During the past four years, I have been involved in a controversy over the impact of hazardous waste buried at Love Canal on the health of the surrounding community. As a scientist employed by a research institute that is a division of the New York State Department of Health, I came to believe that additional studies should be done on the health of Love Canal residents. However, David Axelrod, who became Commissioner of Health in December 1978, maintained that the Health Department’s studies were adequate and showed little or no health risk to the community. At the beginning, I thought our differences could be resolved in the traditional scientific manner by examining protocols, experimental design, and statistical analysis. But I was to learn that actual facts made little difference in resolving our disagreements—the Love Canal controversy was predominantly political in nature, and it raised a series of questions that had more to do with values than science.

The Environmental Protection Agency (EPA) estimates that 50,000 hazardous waste sites may exist in the United States, that 90 percent of these pose a potential health threat because they are improperly located or poorly managed, and that 2,000 are currently threatening the health of nearby communities. Thus the hazardous waste problem is large not only because of the number of sites but also because these sites are usually close to the places where people live and work. Because the issues faced at Love Canal will occur again and again, any lessons we can learn may be helpful in preventing or resolving controversy in similar situations and in protecting the public health.

**Toxic Wastes at Love Canal**

In 1942 Hooker Electrochemical Corporation (now Hooker Chemical and Plastics, a subsidiary of Occidental Petroleum Corporation) began to fill an abandoned canal a half-mile long with toxic chemicals from the manufacture of chlorinated hydrocarbons and caustics. More than 21,000 tons of 200 or more chemicals had been deposited in the canal when the Niagara Falls Board of Education approached Hooker Chemical about purchasing the site for a school. Hooker claims that it warned the Board of Education that the site was not appropriate for a school. The company says it sold the property to the Board in 1953 for a token $1.00 only when the Board threatened to take the property by eminent domain. None of the people who were Board members at the time are living to confirm or deny that claim, and the minutes of the meetings do not bear out the claim. The deed transferring the property from Hooker to the Board of Education does contain a clause that Hooker says, releases the company from liability. It states that the site was filled “with waste products resulting from the manufacturing of chemicals” and that “no claims, suit, action, or demand of any nature whatsoever” could be made against Hooker “for injury to a person or persons, including death resulting therefrom...by reason of the presence of said industrial waste.”

An elementary school was built in the center of the site and the north and south portions were sold to developers who built ninety-eight homes along the banks of the former canal. During the ensuing twenty-five years, chemicals from the dump site migrated as a thick black oily mixture through the topsoil into the surrounding community. As early as 1958 Hooker Chemical and city officials were informed that three children had suffered chemical burns from exposed wastes on the surface of the canal. The Niagara Falls Health Department and other local officials took no action on this and many other complaints.

Through the efforts of determined residents and newspaper reporter Michael Brown, the EPA and the New York State Department of Health eventually entered the picture. In 1978, these agencies identified many chemicals in the air of Love Canal homes, and the Department of Health documented an excess frequency of miscarriages in women living in homes immediately adjacent to Love Canal. On August 2, 1978, Robert Whalen, then the New York State Commissioner of Health, declared a health emergency. Shortly thereafter Hugh Carey, the governor, offered to purchase the 239 homes closest to the canal and to assist in relocating the families. A fence was placed around

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the homes and plans were made to construct trenches to intercept the flow of chemicals from the canal. The Health Department initiated health studies of 850 additional homes in the Love Canal neighborhood by distributing questionnaires and taking blood samples for analysis. In early fall of 1978 the department announced the preliminary results of these studies; officials assured the Love Canal residents that the neighborhood was a safe place to live and that the community beyond the homes that had already been evacuated was not at any increased health risk. This announcement was based on data showing that the miscarriage rate in homes beyond the barrier was no higher than elsewhere.

The community was not reassured, citing visible seepage through basement walls, chemical odors in homes, and odors at storm sewer openings as evidence that chemicals had migrated beyond the fence. The residents also questioned why certain families living three to four blocks from the canal had multiple miscarriages and other illnesses.

History of the Controversy

At the time I was studying genetic variation in the metabolism of chemicals and trying to determine whether such differences might explain differing susceptibilities to environmental toxins. The exposure of 850 families to low levels of chemicals seemed to me an unusual opportunity to locate susceptible families with several sick members, match these with a healthy neighboring family, and compare the metabolism of chemicals in these two groups. I devised a health questionnaire, and a small group of residents systematically surveyed the neighborhood by telephone, collecting information about the number of people in the family, length of residence, and health.

I planned to plot the illnesses geographically with the following expectations: (1) if illnesses were clustered in families, that would indicate a possible genetic susceptibility to low-level chemical exposure and thus provide families for future study in my laboratory; or (2) if illnesses were geographically clustered, that would probably indicate migration of chemicals from the canal; or (3) if illnesses were randomly distributed, that would indicate no relationship to chemical exposure. Of course I realized that the sample size was small (1,140), so that any findings would only be a signal that further studies needed to be done. Plotting the results on a map revealed a strong geographical clustering of disease that appeared to be related to former stream beds and swales, which are low marshy areas that collect water but do not have a particular direction of flow. These streams or swales no longer exist because they were filled with building rubble as the neighborhood was developed. The predominant soil in the area is clay; thus a low-lying area filled with rubble could provide a permeable conduit for the flow of liquid chemicals from the canal.2

The exact locations of these swales, as well as swamps and a pond, were determined by soil scientists under contract to the Health Department. Once these were defined, it was possible to divide the neighborhood into historically wet homes—those bordering streams and swales or built in swamps or the former pond—and historically dry homes. Comparing the incidence of disease in wet and dry homes provided an internal neighborhood control that randomized for reporting bias, occupational exposure, and age.

We found a threefold increase in miscarriages in pregnant women who lived in wet homes compared to those who lived in dry homes. Particularly striking were the women in wet homes with three or more miscarriages. The frequency of such habitual aborters reported in the literature is between 0.4 to 0.7 percent. Of the sixty-four women living in wet homes at Love Canal who became pregnant, five (8 percent) had three or more miscarriages. The probability of this occurring by chance is less than 0.001.

Birth defects were also higher in wet homes. Of 120 children born in wet homes, 24 (20 percent) had birth defects compared to 6.8 percent of children born in dry homes. Some of these birth defects were minor, such as club feet, webbed toes, a missing ear, or an extra set of teeth; but many were serious, such as heart defects, missing or non-functional kidneys, deafness, absence of diaphragm, and mental retardation. Asthma was 3 times more frequent and urinary system disease was 2.8 times more frequent in wet homes than in dry. Various symptoms of central nervous system toxicity were reported by residents in wet homes; these included dizziness, fainting, seizures, blurred vision, depression, hyperactivity in children, suicides, suicide attempts, and nervous breakdowns. Since data included health effects only up to the declaration of the

2emphasis added. The ‘Swales Hypothesis’ was first put forth by Lois Gibbs, who enlisted Paigen’s help in testing it.
health emergency, the stress and anxiety that may have occurred after that date exerted no influence on the symptoms. Since central nervous system problems are very subjective, I evaluated only those that were severe and could be verified. I chose to group together admissions to a mental hospital and suicide attempts and found that these were five times more frequent in wet areas ($p < 0.0005$).

The survey, which was conducted without any funds, was adequate to locate sick and healthy families in order to study metabolism of chemicals, but it had never been intended as a full-scale epidemiological study. Once I had the data, however, I found myself in a very uncomfortable position. The data strongly indicated that chemicals might have migrated beyond the fence and that a health risk might be present in some parts of the Love Canal neighborhood. However, Commissioner Whalen was publicly stating that the chemicals had not migrated beyond the fence.

The department's claim arose from two factors. First, the department had analyzed miscarriage frequency by street (99th, 100th, 101st, etc.). Since the rate of miscarriage did not decrease as the streets grew more distant from the canal, the Health Department concluded that the miscarriages were not related to chemical exposure. However, if chemicals had migrated from the canal preferentially along swales, as I suspected, then miscarriage frequency should not necessarily decrease with perpendicular distance from the canal, but instead would be related to the location of the swales. Second, the Health Department's finding that miscarriage frequency in Love Canal women was no higher than elsewhere was based on the Warburton and Fraser study, which the department had selected as a literature control. However, that study differed in several important ways from the Love Canal study conducted by the Health Department. The women in the Warburton and Fraser study had either previously had a child with a birth defect, or in a minority of cases, had given birth to twins. Thus they were not a representative population. In addition, unlike the Love Canal population, the women in the control study were poor and had little or no prenatal care. Finally Warburton and Fraser counted as valid any miscarriages reported by a woman, while the Health Department counted only those that could be independently confirmed by physicians' records.

All three factors—the previous history of birth defects, poor prenatal care, and the manner of counting miscarriages—could have increased the miscarriage frequency in the Warburton and Fraser study. According to the data I was given, the miscarriage frequency of Love Canal women before they moved to Love Canal was significantly lower (after correcting for the effect of maternal age) than the rate reported in the Warburton and Fraser study (8.5 percent compared to 14.7 percent). This convinced me that the literature study was not an appropriate control. After the women moved to Love Canal, their miscarriage frequency increased to 16 percent, a significant rise when compared to their previous history of 8.5 percent, but not much higher than Warburton and Fraser's 14.7 percent.

After reviewing the data analysis by the Health Department and the results of my own study, I felt I needed to convey my concerns to my superiors. On November 1, 1978, I suggested to the Health Department a hypothesis that needed to be tested: adverse pregnancy outcomes were more frequent in wet homes than in dry homes and adverse effects might be occurring in the urinary, respiratory, and central nervous system as well. The department then reevaluated their own data, and on February 8, 1979, the new health commissioner, David Axelrod, announced that women in wet homes were more likely to have miscarriages, babies of low birth weight, and children with congenital abnormalities. At that time families with children under two years of age or with women who could prove they were pregnant were evacuated. But evacuation was to continue only until the youngest child in the family reached the age of two. Women who wished to conceive were concerned because during most of the sensitive first trimester of pregnancy when the fetus is at highest risk they would be involved in proving they were pregnant and in processing their requests for evacuation. These women applied for evacuation but their requests were denied.

At the February 1979 meeting, the health commissioner publicly praised my contributions and promised the residents of Love Canal that studies would follow on the respiratory, urinary, and nervous systems. More than three years have elapsed, but these studies have not been done or even initiated. Still at the time I felt considerable relief. Since my superiors and I now agreed on the essential points, I thought the controversy was over. But I was wrong. The controversy continued for one-and-a-half years with increasing intensity, until the residents of Love Canal were given the opportunity to move out of the neighborhood.
That “scientific” controversy rolled on regardless of scientific facts was a hard lesson for me to learn. Shortly after the February 1979 meeting, I asked a New York state scientist in bewilderment exactly what we were disagreeing about since we both agreed that adverse pregnancy outcomes were elevated and the other diseases had not yet been examined by the state. He replied that the disagreement was now over the exact number of miscarriages and birth defects. Seeking to end that controversy, I said that I would accept their figures. I changed my slides and reports even wrote to David Rall, chief of the National Institute of Environmental Health Science, that “the diagnosis of diseases in the State’s data base is more reliable those in my data base because the State has checked each disease with physician and hospital records while I have accepted the individual’s self-report” (March 13, 1979). The state used this statement against me later, but the controversy I had hoped to end continued even though there was no longer any difference of opinion over facts.

These events caused me to think carefully about the nature of public health controversy, the factors that prevent resolution of controversy, and the ways in which controversy can be reduced or avoided. In discussing these ideas, I will illustrate with examples from Love Canal, but the events are characteristic of many such controversies.

The Elements of Controversy

The two opposing sides in the Love Canal controversy were the community and the New York State Department of Health. This was somewhat surprising, since the Health Department had declared the health emergency in the first place. However, then the community turned to the agency they regarded as their ally and protector, they felt that the response was inadequate.

Antagonism between a community and a health department is not unique to Love Canal. At a number of other hazardous waste sites, frustrated and angry communities have turned on the local health agency rather than on the industry that created the hazardous waste sites. Perhaps such a response is not so surprising after all. Hooker Chemical was a major industry in the region and employed many people in the Love Canal neighborhood. The community made some allowance for Hooker because the chemicals were buried many years before the chronic toxicity of chemicals was understood and before regulations concerning disposal of toxic waste existed. Hooker Chemical claimed that it had used state-of-the-art technology in burying the waste and that furthermore they had warned the Board of Education not to build a school on the site. The community also understood that the goal of industry is profits and that Hooker was acting in a manner consistent with its goals by using the cheapest method of disposal. So while many in the Love Canal community were inclined to make allowances for Hooker, they did not feel well disposed toward the Health Department, which was acting in the present with full knowledge of chemical toxicity. The stated goal of the department is to protect health, and the salaries of officials came from the community’s tax money. So the community viewed the department as acting in a manner inconsistent with its goals and responsibilities when health effects were minimized or ignored.

Once the controversy was under way several factors impeded a resolution:

1. The failure to resolve any controversy may be advantageous to one side. In this case the state had much to gain from delay. Since over 600 other hazardous waste sites existed in New York, any action taken at Love Canal would set a precedent. Any state official who recommended positive action at Love Canal would have had to justify spending even more than the $42,000,000 the state had already allowed for construction to prevent further leakage and relocation of the families living closest to the canal. In contrast, an official who delayed was taking very little risk. If the decision to delay was later shown to be wrong, the community would suffer the risk of impaired health and some future official would probably have to worry about the results.

The advantages to delay were graphically brought home to me in a conversation I had with a Health Department epidemiologist concerning the data on adverse pregnancy outcomes at Love Canal. We both agreed that we should take the conservative approach only to find that in every case we disagreed on what the conservative approach was. To him “conservative” meant that we must be very cautious about concluding that Love Canal was an unsafe place to live. The evidence had to be compelling because substantial financial resources were needed to correct the problem. To me
“conservative” meant that we must be very cautious about concluding that Love Canal was a safe place to live. The evidence had to be compelling because the public health consequences of an error were considerable. And so we disagreed on specific detail after specific detail.

This is not a scientific issue, nor can it be resolved by scientific methods. The issue is ethical, for it is a value judgment to decide whether to make errors on the side of protecting human health or on the side of conserving state resources. In science this problem is called avoiding type I and type II errors. In a type I error, a scientist accepts as true something that is actually false. The custom in science is to insist that we be 95 percent certain that something is true (for example, that the health of Love Canal residents suffered) before we accept it as a fact. In contrast, a scientist who makes a type II error fails to recognize as true something that actually is true.

The degree to which one is willing to make one or the other kind of error is a value judgment and depends on what one perceives to be the consequences of making the error. To conclude that something is real when it is not means that a scientist has followed a false lead or published a paper that later turns out to be incorrect. This may be embarrassing and harmful to a scientist’s reputation. In contrast, to ignore the existence of something real means that a scientist fails to make a discovery. This may be disappointing but it does not harm the scientist’s reputation, so the scientist is more willing to make type II errors. However those charged with protecting public health and safety should be much more concerned about the second type of error, for a hypothesis that is not recognized drops out of sight.

Before Love Canal, I also needed to have 95 percent certainty before I was convinced of a result. But seeing this rigorously applied in a situation where the consequences of an error meant that pregnancies were resulting in miscarriages, stillbirths, and children with medical problems, I realized I was making a value judgment. In other issues of public health and safety—bomb threats, possible epidemics, etc.—we do not insist on 95 percent probability of harmful consequences before action is taken. Why is that the criterion in environmental health? This issue should be debated widely in the public health community so that choices can be made not out of habit but with full realization of the values involved.

2. Opponents may not agree on the question that needs to be answered. In this case, Commissioner Axelrod informed the residents that the epidemiologist would look for adverse health effects on the human fetus since that was the most vulnerable segment of the population. But the residents assumed that any increase in adverse pregnancy outcomes would indicate that toxic chemicals were present and that the entire population was at risk. They reacted angrily when the commissioner announced that the fetus was indeed at risk, but that the state would evacuate only pregnant women.

The design of a study also has a profound influence on the outcome. For example, in the spring of 1981, the Center for Disease Control (CDC) designed a study to answer the question of health impact at Love Canal. A great deal of money and effort went into answering the question of whether psychological harm occurred. In contrast, few resources went into answering the question of whether there was chromosome damage. The CDC study was cancelled due to lack of funds. However, had the design been carried out, after two years and several million dollars, the public would have been informed that Love Canal residents suffered psychological damage but not chromosomal damage—a conclusion dictated by the study design.

The most costly portion of the CDC study called for detailed health histories, physical examinations, and laboratory tests for all Love Canal residents. However, these were not to be done on a comparable control population, nor were there plans for data compilation and analysis on the results of the Love Canal residents. Instead, each resident was to receive a detailed evaluation of his or her current health status. The residents objected to the lack of controls and data analysis. They claimed that the evaluation of an individual’s health was simply a medical service, one they could get from their own physicians. They wanted to know whether certain health problems were more common in Love Canal residents than expected. At a meeting on October 22, 1980, residents threatened to boycott the study if controls were not added.

3emphasis added
Eventually, the scientists agreed to reconsider their design, but the problem could have been avoided if the residents had been consulted earlier.

3. In any controversy, since the type and quality of information gathered will influence the outcome, no one group should be in complete control of the information-gathering process. At Love Canal the state had the personnel and monies of a very good health department and an additional $1,500,000 specifically allocated by the New York legislature and Congress to gather information about health effects. In contrast, the residents had only their own energy and the help of a few scientists. Of the three small studies done outside the health department, two were done with no money (my survey and a study of nerve conduction by Dr. Stephen Barron) and one with $10,000 (a chromosome study by Dr. Dante Picciano under contract to the EPA). All had flaws in part attributable to the lack of funds. Since the data from these studies were widely available, it was easy for scientists to review and criticize them.

In contrast, the protocols and the data from the well-funded studies of the Health Department were—and still are—secret. According to a fact sheet released by the Department of Health on June 23, 1980, these studies cost $3,292,000 and 205,000 staff hours (122 staff years) and encompassed 4,386 blood samples, 11,138 field interviews, 5,924 soil samples, over 700 air, sump, and water samples, follow-up of 2,000 former residents, and 411 physical examinations of workers involved in remedial construction at Love Canal. With the exception of a provisional draft of the study on adverse pregnancy outcomes, which was released when a newspaper asked for it under the Freedom of Information Act, and the recently published Janerich study, which I will discuss later, the health studies are not available for scientific review or criticism even though conclusions are frequently quoted publicly.

Similar scenarios are being enacted at dump site after dump site. The local health department does not respond to the community’s complaints. The residents then collect their own information on illnesses. The health department responds by criticizing the scientific adequacy of a study done by the community with no money. And so the controversy goes on.

We must develop ways of providing communities with access to resources and expertise. This was done with remarkable success in one case at Love Canal. Shortly after the health emergency was declared, the New York State Department of Transportation planned some remedial construction work to prevent the further flow of chemicals from the canal into the community. A health and safety plan to protect the community was developed. During negotiations between the department and the community, the lawyer for the community arranged for a sum of money to be set aside for a toxicologist who would be on site during the construction to monitor the state’s compliance with the safety plan and to report to the community. The cost was only $10,000 in a project that involved $3 to $4 million.

The Department of Transportation was far more skilled in dealing with the community than was the Department of Health. The Transportation Department officials clearly recognized that they were in conflict with the community, and they were not insulted when the community insisted on a monitor. The Health Department scientists, on the other hand, viewed their department as the community’s ally, and were hurt when the residents criticized their work. Thus, it was the Department of Transportation—not the Department of Health—that gave the community funds for a consultant.

The consultant, Steven Lester, provided significant help in resolving day-to-day conflicts. He was trusted by the community because he worked in the community’s offices, was freely accessible, and sought answers to community leaders’ questions. He was also trusted by state officials because he was low-key, factual, took no stands on issues, and never spoke to the press. He served as an effective communicator between state and community and prevented serious controversy from erupting at several points.

Agencies that undertake health studies should certainly consider allocating money to the community so that residents can obtain their own expertise. But an even better solution would be to have information gathered and funded by neutral third parties. If a federally based and funded response team were established to deal with many hazardous waste sites, it might be in
a position to evaluate the relative seriousness of each situation.

4. _Beyond questions of money and expertise is the issue of full expression for dissident and minority opinions._ Controversy is stifled, not resolved, by silencing the opposition. At Love Canal, scientists working for New York State who disagreed with the official stance were demoted, transferred, or harassed. For example, William Friedman, regional director of the Department of Environmental Conservation, was demoted to staff engineer in November 1978 (he subsequently left the agency) for “prodd[ing] the Albany hierarchy unrelentingly” (Buffalo Evening News, November 12, 1978). And Donald McKensie, a senior sanitary engineer in the regional office, Department of Environmental Conservation, wrote a letter to his superior raising questions about the manner in which the department was handling Love Canal and was promptly transferred from the Love Canal project to air quality projects (Knickerbocker News, May 12, 1980).

I too was harassed in a variety of ways. The most important involved my ability to raise money to support my research by grant applications. I first spoke publicly concerning the Love Canal problem in the summer of 1978. That September, the Department of Health administration withdrew one grant I had submitted without even informing me. That winter the administration refused to process papers so I could get funds from another grant that already had been awarded. This denial led the professional staff of Roswell Park Memorial Institute to charge the administration with scientific censorship. In June 1979, I was informed that, because of the “sensitive nature” of my work, all grants and research ideas had to go through a special review process. I was told to outline my research ideas and submit them for review “at the moment of conception before a single experiment was done.” My professional mail arrived already opened and scotch-taped shut. My office was entered outside of working hours and my files were searched.

My income tax return was audited by New York State for the first time in over twenty years of filing returns and the auditor’s file contained newspaper clippings, including such nonfactual material as “Letters to the Editor,” about my role at Love Canal. Later James Tully, Jr., Commissioner of Taxation and Finance, apologized for several “errors in procedure,” and wrote that the clippings resulted from a “a misunderstanding” of department policy by a local audit supervisor. Added to these serious problems were a variety of petty harassments, which continued until I announced in 1981 that I was leaving Roswell Park and accepting a position in another state.

In addressing the problem of whistleblowers, the Committee on Scientific Freedom and Responsibility of the American Association for the Advancement of Science (AAAS) stated in 1975 that scientists “must be assured of some form of due process in passing judgment on the issues that they raise. This would call for the presence of independent outside members on any board that passes judgment on the issues, and should also include some right of appeal.” My experience showed that no such protection exists.

5. _Scientists, who are no strangers to controversy, should follow the social controls on behavior that they have developed for the advancement of knowledge and the detection of error._ These include openness of data, peer review and criticism, publication of data, and replication of experiments.

These norms of scientific behavior were violated at Love Canal. Secrecy of the state’s data and protection from peer review and criticism prevailed. Of the repeated attempts to obtain state data, I will mention only a few. The Environ-

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4The documents supporting each of my allegations were collected and presented on March 7, 1980, to the Roswell Park Board of Visitors and to each member of the Council of the Association of Scientists, Roswell Park. A copy of these documents, including letters and memoranda, are now on file in the Archives Library of the State University of New York/Buffalo.

5Memo, Council, Association of Scientists, Roswell Park to Dr. David Axelrod, September 19, 1979. “The Council has found that several aspects of the administrative action taken in this case are very disturbing. We are especially concerned that these actions may set a dangerous precedent which may lead to:
(a) arbitrary and punitive administrative control over scientific and professional activities at Roswell Park Memorial Institute and,
(b) an inhibition of the development of new programs, such as environmental carcinogenesis, which clearly relate to the goal of cancer prevention and cure but which may also have political and economic implications.”
mental Defense Fund requested the protocols of the Department of Health studies under the Freedom of Information Act, but this request was denied. On February 8, 1979, a news release from the Health Department made five claims regarding the results of the health studies (no liver disease, no benzene toxicity, no blood problems, no cancer, no epilepsy). My request for data supporting these claims was denied.

A short time later in a face-to-face meeting among the three of us, Governor Hugh Carey asked Commissioner Axelrod to give me the data. Though Dr. Axelrod agreed, he has never done so. Later toxicologist Steven Lester and I were promised by Dr. Axelrod access to the state’s computerized data base. On an arranged date, Lester flew to Albany only to be denied access to any of the health data. On another occasion, Dr. Axelrod explained that he wanted to provide health data but could not do so ethically because confidentiality had been promised to the interviewed residents. He suggested that I get signed consent forms from each resident who provided health data to the state, releasing that data to me. The lawyer for the residents drew up the consent form, and the residents organized and obtained hundreds of signed consents. When I sent these to Dr. Axelrod with a cover letter, all I received back was a reprimand for writing my cover letter on Department of Health stationery. (See Archives Library of the State University of New York, Buffalo). The release of data is still “under review.” Many more examples could be cited.

The Health Department claimed that they set up a peer review system by appointing a Blue Ribbon Committee to advise on study design and to review data. However, Dr. Axelrod refused to name the scientists on this Committee even to Congress. The Congressional Subcommittee Report says “...Dr. Axelrod places great reliance on the reviews of the State’s studies by panels of outside experts. However New York has refused to release the names of the members or minutes of the meetings of the panels. While in his testimony Dr. Axelrod maintained that section 206 (1) (j) of the New York Public Health Law prohibits release of such documents, counsel for the State of New York was unable to cite a single case in support of that position.”

Finally, except for one recent study on cancer, the results of the Department of Health studies at Love Canal have not yet been published in the scientific literature. One could argue that this process takes time, but a year ago I received anonymously in the mail a paper on Love Canal prepared by the Health Department as if for publication. Stamped on every page was the notation, “confidential—prepared for litigation.” I do not believe that scientific work should be kept confidential for legal purposes, particularly when the information contained in that paper has an impact on public health and safety.

The recently published Janerich study on cancer (Science, 212, 1404–07, 1981) illustrates the importance of independent scientific review. The first sentence in the abstract from the study, frequently quoted in the popular press, states, “Data from the New York Cancer Registry show no evidence for higher cancer rates associated with residence near the Love Canal toxic waste burial site outside of New York City.” Yet the study itself has a table of data showing that the Love Canal census tract has a 70 percent increase in lung cancers in men and a 100 percent increase in lung cancer in women, compared to the rest of New York State (excluding New York City). Both increases are statistically significant. Furthermore, although four census tracts for men and three for women (out of twenty-six in Niagara Falls) have cancer increases as high or higher than Love Canal, Love Canal is the only census tract to have a statistically significant increase in lung cancer for both men and women.

6. In any attempt at controversy resolution, all parties to the conflict should agree on precisely what facts need resolving; all parties should agree on the composition of the body chosen to resolve the controversy; all parties should agree on the procedures by which that body will operate; and all parties must agree to abide by the decisions. Unfortunately, such a logical procedure rarely occurs.

There were at least two unsuccessful attempts to resolve controversy at Love Canal, and both failed because these requirements were not followed. The first occurred on February 22, 1979, when the local Congressman John LaFalce requested that representatives of the EPA and Department of Health, Education, and Welfare meet with Dr. Axelrod and me “so that both sets of data can be reviewed by the federal government. I am hopeful,” LaFalce wrote, “that such a meet-
ing will resolve the differences that currently exist and that appropriate actions will then be taken to protect the health and welfare of my people.” Dr. David Rail of the NIEHS was appointed chair, and he convened experts in biostatistics and epidemiology. Since Dr. Axelrod refused to have a face-to-face meeting with me, the federal committee met with me on April 12, 1979, and with State Health Department scientists on April 26. Their report agreed with my concerns and recommended that further studies be undertaken. In response to my suggestion that all women of child-bearing age who wish more children should be evacuated, they recommended that exposure of Love Canal residents be “minimized to the extent feasible.” Those familiar with Love Canal understood that the only way to minimize the exposure was to move the people out of the area. But, as the report pointed out, “The State appears to have a problem in terms of perceived conflict of interest.” Thus the report recommended that “the involvement of outside scientists, both in the interpretation of data and the formulation of recommendations to the State policy makers, should be continued. In a manner such as this where there is much public concern, it is wise that considerations of findings and of alternatives be conducted openly. To this end it might be wise to include representatives of the local population.”

This attempt to resolve controversy failed because the Health Department chose to ignore the report. The department had nothing to gain by resolution of the controversy and had not agreed to abide by the decisions of the group.

The second attempt occurred about a year later. In May 1980, State Senator Thomas Bartosiewicz released a report on the hazardous waste problem in New York State. He then called for an investigation into the handling of Love Canal by the Department of Health. In a letter to Governor Carey and in a Senate resolution, he charged the state agencies (Department of Health and Department of Environmental Conservation) with unethical conduct. The detailed list of charges included:

- “Appointment of a Blue Ribbon panel which had secret members and secret recommendations which were withheld from the public;
- “Manipulation of health data...to minimize risks;
- “Unexplained delays of up to eighteen months before the State was willing to admit a health problem existed;
- “Demotion, transfers, and harassment of state employees sympathetic to Love Canal residents;
- “An effort by the state to discourage and prevent independent professional health studies.”

Sen. Bartosiewicz called for a Moreland Act investigation, which in New York State means an investigation with subpoena powers.

Instead of launching a truly independent investigation, however, in June 1980 Governor Carey appointed a review panel of five eminent scientists who were all physicians and administrators of institutions with close ties to the state. Dr. Lewis Thomas, chancellor of Memorial Sloan-Kettering Cancer Center, chaired the panel. The other members were Dr. Arthur Upton, chairman of the Department of Environmental Medicine, New York University School of Medicine, and formerly head of the federal National Cancer Institute; Dr. Saul J. Farber, dean of the New York University School of Medicine; Dr. Attallah Kappas, physician-in-chief of Rockefeller University Hospital; and Dr. Richard Doherty, associate professor of pediatrics, genetics, obstetrics, and radiation, University of Rochester Medical Center.

The most striking aspect of the Thomas Report, issued in the fall of 1980, was its absence of documentation. The report contained no references to the scientific studies that provided the basis for its conclusions, and no supporting facts or tables of data. The only documentation was a list of studies that the committee had reviewed, together with on sentence about the results. The only Department of Health studies mentioned were: (1) the adverse pregnancy outcomes study with the Warburton and Fraser control, (2) blood counts and liver function tests of residents, and (3) medical examination of 112 construction workers (not residents). Missing was any reference to the major epidemiological effort by the state with its 22-page questionnaire on health. Three other studies on cancer and adverse pregnancy outcomes were listed as “in progress.”

Yet, on the basis of these three studies alone, the Thomas Report concluded (pp. 15 and 22):

It is clear enough from the available data that no acute cases of intoxication by chemical pollutants have been observed within any part of the Love Canal community, ‘wet or dry.’
That is, no clusters of cases of acute liver disease, or kidney disease, or pulmonary manifestations, or hemolytic anemia or agranulocytosis, and certainly no peripheral or central nervous system syndromes...this was clear enough from the outset...no cases of chloracne were found, and there appeared to be no excess of cases of cancer, asthma, epilepsy, liver disease, or hemotological abnormalities.6

These conclusions were so surprising that Dr. Adeline Levine, a sociologist at the State University of New York at Buffalo, who had been studying the Love Canal situation since the summer of 1978, wrote to Dr. Thomas requesting some factual information about the data. He refused, stating: “We [the Panel] have decided that the report should stand on its own without further comment or amplification at this time.” Through the Freedom of Information Act, Dr. Levine found out more about the workings of the Thomas Committee.

1. Although the committee was subject to the open Meeting Law and the Freedom of Information Act of the State of New York, it did not announce the five meetings publicly, it did not hold open meetings, and it did not keep minutes, as required by these laws.

2. Staff helpers from New York State were present at every meeting. (At one meeting they outnumbered the panelists.) Edward Dowling, the associate director of the New York State Health Planning Commission, which advises the Health Commissioner on the allocation of beds and capital expenditures for New York State medical institutions, took care of the agendas, distributed materials, and provided clerical support at all the meetings. Also present at four meetings was Dr. Peter Greenwald, director of epidemiology for the Department of Health, in effect reviewing his own work as well as that of his critics.

Other state officials, including Dr. Axelrod, Governor Carey, and Dr. Kevin Cahill, Special Assistant to the Governor for Health Affairs, also attended meetings. Of twenty-eight comments on the final draft, twelve are by Cahill.

Dr. Levine’s material suggests that changes were made in the final document after the panel’s last meetings. One panel member, Dr. Upton, said he did not see the final draft before it was released. Perhaps this explains why two of the three panel members I spoke to were surprised when I asked them to document the claims of no disease. Each insisted that the panel meant to say that “no adequate studies of disease existed,” rather than to claim that “it is clear enough from the available data that....” Dr. Doherty admitted that the committee saw no data from the Health Department on kidney disease, pulmonary disease, peripheral or central nervous system syndromes, asthma, or epilepsy. The statement on cancer was based not on data but on a verbal statement from Peter Greenwald.

The panel’s report does contain factual errors and ad hominem attacks on the scientists who opposed the Department of Health—phrases such as “incompetence and irresponsibility...believes fervently...impossible to interpret...cannot be taken seriously...polemic.”

The major recommendation of the report is that the New York State Department of Health coordinate and plan all Love Canal studies; that the federal government and independent scientists work only under this central administration; and that “public pronouncements [be] made only by this group.” In other words, the plan allowed no room at the top for independent scientific opinion.

Although many in the scientific community believe that the panel’s report is the definitive word on Love Canal, the panel members were chosen by one side only (the state) and they had many connections with that side. The panel met secretly and never met with the community at all. The community was not even given a final copy of the report before it was released to the press. As controversy over environmental and public health becomes more and more common, there is a strong need to establish standards of ethical behavior for scientists in such situations. There must also be some means of appeal for those who have been injured and some methods for holding scientists accountable. For example, the American Association for the Advancement of Science might be asked to examine the panel’s evidence and decide whether

6 In the list of studies at the end of the report, the statement “no instances of chloracne and no excess of cancer, asthma, or epilepsy were found among these area residents” is listed as a conclusion of the report by Vianna et al. on adverse pregnancy outcomes. However, the Vianna report has no information at all about chloracne, cancer, asthma, or epilepsy. Many area residents broke out in rashes that were thought to be chloracne, but they were unable to get the Department of Health physicians to examine them.
the report’s conclusions are justified.

The Next Decade

The impact of hazardous waste on the health of communities will, unfortunately, require even closer attention during the next decade. Until now, corporations that produce wastes have all been required to report to the EPA annually on their waste disposal practices. But in February the EPA decided to suspend this requirement and suggested instead taking an annual survey of 10 percent of the industries involved. The agency has been considering a change in the rules that would allow toxic liquids to constitute 25 percent of the volume of hazardous waste dumps; and it has proposed a suspension of rules requiring the incineration of certain hazardous wastes.

When controversies arise in communities as they inevitably will, steps can be taken to ease the situation and protect the public health. First, scientists should scrupulously adhere to the norms of their profession such as openness of data, peer review and criticism, and publication of evidence. Second, community involvement should be sought and used at every level of the process. Third, funds should be provided so the community can hire its own experts.

It would also be useful to have a carefully reasoned process for conflict resolution, which could be published by scientific societies and incorporated into the ethical code of behavior for scientists. Such a process would help, even in cases like Love Canal, where the controversy was so political. The standards for conflict resolution should include guidelines for selecting an independent group of fact-finders, the rules of procedure for such a body, an agreement by both parties to abide by the decision, and adequate protection for whistleblowers. Finally, since in conflicts between bureaucracy and community, the bureaucracy often does not gain by controversy resolution, third parties may have to try to apply pressure in order to get the bureaucracy to participate in such a procedure—as Senator Bartosiewicz and Congressman LaFalce did.

Many of the controversies of Love Canal were stated as scientific issues, but they had their roots in ethical considerations. In such instances the controversy would have become easier to resolve if the ethical considerations and value judgments had been openly stated and understood. As things now stand, the CDC has abandoned its efforts, except for repeating a chromosome study on fifty residents two years after their departure from Love Canal (by which time many of the chromosomal effects will have disappeared). A private agency, the Environmental Defense Fund, supported by foundations and some money from the EPA, is examining the health of Love Canal children. But no health studies on all the residents—particularly of long-term health hazards or reproductive changes—are underway or planned.

Love Canal residents can now have their homes purchased by the Love Canal Revitalization Agency, which runs a state-federal program for buying up houses. Seventy-five percent of the residents have chosen that option. The remaining 25 percent—most of whom live on the fringes of the Love Canal area—are staying, either because they could not afford to move or because they are waiting for the long overdue results of an EPA study on the sampling of soil and air before making up their minds. The city hopes that the EPA study will put fears to rest so that tax-paying families will return to the outer ring of Love Canal. (The inner ring of 100 houses will be demolished.) So far, only the director of the Revitalization Agency has moved in (New York Times, May 17, 1982). He would like to see a fence “maybe covered with ivy” around the LaSalle neighborhood, the name he prefers to Love Canal.
Questions

1. What was Beverly Paigen’s role in the Love Canal controversy?

2. Why does the author think the Love Canal incident is important?

3. The DOH assured the ‘outer ring’ residents that there was no health risk from the waste site. What was the basis for their assurances?

4. How did a geographic analysis of disease incidence convince the author that the chemicals had migrated into the ‘outer ring’ and may pose a health risk to those residents? Why didn’t the DOH come to the same conclusions?

5. Why did the DOH recommendation to evacuate pregnant women and young children from the ‘outer ring’ homes anger the community?

6. Why does the author say that the controversy wasn’t about science but was about values?

7. What are type I and type II errors? How do these errors relate to the decision on whether to evacuate the Love Canal residents?

8. ‘The controversy I had hoped to end continued even though there was no longer any difference of opinion over facts.’ According to the author, what factors impeded resolution of the Love Canal controversy?

9. Why did the Love Canal residents apparently feel more anger towards the DOH than Hooker, who had created the toxic waste site?

10. What suggestions does the author make to help resolve future public controversies of this nature?