Oregon Drinking Water News
PIPELINE
Drinking Water Program, Oregon Health Division
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How To Prepare for Your Aquifer Test

By Dennis Nelson

Those in the business of supplying drinking water are finding their jobs a lot more complicated lately. Issues of water quantity and quality seem to occur on a daily basis. You are often asked to make recommendations or reach conclusions regarding an issue without having benefit of the really critical information necessary to do so. From the water quality standpoint, there may be concern as to whether or not the contaminant from a particular spill or release is going to reach the well.

Another common issue concerns land use and community development. Someone wants to locate a particular activity at a specific site in your community. You are asked "Is this going to affect our drinking water?" Neither one of these important issues can be adequately addressed unless the groundwater system that supplies the community's drinking water is better understood. You need to know what area of the community is directly over that part of the aquifer that supplies the well(s).

To determine where in the aquifer your drinking water is coming from, data is needed on the aquifer's characteristics, particularly related to the aquifer's ability to transmit groundwater (its permeability or hydraulic conductivity) and the direction that groundwater is moving (the hydraulic gradient). We will address the hydraulic gradient in a later PIPELINE issue; here we want to talk about how to determine the aquifer's hydraulic conductivity. The principle tool used by hydrogeologists to obtain this information is the aquifer test.

What is an aquifer test?

An aquifer test consists of a carefully planned interval of pumping and water level monitoring. We use the term "aquifer test" instead of "pump test" for two reasons. First of all, the objective is not just to test the pump, rather it is to better characterize the aquifer. Secondly, an aquifer test is a multi-phase effort that includes a number of steps in addition to just pumping the well.

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Dennis Nelson is groundwater coordinator of the Drinking Water Section

Safe Drinking Water Act Amendments of 1995 (S. 1316)

On October 11, 1995, Senators Kempthorne, Chafee, Baucus, Reid, Kerrey, Inhofe and Jeffords introduced legislation in the Senate to reauthorize the Safe Drinking Water Act (S. 1316). Senator Hatfield of Oregon is a cosponsor of the bill.

This bill has not yet had a floor vote. If passed, there would likely be additional amendments, and the bill would then have to be passed by the House of Representatives and signed by the President. Only then would there be any changes to current requirements for public water systems. The major provisions of the bill are as follows:

State Revolving Loan Funds

Many drinking water systems are struggling to comply with recently issued federal standards. The bill establishes a new federal grant program to capitalize state revolving loan funds (SRFs) for drinking water treatment like those now used to finance sewage treatment.

- Authorizations for the federal grants are $1 billion for each year 1995-2003;
- Grants go to the states which make loans or grants to local public water systems;
- Eligible projects include treatment plants, development of alternative water supplies, consolidation of small systems and replacing unhealthful private water supplies;
- States can provide grants rather than loans to 'disadvantaged communities' with up to 30% of their SRF allocation;
- Governors can transfer funds between Clean Water and Drinking Water SRFs to reflect the most important state priorities;

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Aquifer Test *(Continued from page 1)*

For the purpose of obtaining aquifer characteristics, the aquifer test normally consists of a period of constant rate pumping at a sufficient rate and for a long enough interval to involve a representative portion of the aquifer. Generally this means pumping the well at normal operating levels for a period of 24 to 72 hours.

The drop in the water levels (called the drawdown) in the production well and in nearby monitoring wells as a function of time are monitored throughout the test. The drawdown-time data is critical to the proper determination of aquifer properties. Therefore, the monitoring is done according to a rigorous schedule in order to ensure that the data obtained is useful.

How are aquifer test results used?

There is a direct relationship between the aquifer's characteristics and the amount of drawdown relative to both the time since pumping began and the distance a monitoring well is from the production well. For example, if we know the aquifer's transmissivity (equal to the hydraulic conductivity x the aquifer's thickness) and storativity (the amount of water the aquifer releases), we can predict what the drawdown will be for a given pump rate after a certain time and at a certain distance from the well. There are equations that allow us to make those predictions depending on the type of aquifer and the hydrogeologic setting.

It follows, then, that we can use those same equations in reverse to calculate transmissivity and storativity if we know the drawdown, time and distance. Generally, the solutions are graphical, that is, we plot the data and compare the graph to theoretical solutions. There are many different types of solutions, depending on the hydrogeologic setting.

How do we design aquifer tests?

Aquifer tests can be expensive and time consuming. Therefore, it is important that the data be collected in a manner that will yield useful results in terms of aquifer characteristics. We recommend that you consult with a professional early on in the planning of the aquifer test so that the data collected will meet your needs and expectations. The Drinking Water Program will provide technical assistance and advice to help get you started.

Importantly, there is no "off-the-shelf" aquifer test plan that is available. Critical questions of what pump rate, what test duration, what additional wells should be involved and at what distance, what hydrogeologic boundaries may affect the results, and what corrections need to be applied to the drawdown data, all need to be addressed on a site by site basis. As discussed above, there are several solution methods that are applied to aquifer test results depending on the hydrogeologic setting and well construction characteristics. For the solutions to be valid, certain criteria must be met with regard to how the test is performed. Clearly these criteria have to be identified prior to running the test itself.

Your consultant will likely prepare a conceptual model of the hydrogeologic setting based on well reports and other data available. From this information, a simulation of the aquifer test can be run prior to the actual test in order to identify potential problems and critical data to be collected. This allows the consultant to design the test to fit your specific setting and helps to ensure that the data collected will in fact represent your part of the aquifer and groundwater flow system.

What are some of the common mistakes?

a. Inadequate planning. The most common mistake is not planning the test adequately beforehand. As a result the data is only marginally useful and any use of it is open to some question.

b. Too short of test. We often see pump test data that is of limited duration, i.e. 1 to 4 hours. This data may be useful to evaluate the specific capacity of the well or to monitor the groundwater resource regionally, but is generally inadequate to define aquifer characteristics. The purpose of the test is to obtain representative values for those parameters that influence groundwater movement in the aquifer. The longer the duration of the test, the larger volume of aquifer involved and, therefore, the more representative is the data. Another issue here is the potential impact of hydrogeologic boundaries. These boundaries, e.g. streams, geologic contacts, groundwater divides, etc. may significantly affect groundwater flow in the area. Their presence can be recognized in a longer test, but may be completely missed in a test of limited duration.

c. Inadequate recovery. As has already been discussed, the important data that is collected is the amount of drawdown as a function of time in the given well. If the pump has been on just prior to the test and the water level in the well has not fully recovered, i.e. returned to its pre-pumping level, the drawdown recorded subsequently will not accurately reflect the pumping conditions during the test. As a result, the aquifer characteristics determined will be in error. The well should be idle for a minimum of 16 hours prior to the aquifer test.

d. Inadequate corrections to drawdown. A number of factors other than pumping can influence the water level in the well during the test. These include long-term changes in the aquifer due to regional pumping or recharge effects, changes in barometric pressure (especially for confined aquifers), changes in surface water stage (especially for unconfined aquifers) and interference from nearby pumping wells. If these features are identified and monitored before and during the test, corrections can be made to the data.

e. Poor monitoring practices. We have seen aquifer test data in which the water levels have been measured too infrequently or too imprecisely. Careful monitoring is critical to the utility of the data. We provide recommendations for frequency of monitoring water levels below.

With respect to field measurements, it is recommended that the pump rate be monitored on a two hour basis and the rate be maintained within 10 percent of its starting value. Significant variations in the pump rate pose large problems in interpreting the data.

Water level measurements should be determined to the nearest 0.01 feet. Tapes marked in tenths/hundredths of feet should be used as opposed to inches/feet. Time determinations should be made to the nearest minute, and if more than one observer is involved, the measurements should be synchronous to within one percent of the time since pumping began.

f. Improper conveyance of pumped water. The water brought to the surface during the pump test must be piped sufficiently far away from the production and monitoring wells so that it will not seep back into the ground and artificially recharge the aquifer in the vicinity of the well. This is particularly important for aquifer tests involving unconfined aquifers.

How do we collect the data?

Below we list OHD's current recommendations regarding the collection of data during the aquifer test's pre-pumping-, pumping- and recovery phases. These recommendations reflect discussions with staff at the Water Resources Department and review of literature pertaining to aquifer tests. **It should be noted that these are general recommendations only, modifications may be necessary as dictated by the conceptual model and simulation results.**

1. Duration. The pumping phase should be at a constant rate for a minimum of 24 hours for a confined aquifer and 72 hours for an unconfined aquifer.

2. Pump Rate. The pump rate should be a normal operating levels, but care must be taken to avoid the possibility of excessive drawdown, i.e. lowering the water level to the perforations or screens, during the test. It may be necessary to calculate the safe yield of the well and set the constant rate at 75% of that value.

3. Observation Wells. If other wells, e.g. domestic or irrigation, open to the same aquifer as the test well, are available in the vicinity, e.g. within 1000 feet, they should be identified as possible observation (monitoring) wells. The use of observation wells greatly enhances the ability to obtain representative data during the test. The conceptual model and simulation will provide information as to which wells can be used as a function of their depth and distance. If these observation wells are screened over different portions of the aquifer, corrections to the drawdown will probably be necessary. If the aquifer being evaluated is confined, it may be useful to select an observation well completed within the overlying unconfined aquifer to determine if there is any leakage from the overlying aquifer into the confined system.

4. Stream Stage. If there is a stream near the well being tested, and the conceptual model or simulation suggests a potential connection, it may be useful to periodically monitor the stage (depth and width) of that stream during the test.

5. Pre-pumping phase. The well to be tested should remain idle for at least 16 hours prior to the test. During that time, water level measurements should be made at 16, 12, 3, 2 and 1 hours prior to initiating pumping. Within the hour immediately proceeding pumping, water level measurements should be taken at 20 minute intervals. The purpose of this exercise is to establish any long term trends in water level changes that may be occurring. Barometric measurements of atmospheric pressure (inches of mercury) should be made as well. Confined aquifers may show significant responses, e.g. 0.5 to 1 foot, to large changes (e.g. 1 inch of mercury) in atmospheric pressure. These measurements will allow for appropriate corrections to be applied to the drawdown data.

6. Pumping Phase. After initiation of the pumping, drawdown measurements in the production and observation wells should be made according to the schedule below. The most critical period of measurements are within the first 100 minutes, when the water levels are changing rapidly.

Time After Pumping Started	Time Intervals
0 - 1 minute	As frequent as practical
1 - 10 minutes	1 minute
10 - 100 minutes	10 minutes
100 - 300 minutes	30 minutes
300 - 1000 minutes	1 hour
1000 - 5000 minutes	4 hours
5000 - end	1 day

7. Recovery Phase. Water level measurements made during the recovery of those water levels after the pump has been shut down should be taken at the same frequency as the drawdown measurements during the pumping phase. As in the drawdown phase, the most important information is obtained during the first 100 minutes. Measurements should continue for the same duration as in the pumping phase, or until the water levels have reached 95% recovery.

8. Measurement Devices. Water level and flow rate measurement methods should be in accordance to Water Resource Department requirements (see "Pump Test Requirements for Ground Water Right Holders" distributed by the Department).

Who can perform aquifer tests?

Aquifer tests should be performed by qualified individuals. The conceptual model/simulation phase should be performed by registered geologists, engineering geologists or professional engineers, providing they have hydrogeological experience. The actual test itself can be conducted by experienced individuals in the above professional groups as well as licensed well drillers and certified water rights examiners.

Where can I get more information on aquifer tests?

There are many standard texts that address aquifer tests. Among the most useful are:

Groundwater and Wells, Driscoll, F.G., 1986, Johnson Division. [Excellent discussion of test procedures and methods of analysis.]

Groundwater Pumping Tests: Design and Analysis, Walton, W.C., 1987, Lewis Publishers, Inc. [Comes with a disk containing a number of BASIC programs that help in both the design of the test and the analysis of the data.]

Why do an aquifer test?

As indicated at the start of this article, the data derived from a carefully planned aquifer test can be utilized to identify the critical portion of the aquifer that supplies water to your well. With this information, you become a better water manager in that you will be able to contribute in an informed way regarding changes that may be occurring in and around your community and how those changes will impact the community's water supply.

From the perspective of groundwater protection, the aquifer test data is absolutely fundamental to developing a wellhead protection plan for you community because it is the basis for delineation of the wellhead protection area. The aquifer test data is the first step in developing an integrated plan for the use of your community's resources.

STAFF NOTES

Nancy Stellmach is the new Office Specialist I in the Monitoring & Compliance Unit. She is responsible for the Data Entry and tracking of the water system test results.

Lisa Garbo has been hired as an Office Specialist I in the Field Services Unit. She is secretary for Plan Review and Cross Connection.

SDWA *(Continued from page 1)*

- States may use a portion of their federal grant to support administration of the drinking water program, including the new capacity development and source water protection authorities; and
- Funds are allocated to states by a formula based on a needs survey done by EPA.

Standard Setting Authority

Concerns have been expressed with respect to the high cost of some standards promulgated under the Safe Drinking Water Act and the mandate that EPA set standards for 25 new contaminants every 3 years.

- The mandate to promulgate standards for 25 additional contaminants every 3 years is repealed and a new mechanism to identify contaminants for future regulation is established;
- EPA is to conduct a benefit-cost analysis for each new standard before it is promulgated;
- EPA is given authority to set standards that balance competing health risks where treatment for one contaminant may increase risks from another;
- If EPA determines that the benefits of a standard issued under current law would not justify the costs to systems that must comply with the standard, EPA may issue a less stringent standard that maximizes health risk reduction at a cost that is justified;

Monitoring

Monitoring for contaminants is the most expensive part of the program for many systems.

- EPA is to revise current monitoring rules for at least 12 contaminants within 2 years;
- States can establish their own alternative monitoring requirements that may be less stringent than federal monitoring requirements provided that they ensure compliance and enforcement of federal health standards; and
- Systems serving up to 10,000 persons can skip repeat testing (reducing costs by 75%) for many contaminants that do not present acute health risks, if the first sample in a quarterly series does not detect the contaminant.

Small System Variances

Most drinking water systems serve a small number of people and many of these small systems cannot afford the treatment equipment necessary to meet drinking water standards that are established under the Safe Drinking Water Act for large regional water suppliers.

- States are authorized to grant variances from federal health standards for systems serving up to 10,000 people;

- Variances require use of treatment technology that is affordable for small systems to improve drinking water quality.
- EPA is to identify technologies that are feasible for small systems and that provide adequate protection of public health; states decide which systems qualify to use this alternative technology based on a state-determined affordability test; and
- Consumers may participate in the decision to grant a variance.

Capacity Development

Some drinking water systems, including many operated by homeowners' associations and other non-governmental entities, do not have the technical, managerial and financial capacity to comply with the monitoring and treatment requirements of the Safe Drinking Water Act. The bill establishes programs for technical assistance, operator training, restructuring and capacity development to aid these systems:

- Each state is to obtain the authority to prohibit the establishment of new drinking water systems that do not have the capacity to meet health standards;
- States are to establish capacity development strategies to help small systems overcome technical and financial problems and may use a portion of their SRF grant to carry out these strategies;
- Authorizations for grants to groups that provide technical assistance are increased; a national capacity development clearinghouse is established; and
- Systems receiving assistance from the new SRF program may only be operated by persons who have been trained and certified; systems that have a history of noncompliance may not receive SRF assistant unless the compliance problem is resolved.

Source Water Quality Protection Partnerships

Local drinking water suppliers have urged that more emphasis be placed on pollution prevention, to avoid costs of treating and removing contaminants from water that has been polluted.

- States may establish programs to act on petitions submitted by local, voluntary partnerships formed by governments or drinking water systems;
- The purpose of a petition is to redirect federal and state assistance to address source water contaminant problems that would otherwise require an investment in treatment facilities;
- Funds from several other water pollution control programs including the Drinking Water and Clean Water SRFs are available to respond to local petitions; and
- States are to delineate areas that provide source water for drinking water systems and are to conduct vulnerability assessments for high priority areas.

New Drinking Water Standards

Under the 1986 Amendments, EPA has established standards for about 80 drinking water contaminants. Although the bill repeals the requirements for 25 new standards every 3 years, it contains other provisions to keep the program moving forward:

- EPA is authorized to use $10 million of the funds appropriated for the SRF program for health effects research;
- EPA is to establish a priority list of unregulated contaminants and gather health effects and occurrence information on the listed contaminants;
- States and water systems are to monitor for up to 20 unregulated contaminants to collect information for future standards; and
- Every 5 years, EPA is to reach a determination as to whether federal health standards are needed for at least 5 of the contaminants that have been listed and studied.

Radon, Arsenic, Sulfate and Disinfection Byproducts

The bill establishes a schedule to complete standards for several contaminants.

- EPA is to promulgate regulations for disinfectants and disinfection byproducts based on the recent rule negotiated by the environmental community and the drinking water suppliers;
- EPA is to promulgate an enhanced surface water treatment rule including standards for *Cryptosporidium*;
- EPA is to promulgate a radon standard at 3000 picocuries per liter; the standard may be revised in the future if other risks from radon warrant adjustment.
- EPA is to arrange for additional research on the cancer risks from exposure to low levels of arsenic; a revised arsenic standard reflecting these cancer risks is to be promulgated no later than 2001; and
- Reliance on bottled water and public education to address the health threat of sulfate, as proposed by EPA in December, 1994, is ratified.

Cross Connection Update

by Bonnie Waybright

The current list of approved backflow assemblies is dated October 1995. Call (503)731-4899 for a copy.

CROSS CONNECTION RULE REVISIONS

Many changes will occur when the new cross connection rules are adopted. They are too numerous to list here, but some highlights are:

- Two name changes will take place with the adoption of the new rules; **Backflow Assembly Tester** will replace *Backflow Device Tester* and **Backflow Assembly Tester Recertification** will replace *Backflow Device Tester Update*
- The backflow assembly test procedures will change.
- The Backflow Assembly Tester Recertification will include a short quiz covering regulations.
- The written program plan requirements will be modified.

The rule changes are expected to be effective January 5, 1996. To obtain a complete copy of the cross connection rule changes, call (503)731-4899.

NEW BACKFLOW ASSEMBLY TEST PROCEDURES

As most Testers know, the required procedures for testing backflow assemblies will be changing to the methods specified in the 9th Edition of the Manual of Cross-Connection Control, published by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research.

Implementation Schedule:

The change to the new test procedures will be gradual. The new test procedures will become effective when the revised rules are adopted, but with over 400 certified Testers in Oregon, it will take time to complete the transition. In order to allow time for Testers to learn the new procedures, the current test procedures will continue to be accepted until January 1, 1998. This two-year phase-in period will allow Testers to coordinate their training with their normally scheduled Tester Recertification courses.

New Procedures:

The new test procedures will affect the testing of most testable backflow assemblies. There will also be a test procedure for a new assembly, the Spill Resistant Pressure Vacuum Breaker Assembly. The test for the Double Check Valve Assembly is being replaced with a new procedure. The test for the Pressure Vacuum Breaker Assembly has been slightly modified, while the test for the Reduced Pressure Backflow Assembly is essentially the same.

Training:

Most of the currently certified Testers will need an opportunity to learn the new test procedures, although someTesters have already been trained in the new methods. In an effort to minimize the burden to current Testers, a one-day Test Procedure Retraining course has been developed. This offers a better option to current Testers than taking the four-day Backflow Assembly Tester course. The retraining course teaches the new test procedures and offers an opportunity to practice testing backflow assemblies both with and without failure conditions present. There will be no graded exam or hands-on proficiency demonstration during this course. With few exceptions, the retraining course will be offered the day before each Tester Recertification.

The Test Procedure Retraining course is not a substitute for the Tester Recertification, nor is it required for certification renewal. Testers who feel comfortable with the new procedures may take the Tester Recertification without the retraining course. The cost of the Test Procedure Retraining courses will vary. Contact the training centers for this information.

The Backflow Assembly Tester course and the Backflow Assembly Tester Recertification will begin using the new test procedures as soon as the rules are adopted. This means that Testers attending a Tester Recertification after the rules are adopted need to be prepared to perform the hands-on proficiency demonstration using the new procedures.

Certification:

The requirements for certification will remain unchanged. For new Testers, proof of successful completion of the four-day Tester Course and payment of the certification fee will be required. For Tester certification renewals, proof of successful completion of the Tester Recertification, proof of gauge accuracy verification within the preceding year and payment of the certification fee will be required. Certification fees will remain the same.

CHANGES TO THE WRITTEN PROGRAM PLAN REQUIREMENTS

The new rule will require community water systems with 300 or more service connections to have a written program plan as part of their cross connection program. The current rule requires a written program plan for all community water systems. *This is a reduction, not an elimination, of requirements for smaller water systems.*

This revision *will* excuse community water systems with fewer than 300 service connections from having:

- a master list of facilities and premises which are subject to inspections, and the hazard level for each;
- a current list of certified inspector staff and work responsibilities; and,

- provision and schedule for initial inspection, the installation and annual testing of each required backflow assembly, and a periodic reinspection of each required backflow assembly.All community water systems, including those with fewer than 300 service connections, will continue to be required to have an active cross connection control program, including:
- an ordinance or enabling authority which authorizes discontinuing water service to premises for failure to install an approved backflow assembly or conduct a required annual test on a backflow assembly;
- maintenance of current records of backflow assemblies installed, inspections completed, and backflow assembly test results;
- submission of the Annual Summary Report to the Health Division; and
- compliance with other cross connection regulations.

ANNUAL SUMMARY REPORT

When the 1994 Annual Summary Report was sent out, it caught many water systems by surprise. Many water systems had no cross connection program in place and many weren't aware of the requirements until they got their report forms in late February 1995. Many systems, particularly the small water systems, had to start from the beginning to learn about cross connection control and to build programs for their systems. Because this was the first time reporting was required, the Health Division did not initiate any enforcement actions on water systems without active cross connection programs. All water systems were given until the end of 1995 to make progress on their programs.

The 1994 Annual Summary Report responses received to date include 467 reports from a total of 889 community water systems. Of the 467 community water systems responding, 210 had a cross connection ordinance or enabling authority in place at the end of 1994.

Who is required to submit an Annual Summary Report?

All community water systems are required to submit an Annual Summary Report to the Health Division. Several water systems failed to respond because of confusion over the definition of "community water system". A community water system is any water system serving water to 15 or more service connections used by year-round residents, or which regularly serves 25 or more year-round residents. *A water system can be a community water system regardless of whether it is publicly or privately owned.*

This reporting requirement has been in effect since January 7, 1994; however the requirement that community water systems have an active cross connection program has been in place for over a decade.

1995 Annual Summary Report:

The reporting forms for the 1995 Annual Summary Report will be mailed to all community water systems at the end of November. This report will cover cross connection program activities from January 1, 1995 through December 31, 1995. The report must be returned to the Health Division by February 29, 1996.

Recall that **December 31, 1995 is the deadline to:**

- have a cross connection ordinance or enabling authority;
- have a written program plan; and
- have a system in place to track the installation and testing of backflow assemblies.

Water systems with fewer than 300 service connections will be granted an automatic waiver from the written program plan requirement for 1995.

OTHER NEWS

We are on the Internet! Cross connection questions and comments can be sent to: BONNIE.L.WAYBRIGHT@STATE.OR.US

Workshops to Assist Small Communities with Environmental Mandates

Is your community faced with few administrative and technical staff to assess problems, and limited financial resources to meet environmental requirements? If you are an elected or appointed official from a small city or special district (under 5,000 population) and want to comply with environmental regulations, the Small Government Workshop is for you.

The workshops will include overviews of regulations, issues and trends in drinking water and wastewater as they affect small governments and will include suggestions for financing and managing improvement projects. Ideas on where to go for technical assistance will also be covered. There is no cost for workshops, which are planned to start at 9 am and end at 4 pm. A lunch is included.

The first workshops were offered on December 5 in Hillsboro and December 7 in The Dalles. Future workshops are scheduled for Baker City, Bend, Eugene, Grants Pass and Newport in the spring of 1996.

To get your application and exact workshop locations, contact:

Environmental Partnerships for Oregon Communities
Oregon Department of Environmental Quality
2020 SW Fourth Avenue
Portland, OR 97201

or call (503) 229-5588 or FAX your request to (503) 229-6957.

The Oregon Health Division is pleased to be a workshop co-sponsor with the DEQ, Special Districts Association of Oregon, League of Oregon Cities, Association of Clean Water Agencies and the EPA.

Drinking Water Program, Oregon Health Division
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Training Calendar

American Water Works Association
Judy Grycko/(503)246-5845

Dec. 7	Water Utility Safety: Dollars & Sense Teleconference Oregon City, OR; Pendleton, OR; Everett, WA; Spokane, WA; Moses Lake, WA; Tacoma, WA

Oregon Association of Water Utilities
Dan DeMoss/(503)873-8353

Disinfection

Dec. 6	Coos Bay
Apr. 10	Bend

Regulation Update

Dec. 12	Rogue River
Dec. 13	Roseburg
Jan. 10	Bend
Jan. 17	Newport
Apr. 17	Columbia City

Cla-Valve

Dec. 20	Wilsonville

18th Annual Tech. & Mgt. Conf.

Mar. 4-7	Eugene

Lagoon O&M/Collection System

Apr. 24-25	The Dalles

WD & WT Cert. Review I, II

May 7-9	Eugene

Cross Connection/Backflow Courses
Backflow Management Inc. (B)
800-824-4385
Clackamas Community College (C)
(503) 657-6958 ext. 2364

Backflow Device Tester Course

Dec. 4-7	Portland (B)
Dec. 11-14	Oregon City (C)
Mar. 11-14	Warm Springs (C)

Backflow Device Tester Update

Dec. 7-8	Oregon City (C)
Dec. 8	Portland (B)
Dec. 15	Portland (B)
Jan. 4-5	Oregon City (C)
Feb. 1-2	Newport (C)
Mar. 14-15	Warm Springs (C)
Apr. 4-5	Oregon City (C)

Cross Connection Inspector Course

Feb. 12-15	Oregon City (C)
Apr. 15-18	The Dalles (C)

Cross Connection Inspector Update

Dec. 14	Portland (B)
Feb. 16	Oregon City (C)
Apr. 19	The Dalles (C)

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