

COMMUNICATION AND PUBLIC OUTREACH ABOUT EMERGING
CONTAMINANTS IN PUBLIC DRINKING WATER SUPPLIES IN MINNESOTA

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Abstract

Numerous emerging contaminants have already contaminated, or have the potential to contaminate, drinking water resources in Minnesota. An emerging contaminant is a substance that can be found in groundwater or surface water and does not have health-based guidance for how much of the substance is safe to drink. Examples include perfluorochemicals (PFCs), pharmaceuticals, and endocrine active compounds. State agencies and local public water suppliers strive to ensure that the drinking water is safe and must communicate to the public if any issues arise with the water supply. I used phone interviews and website analysis to evaluate how public water suppliers currently communicate to the public about drinking water quality and what is needed for effective communication about emerging contaminants in the future. The research question focuses on the current status of communication about drinking water safety and emerging contaminants and how government entities should address the communication challenges. Communication about emerging contaminants was a new issue that was not a high priority for many public water suppliers and their citizens. Public water supply operators reported that there is little interest or awareness about these contaminants from the general public. Therefore, there was not a strong sense of urgency among the public water supply operators to test for or communicate about emerging contaminants. When testing for emerging contaminants occurs, there should be proactive and strategic communication so that water suppliers are ready to respond to any public concerns. In moving forward, the public water suppliers and the state agencies can strive for strategic messaging, proactive training, and tool development around drinking water quality and emerging contaminants.

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Introduction and Background

Ensuring safe community drinking water supplies is a responsibility undertaken by Public Water Suppliers (PWS) in the State of Minnesota and by the Minnesota Department of Health (MDH). Public water suppliers and MDH provide information and messages about drinking water quality for Minnesota citizens. These entities strive to ensure that the drinking water is safe and must communicate to the public if any issues arise with the water supply.

In Minnesota, the Department of Health uses Maximum Contaminant Levels (MCL), Health Risk Limits (HRL), and Health Based Values (HBV) as guidance for the public when substances are found in drinking water sources. An MCL is the highest level of a contaminant that is allowable in drinking water. They are established at the federal level and take into consideration cost/benefit, the ability of public water suppliers to detect and remove the contaminant given available technology, and health goals (EPA, 2013). In Minnesota, a HRL is used to describe the maximum concentration of a chemical in drinking water that is unlikely to pose health risks to the public. The HRL is developed through a rulemaking process whereas an HBV uses the same methods but has not gone through the formal rulemaking process. The contaminant will likely go through the rulemaking process and a HRL will be established based on the best available science (MDH, 2013).

The HRL and HBV differ from the MCL in that they are based only on the available research around health effects. Factors such as the cost, presence in the environment, and the ability to detect or monitor a compound is not taken into consideration (MDH, 2013). Many contaminants found in drinking water such as nitrates or arsenic have MCLs, which must be met for consumption. An *emerging contaminant* is a substance that can be found in groundwater or surface water and does not have an MCL or health-based guidance for how much of the substance is safe to drink without adverse impacts (MDH, 2012).

Government agencies use the health-based standards and risk communication to inform the public about contaminants in drinking water. This process continues to evolve as emerging contaminants are detected in drinking water. The question becomes how safe is the water supply based not only on each contaminant, but also on the additivity of multiple emerging contaminants in small amounts. Communicating this to the public presents numerous challenges. It is not a simple notion such as the water being either “safe” or “not safe” to drink in some cases because adequate studies have not been done or the rulemaking process has not been completed.

This study evaluates how public water suppliers currently communicate to the public about drinking water quality and what is needed for effective communication about emerging contaminants in the future. I employed qualitative and quantitative analysis, including phone interviews and a website analysis. I found that communication about emerging contaminants is a new issue that is not a high priority for many public water

suppliers and citizens and there is time for proactive training and tool development to address future communication needs.

Emerging Contaminants

Emerging contaminants include perfluorochemicals (PFCs), pharmaceuticals, endocrine active compounds, pesticides, and personal care products. Endocrine active compounds are a group of natural or manufactured chemicals that interfere with the hormone system. Over ten years ago, the United States Geological Survey completed a survey of the occurrence of 95 organic wastewater compounds in 139 streams from across the United States. That study identified human and animal reproductive hormones, along with many other organic wastewater compounds, as commonly occurring in water samples at low levels (Kolpin et al., 2002).

Waste streams that deliver emerging contaminants to the environment include municipal wastewater discharge, runoff from agricultural practices, confined animal feeding operations, urban runoff, and leachates from landfills (Benotti, et al., 2009). Pharmaceuticals and endocrine disrupting compounds have been detected in surface water and wastewater because these compounds are not removed during the wastewater treatment process (Benotti et al., 2009).

Benotti et al. (2009) analyzed for 51 pharmaceuticals, including endocrine active compounds and other unregulated organic compounds, in 19 public water utilities. Eleven contaminants were frequently detected. Recent studies have shown that the concentrations of pharmaceuticals found in drinking water are very low. However, it is unknown if there are any long term effects on human health from the low levels that are found in drinking water supplies (Cooney, 2008). Increases in hormone related cancers have been attributed to endocrine active compounds and pharmaceuticals (Rahman, Yanful, & Jasim, 2009). But in general, scientists and regulators are unsure of the risks these chemical compounds pose to humans when present in water supplies (Benotti et al., 2009). The evidence of reproductive hormones and other contaminants in water bodies and drinking water supplies has become an emerging issue that has drawn a significant amount of attention. Given the uncertainty about adverse effects these compounds may have, makes it difficult for policy makers and public water suppliers to know how to communicate about or evaluate them in drinking water supplies.

Numerous emerging contaminants have already contaminated or have the potential to contaminate drinking water resources in Minnesota. A recent example is the PFC groundwater contamination in the eastern Twin Cities metropolitan area (MDH, 2009). PFCs are a family of manmade chemicals that do not occur naturally. They have been manufactured for use in consumer products such as fabric, carpeting, cookware, and food packaging. They are used in lubricants, pesticides, insecticides, fire-fighting foam and for other industrial uses. PFCs resist heat, oil, stains, grease, and water (Kissa, 2001; Simcik & Dorweiler, 2005). Little information is available on the toxicity of PFCs and when the contaminants were found in drinking water supplies local and state officials

were tasked with trying to communicate with the public on the safety of the drinking water.

Federal and Minnesota State Agency Roles

Minnesota has more than 7100 public water supply systems that serve 25 or more people and have 15 or more service connections (MDH, 2011). Over 700 of these are municipal community systems: 23 rely on surface water but the majority relies on groundwater as the source. Since 1976, these systems have been regulated by MDH through the Federal Safe Drinking Water Act (SDWA).

The SDWA requires regular monitoring for bacteriological contamination, nitrates, inorganic chemicals and radioactive elements, disinfection by-products, pesticides, and industrial contaminants. Much of this testing varies depending on the particular public water supply and whether a given chemical is suspected to be present in the environment in that area (MDH, 2011).

Public water suppliers are required to communicate the results of this testing to the consumers through an Annual Water Quality report or a Consumer Confidence Report (CCR). If testing finds levels that exceed an established MCL, HBV, or HRL the PWS and MDH advise residents and work to correct the issue through treatment or if possible by preventing the contaminant from entering the water supply (MDH, 2011).

A program with the United States Environmental Protection Agency (EPA) called Unregulated Contaminants Monitoring Regulation (UCMR) collects water samples to check for drinking water contaminants that do not have health-based standards (EPA, 2012). This program is unique in that it looks for contaminants that are not usually tested for in drinking water. The intent is to gather data and information on the occurrence of these contaminants that can inform decisions regarding whether regulations for these contaminants should be developed (EPA, 2001). Table 1 below is taken from the EPA website and outlines the history of this federal program.

Table 1: History of the Unregulated Contaminants Monitoring Regulation Program (EPA, 2011 and EPA, 2012).

Program Round	Years	Description
UCM 1 & 2	1988-1997	State drinking water programs managed the original program and required PWSs serving more than 500 people to monitor contaminants.
UCMR 1	2001-2005	The SDWA Amendments of 1996 redesigned the UCM program to incorporate a tiered monitoring approach. The rule required all large PWS and a nationally representative sample of small PWSs serving less than 10,000 people to monitor the contaminants.
UCMR 2	2007-2010	EPA manages the second monitoring cycle. This monitoring cycle establishes a new set of unregulated contaminants.
UCMR 3	2011-2015	Expected to begin in 2013 and will include 28 unregulated chemical contaminants and two viruses. The list includes emerging contaminants such as hormones, perfluorochemicals, volatile organic compounds, synthetic organic compounds, and metals.

In the past few years at the state level, there has been increased attention to address emerging contaminants in drinking water through state water plans and a statewide water sustainability framework (U of M WRC, 2011). Emerging contaminants were highlighted as a top issue facing Minnesota water resources. This framework recommended managing unregulated or under-regulated emerging contaminants.

The Minnesota Pollution Control Agency (MPCA) updated their strategic plan in 2008 and included a new goal to “Maintain the agency’s capacity to recognize and address emerging issues that fall within the agency’s authority.” Their objective is to continually collect and analyze data regarding Minnesota’s environment to document trends for known stressors, identify new stressors, and assess the need for new or improved actions to protect Minnesota’s environment and public health (MPCA, 2010).

In 2009, the Minnesota Department of Health (MDH) formed a Contaminants of Emerging Concern (CEC) Program “for addressing public health concerns related to contaminants found in Minnesota drinking water for which no health-based drinking water standard exists.” The purpose is to develop protective drinking water standards for chemicals that have been detected or have the potential to be detected in Minnesota drinking water (MDH, 2012). MDH has been provided with funding to establish health based guidance for emerging drinking water contaminants (MDH, 2011).

In recent years, MDH and some public water suppliers have been challenged with communicating to the public about emerging contaminants. This was the case with the PFC contamination in the eastern Twin Cities metropolitan area. Also, in Minnesota, 110 public water suppliers completed the UCMR 1 and 2 programs and are scheduled to test for the list of contaminants for the UCMR 3 program beginning in 2013. Many of the contaminants that will be tested do not have health based drinking water standards, yet it is possible that emerging contaminants will be found in the public water supplies. When

science and data about health impacts of drinking the water are limited, it creates unique challenges for the public water suppliers. This uncertainty may make it difficult for public water suppliers to communicate with the public about this issue.

This study adds to previous communication research and can be used by the Minnesota Department of Health Contaminants of Emerging Concern program in conjunction with the other projects they have undertaken in order to better understand and improve communication about emerging contaminants. In 2011, MDH conducted focus groups of citizens on public and private water supplies to determine where they go for information about water quality. The findings were that citizens had a general interest in water quality but lacked overall concern about it. Most were not concerned unless made aware of a problem. Most of the citizens had not searched for information on drinking water and any information they had came from media or from other people in their community (MDH & DeYoung Consulting, 2011).

Hypothesis and Purpose

To conduct this study, I developed three hypotheses:

Hypothesis 1: Surface-water source and large public water suppliers will have more awareness about emerging contaminants than the groundwater source and smaller public water suppliers.

Hypothesis 2: Surface-water source and large public water suppliers will express a more urgent need for information and communication tools than the groundwater source and smaller suppliers for communicating the risks associated with emerging contaminants in drinking water.

Hypothesis 3: Public water suppliers will express a strong demand/need for tools and resources in order to better communicate to citizens about emerging contaminants in drinking water.

I hypothesized that surface-water suppliers could be faced with this issue sooner than groundwater suppliers as surface-water supplies may be more susceptible to the sources of emerging contaminants from wastewater discharge, agricultural, and urban runoff. Unregulated Contaminant Monitoring Regulation program testing to be completed in 2015 could put the need to communicate about emerging contaminants at the forefront for any public water suppliers where even trace levels are found. Large public water suppliers have a much larger, and often more diverse, population to try to reach than small public water suppliers so they may be faced with additional challenges in getting timely and accurate information out to the public. Learning about current communication tools can help in identifying whether there are any steps that should be taken in the future if emerging contaminants are found in drinking water supplies.

The purpose of my study was to evaluate how public water suppliers communicate the potential risks and information about emerging contaminants in drinking water supplies to the public given the uncertainty about health impacts. The ultimate goal of the study was to develop recommendations for the Minnesota Department of Health and public water suppliers in regards to communication about emerging contaminants. These

organizations will need to effectively and clearly communicate about drinking water safety to the public despite the uncertainties regarding health impacts of emerging contaminants. My research question focused on the current status of communication about drinking water safety and emerging contaminants and how MDH and public water suppliers should address the communication challenges.

Methods

Sample Population

I obtained a list of public water suppliers from the MDH Community Public Water Supply Unit (MDH Excel Spreadsheet, 2011). The public water suppliers were all those that participated in the Unregulated Contaminant Monitoring Regulation program through the United States Environmental Protection Agency. The UCMR public water suppliers were sub-divided into four categories dependent on source water—groundwater or surface water—and size of population served—large or small. The UCMR program defines a large public water supplier as serving more than 10,000 people. A small public water supplier is defined as serving 10,000 or fewer people (EPA, 2011).

Of the 725 municipal public water suppliers in the state there were 626 small/groundwater suppliers, 15 small/surface water suppliers, 69 large/groundwater suppliers, and 15 large/surface water suppliers. The large suppliers were all asked to participate in the UCMR program and the small suppliers were chosen randomly by the EPA. In total 110 water suppliers were involved in the UCMR program and 104 of those were operated by municipal government.

At the time of data selection for this project, there were 18 small/groundwater suppliers, three small/surface water suppliers, 69 large/groundwater suppliers, and 14 large/surface water suppliers participating in the UCMR program. A majority of the suppliers in the state are small groundwater suppliers but only 18 were chosen by the UCMR program to participate in the sampling. Given the differences in sample population to pull from I selected a random and purposeful sample of the 104 public water suppliers to determine the 30 that would be interviewed.

I used an excel spreadsheet to randomly select a predetermined number of public water suppliers for each of the four categories. Then I added to the list with a purposeful sample to ensure distribution amongst the hydrologic regions of the state. Some communities with known contamination were also selected because the communication experiences they encountered in notifying the public about that contamination may prove useful in future communication about emerging contaminants. Three of the selected communities recently experienced PFC contamination when there were no established health-based standards (MDH, 2009). I also selected the two major public water suppliers in the Twin Cities metropolitan area that serve a large portion of the State's population. They serve many citizens and could have unique perspectives about the need for communication and the tools needed to reach a wide audience when future communication about emerging contaminants occurs. It will be useful to learn from these

communities that are already finding ways to communicate to the public about drinking water quality. In total, I surveyed seven small/groundwater suppliers, three small/surface water suppliers, 13 large/groundwater suppliers, and seven large/surface water suppliers for a total of 30 public water suppliers (Fig. 1).

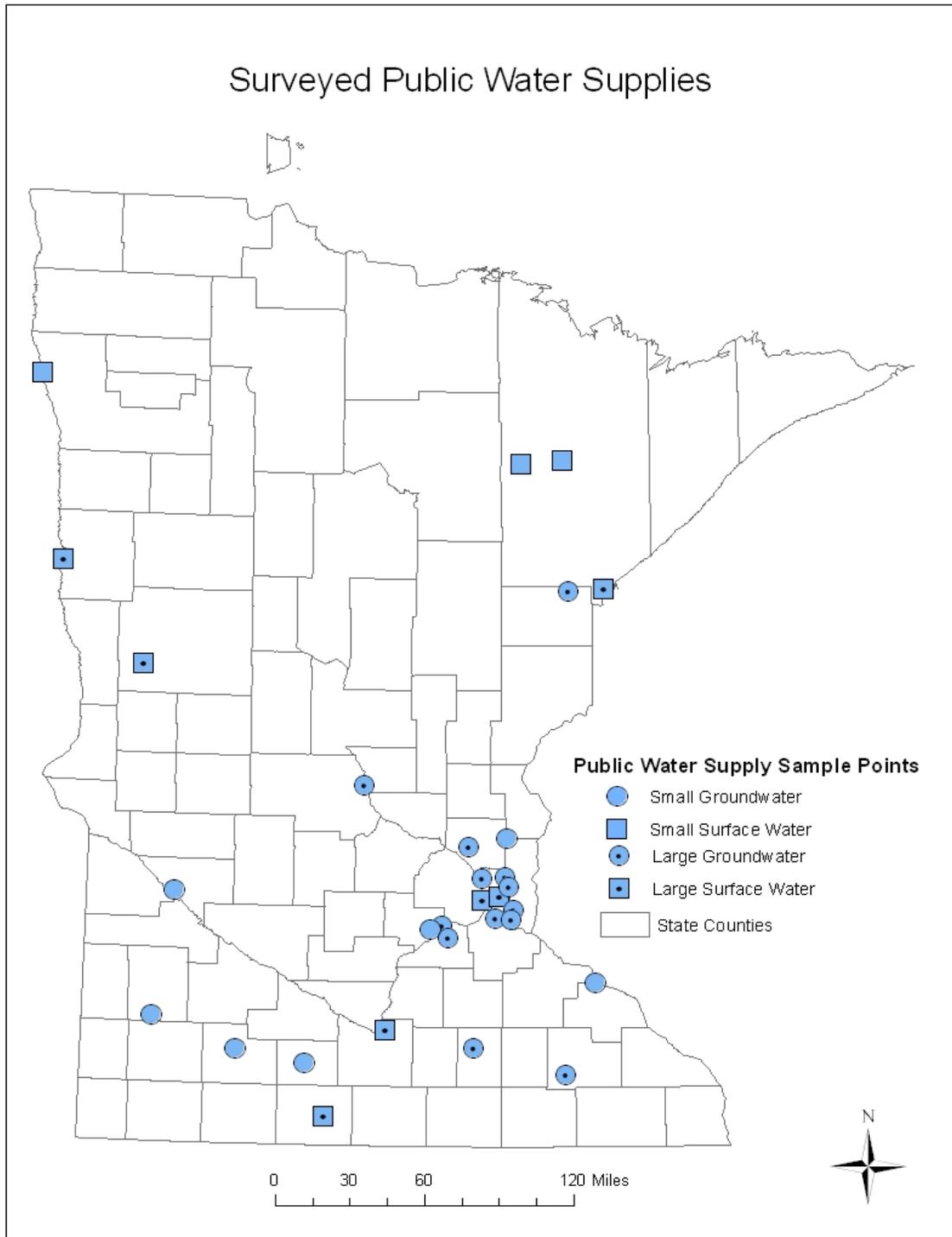


Figure 1: Public Water Supplies Chosen for Interviews, Minnesota, USA.

As the project proceeded, there were three public water supplies that either could not be contacted or that declined to participate. Two were small groundwater suppliers and one was a large groundwater supplier. The communities that were chosen for replacement were chosen based on the random list and based on their location in the state in order to maintain the hydrologic distribution around the state. This sample population is not intended to represent a complete sample of all the public water supplies in the state but is a baseline assessment of how these public water suppliers view communication about the water supply and emerging contaminants.

Website Analysis

To gain insights about current communication efforts and information available to the public, I conducted a municipal website analysis for each sample community. The primary variables of interest were ease of access as well as number and general content of links. Information gathered included the ease of finding the public water supply online (placement of links and number of links to reach the information); the ease of finding contact information; the frequency of webpages for the public water supply and the number of external links about water; percentage of the links that were dedicated to safety or quality of the water as opposed to links about other topics such as conservation, water utility structure, or billing; and information available regarding emerging contaminants. I used descriptive statistics to compare these variables across communities.

Public Water Supply Interviews

The primary data collection method was phone surveys of public water supply operators from the sample. Subjects verbally consented to participate. Interview questions focused on requests and concerns from citizens about drinking water, the consumer confidence report, and emerging contaminants in the water supply (Appendix A). I developed an interview coding guide (Appendix B) and data spreadsheet for the interview questions. The question responses were either yes/no, numerical percentages, scales, or narrative. Quantitative data from the interviews was analyzed using Microsoft Excel and descriptive statistics. Qualitative data from the interviews was voice recorded and transcribed.

Results and Discussion

Communication about emerging contaminants was a new issue that was not a high priority for many public water suppliers and their citizens. Public water supply operators reported that there is little interest or awareness about these contaminants from the general public. Therefore, there was not a strong sense of urgency among the public water supply operators to test for or communicate about emerging contaminants. When testing for emerging contaminants occurs there should be proactive and strategic communication so that water suppliers are ready to respond to any public concerns.

Website Analysis

Seventy-three percent of the communities had the water supply webpage accessible from an internet search when typing in the name of the community public water supply. Ninety-three percent of the water supply webpages were easily found from the municipal home page. The average number of clicks to get from the city home page to the water supply page was 1.7, indicating a relatively easy pathway for citizens to find water supply information from cities. A possible barrier for citizens in locating their community's public water supply information through the Internet may be that most of these sites were accessed from Public Works or Utility Departments. The fact that water is managed by Public Works might not be common knowledge among citizens so it was helpful that the majority of the water supply websites could be found from a general Internet search.

Given the possibility for future contamination from emerging contaminants, I wanted to look at how easily citizens could access information about drinking water and find contact information for key drinking water supply staff. Seventy-seven percent of the communities had direct contact information for public water supply staff and 80% of the websites were up to date with current information. A large majority (83%) of the public water suppliers had the consumer confidence report available online. Communities that did not post the report were those with no website or with minimal information available about the public water supply.

Available information on the water supply websites included links to topic specific pages as well as external links to other organizations. I determined the percentage of information about water supply and safety as opposed to information about water quantity, conservation, or water utility billing. Some communities had no information about the public water supply, quality, and safety while others had much useful information with multiple fact sheets and links to extensive resources. Time and resources are needed to develop web-based, educational information related to water so the analysis is a good indication of how the community prioritizes providing information and education about the water supply.

There was no statistical difference between the four categories of water suppliers regarding the percentage of website pages that contained information about safety and water quality as opposed to general information about the water supply. Small groundwater suppliers had the smallest percentage at 37.8%, next was small surface water at 50%, followed by large surface water and large groundwater at 59.4% and 65.1% respectively (Fig.2). Combined, the public water supplier websites had an average of 56% of the information about water quality and safety so a slight majority of the information that was available was about quality. The large groundwater supply websites may have the largest percentage of website information about water safety given that a few of them had recently been faced with PFC contamination.

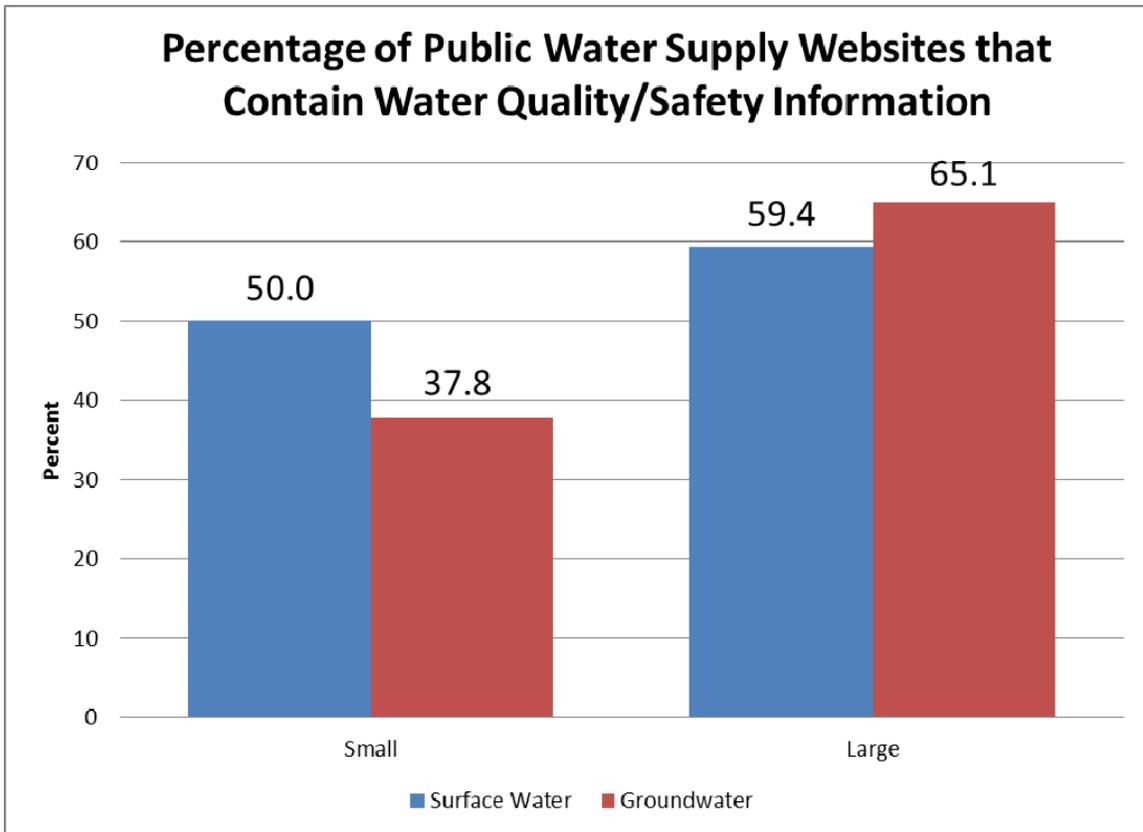


Figure 2: Percentage of Public Water Supply Websites that Contain Water Quality/Safety Information.

Nine public water suppliers (30%) had information about emerging contaminants on their website. None of the small surface-water or groundwater suppliers had emerging contaminants information on their website. Six of the large groundwater suppliers (46%) and three of the large surface-water suppliers (43%) had emerging contaminants information on their websites.

The website review indicates that there is not a significant difference between the public water supplier types. Therefore, the website review does not support the hypothesis that surface-water suppliers have a more urgent need for communicating about emerging contaminants. The websites are an indicator of what the water suppliers think is important to communicate about. Government agencies use websites to post information that they want the public to be able to access and often the information posted is driven by citizen requests. If the public is not seeking out information about emerging contaminants the public water suppliers will not have an urgent need to create and post information.

Public Water Supply Interviews - Citizen Questions and Communication

Interviews with the 30 public water supply operators provided numerous insights that can be used by the state health department and other agencies to design communication strategies about emerging contaminants. The first step of this study was to assess the

current communication tools for water quality and establish a baseline of information. For detailed results and descriptive statistics for the phone interviews of the public water supply operators see Appendix C.

Based on the interviews with public water suppliers, citizens contact the public water supply operators as the first point of contact if they want information about drinking water. The operators believed the citizens were not overly concerned with the safety of the drinking water or the quality of the water. Of the calls that citizens make to the public water supply operators, the operators estimated that the vast majority of calls were about aesthetics such as taste and odor as well as water hardness and setting water softeners (Fig. 3). There was no significant difference in citizen concern about safety between groundwater versus surface-water suppliers or large versus small suppliers. These findings do not support hypothesis #1 regarding increased awareness and interest in emerging contaminants by citizens served by a surface-water source and large suppliers. Overall, drinking water safety was considered a low concern for the general public.

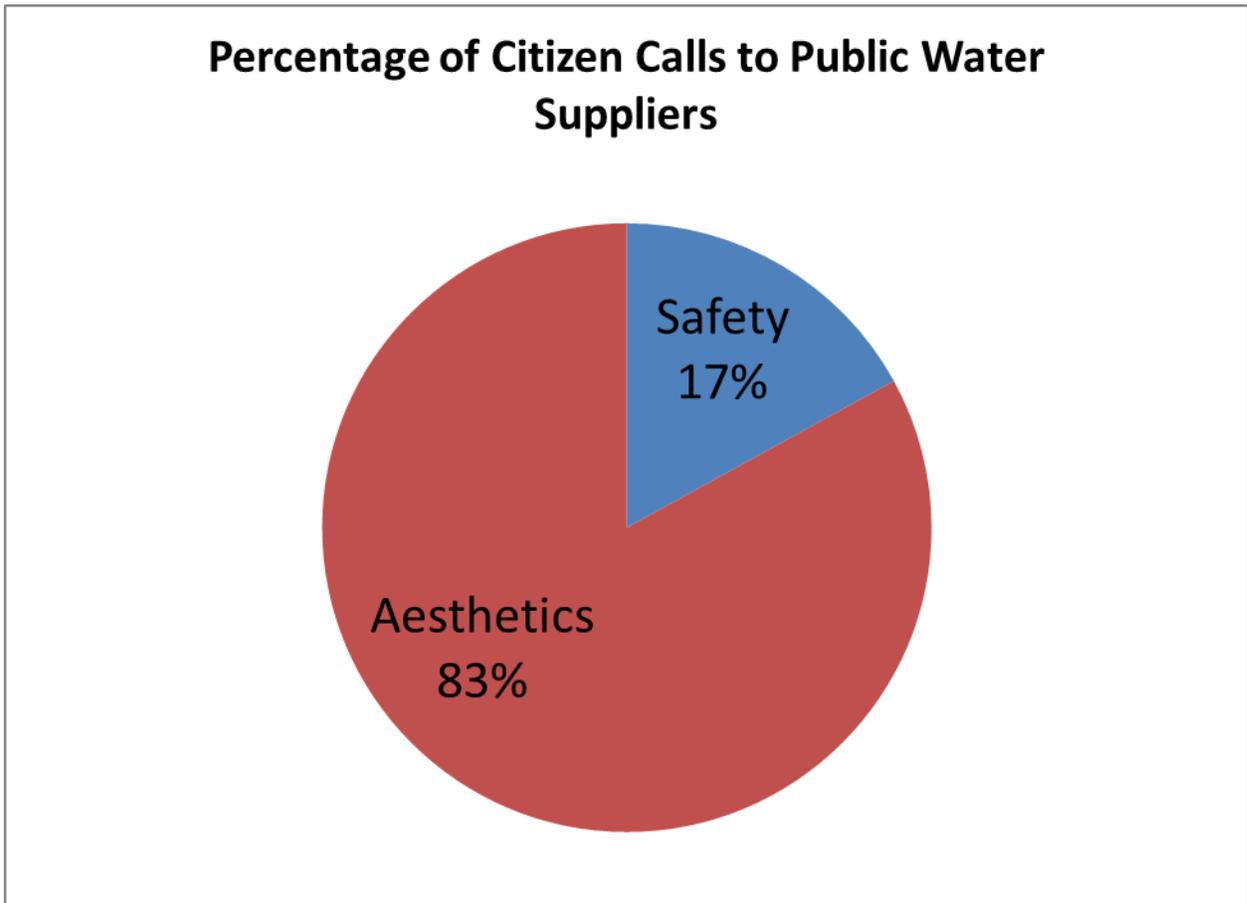


Figure 3: Public Water Suppliers Reported Percentage of Citizen Calls for Aesthetics and Safety of Drinking Water.

Most public water supply operators think that their current communication is adequate with most distributing the consumer confidence report to residents and posting information on an accessible website. There are many other traditional communication tools such as press releases, newsletters, fact sheets, and fliers in utility bills that are used as well. There is little use of radio/television media or social media (Fig. 4). The ability to use diverse communication tools can impact the ability to reach multiple audiences. More groundwater suppliers were found to use three or more communication tools in comparison with surface-water suppliers, 45% and 30% respectively.

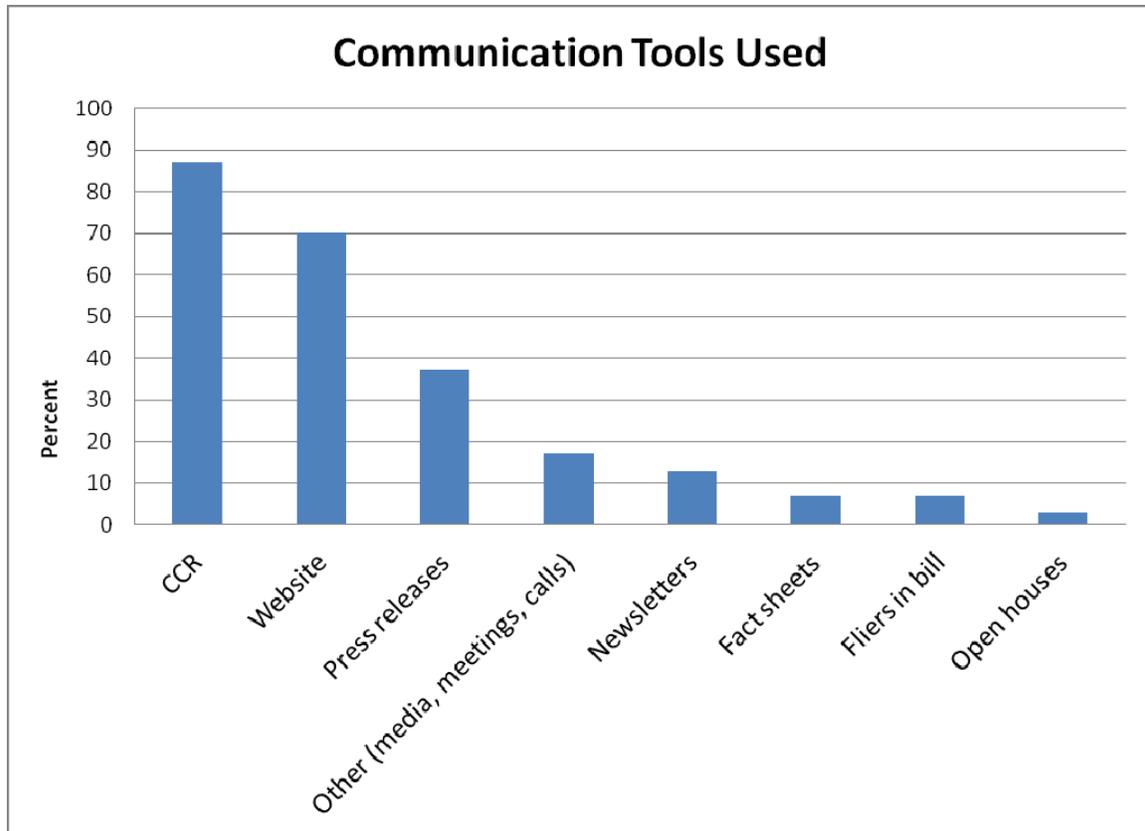


Figure 4: Communication Tools Used by Public Water Suppliers by Percentage.

The public water suppliers respond to the questions and concerns they get from the general public and target their staff efforts towards addressing these concerns. With limited interest in water quality, operators spend less time developing new tools. Notably, all of the public water suppliers use at least one method to communicate with the public about drinking water.

All 30 public water suppliers produce and distribute a consumer confidence report and 87% listed it as one of their communication tools. I wanted to gather information on how the consumer confidence report is distributed and evaluate how effective the report is as a communication tool (Fig. 5). A greater percentage (50%) of the surface-water suppliers used three or more methods for distributing the consumer report than groundwater suppliers (20%). Overall, operators rated the consumer confidence report only

moderately effective with an average rating of six out of ten (one being very low and ten being very high effectiveness). There was no significant difference in the perceptions of effectiveness between surface-water and groundwater suppliers.

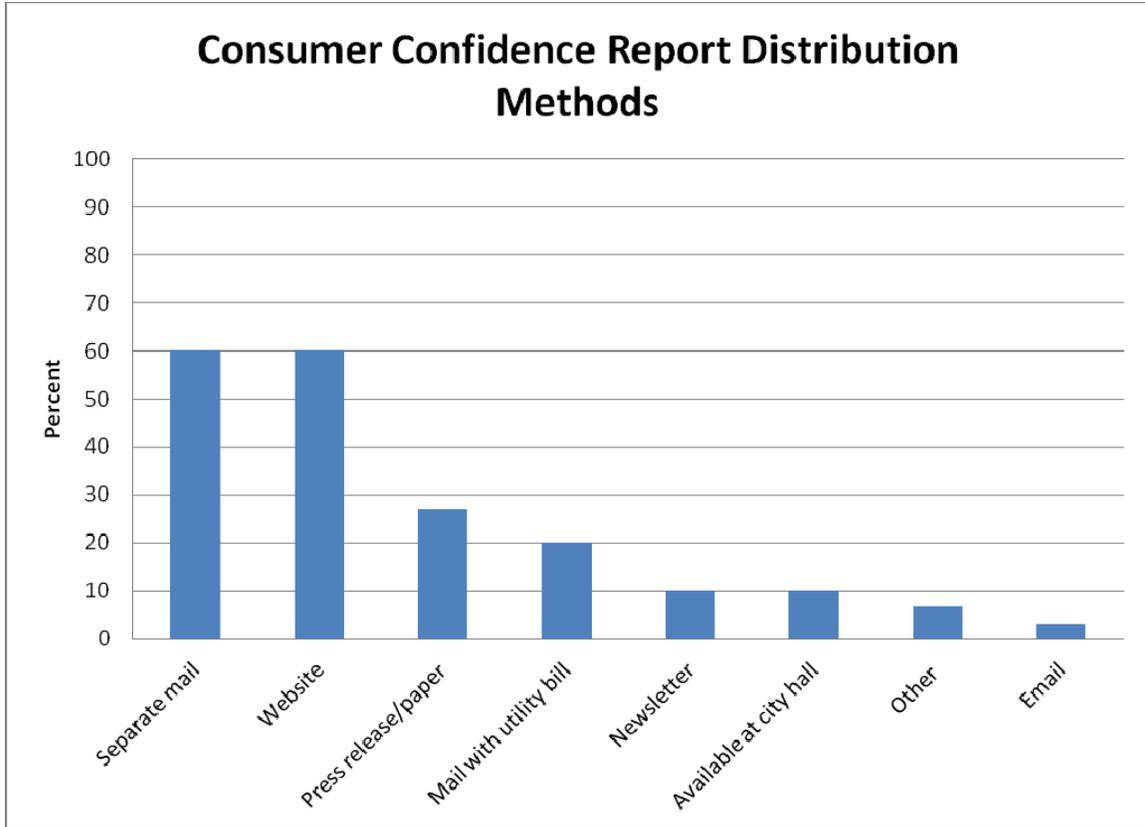


Figure 5: Public Water Suppliers’ Methods for Distributing Consumer Confidence Report by Percentage.

MDH and public water suppliers were currently conducting a pilot project sending out postcards with a link to the community website where citizens can find the consumer confidence report. The hope was that more citizens would be aware of and look at the reports if they receive the postcard prompt. MDH is in the process of conducting a survey of residents on the effectiveness of that new distribution approach.

The public water suppliers had challenges getting citizens to pay attention to the consumer confidence report and being aware of water issues. They also were challenged with what may be the best communication strategy for getting information out or for conducting educational programs. When asked about the challenges, one public water supply operator noted, “I think the biggest challenge is getting the citizens to read and observe the materials that we produce.” Another stated, “It’s pretty hard to make something interesting to people when there’s no problem with it. Everybody goes to their tap, turns it, great water comes out; it’s hard to get interested about anything about that.”

In my study, comments during the interviews provided a snapshot of what the public water suppliers thought about the effectiveness of the annual consumer confidence report. According to one public water supply operator, “I look at my consumer confidence report and I think it’s a real fine document. We spend a lot of time to do a real nice job on it. There’s a lot of good information in it. But, honestly, I’ll bet half the people just throw it in the trash . . . I think it would generate more calls than it does.”

The majority of public water suppliers (63%) said they do not need anything further from the State in order to communicate with their residents about drinking water. Because they do not get many questions from citizens about drinking water safety, they did not see an overwhelming need to do more communication than they were already doing. Those that would like additional communication tools would like template language, attention grabbing fact sheets, use of media (e.g., television, newspaper), more accessible data, and for the State to send out information directly to citizens.

Public Water Supply Interviews - Contaminants of Emerging Concern

Only a small percentage of public water supplies surveyed have had citizens contact them about emerging contaminants (33% have been contacted), with no significant difference between groundwater and surface-water source suppliers ($p=0.22$). Only a small number of public water supplies surveyed have done any type of communication about emerging contaminants (17%): one surface-water supplier and four groundwater suppliers had provided information to the public about emerging contaminants. Three of the groundwater suppliers had PFC contaminants, so their communication was focused on that group of emerging contaminants. Only two of the 30 public water suppliers interviewed as part of this study did any type of communication about the broader range of emerging contaminants such as pharmaceuticals and endocrine disruptors.

Given the low rate of communication hypothesis #1 was not supported by the study findings, in that the majority of water suppliers are not providing communication about emerging contaminants. It is interesting to note that 33% of water suppliers have been contacted about emerging contaminants but a smaller percentage (17%) have developed and provided information to the public about this topic. As the frequency of contacts from the public increases, it is likely that there will be an increase in the communication needed to address public concerns. This survey acts as a baseline about the status of communication of emerging contaminants.

Fifty percent of public water suppliers thought that communication around emerging contaminants is different than traditional contaminants such as nitrate contamination. Thirty-seven percent did not think there was any difference and 13% did not know or did not answer. A public water supply operator who thought communication was different stated, “Yes, well nitrates as an example is pretty well documented what the hazards are and it’s regulated at a defined level and it’s tested for at a routine basis. The emerging contaminants are not those things. We don’t routinely test for them, there are no limits which we can judge ourselves against. We don’t know if there are hazards associated with them and what those hazards are.” Another operator stated, “I guess that would be a harder thing to communicate. You know when you have some numbers out there, some

maximum contaminant level, maximum level goals and so forth you can show what different chemicals are found and what levels they test at . . . If you don't know about a particular chemical you know it would be hard to talk to someone about it. Especially if it was found in your water. You don't know how much of that stuff you have in you or you can take in."

Others thought there was no difference in communication, "You know I don't see a difference . . . I think people are always looking at what could be the immediate effects of any type of contaminant and do we know anything about chronic long-term effects of contaminants . . . for some things we can find scientific research on it. For other things I don't think there's enough data gathered yet to really know if there's an effect with certain types of contaminants over a long period of time and very minute amount." These statements demonstrated conflicting thoughts in regards to whether communication around emerging contaminants should occur and how that communication should be structured. They also highlight the challenges faced by public water suppliers and the Minnesota Department of Health.

Water supply operators expressed moderate urgency in testing for emerging contaminants with an average level of 6.1 out of ten (one being very low urgency and ten being very high urgency). There was no significant difference between groundwater and surface-water suppliers ($p=0.24$). In addition, operators expressed less urgency with an average level of 4.7 out of ten in regard to the need to communicate with the public about emerging contaminants. However, there was a significant difference between groundwater suppliers and surface-water suppliers, 5.6 vs. 3.2 out of ten respectively ($p=0.015$). These findings did not support hypothesis #2, which was that surface-water suppliers would have a more urgent demand for communication tools about emerging contaminants.

The reasoning for these differences could be partially explained by several comments from the public water supply operators. One operator noted, "It might be ok to let the public know yes we're studying them, yes they may be an issue but don't over react this time, let's study it, let's do the right thing to promote awareness but don't over react yet . . . be proactive in reducing the contaminant in the future, be proactive in that so we don't keep adding to the situation." A similar perspective was explained by another operator, "If we were to look at various risk associated with drinking water, they're just unbelievably small, right. It's just absurd to compare the safety of drinking water to walking across the street. You can drink water for your entire life and have a lower risk in many regards than the risk associated with walking across the street and getting hit by a bus. . . They are 'kinda' an easy thing for people to feel bad about, you know it's easy to criticize and talk about all these undesirable substances and nasty pollutants in water. But if we really look at it in an objective manner, it's an unbelievably safe material, drinking water. So even within the water utility there would be other things that would present far more of a risk, deteriorating infrastructure comes to mind as a prime example. We have 100 year old pipes in the ground that are someday going to fail and when they fail it presents a clear and present danger in regards to loss of fire protection, possibilities for contamination to come in due to loss of pressure, things of that nature."

Regarding the urgency to communicate other operators thought that, “The sooner the better . . . with the problems we had, I think the reason we got over the hurdles we did, as quick as we did, is nobody tried to hide anything. Nobody tried to beat around the bush. Everyone was up front and factual on what was going on and so if there are issues with emerging contaminants lets find out and let’s deal with it right up front.” The urgency to test or communicate about emerging contaminants was expected to be higher but there were very different viewpoints among operators on this issue. These diverse views demonstrated that operators did not all think alike about communication about emergent contaminants. Any program development with them would have to take this into consideration. They were not all starting at the same place as far as interest in this issue. It is likely that they did not know their role or did not have the information they needed.

When asked about what they need from the state to support communication about emerging contaminants, the public water suppliers had numerous ideas for things that they may need (Fig. 6). In this instance, no one said that they did not need anything from the State, which was the case for the question about what they would need for general water safety information. They had a good understanding of regular communication about their drinking water supplies. However, when it came to communication about emerging contaminants they wanted help from the State despite a moderate to low urgency or concern about the issue. As research is expanded and new information is discovered, they stated they would be very receptive to education and information from the State on new topics. They would like to be provided with technical expertise and data about emerging contaminants. They would like general information about emerging contaminants, training and education, and template language and materials such as fact sheets or press releases. They wanted continued and strengthened cooperation and support from MDH in order to deal with this topic. These were all things the State could provide to ensure that when the citizens go to public water supply operators these operators have the best information possible. It will be important that these water supply operators have been trained and are knowledgeable and have talking points about emerging contaminants, testing, risk, and safety.

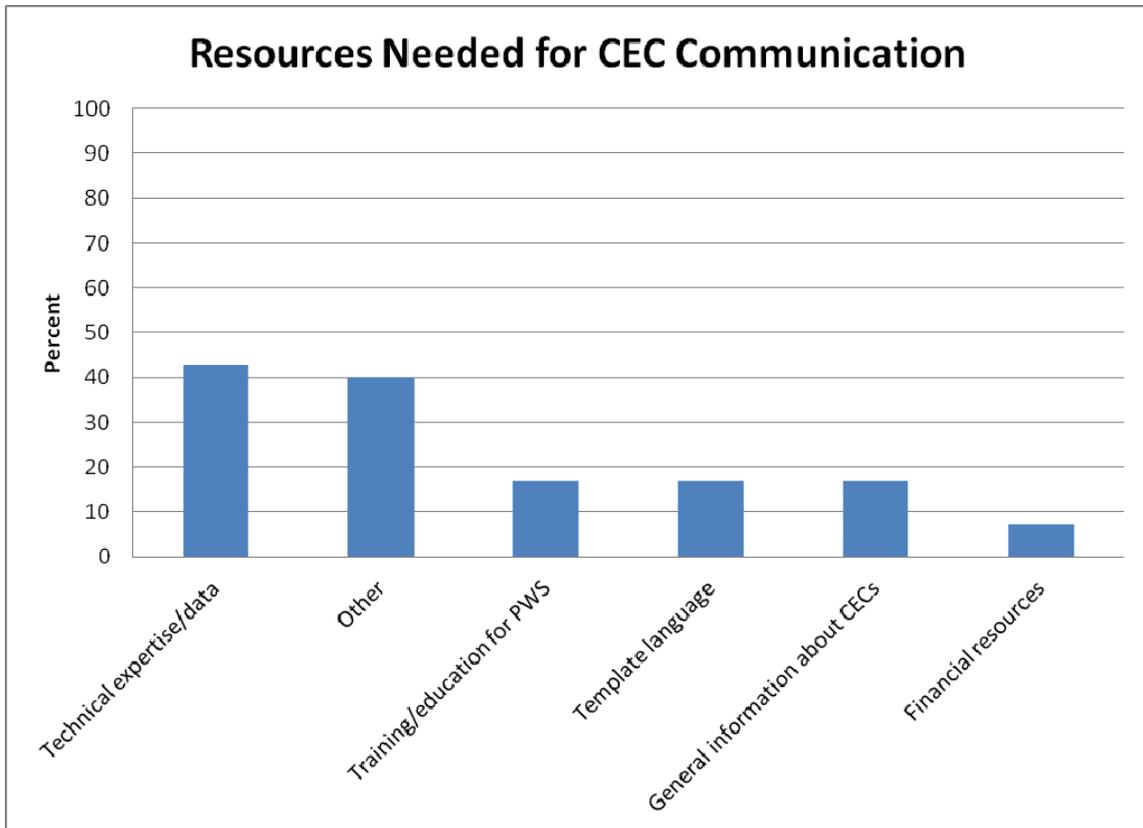


Figure 6: Resources Public Water Suppliers Need for Contaminant of Emerging Concern Communication by Percentage.

Hypothesis #3 was that public water suppliers would express a need for tools and resources about emerging contaminants. The findings of this study supported hypothesis #3. Public water suppliers did seek information and would rely on MDH for education and information. But there will be many things to keep in mind as communication is developed. As one public water supply operator stated, “You know our job really is to guarantee that the drinking water is safe and communicate that to the public. I really don’t want to see us get into the area of concerning the public over things that we ourselves are not completely sure of yet. It’s imperative that we keep our employees well informed so that we not only know what’s coming down and what the actual concerns are going to be to the citizens but that we can do what we need to do on the treatment end of it so that when people have concerns those questions can be answered. We need to keep our people in the industry well informed and well trained.” This quote sums up the need for education and information to be provided directly to the public water supply operators.

Recommendations

The interviews with the public water suppliers led to several recommendations for MDH to consider in moving forward with plans for communication around emerging contaminants. These recommendations are principally guided by the interviews as well as the MDH citizen focus group findings and other available literature on the importance of planned and strategic communication.

Recommendation 1: The Minnesota Department of Health should provide education and information about emerging contaminants to public water suppliers and use public water suppliers to distribute information about emerging contaminants to the general public.

According to the public water supply operators, residents would go to the public water supply with water questions; even if they were interested in or concerned with emerging contaminants. This was also supported by the MDH citizen focus groups, which discovered that citizens will not necessarily seek out information from the state and may use a variety of sources which includes local governments. Because MDH might not be the first place people think of the State should focus on channeling communication efforts, education, and printed materials to the public water suppliers. MDH could develop a templated document that public water suppliers could send out with the CCR that contains basic information about what residents should know about emerging contaminants.

The public water supply operators frequently mentioned their positive working relationships with MDH district engineers. MDH could use the district engineers in addition to other staff working on emerging contaminants or drinking water protection to get messages to the operators. MDH should also utilize trade organizations such as Minnesota Rural Water Association or the American Water Works Association for education and messaging to the water supply operators as these are trusted organizations from which the operators seek information and education.

When MDH conducted citizen focus groups, it was recommended that MDH serve as a central repository where people can get information about water quality, contaminants, and standards (MDH & DeYoung Consulting, 2011). A way to do this would be that MDH provide technical expertise, data, and fact sheets or general information about emerging contaminants to the operators that they can pass onto citizens. The operators could also use assistance communicating with the media and with training and education for the public water supply operators. The benefit to this approach is it further solidifies MDH's role as an overall leader in the communication about emerging contaminants. Working with the public water supply operators to distribute the information will ensure that accurate and reliable information is in the hands of the people that citizens will contact when they have questions or concerns about emerging contaminants.

Recommendation 2: The Minnesota Department of Health should continue to promote the consumer confidence report as a tool for the public to access regarding important drinking water quality information.

Due to an average effectiveness rating for the consumer confidence report MDH could consider possible changes to the report in order to enhance its use as a communication tool. MDH could work with the media to send out press releases that community consumer confidence reports will be sent out in the coming months by the public water suppliers and for residents to pay attention to that and take advantage of that as a resource about drinking water quality. Thirty-three percent of the public water suppliers interviewed said there was nothing that could be done to improve the consumer confidence report. Seventeen percent said it needed to be less technical. Other improvement suggestions included use less narrative, be more condensed, add more data/information/trends, make it simpler with less information, use electronic or different formats, add aesthetic information, use bullets, eliminate mandatory mailing, and don't make distribution online only. Ten percent said more outreach was needed to get people to read the report.

With such low citizen interest in drinking water quality the best option is to get people to pay attention to the fact that there even is an annual water quality report. MDH can consider these suggestions from the public water supply operators in order to make improvements to the report. Implementing some of these suggestions may lead to an improved CCR and more awareness by the public.

Recommendation 3: The Minnesota Department of Health, along with the public water suppliers, should strategically use the media and social media in order to communicate with the public about drinking water quality and emerging contaminants.

Some communication options include the use of additional media attention around drinking water, especially during National Drinking Water Week the first week in May. MDH could utilize a coordinated education/messaging program to raise awareness about the consumer confidence reports or the importance of knowing if drinking water is safe. An option may be to use social media or videos online, explaining water safety issues. Messages could also be paired with drug take back efforts or pharmaceutical disposal options to promote the fact that proper disposal may have a direct impact on keeping these emerging contaminants out of drinking water supplies.

Standard website messaging could be developed for local public water suppliers about emerging contaminants. Ease and accessibility of the information should be taken into consideration. A benefit of this would be that increased use of media and social media would result in consumers being able to find out about the quality of drinking water and more easily locate the annual drinking water reports.

Recommendation 4: The Minnesota Department of Health should continue to use formal collaborations, partnerships, and networks to address emerging drinking water contamination issues.

Much of the necessary communication around the topic of emerging contaminants will not be an issue until the contaminants are found in a public water supply. With the Unregulated Contaminants Monitoring Regulation program that will be started in 2013, it is possible that there will be community drinking water supplies within Minnesota that will show presence of some emerging contaminants. The results of this testing will need to be evaluated to determine how critical an issue this will be for the state. There may be many public water supplies where the contaminants are found or there may be very few. The lessons learned from prior contamination events discussed during the study interviews were that it was better to be clear, direct, and forthcoming with the public if any substances are found in drinking water. Clear communication is important even if those levels are not above a health risk limit or if no health risk limit exists for that substance.

The Environmental Protection Agency has developed a process that includes community involvement and partnerships when evaluating the clean up of an area with contaminated groundwater. They greatly encourage community involvement and have several steps in the remediation process where citizens and communities can become involved and engaged (EPA, 2009). This same type of process is an example of something that can be applied to the issue of emerging contaminants in drinking water supplies in Minnesota.

If state agencies, communities, and other stakeholders are all working towards one common vision and message, they will be better equipped to be successful in communicating potential health impacts from drinking water that contains emerging contaminants. Effective strategic communication is needed if whole system change is the goal. Those that are working on the issue need to fully support the messages that will be communicated to the public. It will be important to identify the audience, plan the communication, shape the messages, identify communicators, choose how to communicate, ensure adequate funding, and evaluate the communication program (Duffy & Chance, 2007).

MDH is already in a good position with the work of the Contaminants of Emerging Concern program, the Health Risk Assessment staff, and other units in the Department. Many of the items listed below may already be in the process of being implemented but further options for the state to consider include:

- Develop an advisory committee of key stakeholders that can determine the mission, vision, and goals in regards to communication and who can lead this process.
- Identify priorities, short and long term goals, objectives, and stakeholder values of concern around communication about emerging contaminants.
- Strengthen relationships and obtain more involvement with internal and external stakeholders through open channels of communication. MDH can properly engage local partners in order to meet goals. They can create networks and

- partnerships and recognize the value of joint drinking water communication initiatives.
- Develop a detailed strategic communication plan.
 - The plan should include information on how and when to communicate, how it will be paid for, who the audience is, and what the message will be.
 - Identify ways to obtain broader awareness and understanding of the issue.
 - Communicate to a broader audience through the use of the Internet, media, and social networking.

Summary and Conclusion

State agencies and local public water suppliers strive to ensure that the drinking water is safe and must communicate to the public if any issues arise with the water supply. The research question focused on the current status of communication about drinking water safety and emerging contaminants and how government entities should address the communication challenges. Communication about emerging contaminants was a new issue that was not a high priority for many public water suppliers and their citizens. Public water supply operators reported that there is little interest or awareness about these contaminants from the general public. Therefore, there was not a strong sense of urgency among the public water supply operators to test for or communicate about emerging contaminants.

Proactive strategic and coordinated communication regarding emerging contaminants in drinking water will be a key aspect if through monitoring we find emerging contaminants in drinking water supplies in Minnesota. Thoughtful communication will be extremely beneficial because drinking water contaminants may not be at levels that are considered harmful. There are also many uncertainties about the impact of these emerging contaminants on public health. The recommendations above are suggestions for how to enhance a communication strategy for the public.

Benefits to communication include increased public knowledge and increased ability of the government agencies to respond to the potential issues that may arise. The responsibility for ensuring safe drinking water supplies falls to the public water suppliers and state agencies. They can use these recommendations to enhance communication to the public regarding information about emerging contaminants and how they affect drinking water safety. In moving forward, the public water suppliers and the state agencies can strive for strategic messaging, proactive training, and tool development around drinking water quality and emerging contaminants.

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Appendix A: Interview Questions for Public Water Suppliers

I.) Citizen Questions and Information

Let's start with some basic questions about citizen questions and public information about drinking water.

For our purposes water quality does not mean taste, odor, or hardness. When I ask about water quality I'd like you to think about if it is safe to drink on a regular basis without health impacts.

- A.) Where do your citizens go first for information about their drinking water?
- B.) If they contact you, what kind of information are citizens most often looking for?
- C.) Overall what percentage of citizen calls you get is related to contaminants and safety and what percentage is aesthetics of the water?
- D.) What type of communication tools do you currently use to inform the public about drinking water quality?
- E.) What are the greatest challenges you face with communicating with citizens?
- F.) Have you ever had any contamination in the water supply? Yes/No – What was it?_____ How did you handle communication of that contamination? What did you do? What was the process? Do you have materials that I could see?

II. Consumer Confidence Report

Now I will ask you some questions about consumer confidence reports.

- G.) Do you use consumer confidence reports to communicate about drinking water quality? Yes/No
- H.) How is it distributed?
- I.) On a scale from 1 to 10, 1 being very low and 10 being very high: How effective do you think is the consumer confidence report for communicating what is in the public water supply?
- J.) What could be done to improve the consumer confidence report?

III. Public Water Suppliers Information and Education

I want to ask you some questions about where you get education and information.

- K.) Where do you most often go for information when you hear about contamination in drinking water?
- L.) What can the state do to help you better communicate with your citizens about drinking water?

IV. Contaminants of Emerging Concern

Now I will ask some questions about contaminants of emerging concern. These are contaminants that do not have health based guidance of how much is safe to drink. Examples include pharmaceuticals or endocrine disruptors or new chemicals such as perfluorochemicals, also known as PFCs.

- M.) Have your citizens ever contacted you about contaminants of emerging concern in the drinking water? Yes/No What did they ask? Or What was their concern?
- N.) Who do you think your citizens most often contact if they have concerns about contaminants of emerging concern in drinking water? Can you give an example? Where do they say they have gotten that information?
- O.) We talked about communication previously but lets this time think about communication you provide about emerging contaminants. Do you do anything around this topic? Yes/No What?
- P.) Do you think communication around emerging contaminants are different than traditional contaminants such as nitrates? Yes/No Why and in what way?
- Q.) In comparison with more traditional contaminants such as nitrates, on a scale of 1 to 10, how urgent do you think is the need for testing for emerging contaminants? 1 is lowest urgency, 10 is highest urgency.
- R.) In comparison with more traditional contaminants such as nitrates, on a scale of 1 to 10, how urgent do you think is the need for communication to the public about emerging contaminants? 1 is lowest urgency, 10 is highest urgency.
- S.) What would you need from county, state, or federal agencies in order to communicate to your citizens about contaminants of emerging concern? (prompts are training and funding)

Now that we have concluded the questions I have, is there anything else about communication and emerging contaminants that we haven't covered that you would like to talk about?

Thank you for taking the time to talk to me today and participate in this interview. I greatly appreciate all your insights and the information you provided. Would you like to receive an electronic copy of my report when it is finished? Yes/No

Appendix B: Interviews with Public Water Suppliers Coding Guide

Standard codes for 'Don't know' is 888, 'Didn't respond' is 999.

I.) Citizen Questions and Information

- A.) Where do your citizens go first for information about their drinking water?
1. City PWS
1 yes, 2 no
 2. State
1 yes, 2 no
 3. County
1 yes, 2 no
 4. Federal
1 yes, 2 no
 5. Private company
1 yes, 2 no
 6. Other
what_____
- B.) If they contact you, what kind of information are citizens most often looking for?
1. Aesthetics like taste and odor
1 yes, 2 no
 2. Safe to drink
1 yes, 2 no
 3. Conservation tips
1 yes, 2 no
 4. Technical treatment issues
1 yes, 2 no
 5. Emerging contaminant
1 yes, 2 no
 6. Other
what_____
- C.) Overall what percentage of citizen calls you get is related to contaminants and safety and what percentage is aesthetics of the water?
% safety & % aesthetics
- D.) What type of communication tools do you currently use to inform the public about drinking water quality?
1. Website
1 yes, 2 no
 2. Fact sheets
1 yes, 2 no
 3. Press releases
1 yes, 2 no

4. Newsletters
1 yes, 2 no
5. Consumer Confidence Report
1 yes, 2 no
6. Fliers in utility bill
1 yes, 2 no
7. Open houses
1 yes, 2 no
8. Other
what_____

E.) What are the greatest challenges you face with communicating with citizens?

1. Technical understanding
1 yes, 2 no
2. Financial resources
1 yes, 2 no
3. Technical resources
1 yes, 2 no
4. Communication
1 yes, 2 no
5. Staff resources
1 yes, 2 no
6. Citizen awareness of issues
1 yes, 2 no
7. Established safety levels
1 yes, 2 no
8. Other
what _____

F.) a. Have you ever had any contamination in the water supply?

1. Yes
2. No

b. What was it?

- i. Nitrate
- ii. Bacteria
- iii. Arsenic
- iv. VOC
- v. Fertilizers
- vi. Emerging contaminant
- vii. Other

c. How did you handle communication of that contamination?

II. Consumer Confidence Report

G.) Do you use consumer confidence reports to communicate about drinking water quality?

1. Yes
2. No

H.) How is it distributed?

1. Mail with utility bill
1 yes, 2 no
2. Separate mail
1 yes, 2 no
3. Email
1 yes, 2 no
4. Website
1 yes, 2 no
5. City Newsletter
1 yes, 2 no
6. Press release
1 yes, 2 no
7. Available at city hall
1 yes, 2 no
8. Other
what _____

I.) On a scale from 1 to 10, 1 being very low and 10 being very high: How effective do you think is the consumer confidence report for communicating what is in the public water supply?

Number between 1 and 10:

J.) What could be done to improve the consumer confidence report?

- i. More narrative
1 yes, 2 no
- ii. More explanation
1 yes, 2 no
- iii. Less technical
1 yes, 2 no
- iv. More visually appealing
1 yes, 2 no
- v. Social media tools
1 yes, 2 no
- vi. Outreach to get people to read it
1 yes, 2 no
- vii. Other
What _____

III. Public Water Suppliers Information and Education

K.) Where do you most often go for information when you hear about contamination in drinking water?

1. Federal
1 yes, 2 no
2. State
1 yes, 2 no
3. County
1 yes, 2 no
4. Private company
1 yes, 2 no
5. Association (AWWA, MRWA)
1 yes, 2 no
6. Ten states standards
1 yes, 2 no
7. Online search engine
1 yes, 2 no
8. Other
What _____

L.) What can the state do to help you better communicate with your citizens about drinking water?

- i. Provide training
1 yes, 2 no
- ii. Provide template language
1 yes, 2 no
- iii. Provide technical expertise
1 yes, 2 no
- iv. Provide financial resources
1 yes, 2 no
- v. Provide education to operators
1 yes, 2 no
- vi. Provide experts to talk about issues
1 yes, 2 no
- vii. Hold open houses
1 yes, 2 no
- viii. Send out information to citizens
1 yes, 2 no
- ix. Nothing
1 yes, 2 no
- x. Other
What _____

IV. Contaminants of Emerging Concern

M.)a. Have your citizens ever contacted you about contaminants of emerging concern in the drinking water?

1. Yes
2. No

b.What did they ask? Or What was their concern?

N.) a. Who do you think your citizens most often contact if they have concerns about contaminants of emerging concern in drinking water?

1. City PWS
1 yes, 2 no
2. State
1 yes, 2 no
3. County
1 yes, 2 no
4. Federal
1 yes, 2 no
5. Private company
1 yes, 2 no
6. Online search engine
1 yes, 2 no
7. Other
What? _____

O.) We talked about communication previously but lets this time think about communication you provide about emerging contaminants? Do you do anything around this topic?

- i. Yes
- ii. No

b.What?

1. Mail
2. Email
3. Website
4. Press release
5. Water plant tours
6. Other

P.) a. Do you think communication around emerging contaminants are different?

- i. Yes
- ii. No

b.Why and in what way?

Q.) In comparison with more traditional contaminants such as nitrates, on a scale of 1 to 10, how urgent do you think is the need for testing for emerging contaminants? 1 is lowest urgency, 10 is highest urgency.

#:

R.) In comparison with more traditional contaminants such as nitrates, on a scale of 1 to 10, how urgent do you think is the need for communication to the public about emerging contaminants? 1 is lowest urgency, 10 is highest urgency.

#:

S.) What would you need from county, state, or federal agencies in order to communicate to your citizens about contaminants of emerging concern?

- i. Provide training
1 yes, 2 no
- ii. Provide template language
1 yes, 2 no
- iii. Provide technical expertise
1 yes, 2 no
- iv. Provide financial resources
1 yes, 2 no
- v. Provide general information about CECs
1 yes, 2 no
- vi. Nothing
1 yes, 2 no
- vii. Other
What? _____

Appendix C: Answers to Public Water Supply Operator Interviews and Descriptive Statistics

I.) Citizen Questions and Information

A.) Where do your citizens go first for information about their drinking water?

N=30

-97% City PWS

-3% Other such as Internet

-3% Didn't know

-0% State, County, Federal, Private Company

B.) If they contact you, what kind of information are citizens most often looking for?

N=30

-70% Aesthetics like taste and odor

-43% Other (hardness, softener, water bill, water usage, skin rash)

-20% Safe to drink

-10% Technical treatment issues

-7% Emerging contaminant

Operators who answered "other" specified the following:

-Hardness level/setting water softener (n=11)

-Water source (n=1)

-Water useage/bill (n=1)

-Pressure (n=1)

-Skin rash (n=1)

C.) Overall what percentage of citizen calls you get is related to contaminants and safety and what percentage is aesthetics of the water?

N=28, Missing=2

17% safety & 83% aesthetics

Table 1: Percentage of Calls Related to Safety.

	Total	Ground water	Surface water	T-Test Sig.
N	28	18	10	
Missing	2	2	0	
Mean	17.0	18.8	13.6	0.46
Median	10	10	10	
Std. Dev.	19.0	20.7	15.7	
Minimum	0	0	0	
Maximum	70	70	40	

Table 2: Percentage of Calls Related to Aesthetics.

	Total	Ground water	Surface water	T-Test Sig.
N	28	18	10	
Missing	2	2	0	
Mean	83.0	81.2	86.4	0.46
Median	90	90	90	
Std. Dev.	19.0	20.7	15.7	
Minimum	30	30	60	
Maximum	100	100	100	

D.) What type of communication tools do you currently use to inform the public about drinking water quality?

N=30

Multiple ways they communicate:

- 87% Use Consumer Confidence Report
- 70% Website
- 37% Press releases
- 17% Other (radio, tv, council meetings, or call residents)
- 13% Newsletters
- 7% Fact sheets
- 7% Fliers in utility bill
- 3% Open houses

30 percent (3 out of 10) of surface-water suppliers use three or more communication tools.

45 percent (9 out of 20) of groundwater suppliers use 3 or more communication tools.

Operators who answered “other” specified the following:

- Radio, tv (n=2)
- Council meetings (n=1)
- Direct call residents (n=1)
- Mailings (n=1)

E.) What are the greatest challenges you face with communicating with citizens?

N=29, Missing=1

- 50% Citizen awareness of issues
- 23% Communication
- 20% Other
- 10% Technical understanding
- 3% Nothing
- 0% Financial resources, technical resources

- “Other” answers included:
- Issues with media (n=2)
 - Staff resources (n=1)
 - Established safety levels (n=1)
 - Language (n=1)
 - Water conservation (n=1)

Table 3: Challenges of Public Water Suppliers by Percentage.*

	Total (n=29)		Ground water (n=19)		Surface water (n=10)		X^2 Sig.
	n	%	n	%	n	%	
Citizen awareness	15	50.0	11	73.3	4	26.7	0.64
General communication	7	23.3	4	57.1	3	42.8	0.55
Technical understanding	3	10.0	1	33.3	2	66.7	0.20
Other-variety of responses	6	20.0	5	83.3	1	16.7	0.41

*Responses were grouped into these categories for operators who provided a response or multiple responses. Included is the percentage of groundwater suppliers and surface-water suppliers who chose those issues as the challenges they face. Evaluated whether statistically there are differences between groundwater and surface water in what their challenges are in communicating with citizens. Start by assuming no difference between groundwater and surface water. Since p-values are above 0.05 do not have enough evidence to show differences between groundwater and surface water.

F.) a. Have you ever had any contamination in the water supply?

N=30
27% Yes
73% No

Operators who answered “yes” specified the following types of contamination:

- PFC (n=3)
- Radium (n=2)
- Arsenic (n=1)
- Atrazine (n=1)
- TCE (n=1)
- VOC (n=1)

II. Consumer Confidence Report

G.) Do you use consumer confidence reports to communicate about drinking water quality?

N=30
100% Yes
0% No

H.) How is it distributed?

- N=30
- 60% Separate mail
- 60% Website
- 27% Press release/paper
- 20% Mail with utility bill
- 10% City newsletter
- 10% Available at city hall
- 7% Other (post in apartments)
- 3% Email

50 percent (5 out of 10) of surface-water suppliers use three or more communication tools.

20 percent (4 out of 20) of groundwater suppliers use 3 or more communication tools.

I.) On a scale from 1 to 10, 1 being very low and 10 being very high: How effective do you think is the consumer confidence report for communicating what is in the public water supply?

- N=30
- Number between 1 and 10: Mean is 6
- From 1-5 = 13, from 6-10 = 17
- Range is 1 to 10, Median is 6

Table 4: Consumer Confidence Report Effectiveness (Scale 1-10).

	Total	Ground water	Surface water	T-Test Sig.
N	30	20	10	
Mean	6.0	6.1	5.9	0.86
Median	6	6	6	
Std. Dev.	2.7	2.9	2.4	
Minimum	1	1	2	
Maximum	10	10	9	

J.) What could be done to improve the consumer confidence report?

- N=28, Missing=2
- 33% Other (less narrative, more condensed, more data/information/trends, make more simple/less info, electronic or different formats, add aesthetic info, use bullets, eliminate mandatory mailing, don't make online only)
- 33% Nothing
- 17% Less technical
- 10% Outreach to get people to read it
- 7% Didn't answer
- 0% for More narrative, More explanation, More visually appealing, Social media tools

III. Public Water Suppliers Information and Education

K.) Where do you most often go for information when you hear about contamination in drinking water?

N=30

-60% State

-60% Trade Association (AWWA, MRWA)

-37% Online search engine

-27% School/Training

-23% Other (other operators, books, journals)

-10% Federal

-0% County, Private company, Ten states standards

Operators who answered “other” specified the following:

-Other operators (n=4)

-Operators manual/textbooks (n=3)

-Trade journals (n=1)

-University of Minnesota (n=1)

L.) What can the state do to help you better communicate with your citizens about drinking water?

N=29, Missing=1

-63% Nothing

-20% Other (media, radio, tv, psas, social media, state do CCR, make data available more frequently, more attention grabbing fact sheets)

-17% Provide template language

-10% Send out information to citizens

-3% Didn't know

-0% Provide training, provide technical expertise, provide financial resources, provide education to operators, provide experts to talk about issues, hold open houses

IV. Contaminants of Emerging Concern

M.) Have your citizens ever contacted you about contaminants of emerging concern in the drinking water?

N=30

-33% Yes

-67% No

50 percent (5 out of 10) of surface-water suppliers have been contacted by citizens about contaminants of emerging concern.

25 percent (5 out of 20) of groundwater suppliers have been contacted by citizens about contaminants of emerging concern.

P-value of T-test is 0.22; not significant between groundwater and surface water.

N.) Who do you think your citizens most often contact if they have concerns about contaminants of emerging concern in drinking water?

N=29, Missing=1

-87% City PWS

-23% State

-10% Online search engine

-3% County, Private company, Other (trade organization)

-3% Didn't know

-0% Federal

O.) We talked about communication previously but lets this time think about communication you provide about emerging contaminants? Do you do anything around this topic?

N=30

-17% Yes

-83% No

Of those doing communication they are mostly using website or bring up during plant tours. One each for mail, press release, or newsletter.

10 percent (1 out of 10) of surface-water suppliers provide communication about contaminants of emerging concern.

20 percent (4 out of 20) of groundwater suppliers provide communication about contaminants of emerging concern. Three of the groundwater suppliers had PFC contamination so the communication is about those emerging contaminants.

None of those three provided communication about other emerging contaminants.

P.) Do you think communication around emerging contaminants are different than traditional contaminants such as nitrates?

N=30

-50% Yes

-37% No

-13% Didn't answer or didn't know

No noticeable difference between surface-water and groundwater suppliers.

Q.) In comparison with more traditional contaminants such as nitrates, on a scale of 1 to 10, how urgent do you think is the need for testing for emerging contaminants? 1 is lowest urgency, 10 is highest urgency.

Table 5: Urgency to Test for Emerging Contaminants (Scale 1-10).

	Total	Ground water	Surface water	T-Test Sig.
N	29	19	10	
Missing	1	1	0	
Mean	6.1	6.5	4.7	0.24
Median	7	7	3	
Std. Dev.	2.8	2.8	3.3	
Minimum	1	1	2	
Maximum	10	10	10	

No statistical difference between surface-water and groundwater suppliers on urgency to test for emerging contaminants.

R.) In comparison with more traditional contaminants such as nitrates, on a scale of 1 to 10, how urgent do you think is the need for communication to the public about emerging contaminants? 1 is lowest urgency, 10 is highest urgency.

Table 6: Urgency to Communicate to the Public About Emerging Contaminants (Scale 1-10)

	Total	Ground water	Surface water	T-Test Sig.
N	29	19	10	
Missing	1	1	0	
Mean	4.7	5.6	3.2	0.015
Median	5	6	2	
Std. Dev.	2.7	2.6	2.2	
Minimum	1	1	1	
Maximum	10	10	8	

Shows a statistically different urgency to communicate between surface-water and groundwater suppliers.

S.) What would you need from county, state, or federal agencies in order to communicate to your citizens about contaminants of emerging concern?

N=29, Missing=1

-43% Provide technical expertise/data

-40% Other (support, research, be the communicator, cooperation, media/radio/tv, need go to person, education about gw as regional system, don't involve public until know its there)

-17% Provide training/education for PWS

-17% Provide template language (fact sheets, press releases)

-17% Provide general information about CECs

-7% Provide financial resources

-3% Didn't answer

-0% Nothing