the strainer systems to the area of the filter shall be about 0.003. The total cross-sectional area of the laterals shall be about twice the total area of the final openings. The cross-sectional area of the manifold shall be 1 1/2 to two (2) times the total area of the laterals.

6.3.a.9. Surface wash or subsurface wash -- Surface or subsurface wash facilities are required except for filters used exclusively for iron or manganese removal, and may be accomplished by a system of fixed nozzles or a revolving-type apparatus. All devices shall be designed with the provision for water pressures of at least forty-five (45) pounds per square inch and a properly installed vacuum breaker or other device approved by the Environmental Engineering Division to prevent back siphonage if connected to the treated water system. The rate of flow shall be two (2) gallons per minute per square foot of filter area with fixed nozzles or 0.5 gallons per minute per square foot with revolving arms. Air wash can be considered based on experimental data and operating experiences.

6.3.a.10. Air scouring -- Air scouring can be considered in place of surface wash. Air flow for air scouring the filter shall be three (3) to five (5) standard cubic feet per minute per square foot of filter area when the air is introduced in the underdrain; a lower air rate shall be used when the air scour distribution system is placed above the underdrains. A method for avoiding excessive loss of the filter media during backwashing shall be provided. Air scouring shall be followed by a fluidization wash sufficient to re-stratify the media. Air shall be free from contamination. Air scour distribution systems shall be placed below the media and supporting bed interface; if placed at the interface the air scour nozzles shall be designed to prevent media from clogging the nozzles or entering the air distribution system. Piping for the air distribution system shall not be flexible hose that will collapse when not under air pressure and shall not be a relatively soft material that may erode at the orifice opening with the passage of air at high velocity. Air delivery piping shall not pass down through the filter media nor shall there be any arrangement in the filter design that would allow short circuiting between the applied unfiltered water and the filtered water. Consideration shall be given to
maintenance and replacement of air delivery piping. The backwash delivery system shall be capable of fifteen (15) gallons per minute per square foot of filter surface area; however, when air scouring is provided the backwash rate shall be variable and shall not exceed eight (8) gallons per minute per square foot unless operating experience shows that a higher rate is necessary to remove scoured particles from filter surfaces, and the filter underdrains shall be designed to accommodate air scour piping when the piping is installed in the underdrain.

6.3.a.11. Appurtenances -- The following shall be provided for every filter: influent and effluent sampling taps; loss of head gauge; rate of flow controls; and a rate-of-flow meter. A rate controller that limits the rate of filtration to a maximum rate shall be used. A pump or a flow meter in each filter effluent line may be used as the limiting device for the rate of filtration only after consultation with the Environmental Engineering Division. Provisions shall be made for filtering to waste (rewash) with appropriate measures for backflow prevention. It is recommended the following be provided for every filter: a continuous or rotating cycle turbidity recording device for surface water treatment plants; wall sleeves providing access to the filter interior at several locations for sampling or pressure sensing; and a pressure hose and storage rack at the operating floor for washing filter walls.

6.3.a.12. Backwash -- Provisions shall be made for washing filters with a minimum rate of fifteen (15) gallons per minute per square foot, consistent with water temperatures and specific gravity of the filter media. A rate necessary to provide for a fifty percent (50%) expansion of the filter bed is required. A reduced rate of ten (10) gallons per minute per square foot may be acceptable for full depth anthracite or granular activated carbon filters. Filtered water shall be provided at the required rate by washwater tanks, a washwater pump, or from the high service main. Washwater pumps shall be in duplicate unless an alternate means of obtaining washwater is available. Washwater pumps shall run a minimum fifteen (15) minutes for the wash of one (1) filter at the design rate of wash. A washwater regulator or orifice plate on the main washwater line shall be provided to obtain the desired rate of filter wash with the washwater valves on the individual filters open wide. A rate-of-flow indicator, preferably with a totalizer, on the main washwater line, shall be located so that it can be easily read by the operator during the washwater process. The design shall prevent rapid changes in backwash water flow.

6.3.a.13. Miscellaneous -- Roof drains shall not discharge into the filters or basins and conduits preceding the filters. Provisions shall be made for continuous operation of all other filtering units while one filtering unit is out of operation. Rate of flow adjustments are mandatory so as not to overload filters in operation. Automatic start-up of filtering units is prohibited.

6.3.b. Rapid rate pressure filters -- The normal use of rapid rate pressure filters is for iron and manganese removal and may be used for surface supplies classified as groundwater under direct influence where turbidity is less than or equal to ten (10) NTU. Pressure filters shall not be used in the filtration of other surface supplies or following lime-soda softening.

6.3.b.1. General -- Minimum criteria relative to rate of filtration, structural details, hydraulics, filter media, etc., provided for rapid rate gravity filters also apply to pressure filters where appropriate.

6.3.b.2. Rate of filtration -- The rate shall not exceed three gallons per minute per square foot of filter area except where in-plant testing, as approved by the Environmental Engineering Division, has demonstrated satisfactory results at higher rates.

6.3.b.3. Details of design -- The filters shall be designed to provide for: loss of head gauges on the inlet and outlet pipes of each filter; an easily readable meter or flow indicator on each battery of filters (a flow indicator is recommended for each filtering unit); filtration and backwashing of each filter individually with an arrangement of piping as simple as possible to accomplish these purposes; minimum side wall shell height of five (5) feet (a corresponding reduction in side wall height is acceptable where proprietary bottoms
permit reduction of the gravel depth); the top of the washwater collectors to be at least eighteen (18) inches above the surface of the media; the underdrain system to efficiently collect the filtered water and to uniformly distribute the backwash water at a rate not less than fifteen (15) gallons per minute per square foot of filter area; backwash flow indicators and controls that are easily readable while operating the control valves; an air release valve on the highest point of each filter; an accessible manhole to facilitate inspection and repairs; and means to observe the wastewater during backwashing, and construction to prevent cross-connection.

6.3.c. Diatomaceous earth filtration -- The use of diatomaceous earth filters may be considered for application to surface waters with turbidity less than or equal to ten (10) NTU and bacterial contamination less than or equal to one hundred (100) total coliforms per one hundred (100) ml and may be used for iron removal for groundwater providing the removal is effective and the water is of satisfactory sanitary quality before treatment.

6.3.c.1. Conditions of use -- Diatomaceous earth filters are expressly excluded from considerations for the following conditions: bacteria removal when contamination is greater than one hundred (100) total coliforms per one hundred (100) ml; color removal; turbidity removal where either the quantity of turbidity is greater than ten (10) NTU or the turbidity exhibits poor filterability characteristics; filtration of waters with algae; and chemical removal.

6.3.c.2. Pilot plant study -- Installation of a diatomaceous earth filtration system shall be preceded by a pilot plant study on the water to be treated. Conditions of the study such as duration, filter rates, head loss accumulation, slurry feed rates, turbidity removal, bacteria removal, etc., shall be approved by the Environmental Engineering Division prior to the study. Satisfactory pilot plant results shall be obtained prior to preparation of final construction plans and specifications. The pilot plant study shall demonstrate the ability of the system to meet applicable drinking water standards at all times.

6.3.c.3. Types of filters -- Pressure or vacuum diatomaceous earth filtration units will be considered for approval; however, the Environmental Engineering Division prefers the vacuum type for its ability to accommodate a design that permits observation of the filter surfaces to determine proper cleaning, damage to a filter element, and adequate coating over the entire filter area.

6.3.c.4. Treated water storage -- Treated water storage capacity in excess of normal requirements shall be provided: to allow operation of the filters at a uniform rate during all conditions of system demand at or below the approved filtration rate; and to guarantee continuity of service during adverse raw water conditions without by-passing the system.

6.3.c.5. Number of units -- See Section 6.3.b. "Rapid Rate Gravity Filters."

6.3.c.6. Pre-coat -- When pre-coating is accomplished with a filter-to-waste system, 0.15 to 0.2 pounds per square foot of filter area is recommended.
6.3.c.6.A. Application -- A uniform pre-coat shall be applied hydraulically to each septum by introducing a slurry to the tank influent line and employing a filter-to-waste or recirculation system.

6.3.c.6.B. Quantity -- Diatomaceous earth in the amount of 0.1 pounds per square foot of filter area or an amount sufficient to apply a 1/16 inch coating shall be used with recirculation.

6.3.c.7. Body feed -- A body feed system to apply additional amounts of diatomaceous earth slurry during the filter run is required to avoid short filter runs or excessive head losses. Rate of body feed is dependent on raw water quality and characteristics and shall be determined in the pilot plant study. Continuous mixing of the body feed slurry is required.

6.3.c.8. Filtration.
6.3.c.8.A. Rate of filtration -- The recommended nominal rate is one (1.0) gallon per minute per square foot of filter area with a maximum of 1.5 gallons per minute per square foot. The filtration rate shall be controlled by a positive means.

6.3.c.8.B. Head loss -- The head loss shall not exceed thirty (30) pounds per square inch for pressure diatomaceous earth filters, or a vacuum of fifteen (15) inches of mercury for a vacuum system.

6.3.c.8.C. Recirculation -- A recirculation or holding pump shall be employed to maintain differential pressure across the filter when the unit is not in operation in order to prevent the filter cake from dropping off the filter elements. A minimum recirculation rate of 0.1 gallon per minute per square foot of filter area shall be provided.

6.3.c.8.D. Septum or filter element -- the filter elements shall be structurally capable of withstanding maximum pressure and velocity variations during filtration and backwash cycles, and shall be spaced such that no less than one (1) inch is provided between elements or between any element and a wall.

6.3.c.8.E. Inlet design - The filter influent shall be designed to prevent scour of the diatomaceous earth from the filter element.

6.3.c.9. Backwash -- A satisfactory method to thoroughly remove and dispose of spent filter cake shall be provided.

6.3.c.10. Appurtenances -- The following shall be provided for every filter: sampling taps for raw and filtered water; a loss of head or differential pressure gauge; a rate-of-flow indicator, preferably with a totalizer; and a throttling valve used to reduce rates below normal during adverse raw water conditions.

6.3.d. Slow rate gravity filters -- The use of slow rate gravity filters shall require prior engineering studies to demonstrate the adequacy and suitability of this method of filtration for the specific raw water supply.

6.3.d.1. Quality of raw water -- Slow rate gravity filtration shall be limited to waters having maximum turbidities of fifty (50) NTU and maximum color of thirty (30) units; this turbidity shall not be attributable to colloidal clay. Raw water quality data shall include examinations for algae.

6.3.d.2. Number -- At least two (2) units shall be provided. Where only two (2) units are provided, each shall be capable of meeting the plant design capacity (normally the projected maximum daily demand) at the approved filtration rate. Where more than two (2) filter units are provided, the filters shall be capable of meeting the plant design capacity at the approved filtration rate with one (1) filter removed from service.

6.3.d.3. Structural details and hydraulics -- Slow rate gravity filters shall be designed to provide: a cover; a minimum eight (8) feet of headroom to permit normal movement by operation personnel for scraping and sand removal operations; adequate manholes and access ports for handling of sand; filtration to waste; and an overflow at the maximum filter water level.

6.3.d.4. Rates of filtration -- The permissible rates of filtration shall be determined by the quality of the raw water and shall be on the basis of experimental data derived from the water to be treated. The nominal rate may be forty-five (45) to one hundred fifty (150) gallons per day per square foot of sand area, with somewhat higher rates acceptable when demonstrated to the satisfaction of the Environmental Engineering Division.

6.3.d.5. Underdrains -- Each filter unit shall be equipped with a main drain and an adequate
number of lateral underdrains to collect the filtered water. The underdrains shall be spaced so that the maximum velocity of the water flow in the underdrain will not exceed 0.75 feet per second. The maximum spacing of laterals shall not exceed three (3) feet if pipe laterals are used.

6.3.d.6. Filtering material -- Filter sand shall be placed on graded gravel layers for a minimum depth of thirty (30) inches. The effective size shall be between 0.30 mm and 0.45 mm. The uniformity coefficient shall not exceed 2.5. The sand shall be clean and free from foreign matter.

6.3.d.7. Filter gravel -- The supporting gravel shall conform to the size and depth distribution provided for rapid rate gravity filters.

6.3.d.8. Depth of water on filter beds -- The design shall provide a depth of at least three (3) feet of water over the sand. Influent water shall not scour the sand surface.

6.3.d.9. Control appurtenances -- Each filter shall be equipped with: a loss of head gauge; an orifice; a Venturi meter, or other suitable metering device installed on each filter to control the rate of filtration; and an effluent pipe designed to maintain the water level above the top of the filter sand.

6.3.e. Direct filtration -- Direct filtration, as used in this subdivision, refers to the filtration of a surface water or groundwater determined to be under the direct influence of surface water without prior settling. The nature of the treatment process shall depend upon the raw water quality. In-plant demonstration studies may be appropriate where conventional treatment plants are converted to direct filtration. Where direct filtration is proposed, an engineering report shall be submitted prior to conducting the pilot plant or in-plant demonstration studies.

6.3.e.1. Engineering report -- The engineering report shall include a historical summary of operating conditions and of raw water quality with special reference to fluctuations in quality and possible sources of contamination. The following raw water parameters shall be evaluated in the report: color; turbidity; bacterial concentration; microscopic biological organisms; temperature; total solids; chemical characteristics; and additional parameters as required by the Environmental Engineering Division. The report shall also include a description of methods and work to be done during a pilot plant study or, where appropriate, an in-plant demonstration study.

6.3.e.2. Pilot plant studies -- The Environmental Engineering Division may, after approval of the engineering report, require a pilot study or in-plant demonstration study by the public water system or their engineer. The study shall be conducted over a sufficient time to treat all expected raw water conditions throughout the year. The study shall emphasize, but not be limited to, the following items: chemical mixing conditions including shear gradients and detention periods; chemical feed rates; use of various coagulants and coagulant aids; flocculation conditions; filtration rates; filter gradation; types of media and depth of media; filter breakthrough conditions; and the adverse impact of recycling backwash water due to microorganisms, solids, algae, trihalomethane formation and other similar problems. The public water system or their engineer, prior to the initiation of design plans and specifications, shall submit a final report including the engineer's design recommendations to the Environmental Engineering Division. The pilot plant filter shall be of a similar type and operated in the same manner as proposed for full scale operation. The pilot study shall demonstrate the minimum contact time necessary for optimum filtration for each coagulant proposed.

6.3.e.3. Control and operation -- A continuous recording turbidimeter shall be installed on each filter effluent line. Additional continuous monitoring equipment to assist in control of coagulant dose may be required by the Environmental Engineering Division.

6.3.e.4. Site requirements -- The plant and its design and land ownership surrounding the plant shall allow for the installation of conventional sedimentation basins if the public water system engineer finds
That they are necessary.

6.4. Disinfection -- Chlorine is the preferred disinfecting agent. Chlorination may be accomplished with liquid chlorine, calcium or sodium hypochlorite or chlorine dioxide. Other disinfecting agents may be considered, providing reliable application equipment is available and testing procedures for a residual are recognized in "Standard Methods for the Examination of Water and Wastewater," latest edition. Continuous disinfection is required for a public water system. Since disinfection agents other than chlorine usually demonstrate shortcomings when applied to a public water system, proposals for use of disinfecting agents in combination with chlorine or other than chlorine require approval by the Environmental Engineering Division prior to preparation of final plans and specifications.

6.4.a. Chlorination equipment.

6.4.a.1. Type -- Solution-feed, gas chlorinators or hypochlorite feeders of the positive displacement type shall be provided.

6.4.a.2. Capacity -- The chlorinator capacity shall be such that a free chlorine residual of at least two (2) milligrams per liter can be maintained in the water after contact time of at least thirty (30) minutes for ground water and to meet the CT for surface water when maximum flow rate coincides with anticipated maximum chlorine demand, maximum pH and minimum temperatures. The equipment shall be of such design that it will operate accurately over the desired feeding range. The chlorinator shall be sized so that at normal operation it will be at approximately fifty percent (50%) of capacity.

6.4.a.3. Standby equipment -- Standby equipment of sufficient capacity shall be available to replace the largest unit. Spare parts shall be made available to replace parts subject to wear and breakage. If there is a large difference in feed rates between routine and emergency dosages, a gas metering tube shall be provided for each dose range to ensure accurate control of the chlorine feed.

6.4.a.4. Automatic switchover -- Automatic switchover of chlorine cylinders shall be provided, where necessary, to assure continuous disinfection.

6.4.a.5. Automatic proportioning -- Automatic proportioning chlorinators are required where the rate of flow or chlorine demand is not reasonably constant.

6.4.a.6. Eductor -- Each eductor shall be selected for the point of application with particular attention given to the quantity of chlorine to be added, the maximum injector water flow, the total discharge back pressure, the injector operating pressure, and the size of the chlorine solution line. Gauges for measuring water pressure and vacuum at the inlet and outlet of each eductor shall be provided.

6.4.a.7. Injector/diffuser -- The chlorine solution injector/diffuser shall be compatible with the point of application to provide a rapid and thorough mix with all the water being treated. The center of a pipeline is the preferred application point.

6.4.a.8. Scales -- Scales for weighing cylinders shall be provided at all waterworks using chlorine gas. At large waterworks, scales of the indicating and recording type are recommended. Scales shall be recessed unless they are of the low platform type.

6.4.b. Contact time and point of application

6.4.b.1. Due consideration shall be given to the contact time of the chlorine in water with relation to pH, ammonia, taste-producing substances, temperature, bacterial quality, trihalomethane formation potential and other pertinent factors. Chlorine shall be applied at a point that will provide adequate contact time. All
basins used for disinfection shall be designed to minimize short circuiting.

6.4.b.2. At plants treating surface water, provisions shall be made for applying chlorine to the settled water, filtered water, and water entering the distribution system. The contact time as required shall be provided after filtration.

6.4.b.3. As a minimum, at plants treating groundwater only, provisions shall be made for applying chlorine to the detention basin inlet and water entering the distribution system.

6.4.b.4. Free residual chlorination is the preferred practice. A minimum contact time of thirty (30) minutes is required for ground water sources not influenced by surface waters. The minimum contact time for surface water sources and ground water sources influenced by surface waters shall be determined by "CT Calculations." Details for calculating "CT" values are contained in the West Virginia Administrative Rules, Division of Health, Public Water Systems, 64CSR3.

6.4.c. Residual chlorine -- Minimum total chlorine residual at all points in a water distribution system shall be 0.2 milligrams per liter. Higher residuals may be required depending on pH, temperature and other characteristics of the water. Booster chlorination may be required to maintain proper residuals.

6.4.d. Testing equipment -- Chlorine residual test equipment recognized in the latest edition of "Standard Methods for the Examination of Water and Wastewater" shall be provided and shall be capable of measuring residuals as contained in the West Virginia Administrative Rules, Division of Health, Public Water Systems, 64CSR3. Automatic chlorine residual recorders shall be provided where the chlorine demand varies appreciably over a short period of time. All surface water treatment plants designed to serve three thousand three hundred (3,300) people or more shall be equipped with recording chlorine analyzers and continuous recorders monitoring water entering the distribution system.

6.4.e. Chlorinator piping.

6.4.e.1. Cross-connection protection -- The chlorinator water supply piping shall be designed to prevent contamination of the treated water supply by sources of questionable quality. At all facilities treating surface water, pre- and post-chlorination systems shall be independent to prevent possible siphoning of partially treated water into the clear well. The water supply to each eductor shall have a separate shut-off valve. No master shut-off valve is allowed.

6.4.e.2. Pipe material -- The pipes carrying elemental liquid or dry gaseous chlorine under pressure shall be Schedule eighty (80) seamless steel tubing or other materials recommended by the Chlorine Institute, Inc. (never use poly vinyl chloride, PVC). Rubber, PVC, polyethylene, or other materials recommended by the Chlorine Institute, Inc. shall be used for chlorine solution piping and fittings. Nylon products are not acceptable for any part of the chlorine solution piping system.

6.5. Softening -- The softening process selected shall be based upon the mineral qualities of the raw water and the desired finished water quality in conjunction with requirements for disposal of sludge or brine waste, cost of plant, cost of chemicals and plant location. Applicability of the process chosen shall be demonstrated.

6.5.a. Lime or lime-soda process -- Design standards for rapid mix, flocculation and sedimentation are in "Clarification," subsection 6.2 of this rule. Additional consideration shall be given to the following process elements.

6.5.a.1. Hydraulics -- When split treatment is used, the bypass line shall be sized to carry total plant flow, and an accurate means of measuring and splitting the flow shall be provided.

6.5.a.2. Aeration -- Determinations shall be made for the carbon dioxide content of the raw
water. When concentrations exceed ten (10) milligrams per liter, the economics of removal by aeration as opposed to removal with lime shall be considered if it has been determined that dissolved oxygen in the finished water will not cause corrosion problems in the distribution system.

6.5.a.3. Chemical feed point -- Lime and recycled sludge shall be fed directly into the rapid mix basin.

6.5.a.4. Rapid mix -- Rapid mix basins shall provide not more than thirty (30) seconds detention time with adequate velocity gradients to keep the lime particles dispersed.

6.5.a.5. Stabilization -- Equipment for stabilization of water softened by the lime or lime-soda process is required.

6.5.a.6. Sludge collection -- Mechanical sludge removal equipment shall be provided in the sedimentation basin. Sludge recycling to the rapid mix shall be provided not to exceed a rate of ten percent (10%) of the incoming flow.

6.5.a.7. Sludge disposal -- Provisions shall be included in the water treatment plant design for proper disposal of softening sludge.

6.5.a.8. Disinfection -- The use of excess lime is not an acceptable substitute for disinfection.

6.5.a.9. Plant start-up -- The plant processes shall be manually started following shut-down.

6.5.b. Cation exchange process -- Alternative methods of hardness reduction shall be investigated when the sodium content and dissolved solids concentration is of concern.

6.5.b.1. Pre-treatment requirements -- Iron, manganese, or a combination of the two, shall not exceed 0.3 milligrams per liter in the water as applied to the ion exchange resin. Pre-treatment is required when the content of iron, manganese, or a combination of the two (2), is one (1) milligram per liter or more. Waters having five (5) units or more turbidity shall not be applied directly to the cation exchange softener.

6.5.b.2. Design -- The units may be of pressure or gravity type, of either an upflow or downflow design. Automatic regeneration based on volume of water softened shall be used unless manual regeneration is justified and is approved by the Environmental Engineering Division. A manual override shall be provided on all automatic controls.
6.5.b.3. Exchange capacity -- The design capacity for hardness removal shall not exceed twenty thousand (20,000) grains per cubic foot when resin is regenerated with 0.3 pounds of salt per kilogram of hardness removed.

6.5.b.4. Depth of resin -- The depth of the exchange resin shall not be less than three (3) feet.

6.5.b.5. Flow rates -- The rate of softening shall not exceed seven (7) gallons per minute per square foot of bed area, and the backwash rate shall be six (6) to eight (8) gallons per minute per square foot of bed area. Rate-of-flow controllers or the equivalent shall be installed for the rate of softening.

6.5.b.6. Freeboard -- The freeboard will depend upon the specific gravity of the resin and the direction of water flow. Generally, the washwater collector shall be twenty-four (24) inches above the top of the resin on downflow units.

6.5.b.7. Underdrains and supporting gravel -- The bottoms, strainer systems and support for the exchange resin shall conform to criteria provided for rapid rate gravity filters.

6.5.b.8. Brine distribution -- Facilities shall be included for even distribution of the brine over the entire surface of both upflow and downflow units.

6.5.b.9. Cross-connection control -- Backwash, rinse and air relief discharge pipes shall be installed in such a manner as to prevent any possibility of back-siphonage.

6.5.b.10. Bypass piping and equipment -- A bypass shall be provided around softening units to produce a blended water of desirable hardness.

6.5.b.11. Additional limitations -- Silica gel resins shall not be used for waters having a pH above 8.4 or containing less than six (6) milligrams per liter silica and shall not be used when iron is present. When the applied water contains a chlorine residual, the cation exchange resin shall be a type that is not damaged by residual chlorine. Phenolic resin shall not be used.

6.5.b.12. Sampling taps -- Smooth-nose sampling taps shall be provided for the collection of representative samples. The taps shall be located to provide for sampling of the softener influent, effluent and blended water. The sampling taps for the blended water shall be at least twenty (20) feet downstream from the point of blending. Petcocks are not acceptable as sampling taps. Sampling taps shall be provided on the brine tank discharge piping.

6.5.b.13. Brine and salt storage tanks.

6.5.b.13.A. Salt dissolving or brine tanks and wet salt storage tanks shall be covered and shall be corrosion-resistant.

6.5.b.13.B. The make-up water inlet shall be protected from back-siphonage. Water for filling the tank shall be distributed over the entire surface by pipes above the maximum brine level in the tank. The tanks shall be provided with an automatic declining level control system on the make-up water line.

6.5.b.13.C. Wet salt storage basins shall be equipped with manholes or hatchways for access and for direct dumping of salt from truck or rail car. Openings shall be provided with raised curbs and watertight covers having overlapping edges similar to those required for finished water reservoirs.
6.5.b.13.D. Overflows, where provided, shall be protected with corrosion resistant screens and shall terminate with either a turned down bend having a proper free fall discharge or a self-closing flap valve.

6.5.b.13.E. Two (2) wet salt storage tanks or compartments designed to operate independently shall be provided.

6.5.b.13.F. The salt shall be supported on graduated layers of gravel placed over a brine collection system.

6.5.b.13.G. The public water system engineer may consider alternative designs that are conducive to frequent cleaning of the wet salt storage tank.

6.5.b.14. Salt and brine storage capacity -- Reserve salt and brine storage capacity for at least thirty (30) days of operation shall be available.

6.5.b.15. Brine pump or eductor -- An eductor may be used to transfer brine from the brine tank to the softeners. If a pump is used, a brine measuring tank or means of metering shall be provided to obtain proper dilution.

6.5.b.16. Stabilization -- Stabilization for corrosion control shall be provided. An alkali feeder shall be provided except when exempted by the Environmental Engineering Division.

6.5.b.17. Waste disposal -- Suitable disposal shall be provided for brine waste. Where the volume of spent brine is reduced, consideration may be given to using a part of the spent brine for a subsequent regeneration.

6.5.b.18. Construction materials -- Pipes and contact materials shall be resistant to the aggressiveness of salt. Plastic and red brass are acceptable piping materials. Steel and concrete shall be coated with a non-leaching protective coating that is compatible with salt and brine.

6.5.b.19. Housing -- Bagged salt and dry bulk salt storage shall be enclosed and separated from other operating areas in order to prevent damage to equipment.

6.6 Aeration -- Aeration may be used to help remove offensive tastes and odors due to dissolved gases from decomposing organic matter, to reduce or remove objectionable amounts of carbon dioxide, hydrogen sulfide, etc., and to introduce oxygen to assist in iron or manganese removal, or both. The packed tower aeration process is an aeration process applicable to removal of volatile organic contaminants.

6.6.a. Natural draft aeration -- The design shall provide: perforations in the distribution pan 3/16 to 2 inches in diameter, spaced one (1) to three (3) inches on centers to maintain a six (6) inch water depth, and eight (8) to ten (10) inches of inert media, such as coke or limestone that will not disintegrate due to freezing cycles; distribution of water uniformly over the top tray and discharge through a series of three (3) or more trays with separation of trays not less than twelve (12) inches; loading at a rate of one (1) to five (5) gallons per minute for each square foot of total tray area; trays with slotted, heavy wire (2 inch openings) mesh or perforated bottoms and construction of durable material resistant to aggressiveness of the water and dissolved gases; protection from loss of spray water by wind carriage by enclosure with louvers sloped to the inside at an angle of approximately forty-five (45) degrees; protection from insects by twenty-four (24) mesh screen; and disinfection treatment of aerated water.

6.6.b. Forced or induced draft aeration -- Forced or induced draft aeration devices shall be designed to: include a blower with a weatherproof motor in a tight housing and screened enclosure and ensure adequate counter current of air through the enclosed aeration column; exhaust air directly to the outside atmosphere;
include a down-turned and twenty-four (24)-mesh screened air outlet and inlet; ensure that air introduced in the column is as free from obnoxious fumes, dust, and dirt as possible; be such that sections of the aerator can be easily reached or removed for maintenance of the interior or installed in a separate aerator room; provide loading at a rate of one (1) to five (5) gallons per minute for each square foot of total tray area; ensure that the water outlet is adequately sealed to prevent unwarranted loss of air; discharge though a series of five or more trays with separation of trays not less than six (6) inches; provide distribution of water uniformly over the top tray; and be of durable material resistant to the aggressiveness of the water and dissolved gases.

6.6.c. Pressure aeration -- Pressure aeration may be used for oxidation purposes only if the pilot plant study indicates the method is applicable; it is not acceptable for removal of dissolved gases. Filters following pressure aeration shall have adequate exhaust devices for the release of air. Pressure aeration devices shall be designed to give a thorough mixing of compressed air with the water being treated and provide screened and filtered air, free of obnoxious fumes, dust, dirt and other contaminants.

6.6.d. Packed Tower Aeration -- Packed tower aeration (PTA) that is also known as air stripping involves passing water down through a column of packing material while pumping air counter-currently up through the packing. PTA is used for the removal of volatile organic chemicals, trihalomethanes, carbon dioxide, and radon. Generally, PTA is feasible for compounds with a Henry's Constant greater than one hundred (100) (expressed in atm mol/mol - at twelve (12) degrees C), but not normally feasible for removing compounds with a Henry's Constant less than ten (10). For values between ten (10) and one hundred (100), PTA may be feasible but shall be extensively evaluated using pilot studies. The Public Water System’s engineer shall discuss values for Henry's Constant with the Environmental Engineering Division prior to final design.


6.6.d.1.A. Process design methods for PTA involve the determination of Henry's Constant for the contaminant, the mass transfer coefficient, air pressure drop and stripping factor. The Public Water System’s engineer shall provide justification to the Environmental Engineering Division for the design parameters selected (i.e., height and diameter of the unit, air to water ratio, packing depth, surface loading rate, etc.). Pilot plant testing shall be provided. The pilot test shall evaluate a variety of loading rates and air to water ratios at the peak contaminant concentration. The public water system’s engineer shall give special consideration to removal efficiencies when multiple contaminations occur. Where there is considerable past performance data on the contaminant to be treated and there is a concentration level similar to previous projects, the Environmental Engineering Division may approve the process design based on use of appropriate calculations without pilot testing. The Public Water System’s engineer shall discuss proposals of this type with the Environmental Engineering Division prior to submission of any permit applications.

6.6.d.1.B. The tower shall be designed to reduce contaminants to below the maximum contaminant level (MCL) and to the lowest practical level.

6.6.d.1.C. The ratio of the column diameter to packing shall be at least seven (7) to one (1) for the pilot unit and at least ten (10) to one (1) for the full scale tower. The type and size of the packing used in the full scale unit shall be the same as that used in the pilot work.

6.6.d.1.D. The minimum volumetric air to water ratio at peak water flow shall be twenty-five (25) to one (1). The maximum air to water ratio for which credit will be given is eighty (80) to one (1).

6.6.d.1.E. The design shall consider potential fouling problems from calcium carbonate, manganese and iron precipitation and from bacterial growth. It may be necessary to provide pretreatment. Disinfection capability shall be provided prior to and after PTA.
6.6.d.1.F. The effects of temperature shall be considered since a drop in water temperature can result in a drop in contaminant removal efficiency.

6.6.d.2. Materials of Construction -- The tower may be constructed of stainless steel, concrete, aluminum, fiberglass or plastic. Uncoated carbon steel is not recommended because of corrosion. Towers constructed of light-weight materials shall be provided with adequate support to prevent damage from wind. Packing materials shall be resistant to the aggressiveness of the water, dissolved gases and cleaning materials and shall be suitable for contact with potable water.

6.6.d.3. Water Flow System -- Water shall be distributed uniformly at the top of the tower using spray nozzles or orifice-type distributor trays that prevent short circuiting. A mist eliminator shall be provided above the water distributor system. A side wiper redistribution ring shall be provided at least every ten (10) feet in order to prevent water channeling along the tower wall and short circuiting. Smooth nosed sample taps shall be provided in the influent and effluent piping. The effluent sump, if provided, shall have easy access for cleaning purposes and be equipped with a drain valve. The drain shall not be connected directly to any storm or sanitary sewer. A blow-off line shall be provided in the effluent piping to allow for discharge of water and chemicals used to clean the tower. The design shall prevent freezing of the influent riser and effluent piping when the unit is not operating. If piping is buried, it shall be maintained under positive pressure. The water flow to each tower shall be metered. An overflow line shall be provided that discharges twelve (12) to fourteen (14) inches above a splash pad or drainage inlet. Proper drainage shall be provided to prevent flooding of the area.

6.6.d.4. Air Flow System -- The air inlet to the blower and tower discharge vent shall be protected with a non-corrodible twenty-four (24) mesh downturned screen to prevent contamination from extraneous matter. The air inlet shall be in a protected location. An air flow meter shall be provided on the influent air line or an alternative method to determine the air flow shall be provided. A backup motor for the air blower shall be readily available.

6.6.d.5. Other Features that Shall Be Provided -- The following shall be provided: a sufficient number of access ports with a minimum diameter of twenty-four (24) inches to facilitate inspection, media replacement, media cleaning and maintenance of the interior; a method of cleaning the packing material when iron, manganese, or calcium carbonate fouling may occur; tower effluent collection and pumping wells constructed to clearwell standards; provisions for extending the tower height; an Environmental Engineering Division approved alternative supply during periods of maintenance and operation interruptions; no bypass unless specifically approved by the Environmental Engineering Division; disinfection application points both ahead of and after the tower to control biological growth; disinfection and adequate contact time after the water has passed through the tower and prior to the distribution system; adequate packing support to allow free flow of water and to prevent deformation with deep packing heights; adequate foundation to support the tower and lateral support to prevent overturning due to wind loading; fencing and locking gate to prevent vandalism; an access ladder with safety cage for inspection of the aerator including the exhaust port and de-mister; and electrical interconnection to allow simultaneous operation and disconnect of the blower, disinfectant feeder and well pump.

6.6.d.6. Environmental Factors -- The applicant shall contact the appropriate air quality office to determine if permits are required under the Clean Air Act. Noise control facilities shall be provided on PTA systems located in residential areas.

6.6.e. Other methods of aeration -- Other methods of aeration may be used if applicable to the treatment needs. These methods include but are not restricted to spraying, diffused air, cascades and mechanical aeration. The treatment process shall be designed to meet the particular needs of the water to be treated and is subject to the approval of the Environmental Engineering Division.
6.6.f. Protection of aerators -- All aerators except those discharging to lime softening or clarification plants shall be protected from contamination by birds, insects, wind borne debris, rainfall and water draining off the exterior of the aerator.

6.6.g. Bypass -- A bypass shall be provided for all aeration units except those installed to comply with maximum contaminant levels.

6.6.h. Corrosion control -- The aggressiveness of the water after aeration shall be determined and corrected by additional treatment, if necessary.

6.7. Iron and Manganese Control -- Iron and manganese control, as used in this subsection, refers solely to treatment processes designed specifically for this purpose. The treatment process used will depend upon the character of the raw water. The selection of one (1) or more treatment processes shall meet specific local conditions as determined by engineering investigations, including chemical analyses of representative samples of water to be treated, and receive the approval of the Environmental Engineering Division. It may be necessary to operate a pilot plant in order to gather all information pertinent to the design. Consideration shall be given to adjusting the pH of the raw water to optimize the chemical reaction. Testing equipment and sampling taps shall be provided.

6.7.a. Removal by oxidation, detention and filtration.

6.7.a.1. Oxidation -- Oxidation may be by aeration or by chemical oxidation with chlorine, potassium permanganate, ozone or chlorine dioxide.

6.7.a.2. Detention.

6.7.a.2.A. Reaction -- A minimum detention time of twenty (20) minutes shall be provided following aeration to insure that the oxidation reactions are as complete as possible. This minimum detention may be omitted only where a pilot plant study indicates no need for detention. The detention basin shall be designed as a holding tank with no provisions for sludge collection but with sufficient baffling to prevent short circuiting.

6.7.a.2.B. Sedimentation -- Sedimentation basins shall be provided when treating water with high iron or manganese content, or where chemical coagulation is used to reduce the load on the filters. Provisions for sludge removal shall be made.

6.7.b. Removal by the lime-soda softening process, as in section 6.5.a. of this rule.

6.7.c. Removal by manganese greensand filtration -- This process consists of feeding of potassium permanganate to a manganese greensand filter. Provisions shall be made to apply the permanganate as far ahead of the filter as practical and to a point immediately before the filter. Other oxidizing agents or processes such as chlorination or aeration may be used prior to the permanganate feed to reduce the cost of the chemical. An anthracite media cap of at least six inches shall be provided over manganese greensand. The normal filtration rate is three (3) gallons per minute per square foot or not to exceed the rate specified by manufacturer. The normal wash rate is eight (8) to ten (10) gallons per minute per square foot. Air washing shall be provided. Smooth nosed sample taps shall be provided prior to application of permanganate, immediately ahead of filtration, at the filter effluent. The smooth nosed sample taps shall be provided at points between the anthracite media and the manganese greensand media and halfway down the manganese greensand media. Recommend potassium permanganate feed system have a means of automatic shut-off if overfeed occurs.
6.7.d. Removal by ion exchange -- The ion exchange process of iron and manganese removal shall not be used for water containing more than five (5) milligrams per liter of iron, manganese or a combination thereof. This process is not acceptable where either the raw water or wash water contains dissolved oxygen.

6.7.e. Sequestration by polyphosphates -- The sequestration by polyphosphates process shall not be used when iron, manganese or a combination thereof exceeds one (1) milligram per liter as phosphate. Where phosphate treatment is used, satisfactory chlorine residuals shall be maintained in the distribution system. Feeding equipment shall conform to the requirements of "Chemical Application," in section six (6) of this rule. Polyphosphates shall not be applied ahead of iron and manganese removal treatment. The point of application shall be prior to any aeration, oxidation or disinfection if no iron or manganese removal treatment is provided. Phosphate chemicals shall meet AWWA Standards and conform to ANSI/NSF Standard 60: Drinking Water Treatment Chemicals - Health Effects.

6.7.f. Sequestration by sodium silicates -- Sodium silicate sequestration of iron and manganese is appropriate only for groundwater supplies prior to air contact. On-site pilot tests are required to determine the suitability of sodium silicate for the particular water and the minimum feed needed. Rapid oxidation of the metal ions such as by chlorine or chlorine dioxide shall accompany or closely precede the sodium silicate addition. Injection of sodium silicate more than fifteen (15) seconds after oxidation may cause a detectable loss of chemical efficiency. Dilution of feed solutions much below five per cent (5%) silica as silica dioxide shall also be avoided for the same reason. Sodium silicate addition is applicable to waters containing up to two (2) mg/l of iron, manganese or a combination thereof. Chlorine residuals shall be maintained throughout the distribution system to prevent biological breakdown of the sequestered iron. The amount of silicate added shall be limited to twenty (20) mg/l as silica dioxide, but the amount added and naturally occurring silicate shall not exceed sixty (60) mg/l as silica dioxide. Feeding equipment shall conform to the requirements of "Chemical Application," in section seven (7) of this rule. Sodium silicate shall not be applied ahead of iron or manganese removal treatment. Liquid sodium silicate shall meet AWWA Standard B404 and shall conform to ANSI/NSF Standard 60: Drinking Water Treatment Chemicals - Health Effects.

6.7.g. Sampling taps -- Smooth-nosed sampling taps shall be provided for control purposes. Taps shall be located on each raw water source, each treatment unit influent and each treatment unit effluent.

6.7.h. Testing equipment shall be provided for all plants. The equipment shall have the capacity to accurately measure the iron content to a minimum of 0.1 milligrams per liter and the manganese content to a minimum of 0.05 milligrams per liter. Where polyphosphate sequestration is practiced, appropriate phosphate testing equipment shall be provided.

6.8. Fluoridation -- Sodium fluoride, sodium silicofluoride and hydrofluosilicic acid shall conform to the applicable AWWA standards and shall conform to ANSI/NSF Standard 60: Drinking Water Treatment Chemicals - Health Effects. Other fluoride compounds that may be available shall be approved by the Environmental Engineering Division. The proposed method of fluoride feed shall be approved by the Environmental Engineering Division prior to preparation of final plans and specifications.

6.8.a. Fluoride compound storage - Fluoride chemicals shall be isolated from other chemicals to prevent contamination. Compounds shall be stored in covered or unopened shipping containers and shall be stored inside a building. Storage of hydrofluosilicic acid shall be in sealed carboys unless the treatment plant is designed with bulk storage tanks. While being used, the unsealed storage units for hydrofluosilicic acid shall be vented to the atmosphere at a point outside any building. Bags, fiber drums and deldrums shall be stored on pallets.

6.8.b. Chemical feed equipment and methods -- In addition to the requirements in "Chemical Application," in section seven (7) of this rule, fluoride feed equipment shall meet the following requirements: scales, loss-of-weight recorders or liquid level indicators, as appropriate, accurate to within five percent (5%) of the average daily change in reading shall be provided for chemical feeds; feeders shall be accurate to within
five percent (5%) of any desired feed rate; the fluoride compound shall be fed by a fluoride saturator, volumetric, gravimetric, or hydrofluosilicic acid fifteen (15) gallon carboy or fifty-five (55) gallon drum only (solution tanks are not permitted, exclusive of saturators); fluoride compound shall be added last, either directly into the clearwell or into the plant discharge line; the point of application for hydrofluosilicic acid or sodium fluoride, if into a horizontal pipe, shall be forty-five (45) degrees from the bottom of the pipe with the injector protruding into the pipe 1/3 the pipe diameter; a fluoride solution shall be applied by a positive displacement pump having a stroke rate not less than twenty (20) strokes per minute; anti-siphon devices shall be provided for all fluoride lines and dilution water lines; a device to measure the flow of water to be treated is required; water used for sodium fluoride saturated solution shall be softened if hardness exceeds one hundred (100) mg/l as calcium carbonate; fluoride solutions shall not be injected to a point of negative pressure; the electrical outlet used for the fluoride feed pump shall have a nonstandard receptacle, unless it would void the pump warranty, and shall be interconnected with the well or high service pump; and saturators shall be of the upflow type and be provided with a meter and backflow protection on the makeup water line.

6.8.c. Secondary controls -- Secondary control systems for fluoride chemical feed devices may be required by the Environmental Engineering Division as a means of reducing the possibility for overfeed; these may include flow or pressure switches or other devices.

6.8.d. Protective equipment -- Protective equipment as recommended by the compound manufacturer shall be provided for operators handling fluoride compounds.

6.8.e. Dust control -- Provision shall be made for the transfer of dry fluoride compounds from shipping containers to storage bins or hoppers in such a way as to minimize the quantity of fluoride dust that may enter the room in which the equipment is installed. The enclosure shall be provided with an exhaust fan and dust filter that place the hopper under a negative pressure. Air exhausted from fluoride handling equipment shall discharge through a dust filter to the atmosphere outside of the building. Provision shall be made for disposing of empty bags, drums or barrels in a manner that will minimize exposure to fluoride dusts. A floor drain shall be provided to facilitate the hosing of floors.

6.8.f. Testing equipment -- Equipment shall be provided for measuring the quantity of fluoride in the water. The equipment is subject to the approval of the Environmental Engineering Division.

6.9. Stabilization -- Water that is unstable due either to natural causes or to subsequent treatment shall be stabilized.

6.9.a. Carbon dioxide addition -- Recarbonation basin design shall provide a total detention time of twenty minutes. Two compartments, with a depth that will provide a diffuser submergence of not less than 7.5 feet nor greater submergence than recommended by the manufacturer are required. One compartment shall be a mixing compartment having a detention time of at least three minutes and the second compartment shall be a reaction compartment. Plants generating carbon dioxide from combustion shall have open top recarbonation tanks in order to dissipate carbon monoxide gas. Where liquid carbon dioxide is used, adequate precautions shall be taken to prevent carbon dioxide from entering the plant from the recarbonation process. Provisions shall be made for draining the carbonation basin and removing sludge.

6.9.b. Acid addition -- Feed equipment shall conform to "Chemical Application" section 7.1.b.. Adequate precautions shall be taken for operator safety, such as not adding water to the concentrated acid.

6.9.c. Phosphates -- The feeding of phosphates may be applicable for sequestering calcium in lime-softened water, corrosion control, and in conjunction with alkali feed following ion exchange softening. Feed equipment shall conform to "Chemical Application," section six of this rule. Phosphate shall meet AWWA standards and shall conform to ANSI/NSF Standard 60: Drinking Water Treatment Chemicals - Health Effects. Stock phosphate solution shall be kept covered and disinfected by carrying approximately ten (10) milligrams per liter free chlorine residual. Phosphate solutions having a pH of two (2) or less may be exempted from this requirement by the Environmental Engineering Division. Satisfactory chlorine residuals
shall be maintained in the distribution system when phosphates are used.

6.9.d. "Split treatment" -- Under some conditions, a lime-softening water treatment plant can be designed using "split treatment" in which raw water is blended with lime-softened water to partially stabilize the water prior to secondary clarification and filtration. Treatment plants designed to utilize "split treatment" shall also contain facilities for further stabilization by other methods.

6.9.e. Alkali feed -- Unstable water created by ion exchange softening shall be stabilized by an alkali feed. An alkali feeder shall be provided for all ion exchange water softening plants except when exempted by the Environmental Engineering Division.

6.9.f. Carbon dioxide reduction by aeration -- The carbon dioxide content of an aggressive water may be reduced by aeration.

6.9.g. Other treatment -- Other treatment for controlling corrosive waters by the use of sodium silicate and sodium bicarbonate may be used where necessary. Any proprietary compound shall receive the specific approval of the Environmental Engineering Division before use.

6.9.h. Water unstable due to biochemical action in distribution system -- Unstable water resulting from the bacterial decomposition of organic matter in water (especially in dead end mains), the biochemical action within tubercles, and the reduction of sulfates to sulfides shall be prevented by the maintenance of a free chlorine residual throughout the distribution system.

6.9.i. Control -- Laboratory equipment shall be provided for determining the effectiveness of stabilization treatment.

6.9.j. Cathodic Protection -- Cathodic protection may be used to prevent or minimize corrosion of the inner surfaces of water tanks and standpipes and the outer surfaces of metal conduits.

6.10. Taste and Odor Control -- Provision shall be made for the control of taste and odor at all surface water treatment plants. Chemicals shall be added sufficiently ahead of other treatment processes to assure adequate contact time for an effective and economical use of the chemicals. Where severe taste and odor problems are encountered, in-plant or pilot plant, or both, studies are required.

6.10.a. Flexibility -- Plants treating water that is known to have taste and odor problems shall be provided with equipment that makes several of the control processes available so that the operator will have flexibility in operation.

6.10.b. Chlorination -- Chlorination can be used for the removal of some objectionable odors. Adequate contact time shall be provided to complete the chemical reactions involved. Excessive potential trihalomethane production through this process shall be avoided by adequate bench-scale testing prior to the design.

6.10.c. Chlorine dioxide -- Chlorine dioxide has been generally recognized as a treatment for tastes caused by industrial wastes, such as phenols. However, chlorine dioxide can be used in the treatment of any taste and odor that is treatable by an oxidizing compound. Provisions shall be made for proper storing and handling of the sodium chlorite, so as to eliminate any danger of explosion.

6.10.d. Powdered activated carbon -- Powdered activated carbon shall be added as early as possible in the treatment process to provide maximum contact time. Flexibility to allow the addition of carbon at several points is preferred. Activated carbon shall not be applied near the point of chlorine application or any other oxidant. The carbon can be added as a pre-mixed slurry or by means of a dry-feed machine as long as the
carbon is properly wetted. Continuous agitation or re-suspension equipment is necessary to keep the carbon from depositing in the slurry storage tank. Provision shall be made for adequate dust control. The required rate of feed of carbon in a water treatment plant depends upon the tastes and odors involved, but provision shall be made for adding from 0.1 milligrams per liter to at least one hundred (100) milligrams per liter. Powdered activated carbon shall be handled as a potentially combustible material. It shall be stored in a building or compartment as nearly fireproof as possible. Other chemicals shall not be stored in the same compartment. A separate room shall be provided for carbon feed installations. Carbon feeder rooms shall be equipped with explosion-proof electrical outlets, lights and motors.

6.10.e. Granular activated carbon -- See "Filtration," subsection 6.3.a.7.C. of this rule, for application within filters.

6.10.f. Copper sulfate and other copper compounds -- Continuous or periodic treatment of water with copper compounds to kill algae or other growths shall be controlled to prevent copper in excess of one (1) milligram per liter as copper in the plant effluent or distribution system. Care shall be taken to assure an even distribution.

6.10.g. Aeration -- See "Aeration," subsection 6.6 of this rule.

6.10.h. Potassium permanganate -- Application of potassium permanganate may be considered, providing the treatment shall be designed so that the products of the reaction are not visible in the finished water.

6.10.i. Ozone -- Ozonation may be used as a means of taste and odor control. Adequate contact time shall be provided to complete the chemical reactions involved. Ozone is generally more desirable for treating water with high threshold odors.

6.10.j. Other methods -- The decision to use any other methods of taste and odor control shall be made only after careful laboratory or pilot plant, or both, tests and in consultation with the Environmental Engineering Division.

6.11. Microscreening -- A microscreen is a mechanical supplement of treatment capable of removing suspended matter from the water by straining. It may be used to reduce nuisance organisms and organic loadings. It shall not be used in place of filtration, when filtration is necessary to provide a satisfactory water nor used in place of coagulation in the preparation of water for filtration.

6.11.a. Design -- Design shall give due consideration to: the nature of the suspended matter to be removed corrosiveness of the water, the effect of chlorination, when required as pre-treatment; and the duplication of units for continuous operation during equipment maintenance. Design shall provide a durable, corrosion-resistant screen, by-pass arrangements, protection against back-siphonage when potable water is used for washing, and proper disposal of wash waters.

6.12. Waste Handling and Disposal -- Provisions shall be made for proper disposal of water treatment plant waste such as sanitary waste, laboratory waste, clarification sludge, softening sludge, iron sludge, filter backwash water, and brines. All waste discharges are governed by West Virginia Department of Environmental Protection (WVDEP) requirements. The requirements under this rule shall be considered minimum requirements as WVDEP may have more stringent requirements. In locating waste disposal facilities, due consideration shall be given to preventing potential contamination of the water supply. Alternative methods of water treatment and chemical use shall be considered as a means of reducing waste volumes and the associated handling and disposal problems.

6.12.a. Sanitary waste -- The sanitary waste from water treatment plants, pumping stations, and other waterworks installations shall receive treatment. Waste from these facilities shall be discharged directly to a sanitary sewer system, when available and feasible, to an adequate on-site waste treatment facility approved by
the County Health Department or to a treatment system approved by the Environmental Engineering Division.
6.12.b. Brine waste -- Waste from ion exchange plants, demineralization plants, or other plants that produce a brine, may be disposed of by controlled discharge to a stream if adequate dilution is available. Surface water quality requirements of the WVDEP will control the rate of discharge. Except when discharging to large waterways, a holding tank of sufficient size shall be provided to allow the brine to be discharged over a twenty-four (24) hour period. Where discharging to a sanitary sewer, a holding tank may be required to prevent the overloading of the sewer or interfering with the waste treatment processes. The effect of brine discharge to sewage lagoons may depend on the rate of evaporation from lagoons.

6.12.c. Lime softening sludge -- Sludge from plants using lime to soften water varies in quantity and in chemical characteristics depending on the softening process and the chemical characteristics of the water being softened. Recent studies show that the quantity of sludge produced is much larger than indicated by stoichiometric calculations. Methods of treatment and disposal are as follows:

6.12.c.1. Lagoons -- Temporary lagoons that are cleaned periodically shall be designed on the basis of 0.7 acres per million gallons per day per one hundred (100) milligrams per liter of hardness removed based on usable lagoon depth of five feet. This shall provide about 2 \( \Box \) years storage. At least two (2) but preferably more lagoons shall be provided in order to give flexibility in operation. An acceptable means of final sludge disposal shall be provided. Provisions shall be made for convenient cleaning. Permanent lagoons shall have a volume of at least four (4) times that for temporary lagoons. The design of both temporary lagoons and permanent lagoons shall provide for: locations free from flooding; when necessary, dikes, deflecting gutters or other means of diverting surface water so that it does not flow into the lagoons; a minimum usable depth of five (5) feet; adequate freeboard of at least two (2) feet; an adjustable decanting device; an effluent sampling point; safety provisions; and parallel operation.

6.12.c.2. Land Application -- The application of liquid lime sludge to farm land shall be considered as a method of ultimate disposal. Approval from the WVDEP shall be obtained.

6.12.c.3. Sanitary Sewers -- Discharge of lime sludge to sanitary sewers shall be avoided since it may cause both liquid volume and sludge volume problems at the sewage treatment plant. This method shall be used only when the sewerage system has the capability to adequately handle the lime sludge.

6.12.c.4. Mixing -- Mixing of lime sludge with activated sludge waste may be considered as a means of co-disposal.

6.12.c.5. Landfills -- Disposal at a landfill may be done as either a solid or liquid if the landfill can accept such waste, depending on WVDEP requirements.

6.12.c.6. Mechanical Dewatering -- Mechanical dewatering of sludge may be considered. Pilot studies on a particular plant waste are recommended. The Environmental Engineering Division may require operational data from similar water treatment facilities treating similar raw water and require performance guaranteed specifications for the mechanical equipment.

6.12.c.7. Calcination -- Calcination of sludge may be considered. Pilot studies on a particular plant waste are recommended. The Environmental Engineering Division may require operational data from similar water treatment facilities treating similar raw water and require performance guaranteed specifications for the mechanical equipment.

6.12.c.8. Drying Beds -- Lime sludge drying beds are not recommended.
6.12.d. Alum sludge -- Lagooning may be used as a method of handling alum sludge. Lagoon size may be calculated using total chemicals used plus a factor for turbidity. Mechanical concentration may be considered. A pilot plant study is required before the design of a mechanical dewatering installation. Freezing changes the nature of alum sludge so that it can be used for fill. Acid treatment of sludge for alum recovery may be a possible alternative. Alum sludge may be discharged to a sanitary sewer; however, initiation of this practice will depend on obtaining approval from the owner of the sewerage system as well as from the Environmental Engineering Division before final designs are made. Lagoons shall be designed to produce an effluent satisfactory to the WVDEP and shall provide for: locations free from flooding; where necessary, dikes, deflecting gutters or other means of diverting surface water so that it does not flow into the lagoon; a minimum usable depth of five feet; freeboard of at least two (2) feet; an adjustable decanting device; an effluent sampling point; and safety provisions.

6.12.e. "Red water" waste -- Waste filter wash water from iron and manganese removal plants can be disposed of as follows:

6.12.e.1. Sand filters -- Sand filters shall have the following features:

6.12.e.1.A. Total filter area, regardless of the volume of water to be handled, shall be no less than one hundred (100) square feet. Unless the filter is small enough to be cleaned and returned to service in one (1) day, two (2) or more cells are required;

6.12.e.1.B. The "red water" filter shall have sufficient capacity to contain, above the level of the sand, the entire volume of wash water produced by washing all of the production filters in the plant, unless the production filters are washed on a rotating schedule and the flow through the production filters is regulated by true rate of flow controllers. Then sufficient volume shall be provided to properly dispose of the wash water involved;

6.12.e.1.C. Sufficient filter surface area shall be provided so that, during any one (1) filtration cycle, no more than two (2) feet of backwash water will accumulate over the sand surface;

6.12.e.1.D. The filter shall not be subject to flooding by surface runoff or flood waters. Finished grade elevation shall be established to facilitate maintenance, cleaning and removal of surface sand as required. Flash boards or other non-watertight devices shall not be used in the construction of filter side walls;

6.12.e.1.E. The filter media shall consist of a minimum of twelve (12) inches of sand, three (3) to four (4) inches of supporting small gravel or torpedo sand and nine (9) inches of gravel in graded layers. All sand and gravel shall be washed to remove fines;

6.12.e.1.F. Filter sand shall have an effective size of 0.3 to 0.5 mm and a uniformity coefficient not to exceed 3.5. The use of larger sized sands shall be justified by the designing engineer to the satisfaction of the Environmental Engineering Division;

6.12.e.1.G. The filter shall be provided with an adequate under-drainage collection system to permit satisfactory discharge of filtrate;

6.12.e.1.H. Provision shall be made for the sampling of the filter effluent;

6.12.e.1.I. Overflow devices from "red water" filters shall not be permitted;

6.12.e.1.J. Where freezing is a problem, provisions shall be made for covering the filters during the winter months; and
6.12.e.1.K. "Red water" filters shall comply with the common wall provisions that pertain to the possibility of contamination of finished water with an unsafe water. The Environmental Engineering Division shall be contacted for approval of any arrangement where a separate structure is not provided.

6.12.e.2. Lagoons -- Lagoons shall have the following features: be designed with volume ten (10) times the total quantity of wash water discharged during any twenty-four (24) hour period; a minimum usable depth of three (3) feet, length four (4) times width, and the width at least three (3) times the depth, as measured at the operating water level; an outlet at the end opposite the inlet; a weir overflow device at the outlet end with weir length equal to or greater than depth; and velocity dissipated at the inlet end.

6.12.e.3. Discharge to community sanitary sewer -- "Red water" may be discharged to a community sewer; however, approval of this method will depend on obtaining approval from the owner of the sewerage system as well as from the Environmental Engineering Division before final designs are made. A holding tank is recommended to prevent overloading the sewers.

6.12.e.4. Recycling "Red Water" waste -- Recycling of supernatant or filtrate from "red water" waste treatment facilities to the head end of an iron removal plant is not allowed except as approved by the Environmental Engineering Division.

6.12.f. Waste filter wash water -- Waste filter wash water from surface water treatment or lime softening plants shall have suspended solids reduced to a level acceptable to the WVDEP before being discharged. Many plants have constructed holding facilities and return this water to the inlet end of the plant. The holding facility shall be of such a size that it will contain the anticipated volume of waste wash water produced by the plant when operating at design capacity. A plant that has two (2) filters shall have a holding facility that will contain the total waste wash from both filters calculated by using a fifteen (15) minute wash at twenty (20) gallons per minute per square foot. In plants with more filters, the size of the holding facilities will depend on the anticipated hours of operation. It is required that waste filter wash water be returned at a rate of less than ten percent (10%) of the raw water influent rate. Filter backwash water shall not be recycled when the raw water contains excessive algae, when finished water taste and odor problems are encountered, or when trihalomethane levels in the distribution system may exceed allowable levels. Consideration shall be given to the concentration effects of contaminants.

64-77-7. Chemical Application.

7.1. General. -- No chemicals shall be applied to treat drinking waters unless specifically approved by the Environmental Engineering Division.

7.1.a. Plans and specifications. -- Plans and specifications shall be submitted to the Environmental Engineering Division for review and approval and shall include: descriptions of feed equipment, including maximum and minimum feed ranges; the location of feeders, piping layout and points of application; storage and handling facilities; specifications for chemicals to be used; operating and control procedures including proposed application rates; and the descriptions of testing equipment and procedures.

7.1.b. Chemical application. -- Chemicals shall be applied to the water at such points and by such means as to assure maximum efficiency of treatment, assure maximum safety to consumers, provide maximum safety to operators, assure satisfactory mixing of the chemicals with the water, provide maximum flexibility of operation through various points of application, when appropriate, and prevent backflow or back-siphonage between multiple points of feed through common manifolds.

7.1.c. General equipment design. -- General equipment design shall be such that: feeders will be able to supply, at all times, the necessary amounts of chemicals at an accurate rate, throughout the range of feed; chemical-contact materials and surfaces are resistant to the aggressiveness of the chemical solution; corrosive
chemicals are introduced in such a manner as to minimize potential for corrosion; chemicals that are incompatible are not stored or handled together; all chemicals are conducted from the feeder to the point of application in separate conduits; chemical feeders are as near as practical to the feed point; chemical feeders and pumps operate at no lower than twenty per cent (20%) of the feed range; chemicals are fed by gravity where practical; and all surface water systems have the capability to feed powdered activated carbon.

7.2. Facility Design.

7.2.a. Number of feeders -- Where chemical feed is necessary for the protection of the supply, such as chlorination, coagulation or other essential processes, the standby unit or a combination of units of sufficient capacity shall be available to replace the largest unit during shut-downs, for all surface water and ground water under the direct influence of surface water systems. The standby unit or a combination of units of sufficient capacity shall be available to replace the largest unit during shut-downs for other water systems. Where a booster pump is required, duplicate equipment shall be provided and, when necessary, standby power. A separate feeder shall be used for each chemical applied. Spare parts shall be available for all equipment to replace parts that are subject to wear and damage.

7.2.b. Control -- Feeders may be manually or automatically controlled, with automatic controls designed to allow override by manual controls. Process shall be manually started following shutdown, unless otherwise approved by the Environmental Engineering Division. At automatically operated facilities, chemical feeders shall be electrically interconnected with the well or service pump. Chemical feed rates shall be proportional to flow. A means to measure water flow shall be provided in order to determine chemical feed rates. Provisions shall be made for measuring the quantities of chemicals used. Automatic chemical dose or residual analyzers may be approved by the Environmental Engineering Division for use and shall provide alarms for critical values and recording charts.

7.2.b.1. Weighing scales -- Weighing scales shall be provided for weighing cylinders at all plants utilizing chlorine gas. For large plants, indicating and recording type weighing scales are desirable and are required for hydrofluosilicic acid and sodium silicofluoride feed and volumetric dry chemical feeders. Weighing scales shall be accurate to measure increments of 0.5 per cent of load.

7.2.c. Dry chemical feeders. -- Dry chemical feeders shall measure chemicals volumetrically or gravimetrically, provide adequate solution water and agitation of the chemical in the solution pot, provide gravity feed from solution pots, completely enclose chemicals to prevent emission of dust to the operating room and be provided with dust removal systems.

7.2.d. Positive displacement solution pumps. -- Positive displacement type solution feed pumps shall be used to feed liquid chemicals but shall not be used to feed chemical slurries unless recommended by the manufacturer for that use. Pumps shall be sized to match or exceed maximum head conditions found at the point of injection.

7.2.e. Liquid chemical feeders. -- Siphon control - Liquid chemical feeders shall be such that chemical solutions cannot be siphoned into the water supply by assuring discharge at a point of positive pressure or by providing vacuum relief, a suitable air gap or other suitable means or combinations as necessary.

7.2.f. Cross-connection control. -- Cross-connection control shall be provided to assure that the service water lines discharging to solution tanks are properly protected from backflow as required by the Environmental Engineering Division, vacuum breakers as a minimum. Design shall prevent liquid chemical solutions from being siphoned through solution feeders into the water supply, and no direct connection shall exist between any sewer and a drain or overflow from the feeder, solution chamber or tank by providing that all drains terminate at least six (6) inches or two (2) pipe diameters, whichever is greater, above the overflow rim of a receiving sump, conduit or waste receptacle.
7.2.g. Chemical feed equipment location. -- Chemical feed equipment shall: be located in a separate room to reduce hazards and dust problems; be conveniently located near points of application to minimize length of feed lines; be readily accessible for servicing, repair, and observation of operation including cleanouts; be located such that the flow to the rapid mix is by gravity, except in case of in-line static mixers; be located with protective curbing so that chemicals from equipment failure, spillage or accidental drainage shall not enter the water in conduits, treatment or storage basins; and have floor drains to facilitate area cleaning.

7.2.h. In-Plant water supply. -- The in-plant water supply shall be: only from a safe, source approved by the Environmental Engineering Division, ample in quantity and adequate in pressure; provided with means for measurement when preparing specific solution concentrations by dilution; properly treated for hardness, when necessary; and properly protected against backflow as approved by the Environmental Engineering Division.

7.2.i. Storage of chemicals -- Space shall be provided for at least thirty (30) days of chemical supply, the convenient and efficient handling of chemicals, dry storage conditions, and a minimum storage volume of 1-1/2 truck loads where purchase is by truck load lots. Storage tanks and pipelines for liquid chemicals shall be specific to the chemicals and not for alternates. Where possible, connectors for each liquid chemical shall be different and distinctly marked. Chemicals shall be stored in covered or unopened shipping containers, unless the chemical is transferred into a storage unit approved by the Environmental Engineering Division. Liquid chemical storage tanks shall have a liquid level indicator and have an overflow and a receiving basin or drain capable of containing accidental spills or overflows. Special precautions shall be taken with: sodium chlorite, to eliminate any danger of explosion and to avoid heat, flame, moisture and shock; activated carbon, which is a potentially combustible material requiring isolated, fireproof storage and explosion-proof electrical outlets, lights and motors in areas of dry handling; and cylinders of chlorine gas that shall be isolated from operating areas, restrained in position to prevent upset, and stored in rooms separate from ammonia storage.

7.2.j. Solution tanks -- A means shall be provided in a solution tank to maintain a uniform strength of solution. Continuous agitation shall be provided to maintain slurries in suspension. Two (2) solution tanks of adequate volume may be required for a chemical to assure continuity of chemical supply. Means shall be provided to measure the solution level in the tank. Chemical solutions shall be kept covered. Large tanks with access openings shall have the openings curbed and fitted with overhanging covers. Subsurface locations for solution tanks shall be free from sources of possible contamination and assure positive drainage for groundwater, accumulated water, chemical spills and overflows. Overflow pipes, when provided, shall be turned downward, with the end screened, have a free fall discharge, and be located where noticeable. Acid storage tanks shall be vented to the outside atmosphere but not through vents in common with day tanks. Each tank shall be provided with a valved drain protected against backflow. Solution tanks shall be located with protective curbing so that chemicals from equipment failure, spillage or accidental drainage shall not enter the water in conduits, treatment or storage basins. Make-up water shall enter the tank from above the maximum solution level, a distance of two (2) pipe diameters but not less than six (6) inches through a smooth nosed tap, or shall be protected with backflow prevention devices approved by the Environmental Engineering Division. Fluoride shall not be made in a solution tank.

7.2.k. Day tanks -- Day tanks shall be provided where bulk storage of liquid chemical is provided. Day tanks shall meet all the requirements of solution tanks. Day tanks shall hold no more than a thirty (30) hour supply, but no less than a one (1) day of operation supply at design flow. Day tanks shall be scale-mounted or have a calibrated gauge painted or mounted on the side if liquid level can be observed in a gauge tube, manometer or through translucent sidewalls of the tank. In opaque tanks, a gauge rod extending above a reference point at the top of the tank, attached to a float, may be used. The ratio of the area of the tank to its height shall be such that unit readings are meaningful in relation to the total amount of chemical fed during a day. Fluoride shall be scale mounted only. Hand pumps may be provided for transfer from a carboy or drum. A tip rack may be used to permit withdrawal into a bucket from a spigot. Where motor-driven transfer pumps are provided, a liquid level limit switch and an over-flow from the day tank shall be provided. Transfer of
hydrofluosilicic acid is not permitted. A means that is consistent with the nature of the chemical solution shall be provided to maintain uniform strength of solution in a day tank. Continuous agitation shall be provided to maintain chemical slurries in suspension. Tanks shall be properly labeled to designate the chemical contained.

7.2.i. Feed lines -- Feed lines: shall be as short as possible, and of durable, corrosion-resistant material, easily accessible throughout the entire length, protected against freezing, and readily cleaned; shall slope upward from the chemical source to the feeder when conveying gases; shall be designed consistent with scale-forming or solids depositing properties of the water, chemical, solution or mixtures conveyed; shall be color coded; shall introduce corrosive chemicals in such manner as to minimize potential for corrosion; and shall not carry pressurized chlorine gas beyond the chlorine feeder room.

7.2.m. Handling -- Carts, elevators and other appropriate means shall be provided for lifting chemical containers to minimize excessive lifting by operators. Provisions shall be made for disposing of empty bags, drums or barrels by a procedure approved by the Environmental Engineering Division that will minimize exposure to dust. Provision shall be made for the proper transfer of dry chemicals from shipping containers to storage bins or hoppers in such a way as to minimize the quantity of dust that may enter the room in which the equipment is installed. Control shall be provided by use of vacuum pneumatic equipment or closed conveyor systems. Facilities shall be provided for emptying shipping containers in special enclosures or for exhaust fans and dust filters that put the hoppers or bins under negative pressure. Provision shall be made for measuring quantities of chemicals used to prepare feed solutions. Chemicals that are incompatible shall not be fed, stored or handled together. Precautions shall be taken with electrical equipment to prevent explosions, particularly in the use of sodium chlorite and activated carbon in accordance with the latest NEC.

7.2.n. Housing -- Floor surfaces shall be smooth and impervious, slip-proof and well drained. Vents from feeders, storage facilities and equipment exhaust shall discharge to the outside atmosphere above grade and remote from air intakes and doors. Structures, rooms and areas accommodating chemical feed equipment shall provide convenient access for servicing, repair and observation of the operation. Open basins, tanks and conduits shall be protected from chemical spills or accidental drainage.

7.3. Chemicals.

7.3.a. Shipping containers. -- Chemical shipping containers shall be fully labeled to include the chemical’s name, purity and concentration and supplier name and address. Chemicals having a distinguishing color may be used, providing the coloring material is not toxic in the concentrations used and will not impart taste, odor or color to the water supply.

7.3.b. Specifications. -- Chemicals shall meet AWWA specifications and shall conform to ANSI/NSF Standard 60: Drinking Water Treatment Chemicals - Health Effects where applicable.

7.3.c. Assay. -- Provisions may be required for the assay of chemicals delivered.

7.4. Operator Safety.

7.4.a. Ventilation. -- Special provisions shall be made for ventilation of chlorine feed and storage rooms.

7.4.b. Respiratory protection equipment. -- Respiratory protection equipment, meeting the requirements of the National Institute for Occupational Safety and Health (NIOSH), shall be available where chlorine gas is handled and shall be stored at a convenient location but not inside any room where chlorine is used or stored. The units shall use compressed air, have at least a thirty (30) minute capacity and be compatible with or exactly the same as units used by the fire department responsible for the plant.
7.4.c. Chlorine leak detection. -- A bottle of ammonium hydroxide, fifty-six per cent (56%) ammonia solution, shall be available for chlorine leak detection. Where ton containers are used, a leak repair kit approved by the Chlorine Institute shall be provided. Continuous chlorine leak detection equipment is recommended. Where a leak detector is provided it shall be equipped with both an audible alarm and a warning light.

7.4.d. Protective equipment -- The public water system shall provide each operator at least one (1) pair of rubber gloves, a dust respirator of a type meeting NIOSH requirements for toxic dusts, an apron or other protective clothing and goggles or face mask. A deluge shower and eye-washing device shall be installed where strong acids and alkalis are used or stored. A water holding tank that will allow water to come to room temperature shall be installed in the water line feeding the deluge shower and eye-washing device. Other methods of water tempering will be considered on an individual basis. Other protective equipment shall be provided as necessary.

7.4.e. Gases from feeders, storage and equipment exhausts shall be conveyed to the outside atmosphere above grade and remote from air intakes and doors.

7.4.f. A plastic bottle of hydrochloric acid (muriatic acid, in commercial form) shall be available for ammonia leak detection where ammonia gas is used or stored.

7.4.g. Facilities shall be provided for washing of face, gloves and protective equipment.

7.4.h. Safety signs shall be posted in all areas where necessary.

7.5. Specific Chemicals.

7.5.a. Chlorine gas -- Chlorine gas feed and storage shall be enclosed, sealed and separated from other operating areas. The chlorine room shall be provided with a shatter resistant inspection window installed in an interior wall, constructed in such a manner that all openings between the chlorine room and the remainder of the plant are sealed and provided with doors equipped with panic hardware assuring a ready means of exit and opening outward only to the building exterior.

7.5.a.1. Full and empty cylinders of chlorine gas shall be isolated from operating areas, restrained in position to prevent upset, stored in rooms separate from ammonia storage and stored in areas not in direct sunlight or exposed to excessive heat.

7.5.a.2. Where chlorine gas is used, adequate housing shall be provided for the chlorination equipment and for storing chlorine. The room shall be constructed to provide the following: a ventilating fan designed specifically to handle chlorine gas with a capacity that provides one complete air change per minute when the room is occupied; the ventilating fan shall take suction near the floor as far as practical from the door and air inlet, with the point of discharge located so as not to contaminate air inlets or entrance doors to any rooms or structures; air inlets shall be through louvers near the ceiling; and louvers for chlorine room air intake and exhaust shall facilitate airtight closure. Separate switches for the fan and lights shall be located outside of the chlorine room and at the inspection window. Outside switches shall be protected from vandalism. A signal light indicating fan operation shall be provided at each entrance when the fan can be controlled from more than one point. Vents from feeders and storage shall discharge to the outside atmosphere, above grade. The room location shall be on the prevailing downwind side of the building away from entrances, windows, louvers, walkways, etc. Floor drains are discouraged. Where provided, the floor drains shall discharge to the outside of the building and shall not be connected to other internal or external drainage systems.

7.5.a.3. Chlorinator rooms shall be heated to sixty (60) degrees F and be protected from excessive heat. Cylinders and gas lines shall be protected from temperatures above that of the feed equipment.
7.5.a.4. Pressurized chlorine feed lines shall not carry chlorine gas beyond the chlorinator room.
7.5.b. Acids and caustics -- Acids and caustics shall be kept in closed corrosion-resistant shipping containers or storage units with the contents identified by signs or placards. Acids and caustics shall not be handled in open vessels but shall be pumped in undiluted form from original containers through suitable hose to the point of treatment or to a covered day tank.

7.5.c. Sodium chlorite for chlorine dioxide generation. -- Proposals for the storage and use of sodium chlorite shall be approved by the Environmental Engineering Division prior to the preparation of final plans and specifications. Provisions shall be made for proper storage and handling of sodium chlorite to eliminate any danger of explosion.

7.5.c.1. Storage -- Sodium chlorite shall be stored by itself in a separate room and preferably shall be stored in an outside building detached from the water treatment facility. It shall be stored away from organic materials that would react violently with sodium chlorite. The storage structures shall be constructed of noncombustible materials. If the storage structure is located in an area where a fire may occur, water shall be available to keep the sodium chlorite area cool enough to prevent decomposition from heat and the resultant explosive conditions.

7.5.c.2. Handling -- Care shall be taken to prevent spillage. An emergency plan of operation shall be available for the clean up of any spillage. Storage drums shall be thoroughly flushed prior to being recycled or disposed.

7.5.c.3. Feeders -- Positive displacement feeders shall be provided. Tubing for conveying sodium chlorite or chlorine dioxide solutions shall be Type 1 PVC, polyethylene or materials recommended by the manufacturer. Chemical feeders may be installed in gas chlorine rooms if sufficient space is provided for facilities meeting the chlorine room requirements. Feed lines shall be installed in a manner to prevent formation of gas pockets and shall terminate at a point of positive pressure. Check valves shall be provided to prevent the backflow of chlorine into the sodium chlorite line.

7.6. Other chemical feed system or treatment methodologies may be installed in accordance with manufacturers and industry recommendations if approved by the Environmental Engineering Division.

64-77-8. Pumping Facilities.

General. -- Pumping facilities shall be designed to maintain the sanitary quality of pumped water. Subsurface pits or pump rooms and inaccessible installations shall be avoided. No pumping station shall be subject to flooding.

8.2. Location. -- The pumping station shall be located so that the proposed site will meet the requirements for sanitary protection of water quality, hydraulics of the system and protection against interruption of service by fire, flood or any other hazard including accumulation of flammable or explosive gasses.

8.2.a. Site protection. -- The pumping station shall be: elevated to a minimum of three (3) feet above the one hundred (100) year flood elevation or protected to such elevations where practical; readily accessible at all times unless permitted to be out of service for the period of inaccessibility; graded around the station so as to drain surface water away from the station; and protected to prevent vandalism and entrance by animals or unauthorized persons.

8.3. Pumping Stations.

8.3.a. Both raw and finished water pumping stations: shall have adequate space for the installation of additional units, if needed, and for the safe servicing of all equipment; be of durable construction, fire and
weather resistant and with outward-opening doors; have a floor elevation of at least six (6) inches above finished grade or provide drains or sumps to keep the station floor dry; have underground structure waterproofed; have all floors drained in such a manner that the quality of the potable water will not be endangered; have floors slope to a suitable drain; provide a suitable outlet for drainage from pump glands without discharging onto the floor; provide sampling taps, suction and discharge pressure gauges with stop cocks; and provide metering facilities.

8.3.b. Suction well. -- Suction wells shall be watertight, have floors sloped to permit removal of water and entrained solids, be covered or otherwise protected against contamination and have two pumping compartments or other means to allow the suction well to be taken out of service for inspection, maintenance or repair.

8.3.c. Equipment servicing. -- Pump stations shall be provided with: crane-ways, hoist beams, eye bolts, or other adequate facilities for servicing or removal of pumps, motors or other heavy equipment; openings in floors, roofs or wherever else needed for removal of heavy or bulky equipment; and a convenient tool board, or other facilities as needed, for proper maintenance of the equipment.

8.3.d. Stairways and ladders shall: be provided between all floors and in pits or compartments that are entered; and have handrails on both sides, and treads of non-slip material. Stairs are preferred in areas where there is frequent traffic or where supplies are transported by hand. They shall have risers not exceeding nine (9) inches and treads wide enough for safety.

8.3.e. Heating. -- Provisions shall be made for adequate heating for the comfort of the operator and the safe and efficient operation of the equipment. In pump houses not occupied by personnel, only enough heat need be provided to prevent freezing of equipment or treatment process.

8.3.f. Ventilation. -- Ventilation shall conform to existing local and state codes. Adequate ventilation shall be provided for all pumping stations. Forced ventilation of at least six (6) changes of air per hour shall be provided for all rooms, compartments, pits and other enclosures below the ground floor and any area where an unsafe atmosphere may develop or where excessive heat may be built up.

8.3.g. Dehumidification. -- In areas where excess moisture could cause hazards to safety or damage to equipment, means for dehumidification shall be provided.

8.3.h. Lighting. -- Pump stations shall be adequately lighted throughout. All electrical work shall conform to the requirements of the AIA and related agencies and to the NEC and the relevant state and local codes.

8.3.i. Sanitary and other conveniences. -- All pumping stations that are manned for extended periods shall be provided with potable water, lavatory and toilet facilities. Plumbing shall be installed so as to prevent contamination of a public water supply.

8.4. Ground Water Pump Stations. -- Where pumping facilities are used, wells and springs shall be vented by properly hooded and screened pipe extending at least twelve (12) inches above the pump station floor or ground surface. Where necessary, provision shall be made for lubricating the pump from a point at least six (6) inches above the top of the well cover, by means that will prevent contamination of the water supply.

8.4.a. Driven or Drilled Wells. -- Pumping stations located over driven or drilled wells shall: have riser pipe or casing extending at least six (6) inches, and preferably twelve (12) inches, above the floor, and equipped with a flange or suitable stuffing box; have riser pipe or casing firmly connected to the pump structure or have casing inserted into a recess extending at least one (1) inch into the base of the pump, if a watertight connection is not provided; have the base of the pump not less than six (6) inches above the pump room floor; and have the pump foundation and base designed to prevent water from coming into contact with
8.4.b. Submersible Pumps. -- Where a submersible pump is used, the top of the casing shall be equipped with pitless adaptors or vents, or both, approved by the NSF or WSC with an approved cap to effectively seal against entrance of water under all conditions of vibration or movements of conductors or cables.

8.4.c. Discharge Piping. -- Discharge piping shall be provided with means to pump to waste but shall not be directly connected to a sewer. The discharge line shall have control valves located above the pump floor, be protected against freezing, be valved to permit testing and control of each well, have watertight joints, and have all exposed valves protected.

8.5. Pumps.

8.5.a. At least two pumping units shall be provided. With any pump out of service, the remaining pump or pumps shall be capable of providing the maximum daily pumping demand of the system. The pumping units shall: have ample capacity to supply the peak demand against the required distribution system pressure without dangerous overloading; be driven by prime movers able to meet the maximum horsepower condition of the pumps; be provided with readily available spare parts and tools; be served by control equipment that has proper heater and overload protection for air temperature encountered; and be able to pump the necessary average demand in a period not to exceed eight (8) hours.

8.5.b. Suction lift. -- Suction lift shall be avoided, if possible, and be within manufacturers specifications, preferably less than fifteen (15) feet. If suction lift is necessary, provision shall be made for priming the pumps.

8.5.c. Priming. -- Priming water shall not be of lesser sanitary quality than that of the water being pumped. Means shall be provided to prevent back siphonage. When an air-operated ejector is used, the screened intake shall draw clean air from a point at least ten (10) feet above the ground or other source of possible contamination unless the air is filtered by an apparatus approved by the Environmental Engineering Division. Vacuum priming may be used.


8.6.a. Booster pump stations shall be constructed in accordance with "Pumping Stations," in subsection 8.3 of this section, and shall contain sampling taps and sufficient room for booster chlorination facilities.

8.6.b. Booster pumps shall be located or controlled so that they will not produce negative pressure in their suction lines. The intake pressure shall be at least five (5) pounds per square inch when the pump is in normal operation. An automatic cutoff or a low pressure controller shall maintain at least five (5) pounds per square inch in the suction line under all operating conditions. Automatic or remote control devices shall have a range between the start and cutoff pressure that will prevent excessive cycling. A bypass shall be available and provide for needed demand in eight (8) hours or less.

8.6.c. Duplicate pumps. -- Each booster pumping station shall contain not less than two (2) pumps with capacities such that peak demand can be satisfied with the largest pump out of service.

8.6.d. Metering. -- All booster pumping stations shall contain a totalizer meter.

8.6.e. In-line booster pumps. -- In-line booster pumps shall be accessible for servicing and repairs.

8.6.f. Individual home booster pumps. -- Individual home booster pumps shall not be allowed for any individual service from the public water supply main where residual pressures are less than five (5) pounds per square inch under any flow conditions. Where used, backflow prevention, approved by the Environmental
Engineering Division, consisting of at least a double check valve assembly shall be provided by the customer to protect the public water supply.

8.7. Automatic and Remote Controlled Stations. -- All automatic stations shall be provided with automatic signaling apparatus that will report when the station is out of service. All remote controlled stations shall be electrically operated and controlled and shall have signaling apparatus of proven performance. Installation of electrical equipment shall conform with the applicable state and local electrical codes and the National Electrical Code.

8.8. Appurtenances.

8.8.a. Valves. -- Pumps shall be adequately valved to permit satisfactory operation, maintenance and repair of the equipment. If foot valves are necessary, they shall have a net valve area of at least 2-1/2 times the area of the suction pipe, and they shall be screened. Each pump shall have a positive-acting check valve on the discharge side between the pump and the shut-off valve.

8.8.b. Piping. -- In general, piping shall: be designed so that the friction losses will be minimized and not be subject to contamination; have watertight joints; be protected against a surge or water hammer; be such that each pump has an individual suction line or lines are so manifolded that they will insure similar hydraulic and operating conditions,

8.8.c. Gauges and meters. -- Each pump shall have a pressure gauge on its discharge line, shall have a compound gauge on its suction line, shall have recording meters and gauges in the larger stations (250 gallons per minute or larger) and shall have a means for measuring the discharge volume.

8.8.d. Water seals. -- Water seals shall not be supplied with water of a lesser sanitary quality than that of the water being pumped. Where pumps are sealed with potable water and are pumping water of less sanitary quality the seal shall be provided with a break tank open to atmospheric pressure and have an air gap of at least six (6) inches or two (2) pipe diameters, whichever is greater, between the feeder line and the spill line of the tank.

8.8.e. Controls. -- Pumps, their motors and accessories, shall be controlled in such a manner that they will operate at rated capacity without dangerous overload. Where two (2) or more pumps are installed for redundancy, provision shall be made for alternation. Provision shall be made to prevent energizing the motor in the event of a backspin cycle. Electrical controls shall be installed in accordance with NEC requirements. Equipment shall be provided, or other arrangements shall be made, to prevent surge pressures from activating controls that switch on pumps or activate other equipment outside the normal design cycle of operation.

8.8.f. Standby power. -- Whenever possible, to ensure continuous service when the primary power had been interrupted, a power supply shall be provided from at least two (2) independent sources or a standby or an auxiliary source shall be provided. If standby power is provided by on-site generators or engines, the fuel storage and fuel line shall be designed to protect the water supply from contamination. Natural gas or bottled gas are the preferred fuels.

8.8.g. Water pre-lubrication. -- When automatic pre-lubrication of pump bearings is necessary and an auxiliary direct drive power supply is provided, the pre-lubrication line shall be provided with a valved bypass around the automatic control so that the bearings can, if necessary, be lubricated manually before the pump is started or the pre-lubrication controls shall be wired to the auxiliary power supply.

9.1. General. -- The materials and designs used for finished water storage structures shall provide stability and durability as well as protect the quality of the stored water. Steel structures shall follow the current AWWA standards concerning steel tanks, standpipes, reservoirs, and elevated tanks wherever they are applicable. Other materials of construction are acceptable when properly designed to meet the requirements of this section.

9.1.a. Sizing. -- Storage facilities shall have sufficient capacity, as determined from engineering studies, to meet domestic, commercial and industrial demands, and where fire protection is provided, fire flow demands.

9.1.a.1. Fire flow requirements established by the ISO shall be satisfied where fire protection is provided.

9.1.a.2. The minimum storage capacity (or equivalent capacity) for systems providing fire protection shall be equal to twice the average daily demand of one hundred fifty (150) gallons per customer per day plus fire flow unless it can be demonstrated that the supply capacity of the system is sufficient to warrant less. This requirement may be reduced when the source and treatment facilities have sufficient capacity with standby power to supplement peak demands of the system.

9.1.a.3. A recommended storage capacity for community and non-community, non-transient public water systems not providing fire protection shall be equal to twice the average daily demand of one hundred fifty (150) gallons per customer per day.

9.1.b. Location of ground-level reservoirs. -- The bottom of reservoirs and standpipes shall be placed at the normal ground surface and shall be above the one hundred (100) year flood level. When the bottom is below normal ground surface, it shall be placed above the groundwater table. At least fifty per cent (50%) of the water depth of the reservoir shall be above grade. Sewers, drains, standing water, and similar sources of possible contamination shall be kept at least fifty (50) feet from the reservoir. A water main pipe, pressure tested in place to fifty (50) pounds per square inch without leakage, may be located from twenty (20) to fifty (50) feet from a sewer, but under no circumstances shall it be located within twenty (20) feet of a sewer.

9.1.c. Protection. -- All finished water storage structures shall have suitable watertight roofs and screened vents that exclude birds, animals, insects, and excessive dust.

9.1.d. Protection from trespassers. -- Fencing, locks on access manholes, and other necessary precautions shall be provided to prevent trespassing, vandalism and sabotage.

9.1.e. Drains. -- No drain on a water storage structure may have a direct connection to a sewer or storm drain. The design shall allow draining the storage facility for cleaning or maintenance without causing loss of pressure in the distribution system.

9.1.f. Overflow. -- All water storage structures shall be provided with an overflow that is brought down to an elevation between twelve (12) and twenty-four (24) inches above the ground surface and that discharges over a drainage inlet structure or a splash plate. No overflow may be connected directly to a sewer or a storm drain. All overflow pipes shall be located so that any discharge is visible.

9.1.f.1. When an internal overflow pipe is used on elevated tanks, it shall be located in the access tube. For vertical drops on other types of storage facilities, the overflow pipe shall be located on the outside of the structure.
9.1.f.2. The overflow of a ground-level structure shall open downward and be screened with twenty-four (24) mesh non-corrodible screen installed within the pipe at a location least susceptible to damage by vandalism.

9.1.f.3. The overflow pipe shall be of sufficient diameter to permit waste of water in excess of the filling rate.

9.1.g. Access. -- Finished water storage structures shall be designed with reasonably convenient access to the interior for cleaning and maintenance. Manholes above the water line: shall be framed at least four (4) inches, and preferably (6) six inches, above the surface of the roof at the opening; on ground-level structures, shall be elevated twenty-four (24) to thirty-six (36) inches above the top or covering sod; shall be fitted with a solid watertight cover that overlaps the framed opening and extends down around the frame at least two (2) inches; shall be hinged at one (1) side; and shall have a locking device.

9.1.h. Vents. -- Finished water storage structures shall be vented. Overflows shall not be considered as vents. Open construction between the sidewall and roof is not permissible. Vents shall prevent the entrance of surface water and rainwater and shall exclude birds, animals and insects, as much as this function can be made compatible with effective venting. For elevated tanks and standpipes, four (4) mesh non-corrodible screen may be used. On ground-level structures, standpipes shall terminate in an inverted U construction with the opening twenty-four (24) to thirty-six (36) inches above the roof or sod and be covered with twenty-four (24) mesh non-corrodible screen installed within the pipe at a location least susceptible to vandalism.

9.1.i. Roof and sidewall. -- The roof and sidewalls of all structures shall be watertight with no openings except properly constructed vents, manholes, overflows, risers, drains, pump mountings, control ports and piping for inflow and outflow.

9.1.i.1. Any pipes running through the roof or sidewall of a finished water storage structure shall be welded, or properly gasketed in metal tanks. In concrete tanks, these pipes shall be connected to standard wall castings that were poured in place during the forming of the concrete. These wall castings shall have seepage rings imbedded in the concrete.

9.1.i.2. Openings in a storage structure roof or top, designed to accommodate control apparatus or pump columns, shall be curbed and sleeved with proper additional shielding to prevent the access of surface or floor drainage water into the structure.

9.1.i.3. Valves and controls shall be located outside the storage structure so that the valve stems and similar projections will not pass through the roof or top of the reservoir.

9.1.i.4. The roof of concrete reservoirs with an earthen cover shall be sloped to facilitate drainage. Consideration shall be given to installation of an impermeable membrane roof covering.

9.1.i.5. Locks shall be provided on valve vaults where applicable.

9.1.j. Drainage of roof. -- The roof of the storage structure shall be well drained. Downspout pipes shall not enter or pass through the reservoir. Parapets, or similar construction that would tend to hold water and snow on the roof, will not be approved by the Environmental Engineering Division unless adequate waterproofing and drainage are provided.

9.1.k. Safety. -- The safety of employees shall be considered in the design of the storage structure. As a minimum, employee safety matters shall conform to pertinent laws and regulations.
9.1.k.1. Ladders, ladder guards, balcony railings, and safely located entrance hatches shall be provided where applicable. Elevated tanks with riser pipes more than eight inches in diameter shall have protective bars over the riser openings inside the tank. Railings or handholds shall be provided on elevated tanks where persons transfer from the access tube to the water compartment.

9.1.i. Freezing. -- All finished water storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing that will interfere with proper functioning.

9.1.m. Internal catwalk. -- Every catwalk over finished water in a storage structure shall have a solid floor with raised edges designed so that shoe scrapings and dirt will not fall into the water.

9.1.n. Silt stop. -- The discharge pipes from all reservoirs shall be located in a manner that will prevent the flow of sediment into the distribution system. Removable silt stops shall be provided.

9.1.o. Grading. -- The area surrounding a ground-level structure shall be graded in a manner that will prevent surface water from standing within fifty (50) feet.

9.1.p. Painting and cathodic protection. -- Proper protection shall be given to metal surfaces by paints or other protective coatings, by cathodic protective devices, or by both. Paint systems shall be certified to conform to ANSI/NSF Standard 61: Drinking Water System Components - Health Effects. Interior paint shall be properly applied and cured. After curing, the coating shall not transfer any substance to the water that will be toxic or cause tastes or odors. Prior to placing in service, an analysis for volatile organic compounds is advisable to establish that the coating is properly cured. Cathodic protection shall be installed on below grade steel reservoirs and shall be designed and installed by competent technical personnel; a maintenance contract shall be provided.

9.1.q. Disinfection -- Finished water storage structures shall be disinfected in accordance with current AWWA Standard C652. Three (3) or more successive sets of samples, taken at twenty-four (24) hour intervals, shall be microbiologically satisfactory before the facility is placed into operation. Disposal of heavily chlorinated water from the tank disinfection process shall be in accordance with the requirements of the WVDEP. The disinfection procedure (AWWA C652 chlorination method 3, section 4.3) that allows use of the chlorinated water held in the storage tank for disinfection purposes is not recommended. When that procedure is used, it is recommended that the initial heavily chlorinated water be properly disposed in order to prevent the release of water that may contain various chlorinated organic compounds into the distribution system.

9.1.r. Provisions of Sampling. -- Appropriate sampling taps shall be provided to facilitate collection of water samples for both bacteriologic and chemical analysis.

9.2. Plant Storage. -- The applicable design standards for finished water storage shall be followed for plant storage.

9.2.a. Washwater tanks. -- Washwater tanks shall be sized, in conjunction with available pump units and finished water storage, to provide the backwash water required. Consideration shall be given to the backwashing of several filters in rapid succession.

9.2.b. Clearwell. -- Clearwell storage shall be sized, in conjunction with distribution system storage, to relieve the filters from having to follow fluctuations in water use and meet peak demands, including filter backwash water. When finished water storage is used to provide contact time for chlorine, special attention shall be given to size and baffling. To ensure adequate chlorine contact time in accordance with the West Virginia Division of Health rule, Public Water Systems, 64CSR3, sizing of the clearwell shall include extra volume to accommodate depletion of storage during the nighttime for intermittently operated filtration plants with automatic high service pumping from the clearwell during non-treatment hours. An overflow and vent shall be provided.
9.2.c. Adjacent compartments. -- Finished water shall not be stored or conveyed in a compartment adjacent to unsafe water when the two compartments are separated by a single wall.

9.2.d. Basins and wet-wells. -- Receiving basins and pump wet wells for finished water shall be designed as finished water storage structures.

9.3. Hydropneumatic Tanks. -- Hydropneumatic (pressure) tanks serving community and non-community, non-transient public water systems, when provided as the only storage facility, are acceptable only in very small water systems. When serving more than 75 living units, ground or elevated storage shall be provided. Pressure tank storage is not allowed for fire protection purposes.

9.3.a. Location. -- The tank shall be located above normal ground surface and be completely housed.

9.3.b. Sizing -- The capacity of the pumps in a hydropneumatic system shall be at least ten (10) times the average daily consumption rate. The gross volume of the hydropneumatic tank, in gallons, shall be at least ten (10) times the capacity of the largest pump, rated in gallons per minute. For example, a two hundred fifty (250) gallon per minute pump shall have a two thousand five hundred (2,500) gallon pressure tank. Sizing of hydropneumatic storage tanks shall consider the need for chlorine detention time, as applicable, independent of the storage requirements. If hydropneumatic tanks are considered for chlorine contact, separate inlet and outlet connectors at top and bottom of the tank are required.

9.3.c. Piping. -- The hydropneumatic tank shall have bypass piping to permit operation of the system while it is being repaired or painted.

9.3.d. Appurtenances. -- Each hydropneumatic tank shall have an access manhole, a drain and control equipment consisting of pressure gauge, water sight glass, automatic or manual air blow-off, a means for adding air, and pressure operated start-stop controls for the pumps. Where practical the access manhole shall be twenty-four (24) inches in diameter.

9.3.e. Coatings. -- The interior of all tanks shall have a coating meeting ANSI/NSF Standard 61: Drinking Water System Components - Health Effects.

9.4. Distribution Storage. -- The applicable design standards of subsection 9.1 of this rule shall be followed for distribution system storage. The minimum storage capacity (or equivalent capacity) for systems providing fire protection shall be equal to twice the average daily demand of one hundred fifty (150) gallons per customer per day plus fire flow unless it can be demonstrated that the supply capacity of the system is sufficient to warrant less. All tanks shall be controlled to provide an adequate turn-over of at least twenty percent (20%) of the total volume each twenty-four (24) hour period. The Environmental Engineering Division may allow a variance to the minimum twenty percent (20%) turn-over requirement, if adequate justification is provided. This may require a main line altitude valve or externally controlled valves.

9.4.a. Pressures. -- The maximum variation between high and low levels in standpipes or elevated storage structures providing pressure to a distribution system shall not exceed thirty (30) feet (thirteen (13) pounds per square inch). The minimum pressure in the distribution system shall be thirty (30) pounds per square inch under static conditions and twenty (20) pounds per square inch under all flow conditions. The normal working pressures of the distribution mains shall be designed based upon the pipe manufacturer’s recommendations and the applicable AWWA standards for the type of pipe. Pressure regulating/pressure reducing valves shall be used to protect the distribution mains from excessive pressures. When static pressures in the distribution mains exceed one hundred (100) pounds per square inch, the utility shall have the option of installing pressure reducing valves on service lines or requiring (or recommending) the customer install and maintain a pressure reducing valve on the customer’s service line.
9.4.b. Drainage. -- Storage structures that provide pressure directly to the distribution system shall be designed so they can be isolated from the distribution system and drained for cleaning or maintenance without necessitating loss of pressure in the distribution system. The drain shall discharge to the ground surface with no direct connection to a sewer or storm drain.

9.4.c. Level controls. -- Commercially available control systems shall be provided to maintain levels in distribution system storage structures for community and non-community, non-transient public water systems. Level indicating devices shall be provided at a central location. Pumps shall be controlled from tank levels with the signal transmitted by telemetering equipment when any appreciable head loss occurs in the distribution system between the source and the storage structure. Altitude valves or equivalent controls may be required for additional structures on the system. Overflow and low-level warnings or alarms shall be located at places in the community where they will be under responsible surveillance twenty-four (24) hours a day.

64-77-10. Distribution Systems.


10.1.a. Standards and materials selection. -- Pipe, fittings, valves and fire hydrants shall conform to AWWA standards, meet ANSI/NSF Standard 61: Drinking Water System Components - Health Effects and shall be acceptable to the Environmental Engineering Division. In the absence of these standards, materials meeting applicable product standards and acceptable to the Environmental Engineering Division may be selected. Special attention shall be given to selecting pipe materials that will protect against both internal and external pipe corrosion. Pipes and pipe fittings containing more than eight percent (8%) lead shall not be used. All products shall comply with ANSI/NSF Standard 61: Drinking Water System Components - Health Effects.

10.1.b. Permeation of system by organic compounds.-- Where distribution systems are installed in areas of groundwater contaminated by organic compounds: pipe and joint materials that are not subject to permeation of the organic compounds shall be used; and non-permeable materials shall be used for all portions of the system including water main, service connections and hydrant leads.

10.1.c. Used materials. -- Water mains that have been used previously for conveying potable water may be reused provided they meet the above standards and have been restored practically to their original condition.

10.1.d. Joints. -- Packing and jointing materials used in the joints of pipe shall meet the standards of the AWWA, ANSI/NSF Standard 61 and the Environmental Engineering Division. Pipe having mechanical joints or slip-on joints with rubber gaskets is preferred. Lead-tip gaskets shall not be used. Repairs to lead-joint pipe shall be made using alternative methods.

10.2. Water Main Design.

10.2.a. All distribution systems shall be designed to provide a residential peak demand flow (not including fire flows) in accordance with Table 64-77 E of this rule.

10.2.b. Pressure. -- All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis based on peak flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of twenty (20) pounds per square inch at ground level at all points in the distribution system under all conditions of flow and thirty (30) pounds per square inch under static conditions. The normal working pressure in the distribution system shall be designed based upon the pipe manufacturer’s recommendations and the applicable AWWA standards for the type of pipe.
10.2.c. Surge Pressures. -- All water mains shall be designed to provide adequate strength to withstand water surge pressure. Table 64-77 F of this rule lists the minimum acceptable pressure surge for PVC for each foot per second velocity of water. Design shall allow for at least 5 feet per second instantaneous flow velocity change or higher if conditions warrant.

10.2.d. Diameter. -- The minimum size of a water main for providing fire protection and serving fire hydrants shall be of six (6) inch diameter. Larger size mains will be required if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressures.

10.2.e. Fire protection. -- When fire protection is to be provided, system design shall be such that fire flows and facilities are in accordance with the requirements of the ISO. Under no circumstances shall fire flows be less than two hundred fifty (250) gallons per minute.

10.2.f. Small mains. -- Any departure from minimum six (6) inch diameter requirements shall be justified by hydraulic analysis and future water use, and can be considered only in special circumstances; however, no mains less than two (2) inches are permitted.

10.2.g. Hydrants. -- Water mains not designed to carry fire-flows shall not have fire hydrants connected to them.

10.2.h. Dead ends -- In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical. Where dead-end mains occur, they shall be provided with a fire hydrant if flow and pressure are sufficient, or with a flushing hydrant or blow-off, approved by the Environmental Engineering Division, for flushing purposes. Flushing devices shall be sized to provide flows that will give a velocity of at least 2.5 feet per second in the water main being flushed. No flushing devices shall be directly connected to any sewer.

10.3. Valves. -- A sufficient number of valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than five hundred (500) foot intervals in commercial districts and at not more than one block or eight hundred (800) foot intervals in other districts. Where systems serve widely scattered customers and where future development is not expected, the valve spacing shall not exceed two thousand five hundred (2,500) feet.

10.4. Hydrants.

10.4.a. Location and spacing. -- Hydrants shall be provided at each street intersection and at intermediate points between intersections as recommended by the ISO. Generally, hydrant spacing may range from three hundred fifty (350) to one thousand (1000) feet depending on the area being served.

10.4.b. Valves and nozzles. -- Fire hydrants shall have a bottom valve size of at least five (5) inches, one 4-1/2 inch pumper nozzle and two 2-1/2 inch nozzles.

10.4.c. Hydrant leads. -- The hydrant lead shall be a minimum of six (6) inches in diameter. Auxiliary valves shall be installed in all hydrant leads.

10.4.d. Drainage. -- Hydrant drains are to be provided with a gravel pocket, or a dry well shall be provided unless the natural soils will provide adequate drainage. Hydrant drains shall not be connected to or located within ten (10) feet of sanitary sewers or storm drains.
10.4.e. Draining type frost proof yard hydrants are not permitted.

10.5 Air Relief Valves, Valve, Meter and Blow-off Chambers.

10.5.a. Air relief valves. -- At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of hydrants or air relief valves. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

10.5.b. Air relief valve piping. -- The open end of an air relief pipe from automatic valves shall be provided with a screened, downward-facing elbow. The pipe from a manually operated valve shall be extended to the top of the pit. Use of manual air relief valves is recommended wherever possible.

10.5.c. Chamber drainage. -- Chambers, pits or manholes containing valves, blow-offs, meters or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer nor shall blow-offs or air relief valves be connected directly to any sewer. These chambers or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water or to absorption pits underground.

10.6. Installation of Mains

10.6.a. Standards. -- Specifications shall incorporate the provisions of the AWWA standards and manufacturer's recommended installation procedures.

10.6.b. Bedding. -- A continuous and uniform bedding shall be provided in the trench for all buried pipe. Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. Stones found in the trench shall be removed for a depth of at least six (6) inches below the bottom of the pipe.

10.6.c. Cover -- All water mains shall be covered with sufficient earth or other insulation to prevent freezing. All distribution mains shall be provided with a minimum of thirty-six (36) inches of earth covering; forty-two (42) inches are recommended. All mains of less than eight (8) inches in diameter within five (5) feet of a heavily traveled highway shall be provided with at least forty-two (42) inches of cover.

10.6.d. Blocking. -- All tees, bends, plugs and hydrants shall be provided with thrust blocking, tie rods or joints designed to prevent movement.

10.6.e. Pressure and leakage testing. -- All types of installed pipe shall be pressure tested and leakage tested in accordance with AWWA Standard C600.

10.6.f. Disinfection. -- All new, cleaned or repaired water mains shall be disinfected in accordance with AWWA Standard C651. The specifications shall include microbiological testing of all water mains. Microbiological sampling shall be collected by a Environmental Engineering Division certified public water system operator or other individual authorized by the Environmental Engineering Division.

10.6.g. All non-metallic mains shall be provided with tracer wire or metallic tape.

10.7. Separation of Water Mains, Sanitary Sewers and Storm Sewers.

10.7.a. General. -- The following factors shall be considered in providing adequate separation: materials and type of joints for water and sewer pipes; soil conditions; service and branch connections into the water main and sewer line compensating variations in the horizontal and vertical separations; space for repair
and alterations of water and sewer pipes and off-setting of pipes around manholes.

10.7.b. Parallel installation. -- Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge.

10.7.c. Crossings. -- Water mains shall cross above sewers and shall be laid to provide a minimum vertical distance of 18 inches between the bottom of the water main and the top of the sewer. At crossings, one full length (20 feet) of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

10.7.d. Force mains. -- There shall be at least a ten (10) foot horizontal separation between water mains and sanitary sewer force mains. There shall be an eighteen (18) inch vertical separation at crossings as required.

10.7.e. Exception. -- The Environmental Engineering Division may approve a variance from the above requirements when it determines that compliance with the specified separation distances cannot be practically achieved.

10.7.f. Sewer manholes. -- No water pipe shall pass through or come in contact with any part of a sewer manhole.

10.7.g. Separation of water mains from other sources of contamination. -- Design engineers shall exercise caution when locating water mains at or near certain sites such as sewage treatment plants or industrial complexes. Individual septic tanks shall be located and avoided. The engineer shall contact the Environmental Engineering Division to establish specific design requirements for locating water mains near any source of contamination.

10.8. Surface Water Crossings. -- The Environmental Engineering Division shall be consulted before final plans are prepared.

10.8.a. Above-water crossings. -- An above-water crossing pipe shall be adequately supported and anchored, be protected from damage and freezing and be accessible for repair or replacement.

10.8.b. Underwater crossings. -- A minimum cover of three (3) feet shall be provided over the pipe where practical. When crossing water courses that are greater than fifteen (15) feet in width, the following shall be provided: the pipe shall be ductile iron of special construction, having flexible watertight joints; valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to flooding; and permanent taps shall be made on each side of the valve to allow insertion of a small meter to determine leakage and for sampling purposes.

10.9. Cross-connections and Interconnections.

10.9.a. Cross-connections. -- There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contaminating materials may be discharged or drawn into the system. Each water utility shall have a program conforming to state requirements to detect and eliminate cross connections.

10.9.b. Cooling water. -- Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the potable water supply.

10.9.c. Interconnections. -- The approval of the Environmental Engineering Division shall be obtained for interconnections between approved public water systems.
10.10. Water Services and Plumbing.

10.10.a. Plumbing. -- Water services and plumbing shall conform to relevant local and state plumbing codes or to the applicable National Plumbing Code. Solders and flux containing more than 0.2% lead and pipe and pipe fittings containing more than eight percent (8%) lead shall not be used. The public water system is not responsible for an individual customer’s private plumbing.

10.10.b. Booster pumps. -- Individual booster pumps are not allowed for any individual service from the public water supply mains where residual pressures are less than five (5) pounds per square inch under all flow conditions. Where used, backflow prevention, approved by the Environmental Engineering Division, consisting of at least a double check valve assembly shall be provided by the customer to protect the public water supply.

10.11. Service Meters -- Each service connection shall be individually metered.

10.12. Water Loading Stations. -- Water loading stations present special problems since the fill line may be used for filling both potable water vessels and other tanks or contaminated vessels. To prevent contamination of both the public supply and potable water vessels being filled, the following principles shall be met in the design of water loading stations: there shall be a double check valve assembly approved by the Environmental Engineering Division and installed to prevent backflow to the public water supply; the piping arrangement shall prevent contaminant being transferred from a hauling vessel to another. Hoses shall not be contaminated by contact with the ground and shall be capped when not in use. Water meters shall be provided.

64-77-11. Enforcement Penalties.

11.1. Violators of this rule are subject to the civil and administrative penalties of W. Va. Code §16-1-9a(d)(2) and (3) and the criminal penalties of W. Va. Code §16-1-9, -9a(d)(1) and -18.

64-77-12. Administrative Due Process.

12.1. Those persons aggrieved by the administrative enforcement of this rule may request a contested case hearing in accordance with the Division of Health rule, "Rules and Procedures for Contested Case Hearings and Declaratory Rulings," 64CSR1.
<table>
<thead>
<tr>
<th>Category</th>
<th>Colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Lines</td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>Olive Green</td>
</tr>
<tr>
<td>Settled or Clarified</td>
<td>Aqua</td>
</tr>
<tr>
<td>Finished or Potable</td>
<td>Dark Blue</td>
</tr>
<tr>
<td>Chemical Lines</td>
<td></td>
</tr>
<tr>
<td>Alum or Primary Coagulant</td>
<td>Orange</td>
</tr>
<tr>
<td>Ammonia</td>
<td>White</td>
</tr>
<tr>
<td>Carbon Slurry</td>
<td>Black</td>
</tr>
<tr>
<td>Caustic</td>
<td>Yellow with Green Band</td>
</tr>
<tr>
<td>Chlorine (Gas or Solution)</td>
<td>Yellow</td>
</tr>
<tr>
<td>Fluoride</td>
<td>Light Blue with Red Band</td>
</tr>
<tr>
<td>Lime Slurry</td>
<td>Light Green</td>
</tr>
<tr>
<td>Ozone</td>
<td>Yellow with Orange Band</td>
</tr>
<tr>
<td>Phosphate Compounds</td>
<td>Light Green with Red Band</td>
</tr>
<tr>
<td>Polymers or Coagulant Aids</td>
<td>Orange with Green Band</td>
</tr>
<tr>
<td>Potassium Permanganate</td>
<td>Violet</td>
</tr>
<tr>
<td>Soda Ash</td>
<td>Light Green with Orange Band</td>
</tr>
<tr>
<td>Sulfuric Acid</td>
<td>Yellow with Red Band</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>Light Green with Yellow Band</td>
</tr>
<tr>
<td>Waste Lines</td>
<td></td>
</tr>
<tr>
<td>Backwash Waste</td>
<td>Light Brown</td>
</tr>
<tr>
<td>Sludge</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>Sewer (Sanitary or Other)</td>
<td>Dark Gray</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Compressed Air</td>
<td>Dark Green</td>
</tr>
<tr>
<td>Gas</td>
<td>Red</td>
</tr>
<tr>
<td>Other Lines</td>
<td>Light Gray</td>
</tr>
</tbody>
</table>
### TABLE 64-77 B

**Minimum Horizontal Distance Between a New Public Water System Groundwater Well and a Potential Contamination Source**

<table>
<thead>
<tr>
<th>Source</th>
<th>Minimum Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septic Tanks</td>
<td>50 feet (100 feet)</td>
</tr>
<tr>
<td>Sewage Treatment Facilities</td>
<td>200 feet</td>
</tr>
<tr>
<td>Sewers and Drains (Watertight)</td>
<td>10 feet</td>
</tr>
<tr>
<td>Sewers and Drains (Non watertight)</td>
<td>50 ft. (100 feet)</td>
</tr>
<tr>
<td>Sewage Holding Tanks and Privies (Vault)</td>
<td>50 feet (100 feet)</td>
</tr>
<tr>
<td>Barnyard/Feeding and Watering Areas</td>
<td>100 feet</td>
</tr>
<tr>
<td>Streams, Rivers and Impoundments</td>
<td>25 ft.</td>
</tr>
<tr>
<td>Sewage Absorption Fields</td>
<td>100 feet</td>
</tr>
</tbody>
</table>

Note that the distance noted in parenthesis shall be required when a water well is lower in elevation than the source of pollution or contamination referenced.

Note that the sewer and drain materials shall be of potable water main standards and installed and hydrostatically tested as approved by the director.
**TABLE 64-77 C**  
Rapid Rate Gravity Filters Size and Depth of Gravel Supporting Media

<table>
<thead>
<tr>
<th>Size</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1/2 to 1 1/2 inches</td>
<td>5 to 8 inches</td>
</tr>
<tr>
<td>1 1/2 to 3/4 inches</td>
<td>3 to 5 inches</td>
</tr>
<tr>
<td>3/4 to 1/2 inches</td>
<td>3 to 5 inches</td>
</tr>
<tr>
<td>1/2 to 3/16 inches</td>
<td>2 to 3 inches</td>
</tr>
<tr>
<td>3/16 to 3/32 inches</td>
<td>2 to 3 inches</td>
</tr>
</tbody>
</table>

**TABLE 64-77 D**  
Groundwater Well Steel Pipe Casing Requirements *

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DIAMETER (inches)</th>
<th>THICKNESS (inches)</th>
<th>WEIGHT PER FOOT (pounds)</th>
<th>WITH THREADS AND COUPLINGS (nominal)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXTERNAL</td>
<td>INTERNAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 ID.</td>
<td>6.625</td>
<td>6.065</td>
<td>0.280</td>
<td>18.97</td>
</tr>
<tr>
<td>8</td>
<td>8.625</td>
<td>7.981</td>
<td>0.322</td>
<td>28.55</td>
</tr>
<tr>
<td>10</td>
<td>10.750</td>
<td>10.020</td>
<td>0.365</td>
<td>40.48</td>
</tr>
<tr>
<td>12</td>
<td>12.750</td>
<td>12.000</td>
<td>0.375</td>
<td>49.56</td>
</tr>
<tr>
<td>14 OD.</td>
<td>14.000</td>
<td>13.250</td>
<td>0.375</td>
<td>54.57</td>
</tr>
<tr>
<td>16</td>
<td>16.000</td>
<td>15.250</td>
<td>0.375</td>
<td>62.58</td>
</tr>
<tr>
<td>18</td>
<td>18.000</td>
<td>17.250</td>
<td>0.375</td>
<td>70.59</td>
</tr>
<tr>
<td>20</td>
<td>20.000</td>
<td>19.250</td>
<td>0.375</td>
<td>78.60</td>
</tr>
<tr>
<td>22</td>
<td>22.000</td>
<td>21.000</td>
<td>0.500</td>
<td>114.81</td>
</tr>
<tr>
<td>24</td>
<td>24.000</td>
<td>23.000</td>
<td>0.500</td>
<td>125.49</td>
</tr>
<tr>
<td>26</td>
<td>26.000</td>
<td>25.000</td>
<td>0.500</td>
<td>136.17</td>
</tr>
<tr>
<td>28</td>
<td>28.000</td>
<td>27.000</td>
<td>0.500</td>
<td>146.85</td>
</tr>
<tr>
<td>30</td>
<td>30.000</td>
<td>29.000</td>
<td>0.500</td>
<td>157.53</td>
</tr>
<tr>
<td>32</td>
<td>32.000</td>
<td>31.000</td>
<td>0.500</td>
<td>168.21</td>
</tr>
<tr>
<td>34</td>
<td>34.000</td>
<td>33.000</td>
<td>0.500</td>
<td>178.89</td>
</tr>
<tr>
<td>36</td>
<td>36.000</td>
<td>35.000</td>
<td>0.500</td>
<td>189.57</td>
</tr>
</tbody>
</table>
* Abstracted from AWWA Standard for Deep Wells, AWWA A100.

**TABLE 64-77 E**

Estimated Peak Design Flows Per Home For Water Distribution Systems

<table>
<thead>
<tr>
<th>No. of Homes</th>
<th>Peak Design Flow gpm</th>
<th>No. of Homes</th>
<th>Peak Design Flow gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>60</td>
<td>76</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>70</td>
<td>82</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>80</td>
<td>88</td>
</tr>
<tr>
<td>6</td>
<td>25</td>
<td>90</td>
<td>94</td>
</tr>
<tr>
<td>8</td>
<td>28</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td>125</td>
<td>110</td>
</tr>
<tr>
<td>15</td>
<td>37</td>
<td>150</td>
<td>120</td>
</tr>
<tr>
<td>20</td>
<td>43</td>
<td>175</td>
<td>132</td>
</tr>
<tr>
<td>25</td>
<td>48</td>
<td>200</td>
<td>140</td>
</tr>
<tr>
<td>30</td>
<td>53</td>
<td>300</td>
<td>175</td>
</tr>
<tr>
<td>40</td>
<td>62</td>
<td>400</td>
<td>200</td>
</tr>
</tbody>
</table>

More than 400 homes, use 0.5 gallons per minute per home.

Note: Commercial, industrial, or other high-user customers are not covered in this table and shall be included in the design of the distribution system.
TABLE 64-77 F  
DESIGN TABLE FOR PVC PIPE  
PRESSURE SURGE vs. DIMENSION RATIO

[In response to 1 foot per second instantaneous flow velocity change]

<table>
<thead>
<tr>
<th>Dimension Ratio</th>
<th>Pressure Surge, psi (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5</td>
<td>20.2 (139)</td>
</tr>
<tr>
<td>14</td>
<td>19.8 (139)</td>
</tr>
<tr>
<td>17</td>
<td>17.9 (123)</td>
</tr>
<tr>
<td>18</td>
<td>17.4 (120)</td>
</tr>
<tr>
<td>21</td>
<td>16.0 (110)</td>
</tr>
<tr>
<td>25</td>
<td>14.7 (101)</td>
</tr>
<tr>
<td>26</td>
<td>14.4 (99)</td>
</tr>
<tr>
<td>32.5</td>
<td>12.8 (88)</td>
</tr>
<tr>
<td>41</td>
<td>11.4 (79)</td>
</tr>
</tbody>
</table>