# 1

# Local Knowledge in Environmental Health Policy

## The Tensions between Communities and Professionals

How do environmental-health professionals typically deal with a situation like the controversy over air quality and public health after the World Trade Center collapse described in the introduction? Typically, environmental health seeks to identify the specific pollutants in the medium of concern. In this example, scientists attempt to delineate the individual toxins in the air. Once the pollutants are identified, they are assessed for their toxicity, or their potential danger and deleterious effects on humans generally. Next, each individual pollutant identified is assessed for its potential impact on humans exposed to the air pollution from the World Trade Center. Determinations of human-health impacts in a specific place generally include assumptions about the routes of exposure (e.g., inhalation in the case of air pollution), how much pollution certain groups are inhaling (e.g., children versus construction workers), and how long certain groups are exposed. The toxicity information and the exposure assumptions are combined to estimate the human-health risk from each individual pollutant contained in the World Trade Center air. This process of identifying each hazard and its toxicity to humans, estimating an individual's exposure to the hazard in a particular place, and extrapolating from this information an estimate of potential harm, is called *risk assessment*.

Risk has been the dominant frame through which environmental health is analyzed in the United States for at least the last thirty years (Fiorino 1989).[3] Risk, and its correlate risk assessment, implies that a problem can be clearly defined, quantified, and therefore managed. Once

some version of health risk is generated, the "benefits" from the source of the pollution or hazard are weighed against the pollution's "costs" to human health. At this stage, policy analysts and planners are charged with the often inevitable task of "risk management," or deciding how to weigh "costs and benefits" and inform policymaking.[4]

In the best risk-management processes, the analyst consults with the public that is being asked to bear a "risk" from the beginning of the hazard assessment (Krimsky and Plough 1988). However, more often analysts—perhaps feeling that professional training gives them ultimate discretion to carry out and implement decisions—omit the public from the decision-making process. Additionally, the analysts may find it difficult to divine what the scientists really found in their study, how the legislature, governor, or mayor wants the "costs and benefits" to be interpreted and administered, and what course is consistent with the "public interest." The analysts may feel that their agency is "captured" by private interest groups that are seeking to influence the analysis and any resulting regulation (Lowi 1969). The "captured agency" then might substitute private goals for those of the public at large because the constituency opposing the private sector may not be organized, the agency may rely on the private sector for resources necessary to implement particular programs, or because of the powerful influence industry has in local, state, and national politics.

In the midst of these potentially conflicting interests, the analysts or planners often decide that the tacit operating rule is that the best public is a quiescent one. The analysts might desire to faithfully represent the values and interests of citizens but be unsure what "representation" actually entails. They may ask whether political representation requires that an agency allow local people to participate in analyses and decision making. Recognizing that the success of environmental-health policy is often contingent on the willingness of ordinary citizens to accept the validity of official policy framings, the analysts might hold a public hearing. Hearings tend to open up to unlimited critical scrutiny expert findings that were generated in closed worlds of formal inquiry. These processes are often recipes for unending debate and spiraling distrust, leaving most participants unsatisfied and frustrated that, for instance, technical uncertainties were left unresolved. Thus, the planners may be torn between

holding a public hearing that might merely act as a forum to placate the demands of competing special interests groups or organizing some other public process that they have no experience in managing. Public officials, unsure of how to deal with these tensions and competing commitments, often try to work quietly, get the job done without disturbing the public "peace," and then often reassure everyone "out there" that there is no reason to be concerned or involved (Reich 1988, 124).

This description might oversimplify the risk-management process, but it highlights some of the tensions environmental-health professionals face when determining how best to use scientific analyses while simultaneously committing to democratic decision making.[5] One way to resolve this tension is to return to and challenge the "risk framework" that tends to dominate environmental health. In the risk frame, certain types of evidence and expertise are valued and other evidence and expertise is ignored. The risk frame tends to prefer formal and quantitative information and the participation of a select group of professionals trained in certain disciplines. For example, Jasanoff (1990) has noted how expert advisors in policymaking are chosen based on their technical competence, ability to construct "objective science," and political independence and neutrality. Experts protect their authority to deal with the uncertain science of risk though a sociological mechanism known as "boundary work."

Boundary work is a process where experts assign the array of issues and controversies lying between the two ideal typical poles of "pure science" and "pure policy" to one or the other side of the policy-science boundary (Gieryn 1995, 405). As Jasanoff observes:

When an area of intellectual activity is tagged with the label "science," people who are not scientists are *de facto* barred from having any say about its substance; correspondingly, to label something "not science" [e.g., mere politics] is to denude it of cognitive authority. (Jasanoff 1990, 14)

As a result, risk-based problem framing and decision-making processes largely ignore evidence that is more informal, experiential, tacit, and explicitly value laden (Wynne 1996; Irwin 1995). Lay publics, even when granted "entry" into policymaking through formalized public hearings, are required to offer evidence in a "voice" or language that mirrors that of experts. As a result, the quantitative risk frame in environmental health puts lay publics at a disadvantage from the outset and limits their

ability to participate in and influence decisions when compared to scientists and other professionals.

## Antecedents to Street Science

Attempts to bring local or lay knowledge into environmental health decision making are not new. From nineteenth-century Progressive Era reformers to 1960s and 1970s anti-toxics activism, today's street scientists are building on ideas and community-based practices that emerged over a century ago (Gottlieb 1993). While taking slightly different approaches and being labeled everything from "shoe-leather epidemiology" to "people's science," community-based science has played a role in shaping environmental-health research and political action. Yet, even before Progressive Era reformers enrolled local knowledge to address the health problems afflicting the urban poor, public-health work in Europe highlighted the importance of considering the social and community aspects of health.

A series of studies in the mid-nineteenth century gave rise to modern movements for community-based environmental health. For example, one of the first modern epidemiological studies of neighborhood health was performed by Louis René Villermé, who used statistics to study Paris neighborhoods in 1840 and demonstrated a clear connection between ill health and neighborhood poverty. In 1848, Rudolf Virchow documented the social causes of a typhus epidemic in Germany. He is credited for linking the biologic, social, and economic underpinnings of health and emphasizing that medicine and public health fail when they ignore the plight of the poor and working class (Rosen 1993).

Perhaps most influential on American reformers was the 1842 publication of Edwin Chadwick's *Report on the Sanitary Conditions of the Laboring Population in Great Britain,* and similar reports that soon followed documenting conditions in New York and Massachusetts (Duffy 1990). These reports stimulated the Sanitary movement in public health and highlighted how inferior living and working environments for the poor and immigrant populations were a key factor in their poor health (Melosi 2000). The Sanitary movement was part of a host of Progressive Era reforms that focused public-health interventions on cleaning up

urban neighborhoods and workplaces (Duffy 1990). One of the most well-known reform movements of this time was the Settlement House movement, best exemplified by Hull House in Chicago, where reformers such as Jane Addams, Alice Hamilton, and Florence Kelley founded the modern epidemiologic methods of occupational and community health.

At the time Jane Addams founded Hull House in 1889, pollution in cities and the workplace was seen as a sign of progress and opportunity, not potential harm. In this context, the public-health work by the women at Hull House was revolutionary because it not only challenged this idea, but also because these reformers used research methods that included the lived experiences and knowledge of those experiencing the greatest suffering. The methods of reformers at Hull House applied the information gleaned from workers and community residents to more detailed investigations (Deegan 1990). An important aspect of their public-health philosophy was encouraging community residents to record and share their experiences with others in the community, the general public, and decision makers. As Jane Addams stated in her introduction to the classic 1895 work *Hull House Maps and Papers*:

The residents of Hull-House offer these maps and papers to the public, not as exhaustive treatises, but as recorded observations which may plausibly be of value, because they are immediate, and the result of long acquaintance. (*Hull House Maps and Papers* 1895, vii)

For Addams and others at Hull House, the knowledge community residents provided was a vital resource for both understanding and changing the unhealthy conditions of the urban environment.

Alice Hamilton, one of the first American specialists in the field of occupational disease and a long-term Hull House resident, pioneered the use of local knowledge to inform her work toward ameliorating common workplace hazards of the day, such as mercury poisoning of felt-hat workers and lead poisoning (Hamilton 1943). Refusing to see workers as appropriate guinea pigs for the discovery of the health effects of industrial chemicals, Hamilton listened to workers' accounts of the workplace experience to help her hypothesize why certain occupations and industrial processes were hazardous (Hamilton 1943). While workers often were reluctant to talk out of fear of losing their jobs, Hamilton met them on their own time, visiting homes to conduct informal interviews and to listen to their stories

of workplace horrors (Sicherman 1984). Hamilton's style of fieldwork, which came to be known as "shoe-leather epidemiology," helped her piece together dangers in the workplace that were routinely underreported by factory owners and physicians (Sicherman 1984).

Florence Kelley, another Hull House resident, also pioneered the use of local knowledge in environmental health investigations. Kelley, like Hamilton, took her investigations into the street and canvassed the neighborhood around Hull House to document hazardous living conditions. One of her major achievements was documenting the "sweating system," or the dangerous garment-work women and children who lived in tenement houses performed (*Hull House Maps and Papers* 1895, 31).

The work of Addams, Hamilton, Kelley, and other reformers at Hull House aimed to understand how, in an unjust world, health is driven by social and economic inequalities. They understood that in order to change inequitable social conditions, one must first learn from the vulnerable groups how they described their suffering, because these stories hold clues about causes and effective interventions. These pioneers of local knowledge also encouraged the use of lay practitioners, such as midwifes and sanitation inspectors, to supplement the work of physicians and engineers (Deegan 1990). Importantly, women were at the forefront of early community-based social reforms and, as chapters 3–6 show, continue to lead most street science investigations.

While the Progressive Era reforms continued through the early years of the twentieth century, the public support for this work waned as germ theory came to dominate public health. Germ theory held that specific agents of infectious disease exist, in particular microbes, and that these agents correspond one-to-one with specific diseases (Tesh 1988). Research and interventions driven by laboratory investigations of microbes quickly replaced the sanitary, social, and political reforms advocated by Progressive Era reformers. Public-health interventions focused on specific immunization plans, with physicians emerging as the new class of public-health professionals, leaving community organizers and lay people with little room to participate in this expert-centered discourse.

One important exception to this dynamic, where local knowledge was integrated into community health, was the neighborhood-health-center movement that emerged around 1910 but declined rapidly after World

War I. Seeking in part to replicate the success of settlement workers, city governments began "demonstration projects" where health- and welfare-agency work was bought together and relocated "from city hall to the neighborhood" to better serve the neediest populations (Rosen 1985). The neighborhood health center aimed to replicate the values of "acquaintance" with "active participation" of the local population in delivering services that had proved so successful for the Settlement House movement (Bamberger 1966). Health centers were started in immigrant neighborhoods of Milwaukee and Philadelphia, the Mohawk-Brighton district of Cincinnati, New York's Lower East Side, and the West End of Boston. A key component of all the health centers was the creation of block committees, which allowed residents to raise neighborhood-specific problems to the nurses, physicians, and other professionals staffing the center (Burnham 1920). According to Rosen (1985), in a radical step for the time, the health officer for the Lower East Side center was a Jewish physician who understood the people, their language, and culture.

The cessation of large-scale immigration during the war years, and accusations that the self-governing aspects of the health centers were a "Red plot" and "socialized medicine," eliminated municipal support for neighborhood-based health programs (Rosen 1985). In addition, antagonism toward lay involvement in delivering health services by the American Medical Association helped eliminate funding for community-based prenatal and child health services provided for under the Sheppard-Towner Act of 1921 (Meckel 1990). By the 1930s lay participation in community-health issues was almost nonexistent because most epidemiologic investigations ignored social factors or treated them as nuisance variables in statistical models that focused on isolating germs. In the classic epidemiology framework of host-agent-environment, interventions focused on immunizing the "host" (e.g., individuals) because the "environment" (e.g., the world outside of microorganisms) was seen as harder to control.

While professionals increasingly adopted the biomedical model of disease—which attributed morbidity and mortality to individual behaviors, biology, and genetics—impoverished communities organized to address health issues with the help of organizations such as The Highlander Folk School, later renamed the Highlander Research and Education Center, in

Tennessee founded by Myles Horton (Horton 1971). Horton and the Highlander Institute brought local people together from impoverished communities in the Appalachian region to investigate and take action to change their conditions. Describing one meeting at Highlander, Horton recalled the power of local knowledge:

I remember they wanted to know about farm problems. They wanted to know about getting jobs in textile mills. They wanted to know about testing wells for typhoid. We discussed these things. To my amazement my inability to answer questions didn't bother them. . . . That was probably the biggest discovery I ever made. You don't have to know the answers. You raise the questions, sharpen the questions, get people discussing them. And we found that in that group of mountain people a lot of the answers were available if they pooled their knowledge. (Horton 1971, 16–17)

Highlander used a method called "popular education" to empower thousands of community members to collectively tap their own experiences and expertise to change social conditions. Many who attended Highlander, such as Rosa Parks, Ralph Abernathy, and Martin Luther King Jr., would return home to organize for civil, labor, economic, and human rights (Horton 1998).

As McCarthyism lost its sting by the late 1950s and 1960s, academic and social movements questioned previously unchallenged assumptions about science, namely its positivist claims of neutral fact-finding disassociated from social values. In academia, social medicine emerged as a legitimate field of inquiry, reintegrating social science ideas and notions of lay participation into medical research and practice (Porter 1997). The social movements of the 1960s also reengaged local people into the public-health discourse primarily by highlighting that despite rising prosperity and increased access to medical care, inequalities in health persisted for some, particularly for the rural and urban poor.

One example of a civil rights group reconnecting local and professional knowledge for community environmental health is the work of the Young Lords, a group of New York City Puerto Rican activists in El Bario, or East Harlem. The Young Lords organized street cleanups after the sanitation department refused to collect neighborhood garbage for weeks. They convinced local professionals to train them to perform door-to-door lead-poisoning screening and tuberculosis testing (Abramson et al. 1971). The group started day-care programs in local churches, provided breakfast in

neighborhood schools, organized tenants to demand housing improvements, and occupied a neighborhood hospital to highlight its inadequate service to the local population. Merging the social, political, and environmental aspects of health, the Young Lords combined local knowledge with professional techniques to address health disparities in their neighborhood (Melendez 2003).

Community mobilizations to address health disparities in the 1960s helped reinvigorate the movement for neighborhood health-centers that had begun fifty years earlier (Schorr and English 1974). Spurred on by the passage of Medicaid and Medicare in 1965 and the Office of Economic Opportunity's Community Action Program (CAP), the neighborhood-health-center movement promoted the health and well-being of impoverished and medically underserved communities by building clinics, developing preventative programs based on team medical practices that involved local people, investigating the environmental causes of poor health, and not limiting their work to categorical disease programs (Hollister et al. 1974). While municipal and state health and welfare departments focused on treating individuals at several locations and departments, neighborhood health centers established "one-stop" locations for clinical and social services, establishing neighborhood institutions run by local people capable of linking existing community resources with newly decentralized governmental programs (Kotler 1969). Neighborhood health centers during this time included the Columbia Point Health Center in a public-housing development in Boston, the Tufts-Delta Health Center in the rural Mound Bayou in the Mississippi Delta, and the North East Neighborhoods Association Health Center in New York City's Lower East Side (Geiger 1967).

During the same time period, a more general public interest in environmental health emerged after a series of highly publicized environmental disasters, such as the contamination of Boston Harbor and the burning Cuyahoga River. These events, combined with the 1962 publication of Rachel Carson's *Silent Spring*, repopularized the nineteenth-century themes of linking industrial pollution and environmental health. The public trust that science was working in the public interest, so dominant in the first half of the twentieth century, had given way to skepticism, citizen action, and calls for new governmental regulations. As Gottlieb notes:

while an earlier critic of the chemical industry, Alice Hamilton, laid the ground-work for discussing environmental themes in an urban-industrial context, Rachel Carson, with the evocative cry in *Silent Spring* . . . brought to the fore questions about the urban and industrial order that a new environmentalism prepared to face. (Gottlieb 1993, 86)

This new environmental activism included community members engaging with and confronting expert views of environmental health hazards, particularly when the hazards were in one's own backyard.

Perhaps the best-known precursor to street science is the grassroots environmental-health activism by residents of Love Canal and of Woburn, Massachusetts. The infamous case at Love Canal, New York, where a concerned mother named Lois Gibbs triggered nationwide interest in the link between landfill contamination and children's health, is the now-classic story of residents organizing to perform and influence science. With the help of Dr. Beverly Paigen, a cancer researcher from Buffalo, Gibbs and other "citizen scientists" were trained to perform telephone and door-to-door health and environmental surveys. This community-driven research found elevated rates of disease but was dismissed by state health officials. Despite the professional rejection of their work, residents pursued, and through the Love Canal Homeowners Association they successfully convinced public officials and scientists to reexamine the environmental health issues in their community. By the summer of 1980 the state and federal government concluded that the neighborhood was unsafe and residents should be relocated.

The Love Canal controversy is an important example of a community struggling to grapple with unexpected health problems because it highlights the challenges local people, public officials, and scientists face when trying to understand the relationships between environmental exposures and health outcomes. Perhaps ironically, the intense scrutiny given to studies of Love Canal residents lead to more rigorous agency peer review, supposedly to ensure the integrity of studies. While at first glance appearing to open up science to public scrutiny, peer review affirmed the proposition that only scientists were qualified to judge the validity of work done by their professional peers. As Jasanoff has noted, self policing not only has enhanced the autonomy and social prestige of science, but it also has encouraged scientists to be accountable to standards considered acceptable by other professionals, not necessarily the general public (1985, 22).

On the heels of the Love Canal controversy another community concerned with sick and dying children, this time in Woburn, Massachusetts, organized residents to investigate the link between local pollution and illness. The story of Woburn citizens engaging in epidemiologic studies, and enrolling scientists from Harvard to help them, also is well documented (Brown and Mikkelsen 1990; Harr 1996). What this case revealed was that residents with no prior scientific training not only could competently engage in complex science, but that they had unique information about exposures and health outcomes that, when combined with traditional epidemiologic methods, could improve scientific inquiry. When a community organizes to enlist the methods and resources from professional epidemiologists and combines these with insights from residents, they are engaging in a process Brown and Mikkelsen have called "popular epidemiology" (1990, 2). When communities engage in science, inject their own knowledge, and reorient investigations, outcomes, and actions, they often are in the process of seeking environmental health justice.

**Environmental-Health Justice and Street Science**

The environmental-health-justice movement combines citizen activism and environmental-health problem solving with demands for civil and human rights (Bullard 1990; Di Chiro 1998; Cole and Foster 2000). While this book focuses on one community seeking environmental-health justice, similar communities around the world are engaging in *street science*, often forging research and action partnerships with outsiders, to address the problems they face. A brief review of some of this work suggests that my study of one neighborhood in Brooklyn is part of the larger movement for environmental-health justice across the United States.

In Los Angeles, Communities for a Better Environment (CBE) has organized poor Latinos to monitor air toxics and address children's health. Partnering with researchers from the University of California, CBE activists formed a "bucket brigade" to take street-level air samples, to analyze these data according to local conditions, and to use these data to address respiratory-health issues facing local Latino children. These bucket brigades are groups of local activists that use a low-tech method

for taking air samples "on the street," or where one breathes. CBE has used young people and other community members to take samples of toxic emissions from oil refineries in Contra Costa County. The brigades rely on local knowledge, such as reports of fouls odors, seeing or hearing a release from the plant, and reports of nausea, eye and throat irritation, or other health symptoms, in order to determine when and where to take samples.

In Boston another environmental justice organization, Alternatives for Community and Environment (ACE), is collaborating with professional scientists, including some from the Harvard School of Public Health, to address asthma and air pollution in the Roxbury section of Boston (Loh and Sugerman-Brozan 2002). ACE organized students to map neighborhood land uses and found 15 diesel bus and truck garages within one-half mile of an elementary school. The organization then tapped the knowledge of high-school students to count truck traffic at a neighborhood intersection and identified over 150 diesel vehicles passing through neighborhood streets every hour. Combing the knowledge of young people, their maps, and traffic surveys, ACE partnered with Harvard and the Northeast States for Coordinated Air Use Management to take particulate samples of their own, further documenting the air-pollution problem in their neighborhood. The street science of ACE activists has lead to a state-funded but locally operated comprehensive air-monitoring system, which provides hour-to-hour data on particulate matter pollution over the Web and via telephone.

In San Francisco, the People Organizing to Demand Environmental and Economic Rights or PODER, have organized low-income residents within the Mission District of San Francisco to address environmental, public health, and redevelopment concerns and to help build a land-use agenda within the larger environmental justice movement. As part of their involvement in the Mission Anti-Displacement Coalition, PODER and its members helped develop a grassroots, comprehensive plan for the Mission that was presented to the San Francisco Planning Commission, Planning Department, and Board of Supervisors in July 2003. PODER also has developed a model for EJ groups to partner with one another, and they helped coordinate a report entitled "Building Healthy Communities from the Ground Up: Environmental Justice in California"

in coalition with Communities for a Better Environment and the Environmental Health Coalition, another EJ group located in San Diego.

In Albuquerque, New Mexico, the SouthWest Organizing Project (SWOP) and the Southwest Network for Environmental and Economic Justice (SNEEJ), have collaborated with one another to organize residents in Veguita, New Mexico, to address water contamination issues. The organizations trained residents to test their drinking-water wells and perform a community survey of water and illegal-dumping concerns in the South Valley of Albuquerque. This work eventually convinced the U.S. Environmental Protection Agency (EPA) to issue a half-million-dollar grant to the local community and water district to plan, build, and maintain a water-distribution and sanitary-sewer system. SWOP also organized residents to perform air monitoring around the Intel Corporation's Rio Rancho facility as a way to pressure the company to address environmental-health issues for workers and communities along the U.S.-Mexico border. SWOP is a unique EJ group because their partnerships span multiple issues (water and air quality, workers rights, globalization) and multiple constituencies (low-income, Latino/as, youth and elderly, immigrants).

The work of all these groups aims to combine environmental-justice organizing with issues of population health. Each group has forged a collaborative research partnership with one or a host of outside professionals to help them combine community knowledge and experience with professional methods of researching and documenting inequitable environmental-health burdens. When community organizations such as these, and the ones in Brooklyn described in this book, engage in the science of environmental health, they grapple not only with understanding complex environment–human health interactions, but also with how to create more democratic partnerships with scientific and political elites that have traditionally ignored their concerns.

## Democracy and Local Knowledge

A fundamental aspect of environmental-health justice is the creation of more democratic partnerships between professionals and the public. This ongoing challenge was perhaps best articulated by John Dewey, in his

1954 work *The Public and Its Problems*, where he highlighted the struggle or "problem" of engaging a citizenry in political processes increasingly dominated by technically elite professionals. Dewey's response was a division of labor; experts would analytically identify problems and citizens would set a democratic agenda for addressing them. The central challenge for Dewey was to devise methods and conditions of public debate, discussion, and persuasion where experts and citizens could integrate their knowledge and understandings. He called for participatory processes to increase the democratic character of decisions, where experts were not asked to judge the efficacy of particular policies, but to act as "interpreters and teachers" to help citizens debate in a way that would reflect the "public interest" (Dewey 1954).

While Dewey's analysis remains important for understanding the democratic challenge presented by street science, his analysis did not fully anticipate the influence of the specialized analyst, operating largely removed from any public discourse, on public policy. Nor did Dewey find the information and knowledge that experts (or lay people for that matter) have problematic; science and expertise for Dewey offered a body of facts and methods that only entered the rhythms and influences of politics at a later stage. Finally, Dewey focused on the optimal procedural conditions for reciprocal dialogue among scientists and lay people, but he did not fully anticipate that the content of the scientist-lay conversation might be problematic; scientists may be unable to translate their information into the ordinary language of everyday practice and publics may be unable to translate their knowledge into the specialized language of science. Thus, the rise of the professional analysts, or technocrat, and an uncritical faith in science as facts and truths, are key components for understanding why professionals tend to ignore community knowledge in environmental-health decision making.

### Technocrats, Science, and Local Knowledge

Theda Skocpol, in her book *Civic Engagement in American Democracy*, notes that "today's professionals see themselves as experts who can best contribute to national well being by working with other specialists to tackle complex technical and social problems" (1999, 495). Skocpol continues that these privileged professionals no longer see their role as

"working closely with and for non-professional fellow citizens" or help-ing to lead "locally rooted" associations for problem solving. The view that public problems ought to be analyzed by a group of autonomous, highly trained and specialized professionals, who offer their dispassion-ate findings to decision makers, is partially rooted in the belief that facts and values can be separated easily. The positivist view of neutral fact-finding as informing value-laden politics remains a powerful decision-making model in environmental politics (Fischer 2000; Habermas 1970). Perhaps most influential in this view is that one form of rationality has come to dominate environmental politics—where science is the only legitimate form of expertise. Technocrats argue that experience in a given area and training in the specialized collection and systematic analy-sis of information allow them as professionals to tackle issues with neu-trality and dispassionate objectivity (Benveniste 1972).

Yet, political scientists have regularly challenged the technocratic model. For example, Charles Lindblom and David Cohen, in their polemic 1979 book *Usable Knowledge: Social Science and Social Problem Solving,* argue not only that has social policymaking relied too heavily on professionals, but that professional knowledge has not contributed any more than ordinary knowledge to social problem solving. In their strong claim, Lindblom and Cohen (1979) argue for *useable knowledge*, as opposed to the professional knowledge that dominates modern policy-making. The problem with professional knowledge is that it has not deliv-ered on its promise of making better, more efficient, cheaper, more fair or more just social decisions. Nor have the policy sciences contributed a great deal, they argue, to solving some of our most pressing social prob-lems. Lindblom and Cohen (1979) argue for a reintegration of "ordinary knowledge" into policymaking in order to make it more responsive to the needs of the public and to remove the barriers between professional pol-icy makers and citizens.

According to policy analysts like Linblom and Cohen, professionals should not be entrusted to speak for lay publics, especially concerning complex environmental-health controversies. Richard Sclove echoes these concerns in his 1995 book *Democracy and Technology*. Sclove claims that professionals are ill-suited to ensure that science and technol-ogy serve democracy because experts normally are more preoccupied

with the mechanisms of science and not its structural bearing on society. Sclove also notes that since "experts enjoy a privileged position within today's inegalitarian political and economic structures, they tend to share with other elites an unstated, and usually quite unconscious, interest in suppressing general awareness of technologies' public, structural face" (1995, 50–51). Additionally, since scientists often have similar backgrounds, professionally socialize, and tend to acquire specialized competence at the expense of integrative knowledge and experience, they are unrepresentative of the "public" and should not be expected to understand or communicate the everyday knowledge of lay people.

Clearly, scientific and technical professionals hold important contributions for environmental-health problem solving, but they alone cannot be expected to ensure science and its results serve the larger society, particularly the least well-off. Lay people often are in a better position than professionals to make judgments over the democratic character of science because they experience how science impacts their everyday lives, from the repetitive mechanical tasks on the factory floor, to navigating inadequate mass-transit systems, to substandard housing and inferior medical care. Thus, to be scientifically and technologically "literate" is to have knowledge and experience not only about a technology's internal principles of operation, but also about how it influences democracy and social justice within the context where it is deployed (Nelkin 1984). Lay people are not only well-situated for this task, they are often more knowledgeable than professionals and therefore ought to be considered "local experts" in their own right.

**The Co-Production of Expertise**

Since both professionals and lay people have "expert" contributions to make to environmental health decisions, we might think about expertise as being "co-produced." Jasanoff and Wynne (1998) refer to "co-production" to describe the interdependence of scientific knowledge and political order. As mentioned above, in the co-production model, scientific knowledge and social order evolve jointly; science is understood as dependent on the natural world, as well as on historical events, social practices, material resources, and institutions that contribute to the construction, dissemination, and use of scientific knowledge. Political deci-

sion making, in the co-production framework, does not take "scientific knowledge" as a given, but seeks to reveal how science is conducted, communicated, and used. The co-production model problematizes knowledge and notions of expertise, challenging hard distinctions between expert and lay ways of knowing. Finally, the co-production model emphasizes that when science is highly uncertain, as in many environmental-health controversies, decisions are inherently "trans-science"—involving questions raised by science but unanswerable by science alone (Weinberg 1972; Jasanoff 1990).

Decision making in the co-production model requires a negotiation among the always partial and plural positions of professionals and lay people (Haraway 1991; Harding 1991). The co-production model also destabilizes the dominant view in science policymaking that science can be uncritically accepted as "fact" and "truth." The destabilizing stories and emphasis on the need for "negotiating expertise" suggest that a deliberative politics is necessary for the co-production of expertise.

In an attempt to articulate how science might be co-produced, Funtowicz and Ravetz call for an "extended peer community" where professionals and publics collaboratively review evidence aimed at improving scientific knowledge:

When problems lack neat solutions, when environmental and ethical aspects of the issues are prominent, when the phenomena themselves are ambiguous, and when all research techniques are open to methodological criticism, then the debates on quality are not enhanced by the exclusion of all but the specialist researchers and official experts. The extension of the peer community is then not merely an ethical or political act; it can possibly *enrich the process of scientific investigation*. (Funtowicz and Ravets 1993, 752–753; emphasis added)

The explicit recognition of both professional information and local knowledge—and that neither ultimately can put to rest the uncertainty of environmental-health problems—can encourage decision makers to acknowledge the necessity of renewal, flexibility, and adjustment as key elements of decision-making success. Instead of portraying themselves as the "source of certainty," professional decision makers can highlight the necessity for contingent decisions that must be open to renegotiation as new information becomes available. This means that the professional's role must be reconceptualized from "guarantor of safety" to "guarantor of recognition"—of new knowledge, new voices, new ideas, new possibilities, and new directions for interventions.

Robert Reich gives an eloquent account of how this practice of public deliberation can spur civic discovery. He suggests that professionals seize the opportunity for the public to deliberate over what it wants by:

convening of various forums . . . where citizens are to discuss whether there is a problem and, if so, what it is and what should be done about it. The public manager does not specifically define the problem or set an objective at the start. . . . Nor does he take formal control of the discussions or determine who should speak for whom. . . . In short, he wants the community to use this as an occasion to debate its future.

Several different kinds of civic discovery may ensue. . . . The problem and its solutions may be redefined. . . . Voluntary action may be generated. . . . Preferences may be legitimized. . . . Individual preferences may be influenced by considerations of what is good for society. . . . Deeper conflicts may be discovered. . . . Deliberation does not automatically generate these public ideas, of course, it simply allows them to arise. Policy making based on interest group intermediation or net benefit maximization, by contrast, offers no such opportunity. (Reich 1988, 144–146)

Both Reich's vision and the process articulated by Funtowicz and Ravetz help frame what the co-production process might look in practice.

However, if co-production requires a negotiation between experts and local people, communities should be weary and enter with caution. As Arnstein's (1969) classic essay on the "ladder of citizen participation" highlighted, public participation can often backfire when the professionals controlling such processes do little to understand the residents of disenfranchised, low-income communities and do even less to meaningfully listen to and include them in decisions. Arnstein wrote that "there is a critical difference between going through the empty ritual of participation and having the real power needed to affect the outcome of the process" (1969, 216).

According to Judith Innes, a professor of urban planning at the University of California, Berkeley, urban planners are attentive to the power dynamics that occur in public dialogues and increasingly "depict planners as embedded in the fabric of community, politics, and public decision-making" (1995, 183). Drawing from critical theory and communicative ethics, this view of planning attempts to ensure, much like Dewey's original problem, that public processes are structured to allow the least powerful, politically disenfranchised to meaningfully participate. In order to accomplish this, a distribution of extra resources, assis-

tance, and guidance to disenfranchised groups by planners may be necessary in order for meaningful and fair public deliberations (Habermas 1984; Forester 1989). The communicative view of planning is employed most often when finding an acceptable policy solution depends on appealing to and mobilizing citizens' knowledge of local or regional conditions, when policy issues have a strong ethical component, and when experts are strongly divided over an issue (Yearley 1999). As planning practitioners are increasingly asked to mediate between professionals and disenfranchised communities in local environmental-health decision making, understanding the benefits and limits of communicative practice becomes a necessary component of the co-production process.

Yet, deliberative forums, especially those involving environmental decisions, rarely have found a way to avoid granting science and technical expertise a privileged position in the discourse (Ozawa and Susskind 1985; Amy 1987). Even some of the most collaborative processes advanced by advocates of consensus building, such as joint fact-finding, have been unable to place science and technical expertise on par with lay knowledge, and these advocates instead recommend not pursuing joint fact-finding when "significant power imbalances among the parties" in a policy dispute exist (Ehrmann and Stinson 1999). Technical language remains a prerequisite for most deliberative forums, often creating an intimidating and "disciplining" barrier for lay citizens seeking to express their disagreements in the language of everyday life (Foucault 1977). Speaking the language of science, as well as the jargon of a particular policy community, remains an essential, but often tacit, credential for participation in environmental health decision making—even in the new deliberative forums. The process of *street science* offers a model for interconnecting and coordinating the different but inherently interdependent discourses of citizens and professionals through the co-production process.

## Street Science as a Practice

While traditional policymaking focuses on "problems" and "decisions," deliberative policy science has emphasized *practices* as its unit of analysis (Fischer and Forester 1993). Practice is admittedly a difficult concept.

The concept of practice is an attempt to develop a unified account of knowing and doing (Dewey 1944). Practice emphasizes that knowledge, knowledge application, and knowledge creation cannot be separated from action; knowing and doing are intimately related (Putnam 1995).

This book argues that *street science* is a practice; a practice of science, political inquiry, and action. Street science is not merely a synonym for action. Street science integrates the actor, her resources, and her external environment in one "activity system," in which social, individual, and material aspects are interdependent (Callon 1986; Latour 1993). The focus in such activity systems is on the way the different elements *relate* to each other rather than just on the elements themselves. As Keller and Keller put it:

An individual's knowledge is simultaneously to be regarded as representational and emergent, prepatterned and aimed at coming to terms with actions and products that go beyond the already known. Action has an emergent quality, which results from the continual feedback from external events to internal representations and from the internal representations back to enactment. (Keller and Keller 1993, 127)

Street science in this view acknowledges that the world in which we operate is always to a large extent provisional and improvisational. Action never is controlled completely by the actor, but is influenced by the contingencies of the physical and social world (Putnam 1995).

An important aspect of street science is its social character. Street science originates and evolves in a community—whether community is defined geographically, culturally, or socially. Street science also distances itself from mentalistic and subjectivistic views of judging, assessing, and knowing (Putnam 1995). Street science is a public process that originates and has meaning within a particular community. People learn about the world in shared public processes in which they test what they have learned, often through public discourse.

Central to the communicative dimension of street science are stories. Stories are central to the generative, emergent quality of action in context. Actors negotiate reality by telling *stories* about their own and other people's actions within the various elements of their community. Stories, however, are not merely representations of actions and consequences; stories are generative. As a form of discourse, by telling stories actors

simultaneously shape, grasp, and legitimate both their actions and the situation that gave rise to their actions (Throgmorton 1996).

While the co-production model and deliberative practice offer frameworks for how street science might happen, they hardly help with understanding its content. How does local knowledge extend science and improve democracy? The next chapter answers this question by detailing what *local knowledge* means and by showing how it acts as the foundation of the *street science* method of inquiry.