Electric Deregulation — One City's Response Leads to Water Department Independence

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Located on the banks of the St. Johns River in northeastern Florida, Green Cove Springs is a quaint town with a resident population of about 5,500. The median household income of $21,500 is 22 percent lower than the average for Florida.

Green Cove Springs has a long and rich history. First settled in 1854 and named White Sulfur Springs, it was renamed in 1866. It became the county seat of Clay County in 1871.

The citrus and timber industries gave the city its start, but tourism became the real impetus for growth. Not surprisingly, in its early years visitors were drawn to the city by the healthful qualities of water flowing from the city's famous spring. Water service utilizing the spring was provided to hotels, and that was the beginnings of the Green Cove Springs water utility in the early 1920s.

The city benefited from renewed growth and expansion during the prosperity of the Florida Land Boom of the 1920's, at which time its population was about 1,750. During World War II the population grew to about 3,000 when the Navy built a 1,500-acre air-auxiliary complex on the south side of the city. The city's water and sewer systems continued to expand to serve the growing population.

By 1960 the population had grown to 4,200 as returning war veterans went to work in the Navy's shipyard, where an estimated 600 ships were mothballed. The Navy decommissioned the base in 1961 and the reserve fleet was transferred out of Green Cove Springs.

Just as the growth of the city has been tied to significant events in its history, so has the expansion of its water and sewer infrastructure. Much of the water distribution system was constructed in the 1920s and 1940s. The majority of the sewer collection system was built in the mid-1970s, along with new water and wastewater treatment facilities on the city's north side. In the mid-1980s, the wastewater treatment facility was expanded. In the early 1990s a new wastewater treatment facility was constructed on the south side. After that, the water and wastewater systems were largely left alone.

Unfortunately, by the 1990s much of the infrastructure was in a state of disrepair. An excessive number of the core city's fire hydrants were inoperable with numerous frozen valves. The network of 2-inch and smaller galvanized water mains was failing because of corrosion. The water treatment plant was operating at capacity, and the wastewater treatment facility was cited for a number of violations of its operating permit. It was clear that the water and wastewater utilities were operating without clear focus and direction and without adequate staffing, resources, and funding.

Complicating the problems with the existing system was the fact that the water department was receiving an increasing number of inquiries about extension of the service area. The limited financial capability of the water department made the matter of addressing the needs difficult, because the utility was operated at a revenue deficit; the water and sewer operations were subsidized by the city's electric utility.

In response to the perceived ramifications of electric utility competition in a deregulated market, Green Cove Springs launched a campaign to create a self-sustaining water and wastewater utility committed to excellence by providing improved water service with minimal impacts to its customers. A strategy was needed to raise the level of service to existing customers, while providing for the capital projects necessary to facilitate orderly expansion and much needed customer growth.

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In 1995 CDM was hired by Green Cove Springs to assist it in responding to Consent Orders issued by DEP for violations in the operation of the water and wastewater systems.

In 1997 the city hired a new manager with a progressive program designed to bring renewed life to programs that had been stalled for years. After resolving the problems that led to the regulatory agency enforcement actions, the city was determined to aggressively address the water and wastewater operations to avoid further enforcement actions. In 1997 the city initiated the first steps toward the re-establishment of the water and wastewater utility business.

Total Program Approach

The program to re-establish the utility business started in March 1997 with a review of the existing status of water and wastewater operations and ongoing projects. Each department function was reviewed, and staff members were asked to contribute to the process by identifying deficiencies and needs. A vision was formulated of a new and improved water and wastewater operations that would be adequately staffed with trained personnel, appropriately stocked with spare parts, adequately funded, in compliance with permits and regulations, prepared to respond to new growth and development, and accurate in document and records management.

In effect, the vision addressed deficiencies in the utility operations and provided the direction for the total program improvement. Over the course of a two-year period, every aspect of the utility business was assessed. Each identified deficiency was addressed to bring improvement in service to its customers.

Operations and Maintenance

Specific attention to operations and maintenance is one benchmark of a well-organized utility. With a priority placed upon proactive operations and maintenance, a utility can operate in a manner that maintains the current level of service without sacrificing an ability to grow in the future.

One of the first tasks that confronted the city's administration was to assess its current level of utilities staffing and training. Utility workers had been used to staff several different positions within the Public Works Department, often being asked to perform public works duties that were outside their area of training, as well as being called upon to respond to line breaks and malfunctioning valves. There was a lack of licensed operators for the treatment facilities. Many times conflicts arose over plant staffing levels and responsibility to field service calls.

An assessment of plant staffing levels revealed that while there were an adequate number of personnel, the level of training and certification of employees was insufficient. In 1997 the water and wastewater staff had three operators with C wastewater licenses and two with C water licenses. As of 1999 the city could boast that five of its operators possessed dual water/wastewater licenses.

Another change effected by the program was the formation of a dedicated line crew to do more efficient training of specific staff for handling specialized tasks. The line crew received formal training in trench safety, equipment use, and repair methods, which brought about a lowering of response time and an improvement of overall service. The result of the training program became evident within a year when the number of completed work tickets doubled without any increase in staffing. By 1999 the preparations were completed to have the line crew staff take the distribution C license test, and one plant operator was preparing to take his B wastewater license.

One of the first tasks of the utility improvement program CDM participated in was an inventory of the city's as-built record documents. At that time there was no central storage area for the documents. As city crews would use the maps to respond to maintenance calls, the original documents would often accompany them to the field, resulting in many damaged or missing records. In the first phase of the mapping project all of the drawings - almost 500 individual maps - were collected from locations throughout the city, sorted, cataloged, and stored in a map library created in the Public Works Department. All of the recorded as-built facility information was then transferred to an electronic base file of the city that was created by the Clay County GIS department. For the first time this map allowed utility staff to see a comprehensive picture of the existing utility systems. Using this map, the city could better manage facility inventories, locate maintenance and isolation points, and visualize enhancements to its systems, as well as plan rehabilitation and replacement programs.

Next, an evaluation of the utility operating permit compliance status was undertaken. While the response to the enforcement actions addressed most of the regulatory violations, DEP still continued to identify deficiencies and non-compliance issues. In response to DEP inspection comments, the city awarded a contract to complete minor repairs to the north side WWTP. The repairs consisted of re-leveling and re-gasketing clarifier weirs and fixing one of the plant's blowers. The city also had a chlorine solution line added to the clarifier weirs to help control algae growth.

After the repairs were completed, the city invited DEP inspectors back to the site to review the plant improvements and to meet the new utility staff. That meeting was the first in a series that served to illustrate the city's commitment to restoring faith and promoting good working relationships with the regulatory agencies. At present, the water and wastewater plants have not received any negative comments on any recent DEP inspections.

The next step was to address an unaccounted-for-water problem that ranged from 30% to almost 40% of total water pumped. The city began by spot checking the accuracy of existing 4-inch and larger meters. Of ten meters for commercial customers chosen at random, eight were either not working or were inaccurate. A service-area-wide program was initiated, and within one year all large meters (3 inches or larger) were either replaced or rebuilt. Also, meter readers were instructed in methods to identify potential unmetered connections, and more than 60 such were found and corrected.

In conjunction with the meter repair and replacement program, the city addressed a significant lack of control of the water distribution system. Isolation valves were either non-existent or non-functioning. Major breaks usually necessitated the complete shutdown of the water plants. Installation or replacements of valves in the distribution system were a priority. Additional valves were installed in strategic locations to establish ten system control zones. In many areas, the distribution system can now be isolated such that service outages are limited to a one-block area.

The last element of the distribution system upgrade was the replacement of numerous inoperable fire hydrants. Of 350 fire hydrants in the city in 1997, 68 were inoperable. Many had persistent water leaks. Most could not be replaced or repaired because of the lack of working isolation valves. As the valve replacement program progressed, the inoperable fire hydrants were also replaced.

By addressing water meters, system control valves, and fire hydrants, the city was able to reduce the volume of unaccounted-for water from more than 35 percent to less than 20 percent.

The results of that program were the springboard to additional preventative maintenance efforts to upgrade the system. The initial work focused on the immediate needs for emergency repairs to non-functioning facilities. The continued efforts were shifted to a systematic repair or replacement of facilities that exceeded their design life. Preventative maintenance programs were outlined for the continued replacement of valves, hydrants, and meters. New programs were outlined for sanitary sewer manholes, water distribution mains, and gravity sewer pipes. An annual TV/cleaning program was also initiated to provide for the inspection and maintenance of the sanitary sewer system.

Planning

The city also had to address critical growth related matters. Experiencing the impacts of overflow development from Jacksonville, the city was encouraged to add more customers to the utilities and to increase the revenues from water sales. The goal was to do so without existing customers being overburdened by expensive capital improvements. To this end, planning efforts became essential.

To begin with, the city prepared a model agreement that standardized many of the terms and conditions relating to the provision of water and sewer improvements and services for new development. The agreements promoted cost sharing and cost reimbursement opportunities for participating developers.

In addition, the city produced a set of utility design and construction standards to be used by all developers within the city's service area. Prior to the production of the utility standards, developers provided equipment and facilities built to standards they were accustomed to. Uniform design and construction standards provided consistent standards of quality for the installation of water and sewer facilities by developers.

The city also had to resolve a major dispute over service area boundaries with the Clay County Utility Authority (CCUA). Although the city's adopted Comprehensive Growth Management Plan defined a utility service area boundary that extended beyond the corporate limits, the CCUA disputed that boundary because it believed that legislative authority to regulate utility service in the unincorporated area provided it the right to serve. Recognizing the significant limitations to plant capacity utilization and impacts to customer growth and rate stability, the city elected to defend the defined service area boundary during the update of the County's Comprehensive Plan. After lengthy negotiations, the two parties agreed to a service area boundary that would allow the city to grow into much of the unincorporated area it previously claimed. The progressive agreement included provisions for a high degree of intergovernmental cooperation in the expansion of water and sewer service in the unincorporated area, as well as giving CCUA the flexibility to establish new treatment facilities in the area, or to reserve capacity in the city's facilities and purchase water and wastewater services at wholesale rates during an interim period. The agreement is beneficial for both parties because it provides for the full utilization of existing plant capacity for service to new customers in the area around Green Cove Springs. Both utili-

ties can accomplish that with the lowest front-end investment in facilities.

Continuing with the visionary process, Green Cove Springs initiated a development study of the newly confirmed service area. This expedited master-planning exercise provides the city with a flexible plan for the development of infrastructure in the north service area to accommodate anticipated growth. With developers beginning to make inquiries about the availability of service, the Public Works Department can respond appropriately regarding ability to serve and options regarding developer contributions to infrastructure expansion.

Capital Improvements

Green Cove Springs also needed to implement several capital projects. Considered projects were evaluated in terms of safety improvements, reliability improvements, compliance improvements, or expansion improvements. Early in the total program, funding constraints limited priority improvements to safety, compliance, and reliability.

The largest project undertaken was the rehabilitation and replacement of three lift stations that had been malfunctioning and causing excessive down time. Two of the three lift stations had confined space entry problems, and all three were adjacent to surface waters. The lack of operational reliability raised significant compliance concerns regarding the likelihood that a sewage spill would reach the river before it could be contained.

Other funded projects included design-build electrical improvements to the high service pumps and motor control center at the north side water treatment plant, the purchase of a trailer-mounted bypass pump, and the elimination of illicit connections to the storm sewer system. In the most recent project the city has purchased new emergency generators for both of its water plants.

One expansion improvement project was undertaken. Encompassing the extension of water and sewer lines along the U.S. 17 corridor, and a product of the master planning process for the north service area, it provides water and sewer trunks for all new infrastructure development. Furthermore, the extension capitalizes on immediate commercial development occurring along the major thoroughfare.

Funding Requirements

In the operation of a water and sewer utility, adequate funding is vital. Success is not measured in terms of profit on sales, but it is reflected in the reinvestment in the systems or in the self-sufficiency of the operation. The initial assessment of financial health of the water and sewer utilities of Green Cove Springs indicated that the electric utility was subsidizing water and sewer operations, and from 1991 to 1997 had done so with more than $800,000 in electric revenues. In 1997 alone, the water and sewer utilities were subsidized by over $100,000 from the electric utility. City management realized that the utility funds could not be combined, and that each department must stand on its own. This decision was made with the expectation that electric system deregulation would force the electric utility to become more competitive, which it could not do with the burden of supporting the other three utilities.

The decision to separate the enterprise fund revenues and make each operation self-sufficient was a difficult one. Acceptance of the decision by elected officials was essentially an acknowledgement that the water and sewer rates would be increased. To reduce public opposition to the rate increases, it became necessary to find a way to increase revenue by restructuring the rate schedules such that the burden of a rate increase could be shifted away from those who could least afford it. A review of the existing rate schedule concluded that it benefited large volume, commercial consumers.

As an example of the imbalance, the base rate for a commercial customer with a 2-inch meter was $9.10 with the first 16,000 gallons included in the base rate. By comparison, the residential customer with a 2-inch meter was charged $4.95 with the first 2,000 gallons included in the base rate. Additional consumption of water was billed at the rate of $1.40 per 1,000 gallons for both classes of customers. The residential customer would pay $24.55, or over twice the amount as the commercial customer using the same amount of water.

The adopted rate structure minimized the impacts to the low volume and residential customers, and it promoted water conservation. It reduced the volume included in the base charge to 2,000 gallons for all customer classes. It also increased the amount of the base rate for larger meters. These increases corresponded to the higher costs and higher demand potential associated with the larger meters, and not only allowed the utility to operate within collected revenues, but also to transfer more than $250,000 per year to the general fund to offset contribution reductions by the electric utility.

Funding Sources

With rates restructured to make utility operations financially self-sufficient, and with a focus on the general upgrade of facilities and operations, Green Cove Springs was poised to take advantage of alternative sources of funding for improvements. The most promising funding was the DEP State Revolving Fund Grant Program. In fact, the city was eligible to pursue grant funding in 1998. As a result of its active pursuit of the funding, Green Cove Springs was one of the first cities to be awarded a grant through the program.

The total amount of the state's commitment to fund water system improvements was $4.5 million, with approximately $2.1 million awarded in the first year. These funds will improve a large portion of the area where 2-inch and smaller galvanized water distribution lines exist. The city has also pursued and received tentative approval of grant funding through the state's dental health program to purchase and install fluoridation equipment at its Reynolds Water Treatment Plant.

Green Cove Springs has also aggressively pursued grant-funding opportunities for its wastewater system. The St. Johns River has been named an American Heritage River, and the city has recognized the need to develop a reclaimed water system to eliminate discharges to the river. The city has received partial funding through grant programs from DEP and SJRWMD to implement a reclaimed water system at nearby golf courses. The balance of the project costs has been applied for through funding by the state's Water Advisory Panel grant program and the SRF Wastewater Grant Program.

Summary of the Total Program

During a two-year period, virtually every aspect of the utility management, operations, maintenance, capital improvements, and financing were assessed and enhanced. Prior to program initiation, the city was spending too much time reacting to emergencies, which manifested itself in consent orders and other compliance and enforcement actions, as well as a general lack of response to growth and development. As a result of the program that began as a way to free the electric utility, the city has increased the stability and control of its utility business and is poised to respond to growth and regulatory changes proactively.

As small utility systems struggle to address the costly rehabilitation of aging infrastructure, being able to demonstrate efficiency gains and improvements in operation and maintenance becomes critical to gaining the public trust. Green Cove Springs' approach is perhaps a model for other utilities faced with monetary constraints and lack of customer awareness. ■

Solving Taste and Odor Problems in Drinking Water

Tai-Yi Su

The water utility that has never experienced a taste and odor problem is rare. Although taste and odor problems do not typically mean inferior water quality or public health threats, they can be a major aesthetic perception issue. A serious taste and odor episode, if not handled quickly and properly, can balloon into a public relations nightmare.

Causes of Taste and Odor Problems

The most common types of taste problems experienced by utilities are reported to be chlorine, sour, sweet, and metallic. The major odor complaints in drinking water have been characterized as chlorine, earthy, musty, fishy, medicinal, chemical, grassy, swampy, and rotten-egg smells. The earthy, musty, fishy odors are reported mainly by utilities using surface water sources; the rotten-egg smell caused by hydrogen sulfide is reported mostly by utilities using groundwater as a raw water source. The likely causes of taste and odor problems include those that develop in the distribution and disinfection process, those resulting from planktonic algae blooms, turnover of lakes or reservoirs, and decaying vegetation.

Taste and odor problems attributed to the distribution system frequently are caused by the need to maintain a chlorine residual to control biological regrowth in the distribution system. While high chlorine residual may cause customer complaints about the chlorinous taste or odor in water, low or no chlorine residual also may expose an underlying taste and odor. In addition to biofilm buildup in water mains, low chlorine residuals also can indicate problems such as stagnant water in water mains or storage facilities. Lining or sealing materials in newly constructed mains, if not properly cured, can leach chemicals into the treated water and cause an undesirable taste and odor. In severely corroded pipelines, leaching of metals can contribute to a metallic tasting water. Blending of water with different qualities, such as ground and surface waters, may cause aesthetic problems when customers detect the difference.

On a smaller scale, taste and odor problems can sometimes be attributed to problems in plumbing systems in customers' homes. Stagnant or corroded pipes, cross connections, hot water systems, or improperly maintained point-of-use filters may cause objectionable tastes and odors.

The growth and decay of algae, actinomycetes (a bacteria that lives on algae or in the sediments of lakes and reservoirs), and other microorganisms frequently cause significant odor problems in surface water supplies. Blooms of blue-green algae often coincide with episodes of earthy, musty tastes and odors. Two important compounds causing such problems are the algal metabolites 2 methyl-isoborneol (MIB) and geosmin. Removal of these odor-causing compounds may pose a challenge because (1) the threshold odor numbers (TON), typically used to describe odor concentration detectable by humans, for MIB and geosmin are extremely low at approximately 5 to 10 nanograms per liter (ng/L) or parts per trillion (ppt); and (2) these compounds are not easily removed by conventional treatment processes.

Many water systems with surface water supply sources experience seasonal taste and odor problems during spring and fall. The turnover process, caused by seasonal temperature changes, causes the sediment and biomass in the bottom layers of lakes or reservoirs to be stirred up, resulting in taste and odor problems.

Suspended and dissolved organic matter originating from decaying vegetation can result in a brown-colored, sweet-smelling water. This often occurs in coastal communities with swampy raw water.

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A Systematic Approach

Identifying and eliminating a particular taste and odor can prove to be extremely difficult. Because the causes of taste and odor problems vary greatly, it is important to think like a detective to identify the sources of the problems. Treatment approaches for different tastes and odors also vary greatly. For example, geosmin and MIB cannot be easily removed by oxidation, but adsorption with powdered activated carbon (PAC) typically works well. However, many PAC products are available in the market and they are not all effective. Therefore, bench-scale testing with an odor/flavor panel should be used to identify the effective PAC product, application point, dosage, and required contact time.

When faced with a taste and odor problem, water utilities should use a systematic approach to troubleshoot the various kinds of taste and odor problems. The approach consists information and sample collection, raw water and watershed water quality evaluation, bench-scale testing with odor/flavor panel reviews, review of existing treatment processes, assessment of existing treatment capabilities, and distribution system evaluations.

A detailed interview with the customers followed by water sample collection should be conducted immediately after the complaint is received to help identify the problems. The following information should be obtained by interviewing the customers:

- Where was the taste/odor first detected? Is it only detected from one tap in the house, or is it everywhere? Can it be found both indoors and outdoors?
- What was the taste/odor like? Most of the time customers have a difficult time describing the taste or odor they experienced, so it is a good idea to give them some words, such as musty, earthy, chlorine, or rotten-egg, to help them come up with an accurate description of the problem.
- When was the taste/odor detected? Is there a particular time the taste/odor exists? How long does it last?
- Does the taste/odor occur only in hot or cold water?

Utilities or public works managers should talk to the plant and distribution system staff to get an understanding of the problem. In addition to the above-mentioned information, the following conditions also should be understood:

- Is it a seasonal problem?
- How often does it occur?
- Is it a localized or system-wide problem?
- How did the water system handle similar problems in the past?
- Were the treatment methods effective?

When samples are collected, the following criteria should be used:

- Collect representative samples.
- Collect when the taste and odor problem is at its worst.
- Collect at different taps in the building.

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Retooling Your Utility Workforce and Enhancing Its Efficiency and Competitiveness

Marc J. Rogoff and Ralph Lassiter

Most water and wastewater treatment employees are being urged by their managers to help reduce operating and maintenance costs by actively participating in optimization, privatization, managed competitive assessments, benchmarking, or cross-training activities. But how does the front-line employee participate in these efforts? What is required of an organization to be competitive from the employees' perspective?

Many communities that have considered privatization have determined that increased productivity, efficiency, and competitiveness can be gained while maintaining public control and management of operations and maintenance. Charlotte, Boston, and San Diego are examples of municipalities pursuing efficient operations through continued public operation. Examples in Florida include Miami-Dade County and Kissimmee.

These and other communities acknowledge that front-line employees — non-supervisory workers such as operators, mechanics, electricians, laboratory technicians, and administrative support staff — are key to efficient operations. However, employees must act as if they were in business for themselves. This behavior comes naturally from employees who are willing to think private and do their best instead of simply "putting in their eight and hitting the gate." But what does it mean to think and act private? And under what circumstances are employees more apt to think private?

Speak to any front-line employee involved in improving operations and the same response is given: Employees can make their facilities competitive, but management has to make changes also. In other words, facility and utility managers must create an environment in which employees can do their best. This environment includes:

- Open communication — not only should employee ideas be sought, but managers should select ideas worthy of being realized;
- Employee training and advancement opportunities;
- Incentives for improvement; and
- Supervisors who are trained to manage performance effectively.

This article will look at what is required of workers.

What Must Employees Do?

To participate actively in and support their utility's efforts, employees must be willing to change. Individuals usually respond to change in one of three ways: they support it, resist it, or take a neutral "wait-and-see" approach. Resistance to change or hesitancy is not necessarily bad. However, blanket opposition without consideration by front-line employees is unproductive for the entire utility.

When management or an outside consultant first suggests change, employees should get involved immediately by requesting additional information and offering suggestions to improve processes. Workers should try to foster discussion instead of providing such responses as "We've tried that before," "That will never fly," or "It costs too much." Examples of efficiency-related changes that often are met with opposition even though they may be favorable to workers include:

- Maintenance cross-training;

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- Flexible schedules — e.g., moving from an 8-hour, 5-day workweek to a 10-hour, 4-day schedule;
- Automation and technology that could result in some unattended operations;
- Reduced number of staff on duty per shift.

Such changes can be less stressful if front-line employees understand the changes. Workers need to know how the changes will affect their specific jobs and whether the benefits will outweigh perceived disadvantages. For example, at one water supply utility, operators were concerned about the elimination of the maintenance mechanic position — the position's primary responsibilities would be transferred to operators. However, operators soon learned that their base salaries would be increased and additional training would be provided for them to handle their new responsibilities.

Employees also should work on the one thing they have total control over — their attitudes. Many employees have admitted how much easier a change became after they began thinking about it as a positive one. Employees tend to view changes positively when at least some front-line workers are as involved as management or the team coordinating the change. They also are more accepting if the organization goes out of its way to clearly communicate the reasons for change.

Employees who see a change as good can encourage others to consider their point of view by providing them with more information. This information could include some factors that no longer allow utilities to operate in a business-as-usual mode. These factors include:

- Lack of capital for maintenance and capital improvements;
- Pressure from the local community and elected officials to reduce rates or at least slow the pace of increases; and
- The belief of some elected officials that private operation is always better.

Strategies for "Acting Private"

Given a work environment that supports employee commitment, not just compliance, what is required of the "front-line" employee (non-supervisory workers such as operators, mechanics, electricians, laboratory technicians, and administrative support staff)? How does he or she "act private?" For the front-line employee in the publicly managed utility, "private" refers to workers who are proficient, skilled, and accomplished.

Imagine Ownership

The first step to acting private is imagining ownership of the utility. People who have owned a business understand the issues that become priorities when profits and reputation are at stake. Owners need no prodding to be encouraged to look for ways to reduce costs or save time, and they constantly look for ways to perform tasks in the most efficient way. An operator who acts like an owner would ask the following questions:

How Can My Current Operation Save Energy?

In a number of optimized facilities, operators have collaborated with management to conserve energy first by conducting energy audits and comparing on- versus off-peak energy rates

from energy providers. Then, when possible, energy-intense equipment is run at times that take advantage of off-peak rates.

Could Time-Consuming Maintenance Tasks Be Handled Better By Cross-Trained Employees?

Broader skills would allow an employee to perform a range of tasks — from scheduled maintenance to routine maintenance and then to more complex repairs.

What Information Can Be Shared With Workers on The Next Shift for Smoother Process Operations?

An owner would see the value in reducing misunderstandings and saving time by sharing information.

Improving Attitude

Many workers mistakenly expect management to make them feel good about their jobs. No one but the individual should be expected to take responsibility for attitude. Even though difficult, unpopular decisions often are made, sometimes without their input, employees who become easily discouraged are limited in their ability to fully understand and make the best of a new situation.

By taking control of their attitudes and working to keep an upbeat outlook on the utility's future, employees can maintain the strength required to not only do their jobs but also to maintain the energy necessary to handle difficult and challenging workplace changes. It is helpful to be able to change those things within one's control, accept the things outside of one's control, and possess the wisdom to know the difference.

"Acting private" requires an understanding that to increase efficiency, staffing levels are going to be maintained at the lowest level possible. Knowing this, each employee should do more than only enough to get by, performing a task only when told, or working to full capacity only when the boss is watching. It also is important to understand that with reduced staffing, the work pace will increase. Just as a professional race car driver keeps his engine revved at the starting line, an operator must always begin his or her shift with a similar sense of preparedness and urgency.

However, ineffective communication that can adversely affect attitude happens all the time, not intentionally but often by human error. It is important to remember that managers are capable of overlooking information that should be communicated. Employees often hear rumors but very little accurate information at the speed that they need it. If managers ignore employees' need for information, the built-up anxiety can turn into a time bomb, ready to explode at any moment.

Workers can improve the situation by asking questions. Just as they can take responsibility for their attitudes, workers also should take responsibility for being informed. When rumors are circulating, workers should check them out with their bosses and try not to assume that information is being withheld purposefully or intentionally. More often than not, management is not even aware of the information gap that exists between managers and operators.

At one southeastern utility, operators designed a unique bulletin board program that shares information determined to be of most importance to them. Located in the break room, the bulletin board holds staff and special-project meeting minutes, graphic charts that compare actual energy and chemical use with projected goals (in dollars), dollars in an employee gain-sharing program, director or board meeting summary reports, and current improvement projects.

At another utility, operators were given the opportunity to set up and facilitate regular staff meetings. This arrangement required operators to gather discussion items from their coworkers, create and distribute agendas, and run the meeting.

Face Reality

Operators act private by not falling prey to the myths that often accompany major organizational changes. Below are several common myths and corresponding truths adapted from the *Employee Handbook for Organizational Change* published by Pritchett & Associates Inc. in Dallas, Texas.

MYTH: If I wait long enough, the changes will be abandoned.
REALITY: As far as cost-efficient services are concerned, elected officials and ratepayers will maintain a continuous demand for change.

MYTH: Changes such as cross-training or taking on nontraditional responsibilities will not help my career.
REALITY: In many cultures, it is stated that "progress often masquerades as trouble." Opportunity may be difficult to recognize in the midst of major changes.

MYTH: I don't have to change.
REALITY: If your organization is changing, you also will be required to change.

MYTH: Problems with implementing changes prove that the changes are inappropriate.
REALITY: Problems naturally occur with any changes. Workers need to realize that progress (two steps forward) usually is accompanied by a setback (one step backward).

MYTH: Management is withholding information on purpose.
REALITY: If you are not getting all of the answers you need or questions are not being answered directly, management may not have the answers.

MYTH: Management does not care about front-line workers.
REALITY: Becoming more efficient requires making tough and sometimes unpopular decisions — it is not proof that management is trying to make things harder for workers or is insensitive to their concerns.

MYTH: The changes really are not necessary.
REALITY: What is necessary now is to make the changes work. Your organization depends on your support and energy. If you know of a better way, suggest it.

MYTH: Top management is supposed to make changes work, not the employees.
REALITY: Do not make the mistake of viewing changes as an "us-versus-them" issue. Employees do not have to like the changes, believe they are good, or even want them to succeed. But as owners, workers must do everything they can to make the changes a success.

Implementing Changes for Efficient Operations

Given a choice, employees prefer to work for a "winner" instead of an organization whose work is merely good enough. That is the consistent message from front-line public employees who have participated in workshops designed to assist their utilities in becoming more competitive. But becoming a winner is not easy due to myths such as:

- Management knows more than it shares with employees; and
- Top management is responsible for making changes successful.

Once employees and managers acknowledge that these myths exist, they can then move toward achieving a higher

degree of competitiveness and efficiency in their operations. For the past four years, the authors have conducted workshops with public utility employees across the country that focus on "principles of competitiveness." These workshops, conducted on several occasions to accommodate employees' work shifts, have several objectives for the employees:

- To understand the political, economic and service-related issues that drive public utilities (and their elected and appointed leaders) to consider means of achieving increased efficiency in operations.
- To understand the various efficiency options available to public utilities, including privatization.
- To understand that all options for enhanced operations involve change.
- To develop an understanding of how to manage changes and how to view operational changes as an opportunity, not as a threat.
- To understand the specific requirements of front-line employees, including the need for increased communication and teamwork.
- To provide managers with candid feedback and input on the issues and barriers that must be addressed for more efficient operations.

The workshops provide an environment that employees say is extremely open and safe for frank discussion on the strengths and weaknesses of their operations. The workshops also are used to communicate the utility's plans and initiate employee involvement in their success — two critical elements to successful organizational change.

Another significant benefit of the workshops is gathering information that may affect the organization's ability to implement strategic change. Experience has proven that past behavior is an indicator of future success; consequently, prior difficulties with implementing operational improvements are likely to be repeated unless they are thoroughly understood.

Workshops with front-line employees often include reviews of past changes that were implemented successfully. These open and often lively discussions offer several advantages:

- Giving an early warning of potential problems.
- Determining the utility's predisposition to change.
- Analyzing barriers that may arise during the implementation process.

Barriers to Implementation

Front-line employees from utilities of all sizes and various regions have participated in such discussions and have ranked the following issues as the most likely to sidetrack their efforts to change unless they are handled appropriately.

Poor communication. Because past efforts were not communicated effectively to everyone, some employees felt confused about how changes would affect them and what they should do differently. Problems result not only from poor information sharing but also because in many instances, it is more important to appear agreeable than to express opinions openly. Managers and front-line employees should develop a comprehensive communication strategy. As discussed in Part 1 of this series, managers should share information as soon as possible, but employees also should take responsibility to make sure they are informed and seek out answers when they are not provided.

Lack of involvement. Employees often report that they are not encouraged to participate in change-related decisions. The tendency is to force compliance with change efforts rather than to encourage involvement and commitment. However, successful utilities form teams that lead and coordinate efforts. Because these teams' members are workers from all levels of the organization, they are more likely to seek input from front-line employees who are closer to the work.

Lack of clear goals. Clearly defined and openly communicated goals are a best business practice: successful organizations in the public and private sector ensure that everyone understands how changes support the organization's overall goals and mission. They also develop action plans to ensure that the goals are accomplished.

Lack of teamwork. Sometimes managers are focused on making their departments look good rather than accomplishing goals. Unfortunately, working effectively with others is not a natural skill for most humans. Employees and their managers need training in how to make decisions, communicate with others, and build trust within a team.

Failure to stay on course. Often decisions are made without a clear idea of who has responsibility for getting things done. When operational problems occur after a change is implemented, management tends to focus on them instead of final goals. Employees attending the workshops often refer to past changes as "flavors of the month" — great ideas that started with considerable fanfare but were abandoned when enthusiasm fizzled. Utility managers should delay changes until they are sure everyone is committed to them.

Although employees rated each problem slightly higher than managers did, both groups viewed the problems as potentially serious impediments to their efforts unless action was taken to prevent them.

Teamwork

If clear goals are established and management is committed to achieving them, front-line employees are left with the responsibility of working as an effective team. Interestingly, however; employees often state that their work does not require them to work directly with others in groups and therefore see no need for teamwork. This attitude reflects a traditional view of teamwork, which is different from the type of teamwork required by a competitive utility.

Teamwork is a commitment by managers to develop and maintain an information network that ensures that all workers know what is going on at a facility. It also is a commitment by workers to develop their skills and capabilities and then perform the job as well as possible. Each employee's job performance has a direct impact on the performance of other workers and the utility.

Teamwork means learning additional skills so that absences have less impact on the utility's overall performance. These additional skills often are picked up through cross-training.

Teamwork requires everyone to be open to constructive criticism and to be able to give others feedback in a manner that does not generate conflict. It also means being an active participant in meetings and other activities that help conduct the utility's business. Finally, teamwork means being consistent and fair in treatment of others so that trust is a core value.

Front-line employees make the difference in making their utilities competitive. Thinking and acting private depends on their attitude.

There are three groups of individuals: those who make things happen, those who have things happen to them, and those who ask, "What happened?" With the right attitude and action, every worker can be in the first group. ■

A Survivor's Guide to Service Area Warfare

Donald E. Maurer and William G. Young

A utility manager must not only be concerned with operational efficiency and regulatory compliance, but also the competitive and sometimes contentious landscape of the utility business.

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St. Johns County is in northeast Florida, immediately south of Jacksonville. One of five counties that make up Florida's "First Coast," it is home to over 110,000 residents and is one of the fastest growing counties in the state. Between 1980 and 1990, the population of the county grew by 63 percent. Since 1990, the property assessment roll has doubled from $3.5 billion to more than $7 billion.

This growth is even more substantial when you consider that St. Johns County's 600 square miles is largely rural; the largest municipality is St. Augustine with a population of approximately 14,000. The county is experiencing a boom in population growth and development activity typical of many communities and areas adjacent to large cities such as Jacksonville. With the expansion in economic development during the 1990s, Jacksonville has been marketing the northeast Florida area nationally to corporate America. The success in this marketing campaign has compounded the problem of managing development activity in St. Johns County. Central to this growth management issue is the response of the county's utility department to the demand for water and wastewater utility service in the unincorporated area.

As development activities grew more intense, developers became more aggressive in their attempts to expedite development approval. As a result, they made the provision of utility services more competitive.

Utility Service Providers

Water and wastewater services are provided in St. Johns County by a number of various entities. In addition to the county's utility department, the municipalities of St. Augustine and Hastings have their own utilities, and there are 16 different private utility companies with certified franchise service areas in the county.

Hastings owns and operates a small municipal utility system in the southwest area of the county. St. Augustine's water and wastewater systems serve customers within the city and in an area of the county immediately west of the city limits.

The private utilities provide water and sewer service in the populated northeast and northwest unincorporated corners of the county. In the northeast, there are four different private utility companies, including United Water Florida. Five different private utility companies provide water and sewer services in the northwest. Another seven have small certificated franchise service areas in the unincorporated area surrounding St. Augustine.

The county's utility department has water and wastewater infrastructure in place to serve the unincorporated area immediately south and west of St. Augustine's service area. Large areas of the north-central, western, and southern portions of the county are not served by any public or private utility companies.

County Utility Department and Service Policy

In 1980 two county-owned water and sewer service providers, the Anastasia Sanitary District and the Mainland Water System, were combined to form St. Johns County's utility department. At that time, St. Augustine was the primary provider of centralized water and sewer service to a population of approximately 10,000 residents. The newly created county utility department served an estimated population of 4,000 with drinking water from two treatment plants and had a total staff of nine. In 1985 the department commissioned its first wastewater plant and entered into an interlocal agreement with St. Augustine to clearly define service areas and avoid duplication of infrastructure as both entities struggled to provide service to a rapidly growing population base.

During the late 1980s and throughout the 1990s the utility department expanded its service area through private utility acquisition (St. Augustine Shores), and by bonding to finance strategically located transmission lines and treatment plants. In addition, the department began the assessment of system development charges to fund capacity while implementing a policy in which the cost of infrastructure is basically passed on to the developer. In other words, "growth would pay for growth." By 1999, the county served an estimated population of 45,000 with four wastewater plants, three water treatment plants, a full service laboratory, and a staff of eighty.

Development Interests and the Utility Service Conflict

From the mid 1990s, the rate of development-related construction in St. Johns County escalated. Many projects that were in the planning stages were moving to design, permitting, and construction to meet the needs of a growing population. In St. Johns County, the population growth was primarily the result of an expansion of the metropolitan area of Jacksonville. Many people working in Jacksonville elected to live in the desirable northeast and northwest areas of St. Johns County. As the growth continued, developers looked for opportunities to capitalize on the demand for housing. Their objective was to move projects through planning and permitting to construction as quickly as possible. In St. Johns County, developers worked within the "provisional allowances" of the prevailing growth management laws to expedite development approvals by avoiding the thresholds that tripped a higher level of review. For example, based on the population of St. Johns County, the threshold that trips a Development of Regional Impact (DRI) review is 800 residential units. As a result, the planning department was reviewing developments of 799 homes or less.

Developers attempting to obtain approvals were able to outline alternatives for the provision of water and sewer services during the development review process. Options that were considered acceptable during the development review process consisted of on-site facilities, private utility service, or public utility service. Many developments were approved with utility service options that permitted the developers the opportunity to decide how water and wastewater service were provided.

When design activities for the approved developments were initiated, the problems associated with the provision of centralized water and sewer services by the utility department became apparent. In the unincorporated areas of the county, the utility department was the developers' first choice regarding the provision of services. In working with the utility department, however, the developers were faced with requirements to participate in cost share agreements for system extensions, and to pay unit connection fees for new connections to the system. The approved development plans allowed the develop-

ers to explore opportunities to avoid these costs of development. As a result, the utility department was faced with the unanticipated reality of competing with other utility service providers for new customers.

The utility department has worked with the planning department aggressively since 1998 to reduce the impacts and the disruption to the development review and utility services coordination processes. As a result of aggressive developer tactics, the county's utility department was faced with competition from the city of St. Augustine and private utilities for provision of services to new customers in the county.

Legal Framework

In addition to the state's growth management laws, there are Florida statutes regulating the public and private utility business.

St. Johns County Water and Sewer Authority

In Florida the rates and territories of investor-owned water and sewer utilities are regulated by the state's Public Service Commission. State law, however, allows Florida counties to decline state regulation and create "home rule" authorities to oversee territorial and rate matters concerning private water and sewer utilities.

In 1989, St. Johns County rescinded PSC regulation and formed the St. Johns County Water and Sewer Authority as the result of an extremely contentious rate case involving a large private utility and several thousand water and sewer customers (and voters). The rules and regulations enforced by the authority are quasi-judicial in nature and are intended to mirror, in many ways, the process, structure and purpose of the PSC.

Since its creation, the authority, made up of five volunteer members and a small, part-time staff, has primarily handled routine, pass-through rate adjustments in relative obscurity. In fact, before 1998 there was talk of replacing the authority's monthly meetings with quarterly meetings due to the lack of activity. By the spring of 1999, inactivity would no longer be a concern.

Public Utility Regulation

Public sector water and sewer utilities such as St. Johns County and the city of St. Augustine are not regulated by the PSC or by the authority. The provision of utilities by public entities is controlled primarily by the Florida constitution and by State Statute 125.01, which gives counties power to provide and regulate water and sewer provision while Statute 180.02 addresses municipal utility provision.

Chapter 125 of the Florida statutes empowers county government to provide and regulate utility services in unincorporated areas. In addition, it enables county government to contract with municipalities and special districts to provide services to those local governments. Chapter 125 also outlines requirements for a public hearing and public interest test in transactions relating to the purchase or sale of water and wastewater utility services by a county government.

Chapter 180 of the Florida statutes is the parallel legislation providing for the local provision and regulation of utility services by municipalities. Chapter 180 enables municipal governments to create a zone or area beyond the corporate limits by ordinance, provided the area does not include any area of another municipality, or extend for more than five miles beyond the corporate limits. In addition, Chapter 180 allows municipalities to charge a surcharge on rates, fees, and charges to water and sewer customers outside of the city limits.

Additionally, local ordinances and interlocal agreements also play a critical role in service area matters. A 1985 agreement between St. Johns County and the city of St. Augustine was used to designate an additional service area to the city beyond the city limits. This extra territorial arrangement was designated to avoid duplication of service, and allow the city to optimize plant capacity. In accordance with State Statue 180.191, the city is permitted to assess a 25% surcharge on utility customers outside of the municipal limits. This surcharge, and the prospects of expansion of the city's utility service area beyond the boundary defined by the interlocal agreement, would be an ongoing topic of discussion (and bone of contention), between the two jurisdictions in subsequent years.

St. Johns County's Dilemma

Consistent with the prevailing growth management policy of St. Johns County, its utility department has always attempted to cooperate with development interests to coordinate utility services and construction within the provisions of the current utility ordinance and regulations. In doing so, the department could maximize the benefit of developer contributions to capital improvements projects associated with system extensions, and maintain consistency with its own master plan for system expansion. In light of the aggressive response to local growth and development activities, the utility department had to contend with an effort by the city of St. Augustine to expand service area beyond its boundary defined by the 1985 interlocal agreement.

City of St. Augustine Service Area Expansion Plans

Considering itself "boxed in" by the county on the west and south boundaries and by the Atlantic Ocean on the east, St. Augustine considered expansion of its service area to the north to be necessary. The city notified the county of its intent to terminate the interlocal agreement and proclaimed a service area that encompassed the area within 5 miles of its corporate limits. The city also took the position that with developer requests it could serve beyond the 5-mile radius.

Private Utility Expansion Efforts

In addition, the county's utility department had to contend with private utility company plans to expand their franchise areas to capitalize on the development boom in St. Johns County. Applications were filed with the PSC and the St. Johns County Water and Sewer Authority by utility companies interested in securing more territory. These applications were filed despite the existence of service agreements between the county's utility department and developers regarding the provision of utility services.

The utility department's dilemma was in the complexities of the disputes over control of service area that was long considered to be its responsibility. The utility department's position was based on the following premises:

- The unincorporated area was considered to be under the jurisdiction of the county government;
- The customers were considered to be residents of the county and constituents of the county government;
- The utility department had a vital role in stronger growth management controls outside the approved development area;
- The utility department's efforts to stabilize rates and realize efficiencies in operations were enhanced by the addition of new customers in higher densities associated with planned development.

Of course, this position conflicted with the positions of the city and the private utilities interested in expanding their own customer bases. The dispute was made more political by developers interested in keeping their development costs to a minimum.

The Utility Department Response

After considering prevailing laws and regulations, the county established a strategy to address the critical aspects of utility service area control and service availability policy. In reviewing the critical aspects of this issue, it was apparent that it encompassed an integrated managerial, planning, technical, economic, and legal response.

Planning and Technical

The first action of the utility department was to refer to the *Water and Wastewater Master Plan* completed in 1994. In the absence of a strong comprehensive plan, the county referred to the master plan as the basis of utility service policy. The utility department referenced the findings and recommendations of the master plan when requested to formulate the county's position in service area dispute resolution.

The county's utility and planning departments evaluated policies and practices that allowed developers to obtain approvals. In addition, the planning department had recently completed the Comprehensive Plan Evaluation and Appraisal Reports (EAR). It was concluded that the county's 1990 comprehensive plan did not definitively address key utility management issues as part of growth management policies related to development and infrastructure. In addition, some of the recommended policies of the comprehensive plan were not fully implemented by the county. In accordance with the 1995 EAR, the planning department initiated work to update and amend the 1990 comprehensive plan. The utility department became an active participant in this process to ensure consistency in developer coordination practices and planning department growth management policies. The planning department was successful in developing new comprehensive planning provisions that integrated the county's utility management policies into the county's growth management policies.

The utility department's participation in the comprehensive planning process also enabled the planning department to incorporate relevant parts of the 1994 *Water and Wastewater Master Plan* into the infrastructure and capital improvements sub-elements. The utility department also contributed to the formulation of updated land use policy.

The utility department also worked with the planning department and the county attorney to draft an ordinance defining service area within the unincorporated areas. The explosive nature of the growth in the unincorporated area and the scramble by developers to any utility service provider illustrated the need for a defining document establishing jurisdictional authority to provide water and sewer service. This ordinance was adopted in an effort to enhance the county's ability to enforce growth management policy.

Managerial

The county and its utility department also appealed to other utility service providers to cooperate in negotiations to settle the service area disputes. With the city of St. Augustine in particular, the county attempted to renegotiate the interlocal agreement. Resolution of the service area dispute had many advantages, including allowing the developer to proceed with construction. The construction had been stymied by the dispute over service.

Legal

When the managerial response to resolve the disputes over service area failed, the county proceeded with what was considered to be the last resort — legal action — to preserve and protect the service area over which it had jurisdiction. In the case of the dispute with St. Augustine, the legal action consisted of a request for a temporary injunction to stop construction of water and sewer line extensions. The county also petitioned the department of community affairs for an administrative hearing regarding the consistency of the city's land development regulation ordinance with the comprehensive plan. Legal action in the form of objections to the private utility applications for expansion of service area were also filed with the PSC and the Water and Sewer Authority. The authority conducted a quasi-judicial proceeding (the first ever in St. Johns County) to hear testimony regarding the application of Intercoastal Utilities, Inc. When faced with the objections to its application at the PSC, United Water Florida withdrew its application for service area expansion from consideration.

Economic and Intergovernmental

In an interesting turn of events, the utility department discovered the mutual benefits of intergovernmental cooperation in developing a "regional" utility system. In an effort to resolve the conflict over service area, while strengthening its ability to serve, the county and the Jacksonville Electric Authority (the utility service provider for the city of Jacksonville) teamed up to fast-track the design and construction of system extension to provide service to customers in new developments approved in the northern part of the county. The utility department was able to retain control of the service area and the new customers. The county agreed to purchase wholesale water and sewer service from JEA at advantageous rates. JEA further agreed to fund the cost of improvements, allowing the county to reimburse the cost of construction through the collection of unit connection fees from the future customers of the system.

In another surprise example of intergovernmental cooperation producing win-win agreements, the city and county were ordered into mediation, and a similar cooperative agreement was reached. In it, the city gained service area, and a commitment by the county to purchase water and sewer service at advantageous wholesale rates. Through this arrangement, the city's opportunity to utilize excess capacity in their treatment facilities is improved. By agreement, the county secured its right to service area beyond the generally accepted 5-mile limit established by Chapter 180 F.A.C. In addition, the county gains additional capacity in its treatment facilities indirectly through the use of the city's excess capacity.

Lessons Learned

The St. Johns County utility department learned valuable lessons regarding the control of service area, the significance of integrated growth management and utility management policy, and the benefit of intergovernmental cooperation in the development of a truly regional utility system. In the process, the department also recognized the importance of new customers and developer contributed system extensions to utility growth and long term rate stability. The intensity of development in St. Johns County also focused public and political attention on the business of utility service making it possible for the utility department to get a service area ordinance adopted. In addition, the county is now in the process of implementing an efficiency optimization and cost reduction program and formulating utility acquisition policy.

Specifically regarding the establishment of control of a utility service area, the lessons learned are as follows:

- Be proactive in the review, development, and implementation of strong policy regarding development, utility service and expansion;
- Periodically review interlocal agreements and negotiate adjustments to maintain balance;
- Adopt necessary ordinances and enabling legislation, including planning documents to offer protection in the worst case scenario;

- Establish a master plan consistent with the comprehensive growth management plan and keep it current;
- Timely implementation of strategic capital improvements projects accommodate system expansion while minimizing expenditures and adhering to growth management policy; and
- Engage legal expertise in the formulation of enabling documents that become the foundation for utility business policy and negotiation strategy.

In areas experiencing explosive growth like St. Johns County where the utility infrastructure is undergoing rapid expansion, it appears that legal experts will play a greater role in the management of the utility business. It becomes critical when competing service providers in a loosely regulated environment compound the problem of responding to explosive growth. By acting on the lessons learned in St. Johns County's situation, perhaps others will expend effort in the development and review of sound planning, technical, and legal documentation, and avoid costly courtroom time. ■

Solving Taste and Odor Problems *from Page 33.*

- Collect at different flushing times.
- Collect plenty of samples to allow for laboratory analyses.
- Record water quality indicators, including basic parameters such as pH, turbidity, temperature, and chlorine residual. If other causes are suspected, additional parameters such as HPC, metal, or hydrogen sulfide, can be analyzed.

Samples from the raw water sources should be analyzed for common taste and odor compounds. In addition to raw water sample analyses, water quality data from the water supply watershed should be reviewed if they are available. Analysis of watershed water quality may help identify upstream pollution or biological growth that may contribute to the deterioration of raw water quality.

Because tastes and odors are very subjective, jar tests with an odor (or flavor) panel review should be used to determine the effectiveness of treatment chemicals, the required dosage, application point, and contact time to remove tastes and odors. In a typical evaluation, the panelists are asked to sniff or taste samples of treated water (resulting from the various combinations of chemicals or dosages). The panelists are asked to subjectively determine the degree of odor reduction. The candidates for odor/flavor panelists should be non-smokers, non-perfume wearers, and people with average to above average senses. It is also best to avoid using water plant operators as panelists because they may be desensitized from working in the treatment plant.

A detailed review of the existing plant treatment processes should be conducted to determine whether any of the internal process streams contribute to the taste and odor problem. For example, many water systems return a recycled flow stream to the head of the plant. The recycled stream may contribute to taste and odor problems.

Once the source of the taste and odor problem is identified and the effective treatment approach is determined, the capability of existing chemical feed facilities should be evaluated. Impacts of the selected treatment method on existing plant operation also should be assessed, including equipment and chemical costs, manpower requirements, and sludge production and disposal.

Finally, the distribution system should be evaluated, if the taste and odor problem is a localized problem. If biological regrowth in the distribution system is suspected, a routine flushing or line-cleaning program may need to be established. Domestic plumbing fixtures used in some areas also may cause localized taste and odor problems. The adequacy of booster chlorine application also should be evaluated to prevent overdoses of chlorine.

Most water systems experience taste and odor problems either periodically or sporadically. It is important that a utility has the capability of handling taste and odor problems when they occur. Respond quickly to your customers; letting them know what you are doing to solve the taste and odor problem in their drinking water will prevent it from becoming a political problem. ■

Glossary of Common Terms Used in this Publication

ASR	aquifer storage and recovery
AWT	advanced water treatment
AWWT	advanced wastewater treatment
AWWA	American Water Works Association
BOD	5-day biochemical oxygen demand
BOD_x	BOD test based on other than 5 days
CBOD	5-day carbonaeous BOD
COD	chemical oxygen demand
cfm	cubic feet per minute
cfs	cubic feet per second
CWA	Clean Water Act
DEP	Florida Dept. of Environmental Protection
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FAC	Florida Administrative Code
fps	feet per second
FSAWWA	Florida Section of AWWA
FWEA	Florida Water Environment Association
FWPCOA	Fla. Water & Pollution Control Operators Assoc.
GIS	Geographic Information System
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
hp	horsepower
MGD	million gallons per day
mg/L	milligrams per liter
MLSS	mixed liquer suspended solids
MLTSS	mixed liquer total suspended solids
NPDES	Nat. Pollutant Discharge Elimination System
NTU	nephelometric turbidity units
ORP	oxidation reduction potential
POTW	public-owned treatment works
ppm	parts per million
ppb	parts per billion
PSC	Public Service Commission
psi	pounds per square inch
PVC	polyvinyl chloride
RO	reverse osmosis
SCADA	supervisory control and data acquisition
SJRWMD	St. Johns River Water Mangement District
SFWMD	South Florida Water Management District
SRWMD	Suwannee River Water Management District
SWFWMD	Southwest Florida Water Management District
TDS	total dissolved solids
TMDL	total maximum daily load
TOC	total organic carbon
TSS	total suspended solids
USGS	United States Geological Survey
WEF	Water Environment Federation
WRF	water reclamation facility
WTP	water treatment plant
WWTP	wastewater treatment plant