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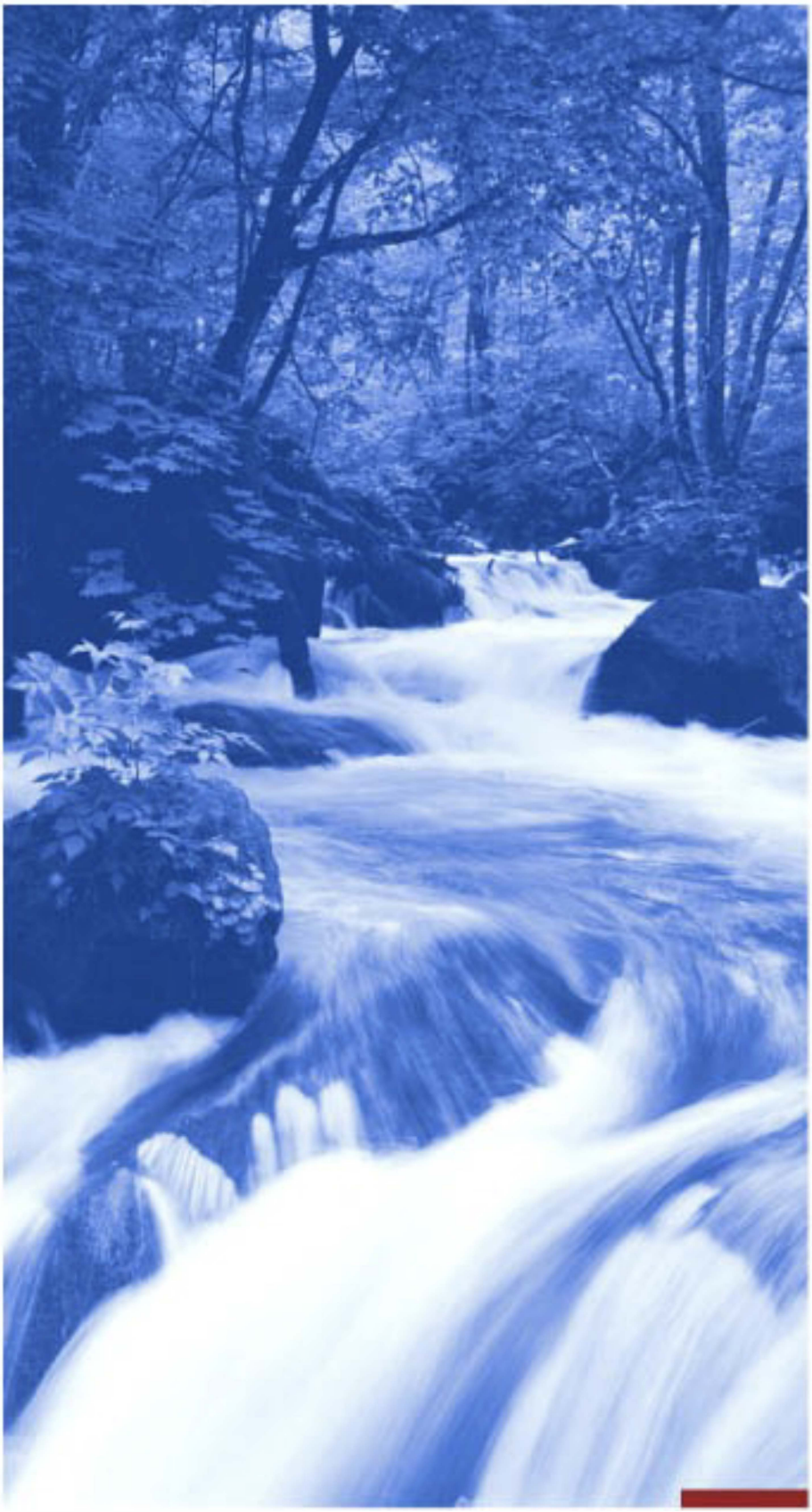

Report

Living in a PFAS World: A Brief Survey and Analysis of Generally Available PFAS/PFOA Health Communications

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Introduction

Discussions centering on PFAS contamination are popping up everywhere. From showing up in traditional medical publications to New York Times Magazine to even headlining an episode of Last Week Tonight with John Oliver, a vast array of communicators currently circulate a myriad of information. Communicating this information to the general public is incredibly challenging - the science behind exposure and treatment is continually evolving, regulations are politically impacted, and the whole topic can be emotionally charged. For these reasons, The Water Center at Penn has conducted a brief survey and analysis of generally available PFAS/PFOA health literature and corresponding outreach communications. This review aims to assess how public health concerns regarding PFAS/PFOA are conveyed and how accurately these communications are messaged.

Methodology

This report is a very high-level, preliminary survey of generally available PFAS/PFOA health literature and corresponding public outreach communications. We first conducted brief technical background research on PFAS/PFOA. We then identified the types of entities communicating about PFAS/PFOA. Based on this information, we structured our research as a two-pronged, top-down approach. The first prong is a survey of communications from federal government agencies and sources continuing through state and local sources. The local level sources include two abbreviated community case studies. The second prong of this study includes publicly available print and digital media from non-governmental sources. See **Figure 1** below.

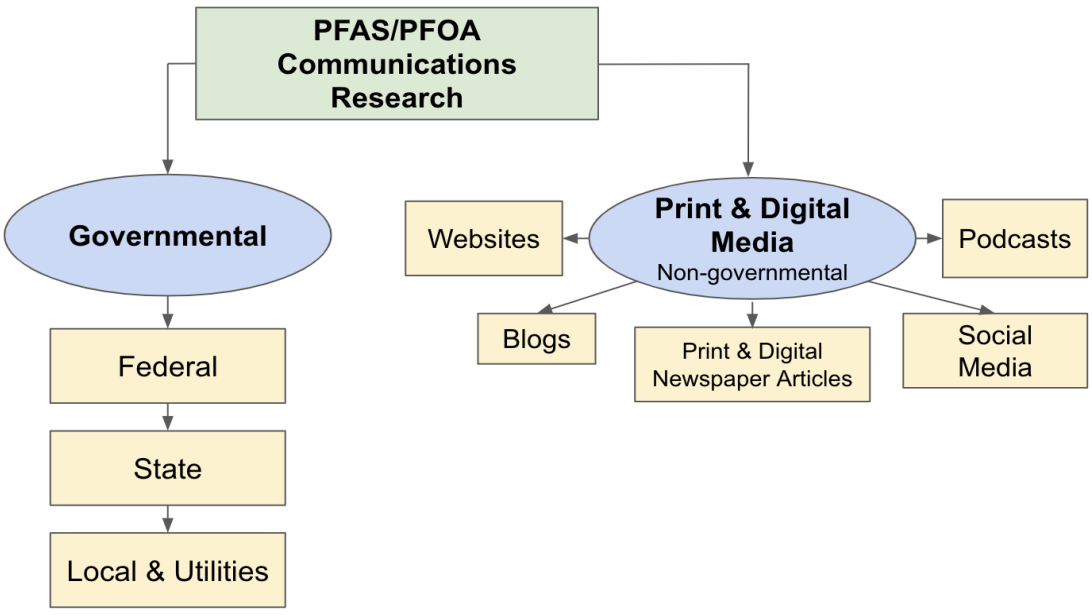


Figure 1

**Please note that for the sake of simplicity, the use of the term "PFAS" or "PFAS/PFOA" in this report is meant to be an all encompassing reference to the entire family of per and polyfluoroalkyl substances, including PFOS.*

US Impact

PFAS/PFOA contamination is wreaking havoc on communities across the United States. A recent study from the United States Geological Survey (USGS) found that nearly half of the nation's tap water is contaminated with PFAS. That's a staggering statistic, even more so considering that exposure occurs through food, air, and additional pathways. In 2022, the Centers for Disease Control and Prevention (CDC) released a study finding that 97% of Americans have some form of PFAS in their blood. It's no wonder, considering that PFAS is in our food packaging, personal care products, carpeting, cleaning supplies, and more.

What are PFAS/PFOA?

Per- and poly-fluoroalkyl substances, commonly referred to as "PFAS/PFOA" are man-made chemicals that consist of varying-sized chains of carbon and fluorine atoms. These chemicals were discovered accidentally by DuPont researchers in the 1930s, connected to research on the Manhattan Project. The PFAS family of chemicals are known as "forever chemicals", meaning they don't readily break down due to their strong carbon-fluorine chemical bonds. This was and is part of their attraction, as they repel water and oil and are resistant to heat and chemical reactions. As such, from the 1940s onward, they have been incorporated into many consumer products, firefighting foam, medical devices, military supplies, and more. See **Figure 2** below for a sampling of the types of products that contain PFAS/PFOA.

Source: Riverside Public Utilities, Riverside, CA
https://riversideca.gov/press/understanding-pfas

Figure 2

Further complicating detection, regulation, and treatment, there are thousands of variations of PFAS. In **Figure 3** below, you can see the various types of PFAS that currently exist, and researchers are uncovering new variations every day.

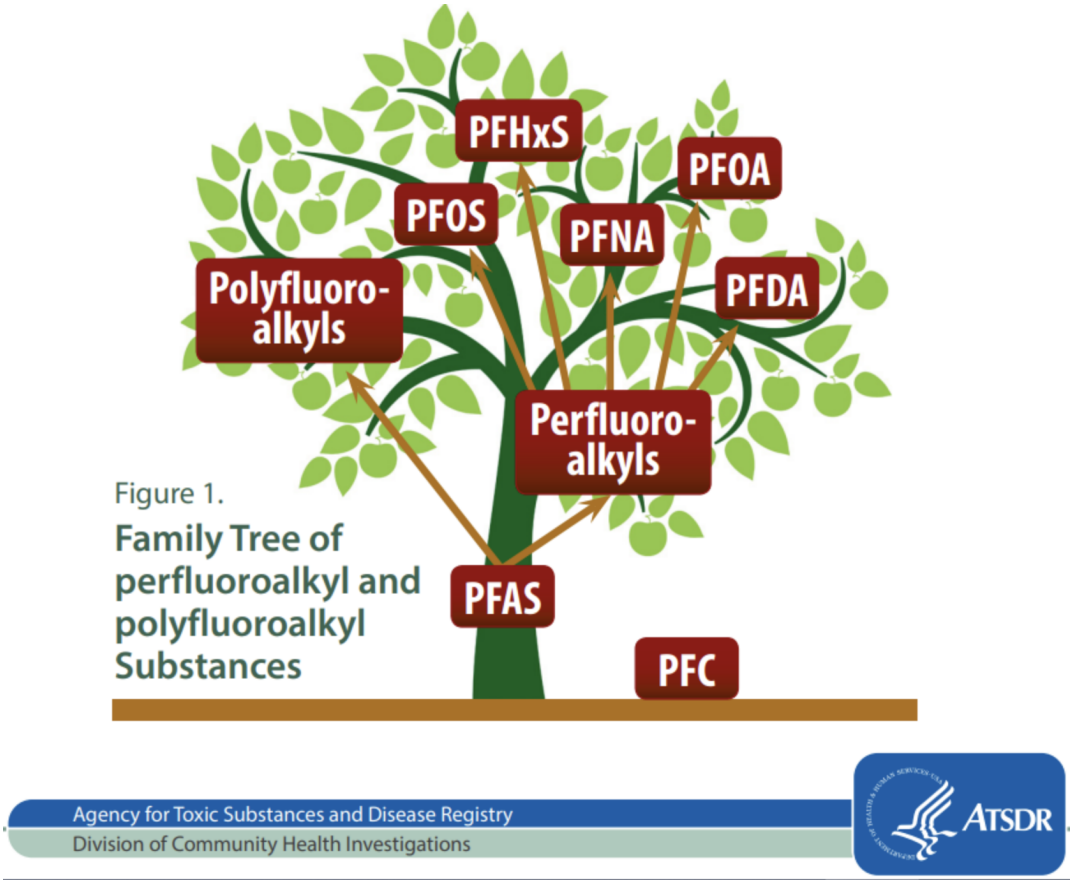


Figure 3

The scale of PFAS contamination is unlike anything seen before. PFAS have been found in polar bears in the Arctic, fish in the United States, and in children in the Faroe Islands. Instead of degrading over time, they bioaccumulate or continue to "pile up" in humans and in animals. As such, their impacts are far-reaching, and long-lived.

The good news is that PFAS in drinking water can be treated. Treatment methods include usage of granular activated carbon (GAC), ion exchange resins, and high pressure membranes. Selecting a particular treatment method takes into account site specific characteristics and may include multiple technologies. The bad news is that treatment is expensive, and often results in vast customer rate increases.

PFAS/PFOA Human Health Implications

As mentioned above, research shows that PFAS bioaccumulate, don't break down readily, and can closely mimic our own body systems. Scientists now understand that once PFAS enter into the human body they bind to one of our major blood proteins and travel through our blood to our organs and other tissues. This characteristic of easily assimilating into body systems makes them particularly dangerous, and a growing number of adverse health issues are linked to PFAS exposure.

Parkersburg, West Virginia is the site of particularly acute contamination from a DuPont Teflon (PFOA) manufacturing facility. A settlement from DuPont required testing of the public, and the resulting 2012 report demonstrated a "probable link" between PFOA and high cholesterol, ulcerative colitis, thyroid disease, testicular cancer, kidney cancer, and pregnancy-induced hypertension.

In the Faroe Islands, a 2012 published medical paper revealed that PFAS reduced the number of antibodies that children maintained after receiving diphtheria and tetanus vaccinations. Unlike the Parkersburg report, it is important to note that the children in this particular study were not exposed to high levels of contaminants but had similar levels to United States and European averages.

There are a number of additional health conditions that have been connected to PFAS exposure but are not supported with as overwhelmingly persuasive evidence as the aforementioned studies. These conditions include liver disease, endocrine disruption, infertility, metabolism and immune dysfunction, and neurobehavioral issues. Further research to understand these connections is ongoing.

PFAS/PFOA & Water Quality Regulations

In the United States, communities and their water systems currently bear the brunt of PFAS contamination. This includes public drinking, wastewater, and stormwater systems, and no system is immune. PFAS are found in both public drinking water systems and in private drinking water wells. For public drinking water systems, in addition to monitoring and reporting levels of PFAS in drinking water to regulatory agencies, communities struggle to alert the public of unsafe levels, clean up the contamination, find new sources of water supply, and pay the costs of both the monitoring and cleanup. We spoke with one mayor in Wisconsin who told us that the need for PFAS remediation is the driver behind a 65 percent rate increase for community members. This can be overwhelming for even the most prepared community, especially since they are most often not the ones responsible for the contamination in the first place.

Though the United States Environmental Protection Agency (USEPA) has estimated that only 20% of a person's overall exposure to PFAS/PFOA is through drinking water, there is a growing emphasis on regulating our public drinking water supply. In the United States, our water systems are regulated under the Safe Drinking Water Act (SDWA). Under the SDWA the USEPA regulates over 90 contaminants, and that will include PFAS/PFOA. In March 2023, USEPA proposed National Primary Drinking Water Regulation (NPDWR) Maximum Contaminant Level (MCL) for 6 separate PFAS compounds. The proposed regulations will require public water systems to monitor for the presence of the regulated PFAS substances, to notify the public of the contaminant levels, and to reduce the levels of the contaminants if they exceed the proposed standards.

Currently, there are a number of states that have already imposed their own drinking water MCL's for PFAS/PFOA in an effort to protect their communities from PFAS exposure. See figure 4 for a map. While none of these states have instituted an MCL as low as what the USEPA is proposing, it's clear that many more communities will be looking for direction in regards to communications best practices once the proposed regulations are in effect.

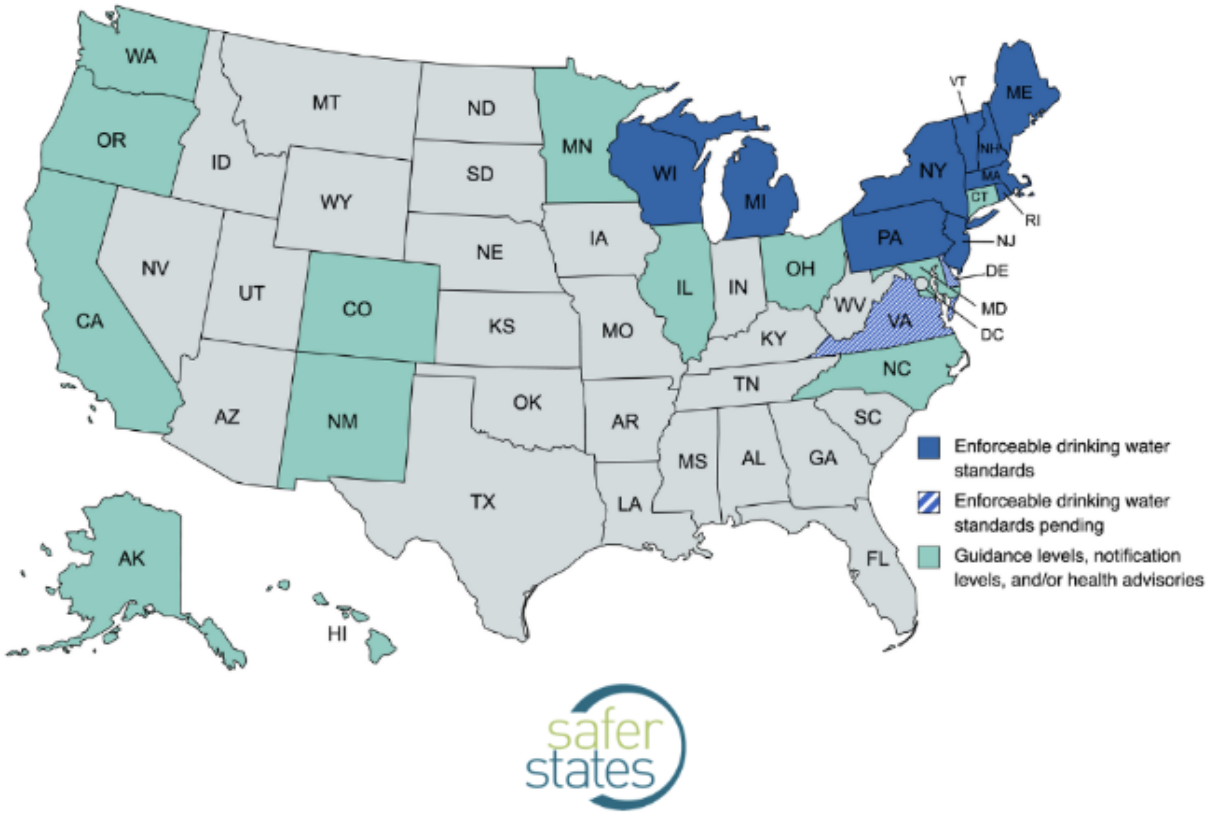


Figure 4

Why PFAS/PFOA Communications Are Important

Amidst all of the craziness surrounding any discovery of contamination, public officials must accurately and effectively communicate the public health risks and other impacts to their community members. This is not an easy task. There are countless recent examples of circumstances where even small missteps in relaying this crucial information can lead to uncertainty, mistrust, fear, and also backlash at municipal leaders and utility staff.

Communicating any sort of public health risk is challenging because it can become very personal and emotional. This is doubly true in the circumstance of drinking water contamination because water is essential to life - everyone needs it, and directly ingests it. Additionally, public notification requirements outlined in our regulations can serve to add to, rather than diffuse the emotional tenor of these communications. We have seen this through recent examples in Flint, Michigan, and East Palestine, Ohio.

With PFAS, additional challenges have arisen due to the evolving understanding of what PFAS is, what the potential exposure pathways are, how a community came to be contaminated and what the human health implications are. What we know for sure is that community members are aware of and concerned about their water quality. A June 2023 poll of Wisconsin voters by Marquette Law School echoes this sentiment, revealing that the public is definitely worried about PFAS in their water supply, with 34% of voters identifying as "very concerned", and 35% "somewhat concerned". This only serves to heighten the importance of effective communication, as more communities are required to test, and ultimately discover contamination in their drinking water.

Profile of PFAS/PFOA Communicators

The main communicators dealing with PFAS/PFOA can be separated into six categories: water utilities/local government, the federal government, state governments, print and digital media, community organizations, and nonprofit experts/academia. Examples of these communicators, how they receive and disseminate their information, and the challenges that they face are discussed in more detail below.

Water Utilities/Local Government

Water utilities and/or local government are at the forefront of PFAS communications, as they are the ones primarily responsible for communicating risks and impacts to the public under the Safe Drinking Water Act (SDWA). This is important because quite often these are the folks that have the least amount of capacity for risk communications due to staffing shortages, budgetary limitations, and lack of technical expertise. According to the USEPA, there are approximately 150,000 public water systems in the United States, most of which are small systems and many have part time employees and/or volunteers who are not trained in risk communications principles and best practices.

The majority of public water utilities in the US are not communicating about PFAS because they are not yet regulated to do so. Two examples of communities that are dealing with PFAS communications are Wausau, Wisconsin and Willingboro, NJ. Both Wisconsin and New Jersey currently have enforceable state standards. Wisconsin currently has an MCL for PFAS and PFOA, which is 70 parts per trillion (ppt), and this can be either individual or combined. New Jersey has MCLs for PFNA (13 ppt), PFOA (14 ppt), and PFOS (13 ppt). For context, the newly proposed USEPA MCL are way below these standards, at both 4 ppt for PFOS and PFOA.

Wausau discovered PFAS through voluntary testing in 2019. The City was in the process of upgrading their current treatment plant. So they initially conducted this testing to better understand the types of contaminants they would need to treat through the design of a new treatment facility. There were no enforceable state levels at the time and little guidance on communicating around PFAS contamination. The City decided to take a proactive approach, issuing a recommendation for customers to use bottled water for drinking, and ultimately supplying their customers with special water filter pitchers. Today, the City maintains a specific web page containing all of the testing results and water quality reports that are required under the SDWA. Additionally the web page includes historical information on PFAS contamination and what the City is currently doing to address it. The information presented is accurate, clear, though only some of it is easy to understand. To the average customer unaccustomed to reading water quality reports, that portion would seem difficult to follow, and there is no summary of the information that makes it more accessible. The City also utilized flyers.

In 2021 the Willingboro Municipal Utilities Authority (WMUA) conducted sampling as a requirement of the 2020 state-enacted MCL. The MCL for PFOS in New Jersey is 13 ppt, and is based on a running annual average (RAA) in which the four most recent quarters of monitoring data are averaged. On November 8, 2021, the WMUA received notice that the samples collected during the four quarters of 2021 showed that the system had exceeded the PFOS MCL. RAA for PFOS based on samples collected over the last year were 15 ppt. WMUA immediately decided to shut down the affected well, and under the direction and guidance of the New Jersey Department of Environmental Protection Agency (NJDEP), WMUA notified the public of the exceedance through the required notice under the SDWA.While the information presented in the violation letter was technically accurate, it was not very clear or easy to understand, and it created hysteria and misunderstanding that the WMUA is still working to correct. Citizens read the violation notice and assumed that since the WMUA had been testing under the RAA methodology, that they had "knowingly" delivered contaminated water to their customers. One utility commissioner recounted her experience of such heightened emotions that while visiting the local grocery store, patrons accused her personally of poisoning their children.

In speaking with Willingboro, Wausau, and other utilities, we have learned that they primarily seek direction and receive information on communicating about PFAS from their state agencies, like the NJDEP. Since the SDWA has specific requirements about public notification, including modes and methods, there is very little discretion that the utility has in terms of editing these communications. It also seems that certain states choose to interpret them differently. For communities like Willingboro that presented a massive problem because the language required to communicate contamination to the public created additional mistrust and fear.

Both utilities cited combating misinformation from outside sources, such as print and digital media, and dealing with the fear and mistrust from community members mentioned above as their biggest communications challenges. Neither utility has a measurable budget for any sort of additional risk communication support or outside contracted expertise.

Federal Government Entities

Though the US Environmental Protection Agency (USEPA) sets standards and regulations for contaminants in drinking water, there are many other federal governmental agencies that are also involved in PFAS communications. These organizations include but are not limited to the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), the US Department of Agriculture (USDA), the US Geological Survey (USGS), the US Department of Health and Human Services (HHS), and even The White House. Communications from these organizations take the form of informational web pages, faq's, fact sheets, in-depth medical reports, detailed scientific studies, and maps of contamination and potential exposure. Examples are included in the References section of this report, and are often collaborative works between multiple agencies.

In reviewing materials from these entities, this study has found them to be accurate at the time they were disseminated. The technical information is truthful though determining whether the communications are effective (communicated in a way that is easy to understand) is not as easy to ascertain. Effectiveness is often measured by action taken or not taken by the recipient, and with many federal communications no specific action is intended. Risk communications experts like Melissa Harclerode of CDM Smith maintain that the most effective communications strategies are community specific. At the federal level this specificity is nearly impossible to achieve.

State Government Entities

As mentioned above, state government agencies appear to be where most utilities go for direction and support on communicating PFAS public health information. These agencies include state departments of environmental protection, health and human services, fish and wildlife, agriculture and rural development, and many others. Like federal governmental entities, communications from state organizations often take the form of informational web pages, faq's, and fact sheets. To date, 30 out of our 50 U.S. states have a website or web page dedicated specifically to PFAS information. The caliber of these web pages and websites vary. Hopefully they will continue to grow in quantity and quality in anticipation of the proposed federal MCLs.

One state that is leading the way on PFAS communications is Michigan. Faced with significant PFAS contamination from various sources, the state formally established its Michigan PFAS Action Response Team (MPART) through an Executive Directive in 2017. MPART is a collaboration among seven state agencies to ensure coordination in implementing a response to PFAS contamination, and their website contains a plethora of knowledge geared toward public engagement and communications. It includes communications materials through different modes: a citizens advisory workgroup, educational videos, presentations, and even a YouTube channel. This kind of collaborative approach appears to be one of the most effective and supportive examples of state PFAS communication.

Print and Digital Media

In reviewing print and digital media this study included print and digital newspaper articles, websites, blogs, podcasts, and social media posts. We did not include television or digital video such as Youtube or other streaming services. Of the sources that we reviewed, most received their information through local, state, and federal governmental sources, non-profit subject matter experts and community organizations. They experienced similar challenges to the various governmental communicators, such as evolving scientific and public health data and uncertainty around regulations. Unlike the prior communicators, these media outlets often incorporated community reaction and opinion instead of solely technical factual information. What stood out most was the usage of attention grabbing titles and bylines that could be misleading or easily misinterpreted.

Community Organizations

Communications from community organizations varied based on capacity and technical expertise. Most community organizations received their information from federal, state and local government agencies, non-profit experts, and academia. They disseminated information in the form of in-person and virtual community meetings, and often passed along print communications materials from the federal, state, and local government agencies, non-profit experts, and academia.

As a whole, this study experienced a reticence on the part of community organizations to participate in PFAS/PFOA communications for fear of transmitting erroneous information. A more in-depth analysis is needed of these particular communications, including attending and recording community meetings to better characterize their accuracy and effectiveness.

Nonprofit Experts & Academia

Nonprofit Experts & Academia often serve as technical experts alongside federal, and state governmental sources. In our survey, these communicators seemed to often specialize in a particular area of expertise, such as public health, environmental health, water quality, municipal finance, and communications. Many are engaged in their own technical research in various areas of PFAS/PFOA contamination.

Of particular note, these nonprofit experts and academic communicators were often brought in to lend a seemingly unbiased and impartial perspective to more contentious public meetings, and as collaborators on print and digital media such as blogs and podcasts. There are a number of examples of communicators in this arena that have their own ongoing digital presence, such as podcasts. Some examples include a new podcast entitled "Public Trust" from the University of Wisconsin Sea Grant, and their partner the Midwest Environmental Advocates, and "Water Loop", a podcast from non-profit, Exploring Solutions.

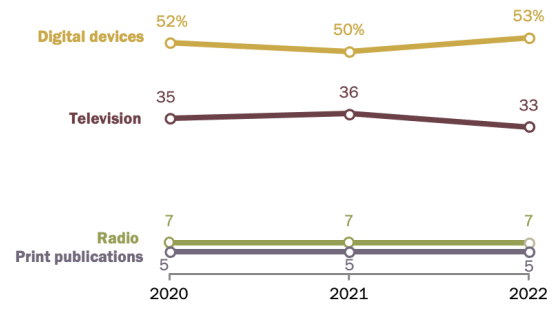
Communications Analysis

Before we go any further, it's important to acknowledge and reiterate the inherent challenges in communicating about PFAS/PFOA: evolving scientific and public health data, and uncertainty around regulations and next steps. With that context and given what we know about who is actually communicating PFAS/PFOA health information, we next looked at how most Americans receive their news.

According to numerous communications experts, there has been a well-documented shift in the news industry away from print, television and radio into digital media. This transition is reflected in a 2022 Pew Research Center study, which found that an overwhelming majority of Americans prefer to receive their news today from digital sources. Television is listed far behind the digital sources, but it is much more popular than radio and print. Among these digital sources, Pew reported that news platforms or apps were the most preferred, with social media and search engines about half as popular. Podcasts lagged behind those sources. See below for Pew's graphic visualization of this data.

News platform preferences

*% of U.S. adults who **prefer** ____ for getting news*



Source: Survey of U.S. adults conducted July 18-Aug. 21, 2022.

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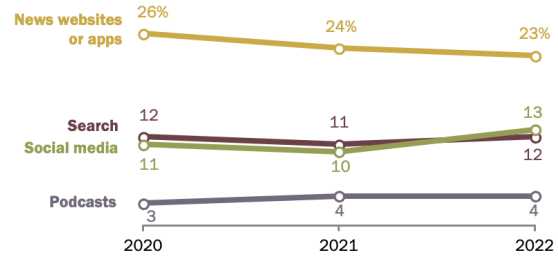
Digital news platform preferences

*% of U.S. adults who **prefer** ____ for getting news*



Source: Survey of U.S. adults conducted July 18-Aug. 21, 2022.

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It is important to note here that news preferences across various platforms differ among Americans based upon characteristics like age, race, ethnicity, gender, education, and more. For example, the 2022 Pew study cited above also found that Americans aged 50 and older are more likely to opt for television to receive their news. We did not analyze television communications as part of this report. Now knowing that a large portion of the over 50 age group receives the majority of communications from television sources, that would be an area for additional research going forward.

As for preferences within digital sources, we next took a closer look at news websites and apps. These sources also simultaneously communicated in print form, such as the New York Times or the Washington Post, and simply mirrored their online version. News websites and apps received their information from a combination of governmental (federal, state, and local) sources, nonprofit experts, and academia, as well as community members. These communications ran the gamut, depending upon whether the piece was more informational or coming from a human interest angle. They often incorporated community reaction and opinion instead of solely technical factual information, which made analyzing their veracity difficult. As mentioned above, what stood out most was the usage of attention grabbing titles and bylines that could be misleading. For example, the following headline, "Forever chemicals" found in freshwater fish, yet most states don't warn residents" uses fear and generalization to imply wrongdoing on the part of state agencies, thereby eroding trust in the communications consumer. Additionally, there were a number of circumstances where the body of the communication was technically factual, but the way it was communicated, and the headlines that were used created room for misinterpretation.

Podcasts enjoyed much less widespread usage. Many of the folks communicating via podcast were in the nonprofit expert and academia category. During our limited review we did not find many podcasts that weren't linked to a governmental entity or nonprofit/academic expert. This mirrors Pew's aforementioned 2022 study results, which indicated that podcasts aren't the preferred medium for receiving news for Americans.

The next digital source we considered is search engines. Search engines presented a different challenge due to the fact that our results varied greatly depending upon the terms that we utilized in our searches. In this regard, a base level of knowledge was required to yield more accurate results. In addition, what actually resulted from the search results did not ensure accuracy or clarity of communications. For example, when googling "PFAS +Willingboro, NJ", the communications sources listed first and most prominently were not the most current, or technically accurate. There was a lot of sifting that needed to be done in order to identify the most current and trusted sources.

Social Media and Blogs were similarly difficult to consider. Accounts tied to more established sources, such as governmental agencies, and nonprofit and academic experts were easier to analyze. These communications tended to be truthful and clear. Where it got more complicated was in trying to understand the effects of general public comments and the sheer amount of information or misinformation circulated as a result. With social media there was also no limitation on who could comment, and that presented additional complications around understanding who actually was communicating. Further research with public risk and social media experts will be needed to pursue this analysis.

Across all news sources, the effectiveness of communications was very difficult to gauge. As mentioned above, effectiveness is often related to some sort of responding action taken to determine whether the receiver has indeed understood the message. In most of the PFAS/PFOA health communications, receivers were meant to take in the information to accumulate a certain level of knowledge, but no responding action was taken. Further research into methods of how to analyze and quantify effectiveness will need to be done.

One additional factor in determining the success of communicating public health risks, whether through digital or other sources, are the pre-existing relationships between the communicator and its audience. Through this survey we have observed that relationships that are marred by a lack of trust struggle even more with communicating the health risks and impacts around PFAS contamination than relationships that do not suffer from pre-existing mistrust. In these situations more effort is needed around building trust or finding alternative avenues to relay crucial public health information for communications to be effective.

Ultimately, the end goal is to make sure that members of the general public are getting the information that they need to make informed decisions about managing risk of exposure, and implications from prior exposure. During her presentation at the USEPA Small Systems Drinking Water Conference in Covington, Kentucky, Community Involvement Coordinator Diane Russell pointed out that “Communities want to know that you care before they care what you know”. Russell elaborated on this point by suggesting that utilities and municipalities incorporate trusted community partners and independent advisors into communications planning to ensure that community members' needs are being met. This sentiment was echoed by Drexel Phd candidate Heather Kostick during her recent presentation on PFAS communications at the Coalition for the Delaware River Estuary’s Fall Forum.

Summary

This report is a very brief preliminary survey of PFAS communications, and more in-depth research will need to be done, taking into account additional types of blended methods and modes of communication from an expanded range of communicators. Most specifically, delving deeper into the actual individual communications at the local level where the public is most closely receiving the information will uncover the nuances of effective communication that couldn’t be gleaned from this high level report. It would also be worthwhile to consider building off of what the medical community learned during the coronavirus, Covid-19 pandemic in terms of combating misinformation and risk communications.

That said, there are a number of themes regarding optimal PFAS risk communications that kept coming up throughout this study that are worth sharing. First, pre-existing relationships matter. If they are poor, then alternative communication pathways must be supported for the public to effectively receive the intended information. This may be in the form of partnering with trusted community organizations, nonprofits, and academic institutions to relay these critical communications.

Second, and arguably most importantly, current regulations often fail to utilize best practices for communicating health risks. Our regulations place an outsized emphasis on liability and covering bases, rather than sharing information that would be most appropriate and useful for the community to receive. This presents a huge gap in what is needed to communicate effectively, and quite often does not consider the needs of vulnerable populations. We must change the policies and regulations that require such communications, and we can rely on numerous case studies, including Willingboro, NJ, to guide improvements.

Additionally, this study recognizes that accuracy of communications does not equate to effectiveness. Said another way, just because something is truthful and timely doesn't mean that the message has been received. Consideration of receipt by all affected populations will require careful planning and proactive attention.

This also holds true in regards to effectiveness of medical communications. Notably, we did not find many communications materials at all that were geared toward educating and supporting the medical community as they navigate interfacing with patients regarding PFAS. Michigan's MPART resource was the most thorough example that we found. This is definitely an issue that will need to be addressed in the near future, particularly with the impending proposed MCL's.

Finally, we want to emphasize that best practices for communications in general must be observed, and are often out of reach for many less experienced and less well-resourced communicators. As referenced above, the folks that are communicating are often doing so without expertise or the budgets to support obtaining expertise. Risk communications support from governmental agencies in the form of technical assistance or contracted experts may be a useful consideration to close this gap.

In summary, through constructing this report, The Water Center at Penn is further convinced of the need for more detailed research on the effective methods and modes of communication around PFAS/PFOA health information to ultimately aid in diminishing the fear, anxiety, and anger that often accompanies discovery of contamination.

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