# Introduction

Risk communication is a process that involves the following steps ([Covello and Allen 1988](#)):

- Identifying, understanding, and engaging your audience and stakeholders
- Defining clear messages that provide the information you want to convey with an understanding of, and respect for, the concerns and perceptions of the audience and stakeholders
- Selecting the appropriate communication methods to deliver those messages

The term "stakeholder" is defined broadly by ITRC as members of environmental organizations, community advocacy groups, tribal entities, or other groups that are concerned or involved with environmental issues, or concerned citizens who are not a members of any organization or group. Public stakeholders, such as advocacy groups, often speak for the communities that are affected by environmental issues. In this document, a differentiation is made between the public, stakeholders, and interested parties (which may include state regulators and past or current owners or operators of or contributors to contaminated sites). Understanding stakeholder context (demographics, affiliations, perception, and concerns) and identifying various opportunities for involvement and participation is a vital and important first step to developing a risk communication strategy.

> Additional information on levels for public involvement are provided in [Appendix H](#) – Communication Methods Summary Table and International Association for Public Participation (IAP2) spectrum of public involvement accessed at: [http://ncdd.org/rc/item/1426/](http://ncdd.org/rc/item/1426/)

Stakeholders share greater ownership of outcomes when they can participate in the remedial action process, as illustrated in [USEPA (2019a)](#) Region 7 Leading Environmentalism and Forwarding Sustainability (L.E.A.F.S.) Awards. Environmental regulators and responsible parties also benefit from informed, constructive stakeholder involvement because it can help them make better decisions, reduce the likelihood of costly and time-consuming repetitive work, and allow those in affected communities to have a voice in governing the long-term use of land, water, and other resources. Stakeholders, such as long-time residents, often have unique local knowledge as well as a major stake in the environmental management decision outcome.

To learn more about stakeholder perspective, see the individual Stakeholder Perspectives section of the ITRC Technical and Regulatory Guidance documents, for example:

- PFAS Technical and Regulatory Guidance Document, [Section 13](#), Stakeholder Perspectives.

The fundamentals of risk communication discussed in this section include stakeholder engagement, understanding risk perspectives and earning trust in a community, timing of information sharing, and methods for interacting with and explaining risk in a community. Additionally, this section describes challenges unique to risk communication.

# 2.1 Stakeholder Engagement

Developing site or project-specific characterization, mitigation, and remediation strategies for communities and tribal organizations can be controversial. This is understandable as issues of health and safety are of deep importance to communities. How a community and the stakeholders within that community view risk management efforts proposed by an outside agency will depend on myriad factors including the stakeholder's trust in the agency, the nature of the hazard itself, and a range of stakeholder characteristics such as numeracy and scientific literacy. Therefore, early and effective stakeholder engagement is important. Stakeholder engagement should emphasize timely access to data, transparency, and responsiveness to stakeholder questions and concerns.

Effective stakeholder engagement not only reduces impediments to the completion of projects according to schedule, but also helps responsible parties and regulators make more informed decisions. One of the best ways for regulators and responsible parties to reach stakeholders is to identify members of the stakeholder groups who are willing to act as liaisons between the community and the regulators. There are five key components to establishing dialogues with communities ([Hance, Chess, and Sandman 1991](#)):

1. How communities see risk
2. Earning trust and credibility

3. Considering when and how to release information
4. Interacting with communities
5. Explaining risk

Attention to each of these components is critical to successful stakeholder engagement. In addition, it is essential for decision makers to understand stakeholder needs and risk perceptions to effectively communicate the potential risks, exposure pathways, and mitigation strategies of emerging issues and concerns, such as **Per- and polyfluoroalkyl substances (PFAS)**, **1,4-Dioxane**, and **Harmful cyanobacterial blooms (HCBs)**.

## 2.2 How Communities See Risk

People evaluate and understand risk differently, depending on the inherent characteristics of the risk itself. Table 2-1 shows how different characteristics of the risk can affect how acceptable the risk is to people (Slovic, Fischhoff, and Lichtenstein 1982). These characteristics are interrelated to individual risk perception factors discussed in Section 2.8. Communications can help people frame the risk and address issues that are of greatest concern to communities. The more you understand the view or perceptions of the affected people and communities, the better you will be able to address their needs.

Table 2-1. Risk characteristics that influence level of acceptance

**Source (Adapted from: USEPA 2007a)**

| More Acceptable | Less Acceptable |
|---|---|
| Voluntary | Involuntary |
| Controlled by individual | Controlled by others |
| Clear benefits | Little or no clear benefit |
| Fairly distributed | Unfairly distributed |
| Natural | Human-made |
| Generated by a trusted source | Generated by an untrusted source |
| Familiar | Exotic |
| Affects adults | Affects children |

Stakeholders who perceive a risk as unacceptable or less acceptable are more likely to express emotional outrage when confronted with news about a hazard in their community. Practitioners need to acknowledge, honor, and address this emotion to facilitate constructive and meaningful dialogue.

## 2.3 Earning Trust and Credibility

Trust is a major factor in effective stakeholder engagement and risk communication. Continuing engagement and transparency from the start sets the stage for successful trust building. Distrust can easily form due to, but not limited to, lack of information, inability to reach decision makers, inconsistency among several site risk management strategies, and inconsistent or contradictory media. In addition, practitioners should keep in mind that trust is influenced by history and

previous interactions with regulatory agencies and potential responsible parties. Engagement and partnership with a community representative group or liaison, local health practitioners, and academic institutions can assist with building trust among the public and community stakeholders (NJDEP 2014; Council of Australian Governments 2018; ATSDR 2011)

▼Read more

Trust building is an underlying theme that is discussed throughout this document. These are some general considerations for building trust:

● Involve the public early in the process, to enhance transparency and better engage the community.

● Express shared goals with stakeholders, even if they are just on the most basic mission level.

● Listen to stakeholders – their concerns are legitimate and important.

● Pay attention to the process: keep to established timelines and proposed milestones to the extent feasible. Aside from managing the regulatory and technical components, ensure that your organization keeps abreast of perceptions and circulating information in the community.

● Establish or identify a community liaison to assist with communication and enhance the sense of alliance.

● Use locally recognized support when possible.

● Explain regulatory procedures and document review times with stakeholders, and be explicit about where and when their input is requested.

● Deliver on recommendations and actions within the time frame communicated.

● Provide information to meet both the lead organization's and stakeholders' needs, and follow up when information is promised.

● Provide clear action steps for the community as needed (for example, switch to bottled water; talk with a medical professional).

## 2.4 Considering When and How to Release Information

If people are at risk, don't wait to release information. If the lead organizations are exploring a potential risk, explain this to the public.  Release information before sharing it with the media.  Impacted individuals and families want to hear directly from decision makers about environmental concerns and hazards in their community prior to learning about it through media channels. Practitioners should make an effort to inform the community and other impacted stakeholders directly and periodically to facilitate trust building.  Taking these actions helps maintain control of the message and interpretation of the data. If you don't trust the data, discuss procedures and what's being done.

With respect to presentation of information, consider the stakeholders who will be receiving it; keep content simple and streamlined. When feasible, authors should provide summaries and roadmaps pointing to key findings or recommendations. Additionally, technical documents should be easily accessible and offered in both printed and, if possible, searchable standard electronic formats. Many facilities have dedicated websites, which stakeholders can visit to download current documents, as well as earlier site documents referenced in current documents.

## 2.5 Interacting with Communities

Involving stakeholders early in decision-making can support better decisions. If stakeholder groups are present, determine how they may play a role in stakeholder engagement. Recognize that people's values and feelings are a legitimate aspect of an issue and listen and acknowledge such feelings.

Ensure that risk communicators are adept at interacting with stakeholders in a public forum, and that the communication team has staff with a sound technical basis and credibility in the subject matter. If possible, agency and responsible party representatives should be consistent throughout the life of the project.

Stakeholders often do not distinguish among government agencies, and few understand how agencies are organized. Consequently, they may not understand lines of decision-making authority. Designate time to provide an overview of the process, including policy document requirements and timeframes, best opportunities and milestones to provide stakeholder feedback, and organizational structures and interagency relationships.

Providing the opportunity or funding for independent scientific, technical, and health consultants to support affected stakeholder groups can foster better understanding of technical information and further engagement and empowerment.

Stakeholders are more trusting of independent consultants that they help direct. In addition, agencies and responsible parties can engage third party academic institutions to assist with stakeholder outreach. A case study presents an example of this approach in response to groundwater contamination in the PFAS Technical and Regulatory Guidance Document, see Section 14.3.6.4.

## 2.6 Explaining Risk

Explaining risk information about any concern affecting communities is often challenging and complicated, particularly for environmental hazards, emerging contaminants and immediate public health risks. Generally, the ITRC technical and regulatory guidance documents are geared toward a technical audience, and it may take some time to educate stakeholders. Explaining scientific concepts, such as potentially complex chemistry, data and knowledge gaps, and current knowledge of health effects is fundamental to building trust. Stakeholders want to know if an exposure will cause or has caused a health impact(s). Thus, risk communication must inform on the basics of the risk assessment process so that stakeholders understand that health effects can be caused by multiple environmental and anthropogenic factors. Education on risk assessment basics can also inform stakeholders on how unacceptable risk can be reduced by risk mitigation activities.

When explaining risk assessment, the entire process must be discussed, including complicated formulas and assumptions. Key concepts such as excess lifetime cancer risk and noncancer health effects, the foundations of risk assessment, and environmental pathways should be presented. Sometimes it is easier to explain risk reduction than quantitative risk. Stakeholders may be confused by or not trust numerical projections of risk, such as excess lifetime cancer risk, but they easily understand when an exposure pathway is blocked.

Take into account stakeholders' concerns; give them as much consideration as you do the numbers. Realize that stakeholders determine what an acceptable voluntary risk is, not the lead organization. It is also important that stakeholders are informed that regulatory agencies do determine "acceptable" risk levels upon which decisions to clean up or not clean up a site are based. Keep in mind that different people see risk in different ways. Avoid risk comparisons especially if the risk is unknown and being imposed on stakeholders. They want control and choices. They want to feel safe and they want a role in decision making on issues that affect them.

Section 4.5 and Section 4.6.1 provide resources to help simplify technical content and complex processes or regulations into laymen's terms so that these concepts are clear to the public. Most stakeholders will not have the background to easily grasp these concepts, and it may take multiple modes and mediums of communication over a period of time to effectively communicate the associated risks.

Academia can also serve a role in public education. Bennington College decided to open the doors of its science classrooms to the problem of PFAS contamination impacting the Hoosick Falls, New York, community. The college developed and offered a new introductory class on perfluorooctanoic acid (PFOA) to local communities free of charge. More information about this case study is presented in the PFAS Technical and Regulatory Guidance Document, see Section 15.4.1.

## 2.7 Challenges to Risk Communication

Many general challenges to risk communication are applicable to any environmental situation. Some are highlighted in this section.

▼Read more

● Risk communicators need to develop and deliver key messages that adequately respond to stakeholder concerns and communicate how data gaps are being addressed.
● The regulatory agency is obligated to take actions in accordance with statutes. These actions may not be consistent with the stakeholders' preferred choice and expectations.
● Stakeholders have diverse backgrounds, education, needs, and interests and thus filter information through different lenses, yielding different results. Relevant social factors include level of understanding, primary language, preference in communication mode, accessibility of information and engagement events, socioeconomic status, environmental justice and other community vulnerabilities, and prioritization of basic needs versus potential hazards.
● It is important to establish trust in the agency or entity addressing the issue or concern. Distrust in either can result in stakeholders not accepting proposed risk management activities and time frames. Unique community histories, such as

those of tribal nations and environmental justice communities, may result in complex relationships with government and site owners. Misunderstanding and lack of acknowledgment of community values and/or implications of risk management activities can exacerbate poor stakeholder relationships.

● Community history with the polluted property and owners/operators can play an important role in stakeholder sentiment. A site may have cultural value and/or have been a major employer in the region for generations. Communities, including workers, sometimes tend to accept environmental costs if the source of pollution is an entity that provides jobs or other economic benefits. Once the employer closes, neighbors and former employees tend to resent closure, so they elevate their environmental concerns: "The polluter left town, leaving behind only pollution."

● Stakeholders may be affected by consideration of cultural commitments and mitigation of detrimental impacts due to site actions. Risk communications must account for cultural diversity and differences in spiritual relationships with the environment.

● Given the complexity of the uncertainties for any specific project, it may be difficult to evaluate and quantify risk reduction.

● Stakeholders may learn that they have been unknowingly exposed to an environmental hazard for what could be a long period of time before the hazard was identified. This involuntary risk can result in outrage and distrust felt by the affected stakeholders.

● Determination of the severity of potential risks to human and ecological health from exposure to anthropogenic background versus localized sources in affected stakeholders.

● A specific individual's health conditions may not be definitively attributable to chemical exposures.

● Evolving scientific research and understanding of risk assessment can lead to changes of toxicity values over time, requiring recalculation of risks.

● Exposure pathways, extent of contamination, and contaminated media (including drinking and irrigation water from a potable source, surface soil, dust, agriculture, and aquatic biota) are complex and vary among sites and projects.

● Estimation of cumulative and aggregate exposures and risk are complex and vary among sites and projects.

● It is challenging to clearly and concisely communicate scientific factors and parameters used to develop risk-based standards and maximum contaminant level (MCLs), including site-specific receptors, exposure factors, and uncertainty factors, as well as the legal and statutory requirements for standard setting and rulemaking.

## 2.7.1 Emerging Concerns: Additional Risk Communication Challenges

Emerging concerns and issues, such as PFAS, 1,4-dioxane, and HCBs, pose unique challenges to implementing risk communication in a meaningful and effective manner. Different sources often put forth divergent information about the potential severity and uncertainty associated with exposure and adverse health impacts and the need for treatment or response actions. For example, people will do their own research that may result in conflicting information. Communicators need to be prepared to explain the choices and decisions made regardless of the conflicting information.

▼Read more

Some additional issues may include:

● "An emerging concern" implies that it is the subject of intensive investigation and the amount of relevant information is increasing. Thus, our understanding and information about hazard, exposure, and risk are emerging and evolving. This can challenge us to rethink determinations of protective approaches within very short time frames.

● A project team has to summarize information in the face of disagreements among experts over the interpretation of available science and the magnitude of uncertainty in the risk assessment; the project team is communicating about risks when the risks are not fully known or characterized.

● For some groups of chemicals and mixtures—for example, PFAS (ITRC 2020) and petroleum hydrocarbons (ITRC 2018)—numerous compounds exist, yet not all can be measured, and there is reliable toxicological information only for a small subset of these chemicals that have been studied in sufficient detail to support risk assessment and remedial decision making.

● Federal and state standards, guidance, and policies are not uniform and may not be available for the emerging environmental issue or concern.

● Identification of responsible parties may be difficult, depending on the specific emerging environmental issue or concern, because data and information collection may not be complete.

● Depending on the specific environmental issue or concern, effective mitigation by established treatment or response

technologies may be available or may still be in development.

● There may not be consensus between responsible parties and federal and state regulatory agencies on health risks or on the risk assessment and management strategy. Consistent messaging is essential for successful risk communication and to best help those in need. Section 4.5 includes guidance on message development.

● 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 estimate "right" but that there may be a delay in taking action until parties have agreed upon the best "right number" that is appropriate for the hazard and exposure scenario of concern.

● Communities that may be impacted will likely request an interim measure, such as an alternate water source, to alleviate concerns of potential continuing 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 information on measures being taken as well as associated milestones for future actions toward making a more informed risk management decision that reduces risk to an acceptable level while using limited resources efficiently and integrating stakeholder values and community needs.

## 2.8 Risk Perception Factors

It is essential for decision makers to learn and understand the risk perception of stakeholders in order to effectively communicate the potential risks, exposure pathways, and mitigation strategies of emerging and persistent contaminants, such as 1,4-dioxane, or immediate public health risks, such as HCBs.

Perceived risk related to a hazard can be either amplified (heightened) or attenuated (diminished) relative to the current scientific understanding of the risk. The degree of risk attenuation or risk amplification influences how stakeholders view the legitimacy of experts and affects their compliance with policies and protective measures. Risk amplification can also influence or be caused by a stakeholder's level of outrage (Sandman 2013). The type and degree of stakeholder risk perception is shaped by site-specific physical, psychological, and sociological factors. These risk perception factors contribute to the manner by which the public perceives a risk, which include voluntariness, controllability, familiarity, fairness, catastrophic potential, reversibility, equity, and effects on vulnerable populations (for example, children and pregnant women). Table 2-2 present the three key dimensions of risk perception factors (Bickerstaff 2004).

### Table 2-2. Risk perception factors*

| Place and Locality | Trust and Communication | Agency and Power |
|---|---|---|
| Knowledge of sources and site history<br>Cultural commitments<br>Stigmatized community<br>Sense of a personal safe place<br>Presence of other hazards | Accountability and interest of stakeholders<br>Role of information transfer<br>Complexity of subject matter<br>Differences in understanding<br>Presence of vulnerable populations | Demographics<br>Capability to respond to hazard<br>Sense of hopelessness and powerlessness<br>Social distrust<br>Stakeholder history with proponent |

* These factors are interrelated to risk characteristics that influence acceptance, as discussed in Section 2.2.

Consideration of risk perception factors among stakeholders can assist decision makers in refining public education and outreach material and modes of delivery to promote understanding, maximize knowledge transfer, and meet the specific needs of the stakeholders (Bickerstaff 2004; Kasperson and Kasperson 1996; USEPA 2005). Risk perception factors relating to the hazard can be identified by conducting surveys, interviews, and focus groups (Botzen, Aerts, and Van Den Bergh 2009; Burger and Gochfeld 1991; Chappells et al. 2014; Harclerode, Lal, et al. 2016; Weber et al. 2001) Vandermoere (Vandermoere 2008). These engagement methods can also be used to conduct a risk hazard analysis to evaluate perceived severity of the risk to a hazard(s) and applicable risk management strategy(ies). As a first step, publicly available databases can be used to perform an initial community assessment of basic demographic information, including number of single-parent homes and families with preschool children, number of young and elderly adults, disposable incomes, and primary and secondary languages. Focus groups can also inform practitioners on where, what, when, and with whom they need to communicate.

The environmental management community is acting largely on the basis of growing evidence of health risks and general precaution as our understanding of exposure and associated risk is continuously redefined. Determination of community-specific risk amplification and attenuation factors can help practitioners better understand stakeholder context and site-specific factors contributing to stakeholders' perceived risk of proposed risk management strategies. Practitioners, responsible parties, community members, and other stakeholders should be cognizant that their statements, actions, and behaviors can unknowingly amplify or attenuate perceived risk. Furthermore, individuals, and sometimes stakeholder groups, may have their own agendas and knowingly amplify or attenuate perceived risk. These parties and organizations often use disruptive tactics as partially discussed in Section 4.5.1.3

## 2.8.1 Role of Risk Perception for Stakeholders

In a scenario of risk amplification, stakeholders perceive their risk to a hazard as a major concern although experts assess the hazard as carrying a lesser degree of risk (for example, low or moderate) (Kasperson and Kasperson 1996). Most of the time, risk perception is heightened by uncertainties and variability among policies and standards due to developing sampling methodologies, analytical procedures, new scientific information on health effects, risk assessment evaluations, and treatment technologies (NGWA 2017), and regulatory changes, as well as overall confidence/trust in the proponent or agency that is communicating risk. Additional human health and exposure factors that may influence risk perception are summarized in Section 2.7.

A 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 within the community by maintaining transparent communication of uncertainties and variabilities early in the project life cycle (USEPA 2005, 2007). New data, findings, and research on emerging environmental issues and concerns should be shared regularly 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.

> Risk assessment factors selected and how they may differ among other state and federal standards should be clearly communicated to the public, as this is often a point of confusion and concern. In Section 8.3 of the PFAS Technical and Regulatory Guidance Document, differences in available regulatory and guidance values for PFOA and PFOS are discussed, including a summary of risk assessment factors (for example, critical effect, study exposure duration, reference dose, receptor, ingestion rate, and normalization factors).

Uncertainties in individual exposure and susceptibility and variability in regulatory guidance can cause the affected individuals to lose confidence in current scientific knowledge. Therefore, a risk communication project team (see Section 4.1.1.3) should communicate these uncertainties and variabilities to the affected individuals in collaboration with risk assessors, project managers, community involvement coordinators, and community leaders/active 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 risk management 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 risk management strategy, as well as assist with alleviating stakeholder concerns associated with uncertainty. For example, applicable secondary risk management performance metrics that could be applied are reduction in contaminant bioavailability/loading, source control/removal, and mitigation of exposure pathways (NGWA 2017; Harclerode, Macbeth, et al. 2016; Hadley, Arulanantham, and Gandhi 2015).

Risk amplification can be heightened when stakeholders perceive that they have limited control over risk. Explicit efforts of site managers and regulators to share control reduces outrage and risk amplification (Sandman 2013). Therefore, public participation 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. Acknowledgement and documentation of questions that cannot be answered communicates transparency and can be a first step toward building trust. In contrast, in a risk attenuation scenario, experts judge hazards as relatively serious although stakeholders do not pay, 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 assessment and management activities (for example, "Why do we need to spend money/do testing, etc., for this?"). 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, Macbeth, et al. 2016). See also the PFAS Technical and Regulatory Guidance Document, Section 14.1

## 2.8.2 Role of Risk Perception for Decision Makers

Due to the evolving science of diverse emerging environmental issues and concerns, project managers, risk assessors, and risk communicators can also get caught in between those who amplify risk and those who deny risk. As noted, uncertainty in the toxicity and exposure 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, operationally, and/or financially feasible. However, 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 avoid or minimize downplaying or embellishing risk due to lack of consensus on risk levels among decision makers. Strategies should be implemented to navigate disagreements and craft an approach to communicate a risk management plan that is most likely to be reasonable and protective. One strategy is to consider and incorporate stakeholder needs and values, placing greater weight on them when risk management is considered. A second strategy is to develop secondary risk management objectives as mentioned in Section 2.8.1. These highlight the importance of formulating a robust risk communication plan, as well as consideration of stakeholder risk perception as part of the risk communication process.