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14 Risk Communication

The PFAS Team developed a training module video with content related to this section, it is the Risk Communication video. In addition, ITRC developed a Risk Communication Training Workshop and has posted a recorded version for online viewing.

The ability to communicate potential risks to human health and the environment is a vital skill to facilitate community participation and decision-making. The process of informing people about potential hazards to their person, property, or community (Hance, Chess, and Sandman 1991; USEPA 2022) is called risk communication. Risk communication can be particularly challenging when dealing with science that is rapidly evolving, as in the case with PFAS. Communicators must grapple with competing interpretations of uncertain science and risk management strategies, while earning community trust and promoting meaningful engagement. This section addresses PFAS risk communication challenges and risk communication tools with PFAS-specific examples. Case studies that demonstrate successful risk communication planning and performance are included in Section 15.4.

Section Number	Topic
14.1	Role of Risk Perception
14.2	Risk Communication Challenges
14.3	Risk Communication Planning and Engagement Tools

According to USEPA's Risk Communication in Action: The Risk Communication Workbook (USEPA 2007, p.1), the overall purpose of risk communication is *to assist affected communities [to]* ***understand*** *the processes of risk assessment and management, to* ***form*** *[scientifically valid]* ***perceptions*** *of the likely hazards, and to* ***participate*** *in making decisions about how risk should be managed*. Risk is the relationship between the probability of harm associated with an activity and vulnerability of exposed elements (Slovic 1987; Slovic 2003).

The ITRC Risk Communication Toolkit for Environmental Issues and Concerns is published as a separate document. In addition, guidance on general performance of risk communication for contaminated sites is provided in *Risk Communication in Action, the Risk Communication Handbook*, (USEPA 2007); *Decision Making at Contaminated Sites: Issues and Options in Human Health Risk Assessment*, (ITRC 2015); and *Improving Dialogue with Communities: A Risk Communication Manual for Government*, New Jersey Department of Environmental Protection, (Hance 1991).

The following subsections present risk communication challenges of PFAS and provide PFAS-specific risk communication information for components of risk communication planning.

14.1 Role of Risk Perception: Public Stakeholders and Decision Makers

It is essential for decision makers to understand stakeholders' risk perceptions of the hazard. Risk perception is the disposition that individuals or communities adopt toward hazards and is the product of their knowledge, beliefs, attitudes, judgments, and feelings, as well as wider cultural and social factors. Stakeholders include, but are not limited to, the community, public entities, potential responsible parties, regulatory agencies, and municipal and state officials. Risk perception for PFAS is challenging to address because the science is rapidly evolving, the exposure is perceived as involuntary, the risk mangagement strategies are a moving target, and health impacts are greatest for the most sensitive populations. The risk management strategies can be a moving target because of these challenges.

The environmental management community is acting largely based on growing evidence of health risks and general precaution as our understanding of PFAS exposure and associated risk is continuously redefined. In this context, risk amplification (heightened perception of risk) and attenuation (diminished perception of risk) can serve as guiding principles to better understand stakeholder context and site-specific factors contributing to stakeholders' perceived risk to proposed risk management strategies. Risk amplification occurs when stakeholders perceive more risk from a hazard than the decision maker's perceived risk. Conversely, risk attenuation describes scenarios where decision makers perceive heightened risk from a hazard while stakeholders perceive less risk from the same hazard. For more information on factors that influence risk amplification and attenuation, see section 2.8 of the Risk Communication Toolkit.

14.1.1 Role of Risk Perception and Public Stakeholders

In a scenario of risk amplification, stakeholders perceive their risk to a hazard as a major concern while experts assess the hazard as carrying a lesser degree of risk (for example, low or moderate) (Kasperson and Kasperson 1996). In the context of PFAS, risk perception is heightened by uncertainties and variability among policies and standards due to developing sampling methodologies and analytical procedures; new scientific information on health effects, risk assessment evaluations, and treatment technologies (NGWA 2017); and overall confidence/trust in the proponent or lead organization that is communicating risk. Additional human health and exposure factors that heighten risk perception for PFAS are summarized in Section 14.2. Section 13 includes information about stakeholder perspectives on PFAS concerns.

This heightened sense of risk may result in opposition to proposed risk management strategies, such as source control (in which there is scientific uncertainty pertaining to the "safe" level of exposure, if any, without risk).

To address risk amplification challenges, it is important to build trust among the community by maintaining transparent communication of these uncertainties and variabilities early in the project life cycle (USEPA 2005, 2007). New data findings and research on PFAS should be regularly shared with impacted stakeholders. Current knowledge, including uncertainties and information about variability of potential susceptibility to health effects in individuals with the same exposures, should be conveyed accurately in an understandable manner.

Uncertainties in individual causation and variability in regulatory guidance can cause the affected individuals to lack confidence in current scientific knowledge. Therefore, a risk communication project team should communicate these uncertainties to the affected individuals in collaboration with risk assessors, community involvement coordinators, and community members to develop site-specific messaging. It is important to understand that standards for the same chemical often differ depending on the entity setting them. This is not unexpected, because standard-setting guidance is not simply a mathematical formula. Risk assessment approaches used in standard-setting processes include best professional judgment in the selection of the factors involved. In addition, a collaborative effort can be made to develop performance metrics, supplemental to cleanup standards, that evaluate how the action will lead to measurable increased protection for public health and the environment, thus leading to the development of targets or objectives (Hadley, Arulanantham, and Gandhi 2015) that offer reductions in risk. These metrics are referred to as secondary risk management performance metrics and can be used to communicate and evaluate success of a proposed PFAS risk management strategy, as well as assist with alleviating stakeholder concerns associated with uncertainty. Examples of applicable secondary risk management performance metrics in the context of PFAS are reduction in contaminant bioavailability/loading, source control/removal, and mitigation of exposure pathways (NGWA 2017; Harclerode et al. 2016).

Furthermore, risk amplification can be heightened when a community perceives that they have limited control over risk. Explicit efforts to share control reduce outrage and risk amplification (Sandman 2013). Therefore, it is essential to create an atmosphere of collaboration. In situations where an open public forum is met by public outrage, it important to be compassionate and lend a listening ear. Acknowledgment and documentation of questions that cannot be answered communicates transparency and can be a first step toward building trust. Effective participation is presented in the ITRC Risk Communication Toolkit for Environmental Issues and Concerns.

In contrast, in a risk attenuation scenario, experts judge hazards as relatively serious while stakeholders do not pay attention or pay comparatively little attention to that risk event (Kasperson and Kasperson 1996). This diminished sense of risk results in challenges in stakeholder participation in risk mitigation activities ("Why do we need to spend money/do testing, etc., for this?"). In the context of PFAS, risk mitigation and monitoring measures include participation in blood testing, installation of a water treatment system, and use of an alternate water source. To address risk attenuation challenges, site-specific risk perception factors related to inaction can be identified via stakeholder engagement and integrated into a communication plan (NGWA 2017; Harclerode et al. 2015; Harclerode et al. 2016).

14.1.2 Role of Risk Perception and Decision Makers

Due to the evolving science of PFAS, project managers, risk assessors, and risk communicators can also become caught in between those who amplify risk and those who deny risk. As noted, uncertainty in the toxicity and risk can lead to lack of consensus on how to evaluate risk and proposed risk management strategies. Due to risk amplification, there may be an elevated demand to take action to reduce potential risks beyond what is even technically and/or financially feasible. The underlying uncertainty feeding this risk amplification may also lead to opposition to proposed risk management strategies from some decision makers prior to establishment of the "right number" to dictate such action. When communicating with the public, it is essential to mitigate downplaying or embellishing risk due to lack of consensus on risk among decision makers.

Strategies should be implemented by the lead organization to navigate this rift to craft an approach and communicate a plan that is most likely to be reasonable and protective. One strategy is to incorporate the community's needs and values to place a greater weight on how risk management is considered. A second strategy is to develop secondary risk management objectives to help evaluate how interim and long-term action will lead to measurable increased protection for public health and the environment (Hadley, Arulanantham, and Gandhi 2015; Harclerode et al. 2016). These complexities highlight the importance of formulating a robust risk communication plan and team, including community and third-party involvement, as needed, as well as considering the dimension of perception as part of the risk communication process.

Case studies that showcase implementation of meaningful and effective community participation and inclusion of a third, neutral party to facilitate implementation of a successful risk communication strategy for PFAS-impacted communities are included in Section 15.4.

14.2 Risk Communication Challenges

There are many general challenges to risk communication about any environmental situation, including diversity of audience backgrounds, importance of establishing trust among the parties, and clearly communicating about the scientific and regulatory requirements. ITRC's Risk Communication Toolkit for Environmental Issues and Concerns includes a more detailed discussion of these challenges.

Emerging contaminants, and more specifically PFAS, pose unique challenges to achieving meaningful and effective risk communication. There is often divergent information available from different sources about the potential severity and uncertainty associated with exposure and adverse health impacts that may result from exposure, and the need for treatment or response actions. For example, people will do their own research, which may result in conflicting information. Communicators need to be prepared to explain the choices and decisions made regardless of the conflicting information. Some of the risk communication challenges for PFAS are discussed in the following sections.

14.2.1 Regulatory

There are regulatory challenges for emerging contaminants, see Section 8.

- PFAS are emerging contaminants, which means that they are the subject of intensive investigation, so new information, and thus our understanding of hazard, exposure, and risk, are emerging and evolving. This can challenge us to rethink determinations of protectiveness within very short time scales. More information is available from USEPA (2023, 2022) about PFAS and emerging contaminants.
- Federal and state standards, guidance, and policies for PFAS are not uniform and are available for only a handful of compounds. This is also challenging given the recent expansion of additional PFAS analytes added to the USEPA Fifth Unregulated Contaminant Monitoring Rule (UCMR5) (USEPA 2023), recent development of proposed federal maximum contaminant levels (MCLs) (USEPA 2023), and the lack of consensus-based toxicity values for all PFAS analytes (see Section 7.1 for information about human health effects).
- Regulatory standards and health advisories are in the parts per trillion range (or parts per quadrillion range), and it is difficult to explain to general audiences what these levels mean in terms of risk, how they were derived, or that, with current analytical methods, may not be detected.
- Most people have little to no understanding of risk assessment, risk management, and existing rules and legislation associated with chemical use and release. Risk communicators often need to provide this context before even discussing site or chemical specifics.

14.2.2 Fate and Transport

There are technical and scientific challenges and uncertainties around fate and transport of PFAS in the environment, see Section 5.

- There are many sources for PFAS and many of them have multiple release mechanisms, so simply explaining where the PFAS came from, including personal/lifestyle-based choices of individuals, and how PFAS got into the environment can be complicated.
- Most people have only a very basic understanding of (and lots of misconceptions about) chemistry, geology, environmental systems, and groundwater. Risk communicators often need to provide this context before even discussing site or chemical specifics.
- Fate and transport behaviors differ among individual PFAS (although broad generalizations may be appropriate based on chain length and functional groups).
- The environmental persistence, solubility, and mobility of PFAAs can result in:
    - very large impacted areas encompassing a wide range of environmental settings and potential transport pathways
    - complex transport pathways between interconnected environmental systems (groundwater-surface water; air-soil-groundwater; etc.).
    - bioaccumulation of PFAS into the food chain from impacted media, such as from contaminated sludges and/or biosolids.
- The multiplicity of sources and pathways (combined with the wide range of potential toxicity values discussed below) can create a sense that everything is equally contaminated and dangerous. Communicators need to help people understand the variability in the degree of contamination and relative risk related to each pathway.
- We are still identifying new PFAS sources (for example, PFAS from compost sites).
- Precursor transformation can affect how a PFAS site will evolve, but this is not well understood.
- Knowledge about uptake by plants and animals is increasing, but it is often difficult to answer questions about specific species.

14.2.3 Toxicological/Epidemiological Information and Risk Assessment

There are challenges and unknowns for toxicological and epidemiological information about PFAS, see Sections 7.1 and 17.2.

- One of the greatest challenges to risk communicators is having to craft messaging in the face of often intense disagreements over the interpretation of available science and the magnitude of uncertainty; we are communicating health risks when the risks are not fully known or characterized.
- There is reliable toxicological information for only a small subset of PFAS.
- A select subset of PFAS has been studied in sufficient detail to support risk assessment and remedial decision-making.
- While human studies may conclude that there is evidence that elevated exposure to PFAS increases the risk of certain health effects, regulatory risk assessment focuses on populations. This means that it is not possible to relate a current health effect in a specific individual to PFAS exposure or to use risk assessment results to predict whether future health effects will occur on an individual basis.
- Although most people have some detectable level of PFAS in their blood serum from consumer products and diet (anthropogenic background), certain populations may have elevated exposure due to localized sources, such as aqueous firefighting foam (AFFF) and industrial discharge, which can contaminate environmental media, particularly drinking water, leading to increased blood serum PFAS to levels that may increase the risk to human health.
- Communities often learn that they have been unknowingly exposed to PFAS for up to several decades prior to the discovery of their presence.
- Community members may want to compare PFAS blood/serum concentrations to PFAS levels in drinking water or other environmental media. A limited number of public-facing tools are available for estimating blood/serum concentrations based on drinking water concentrations, including ATSDR's Estimator Tool (ATSDR 2022) and Silent Spring Institute's Digital Exposure Report-Back Interface (DERBI) (Silent Spring Institute 2022).
- Blood serum levels of certain PFAS can remain elevated for many years post-exposure, while levels of other PFAS decrease more rapidly, and currently there is no accepted method to hasten the reduction of PFAS blood levels.
- Individuals may be part of PFAS biomonitoring studies or can obtain their individual blood serum levels on their own. These individuals have access to information for comparison to regional and national reported levels, and thus may be more informed on their personal exposure than the medical practitioner.
- There is a need to provide understandable and informative public health advice to exposed individuals, including woman of childbearing age and pregnant woman who are making decisions about whether to nurse and/or use water known to be contaminated with PFAS to prepare formula (Section 7.1).

14.2.4 Technical

There are technical challenges in the areas of site characterization and treatment technologies, see Section 10 and 12.

- There may be issues in the identification of responsible parties due to the difficulty in distinguishing between low levels of PFAS from use of consumer products (anthropogenic background) and PFAS contamination resulting from discrete sources, such as industrial uses.
- Although a subset of PFAS can be effectively removed by established treatment technologies, effective methods for the remaining compounds are in development.

14.2.5 Analytical Ability

There are technical challenges in laboratory analytical methods and field sampling, see Section 11.

- There are numerous PFAS in existence, yet not all can be measured. Sampling methodologies and analytical procedures to measure PFAS concentrations are still being developed and refined.
- Units used for reporting PFAS concentrations in environmental media and clinical tests are not uniform, and there are differences between blood and serum testing that are not standardized. For environmental professionals, converting and contextualizing these unit differences are routine practice for understanding risks. However, use of varying units may contribute to confusion for general audiences trying to compare and interpret testing results. There are difficulties in clearly and concisely communicating unknowns and limitations of analytical technologies related to the understanding of the extent of PFAS present in the environment, exposure pathways, and magnitude of the potential risk.

14.2.6 Challenges to Risk Communication around Health Risks

When performing risk communication, it is essential to acknowledge that individuals may receive their information from a variety of sources, which may provide conflicting or inconsistent messaging. As presented in Section 7.1, there is a growing body of research pertaining the adverse health impacts of PFAS in humans and laboratory animals. The discussion potential human health risks from PFAS exposure has been taken up in multiple venues, including peer-reviewed scientific studies, news media, and public comments on draft government documents and proposed regulations. The severity and uncertainty of adverse health impacts that may be associated with PFAS and the need for subsequent action has been communicated in an inconsistent manner. Because of the seriousness of potential health effects such as cancer, developmental delays and altered immune system response, as well as the persistence of PFAS in the human body, there is a case for prudence and precautionary mitigation practices to reduce exposures even in the absence of unequivocal human health consequences.

The risk communication challenge around health risks lends itself to a scenario in which stakeholders, including potential responsible parties and federal and state regulatory agencies, are not in consensus on the risk assessment and management strategy. Consistent messaging about uncertainties is essential for risk communication to be successful and to best help those in need. If stakeholders are in debate about the level of risk, then communicate by informing the public that all parties are striving to get the risk evaluation “right” but that there may be a delay in taking action. Communities that may be impacted may request an interim measure, such as an alternate water source, to alleviate concerns with potential exposure. Interim measures coupled with public outreach and community involvement can be a cost-effective risk management strategy in the short term. Public outreach should include measures being taken as well as associated milestones for future actions toward making a more informed risk management decision that utilizes limited resources efficiently, while integrating stakeholder values and community needs.

14.3 Risk Communication Planning and Engagement Tools

Prior to preparing risk communication materials and performing outreach, a project team should develop a risk communication plan to ensure there is a robust risk communication process in place from the outset. A risk communication plan is critical to guide decision makers to determine modes of information transfer as well as stakeholder engagement methods and tools that are appropriate and applicable for identified target stakeholders and site-specific characteristics. As stakeholder concerns and site characteristics are further defined, the communication team will need to continuously revisit the steps of communication planning. The ERIS PFAS Risk Communications Hub is a resource for risk communication information such as state FAQs, case studies and other resources.

In the case of PFAS, many national environmental organizations have made community outreach a major focus. Local grassroots organizations and one, the National PFAS Contamination Coalition (https://pfasproject.net), have led a major effort to inform the public and influence policy. In addition, ATSDR studies (for example, ATSDR 2022) as well as the National Academy of Science (NAS 2022) have included community outreach efforts.

14.3.1 Risk Communication Planning Model

The ITRC Risk Communication Toolkit for Environmental Issues and Concerns presents a risk communication planning model that has eight components, as shown in Figure 14-1. At the center of this model is a step to review and evaluate. This step indicates that communication planning with stakeholders is two-way, ongoing, and continuous, allowing for review of where you are in your outreach efforts and where you may need to go.

This planning model, adapted from the work of NJDEP (2014), facilitates development of project-specific communication plans to be developed at each stakeholder engagement and/or outreach phase of a project. Of note, the NJDEP 2014 document relied on the work of Caron Chess, Billie Jo Hance, and Peter Sandman, Environmental Communication Research Program, Cook College, Rutgers University, as published by the New Jersey Department of Environmental Protection. The model is interactive, which allows for new information to be incorporated into the plan so that the outreach can be modified accordingly. This approach encourages establishing ongoing dialogue between the lead organization and all stakeholders so that the resulting outreach plan reflects the priorities and concerns from all parties. This will help you develop a robust risk communication plan. Section 4 of the Risk Communication Toolkit provides detailed discussion of each of the communication planning model steps. The key aspects of the risk communication planning model are briefly summarized here.

- Issue identification helps you to clearly understand what the situation is in order to develop a responsive and effective risk communication plan.
- Goals are the big picture or ultimate impact that is desired for a project, issue or situation.
- Identification of communities with whom you need to establish a dialogue and those who wish to talk with your organization is important.
- Community assessment is needed to gain a deeper insight into stakeholder concerns and values that facilitate the development of a dialogue. Section 13 addresses stakeholder perspectives for PFAS.
- Messages are the information you want/need to share with audiences about the issue or case, a question that you need them to answer, or both.
- A communication method is the means by which you communicate with your audiences.
- Once you have a clear goal, understand stakeholder concerns, know your message and have selected your method, it is time to lay out the strategy in order to implement the plan.
- Evaluation is the systematic collection of information about activities, characteristics, and outcomes of projects to make judgments about the project, improve effectiveness, or inform decisions about future programming. Many risk communication efforts require an ongoing presence or outreach to stakeholders. A debrief meeting is an opportunity for you to review the results of the evaluation and will identify what follow-up, if any is needed.

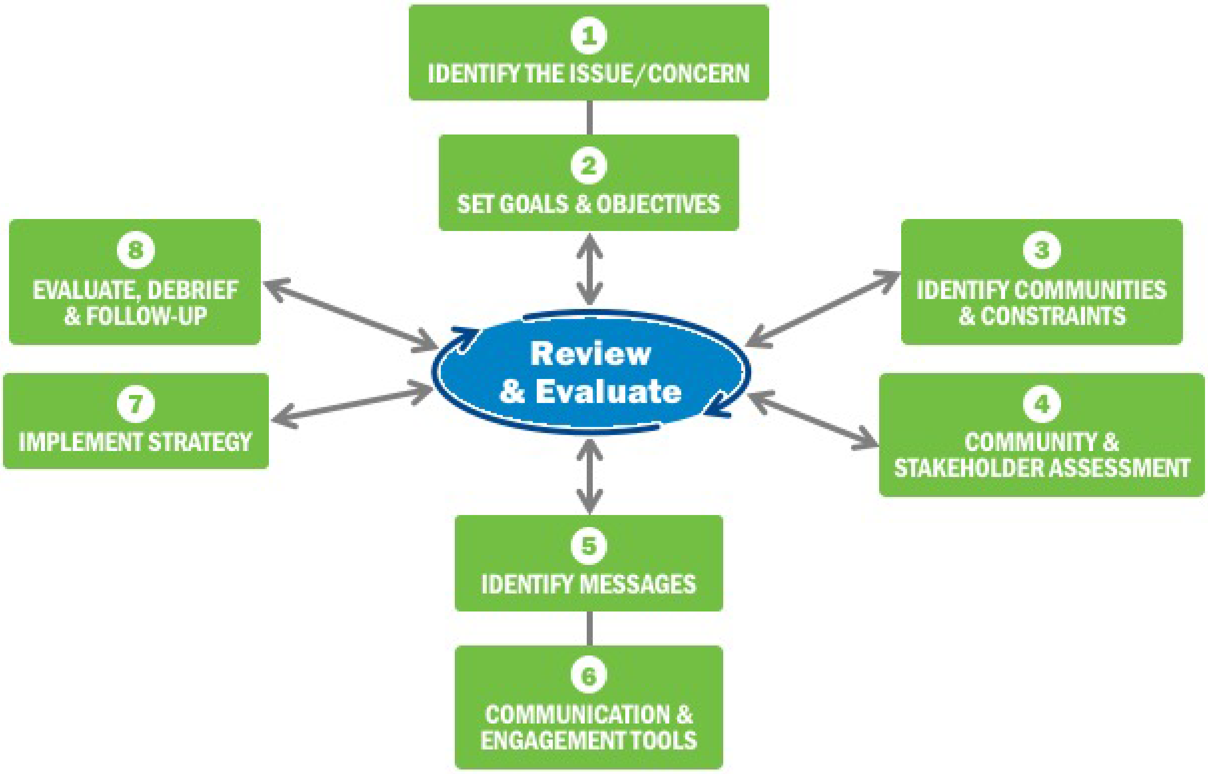

Figure 14-1. Communication plan process diagram.
Source: Modified from NJDEP 2014.

General information about risk communication planning is included in the ITRC Risk Communication Toolkit for Environmental Issues and Concerns document. This toolkit is a good resource for information about risk communication basics and tools. The toolkit can aid decision makers using this process and provide tools to assist with meeting performance metrics at each planning step. In addition, Minnesota Department of Health has developed the *Drinking Water Risk Communication Toolkit*, which can be accessed at https://www.health.state.mn.us/communities/environment/water/toolkit/index.html.

The following subsections are risk communication resources and tools with PFAS examples. The PFAS case studies in Section 15.4 offer examples of community and stakeholder assessment strategies.

14.3.2 PFAS Risk Communication SMART Goals and Objectives

This section includes some examples of SMART (specific, measurable, attainable, relevant, and timely) goals for PFAS. In addition, example messages are included.

Example SMART Goals

Example of Communication of Goals

Issue: The governor established an independent PFAS science advisory panel of national experts to provide guidance to the state on protectiveness of criteria and develop science-based recommendations that will guide the administration and legislature on the best regulatory policy moving forward.

Goal: The PFAS Science Advisory Panel will complete a report within 6 months that will provide a general understanding of human health risks associated with PFAS in the environment. These science-based data will be used to develop a regulatory response that the administration and legislature will take and implement by (date).

Example of Assessing Stakeholder Concerns

Issue: Due to public health concerns, the state agency will conduct a statewide study of PFAS levels in X public water supplies at X schools that operate their own (private) wells by (date.)

Goal: By (date), the environmental agency will develop an inventory and location map of sites where PFAS has been used or disposed; prioritize sites for further investigation based upon the potential to impact drinking water supplies (based upon state groundwater maps, site history, and site ownership); incorporate data into a GIS-based data management system; and develop and implement a plan to sample private and or public water wells to assess potential impacts to drinking water supplies from prioritized sites.

For this example:

- specific: develop an inventory and location map
- measurable: testing
- attainable: implement a plan to sample private and public water supplies
- relevant: testing at prioritized sites will define impact
- timely: by X date

Example of a short-term SMART goal (from the Little Hocking Water Association case study, Section 15.4.1).

- By (date), the community is informed via the municipal website, flyers, and canvassing that bottled water is available as an alternate water source and utilized by 85% of the population.
- After (months), the extent of the impacted water supply is known via well testing and communicated to the community via a public meeting, municipal website, and newsletter.

Example of a long-term SMART goal (from the Little Hocking Water Association case study)

- By (date) and after (months), using a community-first strategy that includes the establishment of a community advisory committee and using multiple methods of communication—media, social media, internet, and meetings—determine whether the study area residents' blood PFOA levels are elevated and provide actions that 12,000 residents can take to produce a measurable reduction of PFOA blood levels.

14.3.3 Community Identification and Mapping Tools

Due to the persistent and recalcitrant nature of PFAS and its presence in the public drinking water supply, numerous and variant federal, state, private, and public stakeholders can be impacted. Actor mapping is a tool to help guide a communication team to lay out, track, and update stakeholder roles and relationships. During this exercise, practitioners learn who is the most affected by site information and decisions, as well as their level of interest and influence.

The outcome of the tool will assist in identification of unengaged/disinterested stakeholder populations, identify needs for relationship and/or capacity building, develop a site-specific communication team, and target outreach resources toward affected and unengaged/disinterested stakeholder populations. In the context of PFAS, this is of particular importance to identify and address affected groups who may not be participating in preventive and mitigation measures (such as an interim drinking water supply and a fishing ban) and/or at sites in which stakeholder groups are facing conflict resolution.

Simplified **examples** of an actor-linkage matrix and interest-influence matrix are presented, followed by resources to perform complex actor mapping, such as social network analysis. The examples provided are not representative of an existing project; stakeholder roles and relationships vary on a project-specific basis. Different types of mapping approaches can be used based on what visual communication method(s) work best for your organization and stakeholders. The examples provided here (actor-linkage matrix and interest influence matrix) are for demonstration purposes only and are not prescriptive.

Example Context: A PFAS site consisting of a groundwater plume that has impacted drinking water supply wells and has identified contaminants in the local fish population.

Example 1: Actor-Linkage Matrix: A tool that assist practitioners in describing relationships among stakeholders through codes (Reed et al. 2009) (Figure 14-2).

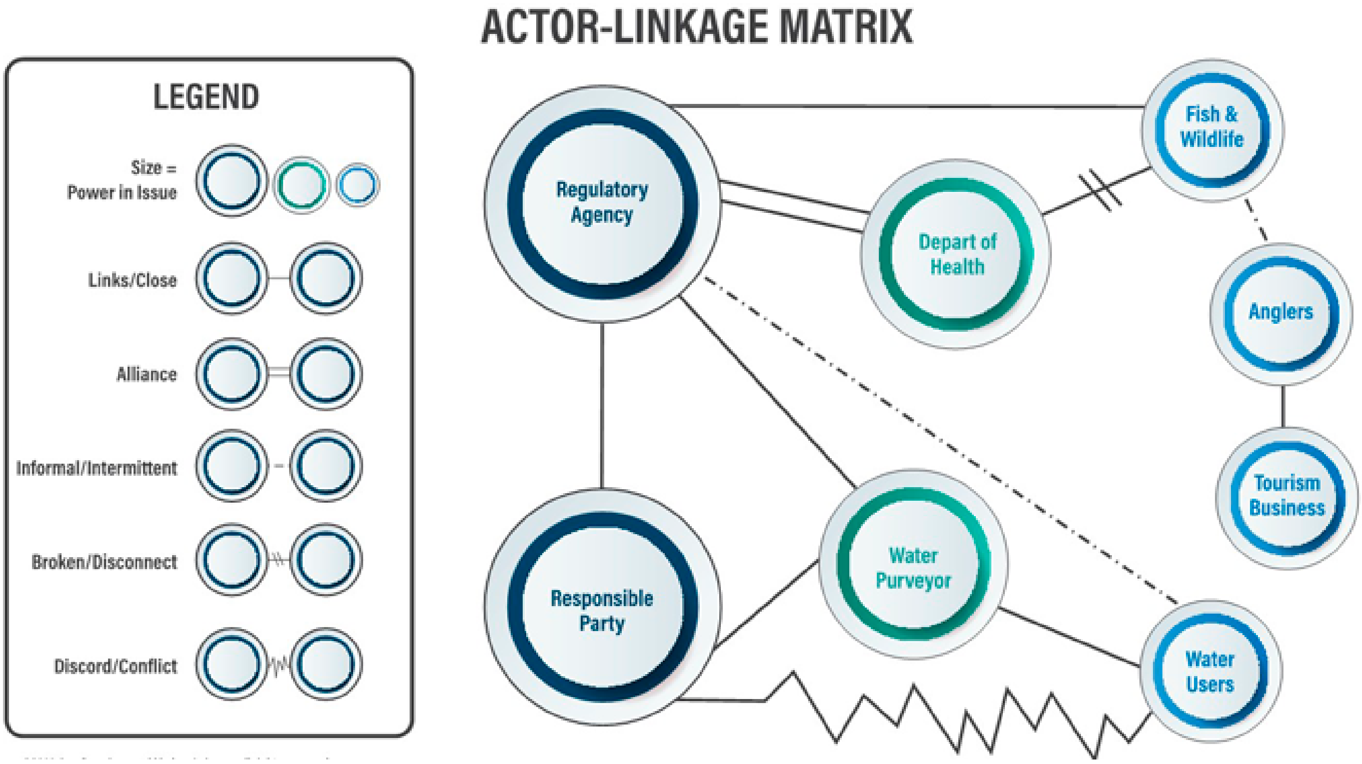

Figure 14-2. Example actor-linkage matrix.

Example 1: Actor-Linkage Matrix Evaluation

- *Identify unengaged stakeholder populations*: potentially anglers and tourism business operators
- *Facilitate relationship/capacity building*: utilize the relationship between the responsible party and water purveyor to restore relationship between the responsible party and water users
- *Identify and develop the communication team*: team consists of a representative for the lead organization and for each regulatory agency, responsible party, water purveyor, and each low-power stakeholder group
- *Target communication strategy resources*: increase information transfer to unengaged stakeholder populations and rebuild intermittent and conflicted relationships with water users in alignment with risk communication strategy SMART goals

The same example is used for the interest-influence matrix.

Example Context: A PFAS site consisting of a groundwater plume that has impacted drinking water supply wells and has identified contaminants in the local fish population.

Example 2: Interest-Influence Matrix: A tool that assist practitioners in identifying the stakes that social actors (stakeholders) have in a cleanup project. Identified stakeholders are placed in a matrix according to their relative interest and influence (Reed et al. 2009) (Figure 14-3).

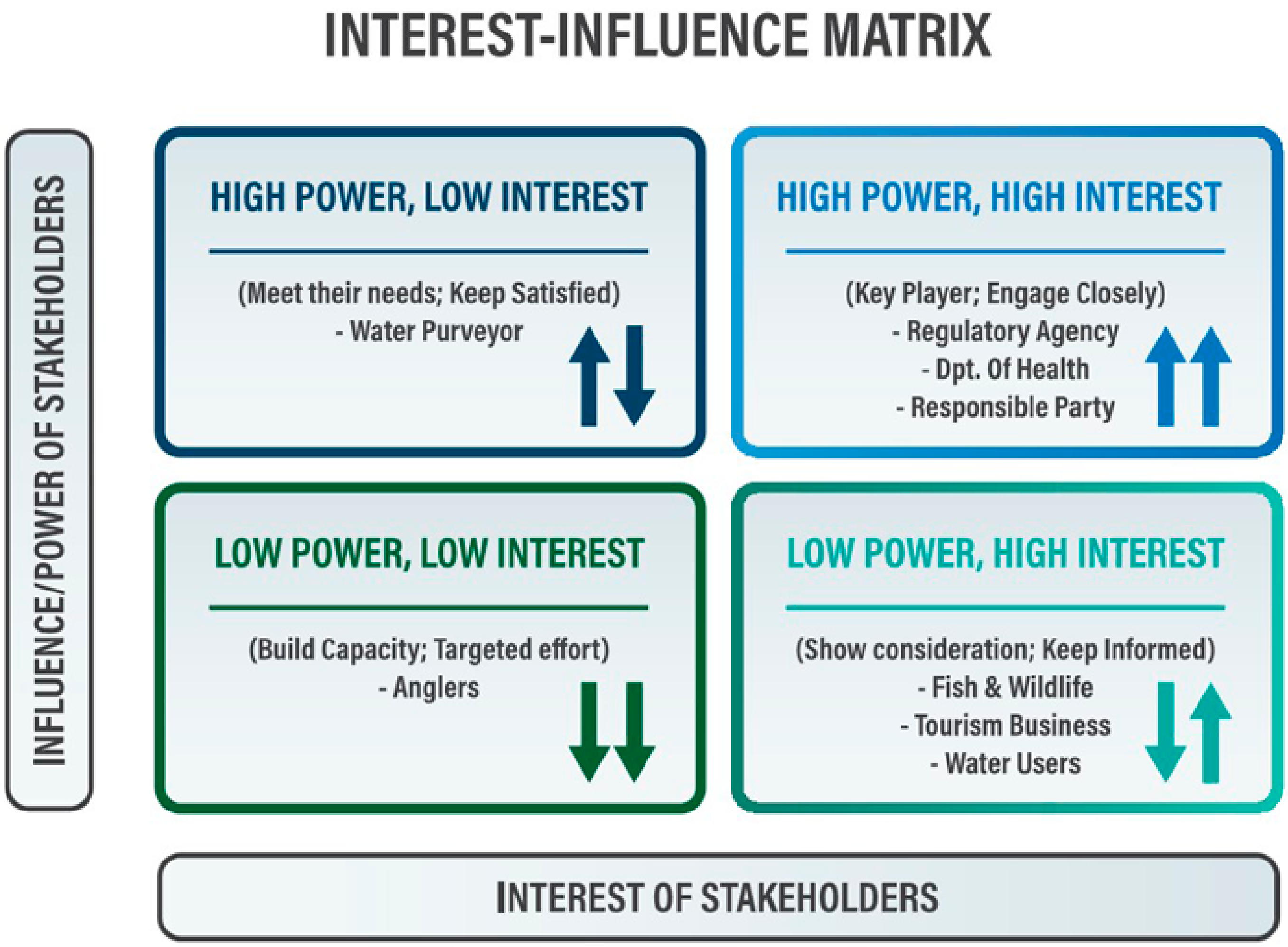

Figure 14-3. Example interest-influence matrix.

Example 2: Interest-Influence Matrix Evaluation

- *Identify unengaged stakeholder populations:* lead organization (for example, state agency or responsible party) (high-power) stakeholders have the role to engage lower power stakeholders who may not be currently engaged or are disengaged
- *Facilitate relationship/capacity building:* utilize high-interest stakeholders to build relationships with lower interest stakeholders, particularly ones with low power (such as the anglers)
- *Identify and develop the communication team:* team comprised of the lead organization and each regulatory agency, responsible party, water purveyor, and a representative of each low power stakeholder group
- *Target communication strategy resources:* increase information transfer to unengaged stakeholder populations and rebuild relationships with low-interest stakeholders in alignment with risk communication strategy SMART goals.

14.3.4 Social Factors Vision Board Tool

Stakeholder risk perception and associated social factors shape individuals' attitudes toward management of hazards that affect personal safety and public health, and play an important role in supporting legitimacy and compliance with policies and protection measures. Due to the evolving state of the science of PFAS, including appropriate risk management strategies and relevant public policy, the present public attitude toward legitimacy and acceptance of proposed policies and strategies is hindered.

The success of public outreach in terms of exerting a positive influence on community stakeholders and in preventing and mitigating their exposure to a risk is based on site-specific physical, psychological, sociological, and demographic characteristics or "social factors." Identification of these social factors among individual stakeholder groups can assist practitioners in refining engagement methods and outreach materials to maximize benefits to the community and meet specific needs of the targeted public sector.

A vision board can be used as a medium for stakeholders to rate their level of importance and/or interest on applicable social factors. Identified factors can then be used to further develop SMART goals and key messages, develop public outreach materials, and select engagement methods. The overall objective is to gain deeper insight into stakeholder concerns, values, and preferred communication method to facilitate a two-way street knowledge transfer and capacity building towards a successful risk management strategy. A social factors vision board tool can be used as starting materials for an engagement survey and interview. The target audience for this tool is an established community advisory group or a periodic outreach meeting, focus group, or decision maker stakeholders' group.

The vision boards (see ITRC RC Social Factors Vision Board attachment) developed for this toolkit are focused on a specific topic of concern and associated social factors identified from presentations by public and community stakeholders during the USEPA PFAS community meetings held in 2018.

Note that the vision boards for a specific project are living documents. The statements/questions and social factors should be updated to represent project-specific conditions and stakeholder concerns. Social factors presented on the toolkit vision boards are representative of affected communities' perceptions as opposed to expert opinion based on scientific studies. This toolkit was prepared as an example to provide a starting point for practitioners to understand the present needs and concerns of a PFAS-affected community. In addition, the rating system presented in each board is interchangeable to any social factor topic. More information on using the social vision board are provided in the ITRC Risk Communication Toolkit for Environmental Issues and Concerns document.

14.3.5 PFAS Key Messages

A message is information you want/need to share with communities about the issue or concern, a question that you need them to answer, or both. It is linked to the case specific goal and addresses key points about the issue that were learned through the community assessment. You start with the community and their concerns. Effective messages reflect what your target group needs are as well as what you need to communicate. In the case of emerging contaminants, elements of a message are likely to include: what is known and unknown about a contaminant, acknowledgement of uncertainty; commitment to share new information when it is learned; explanation of how decisions will be made with respect to protecting public health and remediating the problem, etc.

Message mapping is a process for developing your information so that it is concise and includes the information that is critical to convey. The objective is that the message is simple, yet comprehensive enough, and includes the most pertinent information relevant to your issue. A mapped message starts with a question, responds with three key ideas, is no more than twenty-seven words, and takes no longer than nine seconds to deliver. An example of key messages developed for a PFAS site is provided in Table 14-1. Additional resources on key messaging and mapping is provided in the ITRC Risk Communication Toolkit for Environmental Issues and Concerns document.

Table 14-1. Message Mapping Worksheet

Source: (Covello, Minamyer, and Clayton 2007)

Stakeholder: Community member	**Question/Concern/Issue:** What are PFAS and why is the state concerned about them?	
Key Message/Fact 1 PFAS are a family of human-made chemicals in many products used by consumers and industry.	**Key Message/Fact 2:** PFAS are emerging contaminants of concern.	**Key Message/Fact 3:** Some PFAS may adversely impact human health.
Keywords: Supporting Facts 1.1 PFAS are a large group of thousands of manufactured compounds, produced and used for over 60 years. Some PFAS are still in use, some are not.	**Keywords:** Supporting Facts 2.1 PFAS are a contaminant of active scientific research. Scientific knowledge is changing rapidly.	**Keywords:** Supporting Facts 3.1 PFAS can build up in the body (bioaccumulate) and take a long time to leave the body.

Keywords: Supporting Facts 1.2 PFAS have been used in coatings for textiles, paper products, and cookware and to formulate some firefighting foams, and have a range of applications in the aerospace, photographic imaging, semiconductor, automotive, construction, electronics, and aviation industries.	**Keywords:** Supporting Facts 2.2 Laboratory methods may or may not exist to detect all the PFAS contaminants that we know about; methods are developing and evolving with the emerging science.	**Keywords:** Supporting Facts 3.2 Some PFAS, such as PFOA, have been found to impact fetal development and are passed to babies through nursing and bottles.
Keywords: Supporting Facts 1.3 PFAS are found throughout the environment, in people, and in animals and fish.	**Keywords:** Supporting Facts 2.3 Federal and state regulations are changing as the scientific knowledge evolves; this leads to guidance and recommendations that may vary across the country.	**Keywords:** Supporting Facts 3.3 Studies in exposed humans suggest that some PFAS may cause high cholesterol, higher liver enzymes in blood, decreased response to vaccines, decreased birth weight, and testicular and kidney cancer.

A template of the message mapping worksheet is included in Covello, Minamyer and Clayton (2007).

14.3.6 Communication and Engagement Tools

14.3.6.1 Public Outreach

Public health and regulatory agencies have developed several public outreach materials to inform stakeholders about PFAS, from the compounds' origins and environmental distribution to exposure pathways, associated health effects, and management strategies. Outreach tools include community education classes to inform and support high school teachers, medical professionals, journalists, and municipal water managers. The following provides a summary of available resources for accessing and developing public education materials for PFAS-impacted communities. Although printed public education materials are effective at communicating information, techniques that include face-to-face communication, such as open house meetings, focus groups, and door-to-door canvassing, are often more effective at addressing fears and building trust. Additionally, face-to-face communication provides an opportunity for practitioners to learn from the public and other impacted stakeholders.

The ITRC Risk Communication Toolkit for Environmental Issues and Concerns document includes Guidance for Writing Analytical Results Letter, Guidance for Writing Press Releases.

14.3.6.2 Fact Sheets and Frequently Asked Questions (FAQs)

To achieve effective risk communication, it is essential for public education materials to be presented in a clear and simple manner that is understandable by nonscientists and speaks to a broad audience. Common rules of thumb include writing at a sixth-grade comprehension level, using simple terminology, and providing materials in multiple languages for nonnative speakers. Over the past few years, environmental and public health agencies, nonprofit advisory groups, trade associations, and regulatory agencies have prepared numerous fact sheets and FAQ documents on PFAS-related topics to inform stakeholders, including concerned residents, agricultural and recreational entities, water purveyors, end users, public health professionals, and others. These public education materials developed specifically for PFAS-impacted communities are typically available on the organization's website.

Fact sheets, FAQs, and other public outreach material should be distributed in multiple modes to maximize audience reach and increase opportunity for engagement. Recommended modes of distribution include mailings, websites, local municipal health departments, public health professional offices, public libraries, and information booths at community events.

The ITRC Risk Communication Toolkit for Environmental Issues and Concerns document includes additional information about FAQs.

- **Compilation of PFAS Fact Sheets, Frequently Asked Questions (FAQs)** and other resources developed by the Association of State and Territorial Health Officials (ASTHO) and the Environmental Council of the States (ECOS) are available:

- https://www.astho.org/PFAS/
- https://www.eristates.org/projects/pfas-risk-communications-hub/

14.3.6.3 Active Centralized Information Repository

Unlike a "passive" repository of site documentation at a central location, an "active" repository refers to a platform that remains up to date on site findings and enables two-way exchange of information among decision makers and the impacted community. A common platform for an active repository is a centralized website that contains a complete compilation of site documentation (among all agencies); frequent updates on site activities, health information and regulatory policy; and a depiction of the CSM (such as a source-exposure pathway graphic and geologic maps). The website should also contain a platform to facilitate stakeholder involvement by providing an opportunity for them to ask questions, submit information, and join a listserv (an application that distributes messages to subscribers on an electronic mailing list).

Examples of centralized websites can be found at the following web links:

- Michigan Department of Environmental Quality, *Michigan PFAS Action Response Team (MPART):* https://www.michigan.gov/pfasresponse/

Michigan agencies representing health, environment, and other branches of state government have joined together to investigate sources and locations of PFAS contamination, to take action to protect people's drinking water, and to keep the public informed as we learn more about this emerging contaminant.

- New Hampshire Department of Environmental Services (NHDES), *NH PFAS Investigation*: https://www4.des.state.nh.us/nh-pfas-investigation/

NHDES maintains a website to update interested parties on NHDES's investigation into the presence of PFAS in New Hampshire. The website includes a map that shows PFOA and PFOS data from water samples collected around the state.

- Vermont Department of Environmental Conservation (VDEC), *Vermont PFOA Contamination Response*: https://dec.vermont.gov/pfas/pfoa

Numerous Vermont agencies, including VDEC, Department of Health (VDH), Emergency Management, Agency of Agriculture, and Agency of Education have joined together to investigate and address PFAS contamination in Vermont. VDEC and VDH have created and maintained web pages to push information out to the public as it becomes available to keep the public informed of the PFAS issue.

Not all stakeholders have access to the internet, and depending upon the seriousness of the site's situation, it may be appropriate to hold regular meetings and/or office hours to provide more than one mode for stakeholders to obtain information and engage with decision makers.

14.3.6.4 Community Education

Individual stakeholder groups and individuals themselves process information in a variety of modes and media. An effective risk communication strategy takes this factor into consideration and encompasses multiple forms of outreach. In addition to informative materials, such as fact sheets, stakeholder meetings and interactive sessions (such as poster presentations, question and answer sessions) can be held to involve individuals in the learning and understanding process. Prior to selection of a method, an audience assessment should be conducted to determine how a community communicates and to learn what tool is the most effective to use.

Community Education Example—Bennington College Community Education Strategy, Vermont

In 2016, PFAS were discovered in the public water system of Hoosick Falls, New York, and in hundreds of private residential wells in Petersburgh, NY, and North Bennington, Vermont. In response to this nearby problem, Bennington College asked how the scientific resources of a college or university might become a civic resource in times of environmental uncertainty. After some discussion about how to maintain the scientific and educational integrity of the college while also being a good neighbor to impacted communities, Bennington College decided to open the doors of its science classrooms to the problem of PFAS contamination. This was done primarily in two ways: (1) a new introductory class on PFOA was offered to local communities free of charge, and (2) students in more advanced science classes in chemistry and geology worked to produce independent data on PFAS contamination in the region. More information about both of these strategies is below.

Many residents impacted by PFAS voiced a desire to learn about the science of the problem even as there was a recognition that much of that science was currently quite difficult for residents to grasp. Indeed, many of the risks and ramifications of PFAS contamination are currently published in daunting regulatory reports and peer-reviewed research articles (often behind paywalls). Addressing these concerns, Bennington College designed a new class to review the chemical properties, environmental pathways, and policy concerns of PFOA, entitled “Understanding PFOA.” This class also taught residents how to collect water samples for PFAS analysis at a commercial lab and how to interpret laboratory results from PFAS analysis. Bennington College has offered this class every spring to local residents since 2016, free of charge. A number of local teachers, journalists, nurses, elected officials, parents, and students enrolled, and the class has become a vehicle for the community to get up to speed on the science of PFAS so they can engage the issue more productively.

Bennington College also put together faculty-led research teams to produce independent data on PFAS contamination in conversation with community questions. Bennington College realized that impacted communities often had interesting questions about PFAS that fell outside of the urgent protocols of state agencies, which rightfully focused on safeguarding public health. These community questions, however, provided useful pathways to educate residents about the problem and to encourage local participation in research into PFAS contamination. Working with residents of Hoosick Falls, Petersburgh, and North Bennington, the college helped investigate a number of community concerns, such as:

- “Is there any PFOA in my maple syrup?”
    - Bennington College tapped two maple trees in the spring and analyzed the sap, finding 8.8 parts per trillion (ppt) of PFOA in the sap of a maple tree about 1,000 feet from a plastics plant and 2.3 ppt of PFOA in the sap of a maple tree about a mile from the plant.
- “My well had high levels of PFOA but now I have a filtration system in my basement. If my well was contaminated for years, I wonder if there might be any residual PFOA in my water pipes. Could any built-up PFOA still be contaminating the water coming out of my kitchen faucet?”
    - Bennington College analyzed water from the kitchen faucet from three homes with high levels of PFOA in their well and a point of entry treatment filtration system (Hoosick Falls house, 2,100 ppt of PFOA in well; Petersburgh house, 1,800 ppt of PFOA in well; North Bennington house, 3,000 ppt of PFOA in well). In all three homes, PFAS were nondetectable in water from the kitchen sink.
- “When the state tested my well, they found PFOA levels just below the health guidance level and thus we did not get a filtration system. How stable are detected levels of PFOA in the groundwater?”
    - Bennington College reviewed data from over 200 residential wells that had been sampled and analyzed for PFOA at least twice in one year. They found an average variation of 24% in individual wells. PFOA levels increased in about half of the wells and decreased in about half the wells. This increase and decrease did not have an obvious spatial pattern (for example, a plume moving in one direction) but appeared to be fairly randomly scattered across the sampling area.

More information about Bennington College’s ongoing engagement with PFAS can be found at www.bennington.edu/pfoa.

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