

Love Canal - Public Health Time Bomb

A Special Report to the Governor and Legislature: September, 1978

The complete report is also available in Adobe's Portable Document Format (PDF, 3684KB, 36pg.)

To Governor Hugh L. Carey and Members of the New York State Legislature

In accordance with Chapter 487 of the New York State Laws of 1978, I hereby submit to you a Special Report on the Love Canal crisis.

The profound and devastating effects of the Love Canal tragedy, in terms of human health and suffering and environmental damage, cannot and probably will never be fully measured.

The lessons we are learning from this modern-day disaster should serve as a warning for governments at all levels and for private industry to take steps to avoid a repetition of these tragic events. They must also serve as a reminder to be ever watchful for the tell-tale signs of potential disasters and to look beyond our daily endeavors and plan for the wellbeing of future generations.

We must improve our technological capabilities, supplant ignorance with knowledge and be ever vigilant for those seemingly innocuous situations which may portend the beginning of an environmental nightmare.

The issues confronting our citizens and their elected and appointed leaders in the Love Canal situation are unprecedented in the State's health annals. We can be proud of the swift and compassionate response to the crisis by our leaders and the agencies they direct in easing the plight of those affected and removing the hazards to their health and safety.

Under Governor Carey's personal direction, State agencies moved with dispatch to deal with a variety of complex problems associated with the Love Canal. The Governor asked President Carter to declare the area eligible for Federal disaster assistance - a request which was granted - and enlisted and received the support of Senators Daniel Patrick Moynihan and Jacob Javits, Congressman John LaFalce and others in Washington in expediting the approval of Federal assistance.

Assemblymen Matthew J. Murphy and John B. Daly of Niagara Falls and their colleagues in the New York State Legislature richly deserve the praise of New Yorkers for their bipartisan efforts in passing legislation proposed by Governor Carey authorizing \$500,000 for the State Health Department to conduct long-range health studies and in granting me the additional authority necessary to direct local governments to correct the problems in a timely fashion.

This report embraces the major activities of the various government entities involved in identifying and dealing with the problems encountered.

It also describes in some detail the findings of intensive health studies.

As we proceed, we will be continually asking ourselves if we are following the right course. Yet, history will be our judge as future scientists and government leaders, armed with better information and greater technological know-how, will assess the fruits of our endeavors, benefitting from our precursor experience, to deal more effectively with future potential Love Canals.

For the present we must continue to pursue with the same vigor and dedication that has prevailed over the last several months, the long-range health studies necessary to learn more about the risks associated with human exposure to toxic chemicals.

We cannot undo the damage that has been wrought at Love Canal but we can take appropriate preventive measures so that we are better able to anticipate and hopefully prevent future events of this kind.

With these observations in mind, I respectfully submit this report to you.

Robert P. Whalen, M.D.
Commissioner of Health

Love Canal: A Brief History

In 1836, a U.S. Government engineer surveyed the Niagara County area, looking for a possible site for a ship canal to connect the lakes Erie and Ontario. He reported that Lewiston, New York, by virtue of its location on the Niagara River at the base of a 300-foot escarpment, not only was an excellent place for a ship canal, it also had excellent potential as a source of cheap water power.

Despite many public pronouncements over the years, nothing came of the engineer's report until May of 1892, when a man named William T. Love arrived in Niagara Falls. Love came to town with a long-held dream: to build a carefully planned industrial city with convenient access to inexpensive water power and major markets.

Mr. Love proposed to construct a navigable power canal between the upper and lower Niagara Rivers which would service a massive industrial complex and thereby provide the matrix for his dream city. The site he chose is approximately seven to eight miles northeast of Niagara Falls. Water transportation was afforded directly to the site by the lower Niagara River and Lake Ontario. Within a radius of one-hundred miles there was a population of over two million people.

The heart of Love's plan was a power canal that would connect the upper and lower levels of the Niagara River. With a canal only six or seven miles in length, water could be conveyed to the Niagara Terrace, from which there was a drop of over 300 feet to the lower level.

He could create immense water power on his townsite by virtue of the fall the water would take, and water power was the cheapest available means of power generation. At the time, it was essential that power users be located near the source as it was virtually impossible to transmit electricity over any great distance.

By January of 1893, Love felt he had enough prominent people in favor of his idea to publicly announce his plan for a model city which would accommodate up to 600,000 people. He claimed before he could advance his plan further he would need control of 10,000 acres. Over the space of a few months, he managed to buy or secure options on 20,000 acres and began actual detailed laying out of the site.

Obviously a man of considerable energy and charisma, Love came to Albany, where he personally politicked for a law that would charter his newly founded company. He became only the second private citizen in history to address a joint session of the State Senate and Assembly. After his bill passed, Love met privately with Governor Roswell Flower, who not only signed the legislation but also issued glowing testimonials about the project.

The charter granted to Love's company, appropriately dubbed the Modeltown Development Corporation, stands today as one of the most liberal ever granted any private developer. He had the authority to condemn properties and to divert as much water from the upper Niagara River as he saw fit, even to the extent of turning off Niagara Falls!

Armed with his newly won charter, Love quickly lined up backing from financial giants in New York City, Chicago and England. In October of 1893, the first factory on the townsite was opened for business. In May of 1894, work on the canal was begun. Steel companies and other manufacturers lined up for the chance of opening plants along the Love Canal.

Everything was looking extremely good for Love and his project when the country suddenly found itself in the middle of a full-scale economic depression. Money and backing began to slip away from William Love and his Model City.

Louis Tesla delivered the coup-de-grace. Tesla discovered a way to transmit electrical power economically over great distances by means of an alternating current. No longer was it necessary for industry to locate near the source of electrical power. Love's project was dealt a death blow.

His backers deserted him, and the last of the property owned by his corporation was subjected to mortgage foreclosure and sold at public auction in 1910.

The sole surviving monument to William Love and his Model City was a partially dug section of canal in the southeast corner of the City of Niagara Falls. For several decades of the Twentieth Century, this portion of the canal reportedly served as a swimming hole for children living in the LaSalle section of the city.

But in the 1920's the excavation was turned to a new and ominous use. It became a chemical and municipal disposal site for several chemical companies and the City of Niagara Falls. Chemicals of unknown kind and quantity were buried at the site for a 25-30 year period, up until 1953. After 1953, the site was covered with earth.

In the late 1950's homebuilding began directly adjacent to the Love Canal landfill. Over a period of time about 100 homes were built and an elementary school was opened.

Thus were sown the seeds that became the human and environmental disaster we know today as Love Canal.

And Then The Rains Came....

Love Canal is a name which until recently was relegated to the back pages of history along with the unspent dreams of a visionary for whom it is named.

Today, more than three-quarters of a century later, this 16-acre rectangular piece of land, located only a few miles from the world-famous waterfall which each year attracts thousands to the honeymoon mecca of Niagara Falls, has again become the focus of international attention, but not as the centerpiece for a dream city.

Instead the center of attention is an ominous array of chemicals buried within the boundaries of the unfinished canal for more than 25 years - toxic ingredients which are infiltrating scores of nearby homes, posing a serious threat to human health and upsetting the domestic tranquility of hundreds of families living in this middle class community.

Situated only a few blocks from the Niagara River in the residential southeastern section of the highly industrialized but tourist-oriented city, the Love Canal problem began to surface in recent years as chemical odors in the basements of the homes bordering the site became more noticeable. This followed prolonged heavy rains and one of the worst blizzards ever to hit this section of the country.

Thus began a series of events and momentous decisions involving city, county, State and Federal governments to cope with what can only be described as a major human and environmental tragedy without precedent and unparalleled in New York State's history.

Described as an environmental time bomb gone off, Love Canal stands as testimony to the ignorance, lack of vision and proper laws of decades past which allowed the indiscriminate disposal of such toxic materials.

The consequences of these transgressions are mirrored by the planned exodus of 235 families and the public monies and herculean efforts which now must be expended to contain the disaster and restore a degree of normalcy to the lives of those affected.

For those responsible for containing the problem and for government leaders in New York State and throughout the nation, Love Canal represents what may very well be the first of a new and sinister breed of environmental disasters.

Demographic Data

- The Love Canal is a rectangular, 16-acre, below-ground-level landfill located in the southeast corner of the City of Niagara Falls, Niagara County, about one-quarter mile from the Niagara River.
- In 1970, the population of Niagara Falls was 85,615.
- Manufacturing, particularly of chemical and allied products, is the major industrial enterprise of the county and city. According to 1970 data of the New York State Department of Commerce, nine major chemical-producing companies employing a total of 5,267 people were then located in the county.
- The Love Canal landfill is bordered on two sides by single family homes with a public elementary school separating the northern and southern sections of the landfill.
- In July, 1978, in the homes immediately adjacent to the landfill there were resident 97 families composed of 230 adults and 134 children. During the 1977-78 school year, 410 students were enrolled at the school.
- At this writing, scientific analyses have identified 82 different chemical compounds at the landfill, of which one is a known human carcinogen and 11 are known or presumed animal carcinogens.

Environmental Sampling

The State Departments of Health and Environmental Conservation in the early spring of 1978 launched an intensive air, soil and groundwater sampling and analysis program following qualitative identification of a number of organic compounds in the basements of 11 homes adjacent to the Love Canal.

The new data collected by the two agencies confirmed not only the presence of a variety of compounds but established precise levels for many of the chemical constituents. It became immediately apparent from the data that the problem was not limited to a few homes and that a potential health hazard existed from long term exposure to the chemicals.

Based on this latest information, the Commissioners of Health and Environmental Conservation instructed their

respective staffs to explore every remedy available to the State to protect the public's health and safety.

The two commissioners along with local officials inspected the site on April 13, 1978. Based on their personal observations and the recommendations of public health specialists in the Health Department, Dr. Whalen, on April 25, 1978, officially termed the Love Canal ". . .an extremely serious threat to the health and welfare. . ." and ordered the Niagara County health commissioner to immediately undertake remedial measures to remove visible chemicals and restrict access to the site and initiate health and engineering studies.

Commissioner Whalen's order set into motion a coordinated plan of attack by local, State and Federal agencies to further delineate the nature and extent of environmental and public health hazards.

Public health concerns prompted the Health Department to give priority to evaluating basement air samples from all homes contiguous to the Canal, before ground and surface water samples, to minimize the risk of chemicals entering the human body by inhalation.

As data flowed in, it became evident that unacceptable levels of toxic vapors associated with more than 80 compounds were emanating from the basements of many homes in the first ring directly adjacent to the Love Canal. Ten of the most prevalent and most toxic compounds - including benzene, a known human carcinogen - were selected for evaluation purposes and as indicators of the presence of other chemical constituents.

Air samples were taken in rooms on the first floor of several homes in the first ring. The data showed, however, that vapors had infiltrated beyond the basement in only one case (the residence which had the highest readings of all basements tested).

Scientists concluded:

1. Outside surface contamination and overt signs of basement contamination were greater in the southern portion of the landfill site, but air quality data suggested no such clear distinction.
2. Although homes with a poured concrete foundation had lesser contamination than homes with block foundations, no correlation between air quality and the use of sump pumps, with or without covers, was apparent.

Armed with additional information showing the extensive contamination of homes directly adjacent to the Canal, Commissioner Whalen ordered an extension of basement air sampling to include homes across the street from the Canal - approximately 138 residences. The preliminary basement air data indicate much lower levels of selected contaminants compared to the first ring, both in the number of compounds and the concentrations present. (See Table 1)

A further comparison of air samples from the first two rings of homes indicates that:

- 55 percent of ring 2 homes were free of chemical contamination as compared to only 5 percent of homes in ring 1;
- 30 percent of ring 2 homes showed the presence of only one chemical as compared to 16 percent for ring 1;
- 15 percent of ring 2 homes showed the presence of only two chemicals as compared to 40 percent for ring 1;
- 3 percent of ring 2 homes showed the presence of three chemicals as compared to 30 percent for ring 1;
- Only ring 1 homes showed the presence of more than three chemicals - 7 percent had 4 chemicals and 5 percent recorded 5.

The five chemicals monitored were chloroform, trichloroethene, tetrachloroethene, chlorobenzene and chlorotoluene.

The full extent of migration of chemical leachate is being determined (as this report is being prepared) by extensive analyses of soil samples, shallow wells and sump drains at intervals extending in all directions beyond the Canal. A review of results for a small number of soil samples taken in mid-August from areas near 93rd and 95th Streets suggests migration of chemicals, including lindane and toluene, outside the immediate Canal area. This information was transmitted to the Chief of Toxic Substances for Region II of the U.S. Environmental Protection Agency on August 23, 1978, reiterating our recommendation that remedial action be undertaken immediately to prevent future contamination of private property and additional human exposure to unacceptable health risks.

It should be restated that basement air samples taken from homes in the outlying area have thus far shown significantly lower levels of contaminants as compared to the first ring of homes, both in numbers of compounds and concentrations present.

As part of the State Health Department's investigation, radiological health specialists conducted a scan of the Canal surface for radioactivity and found three spots - all within the Canal's boundaries - where radiation levels slightly exceeded normal background radiation activity. Additional samples were being taken at various depths to ascertain the source of the radioactivity. It should be emphasized that the radioactive readings found did not exceed safe levels and are not hazardous to health.

Hydrogeological analyses of deep groundwater aquifers are being conducted in the Canal area but sufficient information is not yet available to permit any definitive conclusions.

An agreement also has been worked out with Environment Canada - Canada's national environmental protection agency - to bring in its air sampling field laboratory. The unit, the most sophisticated mobile system available for air evaluation, has a 50-foot detector which can be brought into each home and provide on-the-spot results.

Table I Organic Compounds In Air Samples Love Canal June-August, 1978 (micrograms/m3)

Chemical Compound Total of 5 Chemicals	Location	No. Houses	Lowest Value	Highest Value	Median	Mean	% with Measurable Level
	Ring 1 North 97th	25	0	393	17	67	92%
	Ring 1 North 99th	28	0	142	9.5	29	89%
	Ring 1 North, Total	53	0	393	0.12	47	91%
	Ring 1 South 97th	22	0	3616	53.5	427	95%
	Ring 1 South 99th	24	0	6944	24	356	96%
	Ring 1 South, Total	46	0	6944	28	390	96%
	Ring 2 North 97th	22	0	43	0	6	41%
	Ring 2 North 99th	25	0	149	0	12	48%
	Ring 2 North, Total	47	0	149	0	9	45%
	Ring 2 Central 97th	15	0	69	3	10	67%
	Ring 2 Central 99th	13	0	170	0	13	15%
	Ring 2 Central, Total	28	0	170	0	12	43%
	Ring 2 South 97th	21	0	63	8	13	62%
	Ring 2 South 99th	28	0	37	0	4	43%
	Ring 2 South, Total	49	0	63	2	8	51%
	Ring 1 Total	99	0	6944	17	207	93%
	Ring 2 Total	124	0	170	0	9	47%

Epidemiologic Investigation

At the direction of Dr. Robert P. Whalen, State Health Commissioner, the Health Department's Bureau of Occupational Safety and Chronic Disease Research dispatched teams of investigators to the Love Canal area on June 19, 1978 to begin a house-to-house health survey of the 97 families living immediately adjacent to the landfill. A 29-page questionnaire, seeking information on present and past health status, family, social, occupational and residential history, was developed for use by health department interviewers.

Based on preliminary analysis of data collected from these families, the survey was expanded to include all residents living within a four block radius of the landfill site. As of August 20, 1978 medical investigators had spent 13,000 man-hours interviewing residents and had obtained detailed health histories from all persons residing in 250 houses in the Love Canal area.

- To contact persons who once lived on the Love Canal but subsequently moved to other areas, a nation-wide toll-free hotline was established on August 14 and publicized in major news media outlets throughout the country. During the first four days of the hotline's existence 256 calls were received from people now living in 30 different states, 100 of whom identified themselves as prior Love Canal residents.

In addition, with the assistance of technical staff from Roswell Park Memorial Institute (the Health Department's cancer research and treatment center in Buffalo), blood samples were drawn from more than 2,800 persons living in the Niagara County area. Due to public interest and concern, additional blood sampling clinics were scheduled for various locations throughout Niagara County to assure that samples were obtained from all persons with past associations with the Love Canal who wished to be tested.

The ultimate goal of the Health Department's long-range epidemiologic investigation is to obtain a detailed health profile of all persons who presently or ever lived near the Love Canal landfill to determine whether these individuals are at higher risk for acute and/or chronic health disorders.

HUMAN TOXICITY OF CHEMICALS: To date, more than 80 chemical compounds have been identified in the landfill by the Health Department's Division of Laboratories and Research and the U.S. Environmental Protection Agency (EPA). Eleven of these are known or suspected of causing cancerous growth in laboratory animals, and one - benzene - is a well-established human carcinogen.

Following is a list of some of the more important chemicals identified at the Love Canal site and the human biologic hazards associated with them.

Compound	Acute Effects	Chronic Effects
benzene	Narcosis Skin irritant	Acute leukemia Aplastic anemia Pancytopenia Chronic lymphatic leukemia Lymphomas (probable)
toluene	Narcosis (more powerful than benzene)	Anemia (possible) Leukopenia (possible)
benzoic acid	Skin irritant	
lindane	Convulsions High white cell counts	
trichloroethylene	Central nervous depression Skin irritant Liver damage	Paralysis of fingers Respiratory and cardiac arrest Visual defects Deafness
dibromoethane	Skin irritant	
benzaldehydes	Allergen	
methylene chloride	Anesthesia (increased carboxy hemoglobin)	Respiratory distress Death
carbon tetrachloride	Narcosis Hepatitis Renal damage	Liver tumors (possible)
chloroform	Central nervous narcosis Skin irritant Respiratory irritant Gastrointestinal symptoms	

As can be seen from this list, virtually all of man's physiologic systems can be pathologically influenced by exposure to chemicals identified to date at the Love Canal site - a list which must be viewed as incomplete since the types of chemicals dumped into the landfill and the chemical reactions which may have occurred over time cannot be fully documented.

PRELIMINARY DATA ANALYSIS: Based on current knowledge about the effects of certain chemical agents on the human body, Health Department researchers initially selected four health indicators for assaying potential human toxicity in the Love Canal area: miscarriages, birth defects, liver function and blood mercury levels. Complete blood counts also were performed because of the established chronic toxic effects of benzene on blood cells.

Miscarriages and birth defects are considered prime indicators of human toxicity since recent studies in developmental pharmacology establish that the prenatal period is characterized by a unique susceptibility to certain chemical agents. In addition, several known or suspected teratogens (producers of physical defects in fetuses) have been identified among the chemicals dumped in the Love Canal area.

Liver function, as determined through blood analysis, was chosen as a factor for immediate investigation because current experimental studies suggest that many of the chemical agents identified at the site may play a role in development of cancer or direct injury to the liver. Analyses of the 2,800 blood samples taken to date have been completed and all individuals have been notified of test results via their private physicians. No conclusions relative to residence on the Canal can be drawn at this time with regard to the significance of minor abnormalities detected. Efforts will be made to confirm and more fully investigate abnormal test results.

Since mercury is an established teratogen and is readily identifiable in blood samples, blood mercury determinations were conducted on some area residents during the early investigative stage. Results of all mercury tests performed were within normal limits.

The initial epidemiologic investigation was based on historical information and blood test results from the ninety-seven families in the first ring of homes bordering directly on the Love Canal site. The families comprised 230 adults (18 years of age or older) and 134 children. General health information was obtained from 97 percent of the adults and 92 percent of the children.

MISCARRIAGES AND BIRTH DEFECTS: For the purposes of the analysis all women in the study population who had ever been pregnant were categorized as to their present area of residence on the Love Canal (northern or southern section); and the pregnancy histories of these women were compared prior to and following their move to the Canal area.

All reported birth defects were confirmed through medical records, and the past medical and drug histories of the mothers were evaluated for possible confounding influences. Reported miscarriages also were confirmed through private physicians' and hospital records.

Miscarriages per 100 pregnancies and birth defects per 100 live births were calculated. As indicated in Table 1, the percentage of miscarriages and birth defects was higher for pregnancies occurring on the Love Canal, particularly among women living in the southern Canal section.

TABLE I Pregnancy History of Females Prior to and During Residence on the Love Canal

	History on Canal Present Resident Area		Prior History Present Resident Area	
	South	North	South	North
Number of women ever pregnant	17	24	35	44
Total number pregnancies	38	43	97	117
Number women with miscarriages	6	6	7	6
Total number miscarriages	9	8	9	10
Total number live births	30	35	89	109
Total number stillbirths	0	0	0	0
Children with malformations	4	1	2	2
Sets of twins	1	0	2	2
Mean Age at first pregnancy	27.9	28.0	20.8	21.8
Percent women with miscarriages	35.3	25.0	20.0	13.6
Miscarriages per 100 pregnancies	23.7	18.6	9.3	8.5
Children with malformations per 100 live births	13.3	2.9	2.2	1.8
Expected number of twins	0.3	0.4	1.0	1.2

Because maternal age and birth order (1st, 2nd, 3rd pregnancy etc.) can influence the frequency of miscarriages, Health Department researchers calculated the expected number of miscarriages among pregnancies occurring on the Love Canal, based on the women's ages and number of pregnancies reported. As indicated in Table II, the relative odds ratio for miscarriages among women living on the Canal was 1.49, or nearly one and one-half times the expected rate within the general population.

Table II Maternal Age and Number of Miscarriages (Observed and Expected*) Among Residents of the Love Canal

Maternal Age	Number of Pregnancies	Number of Miscarriages		Relative Odds Ratio Observed/Expected
		Observed	Expected	
<20	2	0	0.212	0.00
20-24	13	0	1.852	0.00
25-29	28	3	3.550	0.85
30-34	19	6	2.677	2.24
35-39	15	8	3.104	2.58
All Ages	77	17	11.395	1.49

*Based on Warburton and Fraser: "Spontaneous Abortion Risks in Man: Data from Reproductive Histories Collected in a Medical Genetics Unit." *Human Genetics* Vol. 16, No. 1, 1964, Page 8.

A more detailed breakdown of this data by residents of the northern and southern Canal sections indicated that the highest frequency of miscarriages (up to 3.45 times the expected frequency for women ages 30-34) occurred among residents of the southern Canal section.

Investigators next examined groups of women living in the four naturally defined geographic sections of the Canal: 99th Street north, 99th Street south, 97th Street north and 97th Street south. As indicated in Table III, more than twice the anticipated number of miscarriages (2.08) occurred among women living in the 99th Street south section. There were no significant differences between the observed and expected distributions for the other sections.

To examine the possibility that women living on 99th Street south might have more frequent miscarriages for

reasons unrelated to their residence on the Canal, Health Department investigators examined the observed number versus the expected number of miscarriages (by maternal age and birth order) for this group prior to moving to the Love Canal area. No significant differences were observed.

If the higher frequency of miscarriages is related to chemicals leached from the Canal over a period of many years, researchers hypothesized that women living in older homes or those living on the Canal for the longest time period might represent the highest risk population. Investigators therefore examined the age of houses, the age of women who had ever been pregnant since living on the Canal, and their duration of residence at the site.

This analysis showed that the average age of pregnant women was comparable for residents of both 99th and 97th streets. However, the houses located on 99th Street, especially those in the southern section, were found to be the oldest and the average duration of residence on the Canal was longer for 99th Street women.

These findings led investigators to compare the average duration of residence on the Canal for all women with and without miscarriages. They found that women with miscarriages had resided on the Canal an average of 18.58 years versus an average length of residence of 11.52 years for those without miscarriages. The difference between these two means is statistically significant, representing a chance occurrence probability of 4 in 1,000. The data also indicated that this occurrence was not apparently due to differences in age or number of pregnancies reported by the women.

Table IV provides information on the documented birth defects of five children born on the Love Canal. As was true for miscarriages, there appears to be a concentration of malformations on 99th Street.

Although further investigation obviously will be required, data analyzed to date seems to suggest that the risk for miscarriages and birth defects might be localized in 99th Street, particularly in the southern section. Researchers are now examining the possibility that this phenomenon may be related to the higher concentration of benzene (a known inhibitor of cell division) found in the southern Canal section.

Based on preliminary epidemiologic investigations, the Commissioner of Health recommended immediate relocation of all pregnant women and all children under two years of age from the Love Canal area. He also ordered delayed opening of the 99th Street elementary school which is situated in the central Love Canal section.

Table III Maternal Age and Number of Miscarriages (Observed and Expected*) Among Residents of Four Specified Areas of the Love Canal

Maternal Age	99th. South			99th. North			97th. South			97th. North		
	Obs.	Exp.	O/E	Obs.	Exp.	O/E	Obs.	Exp.	O/E	Obs.	Exp.	O/E
<20	-	0.106	-	-	-	-	-	-	-	-	0.106	-
20-24	-	0.710	-	-	0.290	-	0.571	-	-	0.281	-	-
25-29	2	1.090	1.83	1	0.972	1.03	0.524	-	-	0.968	-	-
30-34	3	0.860	3.49	2	1.132	1.77	0.294	3.40	-	0.391	-	-
35-39	3	1.084	2.77	3	1.554	1.93	0.272	-	2	0.486	4.12	-

All Ages 8 3.850 2.08 6 3.948 1.52 1 1.661 0.60 2 2.232 0.90

Chi Square: P= 0.022 >0.05 >0.05 >0.05

* Based on Warburton and Fraser: Spontaneous Abortion Risks in Man: Data from Reproductive Histories Collected in a Medical Genetics Unit. *Human Genetics* Vol. 16, No. 1, 1964, page 8.

obs - observed

exp. - expected

O/E - Observed/expected
Relative Odds Ratio

TABLE IV Documented Congenital Malformations Among Children From the Love Canal

Type of Malformation	Sex	Date of Birth (month/year)	Location (North, South Canal)	Medication, Radiation during pregnancy
Cleft palate, deformed ears and teeth, hearing defect, mental retardation, heart defect	F	11/68	99th Street (South)	No
Abnormalities of renal pelvis and reflux ureters	F	4/75	99th Street (South)	No
Mental retardation (autistic)	F	1/66	97th Street (South)	No
Congenital deafness	M	2/66	99th Street (South)	No
Club foot	M	1/58	99th Street (North)	No

Relocation of Residents

Well before completion of the Department of Health's preliminary assessment of the scope of the health hazard posed by the Love Canal leachate, the Governor's Office began making preparations to mobilize the expertise and resources of key State agencies, including the Departments of Transportation, Health, Environmental Conservation, Housing, Social Services, Banking, Insurance, Office of Disaster Preparedness and Division of Equalization and Assessment. An initial step was a market survey by Department of Transportation real estate experts to determine availability of temporary and permanent replacement housing and to estimate the cost of relocating Love Canal residents and purchasing their homes.

The day after Commissioner Whalen's August 2 declaration that a medical emergency exists, interviewers from the regional offices of the Department of Transportation and the Department of Social Services opened a relocation assistance office at the 99th Street School - center of the stricken area.

Priority was given to securing temporary housing for families with children under two years of age and pregnant women. Some 41 top priority families were identified in the first two "rings" of homes - the 235 properties nearest the former canal bed.

Following Governor Carey's visit to the area on August 7, teams of interviewers began visiting homes to expedite the process of gathering the personal information needed to match families with available housing. By August 10, the scope of the relocation effort reached its present dimension with the decision to offer to relocate and purchase the homes of all 235 families in the first two rings.

Appraisal of properties which the State will offer to purchase, was begun August 15 by a team of Department of Transportation real estate appraisers, with purchase negotiations expected to begin within two weeks. The Urban Development Corporation will become the owner of the properties.

At this date, the relocation effort is well advanced with some 136 families having accepted alternative housing. Of these, about 85 have already moved out of their canal area homes.

Environmental Cleanup

Following issuance of Health Commissioner Whalen's August 2 order, the Department of Environmental Conservation (DEC) assumed overall responsibility for reviewing remedial engineering plans at the Love Canal.

Specifically, DEC would:

- Provide onsite supervision of construction activity at the Love Canal site;
- Assist the Niagara County Board of Health in its mandate to abate the public health nuisance at the site;
- Consult with the Niagara County Health Department, the State Department of Health and the U.S. Environmental Protection Agency (EPA) to develop a long-range engineering solution;
- Review the cleanup actions proposed by the county in the consultant report by Conestoga-Rovers & Associates, which proposed the construction of a tile drainage system in the southern section of the Love Canal site; DEC also must give final approval to the detailed design and engineering plans;
- Review and approve plans to minimize hazardous exposure during construction;
- Conduct additional studies, in cooperation with the State and County Health Departments and the City of Niagara Falls, to define the boundaries of the Love Canal landfill; to measure, through continued air, water

and soil sampling, the extent to which contaminated waters have moved away from the site; to determine the extent of groundwater aquifer contamination; and to determine the effectiveness of the proposed drainage system to contain and remove the contaminated groundwater from the site.

WORK UNDERWAY: Since August 2, 1978, DEC engineers and geologists have worked with representatives of the City of Niagara Falls and Conestoga-Rovers & Associates to review and improve the proposed short-term cleanup plans.

The major changes made in the plans were to dig the proposed drainage trench in the backyards surrounding the chemical disposal site rather than into the landfill site itself, and to extend the tile drains to include the northern and central sections of the Canal as was suggested in the plan first submitted to the city on June 13. The Department of Environmental Conservation wanted to avoid disturbing the buried chemicals and accidentally releasing toxic substances into the environment, to protect the health and safety of workers and area residents.

EARLIER INVOLVEMENT: The Department of Environmental Conservation's concern over the Love Canal situation dates back to September of 1976 when DEC engineers visited the site to investigate the Hooker Chemical and Plastics Corporation's suspected discharge of the chemical mirex. Through the fall of that year, basement sumps and storm sewer water samples were taken and discussions were held with the chemical firm about previous dumping at the site.

In January 1977, at the strong urging of DEC, the City of Niagara Falls hired a consultant to conduct a hydrogeological investigation of the site and to develop a conceptual pollution abatement system. The report was completed by Calspar Corporation of Buffalo in August 1977 and was reviewed by DEC staff.

Preliminary work indicated the need for more intensive investigations. In October 1977, DEC sought the assistance of the U.S. Environmental Protection Agency in conducting an expanded study of the groundwater pollution. In February 1978, the City of Niagara Falls hired the consulting firm of Conestoga-Rovers to develop the groundwater pollution abatement plan.

SOILS AND GROUNDWATER: A cross-section of soils at the site shows that the top 4 to 6 feet of soil is moderately permeable; beneath that is 30 to 40 feet of highly impermeable clay; and 40 feet below the surface is limestone bedrock. The pollutants move easily through the top layer of soil, which has allowed the contamination to infiltrate the basements. Although the pollutants probably don't move in the lower tight clay soils, the pollutants may be leaking to the bedrock, which contains a supply of groundwater.

INTERIM CONSTRUCTION PLAN: The proposed interim plan is designed to prevent more water from soaking into the chemical waste disposal area, described as an overflowing bathtub; halt the outward flow of chemicals seeping into the upper groundwaters around the landfill; and reverse the flow of these groundwaters away from the surrounding basements and back toward the Canal.

The project consists of a drain tile collection system and a new, impervious clay cover which will prevent any more surface water from entering the Canal. This will accomplish two things: lower the groundwater levels in the area and prevent further precipitation from entering the Canal. In this way, the present surface runoff and leachate, which is in the upper soils, will be contained, and the contaminated waters will flow back to the drain system.

The underground tile drainage system will be put through the adjacent backyards to collect the contaminated groundwaters. To avoid disturbing chemicals in the landfill, the trench lines will be dug in the backyards about 40 feet from the houses and well away from the Canal edge and waste disposal area. The drain tile system consists of an 8 inch perforated pipe surrounded by gravel.

The drains will be 7 to 12 feet below the surface sloped to drain to pumping stations. From there, the leachate will be pumped into a holding tank, then to a special treatment system on the site. This treatment is expected to remove more than 99 percent of all the organic chemicals of concern from the leachate, and produce a high quality water before it is discharged to the city's sanitary sewers and then to the City of Niagara Falls treatment plant. As a backup, a tank truck loading station will be built so that leachate can be hauled to another treatment facility.

The trenches will be dug using a trench box or sleeve, which will hold the sidewalls in place. Only enough trench to install a length of pipe will be opened at any one time, and then will be backfilled when the pipe and graded porous fill are in place. This will minimize the amount of contaminated soil exposed to the atmosphere.

Soils excavated during construction will be handled as if they are highly contaminated. The soils will be covered immediately with a plastic sheet to prevent vaporization of gases from within the soils. After construction of the leachate collection system, the site will be covered with at least three feet of highly impervious clay. The clay

cover will be contoured to direct all rainfall into surface drains leading away from the site. In this way, only a small amount of rainfall will percolate through the chemical waste and become contaminated.

The work, described here, involves the southern third of the Canal site. While this work is being done, engineering plans for continuing the tile drain system along the other two-thirds and for building the clay cover will be prepared. These plans also will be reviewed by DEC staff, other agencies involved and concerned citizens.

LONG-TERM REMEDIAL PLANS: Critical to the design of long-term remedial plans will be the test results from three monitoring wells which are now being drilled into the bedrock in the land adjacent to the canal. The wells will be sampled to determine whether contamination has spread to the deep groundwater aquifer. Once the aquifer has been sampled and the effectiveness of the drain tile system is measured, DEC engineers will determine if additional steps are necessary for long-term cleanup of the canal.

OTHER INVESTIGATIONS: Environmental Conservation Commissioner, Peter Berle, also has initiated an investigation of the wastes in the Love Canal, and other disposal sites in Erie and Niagara Counties to find out what chemicals are buried, who is responsible for dumping the wastes, and whether other closed chemical landfills pose potential hazards to human health or the environment.

The investigation will be carried out jointly by staff of the State Departments of Health and Environmental Conservation, under the direction of a hearing officer with the power to issue subpoenas and require disclosure of relevant documents.

HAZARDOUS WASTE LEGISLATION: New York State adopted legislation in July, 1978, giving the Department of Environmental Conservation full regulatory authority over the generation, transportation, treatment and disposal of hazardous wastes in the state. While DEC had the solid beginnings of such a program, the "cradle-to-grave" provisions of the Industrial Hazardous Waste Management Act enable the State to control hazardous wastes from their generation to their disposal, and thereby prevent the creation of future "Love Canals".

Construction Safety Plan

A comprehensive safety plan is being developed to protect workmen, residents and the public during construction at the Love Canal site. The plan will be designed to guard against and provide emergency procedures for all possible hazards incident to the construction project, such as gas leaks, chemical spills, fires and dust.

An onsite safety officer, representing the State Commissioner of Health, will have final responsibility for safety at the worksite and initiation of protective measures in the surrounding community.

Development and implementation of the safety plan is being coordinated by the New York State Department of Health with the advice and assistance of numerous governmental agencies and community groups, including the Love Canal Homeowners Association, the State Office of Disaster Preparedness, State Departments of Transportation and Environmental Conservation, American Red Cross, Niagara County Civil Defense unit, state, county and city police departments, Niagara County Fire Department, local hospitals and ambulance services.

While the plan is still in the preliminary stages and subject to modification, the provisions outlined below will provide some indication of the scope of safety precautions to be taken during the construction period.

SECURITY & COMMUNICATIONS: Two-way radio communications will be maintained at all times between the worksite and the safety command post to be established at the 99th Street school building. A direct hotline to the fire dispatch office at the Public Safety Building will be installed at the command post.

All vehicular and pedestrian traffic to the worksite will be restricted, with twenty-four hour patrols to maintain security. Contractor personnel will sign in and out daily, and all visitors will be required to check in at the command post to receive identification, safety indoctrination and equipment. The immediate work area will be fenced and posted at all times.

PERSONAL HYGIENE & SAFETY: Prior to commencement of duties at the worksite, all workmen, site representatives and emergency personnel will receive a physical examination and an intensive safety indoctrination program. Washing facilities will be provided at the worksite and all personnel will be required to shower and change clothing before leaving the work area.

Workmen will wear safety glasses and protective clothing, including rubber gloves and boots which must be washed daily to remove chemical residue. If necessary the safety officer may mandate use of special equipment such as plastic face shields and respiratory protection. Rotation of workmen may be necessary to avoid excessive

or prolonged exposure to contaminants.

MONITORING: The State Health Department will establish an onsite monitoring and sampling program to assure that workmen are not exposed to unacceptable levels of contamination. On-line analytical equipment will be installed to detect flammable concentrations of gases and toxic concentrations of specific chemicals known or believed to be present. The monitoring system will be equipped with an alarm which must be audible throughout the work area.

EMERGENCY EVACUATION: In the unlikely event of such need arising, a comprehensive evacuation plan is being developed to provide maximum protection for the resident population adjacent to the worksite. The area and distance out from the worksite to be evacuated will be determined by periodic readings and evaluations of wind/weather data. The evacuation plan will be coordinated by the New York State Office of Disaster Preparedness and the Niagara County Civil Defense unit with the cooperation of the American Red Cross and state and local police, fire, and medical services. The onsite Health Department Safety Officer will have final authority to initiate an evacuation order.

Household surveys will be conducted by the Red Cross and the Love Canal Homeowners Association to determine any physical limitations of the approximately 500 people living in the four block area surrounding the work area. Homes with occupants who are other than fully ambulatory will be identified with a front door marker, and a "Neighbor Help" program will be developed to assure evacuation assistance to physically disabled residents.

Buses will be used for evacuation, with pickup locations clearly marked throughout the evacuation area. Evacuation maps and instructions will be distributed to all residents and media outlets in the vicinity.

Detailed plans for traffic control, fire support and emergency medical care will be developed and coordinated with state and local service units including police, fire departments, ambulance services and hospitals. Four police vehicles equipped with public address systems, an ambulance and a fire pumper with crew will be stationed at the worksite during all work hours.

Chronology

April 13- Health Commissioner Robert P. Whalen and Environmental Commissioner Peter A.A. Berle personally inspect Love Canal site after State Health Department ascertained a potential health hazard may exist.

April 25- Dr. Robert P. Whalen, State Health Commissioner, says conditions at site represent serious threat to health and welfare and orders county health commissioner to remove exposed chemicals, install fence to restrict access, initiate immediate health studies and take other appropriate measures to protect health of residents and correct the environmental problems.

April 26- Top staff of State Health and Environmental Conservation Departments meet in Albany with U.S. Environmental Protection Agency representatives to map out a plan to attack the Love Canal problems in terms of protecting the public's health and removing the environmental hazards.

May 11- Commissioners Whalen and Berle convene meeting to explain State's plans for Love Canal to elected officials and representatives of State legislative leaders in anticipation of proposed legislation.

May 15- U.S. Environmental Protection Agency concludes from air sampling of basements that levels of toxic vapors suggest a serious health threat.

May 15- State officials meet with Love Canal residents at 99th Street School to provide them with information on the state's plan.

May 19- Health Department toxicologist meets with residents to explain hazards from exposure to toxic chemicals.

May 21- State Health Department reveals plan to conduct short and long-term medical studies involving residents of the Love Canal area.

June 13- State officials meet again with residents and local officials to discuss implementation of the Conestoga-Rovers engineering plan as an interim corrective measure.

June 15- State Budget, Health and Environmental Conservation officials and the Niagara County health commissioner meet with representatives of the U.S. Environmental Protection Agency and Research Triangle Institute, consultants to the E.P.A., to share information and obtain advice relating to environmental health studies at the canal.

June 19- State Health Department medical investigators begin house-to-house health survey of residents living in first ring of homes and also collect blood samples for laboratory analysis.

Week of June 25- State Health Department's Division of Laboratories and Research collects air samples outside the homes contiguous to the Love Canal site.

June 28- Pentagon officials repeat their denial of any knowledge of records pertaining to possible disposal of U.S. Army wastes in the Love Canal at a meeting in Washington.

July 7- Health Department researchers issue results of analysis of air samples collected from basements and other rooms of homes showing high level of toluene, chlorotoluene and chloroform.

July 14- Commissioner Whalen convenes meeting in Albany of all interested parties to report on epidemiologic findings and air sampling and to discuss the various engineering studies proposed. Attending were representatives of the State Health and Environmental Conservation Departments, State Division of the Budget, Niagara County health department, City of Niagara Falls, Hooker Chemical Company, Congressman LaFalce's office and Fred Hart Associates and Conestoga-Rovers Associates, consultants to EPA and Niagara Falls City respectively.

July 19- State health officials conduct public meeting at 99th Street School to keep residents informed of State findings and actions to date.

July 20- Governor Carey signs legislation granting additional emergency powers to the State Health Commissioner to deal with the Love Canal problem and appropriating \$500,000 in State funds to conduct long-range health studies.

July 31- Commissioner Whalen convenes six-hour meeting at LaGuardia Airport of nationally prominent experts in toxicology, epidemiology, and industrial hygiene to present State's findings and seek recommendations and review of further actions to protect the public's health and correct the environmental problems.

August 1- Commissioner Whalen orders extension of house-to-house health survey to include residents within surrounding blocks and also announces plans to trace individuals who had lived in the area over the last 30 years.

August 2- Representatives of interested parties who met July 14 called to Albany by Commissioner Whalen for further update of State's actions.

August 2- Commissioner Whalen, acting under additional authority granted him by the new legislation, declares a state of emergency exists at the Love Canal site and issues order to Niagara County, City of Niagara Falls, and Niagara Falls School District reaffirming previous directives, issuing new orders including closing of 99th Street school pending completion of corrective construction, and making a series of recommendations including evacuation of pregnant women and children under two years of age living in homes in the first two rings.

August 2- Governor Carey directs his staff to explore what means of assistance may be available to help individuals affected by Commissioner Whalen's August 2 order and appoints an inter-agency task force to assist residents under the personal direction of William Hennessy, State Commissioner of Transportation.

August 3- Governor Carey directs his staff to explore all forms of possible Federal assistance and telegraphs President Carter requesting Federal aid; enlists support of Senators Jacob Javits and Daniel Patrick Moynihan and Congressman LaFalce for legislative action to deal with the Love Canal situation.

August 3- Thomas Frey, Director of State Operations, Commissioner Whalen, and other State officials meet with 600 homeowners at Governor's request and assures those forced to evacuate that State will pay for their housing.

August 3- Governor Carey directs his special inter-agency task force to find housing for families immediately affected by Dr. Whalen's order; directs that State Banking Department work with local banks to prevent foreclosure on homes and calls on banks to be flexible in their policies to help affected homeowners meet unforeseen financial responsibilities. The Governor also directs the State Division of Equalization and Assessment to prepare emergency legislation which would allow for evaluation and reduction of property taxes until the health emergency has been resolved; the State Insurance Department is directed to provide technical assistance to the homeowners to help assure they receive full benefits from their insurance policies.

August 4- Governor's Task Force opens relocation and health offices at 99th Street School seven days a week to assist residents.

August 5- William H. Wilcox, director of the Federal Disaster Assistance Administration, accompanied by State officials, tours Love Canal site and promises an array of Federal assistance.

August 7- Governor Carey goes to Niagara Falls and tells residents that State Government will purchase homes identified by the task force as affected by the Love Canal chemicals.

August 7- President Carter approves emergency financial aid for Love Canal area.

August 7- U.S. Senate approves by voice vote a "sense of Congress" amendment saying a serious environmental disaster had occurred and that Federal aid should be forthcoming.

August 9- State officials meet at the White House with representatives of the President, Congress, and Federal agencies to discuss aid for Love Canal.

August 9- Love Canal residents at a meeting in the 99th Street School receive message from Governor Carey that State has decided to evacuate all 236 families living on both sides of 97th and 99th Streets.

August 10- State Health Department's chief medical investigator meets with group of Niagara Falls physicians to outline medical findings and assist the physicians in evaluating their patients' conditions.

August 14- State Health Department installs nationwide toll-free hotline to trace former residents of the Love Canal area.

August 15- Governor Carey visits the Love Canal site to assure residents that a safety plan will be in place for the residents as well as the workers.

August 18- State Health Department medical investigators and technicians from Roswell Park Memorial Institute in Buffalo complete two weeks of drawing blood samples from more than 2,200 area residents, bring the total to more than 2,800 persons since testing began in June.

August 22- Installation of an 8-foot high chain link fence around the second ring of homes begins, preparatory to the start of corrective construction.

August 29- 98 Love Canal families have been evacuated as of this date while 46 others have found suitable temporary housing and are ready to move. Task Force relocation staff is working with 91 remaining families.

LOVE CANAL LEGISLATION

STATE OF NEW YORK

13149
IN ASSEMBLY
June 22, 1978

Introduced by COMMITTEE ON RULES-read once and referred to the Committee on Ways and Means

AN ACT to amend the public health law, in relation to the study and alleviation of the hazard of toxic substances from certain landfill sites and making an appropriation therefor

The people of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Article thirteen of the public health law is hereby amended by adding a new title twelve, to read as follows:

TITLE XII **TOXIC SUBSTANCES**

Section 1385. Legislative intent.

1386. Duties of the commissioner.

1387. Contracts.

1388. Powers of the commissioner; emergencies.

1389. Reports.

§ 1385. Legislative intent. Sites formerly operated as landfills to dispose of toxic substances are exposing the citizens of the state to unnecessary hazards, the duration and extent of which is unknown. To develop a plan for

the alleviation of these conditions, it is necessary to conduct a study to determine the extent of such hazards. The potential hazard believed to exist at a specific landfill site in the county of Niagara, has precipitated the need for immediate action to authorize the department of health to undertake such study and to conduct a pilot program to evaluate the effect of individual corrective systems in affected residences.

§ 1386. Duties of the commissioner. The commissioner of health shall conduct a study of both the long and the short term effects of health hazards associated with exposure to toxic substances emanating from certain landfills.

§ 1387. Contracts. The commissioner of health is authorized to enter into contracts and agreements with individuals, corporations and municipalities to perform the study herein directed to alleviate the specific hazard to which the general public or members thereto may be exposed as the result of toxic substances emanating from landfills.

§ 1388. Powers of the commissioner; emergencies. In case of great and imminent peril to the health of the general public from such hazards as may be identified as A. 13149

resulting from exposure to toxic substances emanating from landfills, the commissioner may declare the existence of an emergency and take such measures and do such acts as he may deem reasonably necessary and proper for the preservation and protection of the public health.

§ 1389. Reports. The commissioner of health shall make an initial report to the governor and the legislature on or before September fifteenth, nineteen hundred seventy-eight of his progress and a further report to the governor and the legislature on or before September fifteenth, nineteen hundred eighty-one.

§ 2. Appropriation. The sum of five hundred thousand dollars (\$500,000), or so much thereof as may be necessary, is hereby appropriated to the department of health from any moneys in the state treasury in the general fund to the credit of the state purposes fund not otherwise appropriated, for its expenses, including personal service, maintenance and operation, in carrying out the provisions of this act. Such moneys shall be made payable out of the state treasury after audit by and on the warrant of the comptroller upon vouchers certified or approved by the commissioner of health.

§ 3. This act shall take effect immediately.

EXPLANATION – Matter in *italics* is new; matter in brackets [] is old law to be omitted.

Health Department Order

State of New York: Department of Health

In The Matter

Of

**The Love Canal Chemical Waste Landfill Site
Located in the City of Niagara Falls,
Niagara County**

Order

I, ROBERT P. WHALEN, M.D., Commissioner of Health of the State of New York, pursuant to the statutory authority conferred upon me, having conducted or caused an extensive investigation to be conducted in relation to that certain site known as the "Love Canal Chemical Waste Landfill" located in the City of Niagara Falls, County of Niagara, and State of New York, and having determined, by previous orders made and issued by me in this matter, that said site constitutes a public nuisance and an extremely serious threat and danger to the health, safety and welfare of those using it, living near it, or exposed to the conditions emanating from it, consisting, among other things, of chemical wastes lying exposed on the surface in numerous places and pervasive, pernicious and obnoxious chemical vapors and fumes affecting both the ambient air and the homes of certain residents living near such site and having directed that certain remedial action be taken with respect thereto and, pursuant to my order and direction, further inquiry and investigation of the said Love Canal Chemical Waste Landfill site having been made;

NOW, THEREFORE, based upon epidemiological studies made by personnel of the State Department of Health and air quality sampling and studies made by personnel of both the State Department of Health and the United

States Environmental Protection Agency of both the ambient air and selected homes at or near the site, and upon a review and examination of matters contained in Calspan Report No. ND-6097-M-1 prepared for the City of Niagara Falls by the Calspan Corporation of Buffalo, New York; a review and examination of the Conestoga-Rovers and Associates proposal, entitled "Proposal-Love Canal Chemical Landfill-Niagara Falls, New York - Site Study and Preliminary Design of Ground Water Pollution Abatement Plan," commissioned by and presented to the City of Niagara Falls; and a review and examination of a report entitled, "Phase I - Pollution Abatement Plan - Upper Groundwater Regime" prepared by Conestoga-Rovers & Associates, Waterloo, Ontario, Canada, jointly commissioned by the City of Niagara Falls, the City of Niagara Falls Board of Education and the Hooker Chemical Corporation; and, further, upon a review and due consideration of discussions held and reports submitted at a meeting held in the Conference Room, Division of Laboratories and Research, State Health Department, on June 15, 1978, attended by representatives of the State Health Department, the State Department of Environmental Conservation, the United States Environmental Protection Agency, the State Division of the Budget, the Commissioner of Health of the County of Niagara and by representatives of the Research Triangle Institute, consultants to the United States Environmental Protection Agency, which such meeting was convened to share information and obtain advice in relation to environmental health studies planned by the Department of Health with respect to the Love Canal Chemical Waste Landfill site; and, further, upon a review and due consideration of discussions held and reports submitted at that certain meeting held on July 14, 1978 in the 14th floor conference room, Empire State Plaza Building, Albany, New York, attended by representatives of the State Department of Health, the State Department of Environmental Conservation, the United States Environmental Protection Agency, the Board of Health of Niagara County, including the Niagara County Health Commissioner, the City of Niagara Falls, Conestoga-Rovers & Associates, Fred Hart & Associates, consultants to the United States Environmental Protection Agency, and by representatives of United States Congressman John LaFalce, and New York State Assemblymen Matthew Murphy and John Daly; and, further, upon a personal visit made to the Love Canal Chemical Waste Landfill site on April 13, 1978 by me in company with Peter Berle, State Commissioner of Environmental Conservation, and others, and upon all other proceedings, reports and discussions heretofore held herein and considered with respect to the Love Canal Chemical Waste Landfill site, including information that between the period 1940 and termination of the Korean War, that the Department of Army deposited chemical wastes in said Love Canal landfill site.

I DO HEREBY FIND, CONCLUDE, RECOMMEND AND ORDER, as follows:

FINDINGS OF FACT

1. The Love Canal is a rectangular, 16 acre, below ground level landfill site located in the southeast corner of the City of Niagara Falls, Niagara County, New York, known as the "La Salle" area, with the southernmost portion of the site about 1/4 mile from the Niagara River near Cayuga Island.
2. The site is bordered on the north by Colvin Boulevard; on the south by Frontier Avenue; on the west by 97th Street; and on the east by 99th Street.
3. The southern and northern sections of the site are bordered by single family homes on 97th and 99th streets, while the middle section is bordered by a grammar school.
4. In the late 19th Century the site was excavated as part of a proposed canal project linking the Niagara River and Lake Ontario.
5. The Love Canal project was abandoned and never completed and the abandoned canal subsequently was used as a chemical and municipal waste disposal site.
6. The Hooker Chemical Company, Niagara Falls, New York, used the site for the disposal of drummed chemical wastes, process sludges, fly ash, and other wastes, for a period of nearly 25 years, from on or about 1930 to on or about 1953.
7. The City of Niagara Falls, New York, also used the site for the disposal of municipal wastes for many years prior to and including 1953.
8. In or about 1953, the site was covered with earth and sold by the Hooker Chemical Company to the Board of Education of the City of Niagara Falls, New York.
9. The City of Niagara Falls Board of Education subsequently sold part of the site to others.
10. Ownership of the site is currently shared as follows:

City of Niagara Falls - 6.58 acres
City of Niagara Falls - Board of Education - 3.53 acres
L.C. Armstrong - 5.98 acres

11. There are presently 97 families with 230 adults and 134 children living in the houses adjacent to the northern and southern sections of the Love Canal.
12. The basements of homes bordering the site are now suffering from toxic chemical waste leachate intrusion from the site.

13. The grammar school on the site has no basement, but a crawl space only, however, the possibility of standing water next to classroom windows provides a mechanism for the transportation of and exposure of the school children to toxic vapors.
14. The soil strata surrounding and underlying the wastes, generally, consists of silts and fine sands of low permeability in the levels 4 to 6 feet below the surface; in the next levels 19 to 26 feet below the surface, the soil is silts and clay of very low permeability; the next level to about 40 feet below the surface consists of compact loamy glacial till of low permeability; and the level 40 feet more or less below the surface consists of limestone bedrock.
15. The clay strata acts as a barrier and creates a perched groundwater condition.
16. Leachate containing both halogenated and unhalogenated organic compounds migrates in the top soil layer and is the conduit by which it reaches the basements of homes adjacent to the site.
17. More than 80 chemical compounds have been identified at the site itself.
18. Air samples taken in the basements of 14 houses adjacent to the site by the United States Environmental Protection Agency in February 1978 resulted in the identification of 26 organic compounds.
19. Air samples to monitor 10 selected compounds were taken by the Division of Laboratories and Research of the State Health Department in July 1978 from the basements of 88 houses peripheral to those built adjacent to the landfill site with the following results:

Compounds	No. Of Times Found In Houses	Percent of Total Houses Sampled	Highest Value Observed
Chloroform	23	26	24 ug/m ³
Benzene	20	23	270 ug/m ³
Trichloroethene	74	84	73 ug/m ³
Toluene	54	61	570 ug/m ³
Tetrachloroethene	82	93	1140 ug/m ³
Chlorobenzene	6	7	240 ug/m ³
Chlorotoluene	32	36	6700 ug/m ³
m+p xylene	35	40	140 ug/m ³
o-xylene	17	19	73 ug/m ³
Trichlorobenzene	11	13	74 ug/m ³

20. Seven of the chemicals identified in the air samples taken by the Division of Laboratories and Research are carcinogenic in animals and one, benzene, is a known human carcinogen.
21. In one home, in particular, the concentration of organic chemicals in the living space was well beyond the concentrations measured in the basement of any other house.
22. An epidemiologic study to determine whether residents presently living adjacent to the Love Canal are at increased risk for certain disorders was conducted by the Bureau of Occupational Health of the State Health Department in June 1978, utilizing spontaneous abortions and congenital defects as indicators of potential toxicity.
23. Based upon information obtained relating to maternal age, pregnancy order, and number of spontaneous abortions observed and expected among females residing in different sections of the Canal, the mean ages of females ever pregnant at the Love Canal, the duration of residence, and the mean age of the houses, the following was determined:
 1. A slight increase in risk for spontaneous abortion was found among all residents of the Canal and for the northern and southern sections, with the overall estimated risk 1.5 times greater than that expected.
 2. A significant excess of spontaneous abortions was localized among residents of 99th Street South.
 3. The miscarriage experience in the 99th Street North and 97th Street North and South sections approximated that which could be expected.
 4. A significant excess of spontaneous abortions occurred during the summer months of June through August.
 5. Congenital malformations were found among 5 children of adults presently residing on the Love Canal, with the distribution being 3 children from 99th Street South, 1 child from 99th Street North, and 1 child from 97th Street South.
 6. The mean ages of females ever pregnant on the Love Canal were comparable for 97th and 99th

Streets.

7. The average duration of residence on the Canal for 99th Street females was 16.5 years and 10.8 years for the 97th Street females.
8. The mean ages of the houses located on 99th Street South was 26 years, for 99th Street North 21.6 years, for 97th Street North 18.6 years, and for 97th Street South 13.6 years.

Conclusions

1. A review of all of the available evidence respecting the Love Canal Chemical Waste Landfill site has convinced me of the existence of a great and imminent peril to the health of the general public residing at or near the said site as a result of exposure to toxic substances emanating from such site and, pursuant to the authority conferred upon me by Public Health Law section 1388, enacted by Chapter 487 of the Laws of 1978, the existence of an emergency should be declared by me.
2. That the Conestoga-Rovers report, subject to appropriate modification and approval by the State Department of Environmental Conservation, represents a feasible plan to halt the migration of toxic substances through the soil of the Love Canal site to the houses at or near such site.
3. That the orders and directions heretofore given by me to the Niagara County Board of Health, and its Health Commissioner, to take certain remedial actions to alleviate the hazards emanating from the Love Canal site were reasonable and should be reaffirmed.
4. That further studies should be made to:
 1. delineate chronic diseases afflicting all residents who lived adjacent to the Love Canal landfill site, with particular emphasis on the frequency of spontaneous abortions, congenital defects, and other pathologies, including cancer;
 2. delineate the full limits or boundaries of the Love Canal with respect to possible toxic effects;
 3. determine, by continued air, water and ground sampling, the extent that leachate has moved out of the site to the surrounding neighborhood;
 4. identify which groundwater aquifers, if any, have been contaminated by leachate;
 5. determine the possibility of minimizing the introduction of noxious odors and chemicals by way of drainage from outside the homes and to consider the utility or feasibility of installing customized fans or the special venting of sumps.

Recommendations

1. That the families with pregnant women living at 97th and 99th Streets and Colvin Boulevard temporarily move from their homes as soon as possible.
2. That the approximately 20 families living on 97th and 99th Streets south of Read Avenue, with children under 2 years of age, temporarily move from the site as soon as possible.
3. That residents living in the vicinity assist local and State agencies in defining and abating hazardous conditions arising from the Love Canal landfill site.
4. That residents living on 97th and 99th Streets avoid use of their basements as much as possible, thereby reducing their exposure to elevated levels of organic compounds present in the air of their basements.
5. That consumption of food products home-grown by residents of 97th and 99th Streets and Colvin Boulevard be avoided.
6. That the Department of the Army continue the investigation initiated by it to determine the extent to which the United States Army was involved in chemical waste disposal at the Love Canal landfill site and inform the New York State Department of Health of significant findings obtained through its search of army archives and records, on-site inspections, or other sources utilized.
7. That the Niagara County Medical Society cooperate with staff of the State Health Department and the Niagara County Health Department in any study undertaken to identify former residents of the Love Canal area to determine what, if any, chronic or adverse health effects they now exhibit; further that private physicians and the hospitals of Niagara County also cooperate with such staff; the physicians to assist in identifying and obtaining the necessary consents from such former residents and the hospitals with respect to supplying the necessary medical records.

I DO HEREBY ORDER AND DIRECT:

1. AND DECLARE, pursuant to the authority conferred upon me by Public Health Law, Section 1388, enacted by Chapter 487 of the Laws of 1978, the EXISTENCE OF AN EMERGENCY and direct that the measures herein ordered are deemed reasonably necessary and shall be taken for the preservation and protection of the public health, and by virtue of the limited emergency nature of the action immediately necessary,

which is herein directed to be taken, that the requirements of the State Environmental Quality Review Act are not applicable, except that neither any long-range plans to decontaminate the site, nor the implementation thereof, shall be exempt from the requirements of such Act.

2. The Niagara County Board of Health and the Niagara County Health Commissioner to take the following definite actions:
 1. Take adequate and appropriate measures to cause the removal from the Love Canal Chemical Waste Landfill site of all chemicals, pesticides and other toxic material which lie exposed or visible on the surface of the site.
 2. Take appropriate and adequate measures to limit accessibility to the site by the installation of suitable fencing or other effective means, together with periodic surveillance and monitoring, to assure that access to the site is properly restricted or limited.
 3. Take all other appropriate and necessary corrective action to abate the public health nuisance now existing at the Love Canal Chemical Waste Landfill site, including immediate steps to determine the feasibility of lowering the elevated levels of organic compound contamination in the air of basements by the moisture-proofing and venting of such basements in cooperation with the New York State Departments of Health and Environmental Conservation.
 4. Take all appropriate and necessary steps to undertake necessary engineering studies to provide a long-range solution to decontamination of the site. In connection therewith, that consultation and cooperation of the United States Environmental Protection Agency, the New York State Department of Environmental Conservation and the New York State Department of Health be sought, and approval of the New York State Department of Environmental Conservation be obtained.
 5. Initiate, and periodically repeat, in collaboration with the State Department of Health such epidemiological studies as may be required to determine any excess morbidity or school absenteeism associated with proximity to the landfill site.
 6. Make an initial report to me not later than 30 days from the date of service of this Order, concerning the progress made in implementing the orders and directions herein given, and thereafter report on the monthly basis as to such progress.
3. The City of Niagara Falls and County of Niagara Board of Health shall forthwith take all appropriate steps to implement the Conestoga-Rovers report entitled "Phase I Pollution Abatement Plan Upper Groundwater Regime," subject, however, to the approval of the Commissioner of Environmental Conservation, and they are hereby directed to respond to requests made by the Department of Environmental Conservation for additional information in relation to said report.
4. The City of Niagara Falls and County of Niagara Board of Health to report monthly as to progress in implementing the Conestoga-Rovers report.
5. That the City of Niagara Falls and Niagara County Board of Health, provided they receive approval of the Commissioner of Environmental Conservation for the implementation of the Conestoga-Rovers report, shall develop suitable plans for the safety of the workers employed to do the necessary work to implement the plan and to minimize hazardous exposure to residents that may occur during the course of the work, including appropriate steps to maximize dust control and minimize airborne pollution, such plans shall be submitted to the State Department of Health for its review.
6. That the City of Niagara Falls Board of Education temporarily delay opening the elementary school on the Love Canal site to minimize exposure of school age children to waste chemicals while corrective construction activities at the school take place.
7. The Niagara County Department of Health and the City of Niagara Falls, in cooperation with staff of the State Department of Health, to undertake additional studies to:
 1. delineate chronic diseases afflicting all residents who lived adjacent to the Love Canal landfill site, with particular emphasis on the frequency of spontaneous abortions, congenital defects, and other pathologies, including cancer;
 2. delineate the full limits or boundaries of Love Canal with respect to possible toxic effects;
 3. determine, by continued air, water and ground sampling, the extent that leachate has moved out of the site to the surrounding neighborhood;
 4. identify which groundwater aquifers, if any, have been contaminated by leachate;
 5. determine the possibility of minimizing the introduction of noxious odors and chemicals by way of drainage from outside the homes and to consider the utility or feasibility of installing customized fans or the special venting of sumps.
8. That if monitoring shows that the levels of organic compounds in homes are not reduced to ambient levels at the expiration of 12 months following corrective construction, that a complete re-evaluation of the health hazards at the site shall be made by the Niagara County and State Health Departments agencies at that time.

9. That this Order supercedes all other previous orders and directions heretofore made and issued by me in connection with this matter, except as may otherwise be specified herein.

DATED: August 2, 1978

Revised: October 2005