Benchmarking In Meter Reading

Robert L. Anderson

Benchmarking in utilities is an important way to identify areas for possible improvement or change. When comparing indicators from different utilities, one must be aware of differences in the utilities that could affect the outcome of the indicators.

One area where benchmarking can help a utility identify how well they are doing is in meter reading. Meter reading is the backbone of the billing system. If meters are read incorrectly or not read at all, it will cause a chain reaction of added events that add unnecessary expense for the department and create customer dissatisfaction. When asking various utilities how they identify how well they are doing in this area, the response is widely varied. One utility looks at the number of errors meter readers make for the year and compares it to how many errors they made the previous year. Another utility looks at how many work orders the meter readers make up, the number of unread meters, whether the readers finished their assigned routes, and the total errors.

To have a viable indicator of performance for both the individual and the meter reading department , a comparison needs to be made on an individual's performance in the two main areas of responsibility: to read all the meters assigned during the work day, and to read them all correctly. Two monthly indicators should be made for individual performance. One will show the percentage of unread meters (no-reads) to the total of meters assigned to be read, while the other will indicate the proportion of incorrect readings to the total number of meters actually read.

Suppose a meter reader is assigned 600 meters to read a day in a 20-day monthly billing cycle and has 200 no-reads. The error percentage would be 0.017 (200 errors divided by 12,000 assigned meters). If the meter reader also had 350 mis-reads that month, the mis-read error percentage would be 0.030 (350 errors divided by 11,800 meters actually read). Using this method recognizes the fact that the more meters an employee reads, the more chances errors can occur. It fairly compares meter readers regardless of how many meters are actually read.

A major complaint by employees is that they are held accountable for meters that they are not able to read because of blockage by debris, construction, or vehicles. No one expects a meter reader to be able to read every meter every day—problems do arise. However, problems arise for all the meter readers. When it rains they all have to brave the elements. If one meter reader consistently has problems finishing assigned routes when it rains and has twice as many errors as the rest of the department, it might indicate a problem that needs attention.

Another concern of meter readers is that some meters are hard to read because of scratched lenses. They feel these errors also should not be held against them. Most utilities rotate routes that meter readers read, either monthly or bimonthly, and all routes have some meters with scratched lenses. Over the course of a year, when performance reviews are due, the overall yearly performance is evaluated, not just one individual day or month.

At the end of each monthly billing cycle, a monthly performance report should be given to each individual meter reader showing error percentage along with the group average. The meter readers can see clearly how their error percentages compare with the group as a whole, whether they are above or below average, and in what areas improvement is needed. During the course of the year improvement plans can be made for individuals whose performance is con-

sistently less than the group average. Employees are no longer surprised by their annual performance review overall ratings. Of course, even though these two areas are a major part of the annual performance review, consideration should also be given on a weighted amount to other things pertinent to the job.

Monthly overall group performance can be identified using the same method by combining all employees' results. Upward trends should be evaluated and monitored closely. After about six months, a performance standard of acceptable error percentages should be set and maintained.

Utilities can compare their performance against comparable utilities at the annual national meter reading conference, or on a state/regional level.

Reducing un-read meters and misreads reduces customer concerns and the cost involved on having to send other employees out to get readings. It also improves cash flow. ■

Global Warming: Myth or Reality

John Crane

Part 6: The Politics of Global Warming

There has likely been no environmental issue more politically polarized than global warming. Even the IPCC reports, which constitute the bulk of information available on the subject, are not totally above reproach. Seitz (1996), a former president of both the National Academy of Sciences and the American Physical Society, has challenged that the 1995 IPCC report was changed after its peer review. He maintains that more than 15 sections of the chapter that sets out the scientific evidence for and against a human influence over climate were modified or deleted to remove hints of the skepticism with which many scientists regard claims that human activities are having a major impact on climate in general and on global warming in particular. He presents as examples the following passages that were deleted after peer review: "None of the studies cited above has shown clear evidence that we can attribute the observed [climate] changes to the specific cause of increases in greenhouse gases." "No study to date has positively attributed all or part [of the climate change observed to date] to anthropogenic [man-made] causes." "Any claims of positive detection of significant climate change are likely to remain controversial until uncertainties in the total natural variability of the climate system are reduced."

The position of the Clinton administration is based on the IPCC report, specifically on a seven-page executive summary of the report prepared by Robert Watson of the White House Office of Science and Technology Policy. Watson was appointed to his position by Vice President Al Gore.

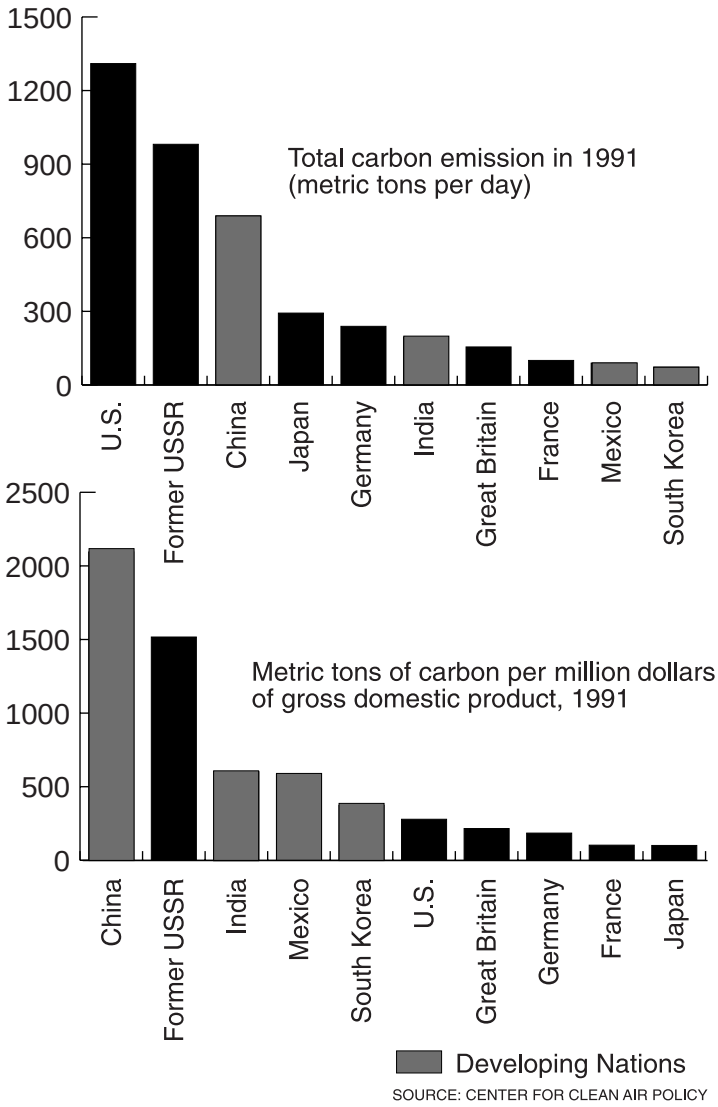
At the first United Nations "Earth Summit" in Rio de Janeiro in 1992, Western European countries drew great international praise when they pledged to reduce their overall emissions of carbon dioxide and other greenhouse gases by 15% below 1990 levels by 2020, regardless of what the United States might do. Since then, only Denmark has actually enacted meaningful legislation. The Netherlands, the leader of the greenhouse-reduction contingency, has increased carbon dioxide generation by 9.5 percent, while the U.S. has increased it by only about 5 percent.

Even beyond the fact that the U.S. is far ahead of most of Western Europe in virtually every aspect of pollution control, a certain degree of hypocrisy exists among the European nations. Great Britain has been converting its inefficient coal-based industry to natural gas for reasons having nothing to do with global warming. Germany is reducing greenhouse gas emissions significantly as it replaces polluting East German factories with modern technology.

In 1993 President Clinton pledged to get emissions in the United States down to 1990 levels by 2000, but nothing happened: the U.S. will be about 12% above 1990 levels in 2000.

In November 1996, Clinton announced that 1997 should be a milestone year in protecting the global environment from warming. In July 1997 he announced that global warming was no longer a threat but a fact. "We see the train coming," he said, "but most ordinary Americans, in their daily lives, can't hear the whistle blowing." The July announcement was the kickoff of a five-month effort leading up to an international conference on climate change in December at Kyoto, Japan. The meeting of 159 nations would attempt to achieve a Global Climate Change Treaty requiring developed nations to cut greenhouse gas emissions.

Opponents to such a treaty include labor unions, who fear job losses, and the fossil-fuel, steel, electricity, chemical, and automobile industries, who fear treaties will bring increased regulations. Proposals that developing nations not be subject to as strict a level of reductions, if any at all, as industrialized nations is of concern to many. R.J. Eaton, chairman of Chrysler Corporation warned that stronger U.S. action would not reduce the total amount of man-made carbon dioxide going into the atmosphere, it would simply mean that less of it would come from the U.S. and more from the Third World. Ford Motor Company chief Alex Troutman predicted



In terms of absolute amounts, the United States generates more carbon dioxide than any other nation. In terms of amount generated in relation to gross domestic product, however, it's far down the list.

a mass exodus of American factories if the U.S. agrees to the treaty. If so, the whole purpose of the treaty could be defeated as carbon-dioxide-generating industries relocate to developing countries and generate as much or more carbon dioxide as before.

Companies that sell pollution-reduction equipment and "cleaner" sources of energy, such as natural gas, are supporters of emissions controls for obvious reasons.

Ironically, many of the same people who promote taking strong action toward carbon dioxide reductions are opposed to nuclear power and hydroelectric power generation, and nuclear power is a primary reason Europe generates lower levels of carbon dioxide than does the United States, where environmentalists have hampered development of nuclear power plants. It would be ironic if it turns out that those environmentalists have played a significant role in bringing about global warming.

In July 1997 the U.S. Senate, in a 95 to 0 vote, approved a

resolution urging the Clinton administration not to sign the proposed climate-change pact, if it exempts developing countries from pollution limits imposed on industrialized nations and if it would result in "serious harm" to the American economy. Senator Robert Byrd of West Virginia, a co-sponsor of the resolution, argued that you can't save the world with a treaty that leaves out most of its countries. Developing nations produce less than one-third of all greenhouse-gas emissions, but by 2010 they will account for nearly half. China already ranks second in the world to the United States. Senate Majority Leader Trent Lott charged that, despite a lack of current scientific evidence, the Clinton administration is trying to enter the U.S. into an agreement that poses a much more immediate and tangible threat to our country than global warming. Reducing carbon dioxide emissions to 1990 levels by 2010, Lott said, could reduce our Gross National Product by $350 billion and reduce fossil fuel use by at least 25 percent.

Syndicated columnist Paul Craig Roberts went so far as to charge that the media madness over the alleged threat of global warming "appears to be a hoax perpetuated by power-crazed federal government regulators who pay researchers with our tax dollars to find the results that justify increased regulatory powers" and warns that "if President Clinton and environmental kooks get their way, the U.S. economy will be devastated."

Australia, the largest generator of greenhouse gases in the southern hemisphere, threatened to withdraw from the December conference if the member countries impose mandatory greenhouse-gas reduction targets. Cited was an Australian Bureau of Agriculture study that said reducing greenhouse-gas emissions by 10% below 1990 levels by 2020 would cost each Australian about $7,000. Any effort to reduce fossil fuel usage is particularly significant to Australia, because coal is its richest export.

In September EPA Administrator Carol Browner (formerly Florida DEP director) came out in support of the international treaty. At a speech at FSU, she stated that those who oppose the treaty take a very short, narrow view. She predicted the U.S. would gain economically because it is the international leader in developing anti-pollution control equipment.

Also in September, the industry-sponsored Global Climate Information Project began a $13 million advertising campaign. Television commercials argued that greenhouse warming is not a real threat and that capping carbon emissions would cripple the economy. CNN, yielding to pressure from environmental groups, pulled the commercials. Then, after "reevaluating its position," CNN allowed them to run again.

In October Clinton released details of a strategy to offer $5 billion in tax breaks and other incentives to American companies to encourage improvements in fuel efficiency and the development of new "clean-energy" technologies. He proposed that industrialized nations reduce carbon emissions to 1990 levels between 2008 and 2010. The plan was criticized by environmental groups as being weak. The Sierra Club's Dan Becker said it was like fighting a five-alarm fire with a garden hose. The European Union wanted 15% reductions below 1990 emissions levels by 2010. The Clinton administration said that could wreck the global economy.

When the Kyoto conference finally came about in December, talks quickly became stalled. It began to appear that a treaty would not be possible. Vice President Al Gore, the driving force for global warming control in the Clinton administration, flew to Japan to save the day. He was determined that the treaty would be signed; whether it would be something that the U.S. Senate would ratify was beside the point. Almost certain to be the Democratic candidate for president in 2000, Gore had long positioned himself as an environmentalist. Justifiably feeling that a failure to achieve a treaty in Kyoto would damage his support from environmentalists, he directed the American delegation to be more "flexible." As a result, the U.S. backed off Clinton's October plan of reducing carbon emissions to 1990 levels by 2010 and agreed to a cut of 7% over 1990 levels by 2012.

Europe would cut by 8% (as opposed to the 15% it had proposed two months earlier), Japan by 6%, and Canada by 6%. Overall, industrialized nations would cut emissions by 5% over 1990 levels. All committed to even deeper cuts after that. For the United States, according to the Department of Energy, a 7% cut from 1990 levels means a 30% cut from what emissions would otherwise be in 2012.

China, India, Brazil, Mexico, Indonesia, and 120 other countries represented at the conference refused to accept any limits at all, but demanded that the industrialized nations implement their commitments in such a way as to minimize adverse social, environmental, and economic impacts on the developing nations. How these countries would be dealt with supposedly will be addressed in future meetings, including one in November 1998 in Buenos Aires.

The treaty would have "expert review teams" assess how well nations are meeting their commitments, but it provided no specific sanctions for failures to meet the commitments.

Reactions to the Kyoto treaty were swift and hard. Al Gore and the Clinton administration claimed victory, despite having achieved only half of the objectives at Kyoto. Environmentalists viewed the treaty with mixed feelings. Daniel Becker of the Sierra Club said that it focused the world's attention on global warming, but that its loopholes made reductions of carbon emissions weaker. Senate Republicans immediately charged that the treaty would hobble U.S. competitiveness against countries not bound to similar commitments, and they predicted that it would not be ratified. Studies financed by the coal, oil, auto, and other industries concluded that such a cut would raise gasoline prices 44 cents per gallon, electric bills 48%, and home heating oil 55%. Environmentalists countered by observing that the same industries predicted that controlling the gases that cause acid rain would cost $350 to $1,000 per ton, whereas it actually costs $62 to $170.

Conclusions

Whether the treaty is a historic first step in controlling global warming or a political non-event depends on who is talking. Even if it is ratified by the U.S. Senate, the effect on greenhouse emissions will be small, but it could nevertheless go down in history as the beginning of a major change in the Industrial Age.

Certainly environmentalists exaggerate the impacts of global warming and the accuracy of predictive models, and certainly they understate the economic impacts of reducing greenhouse emissions by 30% from what they would be in 2010. It is just as certain that industry groups exaggerate the economic impacts.

Most important, it seems doubtful that there is sufficient scientific evidence for us to know that carbon dioxide emissions are really causing global warming. It will probably be at least another five years, perhaps much longer, before there is sufficient data and computer capacity to make reliable forecasts. Environmentalists maintain that even if that is so, we can't afford to wait. Others argue that we can't afford severe economic cuts over something so unsure.

The U.S. Senate probably won't ratify the treaty in its current form. In fact, President Clinton may not even sign it until it can be modified to include developing nations. In any event, it is unlikely that it will go to the Senate before 1999 (after the elections of 1998).

One thing seems for sure: it is becoming politically incorrect to question whether global warming is a serious problem and whether it is a result of human activities. That puts politicians in the difficult position of having to talk the talk without doing anything of substance, such as raising taxes. Fortunately for them, they have considerable practice.

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This article was based primarily on various reports made available to the public by the United Nations, and most particularly on reports from the United Nations Intergovernmental Panel on Climate Change. The IPCC was formed in 1988 to review global warming. Scheduled to issue a report every five years, its most recent report was in 1995 ("The Science of Climate Change 1995"). Other sources used in the preparation of this article included various newspaper and magazine articles. Specific articles include the following:

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Crypto Happens — Report of a Florida Cryptosporidium Outbreak

John Regan, Sandra Roush, and Robert McVay

On July 27, 1995, Gainesville Regional Utilities (GRU) was notified by the local health department of a *Cryptosporidiosis* outbreak among children and counselors attending a day camp held on the grounds of an Alachua County public elementary school. Possible sources of the organism included GRU's city water supply, the school water system, or an isolated section of the school water system.

GRU formed a team with the public health department, school board, University of South Florida, contract laboratories, and DEP to identify and resolve the problem.

Cryptosporidium, recognized as a human pathogen since 1976, can cause severe, life-threatening disease in immunocompromised persons, such as HIV-positive persons, AIDS and cancer patients, and organ transplant patients. In immunocompetent persons, *Cryptosporidiosis* is manifested as an acute, self-limiting diarrheal illness lasting 7 to 14 days and often accompanied by nausea, abdominal cramps, and low-grade fever. The organism has received much national attention due to a massive *Cryptosporidiosis* outbreak in Milwaukee in 1993.

The profile of the day camp outbreak indicated that the disease vector was waterborne *Cryptosporidium parvam*. Even though there were more likely contamination sources, the city water supply became immediately suspect: the school is one of the first customers off a large transmission main leading from a well field one mile away, so the possibility of water supply contamination could not be eliminated.

The water source for GRU, deep water wells tapping a confined Floridan aquifer system, makes it unrealistic that the organism was in the ground water: *Cryptosporidium* is associated with surface water systems. However, GRU's 800 hundred miles of pipe are subject to contamination from sources other than the supply. Possibilities include, but are not limited to, cross contamination, ignorance, or vandalism.

An initial assessment indicated that the school's internal plumbing could be contaminated with *Cryptosporidium*, and that there was a possibility of it entering the transmission main.

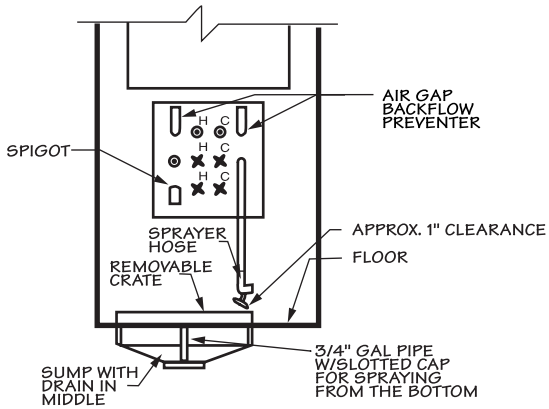
Less than two weeks later 600 students were to return for the fall school session. It was agreed at the initial meeting of GRU, the ACPHU, and the school board that there was need for a strong interagency team approach to mitigating the hazard and preparing for the opening day of school.

The camp had 98 children between the ages of 4 and 12 and six counselors during the three weeks before the outbreak. A questionnaire was administered to each of the 104 persons attending the camp; for some children, information was obtained from parents and camp records.

Of the 104 persons attending the camp, 77 (74%) had symptoms (abdominal pain [74%], nausea [73%], diarrhea [71%], vomiting [57%], and fever [43%]), including 72 of 98 children and five of six counselors. Follow-up phone calls to 67 of 79 households of those who attended the camp indicated that 24 household members had onset of gastrointestinal symptoms during July 20-August 23. The total affected population was 101 persons.

Portable water coolers used during the camp were filled either at a kitchen sink inside the school or an outdoor hose/garbage can washing system located in an alcove outside the kitchen backdoor. The hose/garbage can washing system panel consisted of a spigot and a flexible hose sprayer normally used for washing garbage cans. A spray nozzle inside a sump was located on the floor so that garbage cans could be flipped upside down and sprayed internally. The outdoor fixtures were separated from the kitchen plumbing by air gap backflow preventers built into the panel.

To us, filling water coolers using a faucet connected to an outdoor garbage can washing system seemed to show a lack of common sense, but in an informal poll indicated people presume that a spigot served by a municipal water system is sanitary enough for potable consumption.



Garbage can washing system panel

One of the first emergency activities was to collect *Cryptosporidium* samples at an ice machine, the outdoor faucet, and the well field. The outdoor garbage can washing system used to fill water jugs tested positive for *Cryptosporidium*.

The conclusion was that fecal material had been introduced in the system at the outdoor panel and remained isolated in the piping of the panel system. We believe feces was either deliberately smeared into the outdoor faucet system or entered the sump nozzle and cross connected to the faucets.

Emergency Response Activities

At the August 8 meeting of GRU, the ACPHU, and the school board, it was clear that GRU and the ACPHU were in the best position to marshal the resources to investigate contamination, implement a mitigation plan, and provide solutions to open the school on time. GRU assumed a lead role in clearing the system of *Cryptosporidium*. Approximately 26 GRU employees, varying in skill sets, took part in the emergency activities.

GRU's emergency preparedness manual outlines procedures to be initiated for contamination. Training of staff in responding to this type of situation provided the organizational famework to quickly mobilize and respond to the problem.

• *Preliminary Assessment*. GRU immediately identified the location of *Cryptosporidium* contamination in relation to its known distribution system. Testing was immediately begun on chlorine residual and *E. Coli* in and around the school. The pattern of chlorine residual may identify a cross connected system.

• *Assembly and communication of information to the interagency team*. An overall emergency plan was developed with responsibility assignments and distributed to all parties.

• *Notification of DEP*. GRU immediately notified DEP and invited the agency to be part of the project team. At the time, there was no specific regulatory procedure for clearing the system. DEP provided a great deal of help in determining a protocol that safeguarded public health.

• *Immediate Backflow Preventer Inspection*. GRU backflow technicians inventoried the school and tested all devices. Fortunately the school board staff had properly maintained internal devices and they functioned properly. This gave assurance that the contamination was localized to the school and the transmission main was protected in a low pressure situation. The inspection also determined that the outdoor system was isolated from the kitchen, the

classrooms and public restrooms. Hydraulic considerations were needed to establish monitoring locations since laboratories (HRS and private labs) were limited in analytical capacity.

• *Questioning Key Personnel.* Custodial and maintenance personnel were interviewed about observations and maintenance practices at the school. The custodian reported an incident about a month prior to the outbreak where he had to clean feces off walls and out of the kitchen backdoor lock. Some of the feces materials were washed into the sump shown in the accompanying figure. His report was invaluable in determining that the problem would be localized to the school. School board personnel higher up the organization were unaware of the problems encountered by the custodian.

• Cryptosporidium *Sampling.* The first samples were designed to clear the water source and determine if the *Cryptosporidium* remained isolated at the school. There were limited sampling devices available, so GRU crews constructed six sampling apparatus. Wellfield data were used extensively in public relations with our customer base. Follow-up *Cryptosporidium* and water quality sampling took place throughout the school for weeks following the initial sample events.

• *Installation of Additional Backflow Prevention at the Main Meter.* GRU wanted additional shut-off valving to isolate the school during decontamination (we weren't sure if we would apply pressures greater than the transmission main). An above-ground device was installed at the main meter, which improved the valving, provided a chlorination injection site, and increased the level of backflow prevention against elevated chlorine or *Cryptosporidium* contamination of the public system.

• *Drafting of the Internal Piping System Drawings.* Accurate diagrams were needed to coordinate sampling and aid in data analysis. The as-builts on the school plumbing were hard to read. GRU drafted its own drawing for communication purposes. Also, simplified diagrams were made that could be provided to the newspaper to facilitate an explanation to the general public (this diagram was never used but we were prepared to effectively communicate the problem was isolated to the school).

• *Involvement of* Cryptosporidium *Experts.* We found that the true experts were ready and willing to provide support and assistance. Most notable was one of the world's leading experts on *Cryptosporidium*, Dr. Joan Rose of the University of South Florida, who traveled to Gainesville to assist us. It was important to expediently answer questions about the organism and treatment methods. Also, credibility during a waterborne outbreak from a technical and public trust standpoint is critical. We also interviewed Milwaukee water system personnel to obtain information on their experience.

• *Cross Connection Inspection.* A team of GRU cross connection specialists inspected the school to determine possible *Cryptosporidium* sources. The only significant disclosure was that the outdoor garbage can washing system drain sump could be cross connected to the plumbing through the spray nozzle in the sump.

• *Superchlorination and Line Flushing. Cryptosporidium* is generally reported to be resistant to chlorine, but the literature generally refers to oocyst destruction at acceptable drinking water concentrations. Dr. Rose pointed out that there were literature reports suggesting high destruction rates (>95%) at high chlorine concentrations and detention times of 15 minutes. GRU injected a 3,000 ppm chlorine concentration throughout the school followed by a two-hour detention time. This was done at night so that faculty preparing for the first day of school would not be disturbed. In addition to oocyst inactivation, we felt the chlorine would oxidize pipe biofilm that could be acting as oocyst attachment sites. Subsequent sampling of the water system indicated suspended material, destruction of biofilm, and nondetectable *Cryptosporidium* results.

• *Immediate Press Release of All Known Facts.* Within the first day a press release was available and the situation was reported in the local newspaper and television news. The inter-agency team continued with ongoing press releases with reports of progress. Proactive public communications kept the media supportive of the interagency team. Interestingly, the newspaper stories were almost verbatim of the press releases. Most important, the newspaper articles presented the work as professional and forthright.

• *Distribution of Literature and Facts.* GRU wrote four different information packets based on information supplied by EPA. The packages were recitations of public information. However, it was modified to include Gainesville data to make it more specific and released on GRU stationary. The packets were distributed to the school faculty, parents, commissioners, and other members of the general public.

• *Public Information Workshops.* Sessions were scheduled to communicate the mitigation plan and answer questions. The ACPHU, school board, and GRU participated in the question and answer forums. Attendees generally included school staff, faculty, and parents.

• *Development of a Backup Sanitary Plan.* A program to provide bottled water and a sanitary washing plan was put in place in case the safety of the school system could not be assured. Faculty was fully briefed and prepared for the first day of school, assuming the water supply would not be cleared by DEP.

• *Education of Customer Service Representatives.* Because customer service representatives are the most commonly used customer communication channels, we involved them at the beginning. They were given the information packages and written responses to the most commonly asked questions. An education seminar was provided that included rehearsal phone calls. The plan was to answer questions and mail concerned customers the information package. Difficult or unusual questions, populations truly at risk, or any uncomfortable situation for the customer representatives, were transferred to the environmental engineering staff.

• *Expect the Unexpected.* The ACPHU was communicating with the Center for Disease Control, and others, via e-mail on the Internet. At the time, CBS news was working on a "Eye on America" segment about *Cryptosporidium*. The producer somehow came across the CDC e-mail and decided to come to Gainesville to shoot footage and conduct interviews. Fortunately, the preparation for the local media and emergency activities was satisfactory. Since the situation was in control, GRU was comfortable enough to spend a day with the producer shaping the story as it related to the national agenda of water quality protection and regulation. The program airing about three weeks later did not damage GRU's image or raise undue concern within the Gainesville customer base. By the time CBS ran the story, it was old news in Gainesville.

• *Post Event Reward and Recognition.* A final meeting was held with school faculty to debrief them on the final results and recognize the participating agencies and individuals who assisted in resolving the problem. GRU employees were particularly acknowledged for their hard work and dedication. It was a chance for all staff to feel the appreciation of faculty and parents. The school water distribution system was cleared one day before the opening day.

Conclusions

Customer perception of public health risk is greatly influenced by knowledge, choices, and trust. The emphasis on public education about *Cryptosporidium* helped dispel myths and establish a comfort level with the interagency cooperation. Customers and parents were given choices on how to protect their public health depending on their personal circumstances. For instance, parents could choose to keep their children out of school or elect to participate in the sanitary water plan had the system not been cleared by the first day of school. Options develop a sense of personal control.

Our proactive strategy was effective in maintaining control of the situation. The problem was eliminated in a timely manner while keeping the affected school community calm. This, in turn, kept the Gainesville community calm and trusting that the ACPHU, school board, and GRU had the situation in control. Overall, the isolated *Cryptosporidium* outbreak became a public relations success story for GRU.

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Glossary of Common Terms Used in this publication

AWT, AWWT	advanced wastewater treatment
AWWA	American Water Works Association
BPR	Florida Dept. of Business & Professional Regulation
BOD	5-day biochemical oxygen demand
BOD_x	BOD test based on other than 5 days
COD	chemical oxygen demand
CWA	Clean Water Act
DEP	Florida Department of Environmental Protection
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FAC	Florida Administrative Code
FSAWWA	Florida Section of AWWA
FWEA	Florida Water Environment Association
FWPCOA	Fla. Water & Pollution Control Operators Association
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
NPDES	National Pollutant Discharge Elimination System
POTW	public-owned treatment works
ppm	parts per million
psi	pounds per square inch
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
TSS	total suspended solids
USGS	United States Geological Survey
WRF	Water Reclamation Facility
WTP/WWTP	Water/Wastewater Treatment Plant