Analysis of Risk Communication regarding PFAS Contamination in Cottage Grove, MN

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Introduction

Effective and clear risk communication is essential to create awareness and understanding of a risk so that individuals and communities can make decisions that protect public health. Many communities within the United States are faced with communicating risk surrounding emerging contaminants. Emerging contaminants are pollutants measured in the water supply that have ill-defined health impacts and few or no regulations (WQA 2019). A lack of scientifically-based regulations means the contaminant may already be in the environment, therefore posing a health risk to a community.

A type of emerging contaminant known as "forever chemicals" or per and polyfluoroalkyl substances (PFAS) has been a cause of great concern in towns across the United States. One such town, Cottage Grove, Minnesota, has PFAS contamination due to former industrial activities. In 2017, the Minnesota Department of Health (MDH) established a new regulation for advisable PFAS concentrations in drinking water (MDH, 2017, p. 1). Although citizens had been aware of PFAS in the groundwater, these new regulations caused concern and fear within the community as some drinking water wells had higher than advisable PFAS concentrations (MDH, 2017, p. 3). Using Cottage Grove as a case study this research will examine how the public was informed of the changes in regulations regarding PFAS concentrations in drinking water and using a World Health Organization framework will evaluate the efficacy of the risk communication. Through this I will determine how risk communication to communities affected by PFAS and other emerging contaminants can be improved and handled responsibly.

History of PFAS Contamination in Cottage Grove, MN

Per and polyfluoroalkyl substances (PFAS) are a group of human-made chemicals manufactured in U.S. since the 1950s (U.S. EPA, 2019). PFAS are stable chemicals that effectively repel both water and oil (RI Department of Health, 2019). Because of these key properties, PFAS are used in a variety of products, including nonstick pans, stain repellants, and firefighting foam (Kary, 2018; Snider, 2018; Van Rossum 2017).

PFAS' stability leads to versatile products but ultimately this stability means the chemicals persist in the environment. PFAS chemicals now pollute drinking water sources in cities across the United States and detectable levels have been found in human and animal blood (Marohn, 2019). Continued PFAS exposure can lead to increased risk of cancer, thyroid disease, and high cholesterol levels as well as infertility and developmental defects in infants (RI Health, 2019). While evidence of health risks is clear, scientific debate exists as to what is considered a safe level. This is shown by the ongoing changes in regulatory recommendations (Figure 1). The guideline levels for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), the two most common types of PFAS, have been decreasing

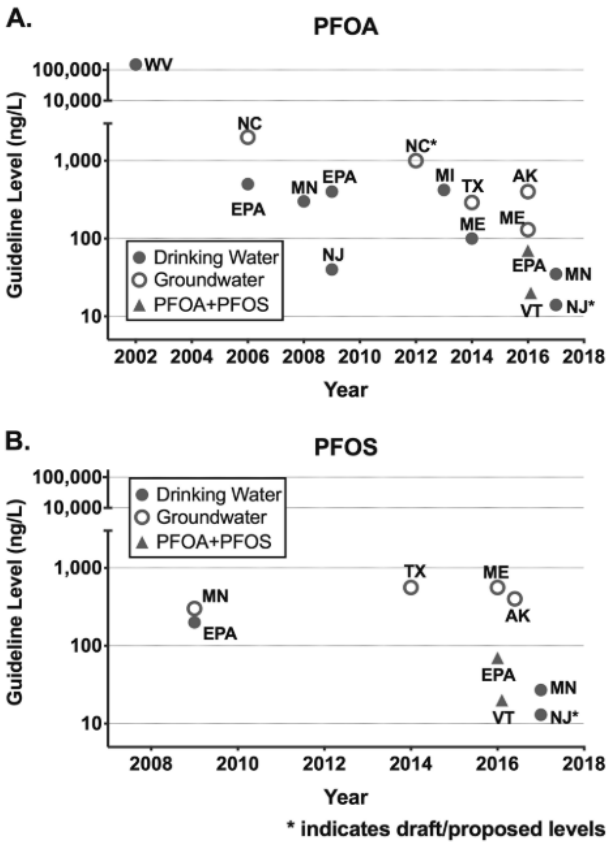

Figure 1: Timeline of select PFOA and PFOS Drinking Water Guidelines. Source: Cordner et al., 2019 pg. 162

over the years as new studies are conducted. The variation in these health advisories (HA) between states and the federal government reveals the ongoing scientific debate about what is considered a "safe level." (Cordner et al., 2019, p. 162).

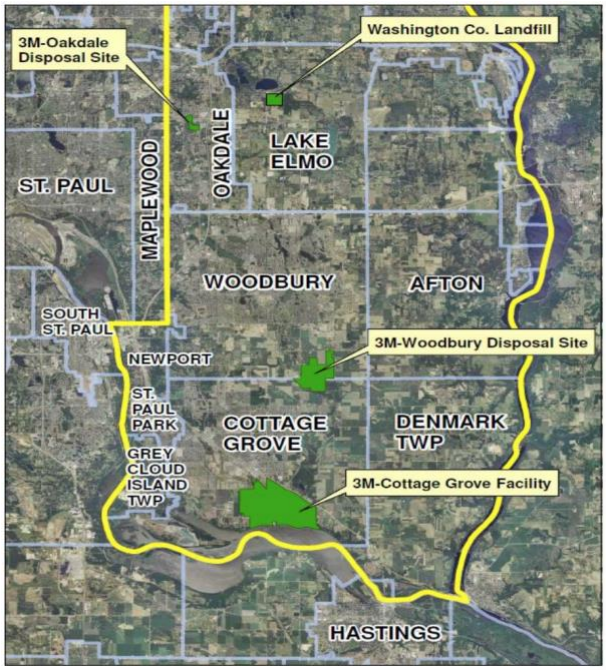

Figure 2: Map of the East Metro Area in Minnesota and PFAS contamination.

Although 3M, a main PFAS manufacturer, voluntarily phased out PFOA and PFOS production in 2000 (3M, 2019), historical contamination still exists today, and 3M continues to manufacture different variations of PFAS chemicals for use in products (U.S. EPA, 2019). The original production began at a 3M plant in Cottage Grove, MN in 1950s in southeastern Minnesota. 3M is best known for products such as Post-it® notes but also manufactures a range of items including Scotch tape, air purifiers, and stethoscopes, among other things. One product, Scotchgard™ relied on PFOA to provide water resistant features (Kary, 2018). Producing and improperly disposing of PFAS chemicals for decades contaminated much of the East Metro Area of the Twin Cities (Brown, 2019). Cottage Grove, a town in the East Metro Area, continues to manage groundwater contaminated by PFAS produced at the 3M-Cottage Grove facility. The pollution affects the municipal drinking water system and private wells. Figure 2 depicts the East Metro Area (outlined in yellow) and the pollution

in Cottage Grove (Kary, 2018; MPCA, 2019).

In 2017, the Minnesota Department of Health (MDH) issued new health advisories for the concentration of PFOA and PFOS in drinking water, which were lower than the EPA standards,

(MDH, 2017, pg. 2). A number of the wells that Cottage Grove relied on for drinking water were above the new recommended level. Although citizens knew of the PFAS contamination around the Cottage Grove facility, the new health advisory and the wells with higher PFAS levels created a new round of concern and fear (Kary et. al, 2018).

Theory of Risk and Risk Communication

Understanding how to effectively communicate risk is imperative to the successful management of environmental problems. A better understanding of the risk by the public leads to "a higher effectiveness of the protected measures established by health institutions" (WHO, 2013, pg. 11). Sharing information about a risk will result in a behavioral response from that public that can be powerful to reduce further harm (Kasperson, 2012, p. 62). Communicating risk is a challenging prospect and must be done with the consideration and inclusion of multiple stakeholders and points of view (WHO, 2013, p. 52).

To analyze a risk communication strategy, understanding the difference between risk and risk perception, as well as the factors that contribute to each is critical. A risk or a risk event refers to an actual or potential incident that could lead to harm (Kasperson, 2012, p. 60). Risk perception, however, "is the subjective judgment that people make about the characteristics and severity of the risk" (WHO, 2013, pg. 11). According to Peter Sandman, a leading thinker in risk communication, risk perception is dependent on two factors: hazard and outrage. "Hazard" is the technical and scientific probability that an event will occur and the level of harm the event could cause (Sandman, 2012, p. 7). "Outrage" relates to the context surrounding the risk event, rather than the extent of the risk. The outrage factor makes risk communication more complicated as the risk may appear more alarming than it should or vice versa (WHO, 2013, p. 12). Table 1 outlines

components of outrage that can heighten or lessen the public's perception of a risk. For each of the 12 components, the context is either more likely to make the public perceive the risk as safer (highlighted in green) or more dangerous (riskier, highlighted in red). The boxes highlighted in green are examples of context that would make the public less concerned about the risk and the boxes in red highlight context that would make individuals more concerned. The table also includes descriptions of how outrage can be effectively managed based on the WHO framework and Sandman guidelines.

Table 1: The principal components of outrage

Safe	Risky	Description	How to Manage
Voluntary	Coerced	Whether or not the impacted community had a choice in participating in the hazard. Smoking is an example of a voluntary risk (Sandman, 2012, p. 14).	A coerced risk can be managed by making the risk more voluntary and providing the community with ways to avoid exposure to the risk (Sandman, 2012, p. 16)
Natural	Industrial	A natural hazard is a natural disaster and does not provoke the same level of dread or outrage as a risk created by a corporation. A natural disaster such as a tornado is seen as "an Act of God" and therefore more acceptable (Sandman, 2012, p. 17).	The hazard of a natural risk should not be used to put the hazard of an industrial risk "into perspective." This approach is likely to increase outrage (Sandman, 2012, p. 19).
Familiar	Exotic	Fear and concern over a risk diminishes over time as it becomes more familiar. Driving a car is an example of a familiar risk (Sandman, 2012, pg. 19).	If a risk is considered exotic the best way to make it familiar is to explain the risk thoroughly, even if it is non-trivial. "Soothing the public" and minimizing the hazard is misleading and ineffective (Sandman, 2012, p. 22)
Not Memorable	Memorable	This factor relates to how the risk lingers in the mind. Personal experience, media coverage, and association with symbols (such as the radiation symbol) make a hazard more memorable, and therefore riskier (Sandman, 2012, pg. 23).	Responsible parties should seek to acknowledge their role in the risk as ignoring it will seem flagrant and cause the risk to become more memorable (Sandman, 2012, p. 26).
Not dreaded	Dreaded	An example of a dreaded risk in the United States is cancer. Dreaded risks may vary by the country and culture. A heart attack in another culture may be viewed as more dreadful due to the suddenness (Sandman, 2012, pg. 28).	Outrage over dreaded risks can be lessened by empathizing with the public instead of dismissing their fear (Sandman, 2012, p. 29).
Chronic	Catastrophic	A catastrophic hazard incites more outrage than a chronic hazard. A plane crash may incite more fear as more people die at once time in one place. Cars may be more dangerous but the deaths are more spread out (Sandman, 2012, p. 30).	Risk managers should take catastrophic risks seriously even if the probability of occurrence is low (Sandman, 2012, p. 31).

Safe	Risky	Description	How to Manage
Knowable	Unknowable	This factor relates to how much the risk is understood. An unknowable risk, one where there is uncertainty, expert disagreement, or the hazard is undetectable is deemed as more concerning (Sandman, 2012, p. 33).	Outrage can be reduced by acknowledging and explaining the uncertainty instead of ignoring its existence (Sandman, 2012, p. 35).
Individually controlled	Controlled by others	Different from voluntariness as "voluntariness is who decides. Control is who implements" (Sandman, 2012, pg. 37). When driving, a person *feels* in control of the car and thus views the activity as less risky than an activity in which they are not in control.	Including a variety of stakeholders in decision making processes (e.g. environmentalists, citizens) can reduce outrage in this category (Sandman, 2012, p. 40)
Fair	Unfair	This factor relates to the distribution of the risk and benefits. A landfill benefits a large region but the negative impacts are concentrated to the neighbors living near the landfill causing increased outrage (Sandman, 2012, pg. 41).	Giving citizens the right to bargain for compensation can help reduce this outrage (Sandman, 2012, p. 42).
Morally irrelevant	Morally relevant	If society has deemed a hazard as morally wrong, such as pollution, introduces an ethical element and can increase outrage (Sandman, 2012, pg. 44).	Although a corporation may not be able to achieve "zero pollution" genuinely striving to that as a "moral asymptote" is necessary to reduce outrage (Sandman, 2012, p. 47).
Trustworthy sources	Untrustworthy sources	Historic examples have led communities to distrust corporations and the government. The involvement of these parties may increase outrage (Sandman, 2012, pg. 49)	If trust is an issue, focus on building accountability instead (Sandman, 2012, pg. 54).
Responsive Process	Unresponsive process	Secrecy, stonewalling, discourtesy, dispassion, and confronting community values are all indicators of an unresponsive process and are likely to increase outrage. (Sandman, 2012, pg. 62).	Open communication, apologies, courtesy, and sharing of community values can decrease outrage (Sandman, 2012, pg. 62).

Sandman argues that risk managers have historically failed to address the outrage component of risk perception (Sandman, 2013, p. 32). Management of outrage does not entail over-assuring the public. If the potential for hazard is high within a community, the public should be aware so that they will participate in actions to protect themselves. Instead, the goal is to minimize the distance between the communicated risk and the actual risk (WHO, 2013, p. 12). In this way the reaction can more appropriately fit the risk.

In addition to the hazard and outrage factors that were defined by Sandman, the WHO framework builds upon Sandman's guidelines to include three new entities, *transparency*, *monitoring*, and *participation*. These factors can increase or decrease risk perception and a number of Sandman's mitigation suggestions are compatible with these factors (WHO, 2013, p. 25). Transparency relates to how the information of the hazard is shared and the motivation behind sharing. Increased transparency allows for better distribution of information and greater knowledge within the affected community (WHO, 2013, p. 25). Monitoring refers to the capacity of public officials to collect and disseminate pertinent information including environmental and health data. Sharing data from monitoring efforts can increase trust (WHO, 2013, p. 26). Participation describes who is involved in the decision making process and when stakeholders gain access to this role. The WHO framework explains how previous risk responses have relied on a technocratic approach that disregards important stakeholders and disciplines. The addition of these three elements of risk is meant to provide a more robust understanding of who should be involved in risk communication and response (WHO, 2013, p. 26). Ultimately, risk communication is a multifaceted and complex challenge for public administration. Understanding the components of risk perception can help local governments more effectively communicate risk.

Applying the WHO's Framework to Cottage Grove

I will be evaluating risk communication documents using the World Health Organization Environmental and Public Health Risk Communication framework, one of the few extensive guidelines that has been developed to assist public officials in developing and evaluating risk communication (WHO, 2013, p. 1). The basis of the risk communication theory is from Peter Sandman's work so his work is also referenced in this analysis.

The World Health Organization (WHO) is a world leader in risk communication during public health crises. The framework was created after a WHO regional workshop in 2013 in Trenno, Italy. Although the document references case studies specific to Italy, the document is designed to be used by public administrators and policy makers when their community is facing environmental and industrial risks. Evaluating the risk communication with a framework provided by a leading institution will provide insight into how to approach risk communication.

To complete this case study, I performed a content analysis of relevant risk communication documents (referencing the new health advisory) released by the city of Cottage Grove and state of Minnesota using the WHO framework. All government related publications were collected from official government website and archives. The government's city council meeting minutes, social media posts, and informational pamphlets were analyzed as these documents encompass much of the formal communications between the government and the public. The minutes from the city council meetings are not transcripts of the events but are written to provide an objective summary of the meeting and therefore should provide a reliable account of the gatherings.

Efficacy of Risk Communication in Cottage Grove, MN

Defining the Hazard

The first step of analyzing Cottage Grove's risk communication is looking at how the hazard, the potential for physical harm, was explained. In risk communication the ability to communicate scientific information to a lay audience is crucial (WHO, 2013, p. 50). On May 23rd, 2017 the Minnesota Department of Health issued a press release describing the new PFAS guidelines and why they were lowered (Table 2). A number of wells that supplied the municipal drinking water in Cottage Grove were contaminated at levels higher than the new guidelines.

Table 2: May 2017 health advisory levels for the EPA and MDH.

2017 Health Advisories	PFOA	PFOS
EPA Standard	70 ppt	70 ppt
Cottage Grove Standard	35 ppt	27 ppt

The Cottage Grove City Council immediately declared a local emergency, allowing them to enforce a watering ban. By reducing the water use of the city, the local government was able to shut down the contaminated wells and rely only on those that were already meeting the new health advisory levels (Cottage Grove City Council, 2017a, p. 2). This action lowered the hazard level quickly but the government still had the responsibility to inform the public of what was occurring, partner with important stakeholders to create a long term solution, and work with individuals drinking from contaminated private wells.

The main documents which show the government's effort to communicate the hazard are the MDH press release and the Cottage Grove City Council meeting minutes from June 7, 2017. The WHO framework advises against the use of jargon and technical terms (WHO, 2013, p. 50). The MDH explains that PFAS chemicals are "water soluble and do not break down in the environment. This means they can move long distances in the environment. [PFAS] can build up

in the body over time. They also can be passed on to fetuses through the placenta and to nursing infants through breastmilk" (MDH, 2017, p. 2). This description accurately describes the persistency of PFAS and potential for bioaccumulation without confusing technical jargon.

The WHO framework also suggests including user friendly elements such as facts sheets and "frequently asked questions" (FAQ) pages to communicate hazards to a lay audience (WHO 2013). The MDH linked an extensive PFAS fact sheet that is updated with new information as it becomes available.

Consistency in messaging will also help the public understand the hazard associated with the risk (WHO, 2013, p. 24). In Cottage Grove public confusion arose as to whether or not the drinking water was safe to drink due to conflicting messaging (Kary, 2018). In a "Mayor's Moment" video released on May 26th, 2017 through Cottage Grove's twitter, Mayor Myron Bailey described the water as "safe to drink, now as it was in the past, and will be into the future" (Bailey, 2017). This message of low hazard is presented alongside information about PFAS concentration, the potential risk to infants, and the action steps taken by the Cottage Grove administration. The messaging aims to reassure the public and reinforce that the guidelines are in place to prevent long-term health impacts. Nevertheless, presenting these messages together can be confusing to citizens and lead them to misunderstand the magnitude of the hazard. The WHO recommends informing the public at the beginning of epidemiological analyses so that they have a better understanding of the final results (WHO, 2013, p. 31). The conflicting messages in Cottage Grove in 2017 reveals the complexity of risk communication when the science around the hazard continues to develop.

Elements of Outrage

In addition to acknowledging the hazard portion of risk perception, the public administration must also address the outrage factor. Table 3 provides explanation as to how these outrage factors apply specifically to PFAS contamination in Cottage Grove, MN. The colors do not describe the management of these outrage factors but instead reflect the likeliness of citizens to feel outrage and thus a heightened sense of risk due to these factors. For example, members of the Cottage Grove community are likely to feel more outrage and perceive the risk as more dangerous due to the fact that PFAS is an industrial pollutant, rather than a natural hazard. Therefore, the industrial box is colored red. Yellow boxes are colored to reflect that elements of that component could either increase or decrease the perception of risk.

Table 3: The principal components of outrage in Cottage Grove, MN

Safe	Risky	Description
Voluntary	Coerced	The risk of PFAS contamination in the drinking water was coerced as citizens did not have a choice in the improper disposal of chemical waste (Kary, 2018).
Natural	Industrial	PFAS are chemicals manufactured by the 3M company in Cottage Grove, MN (US EPA, 2019). The industrial element increases outrage over the hazard.
Familiar	Exotic	A chemical contaminant is likely to be considered an exotic type hazard, however, this community had been aware PFAS contamination for decades. The source of the new public concern centered on the change in regulations. Therefore, the outrage based on this factor was likely highest upon initial discovery but may have lowered throughout time.
Not Memorable	Memorable	PFAS contamination in Cottage Grove can be considered a memorable risk. Members of the community have a personal experience with the contaminant and the ongoing efforts to remediate the sites. News outlets also covered the change in regulations as well as an ongoing lawsuit filed years prior against 3M for the pollution

Safe	Risky	Description
Not dreaded	Dreaded	In the United States, "contaminated water generates more dread than contaminated air" (Sandman, 2012, p. 28) therefore this can be considered a dreaded risk. Mayor Bailey described the situation as, "there was always a perception in [Cottage Grove] that cancer was caused by the drinking water" (Kary, 2018).
Chronic	Catastrophic	PFAS contamination is a chronic issue. PFAS ingestion and bioaccumulation has been linked to a number of health concerns but these complications are developed years after initial and continued exposure (MDH, 2017, p. 2). Potential deaths or health impacts are not concentrated and therefore less triggering (Sandman, 2012, p. 29).
Knowable	Unknowable	Uncertainty regarding safe levels exists, as does dueling expert opinions. The new standards were created because the MDH did not agree with the findings of the EPA (MDH, 2017, pg. 2). It is also impossible for residents to identify by themselves if the water they are drinking is safe.
Individually controlled	Controlled by others	PFAS contamination is mostly controlled by others as 3M was the one to actually dispose of the chemicals. The risk can be individually controlled if citizens decide to switch to bottled water.
Fair	Unfair	The benefits, products such as Scotchgard™ and firefighting foam are spread throughout the country but the contamination is most concentrated in communities where PFOA and PFOS was manufactured and disposed. Cottage Grove is one such community. Many residents, however, benefitted from the employment 3M provided.
Morally irrelevant	Morally relevant	Pollution has come to be considered an immoral action in and of itself (Sandman, 2012, p. 44) and therefore the PFAS contamination is a morally relevant hazard.
Trustworthy sources	Untrustworthy sources	There are varying degrees of trust of different stakeholders involved. 3M, although a household name in Minnesota has been criticized for its lack of transparency in PFAS matters. The Minnesota Department of Health has made strides to create stricter PFAS regulations but has also been accused of "regulatory capture" (Kary, 2018) for downplaying the risk of PFAS. The Cottage Grove City Council is comprised of Cottage Grove residents and appears to be perceived as more trustworthy than the state government.
Responsive Process	Unresponsive process	The process working with city officials was fairly responsive reducing the outrage surrounding the event, which is explained further in the next section.

Half of the 12 elements of outrage are colored red, indicating a high potential for outrage due to the PFAS contamination. Therefore, the context of the risk makes it all the more important

that the public administration works to address and manage outrage. There are a number of examples of how the MDH and Cottage Grove City Council attempted to do just that. Although the PFAS contamination was largely an involuntary risk, the MDH suggested drinking bottled water or using in-home filtering systems as a way to reduce exposure, making the situation slightly more voluntary (MDH, 2017, p. 3). No comparisons were made to natural risks, which would only increase potential outrage. WHO describes how if "risk comparison is used to lessen the sense outrage… the result can often be the opposite" (WHO, 2013, p. 13). The MDH directly addresses the uncertainty in the regulations and explains why the new Minnesota standards are stricter than the EPA's standards. The Minnesota Health Commissioner Ed Ehlinger stated, "As [the MDH] get a better understanding of the long-term impacts of these chemicals, we need to update our guidance to enhance the protections that were in place previously" (MDH, 2017, p. 2). Choosing to directly address the uncertainty and acknowledge expert uncertainty is a more effective way to communicate with the public (Sandman, 2012, p. 34). These instances all reveal the efforts by Cottage Grove and the state government to address the context of the risk event beyond the hazard.

Transparency, Monitoring, and Participation in Risk Communication

Unlike many of the outrage factors, the three factors, transparency, monitoring, and participation are dependent on the government's response to a risk (WHO, 2013, p. 25). The state and city government had varying degrees of success with transparency and participation. Once the new health advisory levels were released MDH and Cottage Grove City Council made efforts to reach the entire populace. The MDH press release was sent to five important media entities that allowed for access to the information from print, radio, online, and cable sources. The press release also included contact information for MDH officials and publicized a workshop at the upcoming

Cottage Grove City Council meeting (MDH, 2013, p. 3). The meeting included a forum to discuss proposed updates to the water system in order to bring it up to date with the new PFAS regulations. This meeting brought together the public, leaders in the MPCA, MDH, and Cottage Grove City Council. This was an effective choice by the public administration as open workshops and meetings are an example of how to increase stakeholder participation and transparency (WHO, 2013, p. 28). Figure 3 is a picture from said meeting. The progress of the water system update was continually discussed public City Council meeting until the project's completion in early August (CGCC, 2017c, p. 3).

Figure 3: City Council Meeting on June 7th, 2017. Source: Cottage Grove City Council

The June 7th, 2017 and subsequent meetings were an important example of how Cottage Grove and the state government created a more transparent and participatory risk communication process. In these meetings the projects were discussed at length and city council members and citizens were able to ask questions (CGCC, 2017b, p. 11).

An area for improvement in transparency and participation throughout the risk communication process was during epidemiological study conducted by the MDH that led to the

new health standards. City Council addressed the lack of transparency in the June 7th meeting saying they felt "blindsided" by the new regulations and did not have time to react (CGCC, 2017b, p.15). According to the WHO Guidelines, "the general public should be integrated throughout [epidemiological studies] and the affected population should receive information on the plans for the study at the outset, intermediate findings on outcomes of interest, and results" (WHO, 2013, p. 31). WHO recommends epidemiological studies should take a sociotechnical approach and that other disciplines outside of science and engineering should be seen as valuable within the process. Risk communication should be built in throughout this type of study as providing reports throughout can help build trust and reduce shock and outrage when new guidelines are released (WHO, 2013, p. 31). Planning for steady communication is especially applicable in the case of "forever chemicals." The stable nature of the chemicals, as well as the evolving scientific understanding, indicates that new developments will continue to occur. Establishing clear communication pathways and opportunities to participate throughout the process will allow for more effective risk management.

Social media can improve participation and transparency surrounding a risk event as the sharing features create a sense of active communication (WHO, 2013, p. 22). Social media can be a powerful tool for information dissemination (WHO, 2013, p. 22). The Cottage Grove city government leveraged social media by updating the Facebook pages of the City, Police, and Fire departments. Messages regarding the water ban were sent to the 31 neighbor groups on Next Door Postings, a website designed to connect neighbors. Alerts were also sent out through a "Code Red" announcement an emergency notification system, which reached 12,000 residents. On June 5th, letters were sent to businesses and homeowner's associations to be distributed to individuals (CGCC, 2017b, p. 11). The government took a comprehensive approach by leveraging social

media, media outlets, and traditional informative letters. Cottage Grove's social media strategy was robust, based on the WHO framework as they used multiple platforms, which were well established before the risk event, provided ways for two way communication, and enabled sharing opportunities (CGCC, 2017b, p. 11; WHO 2013)

An area that Minnesota government agencies excelled in was providing monitoring data. Since 2003, the MPCA and MDH have been monitoring thousands of private residential wells (up to 3,270) and over 100 non-community public wells for PFAS concentrations (MPCA 2020). The MPCA publishes the results of these tests and also provides reasoning for the wells that are chosen to be tested (MPCA, 2020). Results are communicated using an interactive map on the MPCA website (Figure 4). Monitoring is useful to build trust and reduce fear amongst the public. MPCA's continued effort to provide information regarding PFAS monitoring is an important tool in their risk communication methods.

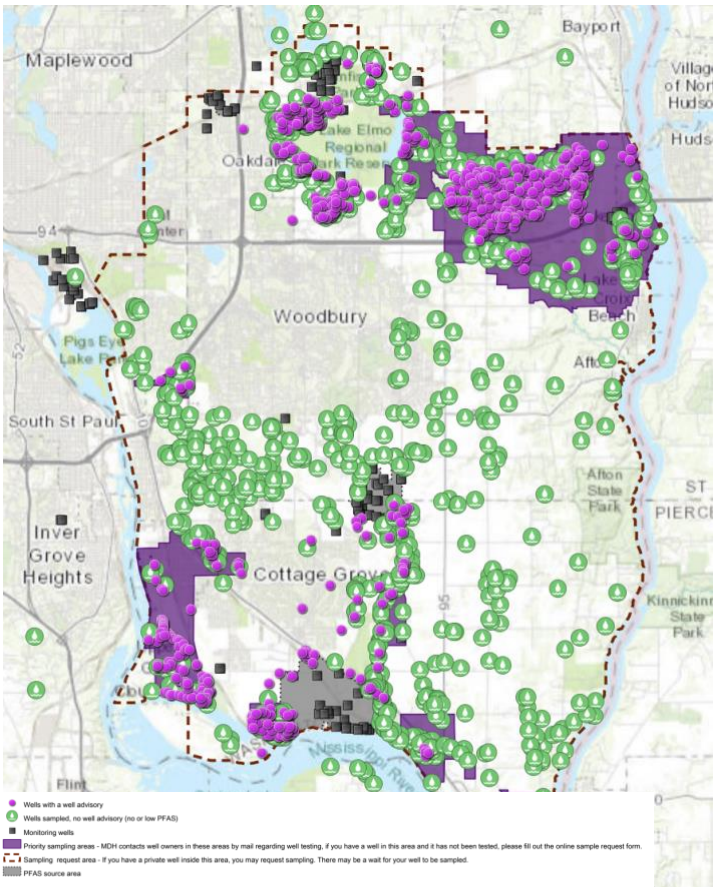

Figure 4: Results of PFAS monitoring in the East Metro Area. Source: MPCA 2020

Conclusion

Communicating the risk of PFAS contamination is an ongoing and complicated issue. This case study focused on the time period in Cottage Grove, MN from May 2017 to the completion of

the updated water system in December 2017. In February 2018, shortly after the new regulations went into effect, 3M settled for $850 million, the third largest settlement for damages to natural resources (Kary, 2018). The release of court documents provided new evidence that had the potential to increase outrage factors surrounding PFAS contamination. This evidence included information on the 3M's efforts to coverup PFAS toxicity and frightening statistics such as the Washington County area had "28 percent more cases of chronic lymphocytic leukemia" (Kary, 2018) than the rest of Minnesota. This new information exemplifies the continuous process of communicating risks of emerging contaminants. As science, policy, and litigation continues to develop, public administrations must be prepared for how to communicate new developments. Inconsistency in messaging and participation can cause the public to lose trust. The failure to address the context surrounding a risk event can lead to further outrage and thus a heightened sense of risk. Informing and *involving* the public and relevant stakeholders is crucial for a more robust risk communication process.

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