

---

**SCIENCE**  
**AND**  
**TECHNOLOGY**  
**ADVICE**

**TO THE**  
*President,*  
*Congress,*  
**AND**  
*Judiciary*

---

EDITED BY

**William T. Golden**

**PERGAMON PRESS**

---

# Scientific Mediation and Technology Policy Convergence

Joel R. Primack and Nancy E. Abrams

In matters of technology, there is, in the United States, constant dispute. Our political system and legal procedures provide a large and shifting selection of moments when arguments can be made, and combatants value their rights to use these opportunities. What our system lacks are equally powerful methods for achieving technical and political consensus—for resolving disputes over technology policy in ways that are generally accepted to be technically sound and politically legitimate. In this article, we discuss two practical methods which, if used seriously, could not only advance the resolution of the problems to which they were applied, but also substantially raise the general level of debate and understanding about technology in this country.

“Scientific Mediation”<sup>1</sup> is a relatively simple and inexpensive procedure which can be extremely useful to policy-makers. It is designed for the very common situation where a decision regarding a technology must be made while significant scientific uncertainties concerning the consequences of utilizing the technology still exist. (It is only appropriate in situations where experts can legitimately differ, not in fake disputes like that, for example, between the Tobacco Institute and the American Cancer Society, where only large transfusions of money keep one side alive.) In legitimate technical

*Joel Primack is Professor of Physics, University of California, Santa Cruz. His research is on cosmology and particle physics, and he is an originator of a current leading theory of galaxy formation. He wrote Advice and Dissent: Scientists in the Political Arena with Frank von Hippel, and helped to create the American Physical Society's program of technical studies on public issues and the AAAS Congressional Science Fellowship Program.*

*Nancy Abrams is a lawyer and mediator who has developed alternative methods of dispute resolution for the Ford Foundation, the Congressional Office of Technology Assessment, the Government of Sweden, and private clients. She is the author of many articles on the application of innovative dispute resolution to scientific controversies and peace.*

disputes, there are generally scientists with impeccable credentials to be found on both sides of the question, and the decision-maker has no way of choosing whom, if anyone, to believe, except on the highly unreliable basis of preference for the personality of a particular scientist or, in a misguided use of democracy, the sheer weight of numbers of scientists on one side rather than the other. As Einstein said when told that Hitler was having a hundred eminent professors compile a book disproving relativity, "If it were true, one professor would be enough." Scientific Mediation allows the decision-maker, as well as eventually the press and public, to understand the technical dimension of the policy dispute, and to make an intelligent decision on that basis.

## HOW IT WORKS

This is how scientific mediation works.

1. The decision-maker, whether it be a judge, a government agency, or for that matter a corporation, determines what the question is. It must be a primarily technical, not political or economic, question. The most extensive use of Scientific Mediation so far has been in Sweden, where it was first applied to the question: "Is the electric utilities' plan for nuclear waste disposal safe and adequate?"<sup>2</sup> This is a largely technical question, even though it involves other elements.
2. The decision-maker then brings together three people: A) a mediator, who need not be a scientist, but must understand the technology policy-making process and be regarded as a person of stature by everyone involved; and B) two reputable scientists from relevant fields who hold opposite views on the policy recommendation, presumably because of their differing underlying scientific opinions. Each must be acceptable to the constituency for that position. (If there are three legitimate positions, then three scientists will be chosen. For the sake of brevity, however, we will outline the procedure on the assumption of two sides.)
3. The two scientists first list, in writing, the main areas on which they agree. This step, analogous to the making of stipulations in law, greatly narrows the dispute, since between any two scientists in the same or related fields, there is usually far more agreement than disagreement, and seeing this is important not only for the decision-maker, but for the scientists themselves.
4. The scientists then list the fundamental points relevant to the issue on which they do not agree.
5. With the help of the mediator, they now embark on the main task of Scientific Mediation: to explain in writing for each of the listed points precisely why they take the positions they do. Each must explain his/her reasoning to the satisfaction of the other one, and since both are experts, they cannot talk past each other. This step in practice resembles

cross-examination, except that the scientists do it with each other. There is no grand-standing and no audience. It is done in private with, at most, the mediator present.

6. They list and explain the areas, if any, in which further research is required before a responsible decision on the current question can be made.

Scientists generally collaborate only with other scientists with whom they agree, and so this is not a familiar task for them. The mediator throughout has three crucial responsibilities:

- A) To help smooth and maintain the working relationship.
- B) To keep the discussion relevant to the policy decision.
- C) To be sure the final product is in clear English with a minimum of technical jargon.

During the fifth step, the personal biases and assumptions of the scientists will surface and be separated to a great extent from their scientific opinions, because what has generally happened is that they have used these, as we all do, to fill in the gaps in their knowledge. They will probably not agree on a policy recommendation in the end (although on several occasions in Sweden, this unexpectedly occurred), but agreement is not the goal of the procedure. The goal is a readable report, signed by both scientists, which lays out the range of possibilities, explains what still needs to be known by a responsible decision-maker, and clarifies the nonscientific beliefs or even biases that may cause a person to come down in one place on that range rather than another.

The procedure is inherently unbiased and fair, and cannot be stacked like a committee. Each side has its say, in a finite amount of time, and the end result is that the reader of the report is in a far better position to make an intelligent decision than by simply relying on the prepackaged word of a scientist or committee.

## TPC

But what about the big technological issues that involve political, economic, ecological, and even moral dimensions? For example, how should the United States handle its nuclear waste problem? Or the AIDS epidemic? Or the arms race? Scientific Mediation can only be used on small aspects of such issues. We propose another procedure for such major questions, which we will call "TPC," standing for "Technology Policy Convergence" or, alternatively, "The Public Counts."<sup>3</sup>

TPC requires the government to accept the premise that the public matters, and should be listened to. The problem from the point of view of many decision-makers and experts, however, is that the public is narrow-minded and ignorant. People with strong opinions object to new technologies (or support them, for that matter) without understanding either the needs and

trade-offs of the larger political entity or the underlying technical issues. The preferred solution is frequently to exclude the public as much as possible. But it is then hardly surprising that disputes persist, and views become even more polarized.

It is true that much of the public is ignorant, but what goes unrecognized is that, on forefront technological issues, everyone, including the experts, is ignorant of the big picture. We will use nuclear waste disposal as an example to illustrate the method of TPC, although it could probably be applied to anything from health care priorities to national defense strategies.

TPC works like this. The people ultimately responsible for nuclear waste disposal should put forth a plan as to how they propose to do it. The federal government has volunteered to shoulder this burden, although we believe it should belong to the nuclear utilities. But either way, the plan should be constructed as a BEST FIRST EFFORT. It must not be a laundry-list of options but a complete plan, covering each step from extraction of spent fuel rods from the reactor to the form and location of the waste thousands of years in the future. It should also contain an explanation of the reasons behind the main technological choices, as well as unvarnished worst case analyses. It is to be understood, however, that the plan is a first draft only, and that criticism of the plan will be incorporated into the next iteration and not be taken as adversarial.

The plan should then be published and opened for scrutiny by a wide range of institutions with relevant expertise, such as universities, state governments, industry groups, energy agencies of foreign governments, and most especially public interest groups. These citizen groups must be adequately funded by the government to hire sympathetic scientists and engineers to perform a thorough analysis of the plan. At least one review, possibly by the White House or a special commission set up for the purpose, should be performed using Scientific Mediation, since this is the only procedure specifically designed to bring out the real trade-offs, both qualitative and quantitative, in such a technical plan.

The plan and reviews should then be discussed at a conference or series of conferences in major political centers such as Washington, DC. This would assure both attentive and sophisticated press coverage and attendance by the largest number of relevant decision-makers. The general understanding that would emerge from an effort of this kind is an absolute prerequisite not only to the development of a safe long-range plan but also to any kind of meaningful public participation, because it would only be at this point that the issues would be defined clearly enough so that the public could competently decide what was worth supporting.

The next version of the plan would likely be of incomparably higher quality, as well as being far more acceptable for implementation in a democratic society. This procedure would result not in perpetual confrontation, but in eventual convergence. And it would bring us, as a society, closer to the goal

of civilized cooperation that is becoming ever more crucial to human survival.

### NOTES

1. Nancy E. Abrams and R. Stephen Berry, "Mediation: A Better alternative to Science Courts," *Bulletin of the Atomic Scientists*, April 1977.
2. Nancy E. Abrams, "Nuclear Politics in Sweden," *Environment*, May 1979.
3. Nancy E. Abrams and Joel R. Primack, "Helping the Public Decide: The Case of Radioactive Waste Management," *Environment*, April 1980. Reprinted in Robert W. Lake, ed., *Resolving Locational Conflict*, (Center for Urban Policy Research, Rutgers University, 1987). A shorter version is Nancy E. Abrams and Joel R. Primack, "The Public and Technological Decisions," *Bulletin of the Atomic Scientists*, June 1980. Sweden has followed an interactive process such as we propose in developing its nuclear waste ("KBS") plan, which is now in its third iteration.