

USING CITIZEN SCIENCE DATA IN LITIGATION



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Preliminary Information

This draft manual serves as an addendum to the *Manual for Citizen Scientists Starting or Participating in Data Collection and Environmental Monitoring Projects*, written by the Emmett Environmental Law & Policy Clinic at Harvard Law School under the direction of Clinical Professor Wendy Jacobs. This addendum was researched and prepared by Clinic students, including Hannah Perls ('20), Basil Williams ('19), under the supervision of Professor Jacobs and the Clinic's Deputy Director, Shaun Goho. Questions or comments on this manual can be directed to EmmettClinic@lists.law.harvard.edu.

Legal Disclaimer

This manual is not intended to operate as a substitute for legal representation and does not create an attorney-client relationship. This manual describes the legal framework applicable to, and addresses some legal challenges in, using citizen science data in litigation. However, if you have specific questions related to a particular project or issue, you should consult a lawyer who is admitted to practice law in the state in which you are working. As discussed in this manual, laws vary from state to state and change over time. The laws and judicial decisions discussed in this manual are intended as a starting point. Neither the Clinic nor any of the authors assume any liability for the actions taken (or not taken) by any party in reliance on this manual.

Glossary of Terms

Burden of Proof: Duty placed upon a party to prove or disprove a disputed fact.

Citizen Science: A grassroots initiative in which ordinary citizens—sometimes in collaboration with professional scientists, organizations and government agencies—collect, generate, and distribute information, either for educational purposes or to address community-centered environmental issues.

Civil Penalties: Financial penalty imposed by a court or government agency to enforce regulations, such as late payment of taxes, failure to obtain a permit, etc. These fines are paid to the government, not the plaintiff(s).

Damages: A sum of money imposed by a court for a breach of some duty or violation of some right. Damages generally fall into two categories: **compensatory** damages, which are intended to compensate a party for a loss or injury, and **punitive** damages, which are intended to punish a party when that party's actions are especially reckless or malicious.

Data: Quantitative and qualitative information collected for reference or analysis.

Defendant: A party that is sued or accused of something in court.

Evidence: A legal term for the information that a party submits to a court to prove the facts that support its side of the case. In an environmental suit, relevant evidence can include things such as testimony about direct observations, photographs, videos, or water and air samples.

Expert: A person who has certain specialized knowledge beyond that of a layperson. *See infra* Section II.

Hearsay: Evidence offered by a witness that is not based on the witness' direct knowledge, but is instead based on oral or written statements that someone else has made outside of court. *See infra* Section II.

Injunction: A court order requiring a person to do or cease doing a specific action.

Layperson: A person who does not have specialized knowledge, training, qualifications, or experience in a particular subject or activity.

Observations: Information that witnesses have obtained through their senses of sight, hearing, smell, and/or touch.

Plaintiff: A party who brings a legal action against another party in a court of law.

Testimony: A statement made in a legal proceeding by a witness while in court and under oath.

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I. INTRODUCTION

A. Purpose of the Manual

This manual seeks to empower and prepare citizens and community groups who want to use citizen science data in litigation. It serves as a supplement to the Emmett Environmental Law & Policy Clinic’s *Manual for Citizen Scientists Starting or Participating in Data Collection and Environmental Monitoring Projects*, which can be found at www.citizenscienceguide.com/. This document adds to that manual by discussing the promise of and obstacles to using citizen science data as evidence in litigation.

Citizens can use litigation to hold accountable polluters and others whose actions adversely impact the environment. These actions can include wastewater treatment plants discharging sewage into public waters, factories or cars emitting harmful air contaminants that make residents sick, or industrial facilities improperly disposing of their solid wastes. While national and state governments have major roles in enforcing environmental laws, federal environmental laws envision citizens playing a “private attorney general” role in environmental enforcement. This role is especially important now, as the federal government and some states are rolling back enforcement efforts, in many cases due to inadequate financial resources.¹ Additionally, regulation can be inconsistent across communities, raising significant environmental justice concerns. Citizen scientists can use environmental citizen suits, supported by citizen science, to fill these enforcement gaps and help address environmental problems in their communities.

Citizen science can play an important role in citizen environmental enforcement by producing evidence for use in litigation. Evidence includes, but is not limited to, **eyewitness testimony, photographs, videos, and sampling data.** This manual provides recommendations to help citizens prepare and present evidence in a way that will increase the likelihood that a

¹ Over the past two years, there have been steep declines in EPA enforcement and compliance actions as a result of cuts to both Agency budgets and state aid, staff loss, and increased delegation of enforcement duties to poorly equipped state agencies. See Environmental Data & Governance Initiative, *A Sheep in the Closet: The Erosion of Enforcement at the EPA* (Nov. 2018), available at <https://envirodatagov.org/wp-content/uploads/2018/11/Sheep-in-the-Closet.pdf>; Environmental Integrity Project, *Less Enforcement: Communities at Risk Federal Data Show Decline in EPA Enforcement Leading to Public Health Hazards* (Feb. 2019), available at <http://www.environmentalintegrity.org/wp-content/uploads/2019/02/EIP-Enforcement-Report.pdf>.

court will (a) admit the evidence, and (b) weigh the evidence more heavily in its decisions.

Specifically, we address the following questions:

- *What are some of the obstacles you are likely to face when introducing citizen science data in court? How can you overcome those obstacles?*
- *When will the evidence that you have collected be admissible in court? When will it not be?*
- *When will you need an expert witness to testify regarding evidence that you have collected?*
- *When can you testify regarding your own evidence and observations?*

By analyzing these questions under environmental statutes and current case law, this manual provides citizen scientists and their attorneys a sense of what to expect in litigation when introducing evidence collected by citizen scientists. In doing so, the manual also provides potential strategies for overcoming evidentiary obstacles.

B. Overview of the Manual

This manual is designed for both laypersons and attorneys new to the field of environmental law. **Each section begins with a non-technical introduction and summary of the issue or case study, outlined in a green box.** The text after each green box provides a more in-depth legal analysis of that same issue or case study. **Additional examples are highlighted in dotted-green boxes, with best practices highlighted in the margins.**

Section II provides an overview of evidentiary issues that citizen scientists and attorneys should keep in mind when collecting and introducing evidence. These issues include rules about who (“experts” or “lay witnesses”) can provide certain types of testimony (“fact” or “opinion” testimony), the rule against hearsay, authentication requirements, and rules about what qualifies as “credible data.” This overview will help citizen scientists understand how evidence that they have collected may or may not satisfy evidentiary requirements under current law.

Section III of the manual describes several case studies analyzing how the use of citizen science can vary under different laws and in different phases of litigation. The section discusses several major environmental laws, including the Clean Water Act (“CWA”), the Clean Air Act (“CAA”), and the Resource Conservation and Recovery Act (“RCRA”). This section also discusses nuisance law and toxic tort litigation. In addition, Section III includes recommendations on how citizens can prepare and present their evidence to improve the likelihood that the court will admit the evidence and weigh it favorably. While these examples

are not comprehensive, they illustrate how the use and limitations of citizen science can vary depending on the type of pollution involved, the harms that individuals experience, the law or doctrine under which plaintiffs bring lawsuits, and the stage of litigation.

C. Best Practices and Lessons Learned

The following points serve as a brief summary of best practices and lessons learned from the discussions below in Sections II and III.

- **Data collected in accordance with a standardized and documented sampling plan is more likely to be accepted into evidence** by a court than data not collected according to these practices. A Quality Assurance Project Plan (“QAPP”) is an example of the framework for such a plan
- When collecting evidence, be it qualitative or quantitative, citizen scientists should **record and report all observations as soon as possible and with as much detail as possible.**
- **Plaintiffs will need to decide when they need a professional to testify about their data in court and when a citizen scientist can testify.** Drawing a line between when an expert is needed and when a lay witness can offer opinion testimony is sometimes difficult to do. In the context of citizen science, courts have not directly addressed whether citizen scientists can qualify as “experts” for the purpose of providing expert testimony. The fact that training and experience other than formal academic qualifications have sometimes been sufficient for witnesses to qualify as experts further suggests that citizen scientists who receive training and have extensive experience in collecting environmental samples might be able to qualify as experts.² Citizen scientists should be able to testify about their sampling methods, but a professional scientist may be needed to interpret the results.
- In general, citizen scientists can contribute to environmental citizen suits by providing evidence or testimony about the following: (1) the **presence of contamination**, (2) the **pathway(s) to exposure** through which contamination could cause harm, and (3) the **type of harm** that results if the contamination moves along the pathway of exposure.

² Cf. *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137, 147 (1999) (noting that the Federal Rules of Evidence “make[] no relevant distinction between ‘scientific’ knowledge and ‘technical’ or ‘other specialized’ knowledge”).

Citizen science that can help establish these elements include eyewitness testimony, photographs and video, and air or water sampling results. However, the specific types of evidence that will be most helpful to citizen scientists in litigation depends on the type of lawsuit they are attempting to bring.

- **Citizen scientists will usually need quantitative sampling results, analyzed in a laboratory, to establish the presence of contamination.** One notable exception to this conclusion is when the pollutant or contaminant in question is **visible, commonly known, and/or smelly** such that it can be readily recognized by the average citizen. Raw sewage or oil sheens generally fall into this category of contaminant.
- When citizen scientists are concerned about water pollution specifically, citizens should conduct an online search for permit violations in their area using the EPA’s Enforcement and Compliance History Online (“ECHO”) Database.³ In some citizen suits, especially under the Clean Water Act, evidence of permit violations can be sufficient to establish key elements of a case.

D. Summary of Limitations and Existing Information Gaps

This manual does not discuss all possible ways in which citizen science might be used in litigation, nor does it cover every statute under which citizen science might support a legal claim. Instead, the manual introduces relevant principles of evidence and presents case studies in which citizen science has the potential to contribute to environmental lawsuits.

This manual is also limited by the lack of existing case law addressing the use of citizen science data as legal evidence. For example, courts have not directly applied rules of evidence governing in-court testimony to citizen scientists. Specifically, courts have not directly ruled on the extent to which citizen volunteers who have gone through extensive training to collect and analyze environmental data can qualify as “experts” for the purposes of testifying in court.

Another limiting factor is the relatively new availability of affordable, reliable environmental monitoring technologies. The manual therefore cannot always provide clear answers regarding how courts will consider data collected with these types of technologies.

³ *Enforcement and Compliance History Online*, EPA, <https://echo.epa.gov/>.

II. OVERVIEW OF EVIDENTIARY ISSUES

Evidence is the legal term for the information that a party submits in court to prove the facts that support its side of the case. **In an environmental suit, relevant evidence can include things such as testimony about direct observations, photographs, videos, or samples of soil, water, or air.** Observations refer to the use of one’s senses of sight, smell, hearing, and touch to report information about an event or occurrence. The types of evidence that may be most helpful to citizen scientists in litigation will depend on the type of lawsuit they are attempting to bring. For example, in a lawsuit regarding the discharge of sewage into a river, plaintiffs may want to introduce into evidence their personal observations, including what the river looked and smelled like, photographs and/or video footage of the raw sewage, and/or water samples, if available. By contrast, in a case involving a less visible pollutant, such as a chemical affecting a river’s pH (acidity), plaintiffs will likely be less able to rely on visual observations and photographs or video, and instead may need to rely more on water sampling and quantitative data.

You may confront several evidentiary hurdles when introducing citizen science in litigation. One hurdle involves the **evidentiary rules that determine who can provide in-court testimony, depending on the topic discussed in that testimony.** Witnesses may need to testify when describing things that they have observed. For example, if you observed sewage overflowing from a drain, you could testify about the date you saw the sewage, the weather at the time of your observation, as well as the color, smell, and quantity of the sewage. Witnesses may also need to testify to explain what the evidence they have introduced is and how they obtained the evidence. To explain evidence about water sampling, for example, you would describe the water sampling techniques used and how the witness personally handled, stored, and tested the samples. In some cases, witnesses may also need to testify to interpret and explain their evidence.

Two key distinctions govern the requirements of providing in-court testimony. First, courts distinguish between “facts” and “opinions” in testimony. Second, courts distinguish between the kinds of opinions that any witness with personal knowledge about an occurrence can provide (known as “lay opinion testimony”) and the kinds of opinions that

only someone with special training, skills, or knowledge can provide (known as “expert opinion testimony”).

There are some additional barriers to introducing evidence in courts. One is a rule against admitting out-of-court statements, also known as the “**rule against hearsay.**” “Hearsay” evidence is evidence offered by a witness that is not based on the witness’ direct knowledge, but is instead based on oral or written statements that someone else has made outside of court. Another barrier is the evidentiary **rule of authentication**, which requires that the party introducing evidence sometimes take additional steps to show that the evidence is actually what the party claims it is. Finally, some states have “**credible data rules,**” which limit the kinds of data that can be submitted to state environmental agencies to encourage agency enforcement. Although this last obstacle is not directly applicable to litigation, courts might look to agencies’ approaches to citizen science data when determining the reliability of evidence for litigation purposes.

A. General Rules on Expert and Lay Testimony

Figure 1 summarizes the two main distinctions courts make regarding fact and opinion testimony and lay opinion and expert opinion testimony. Figure 1 also includes the Federal Rules of Evidence and case law requirements governing these distinctions. The Supreme Court set forth the requirements for testifying as an expert witness in federal court in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (2003). The application of those requirements to citizen science are described in more detail below. Some states have adopted requirements for expert testimony that are different from those laid out in *Daubert*; citizen scientists and their attorneys should refer to those state requirements in Appendix II of the Emmett Environmental Law Clinic’s *Manual for Citizen Scientists Starting or Participating in Data Collection and Environmental Monitoring Projects*.⁴ In general, citizen scientists and their attorneys should research the relevant rules about using evidence in the jurisdiction where they anticipate litigation.

⁴ See *A Manual for Citizen Scientists Starting or Participating in Data Collection and Environmental Monitoring Projects*, Ch. 5, <https://citizenscienceguide.com>.

1. Lay Fact Testimony vs. Lay Opinion Testimony

The first distinction that courts make regarding the admissibility of evidence is whether witnesses are providing *fact* testimony or *opinion* testimony.⁵ In both situations, witnesses must have personal knowledge about the topic of their testimony.⁶ “Opinion testimony” reflects “a belief based upon inferences drawn from ascertained or assumed facts.”⁷ By contrast, “fact testimony” does not include inferences or assumptions about facts. In practice, the line between these two kinds of testimony can be hard to draw; even statements that appear to contain solely facts often require *some* inferences drawn from facts. For example, a witness’s testimony about his or her observation of an oil sheen requires the witness to infer from prior experiences that a shiny, colorful substance in water is, in fact, oil. However, a witness can also testify about many things that do not necessarily require inferences beyond facts, such as a step-by-step explanation of how the witness collected a sample.

2. Expert vs. Lay Testimony: When Do You Need an Expert to Testify?

The second main distinction that federal and state rules of evidence make regarding in-court testimony is between the kinds of opinions that any witness with personal knowledge of an event can provide (known as “lay opinion testimony”) and the kinds of opinions that only someone with special training, skills, or knowledge can provide (known as “expert opinion testimony”). To provide “expert opinion” testimony, a witness must have some kind of “specialized knowledge.”⁸ By contrast, witnesses providing “lay opinion” testimony do not need, and cannot provide, testimony based on specialized knowledge.⁹ Lay opinion witnesses must

⁵ See, e.g., *State v. Kinsel*, 545 N.W.2d 885, 889 (Iowa App. 1996) (“In practice . . . the distinction between fact and opinion can be blurred, and even the most specific and detailed statements are in some measure the product of inference and reflection, as well as observation and memory This subtlety helps explain the wide range of discretion accorded trial courts.”).

⁶ See Fed. R. Evid. 602.

⁷ *Baltimore, C. & A. Ry. Co. v. Turner*, 136 A. 609, 612 (Md. 1927).

⁸ See Fed. R. Evid. 702.

⁹ Federal Rule of Evidence 701 governs lay testimony. It requires that lay testimony be “(a) rationally based on the witness’s perception; (b) helpful to clearly understanding the witness’s testimony or to determining a fact in issue; and (c) not based on scientific, technical, or other specialized knowledge within the scope of Rule 702.” See also *Swaiian v. General Motors Corp.*, 916 F.2d 31, 36 (1st Cir. 1990) (“For opinion testimony of a layman to be admissible three elements must be present. First, the witness must have personal knowledge of the facts from which the opinion is to be derived. Second, there must be a rational connection between the opinion and the facts upon which it is based. Third, the opinion must be helpful in understanding the testimony or determining a fact in issue.”).

simply have personal knowledge of the evidence offered,¹⁰ and can only testify to things that are related to that knowledge.¹¹

When testimony requires “specialized knowledge,” courts require that a witness qualify as an expert to testify.¹² There is no bright line between which topics require such specialized knowledge and which do not. However, courts have required that a witness qualify as an expert to offer opinions on the following topics:

- Functions and environmental risks associated with oil and gas operations;¹³
- The science behind a drug’s cause of birth defects;¹⁴
- The operation of cell towers;¹⁵
- Defects in a tire manufacturer’s design;¹⁶
- Coded terms in a drug trafficking case;¹⁷ and
- Banking practices.¹⁸

When testimony is not based on “specialized knowledge,” a layperson with personal knowledge of the subject of testimony can testify. The following cases are examples of topics about which courts have allowed laypersons to provide lay opinion testimony based on personal, but not “specialized,” knowledge:

- A lay witness was able to testify that orange-colored contamination was emanating from a pipe.¹⁹

¹⁰ See Fed. R. Evid. 602. Where relevancy requires, a foundation must be laid as to the witness’ personal knowledge of facts to which observed facts are being compared. See, e.g., *Marshall v. Williams*, 574 S.E.2d 1, 5 (N.C. App. 2002) (requiring that the witness establish a foundation for personal knowledge).

¹¹ See Fed. R. Evid. 701.

¹² *Miss. State Highway Comm’n v. Gilich*, 609 So.2d 240, 244 (Miss. 1992) (holding that lay opinions are those that require no “specialized knowledge” however attained).

¹³ See *Cerny v. Marathon Oil Corp.*, 480 S.W.3d 612, 620 (Tex. App. 2015).

¹⁴ See generally *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

¹⁵ See *U.S. v. Natal*, 849 F.3d 530, 536–37 (2d Cir. 2017).

¹⁶ See *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137, 141 (1999).

¹⁷ See *U.S. v. Villarman-Oviedo*, 325 F.3d 1, 12–13 (1st Cir. 2003).

¹⁸ See generally *U.S. v. Riddle*, 103 F.3d 423 (5th Cir. 1997).

¹⁹ See *Aiello v. Town of Brookhaven*, 136 F. Supp. 2d 81, 86–87 (E.D.N.Y. 2001).

- A lay witness was able to testify that a powder tasted like cocaine, since the witness had “individual experience and knowledge” with cocaine.²⁰
- The president of a pipeline company provided lay opinion testimony regarding the magnitudes of flows of oil, since the testimony was “about a business based on the witness’s own perceptions and knowledge and participation in the day-to-day affairs in the business,” and because the witness “applied simple arithmetic.”²¹
- A witness who had served in the military was able to provide lay opinion testimony, based on experience, that an odor resembled that of decomposing human flesh.²²

The cases listed in this section demonstrate that **drawing a line between when an expert is needed and when a lay witness can offer opinion testimony is sometimes difficult to do**. In the context of citizen science, courts have not directly addressed whether citizen scientists can qualify as “experts” for the purpose of providing expert testimony. One recent law journal article discusses such a possibility.²³ The fact that training and experience other than formal academic qualifications have sometimes been sufficient for witnesses to qualify as experts suggests that citizen scientists who receive training and have extensive experience in collecting environmental samples might be able to qualify as experts.²⁴ Citizen scientists can qualify as “experts” for the purposes of providing expert testimony only if their testimony complies with the Supreme Court’s science-based standard for expert testimony, set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (2003).

In light of these uncertainties, the decision tree in Figure 1 below provides a rough outline of the basic considerations to take into account when deciding whether a layperson can testify. Citizens and their legal counsel should also be sure to review precedent in the relevant state jurisdiction regarding requirements of expert and lay testimony.

²⁰ See *U.S. v. Paiva*, 892 F.2d 148, 156 (1st Cir. 1989).

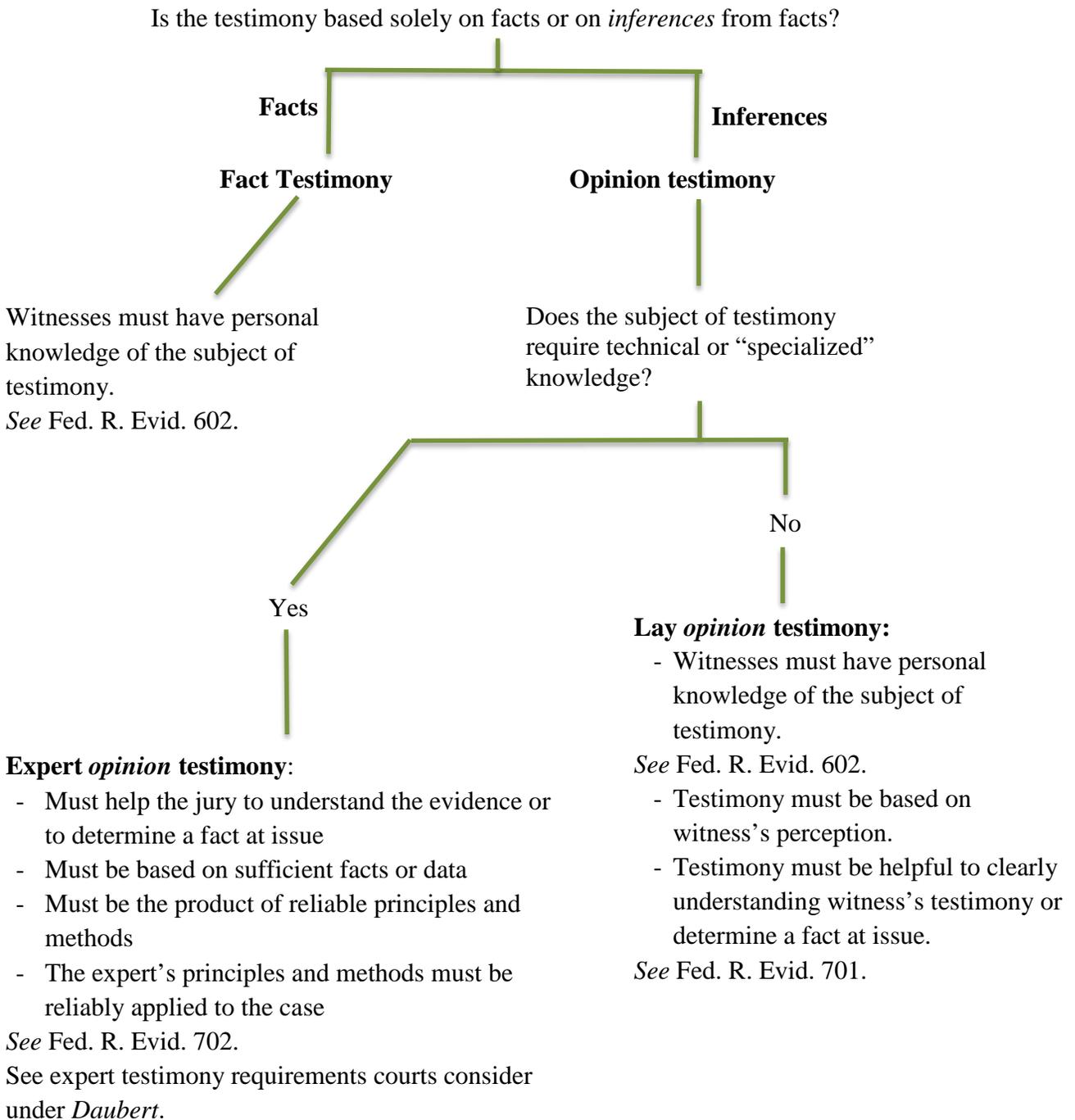
²¹ See *Portland Pipeline Corp. v. City of South Portland*, 288 F. Supp. 3d 321 (D. Me. 2017), Order on Defs.’ Mot. In Limine at 20.

²² See *State v. Lerch*, 677 P.2d 678, 685 (Ore. 1984).

²³ See Annie E. Brett, *Putting the Public on Trial: Can Citizen Science Data be Used in Litigation and Regulation?*, 28 VILL. ENVTL. L.J. 163, 198–205 (2017). The landmark Supreme Court case that discusses this standard is *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

²⁴ See, e.g., *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137, 147 (1999) (noting that the Federal Rules of Evidence “make[] no relevant distinction between ‘scientific’ knowledge and ‘technical’ or ‘other specialized’ knowledge”).

Figure 1: Requirements of Expert and Lay Testimony



B. Rule Against Hearsay and the Hearsay Exceptions

Another obstacle to admitting evidence in court is the “rule against hearsay.”²⁵ **“Hearsay” refers to evidence offered by a witness that is not based on the witness’ direct knowledge, but is instead based on oral or written statements that someone else has made outside of court.**²⁶ For example, if a citizen scientist’s neighbor told her that, one week earlier, the neighbor saw what looked like a toxic substance flowing down a nearby river, the general prohibition against hearsay would prohibit the citizen scientist from offering her neighbor’s statement as testimony. She must observe the toxic substance in the river herself and testify about her own observations or have her neighbor testify about it directly. Similarly, if the neighbor had kept a journal in which she described her observations of the river, the citizen scientist could not testify about the contents of the journal.

Hearsay statements are not admissible in court because they do not allow for cross-examination of the person who asserted the fact directly, and are therefore considered less reliable than statements that rely on direct observations and can be tested through cross-examination. In the hypothetical above, federal and state rules of evidence view the citizen scientist’s testimony about what her neighbor saw in the river as less reliable than the citizen scientist’s testimony about what she saw in the river herself. **Attorneys should seek out people who *directly* observed pollution or those who conducted sampling themselves to testify.**

Best Practice:
The best people to testify regarding observations or sampling results are those who directly observed pollution or those who conducted sampling.

However, both federal and state rules of evidence provide for several exceptions to the general rule against hearsay. Therefore, there may be some situations in which hearsay statements that citizen scientists wish to introduce in court will nevertheless be admissible. While litigators will be familiar with the basic principles of the rule against hearsay and its exceptions, this subsection discusses the hearsay exceptions most relevant to citizen science. It is still important, however, to consult the hearsay rules in the jurisdiction in which litigation is likely.

²⁵ See Fed. R. Evid. 803.

²⁶ *Id.*

1. “Present Sense Impression” Exception

One exception to the general rule against hearsay is when someone makes a statement outside of court about events or conditions *while or immediately after* he or she perceives those events or conditions.²⁷ This exception is called the “present sense impression” exception. In the above hypothetical about the citizen scientist testifying about what her neighbor saw in the river, the citizen scientist’s testimony about her neighbor’s statement would be admissible under the “present sense impression” exception if the neighbor made her statement about the toxic substance while or immediately after she saw the substance. Citizen scientists and their attorneys should bear in mind that, under the rule against hearsay, citizen scientists will generally not be able to testify about things that another person told them, unless citizen scientists have those conversations immediately after an incident that the other person directly observed.

Best Practice:
Record and report all observations as soon as possible.

2. “Recorded Recollection” Exception

Another exception to the rule against hearsay involves “recorded recollections.” This hearsay exception is applicable when a witness has recorded his or her observations of events or conditions but, when it comes time for trial, the witness cannot recall those events or conditions adequately enough to testify. For example, if a citizen scientist kept daily journal entries about the color of water coming out of her faucet, but at the time of trial could not recall which days specifically she observed the water, her daily journal entries are admissible even though they are technically “out-of-court statements.” For this exception to apply, the witness must appear at trial, the record must have been made or adopted by the witness when the matter was fresh in the witness’s memory, and the record must accurately reflect the witness’s knowledge.²⁸

Best Practice:
Keep detailed records of observations and events as they occur.

3. “Records of a Regularly Conducted Activity” Exception

The “records of a regularly conducted activity” exception, also known as the “business records exception,” applies when people, companies, or non-profit organizations **keep regular records about information in the course of their business, organization, or volunteer efforts.** Under this exception, **those records are admissible** if they meet three requirements: (1)

²⁷ See Fed. R. Evid. 803(1).

²⁸ See Fed. R. Evid. 803(5).

the record was made by or transmitted from someone with knowledge of the information, (2) the creation of the record was a regular practice, and (3) there are no indications of the information’s untrustworthiness.²⁹ For example, if a citizen group or citizen scientist regularly kept records of pH levels in a nearby river for purposes of environmental monitoring, then despite being “out-of-court statements,” those records are admissible under the “business records” hearsay exception.

Citizen scientists and their attorneys should be aware of courts’ reluctance to apply the business records exception to records kept *for the purpose of litigation*.³⁰ To avoid accusations of preparing records for the purpose of litigation, citizen science groups can make strong arguments in court about other purposes of monitoring: to educate communities or to support regulatory water quality monitoring. However, if citizen groups only engage in such monitoring for the purpose of bringing a lawsuit, then the “business records exception” will not apply.

Best Practice:
If possible, conduct monitoring before litigation is anticipated. Don’t label monitoring reports and other documents as litigation documents.

4. “Learned Treatise” Exception

Citizen scientists may find that statements in certain peer-reviewed scientific articles support the science underlying their claims. For example, a citizen scientist witness may want to cite a statement in a scientific article that supports her position that a chemical is carcinogenic. While the statement from the scientific article is hearsay, such statements are admissible under the “learned treatise” hearsay exception if, and only if: (a) the statement in the article is relied upon by expert testimony, and (b) the publication is established as a reliable authority by expert testimony or by judicial notice.³¹ Therefore, the citizen scientist (or other witness) would need to qualify as an expert witness before being able to take advantage of this exception.

C. Authentication

Another obstacle to introducing evidence in court is the rule of authentication. The **rule of authentication requires that the party introducing evidence take additional steps to show**

²⁹ See Fed. R. Evid. 803(6).

³⁰ See *Palmer v. Hoffman*, 318 U.S. 109, 113 (1943) (“[T]he fact that a company makes a business out of recording its employees’ versions of their accidents does not put those statements in the class of records made ‘in the regular course’ of the business.”).

³¹ Fed. R. Evid. 803(18).

that the evidence is actually what the party claims it is.³² For example, if a citizen scientist introduces monitoring reports indicating pH levels in a nearby river, the rule of authentication requires that the citizen scientist demonstrate that the monitoring report (1) is, in fact, a monitoring report, and (2) that the report does, in fact, reflect data of pH levels collected in the nearby river.

Below are four authentication techniques that are especially relevant to citizen scientists:

1. Testimony of a Witness with Knowledge

One way to authenticate evidence is to **supplement the evidence with testimony from a witness with knowledge about the evidence.**³³ For example, the simplest way to authenticate a monitoring report drafted by a citizen scientist is to have the citizen testify about his or her process of collecting data and recording the results in the report. This testimony would likely be sufficient to show that the monitoring report is, in fact, the monitoring report that the citizen scientist claims it is.

2. Distinctive Characteristics

Another way for a party to authenticate evidence is to **point to the appearance, contents, substance, patterns, or other distinctive characteristics of the evidence.**³⁴ For example, if a citizen scientist wants to introduce a sample of contaminated soil into evidence, the citizen scientist can point to similarities between the soil in the sample and the soil in her backyard to demonstrate that the sample was taken from the her backyard.

3. Evidence about a Process or System

Citizen scientists can also **provide information about a process or system** to authenticate evidence.³⁵ For example, to show that a sample contains contaminated river water, citizen scientists can provide additional evidence about their sampling procedures. This evidence could include a Quality Assurance Project Plan (“QAPP”) detailing protocols, guidelines, and/or sampling instructions, combined with evidence that the citizen scientist followed the QAPP when collecting, storing, and transporting the samples. To prepare for potential challenges to the

³² Fed. R. Evid. 901.

³³ See Fed. R. Evid. 901(1).

³⁴ See Fed. R. Evid. 901(4).

³⁵ See Fed. R. Evid. 901(9).

authenticity of samples, citizen scientists should seek to follow generally accepted best practices for the particular sampling activity—as outlined by the EPA or another agency—consistently across the entire sampling program.

4. *Self-Authenticating Evidence*

In addition to the three authentication techniques described above, evidence can be “self-authenticating.” **“Self-authenticating” evidence does not require other evidence or testimony for it to be authenticated.** One particularly relevant example is “[a]n inscription, sign, tag, or label purporting to have been affixed in the course of business and indicating origin, ownership, or control.”³⁶ This possibility for self-authentication suggests that a best practice for sampling is to consistently label all samples with an indication of what the sample is and a printed logo or name of the organization that collected the evidence. By adopting consistent labeling protocols, citizen scientists and citizen groups can ease the burden of authenticating evidence by attempting to categorize samples as self-authenticating.

Best Practice:
Label all samples with a unique identifier describing the sample’s location, the date and time when the sample was collected, and your organization’s name or insignia.

To help demonstrate that evidence is what citizen scientists claim it is, citizen scientists should also create defensible “chains of custody” by tracking where evidence moves and when it changes hands. Tracking evidence in this way will enable citizen scientists to establish that evidence moved from point A to point B, and only from point A to point B. By creating this chain of custody, citizen scientists can show that evidence was not altered or tampered with. While laboratories will typically produce their own chains of custody tracking each sample analyzed, citizen scientists are responsible for tracking their samples, including storage techniques relevant to the sample’s preservation, prior to delivery to the lab for analysis.

Satisfying the requirement of authentication does not guarantee that evidence will be admissible in court. Citizen scientists’ evidence will also need to clear other evidentiary obstacles, such as the rule against hearsay described above. As with the other information presented in this manual, citizen scientists’ attorneys should consult the rules of evidence and case law in the jurisdiction in which they anticipate litigation.

³⁶ See Fed. R. Evid. 902(7).

D. State and EPA Credible Data Rules

Some state legislatures have passed “credible data” statutes limiting what kinds of data can be submitted to state environmental agencies to either inform environmental standards or instigate agency action.³⁷ Several of these state rules allow volunteer and citizen groups to submit data to the state EPA from various sources, including state agencies, watershed groups, schools, local volunteers, and citizen groups.³⁸ Generally, states’ credible data rules are more stringent than the federal EPA’s credible data regulations.³⁹ Though courts may not apply these “credible data rules” to decide whether citizen science evidence submitted in litigation was admissible, plaintiffs in these states could potentially use the recommended sampling and/or analytical methodologies outlined in state or federal credible data rules as a way to show their own data’s reliability.

³⁷ As of this writing, five states—Iowa, Montana, Ohio, Washington, and Wyoming—have passed credible data laws or have credible data rules. *See* Iowa Code 455B.194; Mont. Code Ann. 75-5-702; Ohio Admin. Code 3745-4-02; Wash. Rev. Code Ann. 90.48.585; Wyo. Stat. Ann. § 35-11-302. Other states, like Florida, have passed environmental statutes that reference “credible data,” but do not define the term. *See* Fla. Stat. Ann. § 403.067.

³⁸ *See, e.g., Bd. of Comm’rs v. Nally*, 2013 Ohio App. LEXIS 2008, at *100 (Ohio Ct. App. May 23, 2013) (analyzing the Ohio Credible Data Rule, Ohio Adm. Code 3745-4-03).

³⁹ *See, e.g., Thomas v. U.S. EPA*, No. C06-0115, 2007 U.S. Dist. LEXIS 92201, at *33 (N.D. Iowa Dec. 17, 2007) (comparing Iowa’s Credible Data Rule to EPA credible data regulations contained in 40 C.F.R. § 130.7(b)(5), which requires consideration of data that is “existing and readily available”).

III. CASE STUDIES

The kinds and quality of evidence that may be admissible will depend on the facts of each case and the law(s) under which plaintiffs are suing. This section looks at some of the most common types of environmental claims that plaintiffs will bring and gives examples of and recommendations for how citizen science can be used to support those claims.

Specifically, we look at case studies examining the following potential uses of citizen science:

Statute or Legal Doctrine	Pollutant(s)	Use of Citizen Science Discussed
Clean Water Act (CWA) Citizen Suit	Water pollution from point sources	To prove an illegal discharge
Clean Air Act (CAA) Citizen Suit	Air pollution from stationary and mobile sources	To show standing to sue
Resource Conservation and Recovery Act (RCRA) Citizen Suit	“Solid wastes” (including semi-solid, liquid, and gaseous wastes) and hazardous wastes	To show “imminent and substantial endangerment”
Private and Public Nuisance	Water pollution, air pollution, smells, noises, blasting, vibrations, floods	To show interference with use and enjoyment of land, or with public health, safety, or comfort
Toxic Tort	Injuries caused by exposure to toxic substances	To establish facts

These examples are in general ordered from easiest to hardest: from those in which plaintiffs will least often need to retain a professional scientist as an expert witness to those that often require more than one expert and significant quantitative analysis. Each case study also focuses on a different stage or aspect of litigation in order to illustrate how evidentiary requirements can change throughout the course of a lawsuit.

A. *Establishing a Violation of the Clean Water Act*

The Clean Water Act (“CWA”) allows any person to sue anyone who is violating the Act by discharging pollutants into water bodies protected by the Act. **In these suits, known as “citizen suits,” you can get a defendant to stop violating the Act** either by seeking “injunctive relief”—which refers to when a court directly orders a defendant to take necessary actions to come into compliance—**and/or by deterring future violations** by making the defendant pay “**civil penalties,**” which are then paid into the Federal Treasury (see definition of “civil penalties” in the Glossary of Terms). Citizens cannot, however, recover personal damages in a CWA citizen suit. For this reason, if you have suffered personal harm from water pollution, you may want to combine a CWA claim with other civil claims such as a nuisance claim (see below) in order to try and recover personal damages in addition to civil penalties and/or injunctive relief.

To succeed in a citizen suit under the Clean Water Act, you will need to satisfy five different “elements.” These elements are that the polluter was responsible for: (1) a discharge (2) of a pollutant (3) from a point source (4) into navigable waters (5) without a permit or in violation of an existing permit. Many of these elements are legal terms of art with special meanings. It will therefore be important for your lawyer to do their own research into how the courts in your part of the country interpret these elements.

In a CWA citizen suit, plaintiffs can accomplish a great deal without an expert, either because the defendant must submit monitoring reports to EPA or a state agency or because certain kinds of pollutants can be easily observed and identified by laypersons. Citizen groups can often find information regarding current or historic permit violations online.⁴⁰ If the defendant has a permit, citizens can use the defendant’s public discharge monitoring reports (“DMRs”) to establish existing violations. Generally, citizen-generated quantitative data are needed only when challenging unpermitted discharges of an invisible or otherwise not easily identifiable pollutant.

Citizen scientists can play a significant role in producing evidence to support the first four CWA elements. These types of evidence are illustrated in the table below. However,

⁴⁰ EPA, *Enforcement and Compliance History Online*, <https://echo.epa.gov>.

evidentiary requirements often change depending on the pollutant(s), the source, and the receiving environment. For example, lay opinion testimony is often most persuasive when the pollutant at issue is common to people’s ordinary daily experience, and is visible and/or gives off a strong smell, like manure or oil sheens. Additional details regarding each element are included in the discussion below.

CWA Citizen Suit Elements	Evidence Must Show	Citizen Science Evidence
(1) Discharge of a (2) Pollutant	Presence of pollutant at discharge site	Eyewitness observations, photographs, video, water samples
(3) from a Point Source	Pollutant is channeled (does not flow in diffuse form)	
(4) into Navigable Waters	<i>Depends on your jurisdiction. Also subject to change pending new EPA rules.</i>	<i>Varies widely depending on the facts of the case.</i>
(5) without a permit or in violation of an existing permit	Lack of permit or violation of existing NPDES permit	Information in publicly available databases

If citizens wish to conduct their own sampling, they should begin by creating a sampling and quality assurance plan, and follow best practices outlined in the original citizen science manual.⁴¹ For groups interested in submitting those data as part of a citizen suit, documentation of the sampling and analysis process is especially important to ensure data admissible and can be relied on in court.

The CWA regulates the discharge of pollutants⁴² from “point sources” into “waters of the United States” through the National Pollution Discharge Elimination System (“NPDES”)

⁴¹ See *A Manual for Citizen Scientists Starting or Participating in Data Collection and Environmental Monitoring Projects* 57–62, <https://citizenscienceguide.com>.

⁴²The CWA defines “pollutant” as dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. This term does not mean (A) “sewage from vessels or a discharge incidental to the normal operation of a vessel of the Armed Forces” within the meaning of section 312 of this Act [33 U.S.C. § 1322]; or (B) water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil or gas production and disposed of in a well, if the well is used either to facilitate production or for disposal purposes is approved by authority of the

permitting program. Point sources include a variety of discharge points including pipes, sewers, and drainage ditches.⁴³ Point sources can also refer to discharges from publicly owned treatment works and industrial facilities, including concentrated animal feeding operations (“CAFOs”).⁴⁴ Parties can sue under the CWA in two circumstances: either when a party is violating an existing § 402 (NPDES) permit,⁴⁵ or when a party discharges pollutants without a permit.

In order to show a violation of the CWA, the plaintiff must produce evidence to prove five “elements”: that the defendant (1) discharged (2) a pollutant (3) from a point source (4) into navigable waters (5) without a permit, or in violation of an existing NPDES permit.⁴⁶ Citizen science can be used as evidence, or used in support of an expert’s testimony, to show most of these elements in court. In order to bring a citizen suit, the citizen must give the defendant, the state environmental agency, and EPA sixty days’ notice of the citizen’s intent to file suit. A suit cannot be brought, however, if the EPA or the state is “diligently prosecuting a civil action” to bring the defendant into compliance either in state or federal court.

1. Elements One and Two: Discharge of Pollutants

First, plaintiffs must show that the defendants have **discharged pollutants**.⁴⁷ Discharges can come from discrete pipes and outfalls, as well as surface runoff that is “collected and channeled by man” such as through diversion ditches, channels, or gullies.⁴⁸ Evidence of

State in which the well is located, and if such State determines that such injection or disposal will not result in the degradation of ground or surface water resources. 33 U.S.C. § 1362.

⁴³ Point sources are defined in CWA § 502 as “any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture.” *See also* 40 C.F.R. 122.2.

⁴⁴ The CWA regulations define CAFOs as animal feeding operations where animals are stabled or confined for a total of 45 days or more in any 12-month period in an area where neither crops, vegetation or crop residue is sustained. 40 C.F.R. § 122.23(b)(3).

⁴⁵ *See Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc.*, 528 U.S. 167, 174 (2000). The CWA also grants permits for dredging and filling as part of the so-called “wetlands program” under § 404. Because the CWA citizen suit provision does not include discharges under § 404, these permits will not be addressed here.

⁴⁶ 33 U.S.C. §§ 1311, 1342.

⁴⁷ Courts often combine the first and second elements into one inquiry given that it is “difficult to disentangle the evidence necessary to prove discharge from that needed to establish the presence of the pollutant.” *Envtl. Prot. Info. Ctr. v. Pac. Lumber Co.*, 469 F. Supp. 2d 803, 820 (N.D. Cal. 2007).

⁴⁸ *Comm. to Save Mokelumne River v. E. Bay Mun. Util. Dist.*, 13 F.3d 305, 308 (9th Cir. 1993).

discharges can include water samples, photographic and video evidence, and eyewitness accounts.⁴⁹ Whether this evidence is admissible, however, may depend on the nature of the pollutant and whether a layperson or expert collects or presents the evidence in court. In most cases involving permit violations, the evidence of discharge of a pollutant will come from the defendant’s own self-reporting, as required by its permit. The situations discussed below relate largely to cases where the defendant is discharging without a permit.

In one case, a non-profit environmental organization sued a **lumber company** for violating the CWA, alleging that the company’s drainage system used several **unpermitted point sources** to discharge **sediment** (a pollutant) into a nearby creek.⁵⁰ To support these claims, the organization presented **experts’ observations of “muddy water”** and “silts and sands discharged onto [the] hillside,” as well as photographs (see Appendix I), taken at the site **showing muddy water flowing through natural channels.**⁵¹ The court found that these observations were sufficient to establish the presence of sediment at discharge sites even where no samples had been taken. The court did not comment, however, if it would have accepted these observations, or given these observations as much weight, had they been from a layperson and not an expert.

⁴⁹ See e.g., *Pac. Lumber Co.*, 469 F. Supp. 2d at 819 (finding that plaintiffs sufficiently established the CWA discharge element at twelve different discharge points by providing eyewitness observations at each of the sites, photographic and video documentation of some of the discharges taken by experts, and measurements of turbidity levels at several discharge points sampled by experts).

⁵⁰ *Pac. Lumber Co.*, 469 F. Supp. 2d 803.

⁵¹ *Pac. Lumber Co.*, Lozeau Dec., Ex. Q-8 (photographs and report).

Where the **pollutant in question is visible and/or has a strong odor**, lay opinion testimony about the appearance or smell of that pollutant is often admissible, and can even be sufficient to establish the presence of that pollutant. For example, in one case, homeowners sued a municipal corporation that owned a sewer system.⁵² The plaintiffs presented eyewitness testimony from four lay people who stated that manholes from the defendant’s sewer system “contained feces, toilet paper, tampons, and other materials.”⁵³ Though the defendant argued that the lay witnesses lacked “sufficient expertise” to identify raw sewage, the court disagreed, ruling that a court may rely on lay witness’ observations to conclude that discharges contain raw sewage.⁵⁴ Similarly, in another case involving a marina employee who illegally discharged pollutants into a boat basin, the court relied on “circumstantial evidence” provided by several witnesses who testified to “seeing what appeared to be raw sewage on the storm grate.”⁵⁵

Even where the pollutant is visible and/or has a strong odor, **an expert may be required to show that a layperson’s observations or experiences are connected to a particular pollutant**. For example, in another case, the Sierra Club sued a city water and sewer commission for violating the terms of their NPDES permit.⁵⁶ A member of the Sierra Club testified that a river near the city’s water treatment plant “appeared to be dark and oily and smelled like petroleum products” and had an unpleasant odor.⁵⁷ The Sierra Club member did *not* opine, however, that the river actually contained oil or grease discharges. Instead, the Sierra Club introduced expert testimony stating that oil and grease discharges *could cause* the discoloration of water and odors that the member complained of.⁵⁸ Though oil and grease are substances most laypeople can readily identify, in

Best Practice:
In some cases, the defendant’s own public data can be sufficient to show a discharge. Citizens should first check EPA’s online database (<https://echo.epa.gov/>) for polluters in their area that are in violation of existing permits.

⁵² *Georgia v. City of E. Ridge*, 949 F. Supp. 1571, 1577 (N.D. Ga. 1996).

⁵³ The plaintiffs further supported this testimony with photographs and video of the manhole overflows. *Id.*

⁵⁴ *Id.*; see also *Concerned Area Residents for the Env’t v. Southview Farm*, 34 F.3d 114, 118 (2d Cir. 1994) (admitting lay witnesses’ observations of manure flowing in a swale).

⁵⁵ *U.S. v. Strandquist*, 993 F.2d 395, 398 (4th Cir. 1993).

⁵⁶ *Am. Canoe Ass’n v. City of Louisa Water & Sewer Comm’n*, 389 F.3d 536, 538 (6th Cir. 2004).

⁵⁷ *Id.* at 541.

⁵⁸ *Id.* at 543.

some cases plaintiffs will take a “belt and suspenders” approach, supporting lay eyewitness testimony with expert testimony to ensure that the testimony is admissible.

Citizen groups can **corroborate lay testimony with water sampling data**, which in turn may mean that courts give such testimony more weight. For example, in the marina case mentioned above, the court found that “the most compelling evidence” presented was water quality tests confirming witnesses’ testimony regarding the presence of raw sewage on the storm grate.⁵⁹ If plaintiffs decide to collect and introduce water samples as evidence of discharged pollutants, it is critical to follow best practices when collecting, labeling, and transporting samples.⁶⁰ Plaintiffs should also retain all collected samples (if possible) for the duration of the litigation in case defendants request independent verification of the sampling results.

Best Practice:
Keep all your samples throughout the course of litigation in case they need to be independently verified.

In other cases, particularly those **involving invisible pollutants and/or pollutants without an odor**, plaintiffs will need to collect water samples from the discharge point or the

Best Practice:
The more comprehensive and detailed your documentation, the better. Be sure to document every step of your sampling and analysis process and maintain those records throughout litigation.

receiving waters and have them tested in a lab to establish the presence of a pollutant. Before collecting samples, **plaintiffs should consider developing a sampling and quality assurance plan. Though plaintiffs need not develop a formal Quality Assurance Project Plan (“QAPP”)**, which would require EPA or state agency approval, plaintiffs can rely on the EPA’s QAPP guidance as a starting point in creating their sampling and assurance plan.⁶¹ The EPA’s guidance can help plaintiffs define their project, outline the project’s data quality objectives (“DQOs”), and delineate the appropriate sampling procedures to be

used. In addition to following these procedures in the field, **plaintiffs should be sure to**

⁵⁹ Though the water quality tests in this case were conducted by the government, the court makes no comment to suggest the data would be less persuasive if conducted by another party. *Strandquist*, 993 F.2d at 398.

⁶⁰ Chapter 5 of the original Citizen Science Manual includes a full discussion of designing sample collection, analysis and data interpretation methodologies. See *A Manual for Citizen Scientists Starting or Participating in Data Collection and Environmental Monitoring Projects*, Ch. 5, <https://citizenscienceguide.com>.

⁶¹ EPA has produced a Volunteer Monitor’s Guide to QAPPs that is available online: EPA, *The Volunteer Monitor’s Guide to Quality Assurance Project Plans* (Sep. 1996), https://www.epa.gov/sites/production/files/2015-06/documents/vol_qapp.pdf. An updated version is anticipated to be released in 2019.

document their sampling processes fastidiously so that this information can be introduced into evidence. Documentation of sampling protocols is critical to show the reliability of water sampling data. For example, in the logging case mentioned above, the plaintiffs submitted expert lab reports, including lab analyses of sediment concentrations found at several discharge sites. While the defendants argued that the experts' measurement techniques were unreliable, the court held that "in light of the eyewitness accounts of discharges at each location, [the defendant's] contentions merely raise[d] issues *as to the weight of the evidence*," but not its admissibility.⁶² The excerpt below provides one example of the level of detail that should be included in testimony regarding a water sampling process.

I arrived at the Kramer 1760 Facility at 9:45 a.m. I parked my car on Holmes Avenue, and exited my car near to the entrance gate facing Holmes Avenue. I observed a light drizzle falling and evidence of previous heavier rainfall. I then carried my portable cooler containing the Whirl-Paks and sampling bottles over to the westerly gate on Slauson, which is referred to as sampling location K1760-1. I could see a storm water discharge coming from inside the facility, which had run from underneath the gate, across the sidewalk and into the gutter on Slauson Avenue. The water discharging from this location had an oily sheen. Using my marker-pen, I then wrote onto the Whirl-Pak the date, time (to the minute), and the outfall location of the sample, which I marked as "K1760-1." True and correct copies of the photos I took at the Kramer 1760 Facility on February 11, 2007 are attached hereto marked Exhibit D. I took photos of the sampling location (see Exh. D at 47), and then took a water sample using the Whirl-Pak at the point at which the storm water discharge left the Kramer Facility and flowed onto the public sidewalk and down into the gutter on Slauson Avenue. I then placed the Whirl-Pak containing the sample from K1760-1 into the portable cooler, and moved on to check the next stormwater discharge outfall location.⁶³

The full declaration can be found in Appendix II.

⁶² Defendants alleged that the experts' measurement techniques were unreliable and may have artificially introduced sediment into the samples. Defendants also argued that at two sampling locations, the runoff flowed through natural materials before the experts took samples, which would "render the measurements of sediment unreliable." Defendants also contended that where no measurement of sediment had been taken, plaintiffs could not establish a discharge. *Pac. Lumber*, 469 F. Supp. 2d at 819 (emphasis added).

⁶³ *Baykeeper v. Kramer Metals, Inc.*, 619 F. Supp. 2d 914, 916 (C.D. Cal. 2009), Carreon Decl. ¶7.

2. Element Three: Point Source

Generally, courts have interpreted the definition of a point source broadly⁶⁴ to include, among other things, stormwater collected and channeled by pipes and culverts,⁶⁵ “surface runoff collected or channeled by the operator,”⁶⁶ CAFOs and liquid manure spreading operations,⁶⁷ bulldozers and dump trucks,⁶⁸ and generally any “watercourse through which intermittent waters typically flow,” such as swales or ditches.⁶⁹ In order to show that discharge points are in fact “point sources,” a plaintiff must provide evidence showing that each discharge point is a “discrete conveyance[] that channel[s] runoff.”⁷⁰ If, instead, water enters tributaries or navigable waters in a “diffuse form,” then the alleged source is not a “point source” under the CWA.⁷¹

While most agricultural discharges are excluded from regulation under the CWA, Congress explicitly defined “point source” to include **concentrated animal feeding operations (“CAFOs”)**.⁷² These types of sources present unique challenges in a CWA citizen suit because runoff may not flow from a CAFO out of a discrete pipe or culvert, but may instead flow naturally in a diffuse manner or seep into the ground. **Citizens should try to provide evidence of the pollutant being “channeled” by natural or manmade structures from the source to another water body.** It is not necessary for the conveyances to be man-

⁶⁴ *Dague v. City of Burlington*, 935 F.2d 1343, 1354 (2d Cir. 1991).

⁶⁵ *Driscoll v. Adams*, 181 F.3d 1285 (11th Cir. 1999).

⁶⁶ *Sierra Club v. Abston Constr. Co.*, 620 F.2d 41, 44 (5th Cir. 1980).

⁶⁷ *Concerned Area Residents for the Env’t v. Southview Farm*, 34 F.3d 114, 115 (2d Cir. 1994).

⁶⁸ See *U.S. v. Weisman*, 489 F. Supp. 1331, 1337 (M.D. Fla. 1980); *U.S. v. Holland*, 373 F. Supp. 665, 668 (M.D. Fla. 1974).

⁶⁹ *Rapanos v. U.S.*, 547 U.S. 715, 736 (2006).

⁷⁰ *Pac. Lumber Co.*, 469 F. Supp. 2d at 822.

⁷¹ In *Pacific Lumber Co.*, plaintiffs failed to provide evidence showing that for each of the discharge points that water was channeled and did not enter the tributary in diffuse form, and therefore failed to prove that the twelve locations are point sources. *Id.*

⁷² CAFOs are defined as lots or facilities where a minimum number of animals are confined for at least 45 days out of the year and no crops are grown on that same lot or facility. The required number of animals depends on the type (e.g. at least 200 mature dairy cows or 3,000 sheep or lambs). 40 C.F.R. § 122.23(a)(2).

made, so long as those conveyances are “reasonably likely to be the means by which the pollutants are ultimately deposited into a navigable body of water.”⁷³

For example, in one case, lay members of a citizen group observed and took photographs of liquid manure being collected and channeled “into and through a swale on the [defendant’s dairy farm] and through a drain tile leading directly into a stream which ultimately flows into the Genesee River.”⁷⁴ Though the dairy farm argued that this flow was “diffuse run-off,” the court held that the swale and drain tile coupled together qualified as a point source.⁷⁵ When collecting such photographic evidence, **citizens should be mindful of any so-called “ag-gag” laws**, which criminalize the collection of information related to certain agricultural activities on private property.⁷⁶ While these laws typically apply to whistleblowers seeking to document animal abuse, some laws have a wider scope where the language could also be used to criminalize the collection of environmental data.

3. Element Four: Navigable Waters

Plaintiffs in a CWA citizen suit must also prove that the defendant discharged pollutants from a point source into “navigable waters.” “Navigable waters” is a term of art; these waters need not literally be navigable by boat, and traditionally have included both waters that are navigable-in-fact and their non-navigable tributaries. In 1985, the Supreme Court held that “navigable waters” include “adjacent wetlands” that abut traditional navigable-in-fact waters.⁷⁷ On the other end of the spectrum, isolated ephemeral ponds are *not* considered “navigable waters.”⁷⁸

The precise legal definition of “navigable waters” for situations that fall in between these two poles is currently in flux. At the moment, the most recent Supreme Court interpretation is

⁷³ *Sierra Club v. Abston Constr. Co.*, 620 F.2d 41, 45 (5th Cir. 1980).

⁷⁴ *Concerned Area Residents for the Env’t v. Southview Farm*, 34 F.3d 114, 117 (2d Cir. 1994).

⁷⁵ *Id.*

⁷⁶ See *A Manual for Citizen Scientists Starting or Participating in Data Collection and Environmental Monitoring Projects*, Chapter 4, <https://citizenscienceguide.com>.

⁷⁷ *U.S. v. Riverside Bayview Homes, Inc.*, 474 U.S. 121 (1985).

⁷⁸ *Solid Waste Agency of Northern Cook County v. Army Corps of Eng’rs*, 531 U.S. 159 (2001).

from a 2006 case called *Rapanos v United States*.⁷⁹ The court split 4-1-4 in that case, leaving no single binding opinion. Justice Scalia’s plurality opinion restricted “navigable waters” to only include wetlands and streams with a “continuous surface connection” to a “relatively permanent” water body that is in turn connected to traditional navigable waters.⁸⁰ Justice Kennedy’s solo concurrence described a more lenient “significant nexus” test, which analyzes on a case-by-case basis whether a stream or wetland, “alone or in combination with similarly situated lands in the region, significantly affect[s] the chemical, physical, and biological integrity” of traditionally navigable waters.⁸¹ At the time of this writing, all circuit courts that have addressed this issue have found that waters satisfying Kennedy’s “significant nexus” test qualify as “navigable waters” under the CWA.⁸² EPA and the U.S. Army Corps of Engineers, however, have recently proposed a revision to the definition of “waters of the United States” that would more closely track Justice Scalia’s plurality opinion.⁸³

Citizens who want to bring a CWA citizen suit should try to produce as much site-specific, real-world data as possible to demonstrate a “continuous surface connection” and/or a “significant nexus” between the place where the discharge occurs and a traditionally navigable water.⁸⁴ The type(s) of evidence required will vary greatly from case to case, depending on the nature of the water body receiving the discharge and the distance and/or nature of that water body’s connection to the nearest traditional navigable water body. For example, in a 2004 case in the Northern District of California, an environmental nonprofit sued a city for unauthorized discharges into a pond formed from an old gravel mining pit.⁸⁵ The pond contained wetlands that bordered on additional wetlands adjacent to a navigable river. To show a “significant nexus” between the pond and the river, the court cited evidence including underlying geology and groundwater flows in the pond, history of the pond’s development, tree and wildlife species common to both the pond and neighboring wetlands, and chloride concentrations

⁷⁹ 547 U.S. 715 (2006).

⁸⁰ *Id.* at 744.

⁸¹ *Id.* at 780.

⁸² J.B. Ruhl, *Proving the Rapanos Significant Nexus*, 33 NAT. RESOURCES & ENV’T 1 (2018).

⁸³ Revised Definition of “Waters of the United States” (Proposed Rule), 84 Fed. Reg. 4154 (Feb. 14, 2019).

⁸⁴ Ruhl, *supra* note 82, at 3.

⁸⁵ *N. Cal. River Watch v. City of Healdsburg*, No. C 01-04686 WHA, 2004 U.S. Dist. LEXIS 1008, at *4 (N.D. Cal. Jan. 23, 2004).

measured in the river upstream and downstream of the pond, in the pond itself, and in a well located between the pond and river. **While citizens may be able to collect some of these data—such as water samples, dye tests, or species observations—experts will inevitably be required to interpret those data** to demonstrate that a “significant nexus” exists.

4. Element Five: Without a Permit, or in Violation of an Existing Permit

This element is fairly straightforward. The plaintiff bears the burden of showing that the defendant has violated an existing permit or discharged a pollutant without the appropriate permit. You can find whether the polluter has a permit and, if it has one, what discharges are allowed under the permit in EPA’s Enforcement and Compliance History Online (ECHO) database at <https://echo.epa.gov/>.

B. Establishing Standing in Clean Air Act Citizen Suits

The Clean Air Act (“CAA”) is a federal law that **regulates air emissions from both stationary sources (such as factories and power plants) and mobile sources (such as cars and trucks)**. Citizens can bring suit under the CAA against anyone (including federal agencies) who “is alleged to have violated (if there is evidence that the alleged violation has been repeated) or to be in violation of . . . an emission standard or limitation under [the] Act.”⁸⁶ Citizen groups can often search for information regarding current or historic permit violations online, or request copies of a defendant’s continuous emission monitoring (“CEM”) reports from their state environmental agency. The Act regulates the emissions of six priority or “criteria” pollutants, hazardous air pollutants, and in some cases, greenhouse gases. **The Act does not regulate odors** unless those odors are included in a state’s implementation plan.⁸⁷ The CAA does, however, regulate some odor-producing pollutants like sulfur dioxide, which produces a characteristic rotten egg-like smell and thus can be detected by the average citizen.⁸⁸

⁸⁶ 42 U.S.C. § 7604(a)(1).

⁸⁷ See *Concerned Citizens of Bridesburg v. U.S. EPA*, 836 F.2d 777 (3d Cir. 1987); *Save Our Health Org. v. Recomp of Minn., Inc.*, 829 F. Supp. 288 (D. Minn. 1993), *aff’d*, 37 F.3d 1334 (8th Cir. 1994).

⁸⁸ States may opt to regulate odor emissions in addition to the six “criteria pollutants” through their State Implementation Plans (SIPs) developed pursuant to the CAA. See e.g., *Save Our Health Org. v. Recomp of Minn.*, 829 F. Supp. 288, 292 (D. Minn. 1993). In addition, some states have passed laws addressing odors from particular sources, such as CAFOs. See Centers for Disease Control and Prevention, *Menu of State Laws Regarding Odors*

Compared to a CWA citizen suit, CAA citizen suits tend to be more data-intensive and dependent on expert input and testimony. Unlike the CWA, **the CAA does not contain a universal prohibition on all emissions without a permit.** Under the CAA citizen suit provision, you can sue only for violations of (a) emissions standards or limitations (generally listed in a permit), or (b) agency orders. You can seek an **injunction** and/or **civil penalties** of up to \$25,000 per day for each violation.⁸⁹ Definitions of “injunction” and “civil penalties” can be found in the Glossary of Terms.

This manual will not discuss every context in which citizen science evidence could be relevant to a CAA citizen suit. Instead, it will focus on one element: standing. In every lawsuit, plaintiffs must show that they have a particular legal interest in the outcome of the suit; a plaintiff with the requisite interest is said to have “standing” to sue. To establish standing, plaintiffs must show: (1) the plaintiff has suffered a concrete injury, (2) that injury is fairly traceable to the defendant's actions, and (3) it is likely that this injury would be redressed by a favorable decision in court. In the context of a CAA citizen suit, citizen science testimony and data can be used to establish both the “injury-in-fact” and the “fairly traceable” elements of standing, as summarized in the table below.

Standing Elements	Types of Evidence
(1) Injury-in-Fact	<ul style="list-style-type: none"> - Personal testimony including breathing or smelling contaminated air and health symptoms - Air quality monitoring data (especially for odorless, invisible pollution)
(2) Fairly Traceable	<ul style="list-style-type: none"> - Observations, photographs, and/or video of visible emissions - Air quality monitoring data - Online records of defendant’s permit violations

Citizens can sue under section 304 of the CAA for violations of (a) federally enforceable standards, and (b) an order issued by the EPA Administrator or a State with respect to such

Produced by Concentrated Animal Feeding Operations (Jan. 21, 2016), available at <https://www.cdc.gov/php/docs/menu-environmentalodors.pdf>.

⁸⁹ See 42 U.S.C. § 7604(g).

standard or limitation.⁹⁰ Federally enforceable standards include emission limitations that are part of an EPA-approved State Implementation Plan (“SIP”), a standard of performance for new sources (“NSPS”) under section 111, and a schedule or timetable of compliance.⁹¹ As with CWA citizen suits, in order to bring a CAA citizen suit, citizens must give the defendant, the state environmental agency, and EPA sixty days’ notice of intent to file suit. A suit cannot be brought, however, if the EPA or the state is “diligently prosecuting a civil action” to bring the defendant into compliance in state or federal court.⁹²

Emission standards under the CAA can be technically complex and specific to a particular industry or even facility. Thus, even if plaintiffs have access to monitoring data showing clear permit violations, they may still be forced into a “fact-intensive battle of the experts” to determine what actions the CAA’s technology-based standards require of that particular source.⁹³ Finally, plaintiffs should bear in mind that some stationary sources pre-exist the CAA 1970 amendments and have thus been “grandfathered” in. These sources are generally not subject to federal regulation unless they have since been modified or fall within a so-called “nonattainment area,”⁹⁴ though such sources may be subject to regulation under SIPs.⁹⁵

1. Standing Element One: Injury-In-Fact

The first element of standing requires that the plaintiff show an “**injury-in-fact**” that is “concrete and particularized” and “actual or imminent,” as opposed to “conjectural” or

⁹⁰ 42 U.S.C. § 7604(a)(1).

⁹¹ 42 U.S.C. § 7604(f). Some jurisdictions have held that in order for these schedules to be enforceable by citizens, they must be formally approved by EPA or adopted as part of the state’s SIP. *See Cate v. Transcon. Gas Pipe Line Corp.*, 904 F. Supp. 526, 532–33 (W.D. Va. 1995); *cf. Conservation Law Found. v. Fed. Highway Admin.*, 24 F.3d 1465, 1477 (1st Cir. 1994) (rejecting a line of cases holding that CAA citizen suits may only target “individual polluters or government actors that fail to comply with the specific requirements of a state or EPA implementation plan.”)

⁹² 42 U.S.C. § 7604(b)(1)(B). *See Grp. Against Smog & Pollution, Inc. v. Shenango Inc.*, 810 F.3d 116, 119 (3d Cir. 2016) (holding that citizen’s group failed to state a claim because administrative agencies were diligently prosecuting CAA violations and that prosecution required compliance with the Act).

⁹³ Jim Hecker, *The Difficulty of Citizen Enforcement of the Clean Air Act*, 10 WIDENER L. REV. 303, 307 (2004).

⁹⁴ Nonattainment areas are areas that have failed to meet National Ambient Air Quality Standards (NAAQS) for at least one of six priority or “criteria” pollutants. Plaintiffs can look online to see if they live in or near a currently designed nonattainment area. *Current Nonattainment Counties for All Criteria Pollutants*, EPA, <https://www3.epa.gov/airquality/greenbook/ancl.html> (last visited Mar. 4, 2019).

⁹⁵ “Modification” means any physical change in, or change in the method of operation of, a stationary source which increases the amount of any air pollutant emitted by such source or which results in the emission of any air pollutant not previously emitted. 42 U.S.C. § 7411(a)(4).

“hypothetical.”⁹⁶ Two federal courts of appeals have held that “**breathing and smelling polluted air is sufficient to demonstrate injury-in-fact** and thus confer standing under the CAA.”⁹⁷ If the pollutants do not give off a unique odor and/or do not produce commonly understood health effects, quantitative data may be needed to show plaintiffs’ injury. For example, asthma and other respiratory symptoms can result from the inhalation of vehicle emissions including ozone and particulate matter (“PM”). In one case, the Natural Resources Defense Council (“NRDC”) challenged the National Highway Traffic Safety Administration’s (“NHTSA”) indefinite delay of a previously published rule that increased civil penalties for vehicle emission standards violations.⁹⁸ One NRDC member, Janet DietzKamei, included in her testimony vivid descriptions of how she had been diagnosed with severe asthma and experienced debilitating asthma attacks since moving to Fresno.⁹⁹ DietzKamei also testified that she relied on two home air quality monitors—a Purple Air monitor and a monitor from the Air Resources Board District—that recorded hourly concentrations of ambient particulate matter (“PM”) and ozone in order to decide when she could safely leave her home. Though her testimony did not include specific data from those monitors, the court found that DietzKamei’s, along with the other NRDC members’, “well-documented dangers associated with automobile emissions” were sufficient to establish injury-in-fact.

2. Standing Element Two: Fairly Traceable

The second element of standing requires the plaintiff to show a “causal connection between the injury and the conduct complained of.” In other words, the **harm must be “fairly traceable” to the defendant’s actions.**¹⁰⁰ Plaintiffs need not show “to a scientific certainty” that the injuries they suffered are the result of defendant’s actions.¹⁰¹ To establish standing, plaintiffs also need not show that the plaintiffs’ injuries are linked to exact dates or times when the

⁹⁶ *Lujan v. Defenders of Wildlife*, 557 U.S. 555 (1992).

⁹⁷ *Texans United for a Safe Econ. Educ. Fund v. Crown Cent. Petroleum Corp.*, 207 F.3d 789, 792 (5th Cir. 2000) (plaintiffs suffered an injury-in-fact when suffered repeated exposure to “overpowering” sulfurous odors in their homes and yards); *NRDC v. U.S. EPA*, 507 F.2d 905, 910 (9th Cir. 1974).

⁹⁸ This case is an example of the second type of citizen suit—one against an agency for failure to comply with a nondiscretionary duty. *NRDC v. Nat’l Highway Traffic Safety Admin.*, 894 F.3d 95, 111 (2d Cir. 2018).

⁹⁹ *Id.*, Dietzkamei Decl. ¶¶ 9–15.

¹⁰⁰ *Lujan*, 557 U.S. at 590.

¹⁰¹ *Pub. Interest Research Grp. v. Powell Duffryn Terminals*, 913 F.2d 64, 72 (3d Cir. 1990).

defendant is known to have violated the CAA or other regulatory standards.¹⁰² For example, in one case, a citizen organization, Texans United for a Safe Economy Education Fund, sued a nearby oil refinery for exceeding emissions standards for sulfur dioxide. The plaintiffs presented circumstantial evidence including (1) testimony that plaintiffs observed smoke from defendant’s plant at the same time that they smelled “sulfurous odors,” (2) expert evidence showing excess sulfur dioxide emissions in the neighborhood where plaintiffs reside on days when the plant experienced “process upsets,” and (3) evidence showing how frequently the plant exceeded federal sulfur dioxide emission limits.¹⁰³ The court ruled that this evidence was sufficient to establish that “the injuries Texans United complain of are ‘fairly traceable’ to [the defendant’s] emissions.”¹⁰⁴ Though the emissions data in this case were collected by experts, **citizen scientists could presumably collect similar data in their own neighborhoods using reliable, affordable air quality monitors.**¹⁰⁵

Alternatively, plaintiffs can show that defendants violated existing emission permit limits and that those emissions contribute to the type of types of injuries asserted, though this latter assertion will generally require expert testimony.¹⁰⁶ If plaintiffs can present such evidence, defendants must then show either that (1) the defendant did not in fact exceed its permit limits, or that (2) plaintiffs’ testimonies that they smelled and/or observed the pollutants are untrue.¹⁰⁷ Plaintiffs can also rely primarily on a defendant’s reports and data produced from continuous emissions monitors (“CEMs”) in order to establish violations of emission standards or limitations.¹⁰⁸

¹⁰² *Texans United*, 207 F.3d at 793.

¹⁰³ *Id.*

¹⁰⁴ *Id.*

¹⁰⁵ The EPA’s Air Sensor Toolbox website provides citizen scientists with information on how to select affordable, portable air sensors and interpret the results. *Air Sensor Toolbox for Citizen Scientists, Researchers and Developers*, EPA, <https://www.epa.gov/air-sensor-toolbox> (last visited Mar. 4, 2019).

¹⁰⁶ See e.g., *Pub. Interest Research Grp. v. Powell Duffryn Terminals*, 913 F.2d 64, 73 (3d Cir. 1990) (plaintiffs’ observations of water with a greasy or oil sheen sufficient to show injury “fairly traceable” to defendant where defendant discharged oil and grease in excess of its permit limits).

¹⁰⁷ *Id.* at 73 n.10 (citing *U.S. v. SCRAP*, 412 U.S. 669, 687 n. 10 (1973)).

¹⁰⁸ *Sierra Club v. Pub. Serv. Co.*, 894 F. Supp. 1455, 1461 (D. Colo. 1995) (holding plaintiffs’ reliance on defendants’ CEM reports and data, obtained from the Colorado Dept. of Health, provided “undisputed evidence of defendants’ continuous violations.”)

3. Standing Element Three: Likely Redressed

The third standing element requires that it be “**likely**,” and not merely “speculative,” that plaintiff’s injury will be “**redressed** by a favorable decision”¹⁰⁹ granting injunctive relief and/or civil penalties. Plaintiffs can show **injunctive relief** is appropriate by producing evidence that defendant’s emissions “contribute[] to the pollution” injuring plaintiff; it is not necessary to show that an injunction will prevent *all* emissions of the pollutants affecting plaintiffs.¹¹⁰ In addition, plaintiffs must produce evidence showing defendants have failed to comply with existing permit limits.¹¹¹ Plaintiffs can show that **civil penalties** are appropriate for “violations that are ongoing at the time of the complaint and that could continue into the future undeterred,”¹¹² thus making penalties necessary in order to deter these likely future violations.

C. Establishing an Imminent and Substantial Endangerment under the Resource Conservation and Recovery Act (RCRA)

The Resource Conservation and Recovery Act (“RCRA”) regulates hazardous and other non-hazardous solid, semi-solid, liquid, and gaseous wastes.¹¹³ **RCRA’s citizen suit provision enables citizens to bring actions (1) against past or present generators, transporters, and/or owners of a waste treatment or disposal facility (2) who have contributed or are contributing to storage, treatment, transportation, or disposal of wastes (3) that present an “imminent or substantial endangerment to health or the environment.”**¹¹⁴ One of the most important features of RCRA’s citizen suit provision is that **plaintiffs do not need to prove that there is actual or immediate harm, just that there is an**

¹⁰⁹ *Lujan*, 557 U.S. at 591.

¹¹⁰ *Texans United*, 207 F.3d at 793 (citing *Sierra Club v. Cedar Point Oil*, 73 F.3d 546, 550 (5th Cir. 1996)).

¹¹¹ *Id.* at 795.

¹¹² *Friends of the Earth, Inc. v. Laidlaw Env'tl. Servs. (TOC), Inc.*, 528 U.S. 167, 173 (2000).

¹¹³ *Criteria for the Definition of Solid Waste and Solid and Hazardous Waste Exclusions*, EPA, <https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions> (last visited Mar. 4, 2019).

¹¹⁴ Resource Conservation and Recovery Act § 7002(a)(1)(B).

existing risk of substantial harm.¹¹⁵ This section discusses ways in which different forms of citizen science can help support and strengthen RCRA citizen suits.

Given that a finding of an “imminent and substantial endangerment” is the key object of a RCRA citizen suit, citizen scientists’ attorneys should familiarize themselves with how courts in their jurisdictions have interpreted “imminence” and “substantiality” in the context of RCRA.¹¹⁶ The purpose of this section is not to provide a comprehensive overview of the intricacies of RCRA-related case law, but instead to suggest how citizen science might play a role in strengthening one’s case in a RCRA citizen suit and to identify potential evidentiary obstacles that citizen scientists might confront in court. **In general, citizen science can contribute to RCRA citizen suits by supporting three categories of evidence: evidence about the presence of contamination, evidence about the pathways of exposure to contamination, and evidence about the types of harm caused by contamination. To demonstrate the types of harm caused by contamination, however, citizen scientists will often need to hire experts to testify.**

When bringing a lawsuit under RCRA’s citizen suit provision, citizen scientists and their attorneys should bear in mind a few features of RCRA that differ from citizen suits under other environmental statutes. Most importantly, in order to prevail in a RCRA citizen suit, plaintiffs do not need to prove that there is *current or past* harm, just that “there must be a threat which is present now, although the impact of the threat may not be felt until later.”¹¹⁷ Other important features of the citizen suit provision include that plaintiffs cannot recover environmental response costs,¹¹⁸ bring a lawsuit regarding a petroleum leak,¹¹⁹ or bring a lawsuit for waste that

¹¹⁵ See, e.g., *Parker v. Scrap Metal Processors, Inc.*, 386 F.3d 993, 1015 (11th Cir. 2004).

¹¹⁶ See generally *Cox v. City of Dallas*, 256 F.3d 281 (5th Cir. 2001) (explaining in detail the requirements of “imminent and substantial endangerment”).

¹¹⁷ See *Meghrig v. KFC Western*, 516 U.S. 479, 486 (1996).

¹¹⁸ See Randall J. Butterfield, *Environmental Reform in an Era of Political Discontent: Recovering Environmental Cleanup Costs Under the Resource Conservation and Recovery Act: A Potential Solution to a Persistent Problem*, 49 VAND. L. REV. 689, 702 (1996).

¹¹⁹ See *Meghrig*, 516 U.S. at 485.

has already been cleaned up.¹²⁰ Finally, when considering who to bring suit against, attorneys should take note of the broad category of potential defendants in a RCRA citizen suit. RCRA’s citizen suit provision defines potential defendants as:

“any person . . . including any past or present generator, past or present transporter, or past or present owner or operator of a treatment, storage, or disposal facility, who has contributed or who is contributing to the past or present handling, storage, treatment, transportation, or disposal of any solid or hazardous waste which may present an imminent and substantial endangerment to health or the environment.”¹²¹

Three types of testimony can be helpful in establishing standing in RCRA cases: (1) testimony showing the **presence of contamination**, (2) testimony showing that a **pathway to exposure exists** such that the contamination could cause harm, and (3) testimony about the **type of harm** that results if the contamination moves along the pathway of exposure. The cases below serve as examples of how each of these three types of testimony can be helpful in establishing standing and findings of “imminent and substantial endangerment” in RCRA citizen suits:

- ***Testimony related to the presence of contamination:*** In one case, plaintiffs were able to help demonstrate standing under RCRA by reporting their observations of the appearance of snakes and rats in their backyards since the beginning of illegal dumping.¹²² In addition to observations, sampling data is especially useful for demonstrating the presence of contamination.
- ***Testimony related to the pathways to exposure:*** In another case, a plaintiff, who lived near a waste site, helped to establish standing by testifying that she “ha[d] lived all of her life less than a quarter mile from [a contaminated] Site;¹²³ that “[she] continue[d] to be concerned about the risk to [her] health and the health of [her] son”;¹²⁴ and that she “[would] no longer walk near or use the river” as a result of the pollution.¹²⁵ **The District Court also pointed to several pieces of evidence indicating the existence of an**

¹²⁰ *Id.* at 485–86.

¹²¹ 42 U.S.C. § 6972(a)(1)(B).

¹²² *See Cox v. City of Dallas*, 256 F.3d 281, 305 (5th Cir. 2001).

¹²³ *Interfaith Community Org. v. Honeywell Int’l, Inc.*, 399 F.3d 248, 255 (3d Cir. 2005).

¹²⁴ *Id.*

¹²⁵ *Id.*

“imminent and substantial endangerment,” including millions of holes in a plastic liner.¹²⁶

- **Testimony related to the types of harm that contamination causes:** In another case, plaintiffs testified to the impact that mercury had on their lives, including the fact that they were no longer eating fish from a river because they were concerned that the fish had dangerous levels of mercury that may have harmed their health, and that they had also refrained from fishing or swimming in the river.¹²⁷ The testimony in this case, however, was used to establish plaintiffs’ standing; a higher showing is likely required to establish that a contaminant causes harm sufficient to establish an imminent and substantial endangerment. See below for a discussion of expert testimony on this point.

While citizen science can provide support for “imminent and substantial endangerment” claims under RCRA, it is still important to bear in mind the distinction between when expert testimony is required and when lay testimony is sufficient. Section II of the manual discusses that distinction in more detail. **In one RCRA case, plaintiffs were required to hire an expert witness to testify to the following:**

- That groundwater migrated beneath a landfill and did not become surface water until it reached a pond; and
- That a culvert (a tunnel carrying a stream under a road) on the south end of the pond was “located directly on the outflow of the pond . . . [and] flows from the southern part of the creek in a southeasterly direction.”¹²⁸

Best Practice:
When “specialized” or technical knowledge about ecological processes is required for testimony, citizen scientists should hire experts with such knowledge to testify.

In the case above, lay witnesses testified that:

- Based on personal experience, the color of the water had changed over time;
- Based on visual observations, the creek supported new wildlife, including catfish, rabbits, ducks, raccoons, and black snakes; and

¹²⁶ *Id.* at 261.

¹²⁷ *See Me. People’s Alliance v. Holtrachem Mfg. Co, Inc.*, 211 F. Supp. 2d 237, 253–55 (D. Me. 2002).

¹²⁸ *See Aiello v. Town of Brookhaven*, 136 F. Supp. 2d 81, 86–87 (E.D.N.Y. 2001).

- Orange sediments and contamination were coming from culvert pipes flowing underneath and coming out of the south side of a road.¹²⁹

Some of the information that lay witnesses were able to testify to in this case required *some* background ecological knowledge, but not extensive technical or specialized ecological knowledge. If information requires technical or specialized knowledge, citizen scientists should err on the side of caution and hire an expert to testify.

If hiring an expert becomes necessary, the expert must satisfy the requirements of expert testimony articulated by the Supreme Court in *Daubert*. Several other cases are instructive on what kinds of things experts should testify to when attempting to establish the elements of a RCRA claim. Like citizen scientists, experts can and should testify, if possible, regarding the presence of contamination, the pathways to exposure of contamination, and the types of harm caused by contamination.

Best Practice:
Expert witnesses should provide detailed, quantitative testimony about the presence of contamination, the pathways to exposure, and the harms or potential harms caused by contamination.

Of these three aspects of “imminent and substantial endangerment” claims, expert testimony is most useful for showing the types of harm caused by contamination. In one case, plaintiffs conducted sampling in response to a threat of lead contamination.¹³⁰ The court held that the plaintiffs’ sampling did not demonstrate an “imminent and substantial endangerment” where the plaintiff’s expert witness failed to discuss the likelihood or severity of harm.¹³¹ By contrast, in another case about contamination of a river, expert testimony successfully contributed to a finding of “imminent and substantial endangerment” when the expert testimony demonstrated that the river contained elevated levels of mercury,¹³² that the amount of mercury was growing as it traveled down the food chain,¹³³ and that, therefore, dangerously high levels of mercury might be present in fish and other seafood consumed by the public.¹³⁴ **One best practice stemming from these**

¹²⁹ *Id.*

¹³⁰ See generally *Simsbury-Avon Preservation Club, Inc. v. Metacon Gun Club, Inc.*, 575 F.3d 199 (2d Cir. 2009).

¹³¹ *Id.*

¹³² *Me. People’s Alliance v. Holtrachem Mfg. Co, Inc.*, 211 F. Supp. 2d 237, 251 (D. Me. 2002) (citing Joint Exs. 42 App. C–1, 44).

¹³³ *Id.* (citing Joint Ex. 29 at 17; Joint Ex. 32 at 1).

¹³⁴ *Id.* at 250.

two cases is for experts to provide detailed, quantitative testimony about the harm or potential harm caused by contamination whenever possible.

D. Citizen Science in Nuisance Suits

The case studies above demonstrate how citizen scientists can use their evidence to bring *citizen suits* under environmental statutes. In response to environmental harms, citizen scientists can also bring lawsuits under tort law. Unlike citizen suits, the elements of tort claims are not established by Congress, but instead by judicial rulings or by state legislatures. One type of tort claim that citizen science can support is a nuisance claim. **Two types of nuisance claims are available to plaintiffs: private nuisance claims and public nuisance claims.** To bring a successful claim for **private nuisance**, a plaintiff must show that another party’s conduct is interfering with the plaintiff’s use and enjoyment of land that she owns, and that the other party’s conduct is either (a) intentional or unreasonable, or (b) unintentional but negligent or reckless.¹³⁵ Examples of private nuisances include vibrations, blasting, destruction of crops, flooding, and pollution.¹³⁶ Public nuisance involves an “unreasonable interference with a right common to the general public.”¹³⁷ As with several other types of environmental suits, **citizen scientists’ observations can play a significant role in establishing the elements of private or public nuisance.** As with other kinds of lawsuits, **citizen scientists may need to hire experts to testify about information that requires “specialized knowledge” and to show that another party’s actions *caused* a private or public nuisance.**

In a private nuisance case, citizen scientists’ evidence and/or testimony can help demonstrate that another person’s conduct is interfering with private use and enjoyment of land. One case involving a contaminated river in Arkansas demonstrates the kinds of contributions that citizen science and citizen testimony can make. In 2015, residents of the Sulphur River Management Area in Arkansas notified the U.S. Fish and Wildlife Service

¹³⁵ See Restatement 2d Torts § 822; see also Restatement 2d Torts § 821D; *Daily v. Exxon Corp.*, 930 F. Supp. 1, 2 (D.C. Cir. 1996).

¹³⁶ See *Kellogg v. City of Albia*, 908 N.W.2d 822 (Iowa 2018).

¹³⁷ Restatement 2d Torts § 821B.

regarding their concern that contaminants from four industrial facilities were threatening fish and wildlife in the area.¹³⁸ The U.S. Fish & Wildlife Service conducted a study by sampling water, sediment, and fish at various points along the river and found the presence of toxins in the area.¹³⁹ The residents of the area responded by bringing a private nuisance suit. One of the residents testified that four of the samples in the Fish & Wildlife Service study were taken from his property.¹⁴⁰ Several other residents testified about the sights and smells that they experienced on their property, which they attributed to contamination from the industrial facilities.¹⁴¹ Ultimately, the residents did not prevail in the nuisance suit. The court reasoned that the results of the Fish & Wildlife Service study only demonstrated that there was contamination in the watershed, but not on the industrial facilities' property specifically. Additionally, the residents' testimony simply established that the residents' property was tested, but not that contamination was found at those sites specifically. Finally, the residents' testimony did not identify the *sources* of their sights and smells.¹⁴²

This case demonstrates one way in which citizen testimony, based on observations, can play a role in helping to satisfy the elements of nuisance.

The Arkansas nuisance case demonstrates one role that citizen science and testimony can play in establishing private nuisance claims. Residents of the Sulphur River Management Area, relying on the Fish & Wildlife Service study, would have been much more likely to show that the industrial facilities had caused a private nuisance had the residents (a) conducted or encouraged the Fish & Wildlife Service to conduct more targeted sampling on the industrial facilities' property and on their own property, and (b) testified about the *sources* of their sights and smells. While the court accepted the residents' testimony as true, it ruled that the residents' testimony was insufficient to establish a successful nuisance claim. **A few best practices for nuisance lawsuits emerge from this case. When applicable, citizen scientists should conduct sampling in different locations and label their samples with information**

¹³⁸ See, e.g., *Cross v. Western Waste Industries*, 469 S.W.3d 820, 822–23 (Ark. App. 2015).

¹³⁹ *Id.* at 823–24.

¹⁴⁰ *Id.* at 824.

¹⁴¹ *Id.*

¹⁴² *Id.*

about the sources of their samples. Additionally, citizen scientists’ testimony should provide as much detail as possible and describe the sources of any observations.

In public nuisance cases, plaintiffs must demonstrate that defendants are causing “an unreasonable interference with a right common to the general public.”¹⁴³ Factors that courts consider when determining whether a public nuisance exists include (a) whether the conduct significantly interferes with public health, safety, or comfort; (b) whether the conduct is unlawful; and (c) whether the conduct is permanent or long-lasting and has a significant effect on the public.¹⁴⁴

Citizen science and citizen testimony can play a role in demonstrating these factors. For example, in a California case, plaintiffs brought a public nuisance suit against a dairy company after the company’s operations polluted a nearby creek, caused nauseating odors, and gave rise to excessive mosquito and fly populations.¹⁴⁵ Several individual plaintiffs testified in the case

“that large piles of manure maintained on the premises, the open breeding of cattle, and the sight of afterbirth dragged to an open place by dogs offended their eyes; that animal noises in the night disturbed their ears; that stench from the barnyard and from manure born by surface waters onto their properties assaulted their nostrils; and that excessive fly specks which ‘blackened’ paint, made frequent repainting of homes and garages necessary.”¹⁴⁶

This case suggests that, **in public nuisance cases**, as is true in many other kinds of environmental lawsuits, **citizen scientists’ uses of their senses of sight, hearing, smell, and touch can play a powerful role in litigation.** Despite this promising role, citizen scientists and their attorneys may not want to rely *entirely* on testimony about senses. In a federal case in Florida, testimony that shower water smelled like gasoline, without additional testing of the water for chemicals or other substances, was insufficient to establish a nuisance.¹⁴⁷

As is also true in other kinds of environmental suits, citizens should keep in mind when expert testimony is required and when lay testimony is sufficient in court.¹⁴⁸ When testimony

¹⁴³ Restatement 2d Torts § 821B.

¹⁴⁴ *Id.*

¹⁴⁵ See *Wade v. Campbell*, 19 Cal. Rptr. 173, 174–75 (Cal. App. 1962).

¹⁴⁶ *Id.* at 174–75.

¹⁴⁷ See *De Zayas v. Bell S. Telecomms., Inc.*, 841 F. Supp. 2d 1257, 1259–60 (S.D. Fla. 2011).

¹⁴⁸ See *supra* Section II.

requires technical or “specialized knowledge,” citizen scientists should consult an expert to testify. In one nuisance case, a court required an expert to testify to the chemical composition of an effluent and the chemical reactions of various compounds present in water at various points in time; the same court admitted lay testimony regarding the color and odor of a river.¹⁴⁹ **Expert testimony will be especially useful when attempting to show that another party’s actions are causing harm to public health**, since showing causation often requires reliance on scientific findings.

E. Citizen Science in Toxic Tort Suits

Toxic tort lawsuits involve injuries caused by exposure to toxic substances. In many cases, a significant amount of time can pass between when someone is first exposed to a substance and the onset of symptoms. As a result, many toxic tort cases center on showing causation (a demonstration that exposure to *that* substance caused *this* injury) and determining who the defendants in a case should be. While toxic torts can involve a wide range of substances—from prescription drugs and vaccines to manufactured products—this manual focuses on toxic tort claims that can arise from exposure to toxic substances in the environment, namely through drinking water and ambient air.

Citizen science evidence can still play an important role in toxic tort cases, though this role is largely limited to providing fact, as opposed to opinion, testimony. **Toxic tort cases, perhaps more so than any other type of case discussed in this manual, will require expert testimony on multiple issues.** Experts will likely be needed to identify the toxin involved, to evaluate the extent of the plaintiffs’ exposure and how that exposure occurred, and evaluate the effects or symptoms of the exposure. **These experts need not be expensive environmental professionals.** Citizen groups can inquire at local colleges, universities, and government agencies for individuals, or recommendations of individuals, who can provide affordable or even pro bono expert services.

Toxic torts involve claims for “actual or potential physical injuries, emotional distress, property damages, and economic losses, . . . caused by substances in the air, ground, [or]

¹⁴⁹ See *Freeman v. Blue Ridge Paper Prods.*, 529 F. App’x 719, 720 (6th Cir. 2013).

water.”¹⁵⁰ Plaintiffs in toxic tort litigation can recover both compensatory and punitive damages, though states may have their own laws restricting damages in some way.¹⁵¹ In environmental toxic tort cases, the plaintiffs must show that there is some “reasonable connection” between an act or omission of the defendant and the damage the plaintiff has suffered.¹⁵² **Showing this connection, or proof of causation, in toxic tort is notoriously complex** given that the plaintiff’s injury is often due to chronic or repeated exposure to a chemical, the injury is the result of genetic or biochemical disruption in the body, and the injury may manifest only after a long latency period.¹⁵³ In toxic tort cases, the **statute of limitations generally does not bar causes of action brought after discovery of a disease or injury** related to the tortious conduct, even if there has been prior litigation between the parties of different claims based on the same conduct.¹⁵⁴ **Plaintiffs interested in bringing a toxic tort claim should first consult with legal counsel** to review the challenges associated with bringing a toxic tort claim in their particular jurisdiction and the evidentiary requirements for both lay and expert witnesses.

In addition to the general evidentiary requirements discussed above, **states may have their own standards for expert testimony in toxic tort cases.** In Texas, for example, plaintiffs seeking relief for injuries caused by exposure to or migration of a toxic substance must meet stringent proof requirements under the *Havner* standard.¹⁵⁵ *Havner* requires expert testimony in order to prove (a) the applicable standard of care, (b) that the defendant’s actions more than doubled plaintiff’s risk, as shown by two epidemiological studies, (c) that the plaintiff’s injuries were caused by defendant’s conduct, and (d) that the plaintiff’s injuries were not caused by other possible sources.¹⁵⁶

¹⁵⁰ TOXIC TORTS AND PRODUCT LIABILITY: CHANGING TACTICS FOR CHANGING TIMES 11 (Michael A. Brown ed., 1989).

¹⁵¹ *Id.*

¹⁵² *Elam v. Alcolac, Inc.*, 765 S.W.2d 42, 173 (Mo. Ct. App. 1988).

¹⁵³ Steve Gold, Note, *Causation in Toxic Torts: Burdens of Proof, Standards of Persuasion, and Statistical Evidence*, 96 YALE L.J. 376, 376 n.1 (1986).

¹⁵⁴ See *Ayers v. Jackson*, 202 N.J. 557, 584 (1987).

¹⁵⁵ See *Merrell Dow Pharms. v. Havner*, 953 S.W.2d 706 (Tex. 1997).

¹⁵⁶ See also *Bostic v. Georgia-Pacific Corp.*, 439 S.W.3d 332, 347-50 (Tex. 2014); *Merck & Co., Inc. v. Garza*, 347 S.W.3d 256, 259, 265–66 (Tex. 2011); *Borg-Warner Corp. v. Flores*, 232 S.W.3d 765, 770–71 (Tex. 2007).

While a layperson may submit evidence in a toxic tort case, **an expert is required to prove that the alleged injuries were caused by the defendant’s conduct.** In one case in Texas, the trial court found that a layperson was qualified to introduce two air quality samples she had collected with Summa canisters and a FLIR video (used for optical gas imaging) she had recorded.¹⁵⁷ Though the court did not question the layperson’s qualifications to collect those data, the court ultimately did not admit her affidavit on the grounds that the layperson was not qualified to testify that “emissions from [defendants’] oil and gas facilities caused [the plaintiffs’] medical symptoms.”¹⁵⁸ The Texas Court of Appeals affirmed, stating that the layperson’s testimony was “too conclusory and speculative, and therefore constitutes no legal evidence of a causal connection between the [plaintiffs’] alleged loss-of-use damages and the [defendants].”¹⁵⁹

IV. CONCLUSIONS

There is currently a great deal of uncertainty about the opportunities and challenges posed by the use of citizen science evidence in litigation. This uncertainty stems from the lack of existing case law addressing this issue, as well as the rapid improvements and increased availability of low-cost, mobile air and water quality monitoring devices. Nevertheless, there is a great and present need for citizens and citizen organizations to fill the enforcement gap left by federal and state environmental agencies.

Generally, the type, efficacy, and admissibility of citizen science evidence in litigation will depend on (a) the pollutants involved and how they move through the environment, (b) the nature of the injuries plaintiffs have experienced and/or are experiencing, and (c) the laws and/or legal doctrines under which plaintiffs bring their claims. These same variables also influence whether a layperson or an expert can testify to evidence or observations. The lawsuits least likely to require expert testimony and extensive sampling involve visible and/or smelly pollutants familiar to many citizens, like raw sewage. On the other end of the spectrum, cases involving an invisible, complex pollutant, exposure to which may produce injuries or harms after a significant latency period, will typically require expert testimony and extensive sampling.

¹⁵⁷ *Cerny v. Marathon Oil Corp.*, 480 S.W.3d 612, 627 (Tex. App. 2015).

¹⁵⁸ *Id.*

¹⁵⁹ *Id.* at 624.

V. OTHER RESOURCES

Other resources to consult alongside this manual are:

- EPA's [Quality Assurance Project Plan Development Tool](#), a manual compiled by EPA indicating how to draft a QAPP for water quality monitoring projects.
- EPA's [Enforcement and Compliance History Online \(ECHO\) Database](#), where citizens can search by zip code or facility name for existing permits, facility monitoring reports, and potential permit violations under the CWA, the CAA, RCRA, and the Safe Drinking Water Act ("SDWA").
- [EPA's Air Monitoring Toolkit](#), which provides information for citizen scientists and others on how to use and analyze data from low-cost, portable air quality monitoring technology. This website also includes a list of current workshops, trainings, and funding opportunities.
- If you are considering designing and/or participating in a citizen science project, it may be helpful to contact your regional EPA office. You can find contact information for your regional office [here](#).