

## CANCER AND ENVIRONMENTAL HAZARDS IN WOBURN, MA (A)

by Wendy O'Donnell

### Introduction

In the course of 1979, the city of Woburn, Massachusetts, received three pieces of very bad news. First, hazardous wastes were found on the site of one of the new industrial developments—wastes, as it turned out, that would take years to clean up. Two of the city's wells were also found to be polluted: among other contaminants, they contained at least two suspected human carcinogens. Third, the city learned that its rate of death from cancer was significantly above the average for a city of its size and population characteristics.

Government became involved in Woburn's problems in several ways. The Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers worked on the toxic waste site. They tried to stop any further contamination of adjacent land and water, and the EPA coordinated the search for clean-up strategies. The state's Department of Environmental Quality Engineering (DEQE) worked with the EPA on both the toxic waste site and in testing the city's wells for contamination.

Most public attention, however, was focused on the Massachusetts Department of Public Health (DPH), to whom fell the investigation of the elevated rate of cancer deaths. The DPH, with assistance provided by both the U.S. Center for Disease Control and the National Institute for Occupational Safety and Health, investigated the possible link between the pollution by toxic wastes and the wells.

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In 1981, DPH released two studies on the subject of cancer and environmental hazards in Woburn. The studies provided officials and the public with a detailed description of cancer in Woburn, and they were able to collect much information on the environmental hazards.

The one thing the studies could not do, though, was to definitely answer the question of whether the hazards were connected to the cancer.

### **Hazardous Wastes in Woburn**

The city of Woburn is no stranger to complaints about its air and water. At least as far back as a century ago, concerns were being raised about the purity of these natural resources.<sup>1</sup> One area of the city has come under particular scrutiny in recent years—a large parcel of land in northeastern Woburn known as Industriplex (see map, Appendix A). The area was named for the light industrial park that had been planned for the parcel. Only part of the development has occurred because chemical wastes such as arsenic and chromium were found on the site.

The Industriplex land has a long history of use for chemical production and similar industries. Between 1859 and 1968, a wide variety of wastes were dumped on this site in substantial amounts. These included chemicals used in, and by-products of, the production of textiles, leather goods, pesticides, glues, and grease. There is no way to know accurately how many manufacturing chemicals and by-products, including residual animal hides, were disposed of on the land. An idea of the magnitude of the industry is available from a report given by the State Board of Health in 1879: it estimated that 270,400 hides were processed in the towns of Woburn and Winchester in 1875, and noted “to each hundred hides there are 40 barrels of lime, 16 pounds of sulphur, and 40,000 gallons of water. Then most of this filth drains directly into the waters of the Mystic Basin.”<sup>2</sup>

In the early 1970's, William D'Annolfo, representing the Mark Philip Realty trust, acquired the site and began making preparations for the design of the Industriplex Park. At the outset, D'Annolfo was aware the site had some contamination problems and hired a consultant, Melvin First, to determine if the levels of a particular chemical—hydrogen sulfide—in the air were acceptable for construction workers to be exposed to during the process of developing the land. First found the levels all within the standard eight-hour exposure limits.

In 1972, D'Annolfo began the development at the southern end of the site, intending to work northward. According to a study prepared by graduate students at Tufts University: “As the

work progressed, pockets of buried animal hides and chemicals were exposed to the air. The pockets were then excavated and deposited on a stockpile located in the northern end of the site below Boston Edison Company power lines.”<sup>3</sup>

Once work on Industriplex was underway, the Department of Public Health began to receive complaints about odors emanating from the work area. The complaints came from residents of the adjacent town of Reading, as well as from people living in Woburn itself. The department investigated and determined that the work was causing a violation of the state's air pollution regulation. The DPH began issuing notices of these violations to D'Annolfo. The notices, however, were not effective in stopping work on the property. For three years from 1972 to 1975, the odors, complaints, and violations notices continued.

In 1975, one of the divisions within the DPH was spun off into an independent agency to deal with environmental matters. This new agency, the Department of Environmental Quality Engineering, was placed within the jurisdiction of the other new office, the Executive Office of Environmental Affairs. The creation of this new executive office and agency, however, divided the responsibility for dealing with the problems caused by the Industriplex construction; the DPH fell under the jurisdiction of the Executive Office of Human Services. The two agencies thus answered to different state secretaries.

Upon its creation, DEQE took over responsibility for issuing violation notices to D'Annolfo, and continued to issue these notices through May of 1977. At that time, and because of the lack of success the violation notices had produced, the state tried a new strategy: negotiating with the developer to find a mutually agreeable way to abate the odors coming from the property. This began a new cycle; this time of agreements, violations, violation notices, and new negotiations. According to Richard Leighton, the EPA coordinator for Woburn, over 40 violation notices were issued to D'Annolfo between 1972 and 1979. None had more than a temporary effect.

On June 28, 1979, the Army Corps of Engineers became involved in the dispute, concerned that D'Annolfo was placing the polluted material into the Aberjona River. They filed a federal court action against the developer and received an order that he cease work. This time he did.

The Corps went further in their concern, however, and when they suspected possible violations of wetlands protection by the developer they contacted the EPA. When the EPA

investigators arrived they found not only wetlands violations, but hazardous materials, including arsenic, chromium and lead. The EPA conducted tests during the summer of 1979 and filed a brief in the Corps' case against D'Annolfo, detailing the materials they had found and the conditions on the site. In addition to the case against D'Annolfo, the state had filed one of its own seeking to stop work on the property. Both cases were eventually settled through consent decrees. The Corps' decree was the second signed and the stronger of the two, allowing D'Annolfo to develop only those portions of the Industriplex land which were "clean."

The discovery of these wastes, however, was only one of three developments in Woburn in 1979 that caused government officials and residents concern about the town's health.

### **Contaminated Drinking Water**

The second cause for concern that year was the discovery that two of the town's sixteen municipally-owned wells contained organic contamination. In May of 1979, DEQE, as part of routine testing of drinking water quality in the state, took samples from Woburn wells to test for possible pollutants, especially those included on the EPA's priority pollutant list. The tests conducted by DEQE found that two of the wells, referred to as Wells G and H, contained unacceptable levels of several organic contaminants. The two wells were immediately shut down. Later tests, conducted through 1979 and 1980 by both the DEQE and the EPA, showed that one or both of these wells contained levels that exceeded standards set for the following volatile organic substances: Chloroform, trichloroethylene (commonly known as TCE), tetrachloroethylene, 1,1,1-trichloroethane, dibromochloromethane, trichloro-triflouroethane (Freon), dichloroethylene, and dichlorotrifluoroethane<sup>4</sup>. Most of these materials have been or are still being used as solvents in various industrial processes. The long-range effects of regularly ingesting small amounts are not known, but among them, according to the EPA, chloroform is considered a potential human carcinogen, and tetrachloroethylene has produced tumors in laboratory animals, although there is no evidence to prove it is a cause of cancer in humans.<sup>5</sup>

Wells G and H were brought into Woburn's water supply in the 1960s. Both were used as a source of additional water in times of above average consumption or need. At one time or another, the water reached most parts of the city, though the heaviest concentration of water received from G and H was located in the eastern half of Woburn.<sup>6</sup>

After the discovery of the wastes on the Industriplex site, the wells were tested for contamination by arsenic, lead or chromium. No lead or chromium was detected in either well, and arsenic was found only in very small amounts, well below the federal standard for safe drinking water. As far as any tests could tell, the two sites of contamination—Industriplex and the wells—were unrelated.

### Significantly Elevated Cancer Rates

The third discovery of 1979 greatly increased concern about the possible health effects of the city's environmental hazards: in the last months of the year, it was reported that Woburn had significantly elevated rates of certain types of cancer. This discovery had started seven years before. In 1972, a Woburn boy, Jimmy Anderson, was diagnosed as suffering from childhood leukemia. His mother enlisted the help of her pastor, Bruce Young of Trinity Episcopal Church, in getting her son to and from treatments and in giving her support through the ordeal. During this time, Anderson expressed a hope to Young that there were, to her knowledge, three children in her immediate neighborhood with leukemia. Anderson thought the number unusual, and asked Young for confirmation. In an interview, Young explained:

[The number of cases] didn't startle, amaze, or seem extraordinary to me, because I didn't know very much about leukemia. But her concern launched us to find out whether [the number of cases] was high, low, or average. She felt, of course, that it was very high. I thought that perhaps she was overreacting as the parent of a child who had a rare disease. But, in order to prove or disprove her premise, it had to happen that we found what the real numbers should have been. That launched us into a rather frustrating, long trail of trying to get information...which, we found out later, was just nonexistent.

We went to places like the Bureau of Vital Statistics and to the Department of Public Health asking for information about leukemia incidence. We went to the local board of health; we went to City Hall and went through death records because, clearly, the incidence documentation just didn't exist. We didn't find out until later why it wasn't there; no one was straight-forward enough to tell us why. It was one

of those frustrating things when you're dealing with agencies.... You get put on hold, you're on hold for ten or fifteen minutes, then you get cut off, and then you make the phone call again, get transferred to another department who doesn't have a name, it's just so aggravating, so frustrating; it literally wears you out. That happened to us, and it would take a sort of recharging of the batteries before we'd have the courage to try again.... After a long time, we found out we weren't getting anywhere, we were going in circles, ...and only later did we discover that the state couldn't help; they didn't have the incidence data for childhood leukemia.

Out of this frustration, in October of 1979, Anderson and Young organized a meeting for the relatives of children with leukemia and of those who had died from it in the preceding fifteen years. From information gathered from the people in attendance, they hoped to generate some data about leukemia in Woburn. They were successful. Young says:

About the middle of November [1979], I had all the [information] that I thought I was going to get. The number was, I think, fourteen cases of leukemia. The amazing thing was that Mrs. Anderson's contention that a lot of them were in her neighborhood was borne out now. We had names and addresses, the type of leukemia, where the child was being treated and who the doctor was.

Young and Anderson plotted the locations of the fourteen cases they found and took this information to Jimmy Anderson's doctor, pediatric hematologist John Truman. Young also notified the mayor and spoke to the press about his concern that an investigation was needed into the possible causes of so many cases of childhood leukemia. Dr. Truman informed the state DPH and the Center for Disease Control (CDC) in Atlanta that there were an unusual numbering and clustering of leukemias in Woburn.

At the same time, the National Institute for Occupational Safety and Health (NIOSH) received information that three former workers at a now closed Tabby Pet Food factory in Woburn were suffering from kidney cancer. This was from among a workforce that was thought to be less than a thousand workers when the plant was in full operation. There was also the possibility that additional kidney cancer existed among former workers at the plant which had not yet come to NIOSH's attention.<sup>7</sup>

It was this last set of discoveries, "too much" of certain types of cancer in Woburn, that finally caused both the state and federal governments to begin looking at the relationship between public health and environmental hazards in the city.

### Identifying the Problem

"Going public" with their concern about the rate of cancer in Woburn, according to Young, not only engaged the interest of government agencies concerned with health, it brought the issue to the attention of a number of individual officials as well, and created pressure for more information on the specifics of the situation. U.S. Senator Edward M. Kennedy sent a representative to the October data gathering meeting, and State Senator Samuel Rotondi publicly called for the DPH to release any information they had on the deaths from cancer in Woburn.

In December of 1979, the DPH did release a one-page tally of the rates of selected causes of death in the city, comparing them to the expected rates of death for each cause in the Commonwealth. (The data on Woburn had already been gathered as part of a larger effort by the DPH to complete a profile of mortality in every city and town in the state. See Appendix B for copy of the tally.) The report examined deaths in the years 1963–1973 and 1974–1978, as well as for the decade as a whole. The tally showed a significant increase in the rates of death for the following cancers over the number of cases predicted (numbers given indicate the percentage the actual mortality counts were over the expected incidence):\*

**Table 1. Mortality Rates**

All cancers:.....	1969-1978.....	113%
" .....	1974-1978 only.....	124%
Liver cancer:.....	1974-1978 only.....	347%
Female organ cancer (excluding cancers of the breast, uterus, and cervix):...	1969-1978.....	161%
" .....	1969-1973 only.....	177%
Kidney cancer:.....	1969-1978.....	188%
Leukemia in female children....	1969-1973 only.....	245% <sup>8</sup>

\* Calculations showed the increase to be statistically significant at the .01 level, meaning there was only a 1% probability that the increases occurred solely as the result of chance.

The data was given to the Woburn Board of Health by Gerald Parker, assistant commissioner of the DPH for environmental health, in a meeting which also included the DPH commissioner, other department staff—and a representative from DEQE. The press release emphasized that the statistics on the elevated rates of death from some cancers in the city were not necessarily related to the environmental hazards so recently discovered. In part, the release read:

It had been previously reported that the Woburn population had a 13% higher rate of cancer than would be expected\* considering the age and sex characteristics of the residents. During the meeting with the city board of health, Public Health Commissioner Dr. Alfred L. Frechette emphasized that the Public Health Department had found no evidence to associate the existing cancer rate with any environmental problems.

Commissioner Frechette stated that "although the rate gives us reason for concern, the present cancer rate does not in any way represent an epidemic situation. The cancer incidence does present some serious questions for which we want to find answers"<sup>9</sup>

## ENVIRONMENTAL FACTORS AND CANCER INCIDENCE

### Determining Cancer Incidence in Woburn

After the initial release of the mortality data, DPH began to search for a common denominator in the cancer cases. The first problem they faced was to find how many cases of cancer there were in Woburn. At the time no clearinghouse existed for information on cancer incidence or the location of cases. The state faced the same problem Bruce Young had in learning who had cancer in the city. The only data immediately available were death statistics and, in addition to missing those individuals with cancer who were still living, they could prove inaccurate because the direct cause of death of many cancer patients is another condition, such as pneumonia

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\* The 13% figure represents the 113% that actual deaths were of those expected for all types of cancer. The figure was released to local officials prior to the delivery of the one-page report.



or organ failure. Commissioner Frechette described the difficulty to the Boston Herald American:

There is a problem, but it is undefined. We don't know its magnitude in Massachusetts....We seem to learn only in a haphazard way, like a Woburn situation. Ironically, a clergyman gets the information before we do.

The state began with the data they had from the mortality profile and the information provided by Bruce Young on childhood leukemia cases. The Director of the Division of Health Statistics Milton Kotelchuk and the division's research director, Sharon Rosen, met with Gerald Parker to consider an approach to the investigation. Examining such a situation was a totally new task for the three. Rosen describes:

We [Rosen, Kotelchuk and Parker] were really all the department had for resources. The Division of Health Statistics had historically done other kinds of work. This was a new area and few health departments anywhere had staffs looking at chronic disease epidemiology, and particularly environmental epidemiology.

As a result, the DPH requested assistance from the federal Center for Disease Control (CDC). The CDC assigned epidemiologist Dr. John Cutler to assist the department.\* Cutler, who at the time was working out of the University of Connecticut Health Center, began what became a regular commute to Boston. According to Cutler, he began the investigation by examining the information available on the cases of leukemia located by Young and Anderson. Of the 14 cases Young presented, Cutler confirmed 12 to be childhood leukemia.\*\* Cutler then went to Atlanta to discuss the problem with the CDC staff. There it was decided that the best approach would be to do interviews using both the actual leukemia victims and control cases as subjects. In this way it was hoped a common trait or experience would be found that was unique to the actual cases. The CDC had been conducting similar studies during the preceding 15 years. In that time no study had ever established a link between the occurrence of leukemias and environmental hazards.

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\* According to Young, the intervention of Senator Edward Kennedy was instrumental in convincing the CDC to assign Cutler virtually full-time to the DPH and the Woburn investigation.

\*\* To this day, Young disagrees with Cutler's findings, claiming that while one of the original cases was rightly removed, the other was indeed leukemia and was taken off the DPH's list of cases incorrectly and for unknown reasons.

For the DPH, however, the study was a first—although several members of the department had experience with health-oriented surveys, they had never organized a study probing such a link. According to Rosen, the DPH team shut themselves away for days at a time drafting the survey instrument to explore as many factors as possible. She noted the extreme value of the CDC assistance "in scoping out the universe of issues" to be included. "For example," Rosen said, "we probably wouldn't have thought to ask—and a lot of people laughed at this question—whether any of the children ate dirt. It sounds silly, but it could have been an important factor."

The design of the study involved extensive cooperation between the CDC and the DPH. And, although the design and most of the work had been completed by mid-summer of 1980, when the DPH created a new division—the Division of Environmental Health Assessment—in August of that year, the new office began to work with the Health Statistics Division on the study as well.

The survey instrument turned out to be quite long, totalling almost 40 pages and examining about the same number of variables. The writing of the survey and the location of both actual cases and suitable control subjects occupied approximately six months. The study was intended to examine not only the incidence of childhood leukemia but liver and renal cancer, and with only three staff members to work on it, the initial stages went slowly.

Additionally, according to the participants, the work was done painstakingly because they had real hope at the outset that they would be able to establish some connection between the leukemia and some other factor in eastern Woburn—the wells, perhaps, or the hazardous wastes. At the start of the study such a hope seemed reasonable.

Sharon Rosen says that her optimism about finding such a relationship first diminished after a survey of the available literature on similar studies was done: "They had found elevation [in leukemia rates], but they had never been successful in linking them to specific environmental exposures." Young claims that he was "naive in thinking that the technical, mechanical and intellectual resources were all there, and I believed that the cause [of the leukemia] could be identified, that it was not as evasive as it apparently is." Even John Cutler, with his background with the CDC, thought that a link might be established, especially one between the cancers and the Industriplex wastes:

There was all this publicity about the hazardous waste site and there was this hypothesis that something in the site might have led to the increased leukemia. It was really somewhat to our surprise to find that it had nothing to do with it, that the cases were all geographically separated from the site and never went near it. In retrospect, though, it isn't a surprise because Route 128\* kept them away from it.

The survey was carefully constructed. For each childhood leukemia case interviewed, there were two control subjects. Both controls had the characteristics similar to the actual case (age, sex, etc.); one control lived near the case, the other in a more distant part of the city. The control subjects were located through the Woburn School Department.

In addition to the information provided by Bruce Young and John Truman about the leukemia cases, other Boston medical centers were asked to identify any cases that had been missed. No new cases were found. Death records and medical centers were also checked for cases of renal and liver cancer cases. A total of 20 renal cancer victims were found (17 of these were deceased, 3 were living)\*\* as well as 7 deceased liver cancer cases.<sup>10</sup> Interviewers were provided by the CDC and NIOSH. The DPH staff members also conducted some of the interviews. The interviewing was completed at the end of June 1980, and the analysis of the information gathering was begun.

During the months in which the study was conducted, the press began to cover the situation. Two local newspapers, the Woburn Times and the Reading Daily Chronicle, had been faithfully reporting each new discovery or governmental action on a day-to-day basis. And, in the first months of the incidence study, the Boston press joined in. For example, in December of 1979, the Boston Herald American ran a three-part series under the heading "Wasteland in Woburn" which reported on the Industriplex site, the wells, and the local concerns about health.<sup>11</sup> In May of 1980, the alternative weekly Real Paper ran an extensive article on the city. Spanning several full pages, that story ran under the front page headline: "CHEMICAL WARFARE: What the residents of Woburn and the surrounding communities don't know about toxic wastes may hurt them."<sup>12</sup>

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\* Route 128, a major Massachusetts highway, effectively separates the most northeastern portion of Woburn from the rest of the city. For details, see map in Appendix A.

\*\* Six more renal cancer cases were located in the city after the completion of the study.

At the end of June, both the Herald and the Boston Globe ran articles on the DPH study and the possibility of a link between cancer and pollution in Woburn. Both articles described the study in some detail, with the Herald comparing the examination of Woburn to the studies conducted at Love Canal, New York, in the preceding months.<sup>13</sup> In the Globe, DPH officials predicted their analysis would be complete by the following October. They did not make that deadline.

### **Delays in Releasing the Study**

The lack of immediate results from the DPH investigation disturbed Bruce Young. He says, "It had been promised in June or July [1980], delayed until September, then delayed again." In December of 1980, when the report had still not been released, Young went to the Massachusetts State House and held a press conference to demand the results.

[The press conference] was an attempt to see if there was anything we could do to speed things up....People from within the [public health] department had led me to believe the report was there a long time prior to its release and that there was some political reason for the delay and it not being published, i.e., the November [1980] elections....Now I don't know. I don't get into all that stuff, but it just seemed to me that it was rotting my socks to wait, if something of consequence was sitting on somebody's desk and not released simply because it was regarded as an embarrassment to some political figure, or deleterious to somebody or advantageous to somebody else. I didn't want it to become a political instrument, and, as I say, I had information that that was the case.

The DPH staff, however, say that the study was late for several reasons, none of them related to the 1980 elections. The study's authors, Gerald Parker and Sharon Rosen, attribute the delay to the lack of staff, the need to work on other department projects (including the ten year mortality profile of each city and town in the state that was the basis for the original one-page tally of cancer deaths in Woburn), and the fact that they had never before conducted such a study and were unable to judge accurately how long it would take to analyze and edit. DPH Director of

Public Information Petra Langer confirms that these were the principal reasons for the delay in the results' release:

People were concerned that it took us so long to get the study out. This was the first time we'd done a study like this and there was a fair amount of work to do on it....We were treading new ground in a way, and we knew there was a lot of concern in the community. We wanted to do a good job with it....At that point, I think we had three people who were working on the study and the amount of work was staggering. Of course, it was hard to communicate that to people in Woburn like the Reverend Young who were very concerned and weren't about to listen to the fact that we only had three people to work on the study.

### **Conclusions But No Answers**

The study was released a month after Bruce Young held his press conference. On January 23, 1981, both Parker and Rosen travelled to Woburn's City Hall to brief local officials on the findings. After meeting privately with the mayor and members of the Board of Health, the DPH staff met with the public and the press. Several Boston television and radio stations covered the event, along with many of the area's newspapers. Young, who had not been briefed on the results prior to the press conference, attended to hear what the state had found.

It was Petra Langer, the press officer, who made the decision to hold the press conference instead of simply distributing a news release on the report. Langer felt that public interest and concern about the issue warranted the event:

We thought it made more sense to pick a central location where we would have copies of the study and where our people would make some brief statements about what it said and give people the opportunity to ask questions. When you're dealing with a major issue like this, it just makes more sense to do it that way rather than sending out a press release and then having a barrage of tele-phone calls. Plus, people want to see the folks who did the study and want to be able to talk to them face-to-face.

At the news conference, Gerald Parker summarized the study's conclusions. The DPH had succeeded in documenting the incidence of the three cancers in the city, but had not been able to prove or disprove the hypothesis that the cases were linked to some environmental factor. The report's conclusions read:

The investigation has established that in the period under investigation, the overall incidence of childhood leukemia was significantly elevated in Woburn. The incidence of renal cancer is also significantly elevated on that period.

Information gathered thus far fails to establish any association between environmental hazards and the increased incidence of childhood leukemia and renal cancer in Woburn. The hypothesis suggesting that the increase in leukemia incidence was associated with environmental hazards in Woburn and specifically to the contamination of drinking water supplies is neither supported nor refuted by the study findings. Interviews with parents of leukemia cases, two groups of matched controls and family members of renal cancer cases revealed no associations between the environmental factor and disease. Further investigation of this possible association should include the following:

- Attempt to ascertain childhood leukemia mortality and incidence in Woburn prior to 1969, i.e. in the 1950s and 60s. Finding that childhood leukemia became elevated in the eastern part of Woburn only after Wells G and H came on line would support the hypothesis that the elevated leukemia incidence was related to drinking water contaminants.
- Determine the incidence of other lymphatic disease in Woburn to see if it follows a pattern similar to childhood leukemia over the same time period.
- More generally, determine the incidence of other types of cancer in Woburn prior to 1969.

—Environmental agencies are continuing to attempt to identify the present source of organic contaminants in Wells G and H. This information may help identify past practices of waste disposal and sources of contaminants.<sup>14</sup>

The incidence of liver cancer is not addressed in the conclusions because, in the course of the research, errors were found on the death records of three cases and, with those cases eliminated, the rate of liver cancer fell within the state-wide norm for the disease. (The norm was based on expected cancer rates projected from incidence data in the Third National Cancer Survey published by the US Department of Health, Education and Welfare.<sup>15</sup>

Although the DPH cancer incidence study failed to provide any answers to the question of whether environmental hazards had any role in the elevation of certain cancer rates in the city, there were no outcries that the study had been conducted haphazardly. DPH officials say they wanted to find such an answer, but with none available in the data, they felt they had done the best they could. Sharon Rosen summarizes the two goals she believed the department strived for, and achieved, in the investigation:

What I think we tried to do with the study—and both pieces are important—was:

1. To do it well. That is what we're paid to do, and we did it given the constraints of time and personnel; But also
2. To understand that it was never going to be perfect.

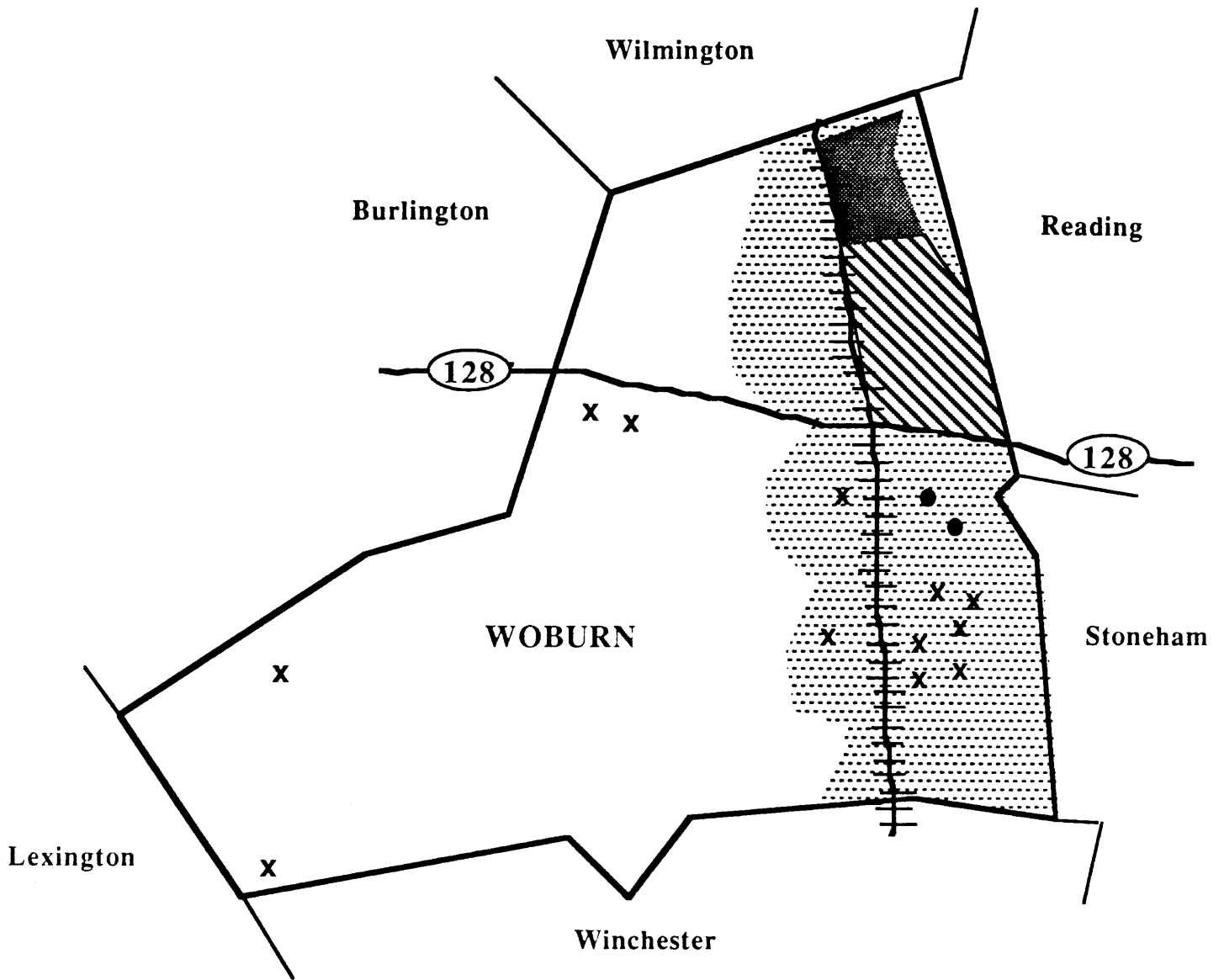
There's a tension you have to balance. If you are going to continue a study, you ought to have some good reason for it. Otherwise, you should say "We did it. It's finished." It's hard to achieve the balance.

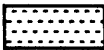


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- <sup>1</sup> See Massachusetts State Board of Health, Seventh Annual Report, 1876, p. 242.
- <sup>2</sup> *Ibid.*, pp. 244-245.
- <sup>3</sup> Urban Advocacy Project, Hazardous Wastes in Woburn, Department of Urban-Environmental Policy, Tufts University, Medford, MA., May 1980, pp. 7-8.
- <sup>4</sup> Norman Telles, Cancer Mortality in Woburn: A Three Decade Study (1949-1978), Department of Public Health, Commonwealth of Massachusetts, November 17, 1981. Appendix, portions of EPA report F1-8010-04B.
- <sup>5</sup> *Ibid.*
- <sup>6</sup> Gerald Parker and Sharon Rosen, Woburn: Cancer Incidence and Environmental Hazards, Department of Public Health, Commonwealth of Massachusetts, January 23, 1981, p. 19.
- <sup>7</sup> *Ibid.*, p. 2
- <sup>8</sup> *Ibid.*, p. 28.
- <sup>9</sup> Anne Bailey, Press Release, Department of Public Health, Commonwealth of Massachusetts, December 12, 1979.
- <sup>10</sup> Parker and Rosen, Woburn: Cancer Incidence and Environmental Hazards, p. 7.
- <sup>11</sup> The actual article titles in the Boston Herald American series were: "Under the gloss, arsenic. animals—and a smell," December 2, 1979, pp. B1, B3; "Woburn Wasteland: Health threat?" December 3, 1979, pp. A1, A8; and "Blame goes 'round...nothing gets done," December 4, 1979.
- <sup>12</sup> "CHEMICAL WARFARE: What the residents of Woburn and the surrounding communities don't know about toxic wastes may hurt them," The Real Paper, May 24, 1980, pp. 1, 14-21.
- <sup>13</sup> "Toxic Wastes: Health threats primary concern," Boston Herald American, June 30, 1980, pp. A1, A5.
- <sup>14</sup> Parker and Rosen, Woburn: Cancer Incidence and Environmental Hazards, p. 25.
- <sup>15</sup> Cited in Parker and Rosen as: Cutler, S.J. and Young, J.L., Jr., Third National Cancer Survey: Incidence Data, NCI Monograph 41, DHEW Publication No. (NIH) 75-787.




APPENDIX A.

WOBURN: Location of Leukemia cases, Contaminated Wells, and Industriplex Site



KEY	
●	CONTAMINATED WELLS G AND H
X	RESIDENCE OF LEUKEMIA CASES AT TIME OF DIAGNOSIS
	AREA SERVED BY WATER FROM MUNICIPAL WELLS G AND H (INCLUDES INDUSTRIPLEX)
	PARTIALLY DEVELOPED INDUSTRIPLEX AREA, WASTES ON WESTERN HALF
	DEVELOPED AREA OF INDUSTRIPLEX

Only for illustrative purposes. Scale and all locations are approximate.



N

0 .5 1

approximate scale (miles)

APPENDIX B

Massachusetts Mortality Profiles for Selected Causes: 1969-1978

MASSACHUSETTS MORTALITY PROFILES FOR SELECTED CAUSES: 1969-1978

PERSON

CAUSE OF DEATH (ICDA CODE)	1969 - 1973			1974 - 1978			1969 - 1978		
	EXPECTED	OBSERVED	SMR	EXPECTED	OBSERVED	SMR	EXPECTED	OBSERVED	SMR
***** TOTAL, ALL CAUSES *****	793.0	897	107	888.1	791	88	1462.0	1338	92
	883.3	713	80	593.4	473	79	1273.7	1368	106
	1476.2	1326	90	1261.3	1624	129	2737.7	2964	108
ALL CANCERS(140-209)	167.2	156	93	161.8	176	109	286.7	332	116
	134.3	137	102	131.8	138	104	253.3	293	116
	281.8	293	104	272.3	336	123	554.8	627	113
STOMACH(151)	8.3	10	120	7.9	7	89	12.2	17	141
	6.1	8	131	8.1	4	49	11.2	12	107
	14.4	18	125	12.1	31	256	24.5	29	118
LG INTEST & RECT(153-154)	29.9	24	80	19.2	20	104	48.8	44	90
	22.2	18	81	21.8	21	96	64.8	36	55
	43.8	39	90	41.8	41	100	84.8	80	95
LIVER(155-8)	1.2	2	167	1.8	2	111	2.2	4	182
	0.8	1	125	0.4	3	750	1.8	6	333
	1.8	3	167	1.4	8	571	3.2	8	250
PANCREAS(157)	7.6	8	105	7.3	11	151	14.9	19	128
	6.9	7	101	6.8	9	130	13.5	12	89
	14.5	15	103	13.9	16	115	24.4	31	127
BRONCHUS & LUNG(162-3)	61.3	44	72	61.6	31	50	91.1	95	104
	11.2	9	81	14.8	22	150	23.7	27	114
	52.7	49	93	56.1	33	59	108.8	122	112
BREAST(174)	28.2	27	96	28.7	37	129	52.3	1	33
	29.8	27	91	28.8	37	128	52.8	64	121
	29.8	28	94	28.8	37	128	55.8	61	114
CERVIX UTERI(180)	0.8	0	0	0.9	0	0	0.8	0	0
	6.4	1	16	3.2	8	250	7.8	6	77
	6.4	1	16	3.2	8	250	7.8	6	77
OTHER FOR ORGANS(181-184)	14.8	0	0	12.8	0	0	0.8	0	0
	14.1	23	163	12.8	18	141	26.7	43	161
	14.1	23	163	12.8	18	141	26.7	43	161
PROSTATE(185)	12.3	0	0	12.7	21	165	24.8	27	109
	12.3	0	0	12.7	21	165	24.8	27	109
	12.3	0	0	12.7	21	165	24.8	27	109
BLADDER(188)	3.8	3	79	4.8	2	42	8.8	5	57
	2.5	4	160	2.4	4	167	4.8	8	163
	7.5	7	93	7.8	6	77	14.5	13	90
KIDNEY(190)	3.2	0	0	2.8	0	0	6.1	10	164
	2.8	0	0	2.8	8	286	4.8	9	228
	8.3	0	0	4.8	11	224	10.1	19	188
LEUKEMIA(200-207)	9.8	0	0	8.7	8	82	11.8	13	109
	6.9	12	173	6.3	3	47	6.4	15	234
	10.8	18	167	10.2	12	118	21.8	30	143
DIABETES(250)	11.8	7	59	10.1	12	119	21.9	19	87
	16.4	11	67	13.8	12	87	29.4	23	78
	28.2	18	64	23.1	20	87	91.3	62	68
HYPERTENSION(400-404)	7.8	0	0	6.3	4	63	11.9	12	101
	9.8	15	153	6.3	9	143	16.1	24	149
	17.4	23	132	10.6	13	123	26.8	36	134
ISCHEMIC HEART DISEASE(410-414)	284.2	311	109	234.8	238	101	822.8	567	69
	232.8	260	112	201.4	213	106	433.4	473	109
	520.2	571	110	438.8	489	111	958.2	1040	109
CEREBROVASC. DISEASE(430-438)	97.8	62	64	63.3	43	68	101.4	105	104
	12.3	98	79	87.9	91	103	190.2	189	99
	140.2	166	119	111.4	134	120	251.8	294	117
HEART ARTERIOLE & CAP(440-448)	18.9	14	74	16.8	17	101	34.9	35	103
	21.1	19	90	18.8	21	112	38.9	40	103
	48.8	37	76	34.8	38	109	74.8	75	103
PNEUMONIA(480-488)	34.8	30	86	26.1	27	103	68.7	65	95
	29.3	28	96	23.8	34	143	53.1	62	117
	63.9	68	106	49.9	61	122	113.8	127	112
BRONCH. EMPH & ASTHMA(490-493)	15.8	20	126	8.8	8	91	24.8	25	101
	3.8	9	236	3.7	3	81	8.7	14	161
	28.8	26	90	12.3	14	112	33.1	43	130
CIRRHOSIS OF LIVER(57)	21.8	20	92	18.8	20	106	34.8	40	115
	11.2	7	62	8.8	12	136	78.8	19	24
	32.8	27	82	25.8	38	147	98.4	65	66
ALL ACCIDENTS(800-899)	68.7	97	141	41.1	43	105	89.8	100	111
	24.3	38	156	25.2	22	87	64.7	69	106
	73.2	95	130	61.2	63	103	134.3	160	119
NOTED VEHICLES(810-813)	23.8	28	118	20.8	25	121	44.1	54	122
	8.8	12	135	8.8	13	149	16.2	27	166
	32.8	48	146	27.7	34	123	64.3	76	118
	11.2	8	71	11.8	16	136	22.8	24	105
	11.2	8	71	11.8	16	136	22.8	24	105

## APPENDIX C.

### Woburn: Cancer Incidence and Environmental Hazards (1969–1978) Executive Summary

#### Introduction

The Massachusetts Department of Public Health (MDPH), with assistance from the U.S. Center for Disease Control (CDC), has completed an investigation of possible associations between the incidence of certain cancers and environmental hazards in Woburn for the period 1969-1978.

#### Background

In the spring and summer of 1979 the discovery of hazardous wastes in a section of northeast Woburn called Industri-plex, and the closing of two of Woburn's drinking water wells because of organic chemical contamination, drew attention to environmental hazards in Woburn. Concern over possible adverse health effects from environmental contaminants was heightened when in October 1979 a local clergyman reported on 10 cases of childhood leukemia that had occurred in one area of the town over the prior fifteen years. Over the succeeding several weeks the MDPH analyzed Woburn's cancer mortality statistics for 1969–1978 and found these mortality rates to be higher than for the state as a whole. At the same time, a Boston pediatric hematologist reported that he had seen six cases of leukemia in one sixblock area of Woburn since 1972. In addition, the National Institute for Occupational Safety and Health was informed of three living cases of kidney cancer among former workers of a now closed pet food plant. These events prompted the MDPH in late 1979 to request the assistance of the CDC in further investigations into the health status of Woburn's residents.

#### Methodology

This study deals primarily with questions concerning childhood leukemia, renal cancer and liver cancer. Cases with these cancers were investigated by means of an interview study. An investigation into the incidence of bladder cancer was also made. Death certificates, informants and hospital records were the sources utilized to locate cases. A case is defined as a person with confirmed childhood leukemia, renal cancer, liver cancer, or bladder cancer, who was diagnosed with the disease between 1969 and 1978 (1969–1979 for the leukemia cases) and who was a resident of Woburn at the time of diagnosis. The study questionnaire was developed, pretested and revised by the MDPH and the CDC. The topics investigated included demographic information, disease process,

past medical history, smoking, residence, schooling, occupational histories, and environmental exposures. The majority of the interviews were conducted by trained interviewers from the CDC and NIOSH. Two age and sex–matched controls were interviewed for each of twelve childhood leukemia cases. One control was a person of the same age and sex who lived close to the case. The other age and sex–matched control lived in a distant part of Woburn. Interviews were conducted with the closest available relative of seventeen deceased renal cancer cases, with three living renal cancer cases, and with a relative of five deceased liver cancer cases.

### Findings

Analysis of the data was performed by the MDPH in consultation with the CDC. The expected number of incident cases for each of the diseases was calculated using age and sex–specific incidence data from the Third National Cancer Survey (TNCS).

The investigation has confirmed that there was a significantly elevated incidence of childhood leukemia in Woburn for the period 1969–1979. Twelve cases were observed whereas 5.3 cases were expected. The excess leukemias stem primarily from excess cases among males—9 cases observed, 3.1 cases expected. Analysis of residence at the time of diagnosis reveals a significant concentration of cases in the eastern part of Woburn, where the incidence of the disease was at least seven times greater than expected. For males, the incidence of childhood leukemia in this area was over 12 times that expected. The incidence of childhood leukemia for the rest of Woburn was not significantly elevated compared to national rates.

The incidence of renal cancer in Woburn also significantly elevated for the period 1969–1978. Thirty cases were observed whereas 19.4 were expected. The excess renal cancers stem primarily from excess cases among males. Analysis of residence at time of diagnosis revealed an apparent geographical concentration of cases in one area of Woburn when residence twenty years prior to diagnosis is analyzed.

The incidence of liver and bladder cancer was not significantly elevated in Woburn. Whereas 7 liver cancer cases were observed, 6.4 cases were expected. The incidence of bladder cancer is somewhat lower than expected in Woburn—29 cases observed, 45.9 cases expected. Analysis by sex and residence revealed no significant associations of liver and bladder cancer cases with any known environmental factors.

Results of the interview study were essentially negative. Responses to interview questions were generally comparable between leukemia cases and their controls. Analysis

of renal and liver cancer case responses revealed no positive leads or associations. In summary, the study failed to identify any relevant factor that distinguished the groups.

### Environmental Hazards

Based on interview responses, few of the cases had physical contact with the site where hazardous wastes, including toxic heavy metals, were discovered. Information regarding Wells G and H, which were closed in May 1979 due to organic chemical contamination, indicate that the wells were on line during the presumed critical exposure period of the childhood leukemia cases and that they served primarily the eastern part of Woburn. The data reflect, however, current types and levels of contamination. No information is available indicating what, if any, contaminants existed prior to May 1979. It is important to note that testing of the remaining wells in Woburn has shown that the water meets the federal and state drinking water standards.

### Conclusions and Recommendations

The information gathered thus far fails to provide evidence establishing an association between environmental hazards and the increased incidence of childhood leukemia and renal cancer in Woburn. Interviews with parents of leukemia cases, two groups of matched controls, and family members of renal and liver cancer cases revealed no associations between environmental factors and the disease.

The investigation has established that the overall incidence of childhood leukemia was significantly elevated in Woburn and that there was a significant concentration of cases in one particular area of east Woburn. The hypothesis suggesting that the increase in leukemia incidence was associated with environmental hazards in Woburn, and specifically with the contamination of drinking water supplies, is neither supported nor refuted by the study findings. Further investigation of this possible association requires more information. Some of the steps that could provide information that could elucidate the association include the following:

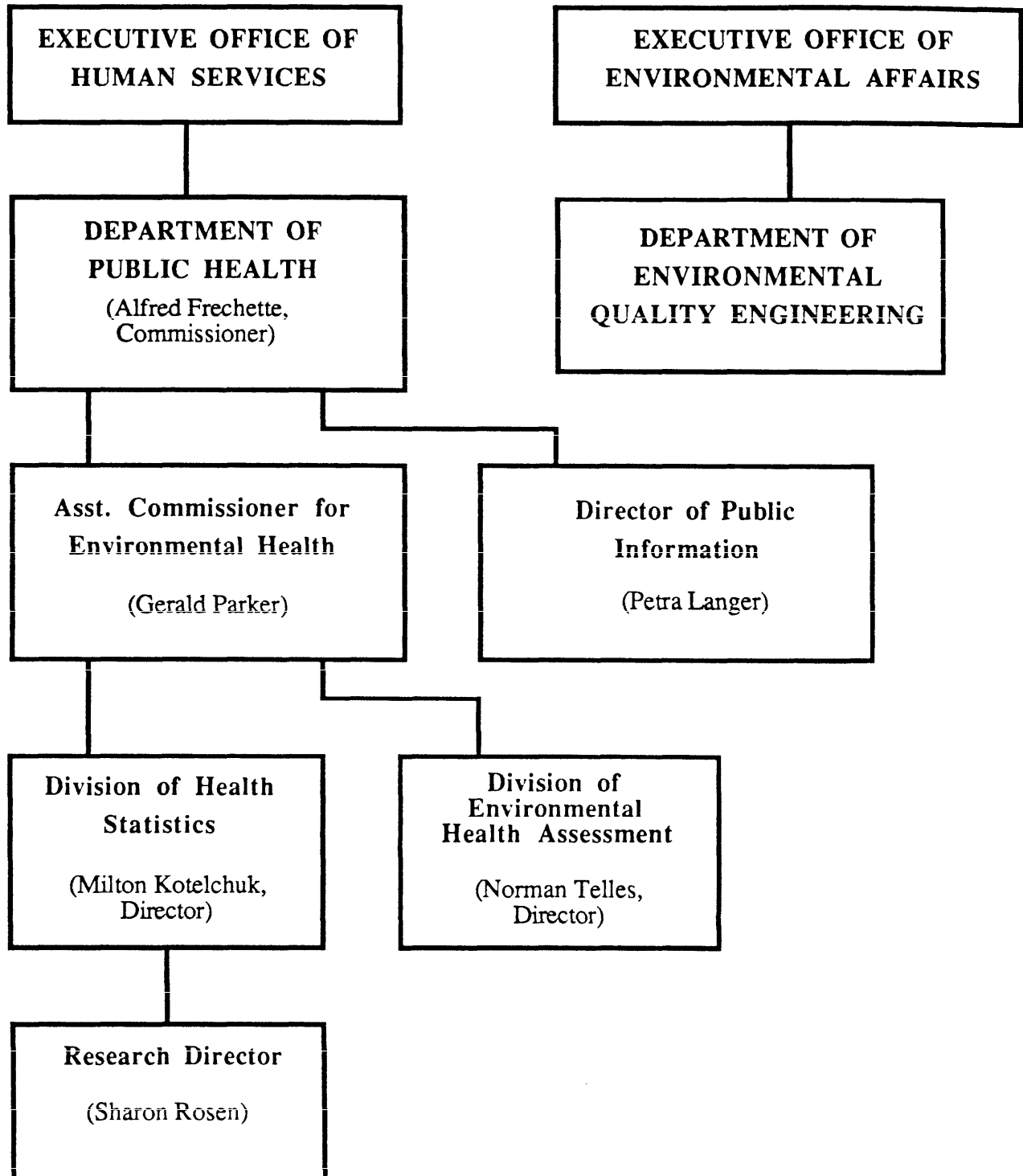
—Attempt to ascertain childhood leukemia mortality and incidence in Woburn prior to 1969, i.e. in the 1950s and 60s. Finding that childhood leukemia became elevated in the eastern part of Woburn only after Wells G and H came on line would support the hypothesis that the elevated leukemia incidence was related to drinking water contaminants.

—Determine the incidence of other lymphatic disease in Woburn to see if it follows a pattern similar to childhood leukemia over the same time period.

—More generally, determine the incidence of other types of cancer in Woburn prior to 1969.

—Environmental agencies are continuing to attempt to identify the present source of organic contaminants in Wells G and H. This information may help identify past practices of waste disposal and sources of contaminants.

**APPENDIX D.**  
**AGENCY ORGANIZATION CHART**



## APPENDIX E. Chronology

### 1979

- MAY: DEQE shuts down Wells G and H.
- SUMMER: Army Corps of Engineers and EPA sue Industriplex developer.
- OCTOBER: Anderson and Young hold meeting on Leukemia cases.
- NOVEMBER: Young notifies mayor, the press
- DECEMBER: DPH releases one-page tally of cancer rates  
3-part series in Boston Herald-American

### 1980

- JUNE: Interviewing for first DPH study completed. Herald and Globe stories on study.
- DECEMBER: Young holds press conference at State House.

### 1981

- JANUARY: Parker and Rosen hold press conference in Woburn.
- FEBRUARY: Second DPH study begun with Harvard School of Public Health.
- NOVEMBER: Second study released.