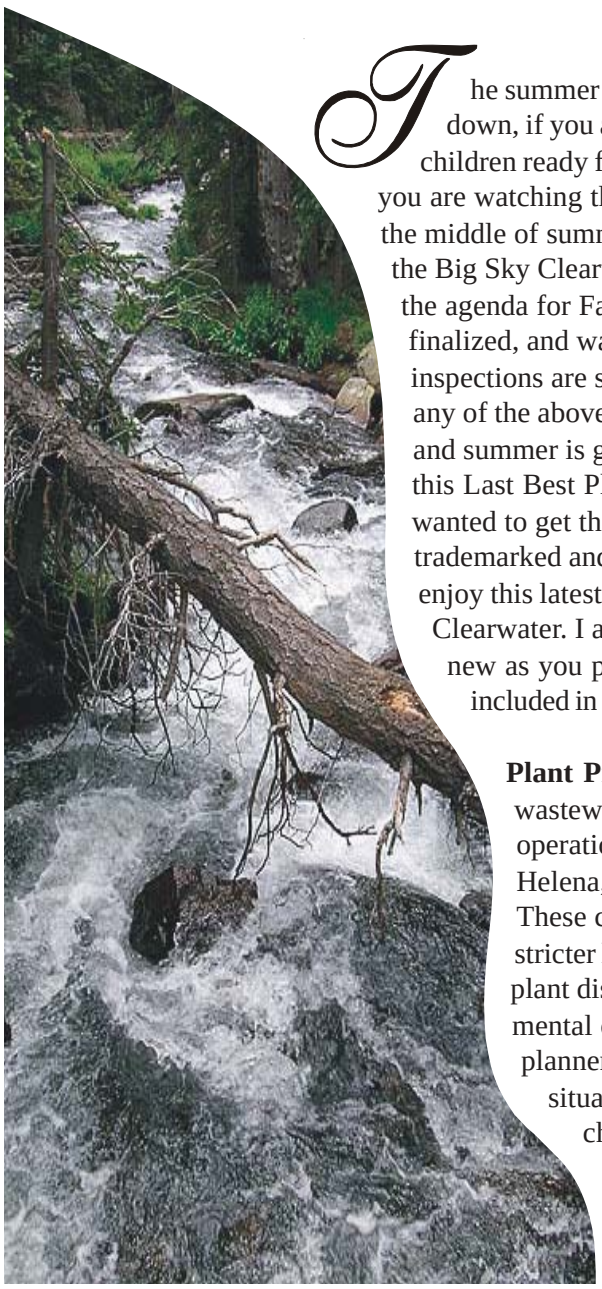
Big Sky Clearwater

Montana Department of Environmental Quality

Volume XXXV, Issue 2 — Fall 2005

Reflections in the Ripples

By Bill Bahr



The summer of 2005 is either winding down, if you are vacationing or getting children ready for school, or is heating up, if you are watching the fire reports. In my case, the middle of summer represents a time when the Big Sky Clearwater needs to be published, the agenda for Fall Water School needs to be finalized, and wastewater treatment plant inspections are scheduled. Needless to say, in any of the above situations, people are busy and summer is generally short and sweet in this Last Best Place called Montana. I wanted to get that last phrase in before it is trademarked and it's use limited. I hope you enjoy this latest version of the Big Sky Clearwater. I also hope you learn something new as you peruse the articles we have included in this edition.

Plant Profiles. There are three new wastewater treatment facilities in operation that I'd like to review, Helena, East Helena and Missoula. These communities were faced with stricter limits on pollutants in the plant discharges to address environmental concerns. The leaders, planners and plant staffs in each situation have risen to meet the challenges of producing cleaner effluents by providing funding and support for the new

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Inside This Issue

Big Sky Clearwater

Volume XXXV, Issue 2

Fall 2005

The ***Big Sky Clearwater***,
a publication of the Montana Department of Environmental Quality,
is for water and wastewater operators and managers. The Department welcomes articles of interest and suggestions for articles related to water quality, water and wastewater treatment and the water environment. Articles may be about your treatment plant experiences, or those of others, technical papers or any information that may benefit other operators or managers.

Please submit articles 30 days before publication (*August 1 and February 1*) to:

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treatment plants. I have yet to find a district, town or city that wanted to raise rates to pay for engineering, new construction and all the other associated costs for operating and maintaining the new plants, but in each of these cases, the progressive nature of the community response was adequate to the task.

Helena's new biological nutrient removal facility provides for the removal of nitrogen in the effluent. The Prickly Pear Creek is a relatively small stream that was impacted by the discharge of ammonia from the Helena WWTP. Ammonia is a toxic constituent in domestic wastewater and the previous facility in Helena, an Activated Bio-Filter plant, primarily removed carbon wastes, but failed to convert ammonia to nitrates in the process; this conversion is known as nitrification, which relies on nitrifying bacteria. The new facility was completed in 2001 and combines both nitrification and denitrification (converting nitrates to nitrogen gas) to remove nitrogen from the system. BNR plants typically remove BOD and TSS at higher efficiencies than ABF plants and Conventional Activated Sludge plants and the solids handling processes had to be improved and expanded, as well, to deal with the extra biosolids generated. Plant Superintendent Don Clark and his staff have done an outstanding job of starting up the facility and in running it efficiently. They discovered problems with a recycle stream that affected ammonia conversion and have made other adjustments in process control to save energy while achieving treatment goals. A review of effluent data over the past year from the plant shows no violations of permit conditions. In addition to removing toxic ammonia, the plant converted from a chlorination disinfection system to one relying on ultraviolet light. Chlorine compounds are also toxic to aquatic life, so this change has improved conditions in the creek, too. The fish and other aquatic life in the Prickly Pear must love it.

East Helena has a new facility, too, to help protect the aquatic environment from toxic conditions. The old aerated lagoon system could not reduce ammonia levels in the discharge during the cold winter months when aquatic life is under greater pressure from environmental conditions. Chlorine disinfection and ammonia in the effluent from the East Helena lagoons created harmful conditions due to the toxicity of chlorine compounds and ammonia. While lagoons do provide adequate treatment of carbon-based wastes, nitrification to convert ammonia to nitrates requires that water temperature be greater than five degrees centigrade to be effective. Winter conditions reduce the ability of the nitrifying bacteria to grow, resulting in high levels of ammonia in the discharge. The new activated sludge facility, built in 2004, is a Biolac system that uses an existing aerated lagoon cell and adds a clarifier at the end. The diffusers for the compressed air system are suspended in the bioreactor. The system is now a BNR Activated Sludge system. This changed not only the operation and maintenance procedures significantly from the simpler lagoon system, but additional solids handling upgrades were included to handle the waste activated sludge that must be removed on a regular basis. Typically, lagoons store the removed wastes in the form of biosolids in the bottom of the cells. Daily process control tests must be conducted to keep the plant performing in an optimal fashion. The operational staff now must be certified as Class 1C. Suffice it to say that the changes from an aerated lagoon system to activated sludge are immense. The facility is performing well and the staff, primarily Julie Muscutt and Bill Casey, are learning to run a complex treatment plant and are finding ways to improve plant operations and performance. Ammonia levels are less than 1 mg/l on a monthly basis and with the new ultraviolet disinfection system, toxic chlorine compounds are removed from the Prickly Pear, as well.

Missoula has constructed a BNR WWTP that is designed to reduce nitrate levels in the Clark Fork River. The Voluntary Nutrient Reduction Plan (VNRP) for the Clark Fork River basin has low in-stream targets for nitrate and phosphate compounds. These constituents act as fertilizers for algae and other aquatic plant growth in the river. This clogs the riverbanks and gravel beds impacting aquatic life. The larger size of the Clark Fork reduces the need for ammonia restrictions at this time, but nitrogen in the form of nitrates is the problem in this basin. The Missoula Advanced Wastewater Treatment Plant (AWWTP) is a modified Johannesburg BNR plant that allows for reduction of P and N compounds in winter and in summer. The plant was started up in the fall of 2004 and has produced a much cleaner effluent, reducing plant nutrient (N and P) loads from the fast-growing City of Missoula on the Clark Fork River. Plant Superintendent Starr Sullivan, Gene Connell, 2005 Operator of the Year, and the rest of the staff are working to optimize plant performance. The plant

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has had no violations of the permit conditions over the past year. We will continue to provide updated information about the plant performance over the next few years. The VNRP has some strict nutrient goals and communities along the Clark Fork, Missoula being the largest in population, will be under increasing pressure to reduce pollutant loads to the river.

METC is on the Move: The Montana Environmental Training Center has been moved to offices in the Hagener Science Center at the MSU-Northern campus in Havre. The training center is a non-profit entity supported by DEQ and MSU-N to provide continuing education opportunities for water and wastewater operators across the state. An EPA grant was received in 1988 by MSU-N in conjunction with DEQ support. Since that time, METC has been in the forefront for bringing quality training events to Montana operators, such as the annual Fall Water school in Bozeman, the Yellow Bay Advanced Wastewater course and many water and wastewater seminars. Starting with Martha Anne Dow, Scott Anderson, Doris Roberts, Ray Wadsworth (at-large member) and Donna Jensen, METC developed courses in water and wastewater and joint sessions, published an annual calendar of training events and developed the now-familiar Basic Lagoon manual. Jan Boyle was hired as the first training center coordinator and the staff was expanded a few years later to accommodate the needs of the training program which has been delivered across the state.

A year ago, the MSU-N campus in Great Falls announced that its offices and classrooms had reached maximum capacity and the METC office space would be needed for curriculum offered by MSU-N. After researching a variety of options in Great Falls, the METC Steering Committee chose to move to offices at the main campus in order to continue to provide training opportunities at reasonable costs. Obviously, there have been a few hurdles to get over for the transfer and to carry out training as usual, and there are still some yet to be jumped. The DEQ Public Water Supply staff and the water and wastewater State Revolving Fund staff are excited to continue the training programs for operations. Once the move is complete and the METC training coordinator hired, things will settle down a bit.

We look forward to the upcoming Yellow Bay Advanced Wastewater workshop with Paul Klopping, Exam Prep sessions here in Helena for the next group of operators and the annual Fall Water Operators School in Bozeman.

Doris Roberts is retiring after 20 years of operator training and technical assistance. Doris and I have had many opportunities to work together over these past couple of decades and there is little doubt that her retirement will be felt for some time as we reach out to systems across the state and try to provide assistance in our wastewater and water treatment plants. I will write more about Doris in the next issue, after we get a chance to thank her for all the hard work and great advice.

Other News: Clopyralid is a herbicide used in controlling weeds in lawns that has shown up in compost products. These composts applied to broadleaf plants, like tomatoes, can retard growth and even kill the plants at low dosages. Washington and Oregon are among states that have placed restrictions in using products with Clopyraild in them for lawn and turf applications. The results show that there has been a significant drop in the persistence and appearance of this chemical in composts since the restrictions were applied. This is good news for those folks using composts from public composting facilities.

Lagoon Water Depths: While there is no specific rule for how much water should be retained in lagoons, if drawdown and fill or seasonal discharge operations are used, all guidance from the EPA and in DEQ2 design criteria for lagoons require that solids levels be covered by a foot of water. This level prevents odors from being released from the solids deposits and continues to provide treatment water for the incoming wastewater. Design criteria require 2 feet of depth be retained for sludge depth in the primary lagoon cells and 1 foot in the final cell for sludge accumulation. Adding another foot to the cell water depth means that at a minimum, 3 feet of liquid level should be retained in the primary lagoon cells at all times and at least 2 feet in the final cell. I hope this clears up any confusion about the correct water depths in lagoons.

Ammonia in Lagoon Discharges: Typical ammonia values will fluctuate in aerated lagoons in a similar manner to facultative lagoons. During the warmer summer months,

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ammonia should be very low in the effluent; maybe between 1 and 5 ppm, depending on circumstances. Air temperatures warm in the period beginning in March or April and ending in late fall, October–November. During winter, ammonia will likely be in the teens (or higher). Receiving water criteria will determine what limits will be placed on ammonia, but if they are very strict, especially in the winter, the lagoons of either operational mode will not convert the ammonia and violations will occur. An easy check is to compare the ammonia values in the influent and effluent to the nitrite/nitrate values in the influent and effluent. You can see exactly when air temperatures warmed up and when they cooled down. Oxygen supply is critical, along with longer detention times. For aerated lagoons, however, ambient air temperatures and lagoon water temperatures still control the reaction.

A Bit More Information: Aerated lagoons have the longer detention times (>20 days) needed for the slow-growing nitrifiers to convert ammonia to nitrite/nitrate. Winter temperatures (<5 degrees C) in the northern states, like Montana, retard the growth mechanisms in both types of lagoon systems. Lagoon waters cool to match ambient conditions. This is unlike mechanical plants, which can retain enough of the warmer wastewater temperatures to maintain nitrification, due to short (4-6 hours) detention times. Bozeman is a good example of how this works. However, sometimes mechanical plants have to use more basins to hold more microbiological mass to grow enough nitrifiers to meet the nitrogen demand exerted by converting the ammonia to nitrate. Aerated lagoons probably do a better job than facultative lagoons in converting ammonia, under certain conditions, due to the ability to provide enough oxygen to meet the nitrogenous demand.

Some Fun Activities: From the AWWA Opflow publication are the following questions for operator certification exam training exercises. See how you do…

1) Which of the following is found mainly in groundwater sources and forms a precipitate when oxidized? a) Hydrogen Sulfide; b) Methane; c) Radon; d) Iron.

2) A well screen must be installed for which of the following? a) All deep wells; b) Only shallow wells; c) Consolidated materials; d) Unconsolidated materials.

3) As water temperature increases, the disinfection action of chlorine will: a) increase; b) decrease; c) double; d) be indeterminate, as it also depends on the pH.

4) After chlorination, the free chlorine residual includes: a) Cl_2, ClO_2, and HOCl; b) OCl^-, and HOCl; c) OCl^-, HOCl and Cl_2; d) ClO_2, HOCl, and OCl^-.

5) If a pump discharges 10,350 gallons in 3 hours and 45 minutes, how many gallons per minute is the pump discharging? a) 43 gpm; b) 44 gpm; c) 45 gpm; d) 46 gpm.

(See answers on last page of this publication.)

I sincerely hope you enjoy this issue of the Clearwater and look forward to working with you on plant problems, at training schools or anywhere else our paths might cross. ■

Change

By Tom Slovarp

A few things have changed since I started working for the state of Montana, Water Quality Bureau in July of 1986. The name has been changed to the Department of Environmental Quality, Technical and Financial Assistance Bureau, but essentially I do similar work, namely review wastewater planning documents, plans and specifications, perform inspections and administer funds to communities. The Construction Grants program has evolved into the State Revolving Fund (SRF) loan program.

The EPA STAG grant also provides funds to communities for water and wastewater facilities. Circular DEQ 2 – Design Standards, has replaced the Ten States Design Standards. Non-degradation limits in discharge permits started in 1992. Secondary treatment has been upgraded to advanced treatment biological nutrient removal for some communities discharging to water quality limited streams or lakes.

Back in 1986, our office had one computer and now everyone has a computer with access to e-mail and the Internet. Communication is faster and better because of the e-mail services.

The dedicated community officials, system operators, engineers and co-workers have not changed that much. They still demonstrate concern for the environment and continue to do the best job possible for their communities.

One change coming down the road for me, besides getting grayer and fatter, is retirement in October. I look forward to it and the changes that retirement will bring. My thanks to all I have had the pleasure of working with these past years. ■

Public Water Supply System Monitoring Report Available on WEB

In the very near future you will be able to access Public Water Supply System data and monitoring reports on the web in a different format than in the past. You will be able to view "live" data as we have it in the Public Water Supply Section database as well as check back several years for it. This is different than presented in the past, which was a snapshot of the day we developed the report. This newer report presents system data including contact information, monitoring schedules, enforcement and violation information in addition to up-to-date bacteriological, nitrate and chemical sample results.

To access the web site visit:

www.deq.mt.gov/wqinfo/pws/reports.asp

We hope to have this up and running in September, so keep checking, you'll like what you see.

Andrea Vickory, Water Quality Specialist, PWS ■

Ed Murgel

Ed Murgel

On May 30, 2005, East Helena lost a remarkable community advocate, Ed Murgel, after a valiant fight with brain cancer. Ed was born March 26, 1949, to Frank Murgel (deceased) and Mary (Strainer). He was the first of five children.

Ed's goal his entire life was to make East Helena the best place to live. He spent nearly 30 years as public works director for the City of East Helena.

He was a founding member of the East Helena Improvement Association, reserve East Helena police officer, and volunteer fireman for the East Helena Fire Department. He spent nine years on the East Helena School Board, first as a trustee and finally as the chairman of the school board. In 2001, he was elected mayor of East Helena. He dedicated many long days towards his dream of making East Helena the best place to live.

Upon retirement from the City of East Helena, he began his second career as an EMT for St. Peter's Hospital. Throughout his five years as an EMT, Ed's genuine love for people, whether it was patients or co-workers, was boundless. His innate ability to provide comfort and care to others during times of crisis brought Ed true satisfaction. Although Ed did not consider his work as an EMT a job, Ed did enjoy time away golfing, fishing, and hunting with family and friends.

It is nearly impossible to encapsulate in a few short paragraphs what Ed did for East Helena and the love he had for the East Helena community and St. Peter's community. He will be missed not only by his family and friends, but his communities as well.

Ed is survived by his wife, Carolyn; son Ryan and wife Julie of Westminster, Colo., son Shaun of Winnemucca, Nevada; daughter Megan of East Helena, granddaughter Emily of Westminster, Colorado; mother, Mary of East Helena, brother David and wife Debbie of Helena, brother Randy (Turtle) and wife Gail of East Helena, brother Joey (Odd Job) and wife Donna of Amarillo, Texas; sister Debbie Schramm and husband Dee of East Helena; and father and mother-in-law Charles and Charlotte Ceartin of Lincoln. Ed is also survived by numerous aunts, uncles, cousins, nieces, and nephews.

In lieu of flowers, the family suggests memorials to the Lewis and Clark Humane Society, P.O. Box 4455, Helena, MT 59604 or the St. Peter's Foundation, 2475 Broadway, Helena, MT 59601. ■

Eddie-Roy you will be missed !

EXAMS PASSED JANUARY 2005 - JUNE 2005

CLASS 1's

HAGEN, BRUCE	GREAT FALLS	1A	CO
JOHNSON, JAMES	BILLINGS	1A	OT
SPENCE, TIANNA	BOZEMAN	1A	OT
STOVALL, JAY	BILLINGS	1A	CO
PAULEY, DAVID	GREAT FALLS	1B	CO
BARDWELL, DEAN	GREENOUGH	1C	OT
BLACK, DENVER	BIG SKY	1C	OT
BROOKS, DANIEL	HAVRE	1C	OT
CASTERLINE, SHANE	HAVRE	1C	CO
KERMAN, PAUL	HAVRE	1C	OT
LOSING, AARON	LEWISTOWN	1C	CO
LOUDERMILK, ANDY	BIGFORK	1C	CO
MARTIN, JON	COLORADO	1C	CO
PRESTON, RONALD	MILLTOWN	1C	CO
TURECEK, ELIZABETH	WEST GLACIER	1C	OT
WILEY, THOMAS	HAVRE	1C	OT
SHAFFER, MICHAEL	BILLINGS	1D	CO

CLASS 2's

PERING, SCOTT	MILES CITY	2A	CO
KILSDONK, ODEAN	CULBERTSON	2A	OT
STEELE, MARK	GREAT FALLS	2A	CO
BURRELL, KENNETH	WHITEFISH	2B	OT
PASSWATER, BRENT	BIGFORK	2B	CO
TURECEK, ELIZABETH	W GLACIER	2B	CO
BLACK, DENVER	BIG SKY	2A3B	OT
GODDARD, TOM	DEER LODGE	2A3B	CO
SPENCER, JULIE	BIGFORK	2A3B	CO
SCHAD, PHIL	LIBBY	2C	OT

CLASS 3's

KILSDONK, ODEAN	CULBERTSON	3A	CO
TURECEK, ELIZABETH	WEST GLACIER	3A	CO
CHRISTENSEN, TOM	LAKESIDE	3A4B	OT
EBY, LORI	GREAT FALLS	3A4B	CO
GEYER, LARRY	BIG SANDY	3A4B	OT
HEIM, JIM	LAKESIDE	3A4B	CO
KRUSE, WESLEY	KALISPELL	3A4B	OT
PALKOVICH, BRIAN	HELENA	3A4B	CO
CHRISTENSEN, TOM	LAKESIDE	3C	OT
COE, BRADLEY	BIG SKY	3C	OT
DOUGHERTY, GREGG	ARLEE	3C	OT
HEIM, JIM	LAKESIDE	3C	CO
PALKOVICH, BRIAN	HELENA	3C	CO
SHOENDALLER, LORI	KEVIN	3C	CO

CLASS 4's

KOESSL, KIRK	FORT PECK	4A	CO
MYERS, JOSHUA	ST. MARIE	4A	OT
ARNOLD, JERRY	HINSDALE	4AB	CO
BOSLEY, ROBERT	KALISPELL	4AB	CO
BOYUM, LARRY	NASHUA	4AB	OT
BROHN, ADAM	WHITEFISH	4AB	OT
BROWN, JEROME	RICHEY	4AB	CO
COE, BRADLEY	BOZEMAN	4AB	CO
DEMPSEY, LARRY	WOLF POINT	4AB	CO
GAUSTAD, GARI	CHARLO WATER	4AB	CO
GILLARD, DONALD	REXFORD	4AB	OT
GINGERICH, DANIEL	ST REGIS	4AB	OT
HARVESTER, TOM	KALISPELL	4AB	CO
HEFFNER, GERARD	BILLINGS	4AB	CO
HOUSLEY, SHERRI	POTOMAC	4AB	CO
JACQUOT, ROBERT	ST REGIS	4AB	OT
LEE, LYNN	MISSOULA	4AB	CO
MATT, ROBERT	RONAN	4AB	CO
PALMER, PHILIP	YELLOWTAIL	4AB	OT
RICHTER, JAMES	CLYDE PARK	4AB	CO
ROGINSKE, SCOTT	JOLIET	4AB	CO
ROSS, EARL	BILLINGS	4AB	CO
SCHWEHR, DENNIS	THOMPSON FALLS	4AB	OT
SOLNOSKY, MARK	RYEGATE	4AB	CO
SOYLAND, JEFF	COLUMBIA FALLS	4AB	OT
TREMBLAY, JERALD	MALTA	4AB	CO
CADY, LONNIE	INVERNESS	4C	CO
GARLAND, DAVID	SIDNEY	4C	CO
GILLARD, DONALD	REXFORD	4C	CO
JILES, ANNA	ROBERTS	4C	CO
JOSEPH J. WALDNER	CUT BANK	4C	CO
MYERS, JOSHUA	ST. MARIE	4C	OT
NIESKENS, MIKE	GLASGOW	4C	CO
PALMER, CHAD	HERON	4C	OT
SIMPSON, AUDIE	SACO	4C	CO
SOLNOSKY, MARK	RYEGATE	4C	CO
THIESSEN, PETER	SIDNEY	4C	CO
TREMBLAY, JERALD	MALTA	4C	CO
WERSAL, KEVIN	GLASGOW	4C	CO
WILLIAMS, JACK	HELENA	4C	OT

CLASS 5's

CAMPBELL, SADIE	LINCOLN	5AB	CO
DYKSTRA, FRANK	BIGFORK	5AB	CO
MILDENBERGER, JIM	HAMILTON	5AB	CO
NELSON, JOE	LINCOLN	5AB	CO
NEVINS, MICHAEL	SIDNEY	5AB	CO
SCHAEFER, MARK	FT BENTON	5AB	CO
SENNETT, MIKE	HELENA	5AB	CO
WEGNER, JONATHAN	GREAT FALLS	5AB	CO
WIEDEMAN, TERRY	EAST HELENA	5AB	CO

A = Water Distribution
B = Water Treatment
C = Wastewater
D = Industrial Wastewater
CO = Fully Certified Operator
OT = Operator-in-Training

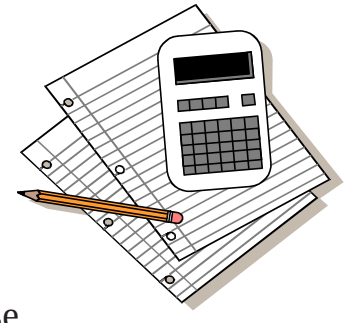
Congratulations!!

The exams for certification require considerable time in study and preparation. Passing represents a lot of hard work and initiative on the part of the individual. Be sure to show appreciation to your water and wastewater operator for working hard to ensure that they are properly trained to care for your system.

CEC NAGGINGS

(THAT YOU MAYBE SHOULDN'T IGNORE)

CONGRATULATIONS
to all operators who got re-certified by having their renewal fees in by June 30, 2005



CONTINUING EDUCATION CREDITS (CEC's) are due by May 31, 2006. It is time to start looking into signing up for a class to earn your credits so you don't have to rush at the end. There are lots of fun and exciting ways to get your credits. These include attending any approved courses (the METC 2005 calendar lists courses from the current training providers, so check out the ones from July through December). You can complete an approved correspondence course (these are also listed in the METC calendar), or find your own class and apply to have it approved for credit. We are starting to get a lot of courses that you can take over the Internet or we have some that you can simply put a CD into your computer and take a course that way. Remember that operators-in-training are not required to earn CEC's, but are encouraged to attend any training.

If there are any problems or questions on your CEC status or you need information on any of the training options, simply contact Ashley Eichhorn, Water/Wastewater Operator Certification Office Technician at (406) 444-4584. ■

Down By The River

by Carole Mackin

The Wednesday afternoon Summer School session answered the question: "Who are those people down by the river and why are they taking water samples?" Deb Fassnacht and Sean Sullivan of the Water Education Network (WEN) provided the answers. They also showed the workshop participants the protocol for collecting surface water samples.

The workshop participants learned that volunteer monitors are taking surface water samples on streams, lakes and wetlands around the state. Often they are trained by WEN or other similar organizations. Sometimes the volunteers are school children whose teachers are interested in teaching science by actually doing science.

The workshop participants learned that the data collected were analyzed according to uniform procedures and posted on websites so the results can be compared within a watershed or across watersheds. The participants were given website addresses so they could track the data themselves.

As to who pays for this? Just follow the money and that winding path will most likely end up at the EPA. EPA is committed to fostering volunteer monitoring as a cost effective way to keep track of water quality changes in our rivers, lakes and wetlands.

Thanks, Deb and Sean, for an informative afternoon.

Deb Fassnacht, Executive Director, helped found WEN in Missoula. The network began as a volunteer stream monitoring effort in 1996 and grew into a successful nonprofit organization focusing on watersheds, wetlands and education.

Sean Sullivan, Program Director, has been with WEN since 2000 helping to implement and improve the school-based water monitoring program and the Volunteer Water Monitoring Project. He coordinates the volunteer trainings, innovative water curriculum and field trip successes. ■

Impact of Clean Water

The introduction of water filtration and chlorination in major U.S. cities between 1900 and 1940 accounts for one-half the steep decline in death rates during those years, according to an article published in the recent issue of the journal Demography.

The analysis found that clean water was responsible for cutting three-quarters of infant mortality and nearly two-thirds of child mortality during that time, according to Harvard economists and article co-authors David Cutler and Grant Miller.

"Inexpensive water disinfection technologies can have enormous health returns in poor countries, even in the absence of sanitation services," said Cutler.

In 2000, the World Health Organization and UNICEF found that more than one-fifth of the drinking water samples from existing water systems were contaminated with bacteria and pollutants. Worldwide, 1.1 billion people lack access to clean water.

Although not a substitute for appropriate investment in sanitation, low-cost water disinfection could prevent a significant share of the 1.7 million annual deaths from diarrhea-related diseases worldwide, according to Cutler and Miller.

"While the (South Asian) tsunami was an enormous, immediate catastrophe," Cutler noted, "the deaths from unclean water are likely every bit as large, but more spread out in time and space."

Cutler and Miller also write that, between 1900 and 1940, U.S. death rates fell 40 percent, more rapidly than in any other time in the nation's history. About one-half of that decline is the result of clean water, according to the study.

For their analysis, the authors used U.S. Census Bureau mortality statistics for specific urban areas; they also gathered information on the timing of the introduction of clean water technologies from reports published in municipal engineering and urban planning journals during the period. Water filtration and chlorination were introduced in the U.S. cities before sewage treatment and sewage chlorination, allowing the researchers to calculate the impact separately.

Cutler and Miller estimate that the social rate of return on clean water technologies in the United States was about $23 gain for every $1 spent. They calculate that the cost per person-year saved was about $500 in present day dollars. The authors add that, had they factored in the impact of less disease and greater productivity, their estimates of the social benefits of investment in clean water would have been much greater.

Demography is the peer-reviewed journal published by the Population Association of America. The full article, "The Role of Public Health Improvements in Health Advances: The Twentieth Century United States," is available at **www.prb.org/cpipr/demography/cutler.pdf**. ■

ATTENTION
Small Water Systems

The City of Helena is in the midst of a water meter conversion from manual read to a radio read system. They are changing meter brands from Badger to Neptune in the process because of a competitive bid. Helena has a number of "new" residential size meters of 3/4" (3000+/-) and 1" (500+/-) as well as some newer compound meters 2" through 6" which will be changed out in the next year and one-half. These meters are less than five years of age; a few have not been used at all.

The City of Helena must go through the surplus process for these meters and will need to dispose of them per city ordinance giving to a number of options: salvage, competitive bid or negotiated sale to other municipality....we want to be reasonable……satisfied seller, satisfied buyer type of deal.

If any small system is in need of metering, or who uses the badger meter would like to acquire some meter bodies and/or manual read heads, please contact Kevin Hart at the City of Helena at 447-1567. ■

Important Rule Changes at DEQ For Public Water Supply Systems

Recent in the Public Water Supply business processes has resulted in changes in Rule Specialists for the individual rules that apply to all systems. Some of these changes are effective today and some will be phased in over the next several months. A summary of the Rule Specialists is provided below so you can have the correct contact information for each specific rule you have to deal with for your water system. Please keep this list for future reference.

Rule	Contact	Phone Number
Consumer Confidence Report	Eugene Pizzini	444-3425
Surface Water Treatment	Rick Cottingham	444-4019
Total Coliform Rule*	Sandi Ewing	444-5314
Total Coliform Rule*	Amy MacKenzie	444-5360
Homeland Security	Amy MacKenzie	444-5360
GWUDISW	Steve Kilbreath	444-4630
Chemical/Radiological/Fluoride	Andrea Vickory	444-3358
Disinfection By-Products	John McDunn	444-5312
Groundwater Chlorination	John McDunn	444-5312
Lead and Copper	Kerry Schmelzer	247-4412

*After October 1, 2005, TCR contact for Transient Systems will be Sandi; and Non Transient Non-Community and Community will be Amy. ■

Wise Water Use

Our Water & Wastewater Tip of the Week is courtesy of the Washington State Department of Ecology:

Publications and facts sheets on wise water use can be downloaded at **www.doh.wa.gov/ehp/dw.**

In-home water audits are a great way to help any homeowner find ways to save water. Try the online audit tool at **www.wateruseitwisely.com.** ■

WATER USE IT WISELY®

100 Water Saving Tips

#1. There are a number of ways to save water, and they all start with you.
#2. When washing dishes by hand, don't let the water run while rinsing. Fill one sink with wash water and the other with rinse water.
#3. Evaporative coolers require a seasonal maintenance checkup. For more efficient cooling, check your evaporative cooler annually.
#4. Check your sprinkler system frequently and adjust sprinklers so only your lawn is watered and not the house, sidewalk, or street.
#5. Run your washing machine and dishwasher only when they are full and you could save 1000 gallons a month.
#6. Avoid planting turf in areas that are hard to water such as steep inclines and isolated strips along sidewalks and driveways.
#7. Install covers on pools and spas to avoid water evaporation.
#8. Use the garbage disposal less often.
#9. Plant during the spring or fall when the watering requirements are lower.
#10. Keep a pitcher of water in the refrigerator instead of running the tap for cold drinks.
#11. Check your water meter and bill to track your water usage.
#12. Always water during the early morning hours, when temperatures are cooler, to minimize evaporation.
#13. Wash your produce in the sink or a pan that is partially filled with water instead of running water from the tap.
#14. Use a layer of organic mulch around plants to reduce evaporation, promote plant growth, and reduce weeds.
#15. Use a broom instead of a hose to clean your driveway and sidewalk and save up to 80 gallons of water every time.
#16. If your shower can fill a one-gallon bucket in less than 20 seconds, then replace it with a water-efficient showerhead.
#17. Reuse the water that you washed produce in for watering house plants or for cleaning.
#18. Water your lawn in several short sessions rather than one long one. This will allow the water to be better absorbed.
#19. We're more likely to notice leaky faucets indoors, but don't forget to check outdoor faucets, pipes, and hoses for leaks.
#20. Periodically check your pool for leaks if you have an automatic refilling device.

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100 Water Saving Tips *- continued from page 13*

#21. Only water your lawn when needed. You can tell this by simply walking across your lawn. If you leave footprints, it's time to water.
#22. When you shop for a new appliance, keep in mind that one offering several different cycles will be more water and energy-efficient.
#23. Time your shower to keep it under 5 minutes. You'll save up to 1000 gallons a month.
#24. Install low-volume toilets.
#25. Adjust your lawn mower to a higher setting. Longer grass will reduce the loss of water to evaporation.
#26. When you clean your fish tank, use the water you've drained on your plants. The water is rich in nitrogen and phosphorus, providing you with a free and effective fertilizer.
#27. Water small areas of grass by hand to avoid waste.
#28. Put food coloring in your toilet tank. If it seeps into the bowl, you have a leak. It's easy to fix, and can save more than 600 gallons a month.
#29. Plug the bathtub before turning the water on, then adjust the temperature as the tub fills up.
#30. Use porous materials for walkways and patios to keep water in your yard and prevent wasteful runoff.
#31. Collect and use rain water for watering your garden. (Check to make sure this is legal in your area.)
#32. Designate one glass for your drinking water each day. This will cut down on the number of times you run your dishwasher.
#33. Instead of using a hose or a sink to get rid of paints, motor oil, and pesticides, dispose of them properly by recycling or sending them to a hazardous waste site.
#34. Install a rain shut-off device on your automatic sprinklers to eliminate unnecessary watering.
#35. Don't use running water to thaw food.
#36. Choose a water-efficient drip irrigation for your trees, shrubs, and flowers.
#37. Grab a wrench and fix that leaky faucet. It's simple, inexpensive, and can save 140 gallons a week.
#38. Cut back on the amount of grass in your yard by planting shrubs and ground cover or landscaping with rock.
#39. When doing laundry, match the water level to the size of the load.
#40. Teach your children to turn the faucets off tightly after each use.
#41. Remember to check your sprinkler system valves periodically for leaks and keep the heads in good shape.
#42. Before you lather up, install a low-flow showerhead. They're inexpensive, easy to install, and can save your family more than 500 gallons a week.
#43. Soak your pots and pans instead of letting the water run while you scrape them clean.
#44. Don't water your lawn on windy days.
#45. Water deeply but less frequently to create healthier and stronger landscapes.
#46. Make sure you know where your master water shut-off valve is located. This could save gallons of water and damage to your home if a pipe were to burst.
#47. When watering grass on steep slopes, use a soaker hose to prevent wasteful runoff.
#48. To get the most from your watering time, group your plants according to their water needs.
#49. Remember to weed your lawn and garden regularly. Weeds compete with other plants for nutrients, light, and water.
#50. While fertilizers promote plant growth, they also increase water consumption. Apply the minimum amount of fertilizer needed.
#51. Avoid installing ornamental water features unless the water is being recycled.

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100 Water Saving Tips *- continued from page 14*

#52. Use a commercial car wash that recycles water.
#53. Don't buy recreational water toys that require a constant flow of water.
#54. Turn off the water while you brush your teeth and save 4 gallons a minute. That's 200 gallons each week for a family of four.
#55. Buy a rain gauge to track how much rain or irrigation your yard receives.
#56. Encourage your school system and local government to help develop and promote a water conservation ethic among children and adults.
#57. Teach your family how to shut off your automatic watering systems so anyone who is home can turn sprinklers off when a storm is approaching.
#58. Set a kitchen timer when watering your lawn by sprinkler or hose.
#59. Make sure your toilet flapper doesn't stick open after flushing.
#60. Make sure there are aerators on all of your faucets.
#61. Next time you add or replace a flower or shrub, choose a low water use plant and save up to 550 gallons each year.
#62. Install an instant water heater on your kitchen sink so you don't have to let the water run while it heats up. This will also reduce heating costs for your household.
#63. Use a grease pencil to mark the water level of your pool at the skimmer. Check the mark 24 hours later. Your pool should lose no more than 1/4 inch each day.
#64. Spot spray or remove weeds as they appear.
#65. Use a screwdriver as a soil probe to test soil moisture.
#66. Install a drip irrigation system around your trees and shrubs to water more efficiently.
#67. Mow your lawn as infrequently as possible. Mowing puts your lawn under additional stress, causing it to require more water.
#68. Don't use the sprinklers just to cool off or for play. Running through water from a hose or sprinkler wastes gallons of water.
#69. Make sure your swimming pools, fountains, and ponds are equipped with recirculating pumps.
#70. Bathe your young children together.
#71. Direct downspouts or gutters toward shrubs or trees.
#72. Winterize outdoor spigots to avoid pipes from bursting or freezing.
#73. Insulate hot water pipes so you don't have to run as much water to get hot water to the faucet.
#74. Drop that tissue in the trash instead of flushing it and save gallons every time.
#75. Wash your car on the grass. This will water the lawn at the same time.
#76. If you have an evaporative air conditioner, direct the water drain to a flower bed, tree, or your lawn.
#77. Make suggestions to your employer to save water (and dollars) at work.
#78. Use a hose nozzle and turn off the water while you wash your car to save more than 100 gallons.
#79. Support projects that use reclaimed waste water for irrigation and other uses.
#80. Encourage your friends and neighbors to be part of a water-conscious community.
#81. Install a toilet dam or bottle filled with water in your toilet tank to cut down on the amount of water used for each flush. Be sure these devices do not interfere with operating parts.
#82. Install water softening systems only when necessary. Save water and salt by running the minimum number of regenerations necessary to maintain water softness.

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100 Water Saving Tips *- continued from page 15*

#83. Turn your water softeners off while you're on vacation.
#84. Prune back heavy foliage. Reducing leaf area reduces water needs.
#85. Report all significant water losses (broken pipes, open hydrants, errant sprinklers, abandoned free-flowing wells, etc.) to the property owner, local authorities, or your water management district.
#86. If your grass is brown, it's not dead, it's just dormant. Dormant grass only needs to be watered every three weeks. When the rain begins, your grass will turn green again.
#87. Start a compost pile. Using compost when you plant adds water-holding organic matter to the soil.
#88. Listen for dripping faucets and toilets that flush themselves. Fixing a leak can save 500 gallons each month.
#89. Use sprinklers that throw big drops of water close to the ground. Smaller drops of water and mist often evaporate before they hit the ground.
#90. More plants die from over-watering than from under-watering. Be sure only to water plants when necessary.
#91. Adjust your watering schedule to the season. Water your summer lawn every third day and your winter lawn every fifth day.
#92. Cook food in as little water as possible. This will also retain more of the nutrients.
#93. If it takes you more than a few minutes to shampoo and condition your hair, turn off the faucet while you work each in, then back on to rinse.
#94. Bathe your pets outdoors in an area in need of water.
#95. Choose new water-saving appliances, like washing machines that save up to 20 gallons per load.
#96. Water only as rapidly as the soil can absorb the water.
#97. Aerate your lawn. Punch holes in your lawn about six inches apart so water will reach the roots rather than run off the surface.
#98. Select the proper size pans for cooking. Large pans require more cooking water than may be necessary.
#99. Share wateruseitwisely.com with everyone you know.
#100. There are a number of ways to save water, and they all start...and end...with you. Water. Use it wisely. ■

Montana Surface Water Treatment Plants Area Wide Optimization Plan (AWOP)

By Rick Cottingham, Water Quality Specialist

The purpose of this article is to inform Montana surface water systems using direct or conventional filtration about an initiative that began in Montana in 2005 to optimize coagulation, flocculation, sedimentation and filtration through a new assistance program called **Area Wide Optimization Plan (AWOP).**

Montana DEQ (MT/DEQ) has been training and emphasizing water treatment optimization since the mid-1990's. The Public Water Supply Section has been doing Comprehensive Performance Evaluations (CPE's) to enable systems to meet optimal treatment goals since the mid-1980's. Many of Montana's public water systems currently optimize their treatment plants because of these training and technical assistance efforts.

The primary goal of AWOP, as is the CPE, is to reduce the finished turbidity of water systems in order to maximize public health protection without major capital expenditures. This goal is accomplished by working with the water treatment system to optimize or fine-tune the treatment barriers of coagulation, flocculation, sedimentation (if conventional treatment) and the filtration processes.

Optimization Performance Criteria

Optimizing water treatment performance for protection from organic contaminants is met by monitoring the barriers listed above with specific monitoring parameters. The treatment goals we intend to target are listed below. It's important to know that meeting these goals in your plant will mean exceeding current regulatory standards. We believe that meeting these criteria will greatly reduce the risk of waterborne disease outbreaks in your system. Water treatment facilities meeting these goals can be considered optimized.

I. Minimum Data Monitoring and Recording Requirements:

- Daily raw water turbidity taken every four hours (or more frequently) that the system serves water to the public.
- Settled water turbidity at 4-hour time increments from each sedimentation basin.
- On-line (continuous) turbidity from each filter.
- One filter backwash profile each month from each filter.
- HPC* top and bottom of each filter (for initial evaluation, then monthly).

Additional Data Monitoring:

- Total Organic Carbon for raw and finished water.
- Trihalomethanes (a complete set for initial evaluation).
- Bacteriological samples from raw, top and bottom of filters, plus representative of the distribution system to be analyzed for total coliform, fecal coliform, fecal strep, and HPC (for initial evaluation).

II. Sedimentation Performance Criteria:

- Settled water turbidity less than 1 NTU, 95 percent of the time, when annual average raw water turbidity is less than or equal to 10 NTU.
- Settled water turbidity less than 2 NTU, 95 percent of the time, when annual average raw water turbidity is greater than 10 NTU.
- In either case never over 5.0 NTU

III. Filtration Performance Criteria:

- Filtered effluent water turbidity less than 0.1 NTU 95 percent of the time (excluding 15 minute period following backwashes or startup of filter) based on the maximum values recorded during 4-hour time increments.
- Maximum Confined Filter Effluent (CFE) water measurement of 0.3 NTU.

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Montana Surface Water Treatment Plants Area Wide Optimization Plan (AWOP) *- continued from page 17*

- Maximum filtered water (CFE) turbidity immediately following backwash of less than 0.3 NTU.
- Maximum backwash recovery period of 15 minutes (e.g., return to less than 0.1 NTU within 15 minutes).
- Maximum filtered water measurement of less than 10 particles (in the 3 to 18 um range) per milliliter (if particle counters are available).
- HPC* counts should go down from top to bottom of filter. Target HPC level at bottom of filter to be 0 colonies/ml.

IV. Disinfection Performance Criteria:

- Ct values to achieve required log inactivation of *Giardia* and virus.
- Assure the most advantageous use of chlorine by substitution of Potassium Permanganate or chlorine dioxide at the intake, or rapid mix for oxidation of Fe, Mn, precursors, etc. Use of P.A.C. (Powdered Activated Carbon) for precursor removal may also be considered.

V. Distribution System Performance Criteria:

- Maintain a complete, thorough, systematically performed flushing program accomplished at least twice yearly. Make use of D.P.D. chlorine test kit during flushing to assure same water quality from plant to first blowoff, and then beyond to each hydrant. Storage tanks shall be cleaned as necessary.
- Maintain water quality throughout distribution system so as to exert the least chlorine demand possible.
- Target a twenty-four hour turnover in storage tanks.
- Assure that purchasing systems are not over chlorinating through booster stations (if THMs is a concern).
- Target HPC levels to be 0.
- Total coliform levels should be 0.
- Fecal coliform levels should be 0.
- Fecal strep levels should be 0.

* If you are not currently sampling for HPC, we recommend that you use the R2A (spread plate) method and incubate for 5 days.

Individual performance criteria may include other parameters. Collection and review of the data listed above will allow determination to what degree these criteria are being met. However, in some situations individual performance criteria may include other parameters.

If your surface water system is not achieving the performance criteria listed above, some things you could do now are:

- Improve baffling of your sedimentation basins.
- Evaluate current chemical performance by running jar tests to achieve optimum coagulation.
- Evaluate filter performance after backwash.
- Improve chemical mixing at the rapid mix.

If you would like more information concerning AWOP, please contact Rick Cottingham at 406-444-4019 or John Camden at 406-444-4071. ■

Facts About Cyanobacteria (Blue-green Algae) and Cyanobacterial Harmful Algal Blooms (CyanoHABs)

What cyanobacteria are:

1. Cyanobacteria (blue-green algae) are a form of bacteria that grow in water and are photosynthetic.
2. Cyanobacteria can be found in terrestrial, fresh, brackish, or marine water environments. They are usually too small to see, but sometimes can form visible colonies.
3. Cyanobacteria have been found among the oldest fossils on earth and are one of the largest groups of bacteria.
4. Cyanobacteria have been linked to cases of human and animal illnesses around the world, including North and South America, Africa, Australia, Europe, Scandinavia, and China.

What cyanobacterial blooms are and how they form:

1. Cyanobacterial blooms occur when algae that are normally present experience exuberant growth. Within a few days, clear water can become cloudy with a bloom.
2. Cyanobacterial blooms usually float to the surface and can be many inches thick, especially near the shoreline.
3. Cyanobacterial blooms can form in warm, slow-moving waters that are nutrient rich. Sources of nutrients can include fertilizer run-off or septic tank overflows.
4. Cyanobacterial blooms can occur at any time, but most often occur in late summer or early fall.
5. Cyanobacterial blooms occur in marine, estuarine, and fresh waters, but the blooms of greatest concern are the ones that occur in fresh water, such as drinking water reservoirs or recreational waters.

How a cyanobacterial bloom looks:

1. Cyanobacterial blooms can look like foam, scum, or mats on the surface of fresh water lakes and ponds.
2. The blooms can be bluish, bright green, brown, or reddish and may look like green, yellow, or blue paint floating on the water.
3. As a cyanobacterial bloom grows and the algae begin to die, the water may smell bad.
4. Some cyanobacterial blooms may not affect the appearance of the water at all.

What a cyanobacterial harmful algal bloom (CyanoHAB) is:

A cyanobacterial harmful algal bloom (CyanoHAB) occurs when an algae bloom threatens people, animals, or the environment. The dangers of CyanoHABs:

> Dense CyanoHABs can block sunlight and use up all the oxygen in the water, killing other plants and animals. Some of the cyanobacteria that can form CyanoHABs produce toxins that are among the most powerful natural poisons known. CyanoHABs can make people, their pets, and other animals sick. In fact, often the first sign that a HAB exists is a sick dog that went swimming in an algae-filled pond. Children are more at-risk than adults because they weigh less and can get a relatively larger dose of toxin.

There are no antidotes for these toxins.

Other effects of freshwater CyanoHABs:

1. They can make drinking water smell and taste bad.
2. They can make recreational areas unpleasant.
3. Species of cyanobacteria that form CyanoHABs in fresh water:

   - Microcystis aeruginosa
   - Anabena circinalis
   - Anabena flos-aquae
   - Aphanizomenon flos-aquae
   - Cylindrospermopsis raciborskii

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Facts About Cyanobacteria (Blue-green Algae) and Cyanobacterial Harmful Algal Blooms (CyanoHABs)

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What cyanotoxins are:

1. The cyanotoxins belong to diverse groups of chemical substances with specific toxic mechanisms (*see a list of toxins and some of their effects below*).

Neurotoxins are which affect the nervous system:

Anatoxin-a
Anatoxin-a(s)
Saxitoxin
Neosaxitoxin
Hepatoxins are toxins which affect the liver.
Microcystins
Nodularins
Cylindrospermopsin Tumor promoters are chemicals that can enhance tumor growth:
Microcystins
Lipopolysaccharides are chemicals that can affect the gastrointestinal system:
Gastroenteritis

How you could be exposed to CyanoHABs and cyanotoxins

You could be exposed by:

- Drinking water that comes from a lake or reservoir with a CyanoHAB;
- Drinking untreated water;
- Doing recreational activities in waters with CyanoHABs;
- Inhaling aerosols from water-related activities such as jet-skiing or boating;
- Inhaling aerosols when watering lawns, irrigating golf-courses, etc. with pond water;
- Using cyanobacteria-based dietary supplements (if they are contaminated with microcystins);
- Having dialysis (this has only been documented in Brazil).

How to get more information about cyanobacteria:

Federal Centers for Disease Control and Prevention (CDC) Harmful Algal Blooms (HABs)
www.cdc.gov/habs (tentative address)
This site defines HABs, describes CDC's HABs-related activities, and provides links to data, publications, and other HABs resources.

Cyanobacteria
www.cdc/gov/cyanobacteria (tentative address)
This site defines cyanobacteria, describes CDC's cyanobacteria-related activities, and provides links to data, publications, and other cyanobacteria resources.
Environmental Protection Agency (EPA)

Drinking Water Contaminant Candidate List
www.epa.gov/safewater/ccl/cclfs.html
This site provides information about EPA's list of contaminants that are not regulated, occur in public water systems, and may require regulation under the Safe Drinking Water Act. Algae that can be harmful are on this list.

International
State of Queensland Australia
HAB site **www.nrm.qld.gov.au/water/blue_green/index.html**
This site describes the state's plans and procedures for multi-agency response to HABs
.
World Health Organization
www.who.int/health_topics/en/
This site provides links to drinking and recreational water quality, including the impacts from cyanobacteria and cyanobacterial toxins.

States
North Carolina Department of Health and Human Services
Occupational and Environmental Epidemiology program, HABs Site **www.epi.state.nc.us/epi/hab/**
This site gives an overview of North Carolina's HAB program, and provides links to the state's HAB-related surveillance, research, and education activities. ■

Treatment Techniques for Wildfire Affected Drinking Water Supplies

Submitted By Rick Cottingham

INTRODUCTION

Montana has had it's share of drought, wildfires and flash flooding, all in recent years. By networking with other plants and utilizing technical assistance from DEQ most Montana plants have persevered through these disasters with amazing results. Please use the following information as a guideline for what barriers of treatment to focus on when experiencing raw water treatment difficulties.

The past wild fires in Montana have seriously affected raw water sources for many utilities throughout the state. These systems are at risk of facing raw water quality that is uniquely difficult to treat and that has the potential to seriously degrade the effectiveness of all of their unit treatment processes. Degradation of any unit treatment process may result in consumer health and system compliance risks. In addition, reduced flows in some stream sources and abnormally low reservoir levels are causing raw water quality to deteriorate. Low stream flows are resulting in large temperature, pH and alkalinity fluctuations and variations in the concentrations of organic and inorganic contaminates. Many communities are in need of optimizing procedures for ensuring effective use of each unit process employed by the treatment facility.

Both large and small utilities are or will be affected by these changes in raw water quality, but those systems most at risk for regulatory compliance and public health issues are generally the small systems. Resources in small systems are more limited than in larger systems and often operator experience in dealing with drastic changes in raw water quality is minimal. Operational responses to raw water changes in well-run plants are typically based on historical operational experience with changes in water quality, confirmed by jar test results. Due to the nature of the water quality changes associated with the fire and drought conditions, there is no historical perspective for most plant operators to work from. Application of jar test results to the full-scale treatment plant requires translation of the test results to the treatment process and chemical feed systems, and on-going checking and monitoring of water quality to ensure that the process continues to be effective. Basic checks on all the plant processes are essential when the plant is stressed by changes in influent water quality, particularly when the changes occur quickly due to rainfall events following fire or drought conditions in the watershed.

The focus of treating such unique water must specifically address concepts and practical operational methods associated with each unit process of conventional water treatment facilities. Operators must closely watch raw water quality monitoring requirements, respond to rapid changes in influent water quality including disinfectant demand, process control testing throughout the processes, coagulation chemistry including jar- testing procedures, and filter assessments.

Areas to focus on might include:

- Raw water quality testing procedures, including manganese and the traditional measures, and instrument calibration and verification in an environment that may include post-oxidation precipitates; Instrumentation may need calibration more frequently than the state rules mandate (monthly on in-line and quarterly on benchtop turbidimeters);

- Basics of jar testing, including the mechanics of doing the jar test, what to measure, how to decide what type and how much chemical to use, what to look for in the jars during the test, what information should be recorded, and why jar tests are important and useful;

- Demonstration of jar test adjustments to accurately mimic plant mixing and holding conditions such as adjusting paddle speed to duplicate processes mixing conditions and adjusting mixing time to match plant conditions at expected treatment flow rates;

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Treatment Techniques for Wildfire Affected Drinking Water Supplies *- continued from page 21*

- Translation of jar tests results to the treatment process and chemical feed system, including verification methods for ensuring that the chemical feed is continuous and appropriate;
- Alternatives to jar testing procedures in a rapidly changing raw water environment;
- Basics of filter operation/maintenance to ensure that the filters are performing well;
- Basics of providing multiple barriers to assure adequate protection from pathogens are maintained at all times;
- Discussion with administrators of options regarding likely need for additional chemical supplies and increased feed rates to meet demands for disinfectant, pH control and/or alternatively, the need to reduce plant water production rates;
- Tracking plant performance through graphs of raw and finished water turbidity, pH, color, etc;
- Specific impacts to raw water quality and treatment from fire runoff, including monitoring suggestions and options for meeting treatment challenges;
- Specific impacts to raw water quality and treatment from drought, including monitoring suggestions and options for meeting treatment challenges; and,
- Basic information on water quality aesthetics and public notification/communication needs.

Senior plant personnel should hold refresher training in plant, to include hands-on jar testing experience and interpretation. This should emphasize how to apply jar test results in the plant and why regular monitoring of chemical feed and turbidity is important and useful in routinely producing high quality drinking water, specifically when raw water quality is changing.

By optimizing each unit process and continuous monitoring of water quality parameters throughout the plant you can successfully provide a product of safe drinking water to your customers.

For further information, please call the Field Services Section of the Community Services Bureau of DEQ at 406-444-4400. ■

Sandia Begins Arsenic Removal Demonstration Project In New Mexico

A pilot plant to evaluate commercially available technologies for removing arsenic from municipal drinking water supplies will begin operating this month in Anthony, N.M.

The project, announced on July 28, is based on a memorandum of understanding between Sandia National Laboratories and Desert Sands Mutual Domestic Water Consumers Association (MDWCA). Commercial vendors have supplied Sandia with a variety of arsenic-removal products for evaluation at the pilot plant.

The project is in response to the National Primary Drinking Water Regulation for Arsenic issued by EPA. This regulation states that the public health standard for arsenic in drinking water is 10 parts per billion (ppb), or 0.010 milligrams per liter (mg/L). Public water systems must comply with the 10 ppb standard beginning January 23, 2006. The current maximum contaminant level for arsenic in drinking water is 50 ppb.

"The strict arsenic standards that take effect in 2006 are placing a tremendous burden on rural communities that simply can't afford to meet the standard," Sen. Pete Domenici (R-NM), said. "We are investing in scientific expertise at Sandia to try to develop technologies that will allow the standards to be met in the most cost-effective manner."

The Arsenic Water Technology Partnership supports the project with congressional funding through the U.S. Department of Energy's (DOE) Energy and Water Development Appropriations Bill. Domenici has secured the funding for this initiative since 2003 as chairman of the Senate Energy and Water Appropriations Subcommittee.

The partnership includes Sandia, the American Water Works Association Research Foundation (AwwaRF) (an international, nonprofit organization that sponsors research to enable water utilities to provide safe and affordable drinking water) and WERC: A Consortium for Environmental Education and Technology Development.

The lab's work is done as part of the Sandia Water Initiative. The initiative's primary objectives are to increase the safety, security and sustainability of the water supply infrastructure through the development of advanced technologies that create new water supplies, decrease demand through water-use efficiency, and provide decision-informing tools to the institutions responsible for balancing supply and demand.

Development of new arsenic removal technologies is the responsibility of AwwaRF. Sandia's role is to pilot promising new technologies from the commercial or academic sectors. WERC will evaluate the economic feasibility of new technologies and transfer information to the water utilities.

The Arsenic Water Technology Partnership seeks to enable water utilities, particularly those serving small rural communities and Indian tribes, to implement the most cost-effective solutions to their arsenic treatment needs. More information about the partnership is available at **www.sandia.gov/water/arsenic.htm**.

Because New Mexico has a particularly high number of communities affected by the new arsenic standard, the initial arsenic removal pilot plant projects are located in the state (another pilot plant is operating at Socorro). Other pilot plants will go on line later in the state and other regions of the country.

"There are several competing arsenic removal technologies on the market," said Paul McConnell, a Sandia staff member. "The pilot plant project provides for an unbiased comparison of the effectiveness of the commercial options for arsenic removal. These results should be very useful to municipal water systems decision makers."

The Anthony pilot will focus on the use of adsorbents, natural or man-made materials that have been designed for the purpose of removing arsenic and other contaminants. The arsenic-removal materials are packed into columns through which untreated water flows. The arsenic is adsorbed by the material and the water comes out nearly arsenic free. Systems can be large enough to treat enough drinking water for large communities or can be small enough to sit under a kitchen sink. ■

Developing a Source Water Protection Plan

Between now and June 2006, each public water system in Montana will receive a Source Water Delineation and Assessment Report (SWDAR) completed or reviewed by the Department of Environmental Quality (DEQ). The assessment provides information on the land area that provides your drinking water (the "source water protection area"), potential contaminant hazards within the protection area, and an evaluation of the susceptibility of your water source to contamination (susceptibility analysis). The source water assessment results are the foundation that the public water system and local community can use to develop and implement a source water protection plan.

Why develop a Drinking Water Protection Plan?

The requirements for water quality monitoring of public water systems in Montana provide some degree of assurance of safe drinking water; however, all systems have some vulnerability to potential contaminants. One of the best ways to ensure the continued delivery of high quality water is to develop a local plan designed to protect against potential contamination. Not only will this measure add a margin of safety, it will raise awareness in the local community of the risks of drinking water contamination and provide information to them about how they can help protect their source of water. The benefits of source water protection planning also include ensuring local management of the resource, facilitating state and federal resource prioritization, potential for reduced monitoring costs (monitoring waiver), and possibly obtaining future priority funding for protection activities in your area.

How do we start?

The first step towards developing a source water protection plan is to form a local team that will represent the interests of the community. The source water protection team should strive to include a balanced representation of various interests that may include the commercial, industrial, agricultural/forestry, regulatory, environmental, municipal, residential (urban and rural) sectors as well as city/town officials or the water system provider. The team will assist in determining how the source area might be protected from potential contamination. One of the first steps for the source water protection planning team is to review the source water assessment report. Members should gain an understanding of the local water system, groundwater basics, the methods used to complete the SWDAR and local issues related to the need to develop a plan. The team will need to review the SWDAR inventory to clarify the presence, location, operational practices, actual risks, etc. of the identified facilities and land use activities. The team can refine the delineation of the sensitive areas and the identification of the potential contamination sources through further research, local input, and coordination with public agencies for publicly owned lands. Additional potential contaminant sources or sensitive areas may also be added based on local knowledge or additional research.

Develop Management Practices for Risk Reduction

Identifying management strategies to protect the drinking water supply is the heart of developing the source water protection plan. The primary goal is to reduce or minimize the risks of drinking water contamination from the potential sources of contamination. It is highly improbable that you can eliminate all risks in any area, but by applying one or more management tools, you will be able to reduce the likelihood of potential contamination impacting your water supply in the future. The goal should be to reduce susceptibility of your sources to significant potential contaminant sources to moderate or low.

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Developing a Source Water Protection Plan - *continued from page 24*

The source water protection team can start by identifying what is already being done (either on a regulatory or voluntary basis) to minimize the potential threats. Recognition of compliance with existing regulations and taking voluntary actions to protect the environment generally causes people to be more willing to explore additional voluntary and/or regulatory measures that can be taken. The team should then develop goals stating a broad vision about desired conditions that the team would like to accomplish.

The next step is to identify various potential management strategies that can be used or modified to fit the needs of the local community. Management options are offered in the SWDAR and Montana DEQ is available to assist the community in identifying and evaluating the various options that are available.

Develop a Contingency Plan

Contingency planning focuses on establishing a plan of action in case of emergency including the water purveyor response to the contamination or disruption of the water supply to a public water system. Generally, these plans should focus on the recognition of potential threats to the supply, and the development of procedures to be followed should these threats materialize.

Plan for Future Public Water System Needs

Water systems may find it necessary, as a result of either existing or projected increased demand, to explore the development of additional sources for drinking water. Source water protection provides a mechanism that can be used to help select the best site and to identify areas that should be protected now in order that they will provide quality drinking water in the future when they are needed. Additionally, it should be realized that the development of a new groundwater source in the vicinity of existing sources may modify the movement of groundwater in the subsurface, perhaps changing the shape and orientation of existing source water protection areas. Evaluation of the significance of those changes should be addressed in the planning process to ensure that the management strategy that is in place will continue to protect the community's drinking water supply.

Encourage Public Participation

The protection planning process can also be a very effective way to encourage citizens to participate in an issue that directly affects everyone in that community. Property owners and residents within the protection area should be notified of the Protection Plan development, and should be encouraged to attend team meetings and participate and provide input as needed or requested by the team. This often leads to more public involvement in other significant local decisions concerning future livability issues (i.e., land use planning). The risks and sources of water quality problems are not only from industries, farmers, and managed forests, but every individual living, commuting and working in that area.

Need Help?

A template to guide you through the development of a Source Water Protection Plan can be found on our Internet site at **www.deq.mt.gov/wqinfo/swp/Circulars.asp**. The whole idea of involving others in the community can be daunting. In-depth technical assistance is available through DEQ and MRWS for communities that choose to move beyond the assessments to voluntarily develop a source water protection plan.

Contact Joe Meek at DEQ at (406) 444-4806 for more information. ■

CCRs and Source Water Assessments

By Jeffrey Frank Herrick, DEQ Source Water Protection Program

The 1996 Amendments to the Safe Drinking Water Act (SDWA) call for Consumer Confidence Reports (CCR) to be written annually for each community water system and provided to those served by that system. Community water system operators are familiar with these reports and the requirements to provide a summary of the water system and of the past year's analytical results. Over the past few years, DEQ and others have been diligently completing Source Water Assessment Reports for all of the water systems in the state. These assessments describe your source water and water system; list significant potential contaminant sources around your source water; and they evaluate the susceptibility of your source water to those potential contaminant sources. The public, system owners, system operators, and consultants have all indicated that these assessments are useful, practical, and valuable resources. The SDWA says that these source water assessments are to be made available to the public served by each water system. It is simple enough to provide a sentence or two in the annual CCR indicating that a source water assessment was completed for your water system and it is available for viewing at the water system office. But the SDWA also says that the CCR should summarize not only the sampling history of the water system, but also provide a brief summary of the significant Potential Contaminant Sources (PCS) that were identified in the assessment of your system.

This required listing of PCSs in the system's annual CCR could make the operator feel vulnerable to a flood of concerned citizens crowding into their office. However, this listing is really an opportunity to say what a good job the system managers and operators are doing to provide excellent water and water service to the public.

I've been writing the above mentioned source water assessments for about four years now. From what I've seen, most of the community water systems I've written about are doing an extraordinary job. You have much to be proud of and to crow about. Since my colleagues (and I) in the Source Water Protection Program routinely write water system summaries, source water assessments, describe PCSs, and summarize the susceptibility of water sources to these PCSs, we can (and are more than willing to) help you to compose these portions of your CCRs.

To take advantage of our offer, please call us at (406) 444-6697 and make the request. ■

Source Water Protection: What's In It For You?

Compiled by Steve Ainsworth and Paul Jehn

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Most people would agree that a vaccination to prevent illness is well worth the time, expense, and inconvenience. Similarly, local governments are trying source water protection to help avoid coping with contaminated drinking water. The potential benefits of source water protection to communities, as well as to locally financed water districts, are worth the cost because in some cases, these are the local entities responsible for dealing with polluted source water.

Where possible, examples have been drawn from the actual experiences of specific communities. They offer concrete support for the common sense principle that the less polluted the water is when it reaches the treatment plant, the less extensive—and expensive—will be the efforts needed to safeguard public health.

What is Source Water Protection?

Simply put, source water protection means preventing the pollution of the lakes, rivers, streams, and ground water that serve as sources of our drinking water. Wellhead protection is an example of an approach to source water protection that is designed to prevent contamination of ground water sources. Management of land around a reservoir used for drinking water is an example of source water protection for a surface water supply.

In 1996, Congress amended the Safe Drinking Water Act (SDWA) to require states to complete source water assessments for their public water systems. An assessment has four components:

- Delineating source water protection areas;
- Identifying sources of contamination that may affect the delineated areas;
- Determining the susceptibility of public water systems to these sources;
- Providing the results of the assessments to the public.

Congress intended that localities would use the assessment results as the basis for source water protection programs through the implementation of prevention measures to manage the potential contamination sources identified in the assessments and through planning for emergencies and other contingencies.

Benefits of Source Water Protection

Perhaps, the benefits of protecting source water can be illustrated most easily if they are compared with the costs of failing to protect this source water. Costs can be divided into those that are relatively easy to capture in economic terms and those that are not. Easily quantifiable costs of source water contamination include the costs of treatment, remediation, finding and establishing new supplies or providing bottled water, paying for consulting services and staff time, litigating against responsible parties, and conducting public information campaigns when incidents arouse public and media interest in source water pollution.

Costs also include those necessary to meet the regulations of the SDWA, such as the Disinfection By-product and Enhanced Surface Water Treatment Rules and monitoring requirements. Additionally, although it is seldom done, communities often find it relatively easy to estimate the value of a drinking water supply that has been abandoned due to contamination. Such costs can be high when the quantity of water rendered undrinkable is large or when the supply of potential drinking water is small. For instance, Wichita, Kansas, lost 2 billion gallons of previously drinkable water for the foreseeable future because of contamination by industrial solvents. The state decided not to clean this water up to the drinking water standards.

Table 1 shows a sampling of localities of various sizes that have borne high and readily quantifiable costs due to source water pollution. The table attempts to isolate community costs by excluding state, federal, and private industry funding. Also, not included are such costs to individuals as lost wages, hospital and doctor bills, reduced property values, higher water bills, and in extreme cases, death.

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Source Water Protection: What's In It For You? *- continued from page 27*

Communities with effective source-water protection programs also may well enjoy substantial savings in the costs of complying with SDWA regulations. Implementation of source water protection programs, for instance, likely will save water purveyors significantly in avoided cost compliance with the Disinfection By-products Rule. This is due to the fact that cleaner source water requires less disinfection, which means reduced requirements for removing disinfection by-products. Water suppliers with source water protection programs in-place also may be eligible for waivers from monitoring requirements that reduce their monitoring costs. Such waivers already have saved Massachusetts water systems $22 million over a 3-year compliance cycle, while Texas water systems have saved $49 million over 2.5 years.

Under the Surface Water Treatment Rule's filtration waiver program, huge savings are potentially available to surface water systems with good source water quality and a working program for source water protection. For example, 15 systems in Maine have saved $108 million in capital costs by avoiding filtration.

Another benefit of source water protection that can be expressed in economic terms (although few attempts have been made to do so) is that it helps to maintain real estate values in areas served by protected water supplies. Also, source water protection avoids the loss of potential tax revenues and jobs because businesses refuse to locate or remain near places with known or suspected problems.

A survey of 21 Minnesota cities by the Freshwater Foundation found that five cities collectively lost more than $8 million in tax revenues because of real estate devaluation as a result of ground water pollution. In commenting that businesses prefer communities with protected water supplies, Charles Renner, executive director of the Pekin (Illinois) Area Chamber of Commerce, asks, ''Who wants to move a business or industry to a town where they can look to pay tax toward a multimillion dollar bond issue to clean up the ground water?'' Sam Rowse, president of Very Fine Products, a major fruit juice manufacturer in Westford, Massachusetts, adds, ''The integrity of a town's water reflects upon the integrity of the companies within that town.''

Benefits That are Harder to Quantify

In addition to the readily quantifiable benefits of source water protection, there are numerous benefits to which it is more difficult to assign a dollar value. These include benefits that may not be wholly translatable into economic terms. Although hard to measure in monetary terms, such benefits may be among the driving forces behind source water protection.

These benefits include the reductions in risks to human health because of cleaner source water. The risks are real enough; experts from the Center for Disease Control and Prevention estimate that water borne diseases transmitted through drinking water infect 940,000 people and are responsible for 900 deaths in the United States each year. Such pollutants as metals, volatile organic carbons (VOCs), synthetic organic chemicals (SOCs), and pesticides also can cause serious health problems, including cancer, birth defects, and organ, nervous system, and blood damage. To quantify reductions in health risks due to source water protection efforts is difficult, however, and any attempt to place a dollar value on serious illnesses and deaths is highly controversial.

Other benefits of source water protection that are not wholly captured by economic measurements include safeguarding a resource for the benefit of future generations (i.e., stewardship), building and keeping consumer confidence in water purveyors or local officials, and helping to support healthy ecosystems, recreation, and other beneficial uses.

Ripple Effects of Source Water Protection

Source water protection can have important secondary benefits. Protection of reservoirs and other surface water sources of drinking water is obviously beneficial to fish, wildlife, and recreation. Where aquifers discharge to surface waters, protecting ground water supplies can help maintain the beneficial uses of the surface water. Areas of ground water/surface water interaction are widespread, and recorded incidences of ground waters discharging contaminants, particularly nitrates, into surface waters are numerous.

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Source Water Protection: What's in It for You? *- continued from page 28*

Table 1

Selected Community Water Systems Incurring Costs of Source Water Contamination
(Costs measured as U.S.1995$)

Community	Type of Problem	Response to Problem	Costs
Perryton, Texas	Carbon tetrachloride	Remediation in ground water	$250,000 (estimated)
Rockford, Illinois	Solvents in ground water	Replace supply, hook private wells to public water supply	$11.5 million (estimated)
Camden-Rockland, Maine	Excess phosphorus in Lake Chickawaukie	Advanced treatment (not yet installed)	$6 million (estimated)
Moses Lake, Washington	Trichloroethylene in ground water	Blend water, public education	$1.8 million (estimated)
Mililani, Hawaii	Pesticides, solvents in ground water	Build and run treatment plant	$2.5 million plus $154,000/year
Tallahassee, Florida	Tetrachloroethylene in ground water	Enhanced treatment	$2.5 million plus $110,000/year
Pittsfield, Maine	Landfill leachate in ground water	Replace supply, remediation	$1.5 million
Rouseville, Pennsylvania	Petroleum, chlorides in ground water	Replace supply	$300,000/ (estimated)
Atlanta, Maine	VOCs in ground water	Replace supply	$500,000 to $600,000
Montgomery County, Maryland	Solvent, Freon in ground water	Install county water lines, provide free water	$3 million plus $45,000/year for 50 years
Milwaukee, Wisconsin	Cryptosporidium in river water	Upgrade water system, immediate water utility, city health department costs	$89 million to upgrade system, millions in immediate costs
Hereford, Texas	Fuel oil in ground water	Replace supply	$180,000
Coeur d'Alene, Idaho	Trichloroethylene in ground water	Replace supply	$500,000
Orange County Water District, California	Nitrates, salts, selenium, VOCs in ground water	Remediation, enhanced treatment, replace supply	$54 million (capital costs only)

Jerri Pogue, former city clerk/ treasurer of Everson, Washington, expresses her community's appreciation of this connection as it considers protecting its source water, ''Since the aquifer that supplies our drinking water is connected to the Nooksack River, source water protection would provide the extra benefit of helping support our community's rights to current and future uses of the river.''

Such benefits make source water protection programs potentially key components of three-dimensional approaches to watershed management.

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Source Water Protection: What's in It for You? *- continued from page 29*

Conclusion

The potential benefits of source water protection to communities are impressive. The benefits that can be captured in economic terms can be compared with estimates of the costs of source water protection in a cost/ benefit analysis. Typical costs include those of program administration, staffing, opportunity losses and tax revenue losses from restrictions on development, revenue losses from excluding businesses from protected areas, and the expenses of structural management measures. Costs may vary greatly from community to community and place to place and also will depend on such factors as the value of real estate in a particular neighborhood or district and the measures that the community selects to protect its source water. For example, estimates of the costs of a local wellhead protection program in Maine range from $8500 to $336,500. The wide range in costs is due primarily to different estimates in the amount and value of land to be purchased and placed under conservation easements. Omitting the costs of easements, which communities may opt to forgo as a protection measure, estimated costs would range from $6000 to $86,500. ■

Cleaning Up Around The Wellhead

One of the easiest ways to implement basic wellhead protection is to look at the area immediately around the wellhead and eliminate or control potential sources of contamination.

The area within 100 feet of your wellhead is called the control zone or well exclusion zone. As the name implies, certain activities should be controlled or totally excluded from this area to protect against contamination. Source water protection at the wellhead can come from a couple of types of action taken by the water system or operator.

Activities to be excluded from the control zone include the storage, mixing, or use of chemicals. For example, certain common chemicals are sometimes found in pumphouses within control zones such as herbicides, insecticides, gasoline, and motor oil; items often associated with yard maintenance or equipment. While it may seem like the pump house is a convenient storage location for these types of materials, a small release of any of these products near the well can cause contamination of the underlying aquifer. And when you remember that the control zone includes utility trenches with water lines and a power supply running to or from the well, and that these trenches may be the "path of least resistance" for spills to follow, you begin to get the idea that your water supply truly is most vulnerable near the wellhead.

The second form of source water protection that occurs at the wellhead is called "continued protection." This form of protection is provided when the water system owns the control zone or is able to limit certain activities within the control zone through the use of an easement. Control zone easements aren't necessarily prohibitive of all land uses, they simply need to protect against land uses that could cause contamination in close proximity to the wellhead. An example of control zone easement language can be requested from the Source Water Protection Section at DEQ by calling (406) 444-6697. ■

Roundup® Kills Frogs As Well As Tadpoles, Biologist Finds

University of Pittsburgh (Pitt) assistant professor of biological sciences Rick Relyea said he has discovered that Roundup® is deadly to tadpoles at lower concentrations than previously tested; that the presence of soil does not mitigate the chemical's effects; and that the product kills frogs in addition to tadpoles.

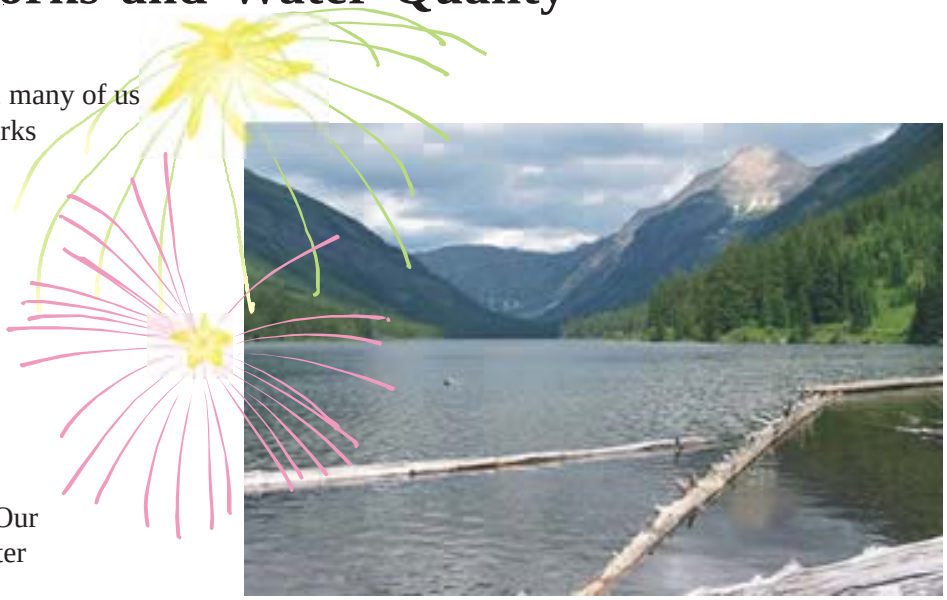
In two articles published in the Aug. 1 issue of the journal *Ecological Applications*, Relyea and two doctoral students found that even when applied at concentrations that are one-third of the maximum concentrations expected in nature, Roundup® still killed up to 71 percent of tadpoles raised in outdoor tanks.

Relyea also examined whether adding soil to the tanks would absorb the Roundup® and make it less deadly to tadpoles. The soil made no difference: After exposure to the maximum concentration expected in nature, nearly all of the tadpoles from three species died.

Although Roundup® is not approved for use in water, scientists have found that the herbicide can wind up in small wetlands where tadpoles live due to inadvertent spraying during the application of Roundup®.

Studying how Roundup® affected frogs after metamorphosis, Relyea found that the recommended application of Roundup® Weed and Grass Killer, a formulation marketed to homeowners and gardeners, killed up to 86 percent of terrestrial frogs after only one day. Relyea Lab Homepage: **http://www.pitt.edu/~relyea** ■

Fireworks and Water Quality



As we celebrated the Fourth of July, many of us remarked on the number of fireworks and how they have noticeably increased in the past few years. In addition, each one seems to carry a bigger load of ordinance. Turn on the television and major fireworks displays are deployed from barges on a body of water. Have you ever wondered if there is a potential impact to water and air quality? Wisconsin Lakes Partnerships have and they put together an informative answer in "Thrills & Chills: Fireworks on Our Lakes," Spring 2005, Lake Tides Newsletter **http://www.uwsp.edu/cnr/uwexlakes/laketides/vol30-2/Text-only.htm#10**.

Some researchers believe heavy metal fallout from exploding fireworks poses a threat to the environment and us. Currently toxicological studies on the effects of fireworks on the environment are limited and vary in results. The solid reaction products that give us the pretty colors and special effects include a nasty bunch of chemical additives. The unknown factor is the concentrations needed to cause a problem.

Fireworks are often propelled by charges of black powder (which contain carcinogenic sulfur-coal compounds). Ammonium perchlorate, which can cause problems with the human thyroid gland, is another ingredient used in fireworks and is not a good thing to find in our water. Ammonium perchlorate has been found in ground and surface water in California, Nevada, Utah, and West Virginia. White phosphorus is another toxic substance used in fireworks. Its residue can persist in aquatic environments and has caused die-offs of fish and waterfowl.

Fireworks contain a number of other toxic metals that are used to create a range of colors. Strontium produces blazing reds; copper compounds burn blue; magnesium, titanium and aluminum create brilliant white sparks. Sodium chloride generates orange-yellow fire; boric acid burns green; potassium and rubidium compounds produce purples and burning lithium glows red. Glittering greens are produced by radioactive barium. These ingredients drift on the winds and settle into our water and soils.

During the Stockholm Water Festival in 1996, air pollutant levels were measured before and after the fireworks display. Levels of airborne arsenic were found to be twice as much as normal, while levels of mercury, cadmium, lead, copper, zinc and chromium were as high as 500 times above normal. Concern about these effects on their waters and people caused organizers to switch to a more environmentally-friendly laser light show.

Another type of pollution commonly complained about on Wisconsin lakes is the fireworks packaging materials such as cardboard, wood or plastic tubes and structural parts that drift up on shore or settle on the lake bottom.

Like so many other activities that we enjoy, watching fireworks comes at a price. Some of those costs, such as the noise and cardboard waste, are immediate and visible. Others, such as the carcinogenic chemicals let loose to contribute to the pollution of our soil, water and air, are not visible and often not thought about. Celebrating this Independence Day can be more enjoyable for everyone if we are all respectful of our neighbors and wildlife, cautious in how we use fireworks and concerned with the potential impact they may have. ■

SCADA Compromised at WW System

WaterISAC Advisory: Supervisory Control And Data Acquisition (SCADA) System Compromised At California Wastewater Treatment Plant

A call-in to the FBI reported that an unknown intruder compromised the supervisory control and data acquisition (SCADA) System of a California irrigation district wastewater treatment plant on 13 and 14 April 2005. The intruder(s) took control of the SCADA system, which controls various systems within the wastewater plant, via the system's dial-up modem. An employee of the wastewater plant became aware of the compromise after viewing unusual activity on the system, including what looked like the use of pc anywhere remote capabilities. The intruder deleted all computer system logs including alarm history, disguising the full extent of the compromise.

Information regarding SCADA Systems can be found on the WaterISAC Portal:

- 21 Steps to Improve Cyber Security of SCADA Networks;
- System Control and Data Acquisition (SCADA);
- The Myths and Facts behind Cyber Security Risks for Industrial Control Systems;
- Harnessing SCADA Without Undermining Security;
- WaterISAC Bulletin - An Example of the Effects of SCADA System Hacking.

As more information becomes available, it will be posted on the WaterISAC Portal.

Amy MacKenzie, RS/REHS
Water Security Specialist ■

Energy Conservation

by Kenneth Phillips, DEQ

2005 Montana State Legislature Passes Performance Contracting Enabling legislation

Montana Department of Environmental Quality, with the support of local governments and school districts, sponsored a bill that would allow performance contracting in Montana. The bill specifically enables both school districts and local governments to acquire the services of an engineering service company to perform an audit of their building(s), water treatment or wastewater treatment plants to determine the level of energy consumption and look for opportunities for energy savings. Then the energy service company, through a performance contract uses the future energy savings to pay for the up-front costs of energy savings projects, eliminating the need to access capital budgets.

In other words, the energy service company identifies saving opportunities and helps establish a project scope that will benefit the facility owner. The energy service company then guarantees the savings over a number of years thus allowing the owner to finance the energy improvements based on the amount of money they save. Typical projects include, lighting, mechanical upgrades and controls. In water treatment this may include variable frequency drive pumps to replace pumps that are throttled through valving. The other benefit is that the energy service company handles all of the engineering and implementation of the improvements. This saves valuable staff time and streamlines the implementation process. A monitoring and verification process is the last stage in which the savings are measured on an annual basis to ensure the original savings projections were correct. If the energy efficiency does not fully materialize, the energy service company is required to make up the difference.

For more information, please contact the Energize Montana website at **www.energizemontana.gov** or visit the Energy Services Coalition website at **www.EnergyServicesCoalition.org**. ■

Pharmaceuticals and Household Health Care Products in Drinking Water

A recent study by the U.S. Geological Survey (USGS) shows that a broad range of chemicals found in residential, industrial, and agricultural wastewaters commonly occurs in mixtures at low concentrations in surface water downstream from areas of intense urbanization and animal production. The chemicals include human and veterinary drugs (including antibiotics), natural and synthetic hormones, detergent metabolites, plasticizers, insecticides, and fire retardants.

One or more of these chemicals were found in 80 percent of the streams sampled across the nation. Half of the streams contained 7 or more of these chemicals, and about one-third of the streams contained 10 or more of these chemicals. This study is the first national-scale examination of these organic wastewater contaminants; a more complete analysis of these and other emerging water-quality issues is ongoing.

Knowledge of the potential human and environmental health effects of these 95 chemicals is highly varied; drinking-water standards or other human or ecological health criteria have been established for only fourteen. Measured concentrations rarely exceeded any of the standards or criteria. Thirty-three are known or suspected to be hormonally active; 46 are pharmaceutically active. Little is known about the potential health effects to humans or aquatic organisms exposed to the low levels of most of these chemicals or the mixtures commonly found in this study.

This information is based on "Pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000: A national reconnaissance," an article published in the March 15, 2002 issue of Environmental Science & Technology, v. 36, no. 6, pages 1202-1211. Data are presented in a companion USGS report, "Water-quality data for pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000" (USGS Open-File Report 02-94). These and other reports, data, and maps can be accessed on the Internet at **http://toxics.usgs.gov**.

In Montana, a project is underway in the Helena Valley and Montana City areas to look at the appropriateness and effectiveness of using coliphage, E.Coli and enterococci as indicators of fecal contamination of ground water used by small public water supplies. The project is a collaborative effort between the Montana Bureau of Mines and Geology of Montana Tech of UM (MBMG), Montana Department of Environmental Quality (DEQ), the Lewis and Clark County Water Quality Protection District (LCWQPD) and the DEQ Environmental Laboratory and is funded through the Water Center at Montana State University. The project is also looking at the presence of certain pharmaceuticals in ground water in the Helena area. ■

Mobile Glass Pulverizer Update

By Brian Spangler

We officially launched the mobile glass pulverizer on May 18th and 19th. Andela, the manufacturer, traveled to Montana and trained Headwaters Cooperative Recycling personnel on the operation, preventive and scheduled maintenance of the unit at the Boulder landfill. It was an exciting two days.

It now appears that the pulverizer may not be available to rotate to other communities in Montana until late September or next spring due to the backlog and stockpiles of glass. It is estimated that 1600 tons of glass is stored at the Boulder landfill which was collected by Headwaters Cooperative Recycling. Based on the tonnage estimate, it will take three months to process. In addition, Bozeman has 400 tons of glass.

The pulverizer is a 3-5 ton per unit which means it can produce approximately 24-50 tons per an eight hour day, however, I believe 30 tons per day is a good estimate based on moving the processed glass cullet and other operational procedures during the daily operation. The pulverizer can operate in winter conditions but it may not be wise due to road conditions, outside working conditions for the operators, etc.

Finally, the pulverizer will be making several special appearances in the next few months.

It appeared at a media day in Helena and at the Sustainability Fair in Livingston in July. In addition, the Helena Community Garden Center was dedicated on Earth Day and they used glass cullet for the pathways. The glass cullet was well received and numerous inquiries from attendees whether the glass cullet was expensive. It appears the glass cullet for landscaping application may gain popularity. Also, the Montana City pilot project with the Montana Department of Transportation (MDT) is still tentatively scheduled for the fall of 2005.

I have attached several pictures from the training session in May. If you should have any further questions, please do not hesitate to contact me or Will Selser, General Manager, Headwaters Cooperative Recycling, 225-3194 or headwatersrecyclemt@earthlink.net. ■

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Submerge and Conquer

By Klaus Vossenkaul, PhD

With the help of submerged membrane modules, a malting company in Antwerp overcomes the disadvantages of membrane bioreactor technology use in large-scale applications, becoming the largest industrial membrane bioreactor plant in Belgium.

Since the late 1990s membrane bioreactor (MBR) technology has rapidly entered the wastewater treatment market. The technology is a simple combination of an activated sludge process and a membrane filtration step. The separation of activated sludge and effluent is achieved by using porous membranes that are able to remove all the suspended solids from the biologically cleaned water. The principle of this technology is not new since membrane bioreactor technology with external pressurized membrane modules has been used in industrial applications for more than 25 years. However, the biggest disadvantages of this technology for large-scale applications are the high investment costs and, especially, the high energy consumption due to the fact that the external membranes have to be operated in cross-flow mode using high feedside velocities. An option for eliminating both of these disadvantages is the introduction of submerged membrane modules into the membrane bioreactor technology.

Membrane bioreactors using submerged membrane modules are being increasingly used in industrial wastewater treatment applications. The use of MBR technology in wastewater treatment plants improves water quality considerably and requires less space compared to conventional methods. The recycling of process water can help industrial companies to cut wastewater disposal costs and to reduce consumption of fresh water. The largest industrial membrane bioreactor plant in Belgium was commissioned in November 2004. The wastewater treatment plant is equipped with sixteen PURON® membrane modules. The submerged membrane filters, with a total membrane area of 8,000 square meters (m2), are treating the wastewater of a malting company in Antwerp.

The Malting Company

The Belgian malting company Sobelgra is located in the Antwerp harbor and is part of the multinational Boortmalt group. The company produces malt for breweries. Malt is the basic ingredient used in the production of beer. The main raw material used in the production of malt is barley. After a thorough cleaning and removal of impurities, chaff, and broken or low-grade kernels, the barley is germinated by soaking it in water over several days. Once enough enzymes have been formed, the process is stopped by means of heating. The color of the beer is influenced by this drying process as well. The entire malting process requires a tremendous amount of fresh air and fresh water.

Sobelgra is currently extending its production from 110.000 to 250.000 metric tons per year. The plant will then be the largest independent malting company in Belgium. The capacity of the existing conventional wastewater treatment plant had to be doubled as well. Due to lack of space on the factory site, conventional wastewater technology could not be used. The compactness of

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membrane bioreactors was the main reason why Solbregra selected this innovative technology. The capacity of an existing wastewater treatment plant can be enlarged without increasing floorspace since the higher bacteria concentration of the sludge increases the performance of the biological step. Additionally, clarification tanks become unnecessary since the separation of sludge and clean water is done by the membranes. The existing infrastructure could therefore be used for the extension of the wastewater treatment plant; there was no need to build new tanks. This meant that separation walls were inserted into the existing biological tank. One-half now serves as a membrane tank for the submerged modules. The former sedimentation tank of the clarifier is now part of the biological treatment process.

In spring 2003, the biological process parameters and the most suitable membrane technology were determined during an on-site pilot study that lasted several months. The submerged PURON hollow-fiber modules were then selected. The Belgian turnkey constructor ENPROTECH was the general contractor for this project and supplied the process design, civils, electro-mechanical, automation, visualization, and electrical equipment. The subcontractor for the supply and assembly of the filtration system was the Belgian Engineering Company.

The Wastewater Treatment Plant

The wastewater treatment plant consists of three stages:

- A mechanical pretreatment;
- A biological stage; and
- The membrane filtration system.

After coarse impurities from the barley processing have been removed by two curved sieves in the mechanical pretreatment stage, the wastewater is fed into the biological stage. The two curved sieves have a mesh size of 0.25 millimeters (mm). The biological stage consists of two aeration tanks connected in series. After a sufficient retention time in the biological stage, the treated water is fed into the membrane stage where it is separated from the activated sludge. The membranes form an absolute barrier to suspended solids and microorganisms. The membrane stage consists of three chambers into which the PURON modules are submerged. In the first phase of expansion, two chambers are equipped with eight modules each. The third chamber is available for future expansions of the plant. The chambers are fed with activated sludge from below so that the sludge flows through the modules from bottom to top. The clean water is sucked out of the membrane modules by means of a vacuum. The concentrated activated sludge is led via spillways back into the aeration tanks. In order to maintain the filtration rate of the membrane modules, a backwash combined with air scouring is carried out at regular intervals. The chambers can be decoupled independently for cleaning and maintenance purposes.

The control equipment (blowers, pumps, electrical equipment, etc.) is located in a control room next to the tanks. Implementing MBR treatment has allowed the malting company to successfully expand without taking up further space on their premises. At the same time, discharge quality of the effluent has increased considerably compared to the conventional wastewater treatment plant. Table 1 shows some of the plant's effluent requirements.

The MBR plant commenced operation in November 2004. During the commissioning phase from November 2004 to January 2005, only one third of the biological plant was in operation. Permeability was high at 530 liters per square meter per hour (l/m2h) bar (a unit of pressure equal to 100,000 pascals or to one million dynes per square centimeter or to 0.9869 atmosphere) in November and rose to 610 in January, as the biological process has started to be optimized. The effluent COD (chemical oxygen demand) values have been at or below the plant's requirements. The flow rate rose from 20.2 cubic meters per hour (m3/h) to 35 m3/h. Once the plant is operating at full capacity with both aeration tanks, more than 2,000 cubic meters (m3) of wastewater will be treated per day. Table 2 shows some parameters during the commissioning phase.

The Membrane Filter Modules

At the heart of the wastewater treatment plant are the submerged hollow-fiber membrane modules. The modules are especially designed for the extremely tough require-

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ments in wastewater — and here particularly for biological wastewater treatment in membrane bioreactors. A key factor for a stable and reliable operation of MBR plants with high flow rates is effective "solids management" in the membrane modules, i.e. the reliable removal of all filtered substances out of the system. The PURON system features hollow-fiber membranes that are fixed only at their lower end. They are operated on the outside-to-inside principle, i.e. all solids and particulates remain on the outside of the membranes while permeate is withdrawn from the inside of the fibers. The membrane pore size is between 0.1 micrometers (ìm) and 0.2 ìm. The lower ends of the membrane fibers are fixed in a header while the upper ends are individually sealed and are free to move laterally. A braid inside the membrane material provides enough mechanical strength to ensure that the fibers cannot break during operation. An air nozzle is integrated into the center of each fiber bundle to apply the air for scouring purposes. The fiber bundles are connected to rows. Several of the rows are mounted into a common steel frame and form the membrane module. The filtrate is removed out of the system via the header and the lateral tubes. The header allows for both collection of the filtrate and distribution of scouring air inside the module. The central arrangement of the air nozzles inside the membrane bundles reduces the energy need for module aeration. The lower air consumption allows for the installation of smaller aeration blowers. In order to prevent the membrane fibers from tipping over during insertion or removal, fiber supports are fixed to the lateral filtrate removal pipes. These supports provide enough space for the membrane fibers to move freely.

MBR Applications

Membrane bioreactors using submerged membrane modules are increasingly applied in industrial wastewater treatment since this technology offers many advantages for industrial companies. It may help to close water cycles, for example, by reusing the treated wastewater as process water. The costs of wastewater disposal can be reduced considerably while saving fresh water at the same time. Examples for industrial applications include: food and beverages, textiles, pulp and paper production, laundries, etc. This technology is also interesting for countries with water shortages where the effluent of membrane bioreactor plants can be used for irrigation purposes, process water applications, or as part of the treatment process for indirect potable reuse. The effluent quality is far beyond the current regulatory requirements for discharge into the environment. It even meets the stringent requirements of the European bathing water directive. In general, MBR technology is always attractive for applications where:

> A compact technology is required because of lack of space or the high cost of land in urban areas; and when a high effluent quality is needed (irrigation, golf courses, industrial use, pretreatment before nanofiltration, and reverse osmosis)

NOTE: This article originally appeared in the March/ April 2005 issue Water and Wastewater Products, Vol. 5, No. 2. ■

Fire In The Watershed

Western Montana to Host Woody Biomass Conference

If you are a surface water based PWS using water from a forested watershed, you may want to consider attending a conference this fall to learn about reducing fire hazard in your watershed. Learning why hazard reduction may be important to water quality and how it can be achieved could give you some ideas about vegetation management in your watershed.

The National Association of Conservation Districts and Bitter Root RC&D have teamed up with a long list of partners to sponsor "When You Get Back Home," a regional conference on hazardous forest fuel reduction, woody biomass utilization and forest health issues. The conference, set for October 11-13 in Missoula, will focus on partnerships between locally led efforts and federal agencies to address the threat of wildfires through fuel reduction and biomass utilization.

Community leaders, natural resource managers, educational institutions and representatives from private enterprise are encouraged to participate. Agenda highlights include prominent speakers and experts in woody biomass; status reports on forest health and hazardous forest fuels in the western U.S.; cooperative bio-energy projects; the role of conservation districts in developing woody biomass energy projects; grants and funding opportunities; the role of grazing in healthy forest environments; building a "Fuel for Schools" program in your community; informative field tours; and more.

In addition to the NACD, sponsors include the National Association of RC&D Councils, Montana Department of Natural Resources & Conservation, National Association of Conservation Agencies, the Western Governors Association, and the U.S. Departments of Interior (BLM) and Agriculture (Forest Service).

The deadline for advance registration is September 27, but interested parties are encouraged to register as soon as possible. The registration fee is $125 in advance, or $150 on-site.

To obtain additional information or register by phone, contact the Bitter Root RC&D at 363-1444 x5.

A special block of rooms for conference attendees has been set aside at the Holiday Inn Parkside. Call (406) 721-8550 for reservations (group rate code: WBC). ■

The Ground Water Rule UPDATE

by Joe Meek

The 1986 Amendments to the federal Safe Drinking Water Act required EPA to promulgate regulations requiring disinfection as a treatment technique for all public water systems. Concerns about economic impact to small water systems and questions about the real need to disinfect all public water systems (PWSs) were raised by numerous stakeholder groups. Eventually enough input was received to cause changes in the congressional mandate that came about as amendments to the Act.

The 1996 Amendments to the federal Safe Drinking Water Act require EPA to develop regulations requiring disinfection as a treatment technique for all public water systems including surface water systems and, as necessary, ground water systems. The regulatory intent is to ensure the continued safety of ground water supplies but disinfection is not mandated for all PWSs.

The proposed Ground Water Rule (GWR (May 2000)) was EPA's response to the congressional mandate found in the 1996 Amendments to the federal Safe Drinking Water Act. The proposed rule was published in the Federal Register in May 2000 and generated significant comment by stakeholders as well as the scientific community. Both the need for the rule and economic impacts to small water systems continued to be major concerns. The GWR (May 2000) continued through the rule-making process but was withdrawn (temporarily?) from further consideration in March 2005. EPA indicates that it "will continue to work expeditiously to address remaining issues, with a goal of promulgating the final rule as soon as possible, but no later than the end of 2005."

The reasons for delays in getting the GWR (May 2000) promulgated are multiple. Most significant was stakeholder review and comment that raised concerns about the accuracy of the cost-benefit analysis used to justify the rule. Given the long history of delays with this rule, any indication by EPA that it will be promulgated in 2005 is questionable. Additionally, any discussions today concerning the GWR (May 2000) can only address what the rule said when published in the Federal Register five years ago. There can be little certainty that much of the five year old language survives. In other words, we can lament the GWR (May 2000) as we knew it in May 2000 but must allow that it may have changed significantly.

The GWR (May 2000) utilized a four-part approach (multiple-barrier) intended to reduce the risks posed by bacterial and viral pathogens associated with fecal contamination of ground water. The major components included:

1. Sanitary surveys and the identification of significant deficiencies;

2. Hydrogeologic sensitivity assessments to identify wells sensitive to fecal contamination;

3. Source water monitoring for systems drawing from sensitive wells without treatment or with other indications of risk;

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4. Corrective actions for significant deficiencies and fecal contamination (by eliminating the source of contamination, correcting the significant deficiency, providing an alternative source water, or providing a treatment which achieves at least 99.99 percent (4-log) inactivation or removal of viruses);

5. Compliance monitoring to insure disinfection treatment is reliably operated, where it is used.

Challenges with implementation would include identifying a "hydrogeologically sensitive" setting. For example, the GWR (May 2000) defined fractured bedrock, karst, and gravel aquifers as sensitive (alluvial gravels were specifically identified as not being considered sensitive).

Further, an aquifer identified as sensitive would undergo an assessment for the presence of hydrogeologic barriers that would prevent or impede contamination. Barriers could include confining layers, thick unsaturated zones, or long travel times between fecal contaminant sources and the aquifer. If the state determined that a barrier were present, the setting would no longer be considered sensitive to fecal contamination.

Other issues would include identifying appropriate disinfection techniques to meet the 99.99 percent (4-log) viral inactivation standard. For example, U.V. light is becoming an increasingly economic means of disinfection from both the initial capital expense and the continued operation standpoints, thus disinfection is no longer synonymous with chlorination.

As Montana DEQ prepared to address the impending GWR (May 2000), it was obvious that it would be necessary to utilize source water assessment reports to the maximum extent practical. For example, the source water assessments that are being completed by DEQ and others address the requirement to identify hydrogeologic sensitive settings. Also, the source water assessments identify hydrogeologic barriers that could be used to eliminate the setting as sensitive.

PWSs in Montana have been diligent in compliance with evolving regulations but need to continue to be active in the public process as they are developed. The GWR (May 2000) is a good example of a congressional mandate that pushed hard against the economic and political realities of the 1990s and early 2000s. The regulated community mobilized appropriately to push back, the state implemented other aspects of drinking water protection, and technology evolved that might ease the economic burden should the rule become final. The end result is a draft rule that is currently on hold. The fate of the Ground Water Rule is not yet determined; PWSs need to remain informed, be active, and continue to provide input to the regulatory authority. ■

Safety Fact Sheet: Hurry Up Can Hurt

In the same way that race cars are marked with racing stripes, people who race on the job are marked with cuts, bruises and bandages. Almost all of us have been guilty of racing through a job at one time or another.

Here are some hurry up acts. Let's see which ones we've practiced lately:

- Didn't wear safety glasses because the job would only take a few minutes.
- Used the wrong ladder because the proper one was too far away.
- Didn't use the proper lockout procedures because no one was around and it was easy to fix alone.
- Took a short cut between machinery or stockpiles of materials.
- Used a wrench instead of a hammer because the hammer was in the tool box on the other side of the room.
- Climbed a ladder with a pocket full of tools because the tool belt had been forgotten.
- Cut the grounding prong of a three-way ground wire plug because there wasn't an adapter.
- Removed a guard to repair the machine or prepare it for a special run and didn't get around to putting it back yet.
- Reached just a little bit further on the ladder because there wasn't time or energy to get down and move it.
- Didn't unplug a power tool before making adjustments because it would only have to be plugged in again anyway.
- Used a dull saw blade for just one more cut.
- Gave a fork lift truck just a little more pedal so one more load would be done before lunch.
- Laid a board full of nails down with the full intention of bending the nails over in a minute.
- Climbed up the side of a bin instead of getting a ladder.
- Didn't slow down at a blind corner this time because no one has been there before.

Does any of this sound familiar? Or are these things only what other people do? Often when we race through a job, nothing bad happens. Sometimes we may experience a "near miss." However, eventually a serious injury will happen because it is only a matter of time. Is it worth risking our eyes, our limbs or our life or someone else's to save a few minutes on the job? When we hurry up on the job we are often not only speeding up our work but speeding up our chances of having an accident. Hurry up can hurt.

Let's review some safe working practices:

- Use personal protective gear when necessary.
- Take the extra steps needed to do the job properly.
- Always use the correct tool for the job.
- Check to make sure safety guards are in place.
- Follow lockout/tagout procedures as if a life depends on it — it does.
- Keep the worksite tidy.
- Return tools to their proper place.
- Use proper lifting techniques.
- Be alert to ways in which the workplace can be safer.

Remember, practice safety. Don't learn it by accident.

Fact sheet courtesy of the Texas Workers' Compensation Commission: E-mail resource.center@twcc.state.tx.us or call (512) 804-4620 for more information; **http://www.twcc.state.tx.us/information/videoresources/onlinepubs.html.** ■

Hurt at Work

- You've carefully thought out all the angles.
- You've done it a thousand times.
- It comes naturally to you.
- You know what you're doing, its what you've been trained to do your whole life.
- Nothing could possibly go wrong, right?

Think Again!

Answers from page 5: 1 (d); 2 (d); 3 (a); 4 (b); 5 (d)