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The global construction industry’s emerging growth markets
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The specification is the most important tool a plumbing engineer has when helping a client choose a contractor for a water treatment system. From his numerous years in the water treatment industry, the author explains how to write a detailed and fully engineered specification to secure the best available solution.

Larry Zinser

THE GLOBAL CONSTRUCTION INDUSTRY

In spite of what is currently reported on the news about the present global economy and the global construction industry, the medium and long-term outlooks for this hard-hit industry actually look bright. The author explains which sectors and markets will be experiencing growth in the coming years and highlights emerging markets around the world.

Ted Garcia

CONTRACTING FOR HIGH-PURITY WATER

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How NSF 350 Helps Plumbing Engineers Address the Growing Concern About Water

The recent 2011 Global Online Environment and Sustainability Survey by Nielsen says that concern about climate change and global warming among consumers around the world took a backseat to other environmental issues such as water shortages and water pollution. While climate change remains a very important concern, the level of concern for water issues is growing.

Some reasons for this increasing awareness in the United States were realized on August 31, when 81 percent of Texas, 69 percent of Oklahoma, and 17 percent of Kansas were in exceptional drought conditions. In cities, the more pressing problems are due to combined waste and storm water system overflows, known as CSOs. The concerns of rural areas can be illustrated by the actions of King County in Washington state, which approved a measure that allows rainwater captured from roofs to be the sole residential water source. One reason for the measure is that extending public water lines or digging wells is not always an option or even feasible in rural and rugged areas.

To help solve some of these problems, areas are developing new graywater and water-harvesting standards, and a variety of systems already is on the market. At the same time, various regulations exist across the country and around the world. To help regulators, designers, contractors, and users address these different regulations, NSF International developed NSF 350: On-site Residential and Commercial Reuse Treatment Systems earlier this year. The purpose of NSF 350 is to establish minimum materials, design and construction, and performance requirements for on-site residential and commercial reuse treatment systems.

WHAT TO KNOW BEFORE DESIGNING A WATER REUSE SYSTEM

If systems are not designed, installed, or maintained properly, they can be more than a nuisance; they can harm the public health. Because of this, the plumbing engineer should do some research before designing a system.

Basic System Design

First, you should know the different types of systems. Rainwater harvesting, sometimes called rainwater catchment, is different than graywater reuse, and both are different than the reuse systems utilized by local utility providers.

The fundamental elements of a system design also are important to know. For example, roofs collect dust, bird droppings, and other contaminants during periods of no rain. As a result, the first flush of water from a roof should not be collected. Many products and methods are available to divert this first flush.

Some states offer free rainwater harvesting manuals, so search the Internet for any applicable references. ASPE and the American Rainwater Catchment Systems Association (ARCSA) offer design guides and informational webinars as well.

Graywater Definition

NSF 350 defines graywater as “wastewater from water-bearing fixtures, including residential clothes washers, bathtubs, showers, or sinks, with the exception of toilets, urinals, bidets, kitchen sinks, and dishwashers.” Keep in mind that even though discharge from clothes washers, showers, and bathtubs is acceptable in NSF 350, some local regulatory agencies may exclude wastewater from these fixtures.

Materials

Some areas may require purple pipe markings that meet EPA recommendations on rainwater harvesting and graywater system piping inside and outside the building. Many manufacturers provide this piping with the EPA-required labeling.

Storage Tank Testing

NSF 350 contains testing procedures for belowground tanks, and visual testing is acceptable aboveground. When designing a system, you may want to perform more testing on these tanks than what NSF requires.

Electrical Components

NSF 350 requires NFPA 70: National Electrical Code as a minimum. Rainwater harvesting systems are usually installed outside, so you may want to include more electrical provisions to account for wet conditions as well as emergency or backup power for pumping and control systems.

Access Ports

In addition to the NSF 350 requirements, access panels should be located in areas inaccessible to the public so children or pets cannot be trapped.

Sensing and Signaling

NSF 350 requires local high-water signals, as well as a remote telemetry to signal the owner. This is a basic level of sensing that should be installed in a system. All systems will have a filtering system on the dis-
charge, so some way to monitor the filtering system should be included. All sensors should report to a building management system. Sensors can be included to show when the system is using potable water backup. Water meters should be monitored as well.

Flow Design
NSF 350 requires the system’s storage capacity to equal 500 percent of the daily rated treatment capacity. Other important factors regarding flow are as follows.
- Rainwater: The rainwater piping system in a building shall meet code in the event the rainwater collection system is not in operation. When rainwater and storm water flow into a storage tank, the overflow of the tank must be designed to handle the full flow out to the site storm water system. The system cannot overflow inside the building during high rain events. The system should have a bypass to allow the water to flow around the collection system. The bypass and overflow should not rely on mechanical systems.
- Graywater: The same issues as rainwater harvesting apply to graywater systems. The system bypass shall be designed to handle the entire load of the piping system. The overflow shall flow unrestricted to the municipal waste system.
- Pumped discharge: If the overflow or bypass depends on a pumped system to lift the discharge flow to a gravity system, the lift station shall be designed to meet the same regulations as all storm water or waste lift stations.

Water Use
You must be aware of what systems will use the rainwater or graywater. After the water is collected, it can be used for many different purposes, such as landscape irrigation, sidewalk washdown, mechanical makeup, and supply water to flush fixtures. Each system has a different set of conditions that must be met.

Criticality of the Water
Will the water be used for a critical system? For example, will it be used to back up the fire protection sprinkler or hose demand? In such cases, many other standards, including those by NFPA, must be met. The water also can be used as a critical backup to cooling systems, which is particularly important in industrial, laboratory, and healthcare facilities.

Regulations
During the approval process of a new system, many different regulatory agencies may be required to work together, such as the building department, plumbing department, municipal storm water agency, or health department. For example, different agencies may be involved depending on whether the piping is aboveground or belowground. The rules and regulations also vary from jurisdiction to jurisdiction. For instance, when using harvested rainwater or graywater for landscape irrigation, some states require the piping to be sleeved when it crosses a potable water line.

Backup Connection to Potable Water Supply
Most systems will not be isolated without any connection to a public water backup system to supply water until the reuse system refills. The public water supply also can provide water to the system when the alternate water system is out of service. Here are some issues to keep in mind.
- Cross-connections: Most of the time, an air gap and/or a backflow preventer is required. Most areas have local regulatory officials who handle cross-connection concerns.
- Dead-end runs: Some systems will operate for long periods without any potable water backup. As a result, the potable line has little or no circulation, which can raise many concerns that include contamination and Legionella growth. The length of the line feeding the system should be decreased as much as possible and dead-ends should be avoided.
- Keeping the line clean: Another measure to keep the supply line clean is to have a system in place that activates the supply water line on a regular basis.

Sizing the System
Using a rainwater system as an example, for the system to operate properly, the plumbing engineer will need to conduct a data-balancing act that is as accurate as the weather data on which it is based. The system should collect enough water during rain events to last through dry events. However, the record-breaking rainfalls and droughts of the last few years have made this more difficult. The owner and operator must be aware of the local conditions so they understand the level of risk they are taking with the system. Another important element in sizing the system concerns the budget and the amount of space that is available.

Water Quality Testing Maintenance
NSF 350 requires startup and testing procedures with a manufacturer’s representative when the system is placed in service. It also requires a graywater challenge to test the water quality with water samples. Each type of water going into the system has unique design loading criteria. Most regulatory agencies will require a test plan to be in place, and local jurisdictions will require testing at different times. Services and electronic data-collection systems are available to help the owner and operator perform the tests and obtain the required data.

Storm Water Retention
Rainwater harvesting systems can incorporate storm water retention in the storage system. This additional load will have to be added to the storage calculation, and it will require an additional discharge to the storage system.
Water Quality in Discharge Areas

Water quality standards and levels must be met for the different types of systems. Here are some hot issues regarding these systems.

- Plumbing flush fixtures: Flushing a fixture will aerate water particles into the air that can be inhaled. As a result, the quality of this water can be near to drinking water quality standards. Another issue is if the water is clear. Some owners do not want the water in their water closet or urinal bowls to be colored. Fixture manufacturers have warranty requirements for the quality of the flushing water, and some manufacturers will not warranty the fixtures if graywater or rainwater is used.

- Irrigation: Similar to flush fixtures, this water vapor can be inhaled, and odors are another concern. Contaminants also can clog sprinkler heads.

- Other systems: An interesting story involves a project in Arizona that plans to use reclaim water from a wastewater treatment plant to make snow for a ski resort. The Hopi Tribe that is located near the resort has sued the city of Flagstaff for maintaining a contract to sell treated wastewater for snowmaking at the Arizona ski resort. They claim that the “snow” will damage their land.

Storage Options

Many locations above- and belowground are available to store rainwater and graywater, and many different types of materials are available for the tank. Designers should be aware of the concerns with the locations and types of materials that can be used. In new construction, the storage tanks can be incorporated into the underground structure of the building.

Energy Use

Some people are concerned that these systems actually use more energy than conventional municipal potable water systems. To alleviate these concerns, you can use energy-efficient motors on pumps, such as variable-speed pump systems to help with efficiencies.

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Metering Data Collection

Meters should be installed on the discharge and on the domestic water makeup to the systems.

This is not a comprehensive list of design issues for rainwater, graywater, and alternate water systems. The key is to coordinate all projects with local and state officials and to keep aware of regulatory changes. After long droughts, local officials typically start looking for ways to conserve water. As a result, more areas will be considering these types of systems, so you should be knowledgeable about the issues to take a lead in your area.
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For a number of years we have observed positive movement in the area of water conservation. As with any good thing, issues eventually arise that cause us to review the reasons we are trying to implement good design practices. I don't know of anyone who would state that sustainable design is not a good thing, and in my opinion we should be trying to do everything we can to promote sustainable solutions in our designs. However, we should discuss some specific aspects of our designs to make sure that we are taking the proper precautions to make our systems work better.

Back in 1993, we had to rethink the way we were designing drainage systems when we began to have issues with clogged drains. As a result of the Energy Policy Act, water usage in water closets was reduced from 3.5 gallons per flush (gpf) to 1.6 gpf. Unfortunately, the fixture manufacturers were not ready for this legislation, and many problems with fixtures not operating properly—not to mention the drainline issues—started to occur. As a result, we decreased the pipe sizes in our drainage systems and reviewed how plumbing systems were connected to drainage systems, and we were able to alleviate most of the problems.

Fixture manufacturers have figured out how to make their fixtures flush efficiently at low flows, and in some cases they perform extremely well even at 1.28 and 1 gpf. The manufacturers have done their due diligence in making sure the fixtures are working properly, so why are we starting to see issues with clogging again? I believe it is not from the reduction in water usage in water closets, but rather the reduction in water usage in other fixtures. We have reduced the water being used in urinals from 1 gpf to 0.125 gpf—when we use water at all. We also have reduced the water used in lavatories to 0.5 gallon per minute (which has been in place for a long time), and we have reduced the water usage in every other water-consuming fixture as well.

So what have we done? We have reduced the flows to an extent that we need to again rethink the way we are piping our systems and review the general physics of our systems. Basically, it boils down to the cross-sectional area of flow (hydraulic radius) and the minimum velocity in the drainage piping system. By reducing the amount of flow in the piping system, we also need to reduce the cross-sectional area of flow to move the waste through the piping system.

As an example, if you take a gallon of water and place it in a 1-foot section of pipe, it will take up a certain area of the pipe. If you reduce the pipe by one size, the same amount of water would create a deeper cross-sectional area of water.

We are trying to achieve a minimum flow velocity of 2 feet per second (fps) in our gravity drainage systems. With less water being available for use in the system, we need to review what impact the reduction in flow will have on the minimum velocity of flow in the piping system. Remember: the premise of maintaining a 2-fps velocity is to keep solids moving down the piping system.

In addition, the manner in which we pipe fixtures also can have an impact on how the drainage system will operate. By putting fixtures that do not produce solid waste upstream of fixtures that do produce solid waste, we can use the water to move the solids through the drainage system. Water closets are designed to move solid waste away from the fixture to a distance of 40 to 60 feet and sometimes farther, but they cannot move the waste for an indefinite distance. Thus, we need to be able to move the waste farther down the drain with other fixtures or subsequent uses of the water closet. The point is to be aware of these issues when you have a toilet room that is a long distance from the other fixtures in the system. You may need to consider putting a hose bibb, mop sink, or other fixture at the end of the run so water can be periodically introduced into the system.

While this situation may not be occurring in every system we design, it is starting to happen again. I hope that you will take the time to review your designs to make sure that you have taken into account the need to deal with the amount of water reduction you have incorporated into your systems.
When you’re designing a drainage system, whether it’s a commercial kitchen, resort hotel, or sanitary manufacturing facility, your specification can make all the difference. Every aspect, from surface drainage to piping, can contribute to the optimum design.

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How to Conduct a Fire Hydrant Flow Test

Fire hydrant flow tests determine the flow rate and pressure in any location throughout a water company’s or water authority’s underground water distribution system. Fire hydrants are tested regularly to ensure that they are capable of providing water at an acceptable pressure and flow rate for public health and firefighting operations. NFPA 291 (2010): Recommended Practice for Fire Flow Testing and Marking of Hydrants recommends that a residual pressure of 20 pounds per square inch (psi) be maintained in fire hydrants for them to be effective for firefighting and preventing the contamination of public water supplies by backflow.

Performing a fire hydrant flow test provides the actual static (non-flowing) pressure, residual (flowing) pressure, and the flow from the hydrant. In addition, it is also necessary to perform a flow test to properly design a fire sprinkler system for a commercial or residential structure. A flow test is required in most jurisdictions and is critical for proper fire sprinkler system design. Incorrect readings can result in additional fire pumps for under-designed systems or costly overdesign in pipe sizing.

TYPES OF HYDRANTS
The two main types of fire hydrants are wet barrel and dry barrel. In a wet-barrel design, the hydrant is connected directly to the pressurized water source. The upper section, or barrel, of the hydrant is always filled with water, and each outlet has its own valve with a stem that sticks out the side of the barrel. In a dry-barrel design, the hydrant is separated from the pressurized water source by a main valve in the lower section of the hydrant belowground. The upper section remains dry until the main valve is opened by means of a long stem that extends up through the top, or bonnet, of the hydrant. There are no valves on the outlets; however, some dry hydrants have ¼-inch outlets to attach pressure gauges, eliminating the need to remove the cap to attach a pressure gauge. Dry-barrel hydrants typically are used where winter temperatures fall below freezing.

HYDRANT CLASSIFICATIONS
Fire hydrants are classified at 20 psi residual pressure, and the hydrant tops and nozzle caps are color coded in accordance with NFPA 291 based on flow results obtained through field testing (see Table 1). Private hydrants can be painted at the owner’s discretion and usually are painted yellow or another color to distinguish them from public hydrants.

BEFORE THE TEST
It is important to notify the water company or water authority before conducting any water flow test, since opening the hydrant could disrupt normal operating conditions in the water distribution system in that area. You should have the proper equipment on hand, including a flow test kit with the correct nozzle size to attach to the hydrants. A water diffuser and sock can prevent damage to landscaping and roadways as well as redirect water to prevent ice patches on surfaces in the winter. Also, ensure that drains are not blocked by leaves or other debris to prevent water backup.

According to NFPA 291 Section 4.3.6, “To obtain satisfactory test results of theoretical calculation of expected flows or rated capacities, sufficient discharge should be achieved to cause a drop in pressure at the pressure hydrant of at least 25 percent, or to flow the total demand necessary for firefighting.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Bonnet and Outlet Cap Color</th>
<th>Rated Capacity (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class AA</td>
<td>Light blue</td>
<td>1,500 or greater</td>
</tr>
<tr>
<td>Class A</td>
<td>Green</td>
<td>1,000 to 1,499</td>
</tr>
<tr>
<td>Class B</td>
<td>Orange</td>
<td>500 to 999</td>
</tr>
<tr>
<td>Class C</td>
<td>Red</td>
<td>Less than 500</td>
</tr>
</tbody>
</table>

Table 1  Fire Hydrant Classifications

Figure 1  Test area sketch
PERFORMING A HYDRANT FLOW TEST

While some flow tests can involve many hydrants flowing at the same time, the following example uses only one flowing hydrant.

It is best to conduct a flow test during peak hours in the morning to reflect the worst-case scenario. Street pressures can fluctuate as much as 10 psi in the morning compared to the afternoon or night when demand is low. Having a sketch of the site is also a good idea (see Figure 1).

During the flow test, be sure to collect the following information:
- Date of hydrant test
- Hydrant location (street name)
- Time of day the hydrant was tested
- Static reading at pressure hydrant B (pressure in the system with no flow)
- Residual reading at pressure hydrant B (pressure during full flow)
- Flow reading (using pitot gauge) at hydrant A
- Water main diameter (in inches)
- Hydrant outlet size and type (coefficient of discharge)
- Hydrant elevation

Follow the steps below to perform a single-hydrant flow test.

1. Locate the test area by choosing the closest hydrant downstream of the building supply line. This will be used to gather pressure readings. Next, select the subsequent downstream hydrant as the secondary flowing hydrant to obtain your pitot reading.

2. Remove the nozzle cap on the pressure hydrant and attach a pressure gauge to the outlet. Note: If the hydrant has a ¼-inch outlet to attach pressure gauges (only found on dry-barrel hydrants), remove the plug and install the gauge in the ¼-inch outlet. Then completely open the valve and take the static pressure reading. No water should be flowing.

3. Note any elevation changes from the pressure hydrant to the structure and the flowing hydrant.

4. Completely open the valve on the flowing hydrant, making sure the path of flow to the drain or pathway is safe and clear of debris and obstacles. Note that it may be necessary to use a diffuser.

5. Record the residual pressure from the pressure hydrant gauge after the pressure needle stabilizes. This could take several seconds of flow from the secondary flowing hydrant.

6. Record your pitot reading by inserting the orifice of the pitot tube into the center of the flow of water and away from the opening at half the diameter of the opening (see Figure 2). The centerline of the orifice should be at a right angle to the plane of the face of the hydrant outlet.

7. Close the hydrant slowly to avoid undue surges and damage to the underground system and equipment.

8. Insert your hand into the back of the hydrant outlet to verify whether the outlet is smooth and rounded, square and sharp, or square and projecting into the barrel (see Figure 3). Record the outlet size and type and include that information with the rest of the data from the flow test.

9. After closing all valves, verify that they are free of leaks, and ensure that the hydrant is returned to service condition.
CALCULATING THE RATE OF DISCHARGE
After successfully completing the flow test and recording the information, enter the test data into the following formula to determine the rate of gallons per minute (gpm) discharged from the outlet of the hydrant.

\[ Q_F = 29.84(c)(d^2)\sqrt{p} \]

where:
- \( Q_F \) = Total residual flow during the test, gpm
- \( c \) = Coefficient of discharge (see Figure 3)
- \( d \) = Diameter of the outlet, inches
- \( p \) = Pitot pressure (velocity head), psi

For Example
Calculate the total residual flow using the following data:
- Static pressure = 59 psi
- Residual pressure = 44 psi
- Pitot pressure = 26 psi
- Outlet size = 2.5 inches
- Outlet type = smooth and rounded = 0.90 coefficient of discharge

\[ Q_F = 29.84 \times 0.90 \times 2.5^2 \times \sqrt{26} \]
\[ Q_F = 29.84 \times 0.90 \times 6.25 \times 5.09 \]
\[ Q_F = 854 \text{ gpm} \]

CALCULATING THE HYDRANT FLOW
Fire hydrant flow is measured at 20 psi. Use the following equation to obtain the fire hydrant flow in gallons per minute at 20 psi.

\[ Q_R = Q_F \times \left(\frac{h_r}{h_r + h_i}\right)^{0.54} \]

where:
- \( Q_R \) = Flow predicted at the desired residual pressure, gpm
- \( Q_F \) = Total flow measured during the test, gpm
- \( h_r \) = Pressure drop to the desired residual pressure, psi
- \( h_i \) = Pressure drop measured during the test, psi

Continuing the Example
Using the previous example, calculate the total flow at 20 psi.
\[ Q_R = 854 \times \left(\frac{59 - 20}{59 - 44}\right)^{0.54} \]
\[ Q_R = 854 \times (2.6)^{0.54} \]
\[ Q_R = 1,430.68 \text{ gpm at 20 psi} \]

After successfully conducting the flow test and calculating the flow to 20 psi, enter the hydraulic information into a design software program and begin the sprinkler system design process. Be sure to contact the water department if the hydrant markings do not match the flow rate for the hydrant. It is also important to use current flow test data that is less than three years old. (Some jurisdictions may require more current data.) Always verify this requirement with the local authority having jurisdiction.

Paul McCulloch is the technical sales representative for Fire Safety at Uponor North America. He has more than 15 years of professional experience in fire sprinkler design and extensive knowledge in U.S. and Canadian building and fire codes. He is NICET Level III certified for fire sprinkler design and is a professional member of ASPE and NFPA. For more information or to comment on this article, e-mail articles@psdmagazine.org.
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Environmental Aspects of Plumbing

by Richard J. Prospal

This is the first part of a paper originally published by the World Plumbing Council in 2010 to foster awareness of the role that the plumbing community plays in developing, promoting, and installing energy-efficient products and renewable systems to provide sustainable heating, safe drinking water, and sanitation to the world. Among the topics and issues discussed in this feature and the second part to be published in the January/February 2012 issue are water supplies, sanitation, and renewable energy systems.

“Water, water everywhere and nary a drop to drink,” an adage coined many years ago by Samuel Taylor Coleridge in *The Rime of the Ancient Mariner*, could be a very valid claim today with drought striking many parts of the world and much of the clean water in peril from runoff pollution and misuse.

Water is an essential building block of our environment. Nothing in our ecosystem can survive for very long without water. We can’t. Our crops cannot. Our food supply would disappear without water.

Long ago some very wise people devised a way to deliver water where it was needed and then to take it away once it was used and no longer fit for consumption. This art or science became known as plumbing—thus the connection of plumbing and the environment.

The plumber and the plumbing community are the people that:

- Install and maintain the systems that deliver the good quality water
- Install and maintain the sanitary systems that collect and take wastewater to a disposal site
- Install and maintain the water reuse systems, whether they be rainwater harvesting, graywater systems, or black water systems
- Help create an awareness of water conservation and pollution control

The challenges of providing drinkable water are found in every part of the world. In the developed countries, long periods of drought, population expansion to areas with little access to indigenous water, and pollution of our streams and rivers create many challenges to providing good quality water. The developing and underdeveloped countries experience similar challenges along with those of an ever-expanding population, a lack of infrastructure for distribution of drinkable water, and, in some instances, a lack of concern by the governmental officials to help solve the problem. The annual growth of the world’s population exceeds 75 million people—this has major implications for water supply.

More than 17 percent of the global population lacks access to improved water sources. This is over 1.1 billion people, with two-thirds of them on the Asian continent.
More than double that number of people lives without access to improved sanitation. Safe drinking water and proper sanitation should be considered a basic human right. Until the entire world accepts this principle, we will not be on our way to defeating the infectious diseases that plague the developing countries.

The scarcity of drinkable water is quickly becoming more than just an environmental issue; it is also a social and political issue around the globe.

This paper will address many of these challenges in order to, one, increase the awareness and, two, attempt to create the dialogue to promote the solutions to these challenges.

Water, Water Everywhere
Where does it come from?

Our water, the water we drink, the water we bathe in, the water we sail upon, has been around for billions of years. Without water, life as we know it could not exist. There is just so much water; we cannot make any more, so we must keep using it and reusing it over and over again. Water is in a continuous cycle, always moving and changing states from liquid to vapor to ice and back again. This is commonly referred to as the water cycle or the hydrological cycle (see Figure 1).

There is no real starting point to the water cycle, but it is probably best to start with the vast oceans of seawater. Some of this seawater evaporates into the air as vapor. Ice and snow also contribute water vapor to the air by the process of sublimation. This vapor is taken up into the atmosphere by rising air currents. Water vapor transpired from plants and grasses and water evaporated from the soils add to this phenomenon. All of this vapor, exposed to the cooler temperatures, condenses and causes the formation of clouds. The air currents move the clouds around the globe. Under certain conditions this condensation falls from the sky as precipitation—rain or snow. The snow can accumulate as ice caps or glaciers, which can store frozen water for thousands of years. The snow pack in the more moderate climates eventually thaws, and the melted water flows into the streams, rivers, and lakes. Some of the snowmelt and rainwater seeps into the ground as infiltration to recharge the many aquifers and wells. Over time, much of this water finds its way back to the oceans where the water cycle ends to begin the cycle all over again. More than 96.5 percent of the world’s total water supply is stored in the oceans. It is also estimated that the oceans supply about 90 percent of the evaporated water that goes into the water cycle. Freshwater represents only 3 percent of all of the water on Earth.

More than 68 percent of that freshwater is trapped in the polar ice caps and glaciers; over 30 percent is in groundwater, leaving less than 1 percent in the lakes and rivers of the world. Nearly 20 percent of that lake water is in the Great Lakes system in the USA, another 20 percent is in Lake Baikal, Siberia, on the Asian continent, with the balance in all of the lakes, rivers, and streams throughout the world. Many of the greatest rivers of the world, like the Colorado and Río Grande in the United States, China’s Yellow River, and the Indus in India, often run dry before they reach their terminus because of the many urban areas that use them as their water source and the extensive agricultural irrigation along the rivers’ paths.

This freshwater is the water that we, as members of the plumbing community, need to safeguard and protect. This is the only available water that we use every day for growing things, for drinking, for bathing, for washing, and for sanitation.

Research has now established that the impact of climate change will be seen through changes to the water cycle, which will lead to increased water scarcity and flooding. These changing conditions will pose huge adaptation challenges to the water sector and will considerably influence how it manages its assets and infrastructure.

Climate change is not someone’s pipe dream or a passing fad. It is, however, a moment in our history (right now, today, and tomorrow) that may be the turning point where we must get serious about our stewardship of the environment. It is about our taking care of the planet and its resources without going too far to the left and creating more negative impact.

Value of Clean Water
The value of anything is only what people are willing to pay for it or are willing to give up for it. Water is life. Water is wealth. Right today, oil is the root cause of many economic discussions and most probably the cause for many battles and wars. In the future, we could very well see wars raged over the ownership of water.

In the developed countries, water is taken for granted because it’s cheap and readily accessible; however, because it’s priceless it should not be seen this way. There is a surprising connection between the quality and availability of water and healthful longevity of life. All over the world and throughout time, wherever you find the cleanest, drinkable water, you find a healthy, vibrant group of people. With our body being more than 70 percent water and the fact that water controls virtually every aspect of our life, we can begin to understand its importance.

“Water use increased six-fold during the 20th century, more than twice the rate of population growth. While water consumption in industrialized countries runs as high as 100 gallons per capita per day in the United States and 34 gallons per capita per day in Germany, in developing countries 5–7 gallons/capita/day are considered enough to meet basic human needs.”

“The UN Children’s Fund says bad water and lack of proper sanitation are killing more than 1.5 million children under age five every year. A new report by UNICEF shows the world, generally, is on track to meet the UN goal of halving the number of people with unsafe drinking water by 2015, but will miss a similar goal for sanitation.”

As stated in a World Health Organization study, water can lead to great economic development for any region of the world. “Improved water supply and sanitation and water resources management boost countries’ economic growth and contribute greatly to poverty eradication. The required financing for improved water supply and sanitation and water resources management is a sound public and private investment strategy that boosts economies and that allows individuals and households to explore new livelihood opportunities as well as businesses to increase productivity and production and venture into new markets. Investments in the water sector—sanitation in particular—must be acknowledged for the economic benefits they generate. Seen this way, the economic benefits outweigh costs considerably.”

At the International Emerging Technologies Symposium, August 19 and 20, 2008, Kamal Khokhani of Akar Info Media stated that India, as a country, at 1.1 billion persons
and growing, has 16 percent of the world’s population but yet only 4 percent of the world’s freshwater. He stated that by the year 2020, that freshwater supply will run out if conservation and water-efficiency measures are not implemented immediately.

Types of Potable Water Systems
There are many types of water-delivery systems. All have some good points, and many have bad points.

- Municipal systems that receive their water from lakes, rivers, streams, and reservoirs: These systems typically have filtration plants with an underground distribution system of piping, valves, pumps, etc. These types of systems are found throughout the developed countries of the world.
- Municipal systems that receive their water from aquifers (ground water) and deep wells (bores): These aquifers can be quite large, some being quite deep with others closer to the surface called surficial aquifers. These surficial aquifers are very vulnerable to contamination by pollutants (fuel spills, landfill discharge, industrial discharge, and saltwater) that can leach through the shallow limestone bedrock.
- Private wells (bores) can provide a water supply to a residential or commercial building or buildings. These systems are typically maintained by the user, although the regional governmental agency or health departments, in some instances, are responsible for the quality of the drinking water. These wells (bores) are normally classified as shallow, less than 100 feet (30.48 meters) deep. A deep well (bore) is generally considered to be a better source of water since it is less susceptible to contamination and the depth of the aquifer usually fluctuates less than the water in a shallow well. Well (bore) water is usually satisfactory for drinking because of the natural filtration created as the water passes through the geological formations. However, when there is an excess of dissolved minerals or gases, treatment of the water becomes necessary.
- In the undeveloped regions of Africa, India, Central America, and China, water sources are often a mile or more walk away and are usually muddied and undrinkable. There are many organizations that are drilling wells (bores) in these communities to provide good quality drinking water.

Water Treatment
“The most simple and basic water treatment used around the world today is essentially not much different than that developed during the Roman Empire. Unfortunately, the ancient Romans knew nothing about many of the demands on today’s water systems, such as how to treat waste from toilets, hospitals, laboratories, and industrial facilities. Combining extremely dirty waste from water closets with moderately dirty water from showers and sinks with clean rainwater and very clean air-conditioning condensate creates large volumes of wastewater that is only as clean as its dirtiest source.”

Primary water treatment differs based upon the source water. When the source is a lake, river, or stream, etc., the water...
first passes through a screening process to remove fish and other large items. Then depending on the quality of the water, the source water passes through a series of treatments that can include aeration to remove undesirable gases such as carbon dioxide, hydrogen sulfide, and methane, clarification to reduce turbidity, filtration using deep bed sand filters to remove coarse suspended particulates, taste and odor control, introduction of fluoride, and finally disinfection by means of chlorination.

Municipal systems that are supplied from aquifers and wells (bores) may or may not require many of the same treatments as above. Private well (bore) systems serving one residence, business, or facility are usually satisfactory, without treatment, for drinking water because of the natural filtration by the geological formations that the source water must pass through. An excess of dissolved minerals or gases in the source water can make treatment of the water necessary to make it drinkable. One of the most common problems with well water is hardness caused by an excess of dissolved calcium and magnesium. This can easily be remedied by a water-softening process.

Depending on the use of the water, no matter what the source, further treatment may be necessary to increase the purity. These can include ultraviolet disinfection, distillation, deionization, and reverse osmosis.

Desalination
Generally, desalination is related to the process of removing dissolved minerals including salt from seawater, but the same process could also be used for other salty or brackish water. The process is expensive and energy intensive when compared to capturing freshwater flows in dams or tapping belowground aquifers with wells (bores) and pumps. Of a number of desalination methods, the two most commonly used for large-scale municipal water supply are the thermal (distillation) method and reverse osmosis (RO).

Thermal distillation is the method where the feed water is heated to produce water vapor; the water vapor is then cooled to collect the distillate as clean water. Multi-stage flash distillation is the most popular method for large-scale production. The world’s largest plant using multi-stage flash distillation is in the United Arab Emirates and is capable of producing 300 million cubic meters of freshwater a year. The distillation method uses more energy than the RO process, and for this reason many distillation plants are co-located with other processes such as power stations where cheap electricity is available and the excess heat generated may be harnessed in the distillation process.

In the reverse osmosis process, seawater (or other feed water) is forced under high pressure through a membrane, removing salts and impurities and producing water suitable for drinking on the outlet side of the membrane.

Benefits
• Unlimited supplies for communities on ocean coastlines
• Not climate dependant
• Depending on the size and type of plant, production may be regulated to suit demand.
• Desalination does not impinge on the land environment in the way that major dam construction does, but disposal of waste products such as the hyper-saline discharge from the process requires careful consideration of the environment.

Energy Efficiency
Although reverse osmosis technology has in itself become more energy efficient over recent years, it is still a large user of electric power. The thermal distillation process, unless co-located with other compatible processes, is less energy efficient than the RO process.

Generation of electric power by renewable energy will reduce the environmental footprint of desalination, but it will remain vastly less energy efficient than collecting rainwater in dams or even pumping groundwater from deep aquifers.

Disposal of By-products
Disposal of the hyper-saline wastewater or brine into the ocean is relatively safe, but care must be taken to adequately defuse the outfall so the brine is suitably diluted without forming a plume of salt-laden water that will not readily disperse. A careful study of prevailing currents must be undertaken to establish the most advantageous location for the outfall so as not to allow increased salinity levels to deplete oxygen levels in the area.

Disposal of saline wastewater at inland locations presents further risks to the environment. Depending on the size and type of desalination plant, lined evaporation ponds could be used.

For seawater desalination, the feed water intake must also be considered for its environmental impact on marine life from fish down to the smallest plankton.

Interest in desalination emerged at least as far back as the 1700s, as the United States Secretary of State, Thomas Jefferson, considered a plan in 1790 to install desalination systems on ships and a British patent was issued in 1852 for a desalination device. The first desalination plant on land was built on the island of Curaçao in the Netherlands Antilles in 1928. Saudi Arabia built its first plant in 1938.

Worldwide desalination capacity has gradually grown from almost nothing in 1960 to about 9.5 billion gallons (36 million m³) per day in 2005, according to the Pacific Institute, a California-based think-tank focused on water issues. Half of this capacity is in the Middle East, where inexpensive energy makes the process more feasible; the U.S. is also one of the largest users of desalination.

While early desalination plants relied on evaporation and condensation (and many in the Middle East still do), most new plants rely on reverse osmosis (RO), a less energy-intensive technology using selective membranes. The largest desalination plant in the U.S. today—run by Tampa Bay Water, Florida’s largest wholesale water supplier—produces about 25 million gallons (95 million liters) per day using an RO system.

Desalination also produces brine with about twice the salinity of the source water. The concentrated brine also often contains elevated levels of constituents found in seawater, such as manganese, lead, and iodine, as well as chemicals from urban and agricultural runoff. When brackish groundwater is desalinated, the resultant brine is usually deposited into evaporation ponds, reinjected into the ground through deep wells, or piped to the ocean.

When seawater is desalinated, the brine is usually piped some distance out to sea, though it may be mixed with treated wastewater or power-plant cooling water first. If it is not diluted first, the desalination brine is denser than seawater, so it sinks, creating plumes of higher-salinity seawater on the ocean bottom—where sea life is concentrated.
How to Submit a Report on Conditions in Your Country as a Case Study

Part of the goal of publishing “Environmental Aspects of Plumbing” is to create an ever-changing, living document including case studies from around the world. To submit a case study for publication, follow these steps.

1. Choose a topic or topics from those listed below.
2. Describe the current status of the topic in your country. Give as much information and details as you can include (e.g., governmental issues, code issues, impact to the end user (consumer), acceptance by the end user, cost issues, etc). Describe any current initiatives or targets that are in place and the actual position of achieving that target.
3. Add any changes proposed during the next five years that would impact the current status, including any governmental targets or initiatives, legislative issues, code revisions, concerns from the manufacturers, etc.
4. Include your name, organization, country, and contact information. If you use direct quotations from other authors, indicate so with the appropriate footnote information.
5. Send your case study to Richard Prospal at rjprospal@asse-plumbing.org.

For Example
In the UK, the current water consumption is 150 liters per person per day, and the current government target is 125 L/person/day. These facts, along with any narrative concerning how the figures were determined, would be included in the current status section of the report. The target to be reached by the year 2016 is 80 L/person/day. There is no clear indication as yet how this figure will or can be achieved, but there is an expectation that this will include graywater and rainwater reuse. There is low penetration of these technologies within the UK market at the present time. These facts, along with any narrative, would be included in the five-year target.

Topics
» Potable water treatment
» Energy-efficient water heaters
» Desalination
» Solar thermal systems
» Water-efficient products
» Heat pump technology
» Infrastructure
» Biomass-fueled systems
» Rainwater harvesting
» Biofuel utilization
» Graywater reuse
» Combined heat & power units
» Sanitation
» Cross-connections & misconnections
» Sewage treatment
» Education
» Dry drains
» Licensing
» Drainage
» Legislative & regulatory issues

Water Efficiency
Products & Conservation

Around the world there are many schemes to assist or enforce conservation of water supplies. The drivers for these schemes are many and include:
- Reduced runoff into municipal dams due to changing weather patterns
- Population growth in areas with limited facility to increase water supply capacity
- Reduced river flows due to increased irrigation of intense cropping for food production

Advances in engineering and design are allowing household appliances and plumbing fixtures to operate on much reduced water flows, thereby conserving water without loss of amenity to the user. Water efficiency or conservation schemes may target domestic/household use, commercial/industrial users, or garden, crop, and landscape irrigators.

Reduction in water use by crop irrigators may be as simple as providing timely and accurate weather forecasts coupled with ground moisture sensors and sensitive irrigation systems able to be easily and even remotely programmed to provide precise amounts of irrigation water only when needed. For systems that utilize open channels to convey irrigation water, vast amounts of water are lost to evaporation; this may be reduced by covering the open channels or replacing them with pipes.

Urban dwellers often use water from the municipal drinking water supply to irrigate their gardens. Water conservation measures include grouping plants in zones depending on the amount of water they require and adjusting irrigation water delivery to suit each individual zone’s requirement.

Inside the home, the installation of water-efficient fixtures, fittings, and appliances may be mandated by government and water supply authorities. One such scheme introduced by the Australian Government in 2006 is the Water-Efficiency Labeling and Standards (WELS) Scheme. Under this scheme, product suppliers are required to provide water-efficiency information, and star ratings, to consumers for a range of products such as clothes washers, dishwashers, showers, taps, toilets, urinals, and flow controllers. Industry must register these products with the WELS Regulator (a government department). The scheme is funded by the industry registration fees and
contributions from Australian federal, state, and territory governments.

Commercial/industrial water users are encouraged to conserve water used in production processes by recycling wastewater. Process water may be treated to reuse within the process cycle, or partially degraded water may be used in other parts of the process or for such uses as dust suppression, truck and equipment washing, or landscape irrigation. Staff amenities and washrooms may be fitted with water-efficient plumbing fixtures to conserve water.6

In addition to the WELS program in Australia, several other countries have introduced or are considering water-efficiency labeling for products as a cost-effective way of influencing purchasing decisions and changing consumers’ water usage patterns.

“In the UK, Waterwise has launched an annual water-efficiency marquee to help consumers choose better products. A select number of Waterwise Marques will be awarded each year to products that demonstrate superior performance. WPC member the Bathroom Manufacturers’ Association (based in the UK) has also launched a Water-Efficiency Product Labeling scheme.

“The five Nordic nations—Denmark, Norway, Sweden, Finland, and Iceland—have adopted the Nordic Swan eco-label, which is used to indicate that a product is a good environmental choice and to encourage manufacturers to develop environmentally friendly products and processes.

“In Ireland a scheme to promote water conservation and help consumers to make informed purchasing decisions has been launched by the City of Dublin in collaboration with the Dublin Region Water Conservation Project. The voluntary Water Conservation label has been developed as a pilot scheme and initially covers dishwashers and washing machines. It is a unique scheme in that it has been introduced at a city level rather than across the country.”7

The United States Environmental Protection Agency (USEPA) has implemented a partnership program named Water Sense that makes it easy for American end users to save water and protect the environment by choosing efficient products. Its mission is to protect the future of the nation’s water supply by promoting and enhancing the market for water-efficient products and services.

There’s a reason that water has become a national priority in the U.S. A recent government survey showed at least 36 states are anticipating local, regional, or statewide water shortages by 2013, but by using water more efficiently, the aim is to help preserve water supplies for future generations, save money, and protect the environment.

If all U.S. households installed water-efficient appliances, the country would save more than 3 trillion gallons of water and more than $18 billion dollars per year! Also, when water is used more efficiently, the need for costly water supply infrastructure investments and new wastewater treatment facilities is reduced.8

“It takes a considerable amount of energy to deliver and treat the water you use every day. American public water supply and treatment facilities consume about 56 billion kilowatt-hours (kWh) of electricity per year—enough to power more than 5 million homes for an entire year. For example, letting your faucet run for five minutes uses about as much energy as letting a 60-watt light bulb run for 14 hours.

“By reducing household water use you can not only help reduce the energy required to supply and treat public water supplies, but also can help address climate change. In fact:

• “If 1 percent of American homes replaced their older, inefficient toilets with WaterSense-labeled models, the country would save more than 38 million kWh of electricity—enough to supply more than 43,000 households with electricity for one month.
• “If one out of every 100 American homes retrofitted with water-efficient fixtures, we could save about 100 million kWh of electricity per year—avoiding 80,000 tons of greenhouse gas emissions. That is equivalent to removing nearly 15,000 automobiles from the road for one year!"

“Depleting reservoirs and groundwater aquifers can put water supplies, human health, and the environment at serious risk. Lower water levels can lead to higher concentrations of natural contaminants, such as radon and arsenic, or human pollutants, such as agricultural and chemical wastes.”9

“Promoting water efficiency is a simple yet highly effective way of reducing water consumption, which will have a wide range of..."
knock-on environmental effects. Greater water efficiency could lead to a significant cut in water usage, which would then have the added benefits of reducing energy consumption and therefore play a major role in reducing the overall carbon emissions of the sector.”

Infrastructure
The aging infrastructure of underground water service piping in the developed nations allows for an unbelievable amount of clean drinking water to leak each and every day. This leakage is not only wasting our precious water supply, but also adds to the waste of the imbedded energy that it took to treat this water.

“The world’s limited supply of freshwater requires careful management. Yet according to the 2005 Report Card for America’s infrastructure, prepared by the American Society of Civil Engineers, ‘Each day, 6 billion gallons of clean, treated drinking water disappears, mostly due to old, leaky pipes and mains—enough water to serve the population of a state the size of California.’

“Some of the factors contributing to the leakage include inadequate corrosion protection, older mains, faulty installation, material defects, excessive water pressure (and objectionable pressure surges), ground movement due to extreme weather conditions, and excessive loads and vibration from road traffic. When leaks prevent water from reaching end consumers, utilities lose revenue and incur unnecessary costs.

“Because leaks follow the path of least resistance, leakage will often escape attention by flowing into an underground pipe such as a sanitary sewer, storm sewer, abandoned line, or other subterranean geological structure.”

Water Reuse
Rainwater Harvesting
Rainwater harvesting has numerous means of collection, and the harvested water has numerous uses. Rainwater harvesting may be simply contouring the ground to direct excess runoff to a dam for future use in irrigation of crops or for the watering of animals such as sheep and cattle. Water harvested in this way may also be directed to maintain wetlands or lakes so as to maintain the biodiversity of an area possibly surrounded by a built environment.

Rainwater harvesting on the large scale is the catchment areas for municipal dams supplying drinking water to large cities. Small towns and villages may utilize a sloping hillside suitably paved with impervious materials or large natural rock outcrops with suitable curbing installed to direct the rainwater to a collection point for piping to the community water supply via dams or tanks. In all these cases, the collection area must be kept clean and should be fenced to prevent stray livestock from fouling the area.

Rainwater harvested for use by individual households is usually collected from the dwelling roof and directed into tanks through roof gutters and pipes. Treatment of stored water at individual levels needs to be looked at.

Storage of Rainwater
Health Aspects of Plumbing has this to say about rainwater storage tanks: “When rainwater is stored for domestic use, the tanks should be of water-tight construction, covered with material that is weatherproof, insectproof, and verminproof, ventilated, and supplied with access for regular inspection and cleaning.”

Treatment of Rainwater
The first important step in any rainwater collection and storage system is to maintain a clean catchment and collection system. The use of first-flush devices on collection pipework allows the first portion of rainfall to flush the catchment area without entering the storage system.

“In rural areas, for rainwater collected and stored in a clean environment it may be only necessary to boil water for use in food preparation or drinking; this may be more important for the very young or the elderly and persons with compromised immune systems such as those who are HIV positive or suffering from diabetes and the like.”

Disinfection of Rainwater Systems
Rainwater can be disinfected by chlorination, ultraviolet light irradiation, or by boiling.

Chlorination
Regular chlorination of rainwater held in domestic tanks is not considered appropriate in most cases and is generally only recommended as a remedial action. The effectiveness of chlorine is short lived, and it will only act on water in the tank at the time of dosing. Fresh runoff into the tank after chlorination will probably not be disinfected.

Ultraviolet light irradiation
Ultraviolet (UV) light irradiation can be used to provide continuous assurance of water quality. UV light systems require relatively low maintenance and have the advantage of not involving the addition of chemicals. The UV light could be installed in pipework delivering water from a tank to a dwelling or selectively to taps used to supply water for drinking and food preparation. UV light systems could be particularly suitable for community supplies.

Boiling
While rainwater should be safe for most people to drink, at times the microbial quality may not be as high as reticulated water supplies. People with lower immune responses, such as the very young or very old, cancer patients, people with diabetes, organ transplants, or those who are HIV positive, should consider boiling the water before consumption.

Corrective action to improve microbial quality
Although there have been isolated reports of illness associated with consumption of tank rainwater, for most people rainwater from well-maintained roof catchments and tanks represents a relatively low risk of illness.

If it is suspected that rainwater is contaminated or if additional precautions are sought in the event of illness, water used for drinking and food preparation could be boiled or the tank rainwater could be chlorinated.

Graywater Systems
Graywater systems separate and treat the wastewater from showers, clothes washers, sinks, and similar fixtures for reuse as flush water for toilets and urinals, for irrigation, and for limited industrial and ornamental uses. These systems require that proper installation methods are followed and require the involvement of the local authority having jurisdiction. The property owners are typically responsible for maintaining the systems in a safe and efficient manner. The prevention of a cross-connection between a graywater and a drinking water system is of primary concern.

Storage of graywater should not be for long periods of time because the water usually contains a significant amount of organic matter that can begin to decompose over time, causing odors and other concerns.

“Today, the ecological movement has become the mainstream of design, and ‘green’ architecture and engineering is all the
vogue. Water has become a scarce and costly commodity everywhere, with water costs often exceeding electricity charges in major cities worldwide. More importantly, everyone is aware that conservation is essential in safeguarding our limited natural resources.

“Graywater systems are dual water supply systems that capture, treat, and recycle a portion of the wastewater flow for use as a secondary, nonpotable water supply in a building. This approach has the potential of reducing the total freshwater requirement by up to 50 percent and the overall sewage water flow by even more. “

“The early promise of graywater systems is being realized with many successful installations already in operation. As the drive for green engineering gains momentum, this engineering solution will gain importance. The current revolution in materials science will allow the development of new and improved treatment processes, which will accelerate the application of these systems. “Graywater is a useful tool for solving water supply problems, a concern in even the most formerly ‘well-watered’ areas. The problem of public acceptance, an important consideration a decade ago, has been largely overcome. The main issue today is innovative engineering to improve economic feasibility. This leaves much latitude for excellence.”

Possibly, one the most difficult tasks ahead of the plumbing community concerning graywater systems is in educating the consumer that graywater is not gray. As well accepted as the term graywater is to the plumbing community, it may be time to coin a new term to put the stigma of gray behind us.

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In spite of what is currently reported on the news about the present global economy and the global construction industry, the medium- and long-term outlooks for this hard-hit industry and the overall global economy actually look bright. The estimated annual global economic output for the next decade is estimated at 3–4 percent, which is similar to the growth demonstrated in the last decade. Similarly, the construction industry, which is a major player in the overall economy, is expected to surpass world economic output by about 2 percentage points. Advanced economies will experience slower general economic growth compared to developing economies due to the rapid rise of emerging markets, including China, India, and Brazil.

For the first time ever, emerging markets will be the engine of growth as a result of population growth, an expanding middle class, economic development, and wealth transfer from developed to emerging economies as developing economies industrialize and commodity prices increase. China will overtake the United States to become the world’s largest economy in five to seven years. In a similar fashion, India will overtake Japan and become the third largest economy in the world by 2020. Also by 2020, half of the top 10 largest economies in the world will be emerging countries; thus, global power will be more balanced in the next 10 years. Some of the developed markets, such as the United States and Australia, will grow at a slower pace than emerging markets but faster than most economies in Western Europe and Japan, where growth is expected to be in the low single digits.

**Global Construction Outlook**

Regardless of whether the country is emerging or developed, the construction industry plays a major economic role. It is estimated that the global construction industry accounts for about $8 trillion a year, which makes up about 15 percent of the world’s economic output. It is no surprise that in terms of sheer size, the United States and China are the two largest markets. Early this year, according to some published reports, China replaced the United States as the largest construction market in the world. China’s share of the total global construction industry is 15 percent, while the United States’ share is 14 percent.

The third largest construction market is Japan, with an estimated market size slightly half of the U.S. market. The next markets in the top seven are Germany, Spain, France, and Italy, with a combined market size of about $1.2 trillion, representing about 15 percent of the total global market. Of these, Germany is the largest, with an estimated market size of about $300 billion, and Italy is the smallest, with a market size of about $260 billion. The remaining top markets are India and England, with market sizes of $250 billion and $240 billion respectively. It is interesting to note that while India’s market is growing very fast, it is still only about 20 percent the size of China’s market.

**Global Construction Tendencies**

Undoubtedly, the 2007–2009 global financial crisis had a major impact on global construction output. During this period, global annual growth slowed to just less than 1 percent, and the largest decrease was in advanced countries, with a decline of 3 percent annually. On the other hand, emerging or developing markets slowed only slightly to about 6 percent in the same period.

As envisioned by most experts and economists, the long-term outlook for the global construction industry is anticipated to grow at an annual rate of 4–6 percent in the next decade. While growth is expected to be fairly evenly distributed during the next 10 years, some experts anticipate that the next five
years will experience a bit stronger growth as the global economy starts to bounce back from the most recent recession.

The bounce back will be uneven for developed and emerging markets. While there are different and divergent opinions on the subject, the overall consensus is that emerging markets will bounce back to historical growth rates of between 6–8 percent, while developed markets will grow at a more modest rate of 2–3 percent annually. The rapid growth rate of emerging markets will increase their importance, and it is expected that in nine to 10 years the emerging markets will be more than half of the total global construction market from the current level of 36 percent.

China, with its continued anticipated rapid growth rate, will hold its position as the largest construction market in the world, with almost 20 percent of the total global market in one decade from about 14 percent in 2011. With its anticipated rapid growth rate of 9 percent, India also will continue to increase in significance and most likely will move into the top five largest markets in the world in the next decade.

**Outlook By Sector**

In the three major sectors of the construction industry (infrastructure, commercial, and residential) in a country, the residential construction sector typically is by far the largest, representing almost half of the total market. On the other hand, commercial and infrastructure are about the same size each, and each represent about 25 percent of the total sector. While variations exist, this is very similar in most countries, whether developed or emerging.

As one may suspect, the residential sector was hit the hardest in the last recession, particularly in the United States, Spain, and other European countries where significant growth took place in the late 2000s. Thus, global infrastructure and commercial sectors are expected to be the engine of growth in the next 10 years, as developed countries upgrade their aging infrastructures and emerging countries build theirs.

**Advanced Markets (Developed Countries)**

The developed countries or markets consist of North America (United States and Canada), Western Europe, Japan, and Australia.

**Western Europe**

According to the United Nations, in the next five to 10 years, population growth in Western Europe will average about 0.25 percent per year. This is well below the 1.1 percent anticipated global population growth rate during the next 10 years. Countries such as Italy, Greece, and Germany are anticipated to have the lowest population growth rate. Europe's low population growth rate will mirror its economic growth, which is anticipated to be around 2.1 percent per annum for the next 10 years. The construction sector is projected to grow at less than 2 percent for the same period. While this is an improvement from the last recession (2006–2008), it is still much lower than the 7–9 percent global construction forecast over the next 10 years.

The only anticipated bright spots in Western Europe are the United Kingdom and Greece, and at the other end of the spectrum are Italy and France, with very little anticipated growth during the next 10 years. U.K. construction output is forecasted to grow slightly less than 3 percent per annum, and even with the financial crisis that Greece is currently facing, most analysts expect its construction sector to grow slightly more than 3 percent in the next decade. In contrast, Italy's construction sector is forecasted to grow about 1 percent per annum for the next 10 years, while France is projected to do slightly better than Italy. The annual growth rate of Germany's and Spain's construction markets for the same period will be between 2 percent and 2.5 percent. Overall, Europe's projected construction market and gross domestic product are expected to be the lowest in the world.

**North America**

Amongst the developed markets, North America (United States and Canada) is anticipated to have the highest construction market growth rate during the next decade, which is anticipated at slightly more than 4 percent. Similarly, gross domestic product is anticipated to be around 3 percent for the same period. Some of the drivers for this growth are a growing population at slightly less than 1 percent and the need to upgrade aging infrastructure, which is rapidly deteriorating.

Taking a closer look at each country in North America, the United States is currently the largest economy in the world with the second largest construction market. Many analysts expect the United States to regain its place as the largest construction market in the world as it comes out of its worst recession since the Great Depression. GDP growth for the United States in the next 10 years is expected to be about 3 percent per year, while the construction industry is expected to grow about 5–6 percent over the next five years and 3–4 percent from 2016 to 2020. This growth will be driven by the residential sector, which is more than half of the total construction market. The commercial sector, on the other hand, is likely to improve in one to two years, but perhaps at a lower rate than the residential market.

Canada is the eleventh largest economy in the world, but it is still about one-tenth of the United States' economy. Even so, Canada has a vibrant construction sector, as this sector is a much larger part of the economy (about 17 percent of GDP). In the next 10 years, Canada's gross domestic product will be similar to the United States as its economy is closely tied to its neighbor to the south. However, the construction sector of the Canadian economy is expected to be a bit more robust, with an anticipated growth rate of 4–5 percent.

**Asia**

Japan and Australia are considered the only fully developed markets in Asia. While Japan is the world's third largest economy and the third largest construction market behind China and the United States, its population and economic growth for the next 10 years do not look promising. Its population is projected to decline at an annual rate of about 0.24 percent as a result of very low birth rates, an aging population, and virtually no immigration. Similarly, its economy will grow at less than 1 percent per year for the same period. This is in sharp contrast to the overall global economic growth rate and to Japan's own impressive economic growth from the 1960s through the 1980s. Japan's construction market in the next 10 years will reflect its overall poor economic growth and is expected to grow around 1 percent or less.

Contrast this with Australia, and one finds a very different scenario. Australia, which has a relatively small population (about 22 million) and a huge land mass, has a rosy
forecast for the next 10 years. Population growth is expected to be similar to the average global rate, while gross domestic product is forecasted to be about 3 percent per year for the same period. Similarly, the construction sector is expected to grow at about 4–5 percent, driven by its infrastructure sector. Australia’s economy is increasingly tied to Asia’s economies, and especially to China’s, which is driving Australia’s economic growth particularly in the mining sector.

**Emerging Markets**

The global financial crisis of 2007–2009 hit the construction industry extremely hard no matter the location. However, while industrialized countries had negative growth, emerging markets slowed from 11 percent growth in 2006 to just less than 1 percent in 2008–2009. Since 2009, emerging construction markets have been growing again at a pace of 5–7 percent, which is significantly better than developed markets. It is estimated that emerging markets will more than double in size during the next decade, with the main drivers being India, China, Asia Pacific, Latin America, the Middle East, and some markets in Africa and Eastern Europe.

The anticipated growth in emerging markets will be highly influenced by population growth where growth is anticipated throughout Asia (except Japan), the Middle East, and Latin America. Asia is expected to be the fastest growing region in the world. With an anticipated population growth rate of 1 percent and an even higher GDP growth rate (6 percent), emerging markets will be the global growth engine for the next 10 years. The leaders in the region for population growth will be the Philippines, followed by India, Indonesia, and Vietnam. China, South Korea, and Thailand are at the low end of the spectrum, with a predicated population growth of 0.2–0.6 percent. In sheer numbers, China has the largest population in the world with about 1.4 billion people. Almost 17 percent of the world’s population lives in China, and it is the third largest economy. Not far behind, India has a population of 1.2 billion people, but while it has the second largest population in the world, it is the twelfth largest economy.

**Asia Pacific**

Asia Pacific’s most influential members are China, India, Indonesia, the Philippines, Vietnam, Thailand, and South Korea, which are the main focus in this segment. Driven by China and India, Asia Pacific is predicted to be the fastest GDP growth region in the world over the next decade. However, the region’s average population annual growth rate (forecasted at about 1 percent) will be slightly lower than the global growth rate. Nevertheless, on average, economic growth for the region is expected to be at 7–8 percent per annum, which is much higher than the forecasted global rate of about 5 percent.

It is no surprise that the leaders in economic, population, and construction market growth rates will be China and India. China is the most populous country in the world with a population of 1.4 billion people and the second largest economy after the United States. In the last 30 years, China has grown its economy more than tenfold and has pulled millions of its citizens from poverty to middle class status. In the next 10 years, the economy is expected to grow at an annual rate of 7–8 percent. In similar fashion, China’s construction market has shown tremendous growth in the past and is expected to grow at an annual rate of about 8–9 percent in the next 10 years.

China’s only rival in terms of growth, population size, and development is India. India’s economy ranks twelfth in the world in terms of size and has a projected annual GDP growth rate of 7–8 percent in the next 10 years. Its construction sector is expected to grow slightly faster than its economic growth over the next decade, making it the second fastest growth market in the world after China. India’s current infrastructure system leaves much to be desired, but it is the focus of the Indian government, which plans to invest heavily in infrastructure development in the coming years. The commercial and residential construction sectors also are projected to grow very fast, but not as fast as infrastructure.

Indonesia, Thailand, Vietnam, Korea, and the Philippines all are projected to grow their economies 4–8 percent per year in the next decade. The growth leaders within these countries will be Vietnam and Indonesia, with close to 8 percent annual economic growth. At the opposite end of the spectrum with modest growth rates are Thailand and Korea, with about 4 percent annual economic growth.

**Middle East**

Closely mirroring Asia Pacific’s tremendous growth is the Middle East, which covers the Gulf States and North Africa. The area’s population during the next 10 years is expected to grow about 2 percent per year, which will make it the fastest in the world. Likewise, gross domestic product growth for the region is expected to be around 5 percent, while the construction sector is projected to grow at about 6–7 percent.

The leaders in population growth will be Saudi Arabia and the United Arab Emirates (UAE) with more than 2 percent annual growth rates. On the other hand, countries such as Morocco will have a relatively low population growth rate of about 1 percent. The GDP growth rate in the next 10 years for most of the Arab states is in the range of 4–6 percent, with UAE and Egypt projected to be the fastest growing countries. The slowest growing countries in the region will be Saudi Arabia and Morocco, with about 4.5 percent growth. While the economies are not expected to grow as fast as Asia Pacific, economic prospects for the Middle East for the next 10 years look bright and promising.

**Latin America**

Although not as fast growing as the Middle East or Asia Pacific, most Latin American countries are full-fledged democracies with established market economies and are poised to grow. The region’s population is projected to increase by just less than 1 percent annually over the next 10 years. This is just below the 1.1 percent global population growth rate; however, the gross domestic product growth rate for the same period is expected to be between 6 percent and 7 percent per year. The construction sector is expected to grow only slightly more than the GDP.

Brazil and Mexico make up approximately 70 percent of regional GDP and are expected to have economic growth of 4 percent per year for the next decade. Brazil is the largest economy in Latin America and is ranked tenth in the world. The construction sector in Brazil is the twelfth largest in the world and is poised to grow at a rate of 5 percent per year during the next 10 years. As a result of the World Cup and Summer Olympics in 2016, the construction industry in Brazil is expected to grow close to 7 percent in the next five years. Brazil’s population is more than 200 million, making it the fifth most
populous country in the world. Population growth is expected to be similar to the region’s growth rate.

Mexico’s population is 115 million, making it the eleventh largest in the world, while its economy is ranked thirteenth globally. Its GDP for the next 10 years is expected to increase 4 percent annually, but the construction sector is expected to grow at a much higher rate of 5–6 percent annually. The infrastructure sector is expected to lead the way in growth, with large projected government investment in building new highways, railroads, airports, ports, and housing. The commercial sector also is expected to be brisk and just under the infrastructure sector growth rate.

The other largest economies—Colombia, Chile, and Peru—are expected to perform well. Argentina, however, will continue to have the lowest economic growth rate as it struggles to control inflation and unemployment.

Eastern Europe
Eastern Europe, Russia, and Turkey will enjoy a healthy economic growth rate even if the population is expected to decline in this region. The average gross domestic product is expected to be in the 5–6 percent rate, and the construction output will be slightly higher. The countries expected to lead the high growth rate in terms of GDP and construction output are Turkey, Russia, and Poland, with an economic growth averaging 6 percent. The low growth rate economies are anticipated to be Hungary and the Czech Republic, with economic growth of about 4 percent annually.

Population growth, on the other hand, is estimated to decline to about fourth-tenths of a percent annually over the next 10 years. The only exception is Turkey, where population growth is expected to be similar or slightly less than the global population growth rate of 1.1 percent. In this region, construction output and growth will be driven largely by the infrastructure sector followed by the commercial and residential sectors. This is particularly true for countries such as Poland, which will continue to benefit from European investment.

CONCLUSION
Today, the construction industry represents about $8 trillion or 14 percent of the total global economic output. In 10 years, it is expected to grow to $13 trillion and be about 18 percent of total economic activity. The fastest growth in the construction industry is anticipated to come from emerging markets, which are expected to dominate growth and will overtake the developed markets in size and importance. The total construction market size in developing countries is expected to increase by more than 100 percent in the next decade, making it close to a $7 trillion market. The fastest regional economic and construction growth will be in Asia Pacific (driven by China and India), followed closely by the Middle East and Latin America. Some countries, such as Nigeria, South Africa, and Angola, also are expected to see significant economic growth, but slightly lower growth than the global average.

On the other hand, developed markets will grow at a much slower rate of about 34 percent over the next 10 years and will be about $6 trillion. Among the developed nations, the growth countries are expected to be the United States, with a growing population, and Australia, with a strong mining sector that will drive overall economic growth. Of the developed countries, Japan is expected to have the slowest growth as its population ages. Growth also will be hampered by high government debt, which will limit infrastructure investment.

As evident by the latest financial crisis reports in Europe and the stalled U.S. economy, the danger of a double-dip global recession is a real possibility, which will have major repercussions on the overall global construction markets. However, in spite of the dark economic clouds, the long-term outlook for the global construction industry remains positive, especially as emerging countries invest in developing their infrastructure, growing their middle class, and benefiting from increasing commodity prices.
Plumbing engineers sometimes need to help clients choose a contractor for a water treatment system, and the most important tool for this selection process is the specification. Frequently, the two are seen as separate activities: choice of contractor and specification. However, from my experience in the water treatment industry, I see these as parts of a cohesive process, with the specification being a living and evolving document that leads to the selection of the best system and the best vendor for the customer’s application. Regardless of the initial approach, however, the end result always must be a detailed and fully engineered specification and a fully capable contractor who understands the expectations of the customer.

Unfortunately, we still encounter outdated specifications detailing some components that not only are inefficient relics, but also are no longer available. A tremendous amount of knowledge and experience is available within the water treatment industry, and the technologies available are improving constantly and at an increasing rate. The point is to capitalize on this characteristic of industrial water treatment to help your client secure the best available solution.

**THE SPECIFICATION**

The specification is a statement of a solution to a problem. As such, it should state the starting and ending performance conditions and the components necessary to achieve the solution. It is the client’s expectation. The specification serves as a tool for a client to clearly state what he wants and how he wants it achieved. The specification then can be used by a contractor to construct his proposal for the solution to that problem.

Various formats are used within the water treatment industry, but to be most effective the specification should answer four questions:

1. What is the system?
2. What is it expected to accomplish?
3. What are its components?
4. What are the products and services offered?

The level of detail will reflect the comfort level of the client with the specified solution. For example, if your client is looking for creative solutions, the initial specification will be less detailed and will emphasize the starting and ending conditions. It then is left to the contractor to respond with the details of his proposed solution. If your client is already satisfied with a particular solution, then the specification’s detail will be lengthy and will leave little flexibility for choice of technology or equipment components by the contractor.

The decision by the client about the specification’s level of detail should not be taken lightly. The decision determines the degree of buy-in by the contractor and the liability of the facility owner. For example, if your client provides most of the detail, then the contractor is liable for providing that detail. Especially at the outset of specification development, this may be a poor strategy because it eliminates the possibility of innovative solutions. If, however, the owner specifies and emphasizes performance, then the prospective vendor is responsible for the analysis and details necessary to meet that standard.

**What Should Be Included?**

Some place in the specification, in the text or as an attachment, the raw water that is available should be described. The details may differ from case to case, but if water treatment is the operation, the analysis...
must include at least the pH, iron and manganese, and total dissolved solids (TDS). These parameters affect most, if not all, cases of water moving through and being used within a commercial or industrial facility. If the water will be heated, the total hardness and alkalinity are additional necessary parameters. Any water treatment contractor who replies without knowledge of these parameters should be discarded immediately.

Additional parameters that typically are required for most treatment systems include turbidity and sulfate. Specific issues for individual resolution include radium, arsenic, hydrogen sulfide, lead, tannin, and volatile organics. When present, these are a specific objective of the specification.

A frequently overlooked raw water parameter is the hydraulics. For proper specification, the dynamic flow and pressure should be measured and clearly stated. Furthermore, if any flow requirement is specified, it is incumbent on the specifier to ensure that the facility is capable of providing the required dynamic flow and pressure. A common error is listing only the static pressure and inlet pipe size. As most hydraulic tables indicate, the difference between the static and the dynamic flow and pressure can be dramatic and, if not subsequently measured, can lead to a failed water treatment system.

Regardless of the detail in the specification, the expectations must be clearly stated. The product water should be specified regarding both quality and quantity. For quality, you can choose from a number of industrial water quality standards, and most industries ascribe to a published national industry standard such as the U.S. Pharmacopeia (USP Purified or WFI), Association for the Advancement of Medical Instrumentation (AAMI), Clinical and Laboratory Standards Institute (CLSI), or the various ASTM ratings. Additionally, numerous unpublished and “unofficial” standards are used in various niche industries for water quality. Among these are breweries and beverage industries, florists and irrigation, photography, ice making, humidifiers, rinses, and high-pressure cutting. Whether the expectation is formally recognized or not, it should leave no doubt as to the desired outcome. In some instances, it will be up to the contractor to fill in the blanks with the proposed equipment items to meet the expectation.

The outcome, or product water, also should be quantified. A clear statement of the flow and pressure to be made available at particular locations within the facility should be included. In some cases, where the specification is mature, the hydraulics already will have been estimated based on the specification of pipe sizes, lengths, and elevation changes. Essentially, if any latitude is given to the contractor to decide pipe size and/or path or equipment type, then the hydraulic product must be clearly specified.

In addition to the flow and pressure, the time-phased volume requirement also should be specified. This is especially true for membrane technologies, but it also will impact the cleaning and maintenance requirements of the equipment required to treat the water. Ideally, the owner will provide an hourly volume requirement for the most demanding 24-hour period. Providing the flow, pressure, and hourly volume helps avoid ambiguities.

The facility itself presents a unique set of constraints. The water source and pipe size have already been discussed. The three-dimensional space available for the treatment equipment is an additional and obvious parameter for specification. However, the unloading site, doorway, and equipment movement dimensions are also important and frequently assumed adequate. Most treatment equipment requires specific electrical energy and drain capabilities, so their availability should be specified. Unless the hydraulic details have been calculated, the points of use should be defined as well. In some cases, unique requirements of temperature, seismic, or flood survivability or other physical constraints are necessary to include.

If equipment items are to be specified, then these should be preceded by a statement of the system’s operation. The system is what produces the results, with contributions from each of the equipment components. Furthermore, in some instances, the system must provide a number of separate products of unique quality and quantity. This is the time to describe the functioning of the system as a whole, including any highlighted functions, such as water or brine reuse or unique regeneration cycles.

Each equipment item then is described in detail, beginning with its primary function and purpose within the system and its performance capability. Beyond that, the amount of detail in the initial specification varies significantly based on the vendor. Some vendor-developed equipment specifications include minute details, but no manufacturer’s part number. This is typically a strategy to minimize competition from other vendors for the job. Other equipment specifications provide little detail beyond the intended outcome performance, which is an effort to allow more competition.

Beyond the initial specification, however, as the decision for contractor selection is approached, additional detail is essential. Such detail includes the utility requirements such as electrical power and current, service, and drain sizes and capacities. The three-dimensional space requirements also are included, along with any peculiar mounting requirements. In some high-purity situations, individual certifications of materials and/or performance may be required. In the specification’s final (submittal) form, the manufacturer’s part number and any accessories included or excluded are essential. For automated components, the controls and instrumentation are included, along with their expected functioning and information displays. Finally, the component is placed inside a system sketch to show all connections and relative positioning.

The final piece to a complete specification is the contractor’s warranty for the system and the equipment items. The definition of performance failure may be necessary, as well as the life span of the warranty. Procedures should be included for claiming and for satisfaction of warranty issues and the liability of each party.

SELECTING A PARTNER

The specification described above is part of the process for contractor evaluation and selection. The response of contractors to the specification may provide clear signals as to their competency and focus.

Some cautions are offered for prospective customers in this contractor evaluation and selection process. Try to avoid contractors who are tied to old and outdated technologies and procedures. The water treatment industry is rife with change, especially regarding the use of electronics to advance the efficiencies of operation. It is in the engineer’s best interest to ultimately team with a contractor who is aware of and applies the best available technology and who can
answer questions regarding efficiencies, installation, and operating costs. The engineer and owner can best develop interview questions by searching the Internet for typical systems and contractor details and by comparing contractor proposals.

Also to be avoided are assemblers rather than problem solvers. Most contractors can read and understand equipment instructions, but fewer fully understand the nuances of water treatment systems. Items such as the effects of pH and total dissolved solids on iron oxidation and ion exchange or the effects of phosphates on brine reclaim are not always considered. The difference is most evident at the initial analysis. The problem solvers will spend time to fully understand the problem before proposing detailed technology solutions. This understanding includes all of the items mentioned above, especially the details of raw water analysis and product water quality and quantity.

The final proposal from the problem solver will stand the test of time, and he will be a trusted partner after the installation.

The option of larger or smaller contractor is a common discussion topic. Essentially, individual competency is more important than the size of the company. Beyond the individual, however, small companies tend to be more aggressive in exploiting new technology, and large companies tend to be more aggressive with pricing. Most likely, small companies will have a smaller geographic range for service or troubleshooting calls. On the other hand, some large companies offer little outside support, so it is prudent to discover the contractor’s service and troubleshooting policy.

On the plus side, the age of the company may be telling. There is probably a reason why a contractor has been active within the industry for several decades, for example. However, be wary of the successful contractor that is being purchased by a larger company. Many times, this evolution has proven fatal to the record and reputation of long-standing companies.

Reputation and favorable references are a great measure of potential satisfaction with a contractor. Follow through with contractor-supplied references, but also reach out to other sources like the Better Business Bureau. Part of the general reputation of the contractor is their affiliation and activity with professional associations. Contractors that

Sample Contractor Proposal

John L. Smith, Inc.
Hometown, USA

1. SCOPE
   1.1 Provide a factory assembled water treatment system as indicated. The system shall be of an approved design as fabricated by a manufacturer regularly engaged in the production of water treatment equipment.
   1.2 System will be installed on site by an approved contractor, and in accordance with a pre-approved schedule.

2. GENERAL DESCRIPTION
   2.1 The design of the proposed water treatment system shall be detailed as to treatment performance, waste generation, space and power requirements.
   2.2 The system shall be designed to meet the following specifications.
      2.2.1 Untreated Water. The well water available has the following characteristics:
      Quality:
         Total Dissolved Solids: 230 mg/l
         Hardness: 12 GPG
         Iron: 0.35 mg/l
         Manganese: 0.08 mg/l
         pH: 6.6
         Alkalinity: 120 mg/l
         Turbidity: 1.5 NTU
      Quantity:
         Dynamic Flow: 60 GPM @ 65psi
      2.2.2 Performance Requirement. The water treatment system shall provide the following:
         Quality: Treated water shall meet the specification for US National Drinking Water Regulations for plant use. Additionally, the treated water at the designated points of use (POU) shall meet the specification for the Clinical Laboratory Standards Institute (CLSI) reagent water.
         Quantity: Treated water shall provide 45 GPM @50 psi for plant use (USEPA). Additionally, treated water (CLSI) shall provide 10 GPM @40 psi at two POU within the plant laboratory.
      2.2.3 Additional Specifications:
         The system shall optimize efficiency, to include brine reuse as required.
         The plant sketch with proposed equipment site is attached.

3. PROPOSALS
   3.1 General. Proposals shall include the following items:
      3.1.1 Water treatment system description.
      3.1.2 Treated water production specifications.
      3.1.3 Water treatment system waste generation.
      3.1.4 Primary system equipment components.
      3.1.5 Space and utility requirements.
      3.1.6 Budgetary estimate for all primary equipment items, FOB Pottstown.
   3.2 Contractor. Proposals shall include background of the contractor together with a customer reference list.

4. SUBMISSIONS
   Proposals shall be submitted not later than 9 AM on Friday July 29. Qualifying contractors shall be invited to attend a site visit on Tuesday, 9 August at 10:00 AM.
frequently teach the technologies likely will be able to respond effectively to post-installation problems, and those that are active in professional associations likely will provide the best available solution.

Costs are always a consideration. However, cost should be compared equally regarding equipment items and performance, shipping, site preparation, and the effects on normal operations for the customer. Additionally, value should be balanced as well. A marginal cost increase for a significant advantage in efficiency may be acceptable, especially over the long run.

**THE CONTRACTING PROCESS**

The following six steps are offered for selecting the best contractor for water treatment.

**Performance Requirement**

Take the time to spell out exactly and simply what result you want from the water treatment process and why. What needs to change in the quality and/or quantity of the current water service? Be sure to conclude that these changes are necessary and for good reasons. This is to be your entry point into the water treatment industry.

**Options and Recommendations**

At the onset, your experience or the experience of your company may allow a clearly stated solution. If this is so, and if you have the experience of current technologies, then your specification will be detailed, and your ultimate selection process will be simple: reputation and cost. If you do not have this experience, keep the initial specification simple and general—even simply stating the performance requirements—and let the industry develop the best options for your assessment. This will cause more effort on your part, but the rewards in future cost avoidance will be well worth the struggle. I would also suggest opening up the solicitation to at least one local small company with a decent reputation. This will keep a balance in your assessment.

**Selection and Specification**

Once you have had an opportunity to review the proposals, you will be prepared to select the solution you want and to flesh out the specification detail. This process should include an interview with each respondent so you can evaluate their proposal. The detail on the specification may be provided by one of the respondents or by your company, but the detail should be adequate for a clear assessment by potential bidders. To me this is the critical step in the project. At this point you have a clear idea of what the deliverables are regarding products and services. All that remains for your decision are prices and company reputations.

**Request for Bid/Proposal**

The bid specification should go out to all respondents, and any other interested party, again to at least one small contractor. The due date and the desired proposal format are critical. All potential costs should be addressed.

**Evaluation and Decision**

If the specification and selection were conducted properly, this step will be easy. You now must choose a partner, and your notes from the earlier steps are germane.

**Schedule and Delay Penalties**

Based on the date of selection, a schedule for the customer and the contractor can be developed for all phases of the project, with deliverables for each date. The project is now mapped out on a schedule and timeline. Delays and penalties can be specified for all parties involved.

The selection of a contractor to solve a water treatment issue is a decision often fraught with consequences. It also can be tedious, fretful, and, if made incorrectly, ultimately costly. However, by applying the specification process with focus and clarity, the selection process will allow the customer to remain in control and to reap the benefit of the best solution and a valuable vendor relationship.

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What’s New for NFPA 99 2012?

The title of NFPA 99, previously called the Standard for Health Care Facilities, has been changed to Health Care Facilities Code.

The committee on laboratories was eliminated, and the various subjects that were its responsibility have been assigned to the Piping Committee.

A new piping system called “proportioned air” (discussed below) was originated and assigned to the Piping Committee.

New items have been added regarding the connections of alarm-initiating devices to master panels.

Liquids containing ammonia used for leak detection are now prohibited due to tests that show this material causes stress cracking in the walls of copper piping and its alloys.

Various aspects of the testing and maintenance of equipment have been revised.

Compressed-air dryer specifications have been revised to lower the dewpoint to 32°F (0°C).

Liquid-ring compressors shall have cooling water filtering to eliminate pathogens and hyperchlorination.

NEW BUILDING CATEGORIES

In Chapter 4: Fundamentals, the way building systems are referenced was changed to meet a new philosophy of the Technical Correlating Committee to refer to building systems in any facility based on risk rather than occupancy.

The four occupancy-based levels of system designations were eliminated and redefined in the new code as categories based on risks to patients and caregivers. (These revisions do not affect the design of a facility.) The new definitions are as follows.

- Category 1: Systems are expected to work or be available at all times to support patients’ needs. Category 1 systems support patient needs and are critical for life support.
- Category 2: Systems are expected to provide a high level of reliability; however, limited, short durations of equipment downtime can be tolerated without significant impact on patient care. Category 2 systems support patient needs, but are not critical for life support.
- Category 3: Normal building system reliabilities are expected. Such systems support patients’ needs, but failure of such equipment would not immediately affect patient care. Such equipment is not critical for patient care.
- Category 4: Such systems have no impact on patient care, and their failure would not be noticeable by patients. There are no minimum requirements for such equipment. (This category is not
MEDICAL PIPED GAS AND VACUUM SYSTEM DESIGNATIONS

In Chapter 5: Gas and Vacuum Systems, the word “level” that previously was used throughout Chapter 5 was changed to “category” in every instance. In particular, to meet the intent of the changes to the definitions, the former levels found in Chapter 3: Definitions were revised to read as follows.

- Level 1 piped gas and vacuum systems are now called Category 1 and are defined as “facility systems in which failure of such equipment or systems is likely to cause major injury or death of patients or caregivers.”
- Level 2 piped gas and vacuum systems are now called Category 2 and are defined as “facility systems in which failure of such equipment or systems is not likely to cause major injury to patients or caregivers.”
- Level 3 piped gas and vacuum systems are now designated as Category 3 and defined as “facility systems in which failure of such equipment or systems is not likely to cause injury to patients or caregivers, but may cause patient discomfort.” For Category 3, the term “medical gas” shall apply only to oxygen and nitrous oxide. (Although not included in the code, as a safety measure it is strongly recommended that nitrous oxide gas be distributed at 5 pounds per square inch lower than that of oxygen due to the possibility of cross-connections.) Category 3 gas-powered device supply systems (also referred to as gas-powered instrument supply systems) shall be compressed air and nitrogen (drive gas). Category 3 vacuum and scavenging systems shall be either wet or dry. No anesthetizing gas is permitted.
- Category 4 systems are those in which failure of such equipment will have no impact on patient care. Category 4 does not apply to any medical piped gas or vacuum system.

DEFINITIONS

The definition of “scavenging” now reads: “evacuation of exhaled mixtures of oxygen and nitrous oxide in Category 3.”

A definition for a demand check valve has been added, which reads: “a paired set of fittings that permit flow when correctly mated but interrupt flow when not correctly mated.”

The nomenclature “drive gas” has been added to the Category 3 piped gas and vacuum systems section. This compressed gas is intended to drive dental drills and handpieces, etc.

The definition of standard cubic feet per second has been revised to reflect the actual figures for standard air.

PROPORTIONED AIR

A new Category 1 compressed medical gas system is called proportioned air. This new system is a mixture of oxygen USP and nitrogen NF and is intended to replace regular medical compressed air when desired by a facility.

A proportioner will be required to obtain the proper mixture. This proportioned air shall have an oxygen content between 19.5 and 23.5 percent, with the appropriate valves and alarms. The system source for nitrogen is cylinders, and the source of oxygen is the facility’s supply. Because of its cleanliness, proportioned air does not require filters.

The size of the piping will be similar to that of normal compressed air. The system pressure shall be the same as medical compressed air.

A personal observation is that this new system generally will be used in small facilities where the installation of an air compressor and various filters might be a hardship due to space conditions, noise, or the constant maintenance required.

BULK SYSTEMS

Some of the information pertaining to the bulk storage of cryogenic liquids has been transferred to NFPA 55: Compressed Gases and Cryogenic Fluids Code. Items exclusively pertaining to bulk systems for healthcare facilities have been retained in Chapter 5 of NFPA 99.

WAGD VS. SCAVENGING

Many designers don’t understand the difference between waste anesthesia gas disposal (WAGD) and scavenging. The following definitions should clarify this difference in nomenclature.

For instance, due to the presence of nitrous oxide, there is some question as to whether a dental vacuum system shall be called a waste anesthesia gas disposal system or a scavenging system. The code does not contain requirements for a WAGD system, so for dental (Category 3) purposes, it could be called either WAGD or scavenging. However, it is preferably referred to as a scavenging system to differentiate it from the medical vacuum in patient rooms and operating rooms of Category 1. (Scavenging is a wet vacuum system, which must be separated from medical vacuum.)

With the revision of Category 3, the use of gaseous anesthesia agents in dentist offices is not permitted. While recent revisions to terminology designations by the American Society of Anesthesiologists delete the phrase “relative analgesia,” nitrous oxide is used for analgesia, which is a state of sedation and partial block of pain perception in a patient by the inhalation of concentrations of nitrous oxide not sufficient to produce loss of consciousness. General anesthesia is a state of sedation produced (among other methods) by the inhalation of concentrations of a gaseous agent that will render a patient unconscious.
LevelGuard

LevelGuard™ Sump Pump Switches from TouchSensor™ introduce Field-Effect sensor technology to reliably detect the presence of fluids without the use of moving parts or need for direct fluid contact. Replacing mechanical contact float switches, LevelGuard Electronic Sump Pump Switches offer the reliability of a solid-state residential sump pump switch for pump and plumbing applications.

LevelGuard Sump Pump Switches are designed with two Field-Effect electronic sensors that are vertically 6.7 inches apart and monitor the presence of fluids. Once both electronic sensors detect the presence of water, a solid-state switch sends power to the pump via a piggyback plug. LevelGuard improves sump pump performance by resisting contaminant build-up, preventing false actuations, and eliminating the short-cycling that burns out pump motors.

The MSRP of the LevelGuard Home Sump Control is $130. LevelGuard Home Sump Pump Switches are Underwriters Laboratories listed and have a manufacturer’s warranty of five (5) years. Please visit http://www.LevelGuardProducts.com/sump/.

Moen

Moen Introduces New M•Dura™ Wall-Mount Bar Faucets

New M•Dura™ two-handle, wall-mount bar faucets from Moen Commercial offer a durable, space-saving solution for commercial food service applications. These faucets feature trouble-free installation, heavy-duty construction and vandal-resistant benefits – all backed by Moen Commercial’s extensive five-year warranty, protecting against leaks, drips and finish defects. M•Dura wall-mount bar faucets feature a resilient chrome finish. Their tamper-proof Torx screws require a special tool for servicing, reducing opportunities for vandalism. The faucets also feature heavy-duty ceramic disc cartridges with internal stops, preventing misalignment and ensuring complete shutoff.

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Zoeller

Automatic Explosion-proof Pumps

Utilizing technology unique to the industry, Zoeller Pump Company’s NEW Automatic Explosion Proof pumps are high head pumps for submersible sewage or dewatering applications. Features include motors FM listed for Class 1, Division 1, Group C & D environments plus durable cast iron cover, motor adapter and pump housing with stainless steel parts that will not rust or corrode. Available in 2" or 3" NPT Flange discharge.

For more information, contact Mark Huntebrinker: 1-800-928-7867, ext. 8237 or markh@zoeller.com or visit www.zoeller.com

HELP SPREAD THE WORD ABOUT ENGINEERING!

The 2012 National Engineers Week is February 19–25, and once again ASPE will join numerous organizations across the country to promote engineering as a career. If you are interested in contributing or just want to share some ideas, contact Pam Newman at 847-296-0002.

Want to host an event in your community? Go to eweek.org for more information and ideas.

2012 National Engineers Week: February 19–25
“Engineers Make a World of Difference”

ENGINEERS WEEK® 2012
February 19-25

PRODUCT SHOW
On Thursday, October 27, the 2011 ASPE Technical Symposium kicked off with the 2011 Technical Symposium Product Show, at which our sponsors and some leading industry organizations showcased their latest products and services. During the show, ASPE President William F. Hughes Jr., CPD, LEED AP, FASPE; ASPE Executive Director/CEO Jim Kendzel, MPH, CAE; and ASPE Director of Affiliate Relations David Jern distributed certificates of appreciation to our Platinum, Gold, and Silver sponsors that were showcasing at the event.
HOST COMMITTEE

The host chapter of the 2011 Technical Symposium was Central Florida, which was recognized during the awards lunch on Saturday, October 29, with Certificates of Appreciation that were presented to Host Committee Chair Eric M. Knauth, PE, LEED AP, and committee members Christopher R. Farr, CET, John J. Basila, CPD, Natalie R. Kizelwicz, CPD, Matthew Clayton Clark, and Rich B. Grimes. In addition to helping with the preparations and planning, the Central Florida Chapter organized golf on Thursday morning for attendees who arrived early and were on hand during the entire event to answer questions about the area and recommend the best restaurants for dinner.
MEMBERSHIP AWARDS
At the luncheon on Saturday, October 29, ASPE President William F. Hughes Jr., CPD, LEED AP, FASPE, announced the chapter membership awards for the past year.

Award of Merit
This award captures the spirit of dynamic volunteerism and is awarded on the basis of a chapter’s accomplishment over the past year. The recipients for 2011 are Region 1: Boston, Capital Region New York, New Jersey, New York City, Philadelphia, and Washington, D.C.; Region 2: Central Ohio, Eastern Michigan, Johnstown, and Pittsburgh; Region 3: Atlanta, Central Florida, and West Coast Florida; Region 4: Seattle and San Francisco; and Region 5: Dallas, Kansas City, Minnesota and Omaha.

CONNECT WITH ASPE
New at the 2011 Technical Symposium was the added interaction on ASPE’s social media pages. Attendees, non-attendees, speakers, and sponsors interacted on Facebook and Twitter through posts, updates, and photos of the event as they happened. Every technical session and networking event was documented. Visit bit.ly/ASPEFacebook and twitter.com/ASPEOrg to see the interaction.

2011 ASPE TECHNICAL SYMPOSIUM CHAIR
Once again, William T. O’Donnell, CPD, FASPE, stepped forward and accepted the challenge of being the chair of the 2011 ASPE Technical Symposium, and as expected he did a tremendous job. Thank you, Bill!
**Membership Growth Award**

The chapter membership growth award is awarded to the chapter vice president, membership for the 2010–2011 membership year who successfully increased membership for his or her chapter. The 2011 recipients for chapters with 99 or fewer members are Ellis R. Lowry Jr., CPD, Richmond; Chad A. Dupler, Central Ohio; Paul D. Alexander, Johnstown; Paul W. Mc Kee, Pittsburgh; Kevin C. Jones, Seattle; Christopher A. Phillips, Central Texas, and David L. McArdle, Omaha. The 2011 recipients for chapters with 100 or more members are David Boutin, Montreal; Marco Barbera, PE, New York City; and Gwynne M. Morrison, CPD, LEED AP, Dallas/Ft. Worth.

**NETWORKING ROUNDTABLES**

At the 2011 Technical Symposium, ASPE launched a new feature: networking roundtable discussions during lunch on Friday, October 28. Attendees gathered with their peers to discuss hot topics in the industry such as holding the spec, BIM, low-flow fixtures, high-purity water, and more. ASPE thanks 2011 Technical Symposium Platinum and Gold sponsors for hosting tables at the event.

**ASPE RESEARCH FOUNDATION RAFFLE**

Throughout the year, ASPE chapters have been selling raffle tickets to help raise money for the ASPE Research Foundation. At the luncheon on Saturday, October 29, RF President Julius A. Ballanco, PE, CPD, FASPE, drew the lucky winner of a one-week stay at a condo in the LaCosta Beach Club Resort in Pompano Beach, Florida, in January. The winner is Henry G. Vickery of the Central Florida Chapter.
Membership Retention Award

To be a recipient of the Membership Retention Award, a chapter must have retained 90 percent or more of its previous year’s membership. This year, the award was given to the chapter vice president, membership for the 2010–2011 membership year.

The recipients for Region 1 are Jason J. Eagles, Baltimore; John P. Callahan, CPD, Boston; Michael W. Mullins, Capital Region New York; Jay P. Dunham, CPD, Central New York; Kyle S. Tasse, Connecticut; David Boutin, Montreal; Marco Barbera, PE, New York City; Matthew F. Martin, Philadelphia; and Jacques R. Paradis, Quebec.

The recipients for Region 2 are Joseph Eppolito Jr., CPD, Buffalo–Niagara; David N. Townsen, CPD, Central Indiana; Chad A. Dupler, Central Ohio; Greg A. Trombold, Cleveland; Rick A. Johnston, Eastern Michigan; Paul D. Alexander, Johnstown; Paul W. McKee, Pittsburgh; Douglas B. Meier, Rochester; and Eric A. Trombold, Southwestern Ohio.

The recipients for Region 3 are Morris O. Kay, Alabama; Christopher E. Rohling, Atlanta; Matthew Clayton Clark, Central Florida; Laura A. Pelchat, Charlotte; Lloyd M. Rainey, Memphis; Douglas A. Ruckman Jr., New Orleans; Andrew H. King Jr., EIT, Raleigh; and Richard B. Little, West Coast Florida.

The recipients for Region 4 are Everett J. Crowdis, British Columbia; Gregory M. Adams, Denver; Jonathan T. Jensen, PE, Intermountain; John R. Zagorski, Los Angeles; Angela M. Bowman, Northern California; James Weil, Orange County; David L. Robertson, Phoenix; Ludmilla V. Podwell, San Diego; Marc A. Santo, San Francisco; and Kevin C. Jones, Seattle.

![Recipient images]
The recipients for Region 5 are Cathy S. McNeil, CPD, Central Illinois; Christopher A. Phillips, Central Texas; Mark G. Mannarelli, Chicago; Gwynne M. Morrison, CPD, LEED AP, Dallas/Ft. Worth; Christopher B. Ennis, CET, Houston; Robert M. Franklin, Kansas City; Brian D. Salisbury, CPD, FASPE, Minnesota; David L. McArdle, Omaha; Michael C. Todd, St. Louis; and Richard E. Davison, Wisconsin.

Multiple Award Winners
One of the most difficult of all achievements in any one year is for a chapter to win all three membership awards: Award of Merit, Membership Growth, and Membership Retention. The chapters that accomplished this feat in 2010–2011 are New York City, Central Ohio, Johnstown, Pittsburgh, Seattle, and Dallas/Ft. Worth.

SATURDAY “MEET THE BOARD” BREAKFAST
One of ASPE’s strategic goals is to create a Society culture built on trust and open dialogue. To meet that objective, 2010–2012 ASPE board members were available during breakfast on Saturday, October 29, to meet with members, answer questions, listen to ideas, and share their thoughts about the Society. Attendees also were able to meet ASPE’s new Executive Director/CEO Jim Kendzel, MPH, CAE, and bend his ear about their concerns or views about the Society.
TECHNICAL SESSIONS

The 2011 ASPE Technical Symposium Committee, Education Committee, and staff worked long hours to develop technical education sessions that would appeal to all types of plumbing industry professionals. This year, beginners benefitted from the Plumbing 101 track, which covered basic system design techniques, while those more experienced in the industry learned how to incorporate sustainable systems into their designs—from solar water heating to rainwater harvesting and on-site water reuse.

A highlight of this year’s educational sessions was the presentation on NASA Shuttle Plumbing. Attendees raved about it, saying that it was one of the best sessions they’ve ever attended even though it wasn’t directly applicable to their job. The information provided gave attendees an idea of what plumbing will be like in the future and the value of the industry for everyone.

STRATEGIC GOALS

During the lunch on Saturday, October 29, ASPE Executive Director/CEO Jim Kendzel, MPH, CAE, and President William F. Hughes Jr., CPD, LEED AP, FASPE, rolled out the long-awaited ASPE Strategic Goals and Objectives. To support the Society’s effort to become the leading source and authority in the plumbing design and engineering field, the ASPE board of directors, with input from chapter leaders and other members, has developed seven target goals and has identified numerous objectives to reach those goals. The goals are:

» Create a Society culture built on trust and open dialogue among all stakeholders.
» Build positive relationships within the plumbing community.
» Enhance membership value, resulting in Society growth and long-term sustainability.
» Provide professional growth opportunities for the plumbing engineer community.
» Produce technical publications addressing current and future needs of the industry.
» Promote uniformity in plumbing codes and the use of sound engineering practices within the codes.
» Enhance recognition of the plumbing engineering profession.

THANK YOU TO THE SPONSORS OF THE 2011 ASPE TECHNICAL SYMPOSIUM

The ASPE Technical Symposium would be a very different experience without our generous sponsors. ASPE thanks the following sponsors for supporting the Society and the industry as a whole.

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THANK YOU TO THE SPONSORS OF THE 2011 ASPE TECHNICAL SYMPOSIUM
ASPE WANTS YOU!
Share Your Knowledge and Expertise at the 2012 ASPE Convention

It's time to start planning the 2012 ASPE Convention, and we are looking for plumbing engineers and designers who want to share their expertise with our attendees. Become part of the educational solution and participate as a presenter at the 2012 ASPE Convention & Engineered Plumbing Exposition to be held October 27–31, 2012, at the Charlotte Convention Center, Charlotte, North Carolina.

Sample Subject Topics
- Green building and sustainable design practices
- Acoustics
- Seismic design
- Venting systems
- Plumbing systems for specialized facilities
- Fire protection
- Domestic hot/cold water systems
- Gas systems
- Plumbing specifications
- Drainage systems
- FOG
- New and emerging technologies
- Project management

Proposal Submittals
Each proposal submittal should include a 200- to 350-word abstract or description of the proposed seminar. Information provided should include:
- How the program will enhance the skills of the professional plumbing engineer/designer
- What practical or professional skills will be augmented and strengthened
- How the attendee to this session will benefit directly
- What benefits this seminar will offer the attendee's employer

Presentations must be nonproprietary in nature as the seminars are about learning—not selling. The preferred technical session is 1.5 hours in length.

Presentation Guidelines
Presentations should include an introduction to the system(s) under consideration, relevant terms and definitions, formulas, applicable codes, and equipment descriptions and specifications. Programs should include full discussion of the system design objectives and parameters and should incorporate one or more realistic design projects to be solved by the attendees. Presenters should be prepared to provide appropriate guidance and leadership. All programs should have relevant material that includes all the information presented, incorporates copies of all visual materials, and includes documentation of the completed design project(s). All final program material must be submitted in advance of the Convention to be included on the flash drive given to attendees.

Biography
Please include a one-page, 250-word biography with each proposal. Be sure to include prior seminar or presentation experience.

Submittal Date
Proposals or a statement of intent to submit a proposal should be received at the ASPE office no later than April 1, 2012.

The success of an ASPE Convention & EPE has a magic ingredient: YOU. Please consider sharing your knowledge with your peers and taking the time to provide an in-depth technical presentation directly relevant to today’s plumbing engineers and designers.

Submit proposals to:
2012 ASPE Convention & EPE
c/o Cliff Reis, Director of Education, creis@aspe.org
OR Pamela Newman, Education Coordinator, pnewman@aspe.org
American Society of Plumbing Engineers
2980 S. River Road
Des Plaines, IL  60018
Fax: (847) 296-2963

Proposals may be submitted online at:
aspe.org/CallForPapers
(Note: Material submitted to ASPE for consideration will not be returned. Every presenter earns as many CEUs as each person in attendance for their program. In addition, presenters get additional CEUs for preparation time.)
My Symposium Wrap-up

WILLIAM F. HUGHES JR., CPD, LEED AP, FASPE, 2010-2012 ASPE PRESIDENT

The 2011 ASPE Technical Symposium in Orlando was a great success for ASPE and all of the attendees. While attendance exceeded the 2009 Technical Symposium, it did not achieve the board’s estimation. From discussions with the board and members in attendance, I believe the economy is still a factor. The general feeling of the attendees was that the economy is getting better, but firms are still not hiring, causing people to do more with less. Due to this situation, many members who wanted to attend were not able due to workload and other time commitments.

The Symposium is one of the few opportunities that we as members have during the year to catch up with old friends and to meet new ones from across the country. This year’s Symposium was no exception. It was great to see many old friends and to meet many of the members of ASPE.

The 2011 ASPE Technical Symposium Committee, led by chair William T. O’Donnell, CPD, FASPE, worked very hard in preparing this premier professional development event for our members and other professionals within the industry. The Education Committee once again did an outstanding job in preparing the program of diverse quality educational topics along with the selection of quality presenters. All the topics that were presented received rave reviews for being current and professionally presented.

Central Florida Chapter members, led by Chapter President Christopher R. Farr, CET, along with the Host Committee chaired by Eric M. Knauth, PE, LEED AP, were exceptional hosts and did a great job with the golf outing prior to the start of the Symposium. The Central Florida Chapter members that took time out of their busy schedules to volunteer their services to assist the ASPE staff were exceptional.

Last, but certainly not least, the ASPE staff, limited in numbers but with plenty of enthusiasm and dedication, once again assembled this event to run like clockwork and graciously solved any situation as they arose.

On behalf of the board of directors, I would like to offer a thank you to Bill, the Symposium Committee, Central Florida Chapter, and ASPE staff for all of their hard work and dedication and for a job well done.

I also would like to take this opportunity to once again say thank you to the sponsors that took the time to participate in the product show on Thursday night and during the roundtable discussions at the Friday luncheon.

The Symposium was full of new and interesting developments. Prior to the official start of the Symposium at the ASPE board meeting, ASPE signed a memorandum of understanding with the International Association of Plumbing and Mechanical Officials (IAPMO) to train, test, and certify qualified plumbing engineers to perform design work generally classified as “green plumbing design.” The program will be tied to the ASPE Certified in Plumbing Design (CPD) program by requiring the CPD as one of the eligibility requirements for sitting for the Green Plumbing Design exam. The Green Plumbing Design certification will be another credential that will increase the plumbing engineer’s competence and credibility for the design of these special types of systems.

The Technical Symposium was also the first opportunity for members from across the country to meet our new Executive Director Jim Kendzel, MPH, CAE. Many members in attendance took this opportunity to talk with Jim, and everyone I spoke with was enthusiastic about what he is doing with the Society and his relationship with the ASPE board of directors.

The Symposium also offered the opportunity for several of the ASPE committees to meet. There was plenty of enthusiasm and participation along with quality committee discussions. I am looking forward to increasing participation in all of our committees during the upcoming year, resulting in increased participation and attendance at the next committee meetings to be held at the 2012 Convention in Charlotte, North Carolina. Anyone who wants to become a member of an ASPE committee, please feel free to contact me or any other board member.

At this Symposium we introduced several new networking programs. The roundtable discussions with the Symposium sponsors and with board members during Friday’s lunch were well received. The Saturday morning “Meet the Board” breakfast got off to a slow start, but as more attendees made their way to the breakfast room, the discussions picked up.

Numerous chapter awards were presented at the Saturday awards luncheon. What was so impressive during the presentation of the awards was the number of membership awards for growth and retention given to the chapters. In these tough economic times, 75 percent of the chapters received an award in one or both of these categories.

The Research Foundation condominium raffle saw three winners. William N. Erickson from the Chicago Chapter was originally drawn as the winner of the condominium, but Bill donated the condominium back to be redrawn. The second winner was the ASPE Research Foundation, as Bill also graciously donated $1,000 to the ASPE RF. The third winner, Henry G. Vickery, a member of the Central Florida Chapter, won the 2011 ASPE Research Foundation raffle. He will enjoy a one-week stay at the La Costa Beach Club Resort in Pompano Beach, Florida, early next year.

Attendees at the Saturday luncheon also were presented with the blueprint for the future of ASPE. This three-year plan is a document called “ASPE’s Strategic Goals/Objectives.” The next step in process is for the board to develop programs and policies to address each item within the document. This process will not be done in a vacuum; the board
will be consulting others in the Society as necessary to help. This is not a document to be created only by the board of directors. We are a Society, and as a Society we need to reach out to our members and include their input.

Also announced at the Technical Symposium was that the board of directors will be implementing a new ASPE logo contest. Contest details and requirements will be issued shortly. The goal is to have three to five new logo ideas to present to the delegates at the 2012 ASPE Convention.

As you can see, plenty of things are happening with the Society, so stay tuned. More new and exciting things are yet to come.

On behalf of the ASPE board of directors and the staff of ASPE, I would like to wish you and your families happy holidays and a prosperous new year.

THE KENNETH G. WENTINK COLLEGE OF FELLOWS

ASPE College of Fellows Is Accepting Nominations

The ASPE Kenneth G. Wentink College of Fellows honors ASPE members of established reputation who have made significant, sustained contributions to the plumbing engineering profession, the Society, or the plumbing industry. Candidates who are nominated must meet the criteria outlined in at least three of the following categories:

- Plumbing engineering and design
- Plumbing industry product or service application
- Research and development
- Education
- Leadership/management in the industry
- Leadership in the profession
- Codes and legislation
- Political statesmanship

If you would like to nominate someone for this prestigious honor, visit aspe.org/Fellows for additional information or call 847.296.0002.

2012 ASPE WEBINAR SERIES

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Earn Continuing Education Credits: This one-hour contact program provides 0.1 CEU or 1.0 PDH.
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Learn the requirements of ICC/ANSI A117.1 and the Fair Housing Accessibility Act, including differences in application and enforcement and how they interface. Additionally, you will learn about installation requirements by product category, reach ranges, and floor space requirements.

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Want some help getting your degree in engineering?

Apply for the ASPE Alfred Steele Scholarship.

Up to $3,000 in scholarship monies may be awarded each year to qualified applicants.

The Deadline Is January 31!

The Alfred Steele Scholarship is limited to ASPE members and their immediate families who have a GPA of 3.0 or higher who are in or plan to attend a college, university, or technical school on a full-time basis (minimum 12 credit hours), enrolled in an engineering program.

Contact ASPE’s Director of Membership Stacey Kidd at skidd@aspe.org for additional information.
I recently was reading the Chicago Chapter’s newsletter and came across an article written by Jason McDonald, CPD, a long-time ASPE member and past president of the Chicago Chapter. I found his words very compelling, so I asked Jason if I could share his thoughts with all of you. Jason agreed, so below is a reprinting of his article (in its entirety) providing a testimony of the intangible and most significant benefit of being an ASPE member. Thank you, Jason.

You folks have been hearing the sales pitch for ASPE over the past few months. It’s true that membership has been dwindling, and we (ASPE), both on the Chicago Chapter level and on the Society level, want to do all we can to keep each of you as members and to recruit new members.

I want to give you a real-world example of the value (and power) of networking in ASPE that involves me personally, and please let me preface this by telling you that I am writing this on the plane as my new wife, Laura, naps on the way to our honey-moon. PLEASE don’t tell her I am working on ASPE stuff!

Many of you have heard that Laura and I are relocating from Chicagoland to Evansville, Indiana. Actually, she is already there, and I will follow as soon as I find employment down there. The main tool I have been using in my job search is ASPE! There are two different paths that became available to me and both are DIRECT results of my involvement with ASPE.

When I first mentioned that I was looking for work in Evansville, some of our ASPE sales representatives and manufacturers (both current and past) were eager to help. I was quick to learn that there are far more than the two design firms in Evansville than I initially thought. Soon, my Evansville contact list grew to more than 30 names and 15 firms because of my ASPE friends Glen Smith, Paul Riedinger, Ed Lichner, and Victor Rilling.

As I started contacting some of the folks on my list, another ASPE opportunity came to light. This is a cool story, and I hope you all will follow along. As you read through this, keep in mind that if I was not involved with ASPE, this opportunity would have NEVER happened! Ready? Here goes...

Central Indiana Chapter President Jim Rodgers emailed me at the end of August asking for suggestions on things to do on an upcoming trip to Chicago. I replied with a couple suggestions (e.g., Ford City Mall, Baby Doll Polka Club, Cabrini Green, and things like that). I also mentioned that I am moving to Evansville and asked if he knew anyone down there who might be looking for a plumbing engineer.

Jim replied immediately saying that they are trying to start a satellite ASPE chapter in Evansville and sent me a meeting announcement for a lunch meeting in Evansville on September 15, the same day as our Chicago Chapter meeting. Everything inside me told me that I had to be at that meeting—the reason I missed the first Chicago Chapter meeting with our new President Frank Sanchez at the helm. My apologies to Frank and the rest of the board for missing that, but I think you guys all understand.

So, now I am ready to go to an ASPE meeting in Evansville on September 15, an opportunity to network with the very people I need to meet! But it gets better! True, the fact that the lunch for designers and engineers was paid by the presenter (VERY cool) didn’t hurt. Here is the awesome part: Jim asked if I would be willing to help his administrative secretary talk about ASPE. Of course I will help promote ASPE. Then the idea sunk in: not only will I be meeting the people I need to meet, but I actually might get to talk to ALL of them! This is what some of us refer to as a Golden Opportunity!

As it turned out, September 15, 2011 became one of my best days ever professionally as the ASPE planets aligned over Evansville. Not only was I given some props by the local host of the meeting, Larry Fox, and Central Indiana ASPE’s Pierre Deubelbeiss, but Pierre turned the floor over to me immediately and for about 15 minutes I was able to talk with 25–30 of my soon-to-be peers both about me being on the job hunt and about how amazing ASPE is. I opened with the fact that I was there to network and never imagined I would have a chance to talk with ALL of them. It was awesome! I basically got to interview in front of all those people at once. I am happy to say that as soon as we get back from the honeymoon, I will be having my third interview as a direct result of that ASPE meeting!

ASPE has truly opened doors for me. The fact that I have been president of this amazing Chicago Chapter a couple times probably hasn’t hurt, but I think there is no denying the importance of networking in ASPE. I am getting help from old members, new members, and more. This is a big reason why we ask you to step up and get involved. Why we ask you to put yourself out there and meet someone new at our meetings. Something we do not mention—even though it is both a way of networking and thanking those sales reps and manufacturers who come by our offices for a quick visit, catalog update, or lunch and learn—give them a few minutes of your time. You never know when one of you might be able to help out the other. No matter what happens in my job search, I will be eternally grateful to ASPE and the gentlemen I mentioned in this article for helping put me in a position to get my name AND face in front of potential employers. This is the value of ASPE at work!

Last thing I want to say is how much I appreciate my current employer, Grumman/Butkus Associates, and especially our company President Dan Doyle (CPD and long-time ASPE Chicago Chapter member, by the way) for the incredible support I have been given. Dan was the very first one to offer me...
leads in and around Evansville. Folks, it is difficult knowing that I will soon be leaving a firm that has been both home and family for the past 15 years, and it is a weird feeling openly looking for a job while still employed and openly discussing it with friends at work and with my boss! G/BA and Dan Doyle, please know that your support has been so appreciated, and I cannot thank you enough.

With that, my ASPE friends, I will let you back to your work. If you get nothing else from this literary masterpiece, please understand that networking is vital, especially in these, as you have heard so often over the past few years, tough economic times. The only way we can get through this is together. Help each other out. Give each other some of your time. Be welcoming to new people. Shake hands. Exchange smiles. Okay, it’s getting deep in here now, so I’ll stop. I’ll give you all an update when I can!

UPDATE: Wow, that was quick! Since I started this article, I am happy to report that I got an offer, and we have decided to accept! I will start working in Evansville at the end of November. I am excited for the challenge and know that there will be much to learn. How did I get in touch with these guys? Well, I said hello to a consulting engineer at the ASPE meeting on September 15, sat at his lunch table, and then he introduced me to someone from my soon-to-be new firm. I had an inter-view with them the next day and now here we are waiting for me to end my days with Grumman/Butkus and start my days with my new company. This door would not have opened without ASPE! And you know what? After this article went out to the Chicago Chapter, I received ANOTHER offer. I think I got both job offers based on my merits, but the doors to those companies would not have opened so easily without ASPE. Three interviews and two offers. Yeah baby! Thanks ASPE!

Jason S.A. McDonald, CPD

Join the Discussion

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Society News

New ASPE Members

Welcome to all new Society members. When you choose a chapter affiliation, you have twice the advantage. Not only can you be involved at the national level, you also can participate in chapter functions and programs. To all members, old and new, this is your Society. Your involvement enhances the plumbing engineering field as well as ASPE. Suggestions about how to make your Society more beneficial to both fellow members and all involved in the industry are welcome.

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Continuing Education from *Plumbing Systems & Design*

Do you find it difficult to obtain continuing education units (CEUs)? Through this special section in every issue of *PS&D*, ASPE can help you accumulate the CEUs required for maintaining your Certified in Plumbing Design (CPD) status.

**Now Online!**

The technical article you must read to complete the exam is located at www.psdmagazine.org. Just click on “Continuing Education” at the top of the page. The following exam and application form also may be downloaded from the website. Reading the article and completing the form will allow you to apply to ASPE for CEU credit. If you earn a grade of 90 percent or higher on the test, you will be notified that you have logged 0.1 CEU, which can be applied toward CPD renewal or numerous regulatory-agency CE programs. (Please note that it is your responsibility to determine the acceptance policy of a particular agency.) CEU information will be kept on file at the ASPE office for three years.

Note: In determining your answers to the CE questions, use only the material presented in the corresponding continuing education article. Using information from other materials may result in a wrong answer.

### CE Questions — “Life-safety Systems” (PSD 183)

1. Which of the following is a type of emergency drench equipment?
   a. face wash
   b. eyewash
   c. drench hose
   d. all of the above

2. The spray pattern of an emergency shower shall be _______ minimum in diameter.
   a. 16 inches
   b. 20 inches
   c. 30 inches
   d. 60 inches

3. _______ are the most-often-used type of activation device on drench equipment.
   a. ball valves
   b. disc valves
   c. gate valves
   d. none of the above

4. Drench hoses require a minimum operating pressure of _______.
   a. 15 psig
   b. 30 psig
   c. 105 kPa
   d. both a and c

5. The minimum pipe size for a combination unit is ________.
   a. ½ inch
   b. 1 inch
   c. 1¼ inches
   d. 2 inches

6. For a wheelchair-accessible combination unit, the handle for the shower valve shall be located _______ from the floor.
   a. 33 inches
   b. 45 inches
   c. 48 inches
   d. 60 inches

7. The most common operating range for breathing-air systems is _______.
   a. 90–110 kPa
   b. 250 psig
   c. 90–110 psig
   d. 1,725 kPa

8. What is the most toxic contaminant of a breathing-air system?
   a. carbon dioxide
   b. carbon monoxide
   c. oil
   d. water

9. Which of the following is a type of breathing-air system?
   a. constant flow
   b. demand flow
   c. pressure demand
   d. all of the above

10. Which of the following is included in a breathing-air system?
    a. humidifiers
    b. respirators
    c. purification devices
    d. all of the above

11. A _______ is used to reduce the temperature of the air leaving an air compressor.
    a. humidifier
    b. aftercooler
    c. cooling tower
    d. none of the above

12. What is the maximum length of a respirator hose?
    a. 100 feet
    b. 200 feet
    c. 300 feet
    d. 400 feet

### About This Issue’s Article

The December 2011 continuing education article is “Life-safety Systems.” A threat to personnel safety often present in pharmaceutical facilities is accidental exposure and possible contact with toxic gases, liquids, and solids. This chapter describes water-based emergency drench equipment and systems commonly used as a first-aid measure to mitigate the effects of such an accident. Also described are the breathing-air systems that supply air to personnel for escape and protection when they are exposed to either a toxic environment resulting from an accident or normal working conditions that make breathing the ambient air hazardous.

You may locate this article at psdmagazine.org. Read the article, complete the following exam, and submit your answer sheet to the ASPE office to potentially receive 0.1 CEU.
Plumbing Systems & Design Continuing Education Application Form

This form is valid up to one year from date of publication. The PS&D Continuing Education program is approved by ASPE for up to one contact hour (0.1 CEU) of credit per article. Participants who earn a passing score (90 percent) on the CE questions will receive a letter or certification within 30 days of ASPE’s receipt of the application form. (No special certificates will be issued.) Participants who fail and wish to retake the test should resubmit the form along with an additional fee (if required).

1. Photocopy this form or download it from www.psdmagazine.org.
2. Print or type your name and address. Be sure to place your ASPE membership number in the appropriate space.
3. Answer the multiple-choice continuing education (CE) questions based on the corresponding article found on www.psdmagazine.org and the appraisal questions on this form.
4. Submit this form with payment ($35 for nonmembers of ASPE if required by check or money order made payable to ASPE or credit card via mail (ASPE Education Credit, 2980 S. River Road, Des Plaines, IL 60018) or fax (847-296-2963).

Please print or type; this information will be used to process your credits.

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I am applying for the following continuing education credits:

I certify that I have read the article indicated above.

Signature

Expiration date: Continuing education credit will be given for this examination through December 31, 2012. Applications received after that date will not be processed.

PS&D Continuing Education Answer Sheet
Life-safety Systems (PSD 183)
Questions appear on page 46. Circle the answer to each question.

Q 1. A B C D
Q 2. A B C D
Q 3. A B C D
Q 4. A B C D
Q 5. A B C D
Q 6. A B C D
Q 7. A B C D
Q 8. A B C D
Q 9. A B C D
Q 10. A B C D
Q 11. A B C D
Q 12. A B C D

Appraisal Questions
Life-safety Systems (PSD 183)

1. Was the material new information for you? □ Yes □ No
2. Was the material presented clearly? □ Yes □ No
3. Was the material adequately covered? □ Yes □ No
4. Did the content help you achieve the stated objectives? □ Yes □ No
5. Did the CE questions help you identify specific ways to use ideas presented in the article? □ Yes □ No
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