

THE ETHICS OF COMMUNICATING SCIENTIFIC UNCERTAINTY: UNDERSTANDING HOW SCIENTISTS, ENVIRONMENTAL LAWYERS, AND JOURNALISTS TREAT UNCERTAINTY

WORKSHOP OVERVIEW

With a grant from the National Science Foundation's Paleoclimate Program, the Environmental Law Institute (ELI) organized and convened a multidisciplinary workshop entitled *The Ethics of Communicating Scientific Uncertainty: Understanding How Scientists, Environmental Lawyers, and Journalists Treat Uncertainty*. Around fifty participants from the fields of science, law, and journalism explored how they address scientific uncertainty on environmental and public health issues, subject to their respective professions' norms and ethical standards.

The workshop's stated goals were: (1) to facilitate effective cross-discipline communications by having participants better understand how their peers approach scientific uncertainty, and the ethical reasons underlying these approaches; and (2) to promote more transparent and constructive debate on major environmental and public health issues by highlighting normative constraints on the scientific, legal, and media professionals charged with communicating scientific uncertainty.

STEERING COMMITTEE

In May 2014, ELI staff convened a steering committee drawn from all three fields to advise on workshop design and help develop the invitation list. The committee included:

- Leslie Carothers, former ELI President and a Visiting Scholar at ELI;
- Neil Hawkins, Corporate Vice President of Environment, Health and Safety and Sustainability, Dow Chemical Company;
- Kenneth Olden, Director of the National Center for Environmental Assessment, U.S. Environmental Protection Agency;
- Scott Schang, Executive Vice President, ELI; and
- Bud Ward, Editor, *Yale Climate Connections*

PARTICIPANTS

With guidance from the steering committee, ELI issued workshop invitations to a broad cross-section of scientists, lawyers, and journalists representing different sectors, perspectives, and regions of the country, with participants drawn roughly equally from each of the three professions. Participant biographies are available [here](#).

PRE-WORKSHOP QUESTIONNAIRE AND READINGS

One month prior to the workshop, ELI sent an informal questionnaire to all participants, asking them to answer the following questions:

1. How do you define uncertainty? In general, how does your profession or institution define and attempt to address uncertainty, risk, unreliability, or incomplete information?
2. What personal experience do you have with addressing scientific uncertainty in the environmental and/or public health contexts?
3. With what audiences (peers, public, policymakers, clients, etc.) do you need to communicate about scientific uncertainty? What considerations go into communicating with each of these audiences?
4. What professional norms and ethical standards apply to your efforts to communicate scientific uncertainty? What constraints do they place on how you communicate scientific uncertainty to your audiences?
5. What do you see as the biggest obstacles to communicating about scientific uncertainty across professions (e.g., scientist to journalist, scientist to lawyer, lawyer to journalist)?
6. Are there good examples of managing or communicating about uncertainty in other professions or other policy areas that should inform this discussion?

ELI also distributed readings for participants to review. These readings introduced some basic elements of the ethics of uncertainty in science, law, and journalism, and laid the groundwork for three study topics to be discussed during the workshop: (1) climate change, extreme weather events, and uncertainty; (2) hydraulic fracturing and uncertainty; and (3) cumulative chemical exposure, environmental justice, and uncertainty. A table of contents and links to these readings are available [here](#).

PRE-WORKSHOP WEBINAR

On September 12, ELI hosted an online webinar, in which three panelists from the fields of science, law, and journalism discussed the ethics of communicating uncertainty in their respective professions. Moderated by ELI Senior Attorney Jay Austin, the webinar featured presentations from: George Gray, Department of Environmental and Occupational Health, George Washington University; Jim Hilbert, Expert Witness Training Academy, William Mitchell College of Law; and David Poulson, Knight Center for Environmental Journalism, Michigan State University.

All workshop participants were asked to attend or listen to a recording of the webinar. The webinar has been archived and remains available at <http://www.eli.org/ethics-of-uncertainty>.

WORKSHOP

On September 22-23, ELI hosted *The Ethics of Communicating Scientific Uncertainty* workshop at the Carnegie Endowment for International Peace in Washington, D.C. The full workshop agenda is available [here](#). After welcoming remarks by John Cruden from ELI and David Verardo from NSF and an introduction by ELI Senior Attorneys Jay Austin and Kathryn Mengerink, participants engaged in a round of introductions.

The first workshop panel, entitled *Communicating Uncertainty: Three Perspectives*, was moderated by ELI President John Cruden and featured remarks from Andrew Rosenberg of the Union of Concerned Scientists, Michael Traynor of Cobalt Law, and Seth Borenstein of the Associated Press. (Borenstein PowerPoint presentation is available [here](#).) Following the presentations, Mr. Cruden moderated a Q&A session with the panelists and audience.

Kathryn Mengerink of ELI then presented the results of the pre-workshop questionnaire and provided an opportunity for workshop participants to provide additional insight (see summary below). Following the questionnaire discussion, David Verardo, Director of the NSF Paleoclimate Program, introduced and moderated the second workshop panel, which presented the three case study topics. First, Paul Huttner of Minnesota Public Radio delivered a presentation on climate change, extreme weather events, and uncertainty. (Huttner PowerPoint presentation is available [here](#).) Next, David Bussard of U.S. EPA spoke about cumulative chemical exposure, environmental justice, and uncertainty. Finally, Marcia McNutt of *Science* magazine delivered a presentation on hydraulic fracturing and uncertainty. (McNutt PowerPoint presentation is available [here](#).) Following the presentations, Dr. Verardo moderated a Q&A session with the panelists and audience.

Workshop participants then divided into five self-selected breakout groups (three on climate, one each on chemical exposure and hydraulic fracking) to discuss the case study topics. The breakout groups discussed and reported back their answers to three questions: (1) What ethical and communication challenges relate to this issue from the scientific, legal, and journalistic perspectives? (2) What steps can be taken to overcome these challenges? (3) Can scientists, lawyers, and journalists overcome these challenges in a collaborative way? If so, how?

Kathryn Mengerink opened the second day by identifying the key challenges and potential solutions that had been discussed the previous day (see summary below). Next, the participants divided by disciplines, and Scott Schang of ELI and David Verardo of NSF charged these breakout groups to renew their focus on the ethics of communicating scientific uncertainty. They asked the participants to think about three questions: (1) How do the ethics of my profession affect how we communicate about scientific uncertainty? (2) How can we address the ethical or professional constraints on communicating scientific uncertainty? (3) What ways can we collaborate across professions to accomplish these objectives? Participants discussed these questions before reporting back to the plenary. The workshop finished with a plenary wrap-up session, followed by concluding remarks from David Verardo and John Cruden.

HIGHLIGHTS OF QUESTIONNAIRE RESULTS AND MEETING DISCUSSIONS**QUESTIONNAIRE RESULTS**

In answering the pre-workshop questionnaire, the meeting participants identified many issues that became topics of discussion at the workshop. This section provides a brief overview of the questionnaire results.

First, workshop participants provided input on **how to define uncertainty**. Many participants noted that at its core, uncertainty is about lack of information or knowledge. Some participants delved deeper and explored types of uncertainty, including epistemic or ontic uncertainty and uncertainty that is a result of forcing, models, and chaos. In addition participants noted that a variety of factors influence uncertainty, including the amount of data available, consistency across data sets and data types, and judgments about plausibility of data. Some participants noted that uncertainty is at times viewed as unreliability. However, as one participant noted, “uncertainty is not ignorance. Tacking back and forth across a stream of data is not the same thing as flip-flopping.”

When asked to discuss **how uncertainty is addressed**, participants’ responses often varied by discipline. Scientists discussed the use of confidence intervals, probabilistic statements, and statistical tests as a way to evaluate levels of uncertainty. They noted that addressing uncertainty depends on its source. To address forcing uncertainty, multiple scenarios are run. Use of multiple models helps address uncertainty in models. And multiple runs of the same model helps evaluate internal variability or chaos in the system. Finally, some respondents noted that uncertainty should be addressed with transparency when sharing results.

Lawyers had a very different perspective when considering uncertainty. In the legal context, several lawyers noted that uncertainty in facts and data are used as a weapon in the arsenal in adversarial and advocacy settings, while recognizing that rules of evidence and rules of legal ethics constrain how uncertainty is portrayed in such settings. In the policy and management realm, uncertainty is addressed through the precautionary principle, calls for research, monitoring and adaptive management.

Journalists often noted efforts to minimize uncertainty in their work through the use of multiple sources. In addition, some respondents noted that if too much uncertainty exists, a story may not be written at all. Finally, while constrained for space, some journalists indicated that discussing uncertainty may provide context for a news story.

When asked about **challenges with scientific uncertainty**, the respondents discussed both general challenges and challenges that relate specifically to communicating scientific uncertainty. General challenges include the following:

- Lack of understanding by the public, journalists, lawyers, judges and even scientists
- Misinterpretation of uncertainty as lack of credibility

- Use of uncertainty as an advocacy tool (lawyers and advocates using it to manufacture doubt, scientists using it to obtain recognition)
- Need for simplicity and clarity means that scientific uncertainty may not be discussed
- Uncertainty can lead to inaction as people may want firm predictions of the future before taking action.

Meeting participants either mentioned communication challenges that relate specifically to journalism or discussed the issue broadly. For journalists, communicating uncertainty is a challenge as it requires journalists to choose words carefully to remain accurate. While some view journalists as “dumbing down” the issues, journalists are writing for an audience with short attention spans who do not want details in many instances and who comes to the story voluntarily, making it difficult to effectively convey scientific uncertainty. In other words, nuance may be lost in the interest of brevity. Lack of consensus can lead to confused communication. “Balanced reporting” can distort public perception of levels of uncertainty. Some journalists may become advocates, especially as social media expands, meaning that uncertainty may be shared in a distorted way.

Questionnaire respondents also provided more general considerations about the challenges of communicating scientific uncertainty. These include the lack of standards, guidelines and best practices for how to communicate uncertainty. Some noted that mainstream scientists may avoid public communication, giving more voice to biased information-sharing by those with an agenda. Participants noted that lawyers, scientists and journalists are all targeting different audiences or the same audience for different reasons, leading to uncertainty being shared in different ways. When used for special-interest or political messaging, scientific uncertainty may be misrepresented. Finally, some noted that scientific uncertainty can be difficult to explain, so there are challenges for lawyers and journalists to understand and interpret scientific uncertainty.

When asked **how to overcome these challenges**, meeting participants provided several ideas. They called for clear and simple communication, but done carefully to ensure accuracy. Considering mechanisms and styles of communication, some called for multi-direction (not one-way) communication with audience, aiming for a dialogue. Some discussed the need to communicate in consistent, easily understandable ways, like the IPCC approach to discussing scientific uncertainty.

In trying to overcome miscommunication about uncertainty, participants found no easy solutions but provided some suggestions. These included calling for scientists to avoid taking sides and avoid advocacy, or to clarify when something is a fact versus an interpretation of the facts. Similarly participants indicated the need for scientists and others to indicate knowledge gaps and acknowledge uncertainty, and to avoid red-flag statements that can be misquoted.

Questionnaire respondents also reflected on the **ethics and professional norms of communicating scientific uncertainty**. For scientists, there is no unified code of ethics, but clarity, accuracy,

transparency, neutrality, honesty, and indicating knowledge gaps were all identified by various respondents as key elements of the professional or institutional norms that influence communication of scientific uncertainty. In contrast, many lawyers noted competing ethical obligations—on the one hand to advocate for a client and select data that best support the client, and on the other hand to refrain from using false data as a duty to the court. For journalists, ethical codes are in flux as technologies and the profession’s business models evolve. Independence, promoting understanding, accuracy, and fairness were identified as professional norms that provide context for how to address scientific uncertainty in communication.

Finally, when asked what fields might serve as **good examples for effective communication** of scientific uncertainty, one or more participants noted the following: insurance industry, medical industry (especially doctors), meteorology, and climate science (especially the IPCC).

In summary, the results of the questionnaire indicate how the three different professions, scientists, lawyers, and journalists, treat scientific uncertainty. Journalists often seek to reduce uncertainty with the use of multiple sources and research to identify scientific uncertainty. Lawyers and advocates often seek to maximize communication of scientific uncertainty as a tool to support a position. Scientists often seek to analyze and explain uncertainty, moving the field toward consensus.

DAY 1 CHALLENGES AND POTENTIAL SOLUTIONS IDENTIFIED

In a series of breakout sessions on the first day of the meeting, the meeting participants explored challenges to and solutions for communicating scientific uncertainty as it related to one of three fields—climate change, hydraulic fracturing, and chemical exposure. While each breakout session explored these individual issues in detail, some overarching observations about challenges and potential solutions were identified. The following table summarizes these observations.

CHALLENGE	SOLUTION
Lack of trust in the information being delivered	<ul style="list-style-type: none"> • Employ a “trusted messenger” whom the audience trusts • Plan for long-term engagement • Start a dialogue, not one-way communication • Undertake crowd-sourcing data collection as a way to get people to understand and accept data
Uncertainty leads to inaction	<ul style="list-style-type: none"> • Design solutions without perfect answers • Recognize that even if data aren’t perfect, they may contain important information. At the same time it is important to recognize utility and limitations of such data (e.g., downscaling climate models)
Too much uncertainty	<ul style="list-style-type: none"> • Undertake additional data collection, research

	<ul style="list-style-type: none"> • Work with funding community to set appropriate priorities
Wrong kind of information being researched and shared, leading to uncertainty about risk	<ul style="list-style-type: none"> • Develop new approaches to data collection and information-sharing requirements (e.g., chemical toxicity)
Scientists lack incentive to share data (within and beyond scientific community)	<ul style="list-style-type: none"> • Develop legal incentives for information-sharing
Scientists are poor communicators	<ul style="list-style-type: none"> • Make communication training part of the conditions for grants • Develop training programs • Give awards for good communication
Lack of connection between scientists, lawyers, and journalists	<ul style="list-style-type: none"> • Develop annual gathering like this meeting—institutionalize this conversation • Reach communities at earlier stages in their careers (e.g., in law school/graduate school) • Expand interdisciplinary education • Host seminars at AAAS meetings and other gatherings
Trend away from neutral information	<ul style="list-style-type: none"> • Design information-sharing systems that provide neutral information (e.g., rather than Google, “True-gle”)
Lawyers using uncertainty as tool in advocacy/litigation tool box	<ul style="list-style-type: none"> • Focus on role of lawyers as advisors and civic leaders
Different cultural perceptions	<ul style="list-style-type: none"> • Trusted messenger, messenger from community

DAY 2 PROFESSIONAL NORMS AND ETHICS OBSERVATIONS

On the second day of the workshop, scientists, lawyers, and journalists broke into groups by profession and explored the ethics and professional norms that influence communication of scientific uncertainty. This section briefly summarizes the key points of discussion in these sessions.

SCIENTISTS

The science breakout session first examined challenges with ethics and professional norms that relate to communicating scientific uncertainty. They focused on two types of issues: (1) misconduct; and (2) norms. First, the group discussed the fact that some scientists behave in ways that are violations of

professional and ethical standards when intentionally miscommunicating science in some instances, illegally obtaining information, etc. Beyond these acts of misconduct, the breakout group examined the internal and external norms that drive communication approaches. These included the system of academic reward, which emphasizes individual publication and recognition, leading to sharing individual results and accomplishments rather than more holistic sharing of information. Similarly, in the competitive sphere of academia and other sectors, scientists may suppress unpublished data, leading to ongoing scientific uncertainty. Also related to publication, the breakout team noted that negative data are not published, so scientific uncertainty may not be fully appreciated or understood. Other examples included the lack of reward for engaging with journalists and lawyers and enormous meetings that don't allow effective communication.

Solutions to these challenges include the need for synthesis-type approaches within and across fields of science so that the full suite of information on a given topic is evaluated and shared holistically. However, some members of the breakout group cautioned that synthesis teams could undermine efforts to question consensus and explore new avenues of research. To address this, the group discussed the need for "red teams" and minority opinions to be included in synthesis documents. Another solution focused on helping scientists communicate through the use of designated spokespeople and public affairs specialists who have the experience and knowledge base to share research results in a way that recognizes specific scientific achievements and the broader field or research. Finally, the group discussed the need for common norms across disciplines, training on communicating scientific uncertainty and the need for humility and recognizing academic scientists' roles in service to society.

JOURNALISTS

The journalist breakout group noted several challenges related to the ethics and professional norms of communicating scientific uncertainty. These included the desire to present balanced information that could in fact represent a false balance of information. However, several professional norms support improved approaches to communicating scientific uncertainty, including the journalist's role as an objective conveyor of information and role in informing the public.

To improve communications and overcome professional challenges, the breakout group identified the role of journalists in engaging with communities and uncovering information that would allow scientists and lawyers to delve deeper into an issue (providing the example of a reporter uncovering illness related to an asbestos mine in Montana). They described the need for mentors for people joining the profession. They also discussed the need for a broader, more clearly defined gap between journalism and advocacy.

LAWYERS

At the outset, the lawyer breakout group noted that truth is not per se the client's priority but recognized that lawyers at least do share the requirement to avoid flat-out untruth. Lawyers' obligations to clients can constrain their ability to fully communicate scientific uncertainty. Further, the group recognized that lawyers have many different roles: not only as litigators, but also as policy-makers, professors, legislative advisors, researchers, and more. Different ethical responsibilities and professional norms arise depending on which role lawyers are playing.

Even in a client-driven setting, recognizing the popular view of lawyer as advocate and potential deliverer of partial information, the group also discussed the role that lawyers play as provider of candid (and often privileged) legal advice. Further, the group noted that lawyers can encourage their clients to focus on long-term consequences of actions that ultimately may lead to broader sharing of information related to scientific uncertainty. Another role lawyers serve is as public citizen with a responsibility to more accurately portray scientific uncertainty. Other ideas that arose included ensuring that lawyers have enough scientific competence to be able to share information about scientific uncertainty.