CLIMATE CHANGE CHALLENGES
Water’s Future Might Be In Question

Also in this issue:
Water Wars
Water Supplies Decrease
How to: Handle Chlorine Safely
Shame On Us

We neglected to identify the locations of the photographs in the spring and summer issues. Several readers wrote and called to ask where the shots were taken and, amazingly, most of them were correct!

The spring issue featured a photo of Mount Snowdon, the highest peak in Wales and one of the highest in Great Britain. The summer cover showed Annapolis Royal, Nova Scotia, with the Fort Anne National Historic Site in the foreground. Our apologies for not stating this in the original magazine.

Special thanks to Keith Lucy and Charlie McConologue.
Features

16 Climate Change Challenges: Water’s Future Might be In Question
by Kathy Jesperson

21 Water Supplies Decrease as Drought Lingers
by Natalie Eddy

24 Water Wars: Whose Water Is It and Why Do I Need a Permit To Use It?
by Jamie Knotts

32 How To: Handle Chlorine Safely
by Zane Satterfield, P.E.

In Every Issue

6 Calendar of Events
7 News and Notes
12 On the Web
14 Ask the Experts
38 Until Next Time

Tech Brief

Development of Low-Cost Treatment Options for Arsenic Removal in Water Treatment Facilities

Illinois State Water Survey and University of Illinois researchers experimented with different combinations of chemical additives and steps along the treatment process.
Rural Development
USDA’s Rural Development Utilities Service strives to serve a leading role in improving the quality of life in rural America by administering its electric, telecommunications, and water and waste programs in a service-oriented, forward-looking, and financially responsible manner. Founded in 1947 as the Farmer’s Home Administration, Rural Development has provided more than $20 billion for water and wastewater projects. For more information, visit their Web site at www.usda.gov/rus/.

The National Environmental Services Center
The National Environmental Services Center (NESC) is a nonprofit organization providing technical assistance and information about drinking water, wastewater, infrastructure security, utility system management, solid waste, and environmental training to communities serving fewer than 10,000 people.

To achieve this mission, NESC offers a toll-free technical assistance hotline, hundreds of low-cost or free products, magazines and newsletters, and several searchable databases. We also sponsor conferences, workshops, and seminars. Visit the NESC Web site at www.nesc.wvu.edu or call toll-free (800) 624-8301 and request an information packet.

NESC is located at West Virginia University, one of the nation’s major doctoral-granting, research institutions.

ISSN 1061-9291
Printed on Recycled Paper

It’s January 4, 2007. It is 59 degrees outside and temperatures are expected to remain in the 50s for the rest of the week. The average high temperature for Morgantown, West Virginia, in January is 39 degrees, according to the Weather Channel. So the temperature today is 20 degrees above the average.

What does that mean? Maybe nothing. The record high for January was 80 degrees and was recorded in 1950. So maybe this is just a topsy-turvy weather pattern that has nothing to do with global warming. Maybe the weather pattern is just going to be erratic for a few years. So we can all breathe a sigh of relief. Right? Maybe not. Volatile weather is all the more reason to be prepared for emergencies, such as floods and droughts.

As the weather becomes increasingly unsettled, water supplies will become increasingly vulnerable. Because of this, water conservation efforts should intensify. Clean, safe water supplies will be in demand not only during droughts when provisions are low but also during floods when sources are contaminated. I could go on, but I think you get the point.
In this issue, the article about global warming on page 16 intends to provide readers with some background about how unstable weather conditions can affect water sources. This issue also contains a story about drought and its affects on water supplies. On page 24 a story about water wars defines to whom water really belongs. The “How To” article explains chlorine handling. And I recommend that you read the “Tech Brief” because it explains an innovative and inexpensive way to remove arsenic from water.

If you are on the Small Flows magazine mailing list, I’ll see you there in the spring. I am taking over its production—not by coup but by assignment. I am looking forward to hearing from you there.

Kathy Jesperson
Editor

Who We Are
A number of people are responsible for putting On Tap magazine together each quarter. We encourage our readers to contact us with ideas and suggestions. An e-mail address is provided for each staff member below, as well as their phone extension. Call our main number toll free at (800) 624-8301 and enter the appropriate extension at the prompt.

On Tap Staff

Dr. Richard Bajura
richard.bajura@mail.wvu.edu
Interim Executive Director
Phone extension: 5514

Mary Stewart
mstewart@mail.wvu.edu
Senior Program Administrator
Phone extension: 5511

Trina Wafle
tkwafle@mail.wvu.edu
Interim Communication Director
Phone extension:

Kathy Jesperson
kathy.jesperson@mail.wvu.edu
Managing Editor
Phone extension: 5533

Mark Kemp-Rye
mkemp@mail.wvu.edu
Editor
Phone extension: 5523

John Fekete
jfekete@mail.wvu.edu
Senior Project Coordinator, Graphics
Phone extension: 5505

Jamie Bouquot
jbouquot@mail.nesc.wvu.edu
Graphic Designer
Phone extension: 5397

Julie Black
jblack@mail.nesc.wvu.edu
Web Developer
Phone extension: 5503

Clement Solomon
csolomon@mail.wvu.edu
Program Coordinator
Phone extension: 5566

Zane Satterfield
zsatterfield@mail.nesc.wvu.edu
Engineering Scientist
Phone extension: 5393

Sheila Anderson
sanderson3@wvu.edu
Administrative Associate
Phone extension: 5517

Special Thanks
Cathleen Falvey
Marilyn Noah
MARCH

Water Quality Association Annual Convention and Exhibition
March 27–31, 2007
Orange County Convention Center
Orlando, FL
Phone: (630) 505-0160
Fax: (630) 505-9637
www.wqa.org

American Society of Civil Engineers/Infrastructure Security Partnership
Annual Infrastructure Security Conference
March 28–29, 2007
Crystal City Marriott
Arlington, VA
Phone: (703) 295-6408
www.tisp.org

JUNE

National Environmental Health Association Annual Educational Conference and Exhibition
June 18–21, 2007
Atlantic City, NJ
Phone: (303) 756-9090
Fax: (303) 691-9490
www.neha.org

American Water Works Association Annual Conference and Exposition
June 24–28, 2007
Metro Toronto Convention Centre
Toronto, ON
Phone: (800) 926-7337 or (303) 794-7711
Fax: (303) 347-0804
www.awwa.org/ace07/

JULY

National Association of Counties Annual Conference and Exhibition
July 13–17, 2007
Richmond, VA
Phone: (202) 393-6226
Fax: (202) 393-2630
www.naco.org

SEPTEMBER

American Public Works Association Annual Conference
September 9–12, 2007
Henry B. Gonzalez Convention Center
San Antonio, TX
Contact: Dana Priddy
Phone: (800) 848-2792 or (816) 595-5241
Fax: (816) 472-1610
Email: dpriddy@apwa.net
www.apwa.net

OCTOBER

Water Environment Federation
WEFTEC ’06
October 13–17, 2007
San Diego, CA
Phone: (800) 666-0206 or (703) 684-2452
Fax: (703) 684-2492
www.weftec.org

If you are sponsoring a water-related event and want to have it listed in this calendar, please send information to Mark Kemp-Rye, National Environmental Services Center, West Virginia University, P.O. Box 5064, Morgantown, WV 26506-6064. You also may call Mark at (800) 624-8301 or (304) 293-4191 ext. 5523 or e-mail him at mkemp@mail.wvu.edu.
UNICEF Report Says One Billion Lack Safe Drinking Water

The statistics are mind-boggling: of the more than six billion people in the world today, more than one billion have no access to improved drinking water—a basic necessity for human life—and about 2.6 billion people do not have access to improved sanitation.

And according to the U.N. children’s agency UNICEF, polluted water and lack of basic sanitation claim the lives of more than 1.5 million children every year, mostly from waterborne diseases.

“Despite commendable progress,” says Ann Veneman, UNICEF executive director, “an estimated 425 million children under 18 still do not have access to an improved water supply, and more than 980 million do not have access to adequate sanitation.”

She said those who die are by no means the only children affected. “Many millions more have their development disrupted and their health undermined by diarrhoeal or water-related diseases.”

In a 33-page report titled “Progress for Children: A Report Card on Water and Sanitation,” UNICEF says these “tragic statistics” underscore the need for the world to meet its commitment to halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation.

More information about the report can be found at: www.unicef.org/publications/
Maine Earthquake Lowers Groundwater

A minor earthquake that shook Maine in October caused the water level in a U.S. Geological Survey (USGS) monitoring well to drop more than 2.5 feet. Nearly 17 hours later, the groundwater level was still dropping, according to scientists at the USGS Maine Water Science Center in Augusta. Hydrologists call the change in the well “dramatic” and note that well-water users may have noticed changes in their drinking water.

The preliminary magnitude 3.9 earthquake was the third such event to shake up residents in Maine in a two week period. This event was centered about four miles south-southeast of Bar Harbor, or 45 miles southeast of Bangor, Maine. A magnitude 2.5 earthquake on September 28 and a magnitude 3.4 on September 22 were centered in the same location.

“It isn’t unusual for earthquakes to cause minor changes in water levels in wells, but this is the most memorable in Maine in the last decade,” said USGS hydrologist Gregory Stewart. “Users of well water could notice cloudy water and possibly a change in availability of water,” said Stewart, who notes that the region’s fractured bedrock means it is difficult to predict whether or not other wells will be affected. “Water-level responses can occur over time periods of a few minutes to several months.”

The well, located in Acadia National Park in Bar Harbor, is a drilled bedrock well that is 98 feet deep. On a normal day, water-level changes are generally three to four inches at this well. One other well near the epicenter also showed a drop in water level from this event. Other local earthquakes in the previous two weeks were not detected at water level monitoring wells in the state.

The earthquake was widely felt in coastal and central Maine. More than a thousand people reported light to moderate shaking on the USGS “Did You Feel It?” Web site: pasadena.wr.usgs.gov/shake/STORE/Xtib1_06/cim_display.html

Although this series of felt earthquakes is notable for this area, Maine has been shaken by stronger events. Several minor earthquakes centered in Maine are recorded each year; many are too small to be felt.

The largest earthquake centered in Maine occurred March 21, 1904. Its magnitude was 5.1. This event toppled chimneys and was widely felt throughout New England. Historic earthquakes centered outside Maine have been large enough to cause damage in the state. The largest historic earthquake to shake the region was a magnitude 7.0 earthquake in 1663, centered in Quebec along the St. Lawrence River. It toppled chimneys in eastern Massachusetts. In 1755, a magnitude 6.0 earthquake off Cape Ann, Massachusetts, shook down chimneys and several brick buildings in eastern Massachusetts.

More information on the earthquake history of Maine can be found at: earthquake.usgs.gov/regional/states.php?regionID=19&region=Maine

View the Acadia National Park well level at: waterdata.usgs.gov/me/nwis/uv/?site_no=442238068154101&PARAmeter_cd=72019

Updated Advice for Emergency Disinfection of Drinking Water

The U.S. Environmental Protection Agency (EPA) has updated and improved its advice for how to disinfect drinking water in situations where tap water may be unsafe to drink due to an emergency. The updated version of Emergency Disinfection of Drinking Water includes metric measurements and line drawings that clearly illustrate different disinfection methods.

Emergency Disinfection also highlights four crucial steps to take when the water supply may be contaminated. Agreement on these steps is the result of collaboration between EPA, other U.S. federal agencies and the Red Cross.

EPA is also making translations of the publication available in French, Spanish, Vietnamese, and Standard Arabic in PDF form on the Safewater Web site at epa.gov/safewater/faq/emerg.html.
U.S. Environmental Protection Agency (EPA) water officials say that too many obstacles stand in the way of its attaining the 2008 target of having 95 percent of people served by community water systems (CWSs) receive water that meets all health-based standards.

EPA’s Office of Water proposes to replace what they termed the “ideal” of 95 percent by 2008 with the “more realistic level” of 91 percent by 2011. The agency says, however, that its current performance against the goal “remains high at 88.4 percent,” but did note that it was falling short of its 2006 goal of 90.9 percent.

EPA cites “significant annual population impacts from the largest systems” such as turbidity violations by Puerto Rico’s largest water utility and New York City’s “failure to filter” its Croton watershed supply, as reasons for the shortfall.

In addition, systems serving fewer than 500,000 people suffered from “sporadic violations of microbial requirements that are hard to eliminate.” EPA also referenced challenges facing small systems, which it says “can be magnified in Indian Country.”

The agency does recognize that it has made “substantial strides forward” in meeting its goals for getting water that meets all standards to a higher percent of the population. EPA says that the percent has risen from 79 percent in 1993 “to current levels that are in the 90 percent range and include even more requirements to protect public health.”

New Rule Boosts Protection of Underground Drinking Water

More than 100 million Americans will enjoy greater protection of their drinking water under a new rule issued by the U.S. Environmental Protection Agency (EPA). The rule targets utilities that provide water from underground sources and requires greater vigilance for potential contamination by disease-causing microorganisms. “The Bush Administration’s Ground Water Rule boosts drinking water purity and public health security,” said Benjamin H. Grumbles, assistant administrator for water. “These first-ever standards will help communities prevent, detect, and correct tainted groundwater problems, so citizens continue to have clean and affordable drinking water.” The risk-targeting strategy incorporated in the rule provides for:

- regular sanitary surveys of public water systems to look for significant deficiencies in key operational areas;
- triggered source-water monitoring when a system that does not sufficiently disinfect drinking water identifies a positive sample during its regular monitoring to comply with existing rules;
- implementation of corrective actions by groundwater systems with a significant deficiency or evidence of source-water fecal contamination; and
- compliance monitoring for systems that are sufficiently treating drinking water to ensure effective removal of pathogens.

A groundwater system is subject to triggered source-water monitoring if its treatment methods don’t already remove 99.99 percent of viruses. Systems must begin to comply with the new requirements by December 1, 2009.

Contaminants in question are pathogenic viruses—such as rotavirus, echoviruses, and noroviruses—and pathogenic bacteria, including E. coli, salmonella, and shigella. Utilities will be required to look for and correct deficiencies in their operations to prevent contamination from these pathogens.

Microbial contaminants can cause gastroenteritis or, in rare cases, serious illnesses such as meningitis, hepatitis, or myocarditis. The symptoms can range from mild to moderate cases lasting only a few days to more severe infections that can last several weeks and may result in death for those with weakened immune systems. The new groundwater rule will reduce the risk of these illnesses.

Fecal contamination can reach groundwater sources, including drinking water wells, from failed septic systems, leaking sewer lines, and by passing through the soil and large cracks in the ground. Fecal contamination from the surface may also get into a drinking-water well along its casing or through cracks if the well is not properly constructed, protected, or maintained.

The Centers for Disease Control and Prevention reports that, between 1991 and 2000, groundwater systems were associated with 68 outbreaks that caused 10,926 illnesses. Contaminated source water was the cause of 79 percent of the outbreaks in groundwater systems.

For more information, visit EPA’s site at epa.gov/safewater/disinfection/gwr.
EPA Program Sparks Consumer Water Efficiency Awareness

“Every drop counts.” That’s the motto of a new partnership program called WaterSense that the U.S. Environmental Protection Agency (EPA) recently launched to stimulate more efficient use of water in homes and businesses.

Growing demands for water and the need to protect water sources have prompted water and wastewater utilities, along with agriculture and industry, to rely on water efficiency as a low-cost approach to meeting customer and business needs.

A recent U.S. Government Accountability Office survey underscored the need to develop a national ethic of water efficiency. The survey reported that 36 states anticipate local, regional, or statewide water shortages by 2013, even without drought conditions. Managing the nation’s water supply is a rising concern for communities across the country.

In response, EPA announced the WaterSense program. This voluntary partnership promotes water efficiency and primes market demand for water-efficient products and services, WaterSense takes its cue from the successful ENERGY STAR program that promotes energy-efficient products.

WaterSense program goals are to raise awareness of the importance of efficient water use and to ensure that consumers can easily identify high-performance products that will meet EPA standards. WaterSense-labeled products will be at least 20 percent more efficient than their counterparts.

Efficient water use doesn’t mean asking consumers to make sacrifices, just to be smarter about how they use water. For example, water leaks cost consumers an additional eight percent on their water bill annually. By sealing leaks and adopting water efficient products and practices, the average family can save money and 30,000 gallons of water per year.

By saving water, you can save money and help ensure there is enough water to satisfy the needs of future generations.

For more information about the WaterSense program, visit EPA’s Web site at www.epa.gov/watersense/.

RDUS Loans: Poverty Rate Unchanged; Others Down

The Rural Development Utilities Service (RDUS) recently announced interest rates for water and wastewater loans. RDUS interest rates are issued quarterly at three different levels: the poverty line rate, the intermediate rate, and the market rate. Each has specific qualification criteria.

The rates, which apply to all loans issued from January 1 through March 31, 2007, are:

- **poverty line:** 4.5 percent (unchanged from the previous quarter);
- **intermediate:** 4.25 percent (down 0.125 from the previous quarter); and
- **market:** 4.125 percent (down 0.125 percent from the previous quarter).

For this quarter, all loans will be obligated at the lower (4.175) rate. RDUS loans are administered through state Rural Development offices, which can provide specific information concerning RDUS loan requirements and applications procedures.

For the phone number of your state Rural Development office, contact the National Environmental Services Center at (800) 624-8301 or (304) 293-4191. The list is also available on the Rural Development Web site at www.rurdev.usda.gov/recd_map.html.
Earth 911’s Mission: Making Every Day Earth Day!

www.earth911.org/master.asp

Most environmental programs have focused on either repairing damage that has already been sustained or attempting to return the environment to its original state prior to the advancement of industrialized societies. Earth 911 seeks to empower the public with community-specific resources to improve their quality of life. Call 1-800-CLEANUP or visit the Web site to access information about community-specific environmental issues at no cost.

For information about your community, simply enter your zip code, and the Web site will easily guide you to information about recycling centers, green shopping, energy conservation, household hazardous waste, composting, and other related topics.

NSF: Help for Homeowners Using Well Water

www.nsf.org/consumer/drinking_water/dw_well.asp?program=WaterTre

Although a vast majority of Americans get their water from a municipal water source, over 20 million Americans have privately owned wells. This section is designed to provide private well owners with general information on water quality and the special needs of well water users. Very few regulations exist to govern the quality of private well water supplies. In view of this dearth, the National Science Foundation provides this site, offering pertinent information about such related topics as: basic water testing, odor and color problems, treatment of well water, and selecting a water treatment system.

Get Connected To CDC

www.bt.cdc.gov/rss/

The Centers for Disease Control and Prevention (CDC) has a new service available—an RSS feed to CDC emergency bulletins on quality threats and issues. Water utilities may want to look into this CDC opportunity to receive automatic alerts about a variety of biological, chemical, and radiological issues or problems via RSS.

RSS stands for Really Simple Syndication and it is an easy way to receive automatic updates from CDC to your desktop or browser. How do you add an RSS feed from CDC’s site? Go to www.bt.cdc.gov/rss/ and follow the instructions about setting up a RSS feed.

Helpful Tips for Drinking Water Outbreak Response

www.cdc.gov/ncidod/dpd/healthywater/helpfultips.htm

The Center for Disease Control provides this Web site with useful tips for health care workers in the event of an outbreak of drinking water contamination. Topics to consider include dealing with the press, establishing a hot line, communicating with other health departments, distributing fact sheets to the press and public about the contagion.

Safe Water For Kids

www.ecn.purdue.edu/SafeWater/kids/index.htm

Offered as part of Purdue University’s Safe Water for the Future program, the Safe Water for Kids Activities have been designed as a tool for teachers, educators, and water company operators to use so that they may more clearly show the balance between our activities and the environment. Each activity can be used to further clarify specific issues and explore hypothetical situations.

These activities can be used indoors, in a classroom setting, or outdoors. Because the activities are hands-on they are able to clearly illustrate the topic at hand. They are “attention getters” and will keep students interested. The featured activities provide answers to questions such as how does water move through the earth and where does contamination go?
ECN Offers Variety of Communication Resources

www.esf.edu/ecn/

The Environmental Communication Network (ECN) is a community of scholars, professionals and activists concerned with the role of communication in environmental affairs.

The ECN Web site aims to be the best place to start when looking for information about environmental communication. Here you'll find resources on a variety of aspects of environmental communication.

This is not a network for simply talking about environmental issues. It is a network for talking about how communication issues interact with environmental issues. Think of it as a meta-network.

For more information about the network, contact Dr. Mark Meisner, Faculty of Environmental Studies, SUNY-ESF, 107 Marsball Hall, 1 Forestry Dr., Syracuse, NY 13210-2278. Or call him at (315) 470-6908.

Site Supplies Environmental Health News

www.EnvironmentalHealthNews.org

This newsletter is published online daily at www.EnvironmentalHealthNews.org by Environmental Health Sciences, a not-for-profit organization founded in 2002 to help increase public understanding of emerging scientific links between environmental exposures and human health. The site contains news about environmental health issues, and visitors may sign up for a free e-mail newsletter, Above the Fold.

For more information about www.EnvironmentalHealthNews.org, write to Environmental Health Sciences, P.O. Box 125, White Hall, Virginia. 22987-0125.

Powell Consortium—Nine States, One Goal

wri.nmsu.edu/powell/

Named in recognition of John Wesley Powell (1834-1902), the Powell Consortium is an alliance of nine Water Resources Research Institutes and Centers from the states of Arizona, California, Colorado, Nevada, New Mexico, Oklahoma, Texas, Utah, and Wyoming formed to work on water resources problems of the Colorado River/Great Basin region.

Relying on its collective expertise of universities and more than 20 other cooperating universities to develop and disseminate knowledge to solve problems of the region and other arid areas of the world, the Consortium seeks to improve the technical and scientific basis for decision-making on water and environmental issues through honest investigation and the application of common sense to problem solving.

Safety Council Promotes Environmental Health

www.nsc.org

The National Safety Council's Environmental Health Center (EHC) mission is to educate and influence society to adopt safety, health, and environmental policies, practices, and procedures that prevent and mitigate human suffering and economic losses arising from preventable causes.

EHC conducts a variety of outreach and education activities on various water issues, including drinking water and coastal and marine issues. In addition to these services, EHC also has information about flooding, hurricanes and coastal storms, and first aid.

For more information about EHC and its services, you may write to them at 1121 Spring Lake Drive, Itasca, IL 60143-3201. You also may call them at (630) 285-1121, or e-mail them info@nsc.org.
Q: Why should a water system manager be prepared? What kinds of problems should they be ready for?

Being Prepared Is Everybody’s Business

Although Title IV of the Public Health Security and Bioterrorism Preparedness and Response Act, Public Law 107-188 requires drinking water facilities serving populations of more than 3,300 to perform a vulnerability assessment and to prepare an emergency response plan (ERP) to incorporate the results of the vulnerability assessment, all water plants of any size would benefit from this exercise.

The preparation for any water emergency whether natural or manmade is necessary as everyone relies on the availability of safe and dependable water supply. As essential as managing the day-to-day operation of a water plant, the management of an emergency is actually best handled when planned and prepared for in advance. When you ask yourself what should you be prepared for, the answer is simply “everything and anything.”

Start at the very beginning with your new water intake and move through your process and distribution system. Ask yourself the question, “How can I deal with this piece of equipment or process if it is damaged and out of service?” In most cases, it is good to include those in the planning process who will be responding for your emergency. This list would include all of your staff, fire, police, state and federal agencies, equipment and chemical suppliers, and other neighboring water utilities who may be able to offer assistance during a crisis.

Most communities have local emergency planning committees (LEPC) that can be a great assistance in identifying potential problems in your water system that are easily overlooked by operators and managers use to their routines. These LEPCs can also play an important role in planning your coordination and response to water system emergencies.

The U.S. Environmental Protection Agency provides a few excellent documents on their Web site (www.epa.gov/safewater) that can help water system managers organize their process and plan for dealing with water system related emergencies. The Federal Emergency Management Agency (FEMA) also offers an excellent interactive and free Web-based independent study course on incident command, which will become very important when dealing with emergencies. This course can be found on FEMA’s Web site at training.fema.gov. I would say that the take home message is that no water emergency is too small or unimportant. Being prepared is essential.
always be ready

stuff happens! that’s why a water system should be prepared for an emergency.

preparation for emergencies has always been an important task for water operations. the kinds of emergencies that each system should prepare for varies to a large degree on the physical location and size of the system, treatment technologies employed, and proximity of populations to hazardous chemicals in large quantities. each system should know of all the apparent risks to its customers and to the water system. routines for handling those risks, if they were to turn into emergencies, should be practiced on a regular basis.

the emergency that can really do serious damage is the one that you as an operator are not prepared for. when i worked as an operator we all had a mental priority list drilled into us that we were to follow in emergency situations:

1. protect the people;
2. protect the system;
3. then worry about the other stuff, like saving money, optimizing operations, etc.

1 realize this may seem like an oversimplification, but when emergencies happen and decisions must be made immediately, you’d be surprised how mixed up things can get and none of us want to make a decision that results in the sickening or death of our coworkers or people in the community.

here’s a brief list of emergencies to prepare for:

1. biological or chemical contamination (of source water, final water, or the atmosphere);
2. loss of electricity or electrocution of personnel;
3. intentional vandalism or tampering with system components to cause harm;
4. system or component damage caused by weather (such as floods, lightning, wind and fire) or more severe events such as earthquakes;
5. construction and repair-related accidents; and
6. mechanical equipment failure that puts the community or system at risk.

consider how emergencies will be handled for all system components and processes related to:

- source,
- treatment,
- distribution and storage, and
- pumps, facilities and controls.

every operations team should analyze specific emergency risks and formulate an emergency plan. you should know how to coordinate with police, fire and other emergency service departments in your community. keep the emergency plan updated and practice, practice, practice! as an operator this is a priority and the customers you serve are relying on you to prepare for and know how to handle emergencies…because stuff happens!
CLIMATE CHANGE CHALLENGES
Water’s Future Might Be In Question
By Kathy Jesperson,
NESC Editor
Water is critical to life on Earth. It is the only known substance that can actually exist as a gas, liquid, or solid within the relatively small range of air temperatures and pressures found on the Earth’s surface. Its presence sets the Earth apart from any planet in the solar system.

But concerns for the future of water have risen lately because greenhouse-gas-induced climate changes may alter the blueprint of the hydrologic cycle. According to NASA’s Earth Observatory Web site, “the science community now generally agrees that the Earth’s climate will undergo changes in response to natural variability and to increasing concentrations of greenhouse gases and aerosols. Furthermore, agreement is widespread that these changes may profoundly affect atmospheric water vapor concentrations, clouds, and precipitation patterns.”

Agreement that global warming—whether by natural occurrence or man-made circumstances—is real does not appear to be in question. In spite of this, how climate change may impact water supplies still needs to be resolved.

According to the PEW Center on Global Climate Change, climate changes will affect the demand and supply of water. And the changes that occur will affect a wide range of water-system components, including reservoir operations and water quality.

**Will there be enough water?**

The outlook for the available amount of water in the future has been shaky for a number of years, even if global warming were not considered. Poor use of resources and population increases contribute to the supply-versus-demand predicament we now face. Add global warming to the quandary, and the odds increase that the future will not have enough water for everyone.

As water becomes increasingly scarce and more expensive, vulnerability to drought increases. And preparing for drought appears to be uncertain, because the capacity to store water looks as if it is declining. The U.S. Environmental Protection Agency’s (EPA) *Drinking Water Infrastructure Needs Survey* advises that not enough money has been put back into the nation’s drinking water infrastructure. Deteriorating infrastructure, such as underground pipes, storage facilities, and reservoirs, has created a tricky situation. Before the future can be considered, funding must first be found to replace collapsed pipes, rusted-out storage tanks, and sediment-filled reservoirs to satisfy the demands that we place on these structures now, says the PEW Center.
Competition Creates Conflict

Another complex issue that creates concern is competition for source-water resources. Water rights, particularly in the West, have always been open to conflict. According to the U.S. Global Change Research Program (USGCR), in many rivers and streams in the U.S., there is not enough water to satisfy existing water rights and claims. Include the public’s changing values about preserving in-stream flows, protecting endangered species, and settling Indian water rights claims with that disparity, and a volatile situation emerges. The right to claim a water supply not only becomes expensive, but also privileged.

McCool, a University of Utah political science professor who specializes in water issues, in the Tribune article. “But the status quo doesn’t exist any longer. It is a system that is hopelessly out of sync with the demographic reality, the economic reality, and the meteorological reality.”

“Battle lines drawn,” Baird continues, “One thing for sure, though. The politics of water, already rough, are going to get even rougher. Especially if the resources are scarce and states wind up pitted against each other. The Colorado River Compact tying together the seven basin states—Utah, Wyoming, Colorado, New Mexico, Nevada, Arizona, and California—has been in existence since 1922. It may not make it through the next century.”

Rainfall and Disease Linked

In the U.S., heavy and very heavy precipitation events, usually rainfall, have caused precipitation to increase from five

“Whether we accept climate change as human induced or just another part of nature, it is happening. How we plan for it will make all the difference in the world.”

Climate change issues will likely intensify this situation. “Across the vast Colorado River Basin, 85 percent of the water consumed by municipal and agricultural users comes from snowmelt,” writes Joe Baird in an August 2006 article in the Salt Lake Tribune. But snow pack of the Rocky Mountains and other sources has declined rapidly over the past few years. Temperature changes have led to less precipitation as snowfall. In some situations, the early snowfalls that do occur are soon washed away by premature rainfall events. And any existing snow pack melts faster and sooner than what has happened typically. These conditions have led to fewer water supplies when they are needed.

“It’s worth pointing out that there are 400 water districts in Utah, a complex set of state water laws, and the law of the Colorado River. And the primary objective of all these districts and statutes is to protect the status quo,” says Dan

Water Quality Creates Concern

When it comes to global warming, however, water’s availability in the future is not the only source of contention. Recent research about the quality of water under certain climate change scenarios has raised more than one eyebrow in the scientific community.

Droughts and floods each may have their own effects on water quality, says USGCR. Droughts can concentrate the contaminants in lakes, rivers, and streams and may create treatment problems that water system managers had not anticipated. Floods can wash contaminants not typically found in a source downstream and thereby create public health risks for which communities are unprepared. Only recently has research begun to estimate what kinds of changes drinking water treatment systems will need to make so that their treatment efficacy remains constant, making them able to comply with different water quality standards and the costs associated with them.

According to the USGCR program, more frequent heavy precipitation brought about by climate change will likely flush more contaminants into lakes and rivers, intensifying pollutants from agriculture and other nonpoint sources. Along the coast, rising sea levels increase the potential that saltwater intrusion will affect drinking water supplies. In areas where rainfall is decreased, water will be scarce and treatment may be the least of the worries.

The study authors verify that a relationship exists between precipitation and waterborne disease outbreaks—an important revelation in the light of predictions that climate change will only increase heavy precipitation in the U.S.

The authors further note that increased runoff from agricultural facilities not only jeopardizes public health, it also can cause overloading of stormwater and wastewater systems. This can, in turn, damage water and sewage treatment facilities, mine tailing impoundments, and landfills, thereby increasing the risks of contamination. And the cycle continues.
According to Wikipedia, the water cycle is the continuous movement of water over, above, and beneath the Earth's surface. Solar energy powers the cycle. And because it is a cycle, it has no beginning or end. As water moves around the hydrosphere, it changes state among liquid, vapor, and ice. The time taken for water to move from one place to another varies from seconds to thousands of years, and the amount of water stored in different parts of the hydrosphere ranges up to 1.37 billion cubic kilometers, which is contained in the oceans. Despite continual movement within the hydrosphere, the total amount of water at any one time remains essentially constant.

Adapted from Wikipedia available at en.wikipedia.org/wiki/Water_cycle.
As an example of this relationship, the study authors note that rainfall can be directly related to a 1980 waterborne disease outbreak of giardiasis in Montana as well as the largest reported waterborne disease outbreak ever documented, which occurred in Milwaukee, Wisconsin, in 1993. Using this background data along with other information, the researchers found that very heavy or heavy precipitation events preceded 51 percent to 68 percent of waterborne disease outbreaks. They also found that outbreaks due to surface water contamination showed the strongest association with extreme precipitation during the month of the outbreak. Groundwater contamination events had a two-month lag period. It is important to note, however, that in some regions, higher average flows will likely dilute pollutants, improving water quality, says USGCR.

**Drought Diminishes Supplies**

Despite the overall increase in precipitation, increased air temperatures related to climate change will likely affect the evaporation rate of water in many interior portions of the nation, meaning drought will become the norm for these areas, and some regions will experience more extreme variations than others.

Drought conditions can concentrate contaminants, impairing water supplies. They also can diminish good hygiene and adequate hydration, say the Physicians for Social Responsibility. Drought also can affect food supplies as water is diverted from agricultural to consumer water resources.

**A Salty Intruder Takes Over**

Over pumping of groundwater supplies creates another insidious problem. Along the coast and even inland, saltwater intrusion is already affecting freshwater resources, according to the U.S. Geological Survey (USGS). Saltwater is typically separated from fresh water through a transition zone. When this zone is compromised, saltwater can intrude upon fresh water. But increases in sea levels also may be linked to intrusion.

Saltwater is denser than fresh water, so fresh water will float on top of saltwater. As the fresh water is removed and the hydrostatic pressure it creates decreases, saltwater intrudes the aquifer, according to the Air and Water Quality, Inc., Web site.

“Because saltwater has high concentrations of total dissolved solids and certain inorganic constituents, it is unfit for human consumption and many other [human] uses,” notes USGS.

**Construct a Contingency**

“All water systems are designed and operated on the assumption that future climate would look like past climate,” says the PEW Center on Global Climate Change. Because many certainties exist, the center suggests that we reevaluate our current assumptions and operating rules. And contingency planning will not only make sense, it will be required in the future. We will need to be open to options and flexible in our decisions when it comes to designing efficient water programs in the context of climate change.

Whether we accept climate change as human induced or just another part of nature, it is happening. How we plan for it will make all the difference in the world.

**More information about climate change and global warming may be found at the EPA’s State Action Plans Web site.**
yosemite.epa.gov/oar%5Cglobalwarming.nsf/content/ActionsStateActionPlans.html.

Information also is available at NASA’s Earth Observatory Web site: earthobservatory.nasa.gov/.

The PEW Center on Global Climate Change Web site address is www.pewclimate.org.

The U.S. Global Change Research’s Web site is at www.gcrio.org/.

The U.S. Geological Survey’s Web site includes information about climate change and can be found at www.usgs.gov.
ome 61 percent of the U.S. is currently experiencing abnormally dry or drought conditions, leading many experts to label it as the third worst in history since the 1930's Dust Bowl and the 1950's drought event.

Unlike previous droughts, however, conditions are no longer limited to regional areas. Today's drought stretches from Georgia to Arizona and across the north through Wisconsin, Montana, Minnesota, and the Dakotas.

All of this dry, parched land naturally leads to a decrease in water supplies. "Many of our water supplies—rivers, lakes, and aquifers—are drawn down quite a bit. In general, they have been drawn way down so they're tenuous, and every month that the drought goes on, that continues to be the trend downward," says Mark Svoboda, a climatologist for the National Drought Mitigation Center (NDMC) at the University of Nebraska at Lincoln.

"We've been drawn down for a long time, so every drop is very, very precious. Most of the reservoirs in Wyoming, Texas, and Oklahoma are also down. In the Southwest, the smaller ones rebounded nicely after the bumper winter of 2004/05, but last winter was very dry. I don't know the exact number today, but they are still at or below half of capacity."
Recharging these water supplies doesn’t happen overnight, Svoboda added. “Hydrological drought takes awhile to build up. There’s a lag; but when you see the impact, you know you’re in a fix. You usually can’t just snap your fingers and jump out of it, hydrologically speaking,” he added.

Additionally, severe drought can be seen in 29 percent of the country, which usually carries only a 12 to 15 percent rate.

“That’s pretty significant,” said Svoboda. “We’re roughly double on the severe side that you would perhaps expect to see. In the mid-section of the country—like the Dakotas, Nebraska, Kansas—this drought has been lingering around since the fall of 1999.”

“Dwindling snowfall totals in the middle Rockies have contributed to the shrinking water supplies. The river valleys in those areas are significantly down, according to Svoboda.

**Comparisons**

Although conditions in the 1930s measure far worse in terms of temperature, rainfall, and soil moisture, when you look at need—the growing demand for water and the increasing population—many authorities believe today’s conditions rival the Dust Bowl.

There are, however, some distinct differences. Svoboda said the Dust Bowl was a very long event with excessive heat. “The 1930s were marked by persistent high temperatures year in, year out. That would be the biggest offsetting difference between this one and the Dust Bowl,” said Svoboda. “The other factor would be the upper plains over the Pacific Northwest; that area was impacted more then.”

He added that a more appropriate comparison to today’s drought would be to the 1950’s event, in terms of both its temporal length and its severity.

“The thing is, it’s hard to rank this drought because it’s not over,” he said. “If this drought goes on another two or three years, then that cumulative impact will keep occurring and compounding over the years. Then, I think you could start looking at how this drought compares to the Dust Bowl.”

Another factor that hinders comparisons is the difference in the storage capacity today. The first national conservation movement in the U.S. occurred in 1933 with the establishment of the Soil Erosion Service (SES). As the Dust Bowl swept across the Great Plains, dust storms rendered much of the land useless and accentuated the need for conserving water.

“You didn’t have the soil and water measure conservation efforts in place. I think people are much better stewards of the land, so it’s able to absorb more in some ways. On the other hand, demographics have changed. There’s been a mass population movement to the arid, semi-arid regions of the country,” said Svoboda.

“It’s pretty much a finite water supply, but yet the growth keeps going up. So the demand on the finite water supply is increasing. I would argue that our risks, our vulnerability to drought have changed. You don’t need a drought of the 1930s or 1950s to have major impacts.”

Between 1990 and 2000, the average U.S. population growth was approximately 13 percent, according to U.S. Census statistics. Over that same 10-year period, in Arizona, it was 40 percent; in Nevada, 66 percent; and New Mexico and Colorado, both more than 30 percent.

“There’s no more water than there was 20 or 30 years ago because our reservoirs were all built a long time ago, and that’s basically been about it,” said Svoboda. “The only [population increase] that was that big in the Southeast was Georgia, which was around 30 percent.”

“Today you’ve got droughts that don’t need to be as long, as severe, or as intense as the droughts of the 1950s or 1930s. You’re going to have some major impacts due to the precarious balancing act we’re doing between supply and demand. We’re more vulnerable to droughts as I think we are to most hazards now.”

**Impacts**

The most obvious impact of droughts can be seen in the agricultural field. Dying crops means dwindling feed for livestock, which, in turn, means more decline, ultimately leading to higher prices in the grocery stores and meat markets. Ranchers are forced to sell their herds, and acres of land become ripe kindling for fires.

Other impacts are pests and disease. Pine beetles can wreak havoc on trees and forests, killing trees, which also leads to dry fuel for fires. Grasshoppers have been plaguing regions of the West, damaging plants and even eating the paint off houses.

Another impact that is often overlooked is the effect droughts have on tourism. “Tourism is huge, whether it is hiking, camping, fishing, canoeing, whitewater rafting, [and people aren’t going to be] staying in parks or national forests when they’re closed down due to low flows or fire threats,” said Svoboda.

“That’s a huge amount of money that’s not going into local economies. Typically you see it at the local level. People think droughts are these national, large-area things, but really, droughts are defined by their impacts and what occurs down at that local level with small businesses and the people who are impacted by that.”

**Preparedness**

How can states be proactive and reduce their vulnerability “The whole goal is about being prepared and addressing our vulnerability to future droughts. You can’t stop the drought from occurring, but you can take measures to lessen the impacts or buffer them to get you through the rough times,” said Svoboda.

“That’s the common sense message of sustainability of water—good conservation even when times are good. There are a lot of things states can do to buffer themselves, maybe not drought proof, but at least reduce their risk to droughts in the future. We do that through planning; we do it through early warning and monitoring; and we do it through risk and vulnerability assessment. We can determine where we’re vulnerable due to droughts.”

Svoboda recounted a success story in Nebraska. He said during the drought of 2002, Nebraska experienced a lack of precipitation that rivaled the Dust Bowl. Unfortunately, at that time, a lot of cities there had only one water supply and those wells went dry for many locations.
As a result of that experience, officials identified all of the one-source systems across the state, wrote grants, and secured funding from the Bureau of Reclamation and through some emergency drought appropriations. Those communities were able to add a second source or connect to another system, which enabled water to be rerouted to them if their first system failed.

“We had about 100 communities across our state in the 2002 drought that were severely impacted to the point where they almost had to truck water into some of the areas. They identified at-risk communities, took care of the problem, and the next time the drought got bad, only five communities were in a serious situation instead of 100,” said Svoboda.

Preparedness is the flagship of the NDMC. Its Web site, www.drought.unl.edu/mitigate/status.htm, contains a list of state drought plans. Svoboda said, in 1982, there were only three states with drought plans—Colorado, South Dakota, and New York.

Today, the site lists 38 states with drought plans. “We’re making progress, but there’s still work to do,” said Svoboda.

Drought preparedness plans are designed to reduce vulnerability and dependence on emergency assistance. The Web site states, “The process of developing a plan will identify vulnerable areas, population groups, and economic and environmental sectors. The process also seeks to identify data and informational gaps and research and institutional needs.

“Ultimately, preparedness plans will improve coordination within and between levels of government; procedures for monitoring, assessing, and responding to water shortages; information flow to primary users; and efficiency of resource allocation. The goals of these plans are to reduce water shortage impacts, personal hardships, and conflicts between water and other natural resource users. These plans should promote self-reliance by systematically addressing issues of principal concern to the region or nation in question. To be successful, drought preparedness plans must be integrated between levels of government and with other national plans or strategies, such as those to ensure food security and combat desertification.”

Drought plans contain three critical components: an early warning system, risk and impact assessment procedures, and mitigation and response strategies.

Svoboda said plans across the country vary. “States will typically ask for voluntary restrictions. As droughts progress or they discover that their groundwater levels are dropping, they begin to move into more of a mandatory stance,” said Svoboda.

Global Warming

Is there a relationship between global warming and droughts Svoboda believes that what we are putting in the atmosphere is having some effect. But to what degree, he says, “the jury is still out.

“We’ve seen droughts that have been warmer and longer than today’s, so it doesn’t mean the droughts of today are attributable solely based on that,” said Svoboda.

“There’s science that says we’re getting warmer. You would think that would speed up the cycle and mean more droughts. Does that mean there will be more droughts that don’t last as long Or will there be fewer droughts that last longer That’s what we don’t know, what influence it will have on the behavior of droughts.”

Svoboda added that more data will have to be collected to define the exact effect global warming may be having on droughts. “We have to remember that droughts are part of the natural cycle, and in a lot of ways, it’s a vital part of regeneration of our environment. Droughts are a normal part of the climate cycle, and there will continue to be droughts, just like there have been. Our response to droughts is what really matters.”

For more information, contact Svoboda at msvo-boda2@unl.edu or call the NDMC at (402) 472-6707.

Natalie Eddy teaches in the journalism program at West Virginia University and writes for the university’s Office of News and Information Services.
ack when homesteaders were slowly moving to undeveloped areas of countryside, they simply diverted a stream or dug a well to meet their family's water needs. If their garden was dry, they merely used all the nearby water they wanted to irrigate it. If field crops or farm animals were parched, landowners funneled the typically unlimited supply their way.

As years went by, technology gave home and farm owners new tools to tap the Earth’s underground water. Drilling rigs set up shop and tore through the soil and rock until trickles turned to torrents of flowing water. Pumps brought subsurface water skyward as landowners' burgeoning need for water increased with each passing year. But the days of open and unlimited access to the water landowners wanted or needed are gone in many places and have been for years.

Tighter restrictions, permits, and case law dictate when, where, and how much water a user can take for consumption. Home and landowners aren't the only ones limited to water usage through permitting. Small and large municipalities also must go through the complicated water-rights processes to secure enough flow to meet consumers' needs.

Editor’s Note:
Water rights have always been a source of conflict in the arid West. The Colorado River Law is a leading example of how sensitive water rights can be. But now the eastern part of the country is staking its claim to water sources. The Great Lakes region has developed agreements with bordering states and Canada about the amount of water that be taken out of the Lakes and limiting its use to that specific region. This article is reprinted from the Fall 2001 issue of On Tap.
What is a water right?

A water right is a legal authorization to use a certain amount of public water for specific beneficial purposes. Water flowing in creeks, rivers, and bays is usually state water. This surface water is public property; however, states give individuals, organizations, and municipalities the right to pump water from a stream, creek, pond, or lake, or to impound water in a lake or pond.

In many states, laws require certain public water users to receive approval from the state prior to using the water. In almost all cases, surface waters may be used only with explicit permission of the state. Water for livestock and household uses is sometimes exempted from this requirement, so long as people who live adjacent to a stream or river divert the water.

Landowners with water flowing past, through, or under their property do not automatically have the right to use that water without a permit in some states. Often, county and rural community fire departments and other similar services are allowed to divert and use state water from streams and reservoirs for emergency use without first obtaining a permit.
Understanding who gets to use water is often a confusing process because no national water rights system exists. In its absence, state water laws have evolved with different traditions and conditions. Each state’s water allocation system—which defines the type and quantity of use—is based on the state’s individual approach to water rights.

Ralph Edwards, an attorney who works with water-rights law in California, says that the complexity of water-rights law often overwhelms his clients. “You just can’t divert water from a stream without following the prescribed legal process for using the water,” he says. “California is very specific in how a user can gain access to a water right. It can be complicated for those unfamiliar with the process. There’s no doubt about it.

"Western states follow variations on the prior appropriation doctrine, which basically means that one gets the water right by simply having used the water in the past. Eastern states generally use riparian rules and state permits for use. Riparian rights give water preferences to those who own property adjacent to the riparian or water zone from which the water is drawn. Under the riparian doctrine, only landowners with water flowing through or adjacent to their property have claims to the water."

**Riparianism vs. Prior Appropriation**

There are many factors that must be considered in allocating water to users. The first is the traditional water law doctrine that has developed in the U.S.: the older riparian principles of the eastern states and the doctrine of prior appropriation in the arid western states.

Riparianism starts with the assumption that water is plentiful and available to all riparian and littoral property owners. Under this doctrine, all water uses are allowed as long as they do not unreasonably interfere with other uses. This means that water uses that have been in place for a long period of time and any new users have equal...
rights and entitlement to the water. This doctrine works well as long as water is plentiful and there are no disputes that involve “ownership” of the resource. However, in times of water scarcity, the shortcomings of the riparian system become evident.

Prior appropriation operates on the “first-in-time, first-in-right” principle. The first or prior user’s rights are superior to later-arising uses, regardless of scarcity or social benefits. Users typically acquire rights from the state to withdraw and consume water and even in times of drought may continue to do so at the expense of subsequent users.

There is also a relative newcomer to the water-rights law that is being embraced by a growing number of eastern states, that of a hybridized version of the riparian and prior appropriation doctrines.

**States Handle Rights Differently**

Some state water laws rely on common law doctrines and court decisions over time that resolved private disputes. In other states, the legislature developed statutory and administrative arrangements that determined water rights. Water rights laws and statutes in various states are peppered with the term “beneficial use.” Beneficial uses include domestic use, irrigation, stock watering, manufacturing, mining, hydro-power, municipal use, aquaculture, recreation, and fish and wildlife. The amount of the water right is the amount of water put to beneficial use. Due to the beneficial use requirement, a water right (or a portion of a water right) may be lost if it is not used in a certain period of time in most states.

In Texas, state law requires a water-rights document for all other surface water uses, aside from household needs or for irrigating a yard or home garden. Residents may impound up to 200 acre-feet of water in stock tanks for domestic and livestock use. Texas’ various water right documents—including certificates of adjudication, permits, term permits, and temporary permits—do not guarantee that water will always be available. But some of them provide more certainty than others. Each such document has a priority date assigned to it.

Under Oregon law, all water is publicly owned. With some exceptions, cities, towns, farmers, factory owners, and other users must obtain a permit or water rights from the state’s water resources department to use water from any source, whether it is underground, or from lakes or streams. Oregon’s water laws, like many states, are based on the principle of prior appropriation. Usually the first person to obtain a water right on a stream is the last to be shut off in times of low stream flow. In water-short times, the water-rights holder with the oldest date of priority can demand the water specified in their water rights regardless of the needs of junior users.

If there is a surplus beyond the needs of the senior right holder, the person with the next oldest priority date can take as much as necessary to satisfy needs under their right and so on down the line until there is no surplus. The date of application for a permit to use water usually becomes the priority date of the right. The appropriation doctrine has been law since 1909 in Oregon when passage of the first unified water code introduced state control over the right to use water. Before then, water users had to depend on themselves or local courts to defend their rights to water.

Edwards says that in California, there are two general classes of rights to surface water: riparian and appropriative. “Within the appropriative category, there are four main sub-groups of rights: pre-1914 rights, small domestic use, small stock ponds constructed prior to 1969, and general appropriative rights obtained through the application, permit, and license process,” he says.

“In order to have a right to divert and/or store water, whether it be for domestic use or for commercial use, the person or group using the water must generally have either a riparian right or one of the types of appropriative rights. There are also certain miscellaneous water rights, including prescriptive rights and rights to a spring. Each type of right has its own nuances and required documentation.”

**How is a water right established?**

Because water rights laws vary so widely from state to state, the process for obtaining rights is also different. In Idaho, there were two ways a surface water right could be established prior to May 1971, according to the Idaho Department of Water Resources’ Web site, the agency that oversees water rights in the state. The first way was to simply divert water and apply it to a beneficial use. These water rights are called “beneficial use,” “historic use,” or “constitutional” water rights.

The priority date for a water right established by this method is
On the date that water was first put to beneficial use. The second way to establish a surface water right was to comply with the statutory method in effect at the time the water right was established. The current statutory method is an application/permit/license procedure. The priority date for a water right established by this method is the date that a person files an application with the state.

Prior to 1903, Idaho used a "posted notice" statute, which allowed water users to post notice at the point of diversion and record the notice at the county recorder’s office. The user then had to actually divert and use the water, among other things. If the statutory requirements were met then the priority date for a water right established under the posted notice statute was the date of posting the notice. Water rights established under the old statutory method are called “posted notice” water rights, but are considered beneficial-use rights because they are not confirmed by a permit, license, or decree. In May 1971, the state changed its procedures, resulting in only one way to establish a right to water, which is to follow the application/permit/license procedure the state put into effect. The one exception to this rule is for water rights used solely for watering domestic livestock in stream.

The process for gaining a groundwater right closely resembles the surface water procedure in Idaho. There is one exception to this rule: a “beneficial use” right to groundwater may still be established for domestic purposes. "Domestic purposes" is defined by statute as "water for household or livestock uses and all other purposes, including irrigation of up to one-half acre of land in connection with said household where total use is not in excess of 13,000 gallons per day." The state limits the “domestic purpose” statute by not including water for multiple ownership subdivisions, mobile home parks, and commercial or business establishments. Idaho interprets the rule of domestic exception for single-family domestic purposes only.
In California, Edwards says anyone wanting to establish a water right for small domestic use must do two things. “First, the appropriator must register with the state’s water board. Second, the appropriator must apply the water to reasonable and beneficial use with due diligence,” he says. “It is important to remember that both requirements must be satisfied. A small domestic-use right cannot be acquired simply by using the water; you must also register with the water board. Similarly, a registration alone does not give the registrant a water right. The registrant must also make reasonable and beneficial use of the water in a timely fashion.

“Once an appropriator acquires a right to appropriate water for small domestic use, the appropriator must comply with the conditions established by the Water Board in order to maintain that right,” Edwards notes. “The water board is required to give registrants a written document setting forth the conditions. An appropriator must also renew his or her registration prior to the expiration of each five-year period following the completed registration. If the registration is not renewed timely, the water board may revoke the registration.”

**Federal Rights Complicate Matters**

Not only do landowners and other groups wanting water need to understand state water rights of the reservation. Based on the western states’ prior appropriation doctrine, Native American water rights are generally senior to rights held by non-Indian users because Native Americans were often the first inhabitants of an area.

Until recent years, states and courts have made little effort to determine the quantity of water reserved for Native Americans. As a result, Indian water rights still remain largely unused and unquantified. Because these rights are not quantified, non-Indian water users with junior water rights face considerable uncertainty when planning their long-term water use. Settling or adjudicating Indian water rights can help both Indian and non-Indian water users to plan future water resources development.

But tribes have multiple interests in water. Water development is important for tribal economic development on reservations. Conversely, tribes also strongly support the protection methods of in-stream flows for fish and wildlife resources downstream. Indian rights could have a significant effect on water rights established under state law. Disputes occasionally arise regarding whether the state or a tribe (or both) have jurisdiction over non-Indian use of water on Indian reservations. Case law is mixed on this issue; so more case law may be necessary over time to provide clarity. State, tribal, and federal negotiations over

**Growing Needs Cause Disputes**

As population growth hits various regions of the country, local community leaders must strive to maintain adequate water supplies. Couple human and industrial growth with drought conditions and you’ve got the makings of a large-scale problem. And that’s exactly what happened in the southeastern states of Georgia, Alabama, and Florida.

The so-called “tri-state water war” kicked off in 1990 when Atlanta sought a permit from the U.S. Army Corps of Engineers to create reservoirs on the Chattahoochee, Flint, and Coosa Rivers.
The water wars of the West have moved east. The explosive growth of Atlanta is draining nearby rivers in the Southeast, threatening ecosystems and livelihoods in a region unused to resource shortages.

Marcello Ballve, Pacific News Service
The city cited anticipated growth and future water needs as the reason to increase its withdrawals of up to 50 percent from the Chattahoochee and Flint Rivers by 2010. The proposal set off a dispute between Georgia and its downstream neighbors, Alabama and Florida.

Alabama saw the plan as a threat to its own water supply, possibly stunting industrial and population growth in the state and resulting in degraded water quality due to the decrease in water flow. Alabama argued that the downstream flow already brings with it Atlanta’s pollution and that a decrease in the water flow would mean more pollutants that would not get diluted. Florida joined the dispute contending that the plan to siphon off more water from the Chattahoochee and Flint rivers would deplete the flow into Florida’s Apalachicola Bay and would critically injure the state’s $70 million oyster industry.

Unable to convince Atlanta to halt its plans, Alabama filed a lawsuit in federal court to prevent the Corps from implementing the siphoning plan. Florida later joined the suit. In 1992, the lawsuit was suspended pending a comprehensive study of the future water needs of the three states. Worried about what the study results might show, the three states entered into two interstate water compacts that would allow the governors of each state and one federal appointee to analyze the study’s findings and divide the water supplies accordingly.

The compacts cover two separate river systems: the Alabama-Coosa-Tallapoosa river basin and the Apalachicola-Chattahoochee-Flint river basin. The two river systems serve a wide variety of municipal, industrial, and recreational uses, and support a complex natural ecosystem. The two compacts are the first of their kind in the Southeast. While water compacts are commonplace in the water-scarce West, prior to this dispute, only one other compact was in place outside the western region.

Is the water being stolen?

While various permits, laws, and court decisions dictate how water should be delegated in a given area, the reality is that not everyone follows the rules. Water being used without a permit becomes a growing problem in times of drought and low stream or river flows. In Texas, the honor system governs compliance with water rights, according to the Texas Natural Resource Conservation Commission’s (TNRCC) Web site. However, when rainfall is low, some users may not realize that the river conditions do not allow them to divert the water flowing past their property. For example, the flow may represent stored water that has been released for downstream buyers or to satisfy environmental flow requirements for wildlife, or the flow may need to pass because downstream users have senior rights and need the water.

During 1996’s dry summer, some users complained to the TNRCC that users other than the ones intended had diverted water that had been stored in upstream reservoirs. Because of low rainfall, pumping demands had increased. To satisfy downstream purchasers, river authorities, water districts, and other water suppliers had released substantial amounts of stored water from reservoirs. In some cases, downstream users complained that the water they had purchased never reached its intended destination.

In response to complaints, the TNRCC set up a temporary water-rights protection program. The agency increased its streamflow monitoring in the river basins to detect unauthorized diversions. In addition, the TNRCC stopped granting temporary water-use permits in several key river basins. Where low streamflows rendered normal pumping sites high and dry, the agency also allowed water-rights holders to amend their permits temporarily to change diversion points in order to gain better access to their water. These amendments did not adversely affect other water-rights holders. In Oregon, state law allows water resources department personnel to enter private land to inspect and water diversion systems to ensure that water laws are obeyed.

“Watermasters” and well inspectors—who are employees of the department—usually conduct inspections. The department’s groundwater geologists also make inspections. The state’s watermasters respond to complaints from water users and determine in a time of water shortage who has the right to use water. They may shut down junior users in periods of shortage. Watermasters work with all of the water users on a given water system to ensure that the users voluntarily comply with the needs of more senior users. Occasionally, Oregon’s watermasters take more formal actions to force compliance of unlawful water users or those who are engaged in practices that “waste” water, or continuously use more water than needed to satisfy the specific beneficial use for which the right was granted.

What does the future hold?

Some say that increasing population growth will put even more stress on water utilities to provide enough water for customers in the future. Critics of the current mish-mash of water-rights laws from state to state say that without changes in policy, Americans could be short of water in the next 25 years.

Current regulations encourage inefficient agricultural water use. For example, the “use-it-or-lose-it” rule forces water-rights holders to use their entire water allotment or risk forfeiting it. In some states, rules prohibit farmers from storing or selling water they have a right to, but that is beyond their agricultural needs. While many cities search for water, critics say these regulations discourage farmers from practicing water conservation. As a result, in many areas, municipal water users suffer or will suffer chronic shortages, and governments react with severe water-use restrictions.

For more information about water rights in your state, contact your state primacy agency. For the number and address of your state primacy agency, call the National Drinking Water Clearinghouse at (800) 624-8301 and ask to speak with a drinking water technical assistant.

Living in West Virginia where water is plentiful, the only war author Jamie Knotts has battled is keeping his football field-sized garden watered during drought conditions.
Chlorine gas has a characteristic bleach odor and is yellowish in color. It is highly corrosive and irritating to the eyes, nose, throat, and mucous membranes. It reacts violently with petroleum products such as gasoline, diesel, oil, solvents, and turpentine. Chlorine gas is about 2.5 times heavier than air and will settle in low-lying areas unless there is sufficient wind for dispersal. It can form phosgene (a toxic and corrosive gas) in the presence of carbon monoxide from a fire, and it also can form sulfuryl chloride (a toxic corrosive gas) in the presence of sulfur dioxide from auto exhaust.

Despite its hazards, chlorine does not have to be a serious risk to those who handle it if they are properly trained. Although not a substitute for formal training, this how-to article discusses chlorine handling and safety practices, particularly for small water treatment systems.
Emergency Help

Don't wait until you need a phone number and then find yourself scrambling through phonebooks or scraps of paper. Make a list of all relevant contact numbers and keep them posted at several locations in the plant and office. These phone numbers should include the fire department, police department, county emergency management office, and state regulatory agency. Posting these numbers is especially important if you don't have 911 service in your area. Keep the numbers updated.

Inform the local police and fire departments of the possible hazards of all the chemicals used in your plant, especially chlorine, so they can be prepared in the event of an emergency. Organize escape plans from areas where there might be chlorine emission. Taking short cuts may not only be dangerous, they could be deadly.

Protective Equipment

Your water system should provide each operator at least one pair of rubber gloves, a dust respirator that meets the National Institute for Occupational Safety and Health (NIOSH) requirements, an apron or other protective clothing, and goggles or face masks. The system should install a deluge shower and eye-washing device where strong acids and alkalins are used or stored. In addition, the system should have a water holding tank that will allow water to come to room temperature in the water line feeding the deluge shower and eye-washing device.

The system also should make sure that respiratory protection equipment, meeting NIOSH requirements, is available where chlorine gas is handled. This equipment should be stored at a convenient location but not inside any room where chlorine is used or stored. The unit(s) should use compressed air, have at least a 30-minute capacity, and be compatible with or exactly the same as units used by the fire department responsible for responding to the water treatment plant. The unit(s) should also be tested and refreshed on a regular basis. Ask the local fire department that will respond to any emergency to inspect and test the unit(s).

The Buddy System

Having a second person at the plant when changing or handling chlorine is ideal in case one operator becomes incapacitated, the other can call for help. If you are working alone, let someone know when you are handling the chlorine. Right before going into the chlorine room, call someone who is familiar with your work and location, and then when finished, call back so they know that you are all right.

Separate Room Please

A separate room for chlorine, especially gas chlorine, is important and most states require it. This room should be enclosed, sealed, and separated from other operating areas. It also should have a shatter-resistant inspection window mounted in an interior wall that is constructed so that all openings between the chlorine room and the remainder of the plant are sealed. However, the room should have doors equipped with panic hardware assuring a ready means of escape. These doors should open outward to the building exterior.

The system should locate the chlorine room on the downwind side of the building—away from entrances, windows, louvers, walkways, etc. It must equip the room with a ventilating fan that provides one complete air exchange per minute when the room is occupied. The fan should move air as far as practical from the door and air inlet and discharge to the outside atmosphere. Also, louvers should facilitate airtight closure for air intake and exhaust.

Locate separate switches for the fan and lights outside of the chlorine room and at the inspection window. Protect outside switches from vandalism. Provide a signal light indicating fan operation at each entrance when the fan can be controlled from more than one point.

The floor of the room should be finished in a non-slip surface, and floor drains are discouraged. If a floor drain is used, it should discharge to the outside of the building and should not be connected to other internal or external drainage systems. The end of the drain should discharge to the outside atmosphere, above-grade, so as not to contaminate air inlets or entrance doors to any rooms or structures. The room should be heated to at least 60 degrees F and be protected from excessive heat.
Chlorine Leak Detection

The room should have continuous leak detection equipment with sound and visual warnings that can be heard and seen throughout the treatment plant. This unit should be calibrated and tested at regular intervals and documented. A bottle of ammonium hydroxide, 56 percent ammonia solution, should be available for chlorine leak detection. Where ton containers are used, a leak repair kit, approved by the Chlorine Institute should be provided.

Safety tips for 100- and 150-pound cylinders and one-ton containers

- Never lift a cylinder by its hood.
- Always keep the hood in place, except when the cylinder is being used.
- Never expose cylinder to heat or direct sunlight.
- Never drop or knock over a cylinder.
- Never tamper with a fusible plug.
- Always keep empty cylinders separate from the full ones.
- Always secure the empty and full cylinders with a cable or chain.
- Never store liquid or gas chlorine with ammonia.
- Do not move full one-ton containers with equipment designed to handle less than two tons.
- Do not connect liquid valves of two or more containers to a common manifold.
- Never store combustible or flammable materials near chlorine containers.
- Never attempt to weld an “empty” chlorine pipeline without purging it with air.
- Spraying water on leaking containers will make the leak worse.
- When entering the chlorine room, take shallow breaths until you are sure that there is not a chlorine leak.

Don’t wait until you need a phone number and then find yourself scrambling through phonebooks or scraps of paper. Make a list of all relevant contact numbers and keep them posted at several locations in the plant and office.

Fire:

Police:

County Emergency Management Office:

State Regulatory Agency:
Changing 100- and 150-Pound Cylinders

1. Turn valve stem clockwise to close cylinders valve.
2. Allow float in flow meter to drop to zero. Indicator on front of gas feeder should indicate no gas.
3. Wait approximately one minute. Float should remain at zero. If float flutters or does not drop to zero, valve may not be closed tightly. Make certain valve is closed before proceeding.
4. Turn off ejector, and make certain the gas supply indicator stays in the “No Gas” position by turning the “Reset” knob. If the indicator resets, either gas pressure is still present or there is an air leak in the system. Refer to instruction manual if an air leak is evident.
5. Loosen gas feeder yoke screw. Remove gas feeder from valve.
6. Replace gas cylinder
7. Remove old lead gasket. Inspect and clean mating surfaces of gas feeder and valve. Install new unused lead gasket.
9. Crack open gas cylinder valve and close quickly. Check for leaks. If leaks exist, turn on ejector and repeat steps number 2, 3, 4, and correct leaks.


10. Open gas cylinder valve, approximately one-quarter of a turn only, and leave cylinder wrench on valve.
11. Turn on ejector.

Notes:
A. Refer to gas feeder instructions bulletin for more gasket detailed instructions.
B. Contact your gas supplier if the cylinder valve or cylinder is considered to be defective.

INHALATION
- Remove victim from contaminated area.
- Keep victim warm in a reclined position with head and shoulders elevated.
- Give artificial respiration, if necessary.
- Administer oxygen as soon as possible.
- Call a physician immediately.

SKIN CONTACT
- Shower victim, removing all contaminated clothing.
- Wash affected area with soap and water.

EYE CONTACT
- Irrigate eyes with water for 15 minutes, holding eyelids wide apart.
- Call a physician immediately.
- Irrigate for second 15-minute period if physician is not immediately available.

HEALTH EFFECTS
Low concentration: burning in the eyes, nose, and throat; redness in the face; sneezing and coughing.
High concentration: tightness in the throat and chest-pulmonary edema. 1,000 ppm is rapidly fatal or even an hour at 35–51 ppm can be fatal.
Changing Ton Cylinders

1. Turn the valve stem clockwise to close ton container valve.
2. Allow float in flow meter to drop to zero. Indicator on front of gas feeder should show red indicating no gas. All liquid must be vaporized from the trap.
3. Wait approximately one minute. Float should remain at zero. If float flutters or does not drop to zero, valve may not be closed tightly. Make certain valve is closed before proceeding.
4. Turn off ejector and make certain the gas supply indicator stays in the “No Gas” position by turning the “Reset” knob. If the indicator resets, either gas pressure is still present or there is an air leak in the system. Refer to instruction manual if an air leak is evident.
5. Loosen gas feeder yoke screw. Remove gas feeder from valve.
6. Replace ton container. Make sure the full container is oriented with the valves in the vertical position, one valve above the other.
7. Remove old lead gasket. Inspect and clean mating surfaces of gas feeder and valve. Install new unused lead gasket.
9. Be sure heater is plugged in and operating. An operating heater provides the heat of vaporization to any trapped liquid.
10. Crack open gas cylinder valve and reclose quickly. Check for leaks. If leaks exist turn on ejector and repeat steps number 2, 3, 4, and correct leaks.

11. Open ton container valve slowly approximately 1.4 turn only and leave cylinder wrench on valve.
12. Turn on ejector.

Notes:
A. Refer to gas feeder instructions bulletin for more gasket detailed instructions.
B. Contact your gas supplier if the cylinder valve or cylinder is considered to be defective.

References:
Public Water System Design Standards, 64CSR77, West Virginia Bureau For Public Health, Office of Environmental Health Services, Environmental Engineering Division, Section 7.
Occupational Safety & Health Bureau, Montana Department of Labor & Industry. Chlorine Safety.

NESC Engineering Scientist Zane Satterfield is a licensed professional engineer and previously worked for the West Virginia Bureau of Public Health, Environmental Engineering Division.
Do we have a water problem?
Using Social Marketing to Solve Problems
By Jeff Hoffman, President, The Hoffman Agency

A recent seminar on environmental communications posed a hypothetical: How do you get people to reduce fertilizer and pesticide use?

An official from a state’s department of environment protection answered, “Just tell them to stop. They know how bad it is.”

Maybe yes. Maybe no.

Water managers traditionally take a top-down approach to attempt to conserve and protect the quality of our water resources. We’re often told what we can’t do or given recommendations that drastically change lifestyles. The general public perceives such messages as negative and unrealistic.

People don’t want to be told they are bad—or wrong—in their behaviors. Most people truly believe they do not contribute to increased nitrogen levels in our waterways. Nor do they believe they use too much water. (But they will point fingers at their neighbors, businesses, and golf courses.)

Most people want to do the right thing—as long as they’re told what the right thing is, why it is important, and that it is easy to adopt in our modern lifestyles.

As an attempt to help the public ease into a reduction in water use, water management districts and municipalities give away or provide rebates for low-flow toilets, showerheads, faucets, dishwashers and clothes washers. Millions of these water-saving devices are now in American homes. And water managers have a metric to measure the amount of water saved.

Easy and done, you say.

Maybe yes. Maybe no.

Sure, water-efficient devices help save water, but some water managers (often behind closed doors) fear that they are not addressing the real issue—behavior change.

That’s where social marketing comes in. This method of applying commercial advertising and marketing techniques to advocate behavior change, long an ally in health issues, is relatively new to environmental issues. Social marketing starts with reality and moves the public gradually.

It studies behaviors, motivations, and inspirations before crafting messages that resonant with audiences.

Studies suggest that we are bombarded with some 3,000 different marketing messages daily. That’s 3,000 messages that compete with a simple message to turn off the water when brushing, or that pesticides run off into storm drains.

Those flyers on 101 ways to save water are no longer enough.

A good social marketing campaign can help. Three themes are key—fear, facts and fun.

Fear has greatest impact during emergencies. People react immediately when seeing physical changes in water quality or supply (polluted rivers or drying reservoirs). But fear is a temporary motivator. When the situation returns to normal, people revert to pre-emergency behaviors.

Facts are always appreciated by the public—as long as facts are simple and easy to remember. Most people will comply with behavior-change suggestions as long as they understand—and believe—the reasons given.

Fun is a social marketer’s secret weapon. People decide to read, watch, or listen to a message in fewer than three seconds. Humor, energy, and upbeat messages engage audiences long enough to ensure memorability.

At stake is having new behaviors seen as socially responsible. The best way is through a well-planned and orchestrated, broad-based media communications campaign. Cost efficiencies can be achieved, and, best of all, water managers can show us that we all benefit when we all participate in positive change.

Jeffrey R. Hoffman is president and chief strategist for The Hoffman Agency. He is a 25-year marketing communications professional with expertise in social marketing, behavior change marketing, and public relations. For more information, contact The Hoffman Agency, 1056 Hendricks Ave., Jacksonville, FL 32207, jhoffman@thehoffmanagency.com, or call 904-398-9663.
Looking for National Drinking Water Clearinghouse products?

For the last five years, we’ve printed a list of our products in *On Tap*. Like many other organizations, though, we’ve had to cut costs. So, we won’t be running the product list here anymore.

Rest assured we still have hundreds of free and low-cost products. You may peruse these items on our Web site at www.ndwc.wvu.edu.

If you don’t have Internet access or you’d like to discuss your particular situation, please call us toll free at (800) 624-8301 and select option “3” to talk with one of our technical assistance specialists.
The National Environmental Services Center (NESC) exists to help small and rural communities with their drinking water, wastewater, environmental training, solid waste, infrastructure security, and utility management needs and to help them find solutions to problems they face. Our staff of environmental specialists, engineers, certified operators, technical writers, editors, and trainers understand the latest technologies, regulations, and industry developments. Over the last 25 years, we’ve helped thousands of communities find solutions to their environmental problems. We’ve also helped thousands of individuals learn more about environmental issues.