

**SECOND REPORT
OF THE
TASK GROUP
ON
GLOBAL LANDFILL
AND THE
SOMMERS BROTHERS
PROPERTY SITES**

June 1992



Environmental Health Service

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Governor**

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EXECUTIVE SUMMARY

In response to public health concerns voiced by residents of the local community near Global Landfill and the Sommers Brothers Property, 1987 legislation (P.L. 1987, c. 368) appropriated \$75,000 to the New Jersey Department of Health (NJDOH) to fund certain activities considered by the Department to be necessary in addressing the community's health concerns.

A Task Group was formed and chaired by NJDOH with the cooperation of the New Jersey Department of Environmental Protection (NJDEP), local officials of Old Bridge and Sayreville, and community representatives from the residential advocacy group, Citizens Helping Environmental Cleanup (C.H.E.C.). The Task Group was charged with collecting and reviewing available environmental data, identifying gaps, and determining how best to address residents' health concerns. The Report of the Task Group on Global Landfill and the Sommers Brothers Sites was printed in 1988. The 1988 Report of the Task Group concluded:

- * There were scant data describing possible offsite community exposure to chemicals emanating from the sites;

- * There was a need to collect offsite soil and ambient air exposure profiles of the community; and

- * The contribution of the site sources to these exposure profiles needed to be determined.

Information gathered would be used to determine the necessity of a health study and what means would be appropriate to reduce exposure's of health concern. In 1988, the Task Group outlined the activities to be addressed by appropriated funds, including: a Community Soil Monitoring Program; a Pediatric Health Examination; a Community Demographic Profile; and an Outreach and Education Program.

In 1988, the Task Group also recommended two activities they felt were necessary to address health concerns, but would require additional funds:

- (1) A Community Ambient Air Monitoring Program to identify and manage major sources of ambient air exposures; and,
- (2) An Odor Control Program to eliminate nauseating effects and any potential hazard posed to the nearby community from air emissions emanating from the landfill.

The 1988 Report of the Task Group also urged the expeditious cleanup of the Sommers Brothers property site.

Since the printing of the 1988 Report of the Task Group, Global Landfill was officially included on the U.S. Environmental Protection Agency's National Priorities List (NPL) for clean-up under the Superfund Program. Some recommendations made in 1988 by the Task Group were later modified to reflect plans for NJDEP's cleanup of Global Landfill under the Superfund Program. NJDEP actions, such as the capping of Global Landfill and the Remedial Investigation/Feasibility Study, expect to address the air quality issues raised by the Task Group.

The purpose of the Second Report of the Task Group on Global Landfill and the Sommers Brothers Sites, 1992, is to present the methods and results of activities implemented under the legislation (P.L. 1987, c. 368), and the Task Group's conclusions and recommendations. This document also includes a Community Cancer Investigation conducted by NJDOH, environmental data, cleanup plans and health assessment information on Global Landfill.

Community Soil Monitoring Program

The purpose of the Community Soil Monitoring Program, as identified in the Final Report prepared by Eikon Planning and Design, Incorporated, (see Section 3.1), was: (1) to determine if the apartments bordering Global Landfill were built on a waste landfill and (2) to ascertain whether any contaminants are present in the soils adjacent to residential buildings.

The Eikon Report stated that the apartments were not built on a former landfill and the Task Group concurred with this determination. This conclusion was based on historic aerial photographs, soil boring logs from the Community Soil Monitoring Program, and photographs from the slope failure adjacent to the London Terrace Apartments.

The environmental investigation, conducted as part of the Community Soil Monitoring Program, revealed a random distribution of minor contamination in the area. Soil vapor results detected elevated volatile organics primarily along Westminster Boulevard and former unimproved access roads. Low levels of volatile and semi-volatile organic compounds were found in the soil samples collected from the borings. Total volatile organic compound levels ranged from "not detected" to 0.035 parts per million (ppm). Total semi-volatile organic compound levels varied between "not detected" and 9.6 ppm. None of the contaminant levels were above the New Jersey Department of Environmental Protection and Energy's (NJDEPE) Interim Soil Action Levels.

The Eikon Report indicated that two suspected sources of the soil contamination were degradation of utility lines along Westminster Boulevard and localized unauthorized dumping along former access roads. The Task Group concurs with these findings. The Eikon Report also recommended that an indoor/basement air monitoring program be instituted to evaluate the indoor air quality of residences and assess the health implications to the residents. Further work on these two issues is outside the scope of the Task Group.

Pediatric Health Examinations

The purposes of this service were (1) to assess the current health status of the children residing in the vicinity of Global Landfill and the Sommers Brothers Property sites, and (2) to provide parents with guidance regarding their children's medical care. The screenings were not designed as a study to determine a link between exposure and symptoms. The Division of General Pediatrics of the University of Medicine and Dentistry of New Jersey (UMDNJ), under contract with the NJDOH, agreed to perform medical examinations of children living and playing near the landfills and to interpret the findings.

Between August 1989 and February 1990, 175 children volunteered for comprehensive medical exams consisting of a complete history, physical examination and laboratory tests. The results of the majority of physical exams were within normal limits. The most common complaints reported during the medical history were a variety of minor respiratory problems. There were no significant heart problems identified, but from a question asked during the cardiac review, UMDNJ found that 21% of the children were reported to have had pounding headaches. Analysis of the laboratory data found 8 children with mild anemia, 35 children with lead levels between 11 and 15 ug/dl (micrograms per deciliter), 3 children with levels between 16 and 20 ug/dl, and one child with a level of 23 ug/dl (all venous samples). Staff of the Environmental Health Service (NJDOH) forwarded the laboratory records of children with blood lead levels exceeding 10 ug/dl to the Maternal and Child Health Service (NJDOH) and the Middlesex County Lead Poisoning Control Project for appropriate public health follow-up. There were no significant urinary abnormalities identified. Although most of the serum chemistries were normal, there were some children with mildly elevated liver function tests. If laboratory tests indicated a follow-up test was suggested, parents were notified of their child's results within a week of the exam. When requested by the parent, information was also sent to the family physician.

The Task Group concluded that the pediatric health exams provided an important and valuable service to the community. Since the medical examination was not designed to assess a link between exposure and symptoms, the findings should be interpreted with caution. The Task Group agrees with UMDNJ that any proposed cause-effect relationship must be considered speculative.

Community Demographic Profile

The objectives of this effort were (1) to characterize the population of the community living near the sites, (2) to document in detail a representative sample of the residents' health concerns, and (3) to collect information necessary to develop specific education and outreach interventions.

A stratified random sample of 10% of the 4,000 households was selected for the survey. The low response rate (49.2% of households contacted) impeded accurate description of the community. Among households which responded, almost 8% of residents were preschool children (birth to 4 years old), while residents between 20 and 39 years comprised greater than 42% of the sample. More than 68% of the survey area population was under 40 years of age. More than one-third of the households with children expressed concerns about their children's health. More than a quarter of respondents expressed concern over the health of at least one adult in the household. The most frequently reported health concerns were respiratory complaints.

Limitations of the interviews and the lack of information about the nonrespondents, resulted in an inability to generalize findings from the survey to the approximately 4,000 residents living in the vicinity. However, although the poor response rate weakens the usefulness of the demographic survey, it demonstrates the need for new strategies in community studies and awareness campaigns. The Task Group recognized that the process of conducting the Community Demographic Profile identified several formidable barriers hindering a successful community awareness and education program. The Task Group concluded that the survey information has value in planning educational programs for this population.

Community Outreach and Education Activities

The primary purposes of these ongoing efforts are (1) to assist individuals in making decisions about actions to be taken by them or their families, and (2) to stimulate community participation in the decision-making process related to the clean-up of the sites.

Residents of the nearby community had expressed concern about unrestricted access to the Global and Sommers sites and the use of those properties as recreational areas. The Task Group discussed the need to protect individuals from exposure to potential hazards (such as hazardous

leachate and steep grades) by restricting access to the site. Although fencing the perimeter of Global Landfill is a part of the remediation plans, the Task Group concluded that, in addition to the fencing measures, residents, especially children, should be educated regarding the reasons for restricting access to the sites. The educational efforts should include specific information about health effects and ongoing site remediation.

The Task Group believes it is important that schools build environmental issues into the routine K-12 school curriculum. Incorporated into this content should be information on proper safety behaviors regarding landfills. Providing information to assist individuals in making informed decisions about potential health risks in the environment was given a high priority by the Task Group. Strategies were suggested by Task Group members including lessons consisting of visuals to reinforce learning concepts. Educational sessions for teachers regarding this subject is imperative.

The Task Group concluded that stimulating the interest of students in the Old Bridge School District's Environmental Clubs was essential in order to begin a student-conducted education effort. One student per high school (grades 9-12) and one student per middle school (grades 6-8) were invited to become Task Group members. The Task Group and its student members are committed to student-conducted educational activities in elementary grades.

The Task Group considers community outreach and education efforts to be integral to the success of efforts to alleviate or lessen community health concerns related to the Global Landfill and the Sommers Brothers site. The Task Group endorses further development of educational activities.

Impact Of Sommers Brothers Property Contamination

In 1991, the Trustees of the Sommers Brothers property submitted a report to the New Jersey Department of Environmental Protection and Energy (NJDEPE). Preliminary analytical results of the groundwater collected indicated contamination of the site by organic compounds. When considered from a regional perspective, the contamination levels found in the groundwater at this property were generally one or two orders of magnitude higher than groundwater samples collected from the Global site. Despite the fact that the

analytical data were not validated (since a complete Quality Assurance/Quality Control package was not received by NJDEPE), contamination levels found in the groundwater at the Sommers Brothers property were so significantly above any found at the Global site, that these results caused concern among the Task Group about the contamination potential to the region and Cheesequake Creek. Members agreed that, from these data, the potential for impacting the environment is significant at the Sommers Brothers site. Additional review of these data is not within the purview of the Task Group.

Community Cancer Investigation

Cancer is a reportable disease and new cases of cancer are reported confidentially to the State Department of Health Cancer Registry. New Jersey Cancer Registry records were reviewed for the period from January 1979 through December 1987. Seven census tracts surrounding Global Landfill were grouped together and defined as the study area. The investigation was an attempt to take a "snap shot" of cancer incidence in the study population over a defined time period. The investigation could not attribute any cause-effect relationships. Limitations of this investigation exist with respect to sufficient time for latency, mobility potential of the population and a lack of exposure information. The investigation found that total cancer incidence in the study area was significantly lower than expected when compared to average State cancer incidence rates.

The Task Group concluded that, based on this information, additional follow-up of cancer concerns is not justified at this time.

Recommendations

Based on their conclusions, the Task Group recommends the following actions.

- * The Task Group should remain and continue in its current functions of oversight and coordination of efforts to address community health concerns related to Global Landfill and the Sommers Brothers property.

- * The State Departments of Health and of Environmental Protection and Energy should continue to provide technical information and expertise.
- * The Task Group recommends that its efforts continue to be dedicated to developing and implementing additional outreach and education strategies for the community in partnership with the local school districts.
- * The Task Group urges the State to proceed with capping Global Landfill (Operable Unit 1) as expeditiously as possible, including the installation of perimeter fencing to restrict access to the site.
- * The Task Group recommends that municipal police be made more aware of the site and urges that site access be monitored as part of normal patrol activities.
- * Results of the Community Soil Monitoring Program should be submitted to the Old Bridge Municipal Utilities Authority with a request for a thorough investigation of the integrity of the utility lines along Westminster Boulevard. The Old Bridge Health Department and the Task Group should be kept informed of this investigation as it progresses.
- * The Task Group should review and provide comment on the Remedial Investigation/Feasibility Study currently underway at the Global Landfill Superfund site.
- * The Task Group requests that NJDEPE initiate a focused investigation of the Sommers Brothers property contamination, as soon as is possible, to assess the potential impact on the environment and health of individuals living in the vicinity.
- * The Task Group recommends State agencies fully evaluate air quality data for potential health impacts as soon as the data are available, and report findings to the Task Group and the Agency for Toxic Substances and Disease Registry.
- * The Task Group recommends that individuals with concerns about their health seek a medical evaluation from their family physician.

Community Concerns

At the outset of any project between the state and a local community, there is often a considerable amount of mistrust. The Task Group acknowledged that trust grew over time with familiarity. Task Group members asserted that strong, diversified representation from the community on this and similar task groups is important.

Task Group members expressed a responsibility toward sharing their experience with other groups with similar concerns and goals. The Task Group hopes this report will document that progress can be achieved although limitations may be encountered when public agencies and citizens join together to solve environmental problems. The Task Group hopes that this report will provide guidance to current and future groups comprised of citizens and public agencies.

The members of the Task Group felt fortunate to have received a State grant of \$75,000 to address the concerns of the community. The Task Group made suggestions about the methods of administration of funds which, in reflection, would have facilitated Task Group responsibilities.

Work at Global Landfill is in an evaluation phase with a completion date five to seven years in the future. Task Group members unanimously agreed upon the need to continue to meet, discuss and oversee the completion of all work related to the sites. The Task Group is committed to continuing its oversight responsibilities established under P.L. 1987, c. 368. Task Group members unanimously support the participation of the community in the decision-making process relative to Global Landfill and the Sommers Brothers properties.

Additionally, the Task Group encourages the establishment of such groups in other, similar situations but caution that such committees should enhance rather than place any delays on the clean-up process. The Task Group as a whole believes that the process has helped to improve the communities' understanding of environmental issues and trust in state government.

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1.0 INTRODUCTION

In response to public health concerns voiced by residents of the local community near Global Landfill and Sommers Brothers Property, legislation was introduced by Assemblywoman Joann Smith, 13th District in 1987. The legislation appropriated \$75,000 to the New Jersey Department of Health (NJDOH) to fund certain activities considered by the Department to be necessary in addressing the community's health concerns. The legislation, P.L. 1987, chapter 368, also directed the NJDOH to provide the Governor and Legislature with a progress report outlining the community's concerns, the activities to be implemented with the appropriation and any recommendations. The Report of the Task Group on Global Landfill and the Sommers Brothers Property Sites was printed in 1988.

The 1988 Report described NJDOH's formation of a Task Group to develop specific recommendations. The Task Group was chaired by NJDOH with the cooperation of the New Jersey Department of Environmental Protection (NJDEP), local officials of Old Bridge and Sayreville, and community representatives from the residential advocacy group, Citizens Helping Environmental Cleanup (C.H.E.C.). The consensus of the Task Group was that formation of a working committee comprised of various representatives was valuable and necessary to help alleviate local problems and to enhance the community's participation in the decision-making process, their understanding of environmental issues and their trust in state government.

In 1988 the Task Group concluded:

- * there were scant data describing possible offsite community exposure to chemicals emanating from the sites;
- * there was a need to collect offsite soil and ambient air exposure profiles of the community;
- * the contribution of the site sources to these exposure profiles needed to be determined.

Information gathered would be used by the Group to determine whether a health study is necessary and what means would be appropriate to reduce exposure's of health concern. The Task Group outlined the activities to be addressed by appropriated funds, including: a Community Soil Monitoring Program; a Pediatric Health Examination; a Community Demographic Profile; and an Outreach and Education Program.

In 1988, the Task Group recommended two activities which they felt would be necessary to address health concerns. These would require additional funds:

- (1) A Community Ambient Air Monitoring Program to identify and manage important sources of ambient air exposures and to assist in consideration of a health survey.

- (2) An Odor Control Program to eliminate nauseating effects and the potential hazard posed to the nearby community from continuing air emissions emanating from the landfill. The 1988 Task Group recommendations included design, construction, and maintenance of a temporary cap on the landfill and of an odor reduction plan until a final remedial plan could be developed under the Superfund Program.

At the time of the printing of the 1988 Report of the Task Group, Global Landfill was proposed for inclusion on the National Priorities List for clean-up by the United States Environmental Protection Agency. The time frames and funding recommended in the 1988 Report were later modified to reflect plans for NJDEPE's clean-up of Global Landfill under the Superfund Program. NJDEPE actions, such as a landfill cap for Global Landfill and the Remedial Investigation/Feasibility Study, expect to address the air quality issues raised by the Task Group. The 1988 Report of the Task Group also included additional recommendations such as the expeditious cleanup of the Sommers Brothers site.

This document, the Second Report of the Task Group on Global Landfill and the Sommers Brothers Sites, 1992, details activities implemented under P.L. 1987, c. 368 and describes the results, conclusions and recommendations

of the Task Group. Activities addressed with appropriated funds include the Community Soil Monitoring, the Community Demographic Profile, the Pediatric Health Examinations, and the Outreach and Education efforts. A Community Cancer Investigation was also conducted by NJDOH but did not utilize any appropriated funds. This document also includes environmental data, cleanup plans and health assessment information on Global Landfill.

Note: In October 1991, the New Jersey Department of Environmental Protection (NJDEP) was reorganized and renamed the New Jersey Department of Environmental Protection and Energy (NJDEPE).

2.0 STATUS OF THE SITES

2.1 Global Landfill

Site Background and Superfund Status

Global Landfill is a former municipal landfill located in Old Bridge Township, Middlesex County. It is bordered by wetlands to the northeast, southeast, and southwest, in the drainage basin of Cheesequake Creek. The site is bordered on the northwest by a former sand borrow pit. To the west, northwest, and north of the site, are residential areas of Old Bridge Township and the Borough of Sayreville. The residential areas are between 500 and 2400 feet from the site and include several apartment complexes as well as single family homes.

Global Landfill was in operation from 1968 until 1984. It is approximately 57.5 acres in size, and consists of two areas. The first is a 51-acre mounded area which is 108 feet above mean sea level at its highest point; the second is a 6.5-acre area, adjacent to the northwest sideslope which is 32 feet above sea level at its highest point. The areas are partially separated by a 42-inch underground gas pipeline owned by the Transcontinental Gas Pipe Line Company (TGPL).

A New Jersey Administrative Order was issued to Global Landfill Reclaiming Corporation in May 1981 for violation of state regulations at the landfill. Global was later required to establish an escrow account for closure of the landfill. The site was summarily closed in April 1984 by the New Jersey Department of Environmental Protection (NJDEP), after the southeast sideslope of the landfill failed and slid into the adjacent wetlands. The sideslope failure was caused in part by two days of rain and extraordinarily high tides in surrounding wetlands.

Superior Court appointed Richard Sullivan of New Jersey First, Inc., as Administrator for the closure fund. In 1986, Mr. Sullivan authorized the consulting firm of E.T. Killam Associates of Millburn, NJ to conduct an investigation of the site. A subsequent slope stability study was performed

which showed that the side slopes adjacent to the wetlands generally do not meet acceptable safety levels. Slope movement (creep) of the southeast sideslope is occurring. It is likely that this creep will continue until engineering controls are implemented.

The landfill was said to contain municipal solid, bulky, vegetative and non-chemical industrial waste as prescribed in its registration. Allegations that large numbers of drums containing hazardous industrial waste were buried at the landfill led to an exploratory excavation of the 6.5-acre northeast tract in March 1988. Drums of hazardous waste were discovered during the preliminary investigation.

In June 1988 Global Landfill was proposed for inclusion on the National Priorities List (NPL) by the United States Environmental Protection Agency (USEPA). In March 1989 Global was officially placed on the National Priorities List (NPL) becoming eligible for action under Superfund with NJDEP as the lead agency. Killam Associates was authorized by NJDEP and Administrator Sullivan to prepare a Feasibility Study (FS) under Superfund regulations for on-site controls and closure of the landfill.

Killam submitted a preliminary draft FS to Administrator Sullivan and the NJDEP for the landfill closure in April 1989. With Global's inclusion on the Superfund List, the FS was reviewed by USEPA and NJDEP. It was determined that a supplemental geotechnical investigation was necessary. This was conducted by Killam's subcontractor (French and Parrello Associates) in the Spring of 1990. Due to Global's sideslope failure in 1984 and its location on wetlands, this more thorough subsurface evaluation was necessary to aid Killam in evaluating and selecting alternatives for the cap.

In February 1991 a final FS report was submitted by Killam to Mr. Sullivan, USEPA and the NJDEP. This was the basis for the Proposed Plan for landfill closure (Operable Unit 1). The NJDEP briefed the local Global Task Group on February 13, 1991 with a summary of the alternatives in the Proposed Plan and the proposed schedule of remediation for Operable Unit 1.

As with many Superfund sites, the problems at the Global site are complex. As a result, the NJDEP in consultation with the USEPA, has separated

the remedial work into two planned actions (Operable Units). Operable Unit 1 (OU1) addresses the proper closure of Global Landfill by containing contaminants at the site and limiting exposure levels to be protective of human health and the environment. Operable Unit 2 [OU2] (Remedial Investigation/Feasibility Study) is to further define the nature and extent of the migration of contaminants from the site into nearby surface and ground water, air sediment and soil; assess the risks associated with any contamination; and evaluate remedial alternatives to address this contamination.

Proper Closure of Global Landfill (Operable Unit 1)

The Proposed Plan for closure of the landfill was officially placed in repositories on February 19, 1991. From February 19, 1991 through May 6, 1991, the NJDEP held a public comment period to obtain verbal and written comments from local residents, elected officials and other interested parties on the preferred remedy as presented by NJDEP and USEPA for Operable Unit 1. NJDEP held a briefing on February 13, 1991 with the Global Task Group to discuss on-site controls and the proposed project schedule. NJDEP held a public meeting on March 12, 1991 to discuss the preferred option for proper closure of the landfill and respond to residents' comments and questions. NJDEP also held a public information session on March 13, 1991 to answer residents' questions.

The NJDEP's Proposed Plan was based upon the Feasibility Study performed by Killam Associates. The Proposed Plan presented six alternatives for capping the landfill, including:

1. No action (inclusion is required by law) would include only quarterly sampling of ground water monitoring wells.
2. NJDEP Solid Waste Cap - three foot cap including 12 inches of clay.
3. NJDEP Hazardous Waste Cap - six foot cap including 3 feet of clay and a synthetic geomembrane layer.

4. RCRA Hazardous Waste Cap - five foot cap including 2 feet of clay and a synthetic layer.
5. Bentonite Clay Cap - 2.2 foot cap of pure bentonite clay layer sandwiched between two geotextile layers.
6. Modified NJDEP Hazardous Waste Cap - 3 foot cap including 1 foot of clay overlain by a synthetic geomembrane.

Alternatives 2-6 also included:

- * Site security measures: fence the perimeter of the landfill and erect guard rails to prevent vehicular access.
- * Stabilization berm, storm water management and soil erosion controls.
- * Monitoring of landfill side slopes.
- * An active gas collection and treatment system.
- * A leachate seep collection and treatment system, (See options below).
- * Operation and Maintenance for 30 years.

Leachate System Options:

1. No on-site treatment with discharge by truck to industrial waste treatment facility.
2. On-site pretreatment with discharge by truck to publicly owned treatment works (POTW).
3. On-site treatment with discharge to surface water.

Construction period of any leachate treatment options will be concurrent with cap construction. (For more detailed information on the Proposed Plan see Appendix #1.)

On September 11, 1991 the USEPA signed the Record of Decision (ROD) for Operable Unit 1 at the Global Landfill Superfund site. The ROD is the decision document that explains in detail the selection of the remediation for Operable Unit 1 (the closure of the landfill). The ROD includes the Responsiveness Summary which summarizes all comments received during the comment period (February 19, 1991 through May 6, 1991) and the responses of NJDEP and USEPA. The ROD identifies the remedial actions selected and describes the major components which include:

- * A modified hazardous waste cap including 12 inches of vegetated topsoil, 12 inches of clay, 12 inches of sand drainage and 30 mil textured synthetic liner material.
- * Slope stability enhancement through construction of soil stabilization.
- * Construction and operation of a gas management system.
- * Construction and operation of stormwater and leachate management systems.
- * Installation of perimeter security fence to restrict access to the site.
- * Implementation of a monitoring program to ensure the effectiveness of the remedy.

All related documents for Operable Unit 1 (closure of the landfill) are available for public review at the following local repositories:

Old Bridge Public Library **
1 Old Bridge Plaza
Old Bridge, NJ 08857

Sayreville Borough Clerk's Office
167 Main Street
Sayreville, NJ 08872

Sayreville Public Library
1050 Washington Road
Parlin, NJ 08859

Old Bridge Township Clerk's Office
1 Old Bridge Plaza
Old Bridge, NJ 08857

Middlesex County Health Department
Solid Waste Program
841 George Road
North Brunswick, NJ 08902

** The complete Administrative Record for Global Landfill is available at this location, as well as the NJDEPE and USEPA offices.

Additional Remedial Activities (Operable Unit 2)

NJDEP hired URS Consultants in August 1990 to conduct the \$1.2 million Remedial Investigation/Feasibility Study (RI/FS). The RI/FS is a comprehensive study to further define the nature and extent of contamination of ground water, surface water, air, soil and sediments. The RI/FS will also assess the risks associated with any contamination and develop additional remedial alternatives, as necessary. Information will be gathered for the RI in all these areas, plus delineate the extent of fill and attempt to locate areas of drum disposal. The purpose of the FS is to examine the remedial alternatives which may be used to mitigate any potential risks to public health and the environment.

URS initiated the Phase 1 RI/FS field work in May 1991 and completed it in July 1991. The Phase 1 field work included: site surveying, air quality monitoring, geophysical and soil gas surveys, surface water and ground water sampling, leachate seeps and wetlands sediments sampling, soil borings, soil sampling, installation of ground water monitoring wells and wetlands assessment.

The results of the Phase 1 field work are expected to be final and released to local repositories, the Old Bridge Township Environmental Commission and the Global Task Group by early 1992. A public meeting to discuss the findings of the RI/FS and receive public comment on a second Proposed Plan (Operable Unit 2) for the entire site is expected to be held in the spring of 1993.

1988 Task Group Recommendations Regarding Closure

In the first Task Group report (August 1988), concerns were delineated about odors and their relationship to the proper landfill closure (i.e., cap, gas collection and treatment). The report considered the odor problems emanating from Global as possible signs of potential health effects. Therefore, the Task Group recommended that the Global site should be capped by the summer of 1989 as a reasonable target date. The fact that Superfund

status had not been conferred upon Global Landfill at the time of the 1988 report caused the Task Group to recommend two alternatives to cap the landfill, for non Superfund status or Superfund status.

Non Superfund Site Status

"Final Closure of Global should be pursued under New Jersey's Solid Waste Act. The permanent capping system under final landfill closure should include systems for surface runoff, leachate collection, gas recovery and flaring, site security and long-term maintenance."

Superfund Site Status

"Until a final remedial plan is developed for Global Landfill under Superfund, which may require a minimum of five years to finalize, a temporary capping system should be designed and constructed for the site to reduce odor and chemical emissions. The components to the temporary capping system should make the most of available funds in the landfill's escrow account which could become eligible for reimbursement by Superfund once the landfill is placed on the NPL."

The Task Group also recommended in 1988:

- The capping system, final or temporary, should be consistent with any other effort, current or future, designed to identify and remediate real or potential hazards that may exist on Global Landfill and Sommers Brothers Site.
- The landfill's escrow account should be supplemented through a special appropriation thereby assuring the funds to construct and maintain a temporary or permanent capping system.

The Task Group's recommendation to cap the landfill by the Summer of 1989 was due to concerns surrounding odors from Global. The Group believed that accompanying the odors were toxic volatile chemicals that could impact public health. The Task Group felt that the capping Global, whether final or temporary, should reduce or eliminate odors and potential non-odorous chemical vapors emitted to the air and any potential health impacts. The final closure

they suggested would include a permanent cap, surface runoff controls, leachate collection, gas recovery and flaring, site security and long term operation and maintenance.

The 1988 report noted that plans for final closure under the New Jersey Solid Waste Act were already underway by Killam Associates under the direction of Global Administrator Sullivan. After Global was officially placed on the Superfund List in March 1989, Killam Associates was authorized by Mr. Sullivan and NJDEP to conduct a Feasibility Study (FS) for the final closure of Global under Superfund regulations. The purpose of the FS was to determine the need for and to evaluate alternatives to provide on-site controls prior to the completion of a comprehensive Remedial Investigation/Feasibility Study (RI/FS).

The closure of Global is an early response action. This action allows the design for the cap and leachate and gas management systems to proceed while the RI/FS for OU2 is in progress. This means that the OU1 remedial actions can be instituted in an expeditious manner. (Usually, the OU1 actions would occur after the completion of the RI/FS.) The current sequence of site activity will reduce by several years the time necessary for the remediation of Global.

In their 1988 report, the Task Group also recommended that:

- The Task Group should maintain an oversight role in selection of the appropriate capping system and in the selection of the contractor;
- The Task Group wanted to be assured of active participation in the remedial efforts for Global Landfill and recommended that NJDEP be the lead agency;
- The Task Group urges the continuation of the close relationship of the Task Group with NJDEP, NJDOH and USEPA in the activities under New Jersey Legislation (P.L. 1987 c. 368) and the overall remedial investigation.

As they requested in 1988, the Task Group has been kept in an oversight role for the landfill closure and the Remedial Investigation/Feasibility Study (RI/FS) of Global. The NJDEP met with the Task Group on almost a monthly basis from January 1988 through December 1990. Since then such meetings are held quarterly. The NJDEP explained the proposed Phase 1 RI/FS field activities and received input from the Task Group on December 12, 1990.

The NJDEP held a briefing with the Task Group on February 13, 1991 to discuss on-site controls and the Operable Unit 1 project schedule. During the briefing the NJDEP presented a summary of the alternatives in the Proposed Plan for Operable Unit 1. The NJDEP also held a public information session on March 13, 1991 in conjunction with the Task Group to discuss with the public the Proposed Plan for Operable Unit One.

Sampling Activities

As part of the Feasibility Study conducted by Killam Associates for Operable Unit 1, a total of 63 55-gallon drums were discovered during the drum excavation in March 1988. Eighteen drums were removed for sampling and analysis. The drums were generally in poor condition, having been previously crushed or corroded. Their contents included solids, sludges and liquids. Analysis indicated the presence of volatile organic compounds, base neutral extractable organic compounds and petroleum hydrocarbons. Fourteen of the eighteen drums were classified as hazardous by NJDEP standards.

Leachate seeps in the landfill were found to have much higher concentrations of contaminants than in other media of concern at the site. Contaminants found in the leachate included: metals (particularly lead and cadmium) and benzene related compounds (including chlorobenzene up to 4600 parts per billion). Data obtained from analysis of the leachate seeps and during the drum excavation were used by Killam to estimate concentrations typical of the entire landfill.

Contaminants which were present in the leachate were also found in the upper water table aquifer beneath the site. Although this aquifer is not a potable water source for the area, it does discharge directly to the adjacent

wetlands, and therefore is a potential threat to the surrounding natural resources. The major contaminants of concern in the upper aquifer are: chlorobenzene, tetrachloroethylene, xylene, heptachlor epoxide, benzene, methylene chloride, metals (cadmium, chromium and lead) and Aldrin. These contaminants were found at elevated levels in excess of New Jersey Maximum Contaminant Levels (MCLs) for drinking water.

Beneath the upper water table aquifer lies the Old Bridge Sand aquifer, which is a regional potable water source. In this aquifer were isolated instances where low levels of contamination, in excess of MCLs, were detected. Metals (cadmium, chromium and lead), volatile organic compounds (chlorobenzene, methylene chloride, tetrachloroethene and vinyl chloride) and the pesticide 4,4-DDT were all detected in the Old Bridge Sand aquifer. Since the nearest potable wells are one mile upgradient of the site, there is little likelihood that they represent an immediate threat to public health. However, the presence of these contaminants poses a potential future threat, and thereby justifies taking action at this site.

In addition to ground water, air is a medium of concern at Global. The detection of odors by residents surrounding the site indicates that air is a pathway for gases emanating from the landfill. Gases are generated by the landfill due to the natural decomposition of organic matter. Although no specific toxic compounds have been identified in emissions from the landfill, there exists the potential of public health risk via the air pathway. The proper closure of the landfill requires that landfill gases be collected and appropriately treated.

All of the contaminants present in the upper aquifer can be expected to discharge directly into the adjacent wetlands. The wetlands are also subject to contamination from storm water run off and leachate seeps.

Limited surface water sampling shows high levels of fecal coliform bacteria and ammonia, which pose a potential threat to the local fauna. These and other contaminants were found in the surface waters in excess of New Jersey Surface Water Quality Standards. Other contaminants found in the

surface water at levels exceeding New Jersey Safe Drinking Water Act standards include pesticides (Lindane and DDT) and metals (cadmium, nickel, copper and zinc). [See attached Tables 1-2, 1-3, and 1-4 for more complete sampling results referred to here.]

As part of the Remedial Investigation/Feasibility Study for Operable Unit 2 (OU2), the Phase 1 sampling took place in May through July 1991. This sampling included: air quality monitoring at 8 locations on the landfill; geophysical survey; soil gas survey; surface soil sampling at 5 offsite locations; leachate seep sampling at 5 locations; surface water sampling at 10 locations; surface sediment sampling at 10 locations; subsurface soil samples at 12 locations during soil borings and 7 new monitoring well installations; ground water sampling of 24 monitoring wells (9 new and 15 from previous studies); measurement of tidal influence on surrounding wetlands; and ecological assessment. The results of this Phase 1 field work should be available in early 1992 and will be presented to the Task Group with copies distributed to the Old Bridge Township Environmental Commission and the local repositories listed previously.

Table 1. Comparison of Groundwater Quality in Shallow Wells, Global Landfill, Final Feasibility Study For On-Site Controls, Volume 1 of 2, February 1991
 Prepared by Killam Associates, Millburn, New Jersey



TABLE 1

COMPARISON OF GROUNDWATER QUALITY
 IN SHALLOW WELLS WITH WATER QUALITY
 CRITERIA FOR HEAVY METALS AND
 PRIORITY POLLUTANT ORGANICS

Downgradient Wells MW-2S, 4S, 5S, 6S, 8S (Con't)

<u>Parameter</u>	<u>Standard</u>	<u>No. of Samples Exceeding</u>	<u>Total No. of Samples</u>	<u>Range of Reported Concentration</u>
Heptachlor Epoxide	0.2 ^C	2	45	ND - 2.0
Aldrin	0.003	2	45	ND - 0.33

Units are ug/l. Data collected from 10/87 through 4/90. All analyses included Priority Pollutant metals and organics. Compounds not listed either never exceeded applicable criteria or do not have a numerical limit at this time.

- a. Provided by NJDEP. See Appendix F for specific source.
- b. Methylene chloride concentrations are subject to blank contamination and are not believed to accurately reflect actual concentrations in groundwater.
- c. Proposed.
- d. Elevated concentrations are believed to be attributed to positive matrix interference during analysis.
- e. Federal water quality criteria value.

Table 1 continued
Comparison of Groundwater Quality in Shallow Wells, Global Landfill

DE Killam

TABLE 1
COMPARISON OF GROUNDWATER QUALITY
IN SHALLOW WELLS WITH WATER QUALITY
CRITERIA FOR HEAVY METALS AND
PRIORITY POLLUTANT ORGANICS

<u>Parameter</u>	<u>Standard^a</u> (ug/l)	<u>No. of</u> <u>Samples</u> <u>Exceeding</u>	<u>Total</u> <u>No. of</u> <u>of Samples</u>	<u>Range of</u> <u>Reported</u> <u>Concentration</u> (ug/l)
<u>Upgradient Wells</u>				
<u>MW-1A, 7S, 9S</u>				
Nickel	13.4 ^e	3	24	ND - 40
Methylene Chloride	2	21 ^b	27	ND - 150
Tetrachloroethene	1	2	27	ND - 38
Trichloroethene	1	1	27	ND - 65
Vinyl Chloride	2	1	27	ND - 11
Xylene	44	1	27	ND - 91
Heptachlor Epoxide	0.2 ^c	1	27	ND - 0.3
<u>Downgradient Wells</u>				
<u>MW-2S, 4S, 5S, 6S, 8S</u>				
Barium	1000	3	45	ND - 2000
Cadmium	10	14	45	ND - 40
Chromium (Hex.)	50	4 ^d	40	ND - 400
Chromium (Total)	50	18	45	ND - 530
Lead	50	8	45	ND - 340
Nickel	13.4 ^e	30	40	ND - 850
Selenium	10	1	45	ND - 27
Silver	50	2	45	ND - 70
Benzene	1	39	45	ND - 100
Chlorobenzene	4	42	45	ND - 780
Methylene Chloride	2	36 ^b	45	ND - 170
Tetrachloroethene	1	2	45	ND - 2
Trichloroethene	1	2	45	ND - 4
Xylene	44	16	45	ND - 140
1,4 Dichlorobenzene	6	8	45	ND - 16
Acenaphthene	20	9	45	ND - 95
Aroclor - 1260 (PCB)	0.5	1	45	ND - 1.2
Heptachlor	0.4 ^c	1	45	ND - 71

Table 2 Comparison Of Surface Water Quality, Global Landfill
Final Feasibility Study For On-Site Controls, Volume 1 of 2
 Prepared by Killam Associates, Millburn, NJ

 Killam

TABLE 2
COMPARISON OF SURFACE WATER QUALITY
WITH NJDEP WATER QUALITY CRITERIA AND STANDARDS

<u>Parameter</u>	<u>Standard or Criteria</u>	<u>No. of Samples Exceeding</u>	<u>Total No. of Samples</u>	<u>Maximum Reported Concentration^c</u>
Fecal Coliform Bacteria	200 per 100ml ^a	10	10	24,000
Lindane	0.004 ug/l ^a	1	11	0.130
DDT	0.001 ug/l ^{a,b}	1	11	0.120
Cadmium	4.5 ug/l ^b	1	12	5.3
Nickel	7.1 ug/l ^b	3	12	61
Zinc	58 ug/l ^b	6	12	255
Copper	4.0 ug/l ^b	1	2	4.6
Silver	2.3 ug/l ^b	1	2	2.5
Chromium	50 ug/l ^a	1	12	289

Monitoring was conducted in October 1986 by NJDEP and October 1987 by Killam Associates.

a - NJDEP Surface Water Quality Standards

b - NJPDES Criteria for Protection of Salt Water Aquatic Life.

c - Units are the same as for the appropriate standard or criteria.

Table 3 Comparison of Groundwater Quality in Deep Wells, Global Landfill
Final Feasibility Study For On-Site Controls, Volume 1 of 2, February 1991
 Prepared by Killam Associates, Millburn, NJ

 Killam

TABLE 3

COMPARISON OF GROUNDWATER QUALITY
IN DEEP WELLS WITH WATER QUALITY
CRITERIA FOR HEAVY METALS AND
PRIORITY POLLUTANT ORGANICS

<u>Parameter</u>	<u>Standard^a</u> (ug/l)	<u>No. of</u> <u>Samples</u> <u>Exceeding</u>	<u>Total</u> <u>No. of</u> <u>Samples</u>	<u>Range of</u> <u>Reported</u> <u>Concentration</u> (ug/l)
<u>Upgradient Wells MW-7D</u>				
Nickel	13.4 ^d	1	8	ND - 14.7
Methylene Chloride	2	7 ^a	9	ND - 120
Tetrachloroethene	1	5	9	ND - 4.1
4,4-DDT	0.001	1	9	ND - 0.043
<u>Downgradient Wells</u> <u>MW-2A, 3A, 4A, 5A, 6D, 8D</u>				
Cadmium	10	1	54	ND - 15
Chromium (Hex.)	50	2 ^b	54	ND - 110
Chromium (Total)	50	1	54	ND - 70
Lead	50	1	54	ND - 280
Nickel	13.4 ^d	38	48	ND - 320
Benzene	1	4	54	ND - 3
Chlorobenzene	4	3	54	ND - 43
Methylene Chloride	2	42 ^c	54	ND - 110
Tetrachloroethene	1	3	54	ND - 5
Trichloroethene	1	2	54	ND - 10
Vinyl Chloride	2	3	54	ND - 7
4,4 - DDT	0.001	4	54	ND - 0.060

Units are ug/l. Data collected from 10/87 through 4/90. All analyses included Priority Pollutant metals and organics. Compounds not listed either never exceeded applicable criteria or do not have a numerical limit at this time.

- a. Provided by NJDEP. See Appendix F for specific source.
- b. Elevated concentrations are believed to be attributed to positive matrix interference during analysis.
- c. Methylene chloride concentrations are subject to blank contamination and are not believed to accurately reflect actual concentrations in groundwater.
- d. Federal water quality criteria value.

GLOBAL LANDFILL
OLD BRIDGE TOWNSHIP
MIDDLESEX COUNTY

Brief Chronology Leading To Present Superfund Status

- 1968 Began landfill operations owned by Global Reclaiming Corporation.
- Mid 1970 to 1981 Accepted sewage sludge, one source of which was found to have contamination including PCBs and lead.
- 1981 Refused to accept any more sludge.
- May 1981 NJDEP issued Administrative Order for violation of state regulations.
- Fall 1982 NJ Board of Public Utilities (BPU) ordered Global to establish an escrow account for closure of the Landfill.
- April 1984 NJDEP ordered closed after southeast sideslope of the landfill failed and slid into adjacent wetlands.
- July 1984 through June 1985 Area of sideslope failure is regraded and covered.
- 1986 New Jersey Court appointed Richard Sullivan of New Jersey First, Inc. as Administrator of the Global Landfill closure fund.
- Fall 1986 Mr. Sullivan authorized the consulting firm, E.T. Killam Associates of Millburn, NJ to conduct an investigation at the site.
- March 1988 Drums containing hazardous waste were found in one section of Global as part of Killam's preliminary investigation.
- June 1988 Global Landfill officially proposed for inclusion on the National Priorities List (Superfund List).
- March 1989 Site officially placed on Superfund List with NJDEP as lead agency.
- 1989 NJDEP and Mr. Sullivan authorized Killam to prepare a Feasibility Study for on-site controls and closure of the landfill (Operable Unit 1).
- August 1990 NJDEP awarded a \$1.2 million contract to URS Consultants of Paramus, NJ to perform a Remedial Investigation/Feasibility Study (RI/FS) for Operable Unit 2.

February 19, 1991

NJDEP officially placed a Proposed Plan for the closure of Global Landfill (Operable Unit 1) in repositories for public comment.

March 12, 1991

NJDEP held a public meeting to formally present the Proposed Plan for Operable Unit 1 (landfill closure).

March 13, 1991

NJDEP held a public information session to answer questions about the Proposed Plan for Operable Unit 1.

May 6, 1991

Comment period for Proposed Plan, Operable Unit 1, ended after two requested extensions.

May 30, 1991

NJDEP held a public meeting to formally initiate the RI/FS, Operable Unit 2, being performed by URS Consultants.

May 1991 through

July 1991 NJDEP's consultant, URS, completed RI/FS Phase 1 field work.

September 11, 1991

USEPA Region II Administrator signed the Record of Decision (ROD) for Operable Unit 1 (landfill closure).

For a more detailed history see A Report of the Task Group on Global Landfill and the Sommers Brothers Property Sites, August 1988.

2.2 Sommers Brothers Property Site

The Sommers Brothers property covers 234 acres in Old Bridge Township and is bordered by wetlands in the drainage basin of Cheesequake Creek. The site is situated northeast of the Route 34-Route 9 intersection and immediately adjacent to the Global Landfill Superfund Site. From the mid 1900's to 1968, approximately 20 to 30 acres of the site were utilized as a municipal dump site for Madison Township (Old Bridge Township). Additional areas of dumping are evident throughout the remainder of the site.

In April 1986, the Central Field Office of the Department of Environmental Protection was notified of the existence of drums at the Sommers Brothers Property Site. A field visit on 7 April 1986 identified eight areas with approximately 200 drums. Some of the drums were found to contain tars, resins, vermiculite and unknown solids. Sampling of the drum contents revealed no hazardous waste constituents. Representatives of the Sommers Brothers Property estate contracted with Accutech to provide sampling analysis and removal services. Removal of a total of 631 tons of crushed drums and soil was completed on August 18, 1986.

Additional drums were detected in September 1986 and subsequently removed. These drums were discovered after dense vegetation receded.

At the direction of NJDEP's regional field office, the Trustees for the Sommer Brothers Property installed monitor wells and collected groundwater samples in the Spring of 1990. Preliminary summary tables of the sample results suggest groundwater contamination significantly above current groundwater criteria and levels detected at the adjacent Global Landfill. The primary groundwater contaminants observed include benzene, chlorobenzene, ethylbenzene and toluene.

As indicated above, the results suggest groundwater contamination significantly above any found at Global Landfill. For example, the proposed standard for ethylbenzene at Global is 700 ug/l; at Global Landfill, concentrations of this compound were generally less than 100 ug/l, while at Sommers Brothers, the concentration ranged from 4 to 10,800 ug/l.

While still considering the preliminary nature of these results, and the concerns regarding the absence of quality assurance/quality control data, the levels of contamination found prompt concern and warrant further action. Based, in part, on these results, the Department of Environmental Protection and Energy (NJDEPE) is currently expediting responsible party search through the Bureau of Case Management to identify those individuals or groups who have dumped wastes at the site.

**3.0 TASK GROUP ACTIVITIES IMPLEMENTED UNDER P.L. 1987, c. 368 IN
THE COMMUNITY NEAR THE GLOBAL LANDFILL AND SOMMERS BROTHERS SITE**

3.0 TASK GROUP ACTIVITIES IMPLEMENTED UNDER P.L. 1987, c. 368 IN THE COMMUNITY NEAR GLOBAL LANDFILL AND THE SOMMERS BROTHERS SITES

The activities mandated by P.L. 1987, c. 368, the appropriation act, were first implemented during the latter half of 1988. As with the development of plans detailed in the 1988 Report of the Task Group, Task Group members have worked together on all phases of the project. Through a consensus process, the Task Group selected and evaluated potential contractors for the various components of the programs. All information (excluding confidential medical data) generated from these activities has been shared with the Task Group. Accomplishments were acknowledged and results shared. The Task Group has participated in the review and drafting of this Second Report.

Cooperation with the Old Bridge Health Department

State legislation P.L. 1987, c. 368 appropriated funds to the New Jersey Department of Health (NJDOH) to collect exposure data and any relevant information to address community health concerns related to the Global Landfill and Sommers Brothers Dump Sites. In discussions with the Global Task Group, NJDOH agreed to contract the data collection and field work to the Old Bridge Health Department through a Health Service Grant. The grant process required NJDOH to provide oversight to monitor and obtain the deliverables under the health service grant, while the process enabled the Old Bridge Health Department to secure necessary services for implementing the soil testing, demographic survey, pediatric exams and educational activities planned by the Task Group.

The Old Bridge Health Department provided numerous administrative, fiscal and programmatic services essential for completion of the Task Group's plans. Site visits requested by the federal Agency for Toxic Substances and Disease Registry were facilitated by the Old Bridge Health Department and other members of the Task Group. Old Bridge Township municipal facilities

were utilized for regular Task Group meetings and associated public meetings while the Old Bridge Health Department clinic served as the location for the pediatric examinations. Local health staff assisted in scheduling exam appointment times and assisted with locating cases as part of the community cancer incidence investigation conducted by NJDOH.

Community Concerns Regarding Exposure

During the early months of 1988, Task Group discussions centered around local residents' request for a health study. This discussion repeatedly raised the question of residential exposures to hazardous chemicals migrating from Global Landfill and the Sommers Brothers Property nearby. However, documentation of offsite exposure was neither available nor conclusive. Onsite data were limited and of insufficient quantity and quality to reasonably assess any exposure to the nearby community.

The Task Group agreed that without necessary environmental data about the extent and magnitude of exposure and the implication to community health, a health study would be premature.

Collection of Data Necessary To Address Concerns

The proximity of homes to the Global and Sommers Brothers sites and odor concerns led the Task Group to agree that there was a need to collect samples of offsite soil and to monitor ambient air in order to characterize potential community exposure to toxic landfill emissions. This exposure information was sought to determine whether the data would support the need for a health study, and to determine the most appropriate means, if needed, to reduce exposure to any toxic contaminants based on the identified major sources.

The Report of the Task Group in August 1988 concluded that an ambient air monitoring program fully addressing community concerns would require funds in excess of the \$75,000 appropriated by the legislature. The Task Group identified issues which could be addressed with the funding available at the time, and identified the scope of work for projects such as the soil borings with the cooperation of the NJDEP representatives on the Task Group.

3.1 Community Soil Monitoring Program

Evaluation Of The Presence Of A Former Landfill

Local residents had expressed concern that the London Terrace apartments may have been constructed upon an old municipal landfill. This concern was based on information provided by individuals familiar with the history of the area. A municipal landfill underneath the apartments could act as a source of indoor air pollutants such as volatile organics, potentially adding to migrating contaminants from the Global/Sommers sites. This was of particular concern to first floor occupants of the London Terrace apartments, which have unfinished basements. Such a situation might be responsible for some of the health problems originally reported by the community.

By 1970, some housing development near the sites was completed and London Terrace was almost one-third completed. In 1988, although historical soil records used during the London Terrace apartment construction permitting process could not be located, several aerial photographs taken of the area in the 1970s were found and evaluated for the Task Group's first report. The photos showed remnants of the old Madison municipal landfill on the Sommers Brothers property close to London Terrace and Nieuw Amsterdam apartment complexes west of Global Landfill. The Madison municipal landfill operated until the late 1960's before regulatory programs were established by the New Jersey Solid Waste Act passed in 1970.

The Old Bridge Township Engineering Office provided photographs of a 1984 slope collapse in the area of the London Terrace Apartments. These photos suggested that a landfill was not underneath this apartment complex. From appearances, soil strata exposed as a result of the collapse were not landfill materials. Although this observation was well received, the Task Group believed that analysis of soil samples would address this concern more completely. Soil samples taken among the residential buildings and at several depths were expected to provide conclusive evidence of the absence or presence of an old landfill or any other contamination.

Objectives of Offsite Soil Sampling

The Task Group recognized that soil and ambient air environmental data were needed to determine the possibility of community exposure to chemicals. Therefore, the Task Group outlined a soil testing plan which could be implemented in a reasonable time period and within the funding available at the time. The soil investigation efforts were designed to answer two questions:

- (1) Were the apartments built on a landfill?
- (2) Were any contaminants present in the soil adjacent to homes?

Chemical contaminants selected for testing included volatile organics, pesticides and PCBs, base/neutral extractable organics, acid extractable organics, metals and miscellaneous analytes from the USEPA Priority Pollutant List.

The soil investigation consisted of several components, including:

- * Analysis of soil gas samples collected from locations in the residential areas of London Terrace, border of Parkwood Village and Nieuw Amsterdam, with comparison samples taken from the residential area of Skytop Garden Apartments near the Municipal Water Tower.
- * Collection of soil boring samples at locations determined by detection of contaminants in soil gas sample results;
- * Analyses of 6 soil boring samples for contamination at selected depths.

The scope of work was reviewed and discussed by the Task Group. Based on the technical advice of its NJDEP members, the Task Group then decided to add a comprehensive Quality Assurance/Quality Control (QA/QC) component to the soil testing package. The QA/QC modifications to the contract added \$9,000 to the original estimated expenditures. The Task Group felt strongly that this was an essential component and the expense was justified to insure the validity of the data.

Methods

Late in 1988, the Task Group selected Eikon Planning and Design, Inc. of Netcong, New Jersey, and Eikon's subcontractors, Enseco Laboratories, of Sommerset, New Jersey, to conduct soil borings and analysis. The methods were to be consistent with the specifications of the scope of work in the 1988 Health Service Grant and subject to standards set by NJDEP. (reference: Report of the Task Group, August 1988)

The initial phase of soil gas sampling began in early 1989. Details on methodology and techniques used are referenced in the Report of Findings, Eikon Planning and Design, Inc., February 1990, (Appendix # 2). Locations for some of the subsurface soil vapor samples were pinpointed using a "grid approach" on maps of the residential areas. (See Appendix #2, page 3, for Grid Map.) Other sampling sites were selected by a review of historical aerial photographs. The combination of randomly selected soil vapor sampling points along with the selection of locations assisted by the aerial review was expected to identify the most appropriate soil sampling places.

Eikon applied transparent overlays of the present day community to aerial photographs from 1959, 1966, 1969, 1976 and 1984. [Sections of four of the maps have been reproduced on the following pages.] This enabled the documentation of historical construction activities and landfill operations with greater detail than previously obtained aerial photographs. Using this technique, suspected landfill access points and the parameters of the landfill were more accurately delineated. The review is detailed in the Report of Findings (Appendix #2, p.11).

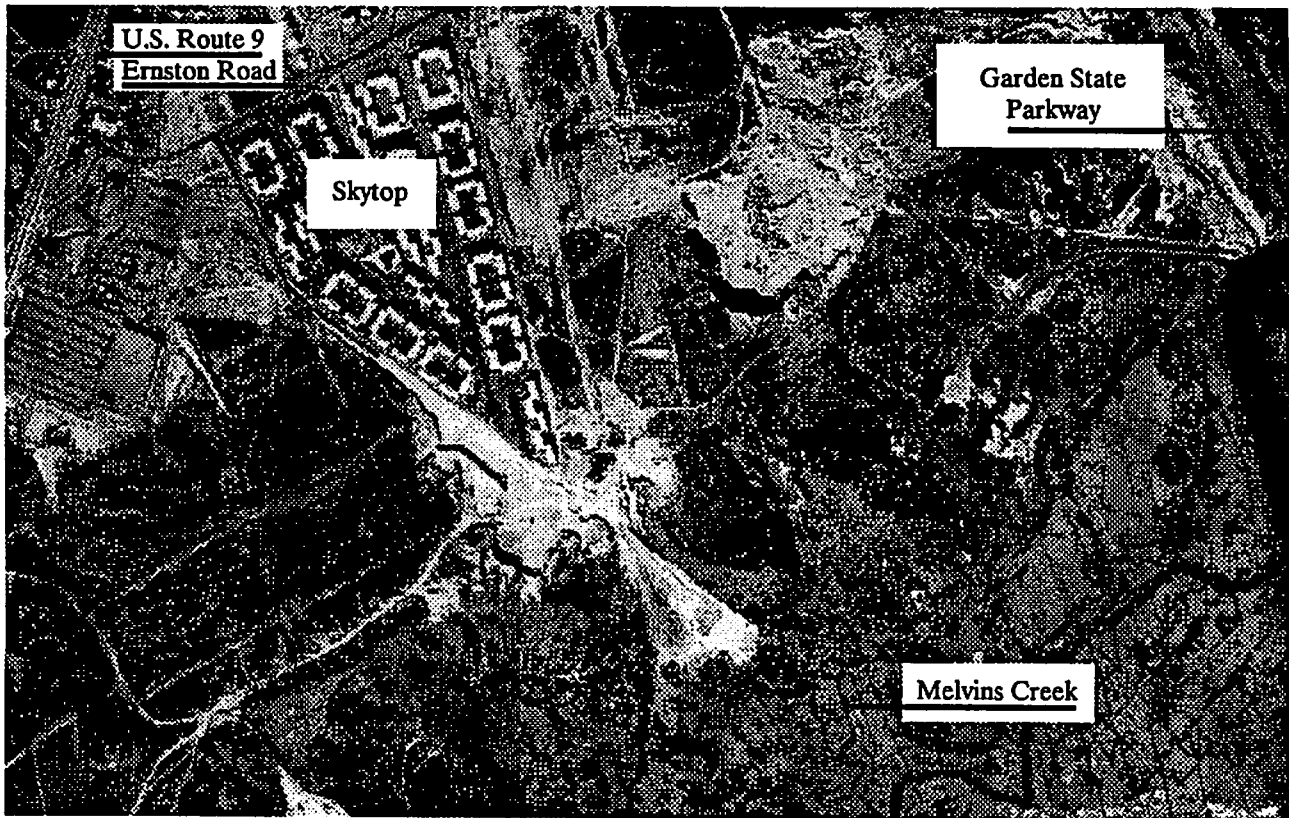
Based on the results of the soil gas survey and the review of the historic aerial photographs, six (6) soil boring locations were selected, including a control site. Field activities commenced on June 14, 1989, with each boring advancing to a depth of 22 feet. Two (2) soil samples were collected from each borehole at the 5'-7' and 20'-22' soil horizon and sent to Enseco Laboratories for analyses. Representatives of the NJDEP monitored the field activities and provided technical recommendations to Eikon's field

Figure A



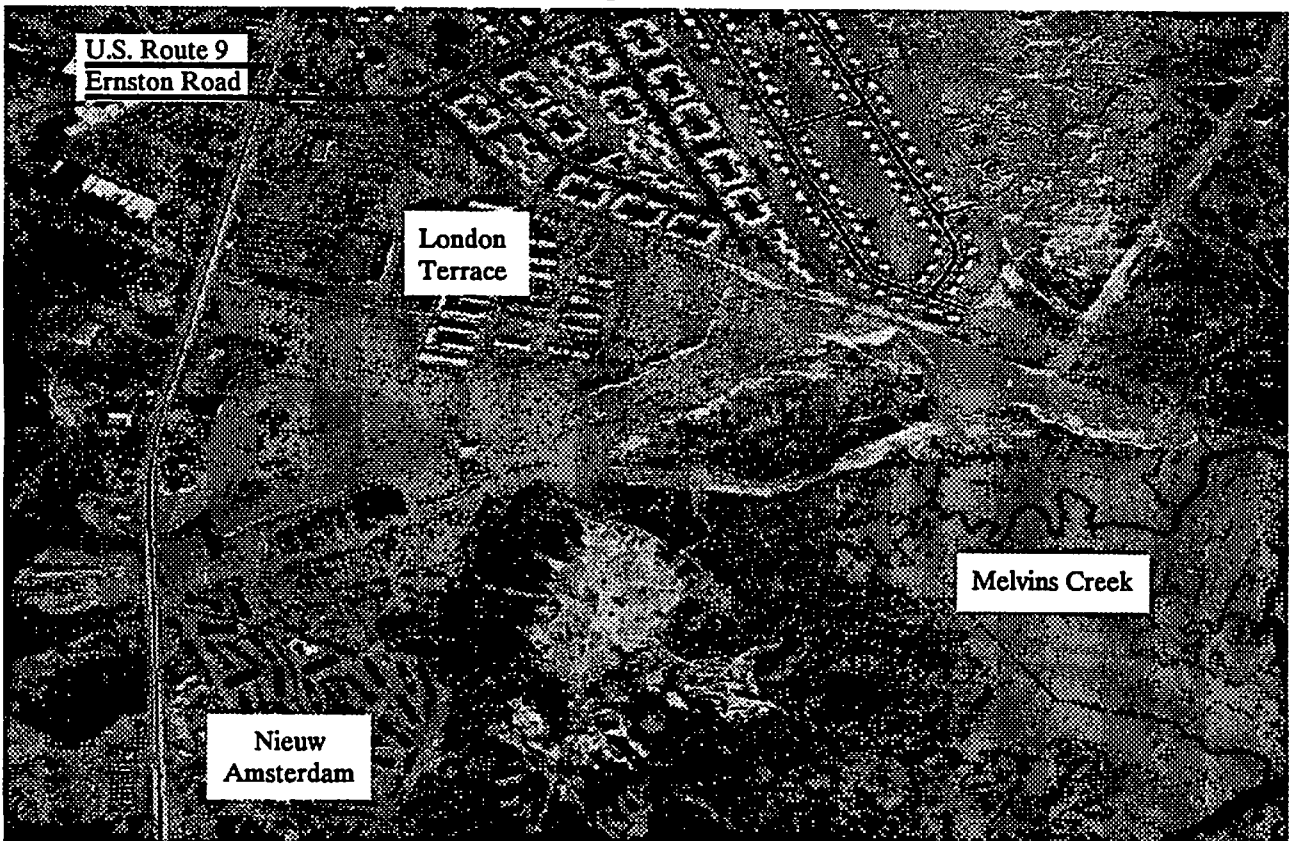
Old Bridge Township Aerial Photo 1959

Figure B



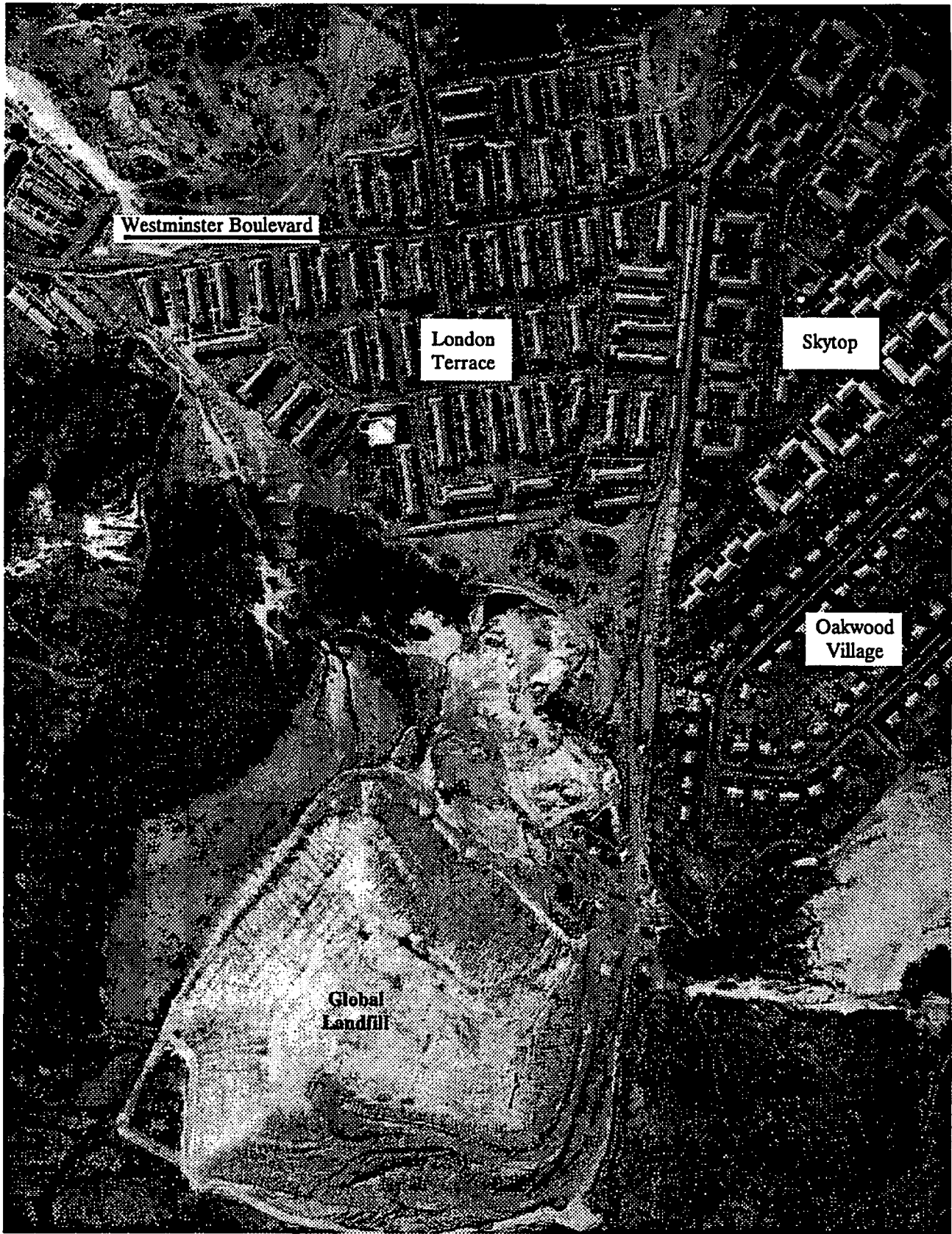
Old Bridge Township Aerial Photo 1966

Figure C



Old Bridge Township Aerial Photo 1969

Figure C



Old Bridge Township Aerial Photo 1984

personnel. The soil samples were analyzed for the USEPA Priority Pollutant List compounds, plus a library search of the 40 largest non-targeted peaks.

Project Delay and Resolution

The project came to an unexpected standstill when third-party liability questions arose in early Spring, 1989. Shortly after soil gas sampling began, the owners of the London Terrace property became concerned about the possibility of utility line damage resulting from sampling activities. (Utility line pathways were not recorded precisely beyond the main hook-ups.) Eikon was not bound by their contract with Old Bridge Township to provide insurance coverage for the project. The owners did not allow further soil testing. Through local citizen action and the interventions of Assemblywoman Smith and other officials, the Township Council passed a resolution supporting the necessary steps to continue the soil tasks. Old Bridge Township secured the additional insurance coverage to enable work to continue. (See Appendix #3).

Results

The Report of Findings was submitted to the Task Group by Eikon Planning and Design, Incorporated, in February 1990. It has been reproduced, in part, in Appendix #2. The full report plus a complete set of the volumes of laboratory test documentation were placed in the Old Bridge Township Public Library.

Representatives from Eikon Planning & Design and Enseco Laboratories attended a meeting of the Task Group on February 14, 1990, to present the results and answer questions. Based on the findings, it was determined by Eikon that the London Terrace apartment complex was not built on top of former landfilling operations. However, several access roads to landfill sites did cross the property. A variety of contaminants, primarily organic compounds, were found in the soils at low levels. Trace concentrations of select volatile organics were found in six (6) samples and at both depths, including the control boring. Semi-volatile organic compounds were found to

be elevated in four (4) soil samples. No contaminant concentrations were detected above the Interim NJDEP Soil Action Levels. Appendix #11 contains the summary tables from the Report, detailing the detected compounds at the various depths for each of the six soil borings. Eikon responded to questions regarding the possible sources of contamination. Three sources were suggested:

1. "Degradation of the sanitary sewer and storm sewer pipeline along Westminster Boulevard;
2. Localized dumping along access roads, and/or dumping associated with construction were noted as possible sources;
3. Migration of off-site sources (Global Landfill and Sommers Brothers Property site)."

(See Appendix #2, page 48: Report of Findings, Section 6, "Conclusions and Recommendations", Eikon Planning and Design, Inc.).

Discussion

Following Eikon's presentation, the Task Group considered the complexity of the soil tasks and discussed the interpretation of the findings. While the soil monitoring program successfully addressed key community concerns, there were some questions yet unanswered and new issues raised. The Task Group speculated that elevated volatile organic levels in the control boring sample could not logically have resulted from soil migration. Other potential reasons were explored but no conclusion could be made. Further action was not taken.

The validity of the analytical data was questioned by the Task Group over the lack of chain-of-custody forms, elevated sample temperature upon receipt at the laboratory, and other Quality Assurance-Quality Control (QA/QC) issues. (Appendix #4, NJDEP QA/QC Review). A "Soil Task Subcommittee" of the Task Group was formed to examine the validity of the soil boring results. The Soil Subcommittee reviewed the residential soil

findings and concluded that the data should not be rejected. They stated that the results for volatile and semi-volatile organic fractions should be labeled "qualified - biased low." "Qualified - biased low" informs the user of the data that the analytical results for the samples in question are considered to be estimated and possibly lower than what actually was present in the samples. There are many reasons for qualifying data as "biased low". In this case, the results were qualified due to the elevated temperatures in the shipping containers. Additionally, the results that are recorded as "non-detect" (or below the level at which the instruments can detect the contaminant) may actually be higher than reported.

Though scientifically accurate, the technical nature of the concepts enumerated above were the subject of intense debate by the Task Group and were discussed at length. The logistical and practical problems associated with environmental sampling and analysis require the incorporation of not only quality control principles, but validation principles as well. While qualifying the results, the usefulness of the information is retained.

3.2 Pediatric Health Examinations

Introduction

The primary purpose of the pediatric health screenings was to assess the current health status of the children residing in the vicinity of Global Landfill and the Sommers Brothers sites. Additionally, this service was provided in order to reassure parents that their children were receiving proper medical attention. An individualized approach was chosen to enable a one-to-one interaction between the child and pediatrician in order to address specific medical and informational concerns. If laboratory tests indicated a follow-up test was suggested, parents were notified of their child's results by telephone within a week of the exam. All parents were notified by mail of their child's results in the Fall of 1990. (Appendix #5). When requested by the parent, information was also sent to the family physician.

The screenings were not designed as a study to determine a link between exposure and symptoms. Such cause-effect studies include a non-exposed comparison group and do not usually address specific individual medical and informational concerns as in this screening. Any cause-effect evaluation from screening data, therefore, can only provide a crude indicator of health problems potentially related to a site. A copy of the report submitted to the New Jersey Department of Health (NJDOH) by the University of Medicine and Dentistry of New Jersey (UMDNJ) is attached (Appendix #6). In this section NJDOH has provided additional evaluation in order to enhance the final UMDNJ report.

Residents of Old Bridge and Sayreville, New Jersey (NJ), have raised concerns about possible health effects of exposure to materials dumped in the Global Landfill and in the Sommers Brothers property sites. The NJDOH responded and recommended a comprehensive medical evaluation of children

living and playing near these areas. The Division of General Pediatrics of the University of Medicine and Dentistry of New Jersey (UMDNJ) in New Brunswick, NJ agreed to perform interviews and the medical evaluation of children living and playing near the landfills. UMDNJ and the NJDOH entered into a Memorandum of Agreement (MOA) to implement and interpret these health screenings. UMDNJ met with representatives of the Department of Health (DOH) during 1988 and 1989 to plan the protocol for these screenings.

UMDNJ reviewed medical literature regarding the evaluation of health effects resulting from exposure to hazardous waste sites, such as the well-known Love Canal area in New York State. Adverse health effects may result from human exposure with waste sites through skin contact, ingestion or inhalation of contaminants from the landfill. Some short-term health effects which have been noted in the literature include respiratory problems (such as exacerbations of asthma, bronchitis, chronic cough), skin problems (such as rashes, skin discolorations, unusual acne), neurological symptoms (such as headaches, dizziness, balance problems), and mood disorders (such as irritability and insomnia). Longer-term health effects have been reported to include reproductive abnormalities, developmental and learning problems, chronic diseases and some cancers.

UMDNJ focused on the Task Group's primary purpose of providing a medical service to the community in developing the screening questionnaire. Questions were included on demographic characteristics and potential routes of exposure to hazards, as well as a thorough review of perceived symptoms and problems. UMDNJ also collected information about health problems that had been evaluated and/or treated by a physician to verify reported health outcomes. In this way UMDNJ could attempt to minimize reporter (recall) bias. The evaluation included a complete physical examination, in particular to look for physical signs of adverse health problems. Finally, UMDNJ provided laboratory testing to screen for previously unknown problems. UMDNJ hypothesized that if health problems were resulting from exposure to the landfill that they would be more prevalent in those individuals with the greatest exposure. The group targeted for the health screenings was children 18 years of age and under.

Materials and Methods

Letters announcing screening activities were distributed to children at schools within the area of the Global Landfill sites (approximately 4,000 households). (See Appendix #7.) Announcements were also circulated in area newspapers. Parents who expressed interest enrolled their children in response to the announcements. (See "Consent Form", Appendix #8.) A Task Group subcommittee selected those children to be screened, prioritized by distance of the residence from the landfill. The health screening program was conducted at the Old Bridge Health Department clinic. At the time of the screening, each child's parent was asked questions about their family members (number, age, etc.), family health problems, the family's residences for the preceding 15 years, and potential household exposures (including cigarette smoke; wood, kerosene, or oil-burning heaters; and materials used in hobbies and recreational activities). UMDNJ asked for a list of places the children regularly played and for a list of household members with known or suspected chemical exposures and the circumstances of any such exposure(s). UMDNJ also asked about other, non-site related risk factors (such as alcohol use and about family history of reproductive abnormalities) for the health outcomes under question. The remainder of the questionnaire focused on collecting information about the child's health signs and symptoms (e.g. heart problems, chest pain, abdominal pain, gastric disturbance, changes in bowel habits, kidney and bladder problems, skin problems, coughing, wheezing, asthma, bronchitis, allergies and upper respiratory infections, bruising, nosebleeds, anemia, lead poisoning, leukemia, immune problems and other cancers, mood disturbances, headaches, insomnia, behavior and learning problems, coordination problems, "blackouts", and seizures). UMDNJ conducted a complete physical examination and laboratory analyses including a complete blood count, urinalysis, erythrocyte protoporphyrin, lead level, and serum chemistries including liver function tests (SMA-12).

As previously mentioned, parents and family physicians were notified of any laboratory tests which indicated further evaluation was suggested. Staff of the Environmental Health Service (NJDOH) forwarded the records of children

with blood lead levels exceeding 10 ug/dl to the Maternal and Child Health Service (NJDOH) and the Middlesex County Lead Poisoning Control Project for appropriate follow-up.

Since no actual personal exposure information was available, children's exposure was estimated by using residential location and play area proximity to the landfill as a surrogate measure of exposure. A potential problem with this type of exposure classification is the possibility of misclassifying people's true exposure. This is called exposure bias. The effect of exposure misclassification would be to obscure any real association if there really was an impact on children's health from the landfill.

Statistical Analysis

UMDNJ chose to calculate percentages using the total of 175 children as the denominator. However, for some calculations there were data lacking for some participants resulting in a denominator as low as 168. In no case, however, would the use of the smaller denominator change the interpretations of the data or the conclusions from the screenings.

Two different statistical tests were conducted to evaluate the screening data: 1) a trend analysis of outcome and exposure level and 2) a comparison of each exposure level with the group designated least exposed.

The first method of analysis utilized unstratified trend tests to evaluate the relationship between outcome (illness, symptoms, etc.) and more than two levels of exposure (ranked by how close by a person lived or played to the landfill). In the second method of analysis, the lowest exposed group was separately compared to each of the higher exposed groups and tested for statistical significance using 95% confidence intervals. Stratified trend tests were also used to control for the effect of possible confounders on the relationships between the different levels of exposure and outcome. A chi-square test was used to evaluate relationships when there were only two levels of exposure and outcome. A significance level of $p=0.05$ (one-sided) was chosen.

The residential and play areas were ranked to investigate the relationship between distance from the landfill and complaints. Residential areas were coded so that 2 represented the closest and 0 the furthestmost from the landfill. Residential locations were ranked as follows:

RESIDENCE OF CHILD	RANK
Anchor Park Development	1
Central Park Development	1
Harbor Club Condos	0
Laurence Harbor	1
Le Mer Condos	1
London Terrace Apts	2
Madison Garden Apts	0
Nieuw Amsterdam Apts	2
Oakwood Village Development	2
Old Bridge Twp (other)	0
Parkwood Apts	2
Skytop Apts	2

Play areas were coded so that 4 represented the closest and 0 represented furthermost from the landfill. Play areas were ranked as follows:

PLAY AREA	RANK
Anchor Park Development	2
Central Park Development	2
Cheesequake Park	2
Harbor Club Condos	1
Laurence Harbor	2
Le Mer Condos	2
London Terrace Apts	3
Madison Garden Apts	1
Near Landfill/In Leachate/ On Global-Sommers Property	4
Nieuw Amsterdam Apts	3
Oakwood Village Development	3
Old Bridge Twp Other	1
On the Landfill	4
Outside Old Bridge-Sayreville but in New Jersey	0
Parkwood Apts	3
School Playground	1
Skytop Apts	3

In epidemiology and medicine, potential associations are measured by applying statistical methods to the data. The actual estimate or measurement of the association (such as average difference, relative risk or odds-ratio)

is useful to gauge the strength of an association (such as the association of an exposure with a disease). The significance level, or p-value, provides evidence for or against the hypothesis that chance could produce the observed measure of association. However, the assessment of the possible relationships between exposure and health outcome depends not only on the statistical tests but also on a critical evaluation of the study design, possible biases in the results (in order to look at the real underlying relationships, if possible), and any scientific knowledge about the nature of the relationship between the exposure and the disease. The synthesis of these considerations are generally more important than how extreme the value of the significance test might be. By convention, if the p-value is less than 0.05 it is statistically significant. If it is more than 0.05, then it is generally not considered statistically significant. NJDOH applied the chi-square analysis to evaluate the association of asthma and at least one family member smoking.

The 95% Confidence Interval (CI) was used to separately evaluate the difference between the lowest exposed group with each of the higher exposed groups. The CI is a range of values determined by the degree of potential random variability in the data, within which the level of association between exposure and health outcome is thought to lie, with a specified level of confidence (similar to the p-value). If the CI includes 1.0, then the degree of association or odds ratio is not considered to be significantly different for the two groups compared.

Results:

Physical Examinations

There were 175 children enrolled in the health screening program between August 1989 and February 1990. The ages of the children ranged from 12 months to 18 years. There were 90 boys and 85 girls. The racial and ethnic distribution reflected that of the community. Since the vast majority of the physical examination were completely within normal limits, the data analysis focused on seeking potential relationships between reported health problems and proximity of the child's residence and play areas to the landfill.

There were a variety of respiratory problems reported. Fifty-four of the children (30.9%) had problems with frequent coughing, wheezing or asthma, and the likelihood of such problems increased with proximity of residence ($p=0.018$; 95% CI included 1 for all exposure levels) to the landfill. The correlation of these to play area was of marginal significance ($p=0.062$; 95% CI included 1 for all exposure levels). In further analyzing this group of symptoms, 24 children (13.7%) had "hay fever", 29 (16.6%) had "respiratory allergies", 22 had been diagnosed with pneumonia (12.6%) and 18 (10.3%) had recurrent "bronchitis". There was no significant relationship of any of these problems to proximity to the landfill. Forty-one of the children were reported to have throat infections more than three times per year (23.4%) and 39 had ear infections more than three times per year (22.3%). Again, risk for these problems did not increase with proximity to the landfill ($p>0.10$; 95% CI included 1 for all exposure levels).

There were 23 children (13.1%) with asthma. A borderline relationship between asthma and the proximity of residence to the landfill was noted ($p=0.047$; 95% CI included 1 for all exposure levels). A relationship was also found between asthma and at least one family member smoking ($p=0.044$; 95% CI included 1 for all exposure levels). When the relationship between the landfill and residence was stratified by family smoking, however, the relationship was not statistically significant ($p=0.17$; 95% CI included 1 for all exposure levels). Noteworthy, 15 out of 69 (21.7%) of the children in the closest residences in which at least one family member smoked had asthma compared to six out of 50 (12.0%) of the children from residences further from the landfill. Risk for asthma from playing near the landfill was not significant ($p=0.15$; 95% CI included 1 for all exposure levels).

There were no significant heart problems identified. However, during the cardiac review, UMDNJ asked if the children ever had frequent pounding headaches. From the responses, thirty-seven (21.1%) were reported to have pounding headaches. There was a significant trend correlation between headaches and living or playing near the landfill ($p=0.025$ for proximity of residence and $p=0.015$ for proximity of play area). A second statistical test was used to compare the highest exposed to the least exposed group for both

residence and play area data. When residential distance was compared, there was no difference of frequent pounding headaches between those closest and furthest away (95% CI included 1). However, when children who reported playing near, in, or on the landfill or leachate were compared to those playing furthest away, frequent pounding headaches were significantly elevated ($p=0.011$; 95% CI = 1.27, infinity) in the closest play area group. (Note: There were only 16 children in the furthest play area group, none of which experienced frequent pending headaches, while 24 (26.7%) children in the closest play area group experienced this symptom).

With respect to gastrointestinal problems, no significant correlation was observed. Abdominal pain was reported in 27 children (15.4%), however, the presence of abdominal pain was no more likely for children living closer to the landfill ($p>0.1$; 95% CI included 1 for all exposure levels). Nausea, vomiting, diarrhea and constipation were not found to be significant problems.

There were 39 children (22.3%) who were reported to have rashes. Most of these were likely eczema or atopic dermatitis by description. There was no significant risk for such rashes, however, from living or play near the landfill.

Conjunctivitis was grouped with "upper respiratory infections" and had been recurrent in 52 children (29.7%). However, no association was found for children living or playing nearest the landfill ($p>0.2$; 95% CI includes 1 for all exposure levels).

There were no significant hematopoietic problems identified, such as easy bruising, nosebleeds, lead poisoning, or other blood diseases. There were a few children who had iron deficiency anemia as toddlers but no other significant anemias. There were no cases of leukemia, other cancers, or immune deficiency in any of the children screened or their siblings.

There were no significant problems with emotional or psychiatric disturbances. However, there were 21 children (12.0%) with sleeping problems. This was not related to distance from the landfills ($p=0.40$; 95% CI included 1 for all exposure levels). Twenty-nine children (16.6%) had been evaluated for

learning problems and about half of these were in special education (again not significant, $p > 0.14$; 95% CI included 1 for all exposure levels). There were no significant problems with balance, coordination or seizures.

Laboratory Evaluation

In analyzing the laboratory data, there were no significant cases of anemia identified. There were 8 children with mild anemia, all of which appeared related to mild iron deficiency. The blood counts were otherwise all completely within normal limits. There were 35 children with lead levels between 11 and 15 ug/dl, 3 children with levels between 16 and 20 ug/dl and one child with a level of 23 ug/dl (all venous samples). There was no significant correlation with exposure to the landfill in the children studied. There were no significant urinary abnormalities identified.

Although most of the serum chemistries were normal, there were some children with mildly elevated liver function tests. Thirty-eight children had aspartate aminotransferase (AST) levels above 40 (maximum = 75), 8 had alkaline phosphatase levels above 400 (maximum = 553), and two children had mild elevation of both. AST elevation was not correlated with landfill exposure, but alkaline phosphatase elevation and play area was suggestive ($p = 0.03$; 95% CI included 1 for all exposure levels). Two children had mild elevation of both values and were residents of one of the closest developments, the Parkwood Apartments. Neither of these children had any significant health problems except headaches.

It should be noted that alkaline phosphatase is made by the bone as well as the liver and is higher in adolescents (References: Merck Manual, Thirteenth Edition, 1977, p. 846; Pediatrics, Seventeenth Edition, 1982, Appleton-Century Crofts, p. 1005). Further, a greater proportion of the children with elevated alkaline phosphatase values were in children aged 10-18 (9.8% vs 3.8% less than ten). Although this was not statistically significant, the three residence groups had different proportions of older children over ten years of age. Group "0" had 14% older children vs. 39% and 42% for groups "1" and "2" respectively. When alkaline phosphatase was stratified by age category, however, the association with residence disappeared.

Discussion:

There are a variety of factors which make valid determination of any relationship between exposure and health effects difficult at best. These include a small number of people exposed, low levels of exposure, exposures to other health hazards in daily life (air pollution, smoking, drugs, alcohol, occupational hazards, etc.), short-term exposure because of frequent movement of residents, genetic predispositions for disease, and socioeconomic factors. In addition, many of the potential health problems are difficult to identify as related to exposure because they are rare (e.g. certain reproductive abnormalities), they take many years to develop (e.g. most cancers), or their occurrence in the general population is not well-known (e.g. bronchitis and headaches).

Additionally, there are two types of bias that may have affected the pediatric screening outcome. These are selection and recall bias and are discussed below.

All participants were self-referred. Because all children could not be accommodated, the final selections were made by a community committee. This selection process was consistent with the true mission of the project - "To provide the parents with some assurance that their children are receiving proper medical attention". Understandably, the committee chose to have the children examined who they believed had the greatest exposure. Unfortunately this creates a problem of selection bias when attempting to use this study as evidence of either adverse health effects or a lack of adverse health effects from exposure. In this case, selection bias could occur if the individuals who come to the clinic were different in important medical ways from the community they represent. For example, only one child over the age of 11 was classified in the lowest residence exposure group. If exposure or effect was in some way age dependent, then it would be very likely that false conclusions could be made.

Recall bias occurs because people who have a symptom will generally spend time thinking about what happened before they got ill and therefore recall exposures more clearly than people who are not ill. Recall bias is likely to have occurred when the questions in the pediatric evaluation were asked. The analysis of laboratory results would not be affected by recall bias.

THIS SCREENING WAS NOT DESIGNED TO MAKE DEFINITIVE STATEMENTS ABOUT EXPOSURE AS A CAUSE OF ILLNESS. This service was designed to assist the community in evaluating the health of their children and to detect problems in individual children. In this respect the service was very successful.

The health screening service revealed that there were some children with minor health problems which may be related to exposure to the landfills. Since this health screening was not designed to link exposure and outcomes, however, it is impossible to determine whether these problems are related to the landfills. The types of health effects seen in some of the children - headaches, respiratory problems (such as asthma), and mild elevation of liver enzymes - are ones which have been associated with low-dose exposure situations. Although most of the health effects noted were not statistically significant, this does not mean that these data provide proof that the effects were not related to exposure. The results simply reflect that the screenings were not designed to document relationships.

It is not surprising that the screenings failed to identify a relationship. As a screening activity to assess the current health status of children, there was no comparison group. The majority of the children lived close to the landfill with only 21 children living in the group designated furthest from the landfill. Because of the low number of screened children living the furthest, only very large effects would be detectable using statistical tests.

In view of this there may be health effects related to exposure that were not detected. There may be inhalation exposures since a number of families commented on the frequent fumes and foul odors they detected from the landfill. There may also be some contribution of direct contact with the

landfill, especially in the case of frequent throbbing headaches. Water ingestion would not be a possible route of exposure, unless any of the children actually drank the leachate or water from any of the local streams.

Headaches and other central nervous system manifestations of toxic exposure have primarily been reported related to exposure to organic chemicals (such as alcohols, aromatic hydrocarbons, solvents and insecticides) and heavy metals (such as lead, mercury and arsenic). In addition, headaches may be manifestations of stress related to living near a hazardous waste site. One reason UMDNJ screened lead levels was to look for indications of significant heavy metal exposure. The blood lead levels observed were not high enough to account for the headaches. However, there has been concern lately among experts that these lead burdens may have significant adverse effects: for example, decrement of learning capabilities. Therefore, it would be more likely that if the landfill is contributing to headaches in nearby residents, they are related to stress or organic chemical exposure (e.g. fumes or direct contact in the case of children playing). Although asthma was not found to be statistically related to the landfill after stratification by family smoking, the possibility of an additive or synergistic effect upon asthma between smoking and toxins exists. Respiratory problems have been reported to be related to a number of different toxins. These include organic chemicals (such as anhydrides, formaldehydes, methane and ethane), inorganic chemicals (such as ammonia, hydrogen sulfide, sulfur oxides, and halogenated compounds), metals (e.g. cobalt and cadmium), and minerals (e.g. asbestos and silica). Many of these compounds are also included in the routine, ongoing analysis of the landfills and their leachates. The design of the study does not preclude the possibility that respiratory symptoms could be the result of inhalation exposure to organic or inorganic chemicals, either alone or in combination.

Mild liver abnormalities were detected in some of the children. These mild elevations are not necessarily of medical concern. Alkaline phosphatase as stated earlier is made by the bone as well as the liver and is associated with growth spurts. Mild elevations of AST are known to occur in otherwise normal children and often resolve spontaneously. They can be the result of

transient viral illness as well as treatment with antibiotics such as penicillin. Mild liver abnormalities have also been associated with exposure to organic chemicals (such as halogenated compounds, insecticides, and carbon tetrachloride), inorganic chemicals like phosphorus compounds, and metals like arsenic. Because this screening was not designed as a study, it is impossible to conclusively determine the association of these chemicals and metals to the landfills.

Studies of hazardous waste sites to date have been plagued by a number of technical and human problems in trying to establish cause and effect relationships. These problems include:

- The study populations tend to be small (as ours is), therefore, the ability to detect associations, if existing, is limited.
- The people in the studies tend to have a variety of demographic and exposure factors which may also be contributing to their health problems. (For example, the people may have limited access to health care, and may not be able to pay for health care services).
- Exposures to toxins in the general population, especially in urban areas, are difficult to define and this study attempts to evaluate children living in a very industrialized urban area, where numerous sources of pollution may be present.
- There are very limited data regarding the prevalence of common health problems (such as headaches and coughing) in the general population, let alone in children, to use as a basis of comparison for this screening.
- Some health effects possibly related to toxic exposures are rare or have a long latency period, so it is possible that there may be some health effects that have not yet manifested.

- Publicity and speculation often introduce or accentuate reporting biases regarding adverse health effects making waste site studies especially difficult.
- Surrogate measures for exposure, such as distance from the contamination source used in this report, may not adequately reflect true exposure.

In conclusion, this health screening service seems to identify several minor health effects in children living and playing near the Global Landfill in Old Bridge, NJ and has provided valuable information concerning individual children. However, the screening has very recognized limitations in terms of linking exposure to symptoms (i.e. cause and effect) and should be interpreted with considerable caution. The health effects identified are similar to those found in other studies evaluating health effects from hazardous waste sites and may be related to low level exposure. The NJDOH fully supports UMDNJ's conclusion that any proposed cause and effect relationship must be considered speculative. Nonetheless, it would likely be in the best interest of area residents to minimize or eliminate toxic exposure from this landfill as much as possible and in a timely fashion.

3.3 Community Demographic Profile

Introduction

Residents of the community adjacent to Global Landfill and the Sommers Brothers Property have raised many concerns to state and local agencies about odors and potential hazards connected with these sites. Residents from Old Bridge and Sayreville blamed many of their health complaints on living near the dump. A community activist group, Citizen's Helping Environmental Cleanup (C.H.E.C.), surveyed nearby residents and noted many health problems in the vicinity of the sites. Additional concerns were voiced about the possibility that two apartment complexes, Nieuw Amsterdam and London Terrace, may have been built on top of a former landfill area.

In 1988 State legislation (P.L. 1987 c. 368) directed the Department of Health (NJDOH) to be the lead agency in addressing health concerns of the people living near the Global Landfill and the Sommers Brothers sites. A Task Group was formed to implement the legislation. The Task Group was chaired by NJDOH with the cooperation of the New Jersey Department of Environmental Protection (NJDEP), local officials, and community representatives. The Task Group was responsible for determining the types of activities and programs which could be carried out under the legislation. The first Report of the Task Group outlined several key elements to address community concerns, including the Demographic Profile.

The purpose of the Community Demographic Profile was to obtain information on the demographic characteristics and health complaints of the population residing in the vicinity of the sites in question. The first objective of this activity was to characterize the population, especially the age distribution, of the community living near the sites. Second, the Profile was designed to document in detail a representative sample of the residents' health concerns. The last objective was to collect information that could be used to develop specific educational and outreach efforts for targeted population subgroups.

Methods:

Survey Population and Area

The neighborhoods and apartment complexes to be included in the survey area were chosen by the Task Group in 1988 based on their close proximity to the Global Landfill and Sommers Brothers sites. The selected areas were:

Skytop Garden Apartments
Parkwood Apartments
Nieuw Amsterdam
Oakwood Village
Le Meir
Harbor Club
Central Park
Anchor Park
London Terrace

Because the survey area contained thousands of households, it would be prohibitively expensive and time consuming to conduct interviews in all of them. Therefore, instead of interviewing all households in the survey area, a stratified random sample was selected. Following discussions with the Task Group, it was decided that a ten percent stratified random sample would be sufficient.

The stratified random sample method was used to get a proportional random sample of each housing complex in the survey area. Household eligibility for the survey was weighted by neighborhood size, so that larger complexes would have more households selected than smaller complexes.

The purpose of this sampling strategy was two-fold. First, it was meant to reduce the overall number of interviews needed to characterize the population in the survey area. Second, a random selection of households would yield a representative sample of the total population and their health concerns, thereby avoiding potential biases due to self-selection among complainants.

In order to identify the sample, addresses in the survey area had to be physically mapped and detailed to determine the number of households in each apartment complex. The mapping step revealed that approximately 4,000 households were in the survey area. A ten percent stratified random sample was selected by assigning each household an identification number and randomly selecting numbers from a statistical random number table.

Residential Distance Categories

In environmental health evaluations, it is desirable to have information on individual exposures so that exposure categorizations can be used in the analysis. Usually, little or no such individual information is available (as is the case here) so surrogate measures of exposure were based on geographical distance and used to indicate potential for exposure.

In this case, the distance of each housing complex from the site was coded as 0, 1, or 2. Zero (0) was assigned to complexes furthest from the site and considered "least exposed". Two (2) was assigned to complexes closest and considered "most exposed". In the analysis, the nine residences have been coded into the proximity variable as close, intermediate, or far exposure.

<u>Far (0)</u>	<u>Intermediate (1)</u>	<u>Close (2)</u>
Harbor Club	Central Park	Skytop Apartments
	Anchor Park	Parkwood Apartments
	Le Meir	Nieuw Amsterdam
	Oakwood Village	
	London Terrace	

Questionnaire Design

The questionnaire used in the Demographic Profile was designed by NJDOH, and included input from the Task Group, to collect basic demographic and health complaint information.

The basic demographic information requested included the number of persons in the household and the name, sex, date of birth, years of school completed, occupation, and length of residence in household for each occupant.

Smoking history and children's bicycle riding and playing on or near the landfill were also surveyed. In addition to the demographic information, several health-related sections were included to evaluate individuals' general health and specific health concerns.

An earlier C.H.E.C. survey of the area identified many health concerns of nearby residents. The health complaints raised by the community included a wide array of health problems. NJDOH reviewed the list with the Task Group to determine how best to construct questions aimed at documenting local health concerns. The Task Group believed that asking each respondent to indicate his specific health concerns using a listing of all possible health problems was impractical. It was felt that some respondents could overlook a clinical disease name while waiting for a more specific symptom name to describe their problem. The health-related questions were, therefore, designed to be open-ended. (A sample questionnaire is available at Old Bridge Township Public Library or from NJDOH).

Interviews

Prior to conducting interviews, attempts were made to notify all survey area residents of the purpose, duration, and time frames for conducting the survey in order to maximize household participation. The means of survey notification were:

- local and regional newspapers (specifically The Home-News, The News Tribune, The Star Ledger, and The Suburban);
- a Fall 1988 letter delivered by a local volunteer or NJDOH staffer to each of the 4,000 households in the survey area explaining the survey and interview process (See Appendix #9); and
- a similar follow up letter in March 1989 distributed to the approximately 400 homes which were the final sample selected.

New Jersey Department of Health (NJDOH) staff contacted three colleges and university centers closest to the community to recruit interviewers.

These institutions were the University of Medicine and Dentistry of New Jersey, Middlesex College, and Monmouth College. Four college students were selected and trained by NJDOH staff to conduct interviews. A list of instructions emphasized during interview training sessions comprised an "interview protocol".

Interviewers were instructed to keep logs of their attempts to contact the preselected random sample of households. The log was used to record the time of day and day of the week of attempted contacts. One adult was interviewed for each household selected. A total of three visits were attempted at each household. Nonresponse rates were calculated by including those not at home on repeated visits as well as those declining to respond.

As the interviewers proceeded, it became clear that several potential respondents were involved in litigation against the landfill owners and were hesitant to participate in the study. Initially, some of these people refused to participate. Because of the potential impact this had on reducing the sample size, attorneys for C.H.E.C. were contacted about this problem. C.H.E.C. attorneys encouraged their clients to participate in the survey.

Coding of Self-Assessed Symptoms

The participants were asked to elaborate their health concerns. Their answers about the nature of any health problems reported were converted to International Classification of Disease Codes (ICD9). Data were recorded according to first, second, and third disease reported. The ICD codes were then categorized into ten groups according to a scheme which was intended for discrete categories and conformed to the ICD9 system as much as possible. It was also an objective to categorize documented health concerns in a manner appropriate for evaluating environmental exposures.

Coding of Occupations

Reported jobs were coded using the Standard Occupational Codes found in the Numerical List of Titles of Occupational Groups. Separate codes were also used for Unemployed, Self-employed, Preschool Child (less than six

years of age), Student, Retired, Disabled, Housewife, Unknown, and Refusal to respond.

As a second approach Standard Occupational Codes were grouped into more familiar aggregates: Blue Collar and White Collar. This classification was useful to describe the survey group in both economic and social terms and to evaluate the possible workplace influence on health complaints as an alternative explanation to landfill exposure.

Blue Collar jobs were classified as jobs requiring manual work. White Collar jobs included non-manual occupations ranging from clerical, technical, managerial, and professional.

Statistical Analysis

Questionnaire responses were coded by NJDOH staff onto coding sheets which were then entered into dBase III, a database package. Once the database was entered and edited, data were displayed for review and transformation into categories as frequencies and tables in SPSS, a statistical computer package. Analysis was exploratory and descriptive.

Results:

Response Rates

The survey interviewers attempted to contact the 394 households identified in the stratified random sample. Questionnaires were completed for 194 households, giving a household response rate of 49.2%. Among the nonresponding households, 59 (15.0%) were refusals, 16 (4.1%) were vacant addresses, 107 (27.2%) were not at home on three or more contacts, and 19 (4.8%) were nonresidential addresses, offices, etc.

Population Characteristics

The 194 responding households included 492 individuals. The age distribution of these individuals is shown in Table 4.

Table 4. Age Distribution of Occupants in Responding Households

<u>Age Group</u>	<u>Number</u>	<u>Percent</u>
Birth to 4 years	39	7.9
5 to 9	24	4.9
10 to 14	24	4.9
15 to 19	35	7.1
20 to 29	119	24.2
30 to 39	89	18.1
40 to 49	64	13.0
50 +	78	15.8
Unknown	<u>20</u>	<u>4.1</u>
Total	492	100.0%

Forty-eight percent of the sample was male, which is similar to the 1980 U.S. Census summary of the populations of Old Bridge (49.2% males) and Sayreville (49.1% males). Over 68% of the survey area population was under 40 years of age.

Population According to Neighborhood of Residence

The 4,000 housing units in the survey area were distributed in nine neighborhoods or housing complexes. The number of households and residents from each of the nine complexes in the random sample chosen are given in Tables 5 and 6 respectively.

Table 5. Number of Households Responding from Survey Area

<u>Complex</u>	<u>Number of</u>	
	<u>Households</u>	<u>Percent</u>
Harbor Club	14	7.2
Central Park	31	16.0
Anchor Park	4	2.1
Le Meir	9	4.6
Skytop Apartments	44	22.7
Parkwood Apartments	19	9.8
Nieuw Amsterdam	21	10.8
Oakwood Village	7	3.6
London Terrace	<u>45</u>	<u>23.2</u>
Total	194	100.0%

Table 6. Number of Individuals in Households from Survey Area

<u>Complex</u>	Number of	
	<u>Individuals</u>	<u>Percent</u>
Harbor Club	28	5.7
Central Park	104	21.1
Anchor Park	7	1.4
Le Meir	31	6.3
Skytop Apartments	94	19.1
Parkwood Apartments	46	9.3
Nieuw Amsterdam	47	9.6
Oakwood Village	29	5.9
London Terrace	<u>106</u>	<u>21.6</u>
Total	492	100.0%

Residential Distance Categories of Housing Complexes

Distance categories were based on proximity to the sites and classified as close, intermediate, or far. The residential population size in each category are shown in Table 7.

Table 7. Housing Complexes According to Distance Category

<u>Distance</u>	<u>Residence</u>	Number of	
		<u>Residents</u>	<u>Percent</u>
Far (0):	Harbor Club	28	7
Intermediate (1):	Central Park	104	21.1
	Anchor Park	7	1.4
	Le Meir	<u>31</u>	<u>6.3</u>
	Subtotal	142	28.9
Close (2):	Skytop Apts.	94	19.1
	Parkwood Apts.	46	9.3
	Nieuw Amsterdam	47	9.6
	Oakwood Village	29	5.9
	London Terrace	<u>106</u>	<u>21.6</u>
	Subtotal	322	65.4
Total		492	100.0%

Education

The participants were asked to specify the highest year of school completed. This information was collected for use as a proxy for life-style and socioeconomic factors, generally considered confounders of environmental outcomes. The reported educational levels are shown in Table 8.

Table 8. Educational Levels Attained by Study Participants

<u>Highest Level Attended</u>	<u>Number</u>	<u>Percent</u>
Preschool	39	7.9
Grammar School (Grades year 1 to 8)	51	10.3
High School (Grades year 9 to 12)	207	42.1
College (13 to 16 years)	150	30.5
Postgraduate (17 or more years)	30	6.1
Unknown	<u>15</u>	<u>3.0</u>
Total	492	100.0%

Potential Risk Factors

Data were collected on occupation and smoking since they are potential risk factors for health effects (such as respiratory illness) similar to those potentially related to landfill exposures.

Information on "usual occupation" was collected for all survey residents. "Usual occupation" was defined as a job at which the resident was employed for more than 19 hours per week. The occupational categories are shown in Table 9.

Table 9. Usual Occupation

<u>Category</u>	<u>Number</u>	<u>Percent</u>
White Collar	203	41.3
Blue Collar	79	16.4
Military and miscellaneous	4	0.8
Students	80	16.3
Housewives	22	4.5
Retired	31	6.3
Preschool	39	7.9
Unknown	30	6.1
Declined to report occupation	<u>4</u>	<u>0.8</u>
Total	492	100.0%

The smoking information obtained during the interview included the number of household members that ever-smoked and the type of tobacco used. The cigarette smoking results are shown in Table 10.

Table 10. Smoking History of Study Participants

<u>Smoking Status</u>	<u>Number</u>	<u>Percent</u>
Ever smoked	175	35.6
Never smoked	312	63.4
No Response	<u>5</u>	<u>1.0</u>
Total	492	100.0%

Only two subjects reported ever-smoking cigars. Three subjects reported ever-smoking pipes. When the cigarette smoking data were age restricted to exclude the 122 people less than 20 years old, the ever-smoked figure was 45.9%.

Health Concerns and Self-Assessed Health Symptoms

An adult in each household was asked whether occupants had current concerns about their children. Of the 78 households with children, 30 (38.5%) expressed concern over their children's health. Respondents were also asked about health concerns of adults in the household. Of the 194 households, 53 (27.3%) expressed concern over the health of at least one adult in the household.

Self-Assessed Symptoms

The respondents were asked to elaborate household health concerns. Their answers about the nature of any health problems reported were converted to International Classification of Disease Codes (ICD9). A maximum of three health concerns were recorded per resident. The ICD9 codes were categorized into ten discrete groups, in conformance with the ICD9 system as much as possible, and that would be appropriate for environmental exposure evaluation. Table 11 presents the total reported health complaints by ICD9 grouping.

Table 11. Categories of ICD9 Codes

<u>ICD9</u>	<u>Health Concern</u>	<u>Number of Reports</u>
0.1 79.9	Infections and Parasites	4
169.0 to 214.9	Neoplasms	3
395.0 to 459.9	Heart Disease/Circulatory System	14
460.0 to 494.9	Respiratory System	47
531.0 to 576.9	Digestive System	4
634.0	Spontaneous Abortions	1
691.0 to 696.9	Skin and Subcutaneous Tissue	5
746.0	Congenital Anomalies of the Heart	1
780.0 to 799.9	Headache, Dyspnea, Cough, and Ill-defined Conditions	25

When the health effects, grouped by ICD9 codes, were analyzed and compared according to residential location, those living furthest had the smallest proportion of complaints (3.6%; 1 of 28 residents). In the intermediate and closest residential areas the proportion of total health complaints were 17.6% (25 of 142 residents) and 27.6% (89 of 322 residents) respectively.

The most common health problem reported was respiratory system complaints: 9.3% (30) for those closest, 11.3% (16) for the intermediate distance group, and 3.6% (1) for those furthest from the sites.

Children's Activities on or near the Landfill

Respondents in households with an occupant 18 years of age or younger were asked about children's activities on or near the landfill, including playing and riding on bicycles, dirt bikes, all terrain vehicles (ATVs), or skateboards. A total of 19 children were identified as having activities on or near the landfill. Bicycle riding and playing were the primary activities reported with 14 and 16 children respectively. Eighteen of the 19 children lived in households closest to the landfill. Three of the 19 children (15.8%) were reported to have health complaints including dermatitis and respiratory symptoms.

Discussion:

The Community Demographic Profile was conducted for two main reasons: 1) to obtain information on the demographic characteristics of the population residing in the vicinity of the two sites and 2) to document a representative sample of health concerns in the community. The Task Group believed that the demographic information was essential in order to design the appropriate Pediatric Health Care Service, an educational and outreach program, and if necessary, a community health study. Additionally, self-reported health problems were also requested in order to evaluate health concerns of those living in close proximity to the two sites.

The demographic information collected included questions on age, education, occupation, and smoking. The basic use of these data was to characterize the survey population. Regrettably, information on race was inadvertently omitted from the questionnaire. Although this problem was recognized in the early stages of the survey and steps were taken to correct it, many of the households were not asked to respond to "race". Because of this oversight and the limited reliable data, race information has not been presented in this report.

When the survey population age structure is compared to the 1980 census data for Old Bridge and Sayreville, it can be seen that the survey population has an age structure similar to that of these towns. The survey area does have a slightly higher proportion of young adults than the two towns combined, perhaps because the survey area is comprised of high density apartment complexes.

The information collected during the Demographic Profile has already been useful in targeting school aged children with appropriate messages of the hazards of playing on the sites. This has been detailed further in the education and outreach section of this report.

The proportion of college educated people in the study is more easily evaluated by restricting the age of analysis to those aged 20 and older. When this was done, the proportion of people with at least thirteen years of education was 46.7%. The education level appears to be similar to other populations examined by other researchers (New York State, Public Concern about chemicals in the Environment: Regional Differences Based on Threat Potential, Public Health Reports, March-April 1990; 58.8% for Long Island, 54.3% for Central and Eastern New York, and 46.5% for Western New York). Western New York is the most comparable to the demographic survey area since it is the least urbanized of the New York State regions and has the lowest percentage of home ownership of the three.

When age was restricted to 20 and older to assess smoking, ever-smokers comprised 45.9% of the survey population (never-smokers - 53.0%). The study area ever-smoking status was lower than National Center for Health Statistics (National Center for Health Statistics, USDHEW, Use Habits Among Adults of Cigarettes, Coffee, Aspirin, and Sleeping Pills, U.S. 1976, Vital and Health Statistics Series 10 - Number 131, October, 1979), which found that 52.5% of the respondents more than 20 years old were ever-smokers, while only 39.5% reported never-smoking. This difference could reflect under-reporting due to second party interviewing in the demographic survey group or an actual lower level of smoking than the national average.

In an earlier health poll by C.H.E.C. of its members, illness rates were perceived to be very high. Since C.H.E.C. members may have been more concerned and, therefore, a self-selected population, the Demographic Profile was intended to document health concerns of residents in a more objective way.

The results for household health concerns of children and adults indicate a substantial proportion of participating households with concerns (38.5% for children and 27.3% for adults). When the respondents' health concerns were grouped by ICD9 categories, there was an increasing trend in all complaints with proximity to the landfill. The most frequently reported health concerns were respiratory system complaints. Although respiratory effects might be expected as a result of landfill emissions, there was no trend based on residential distance. However, it is important to note that there were only 28 residents in the area furthest from the landfill, weakening the reliability of the residential trend comparison.

In general, it has been difficult to relate the self-reported conditions to occurrence of disease in the general population. However, it is safe to say that, as with other studies of environmental contamination, perceived health concerns appear to be higher in populations living closer to the

contamination (Howe, H., Public Concerns about Chemicals in the Environment: Regional Difference based on Threat Potential, Public Health Reports, March 1990). The current Demographic Profile has also found large numbers of perceived health concerns, but cannot relate these complaints to a specific cause.

One major difficulty with assessing the collected information was the relatively low response rate (49.2%) in this survey. Residents in the nonresponding households may be very different from the responders in terms of their demographic characteristics and health concerns. Therefore, the lack of information on this large nonresponder group makes definitive statements about the entire adjacent population's health concerns difficult. Although the results of the survey have limited utility, they should provide a framework for designing educational and outreach activities.

3.4 Community Outreach and Education Activities

Introduction

Since the early meetings of the Task Group, the members agreed that implementation of a community outreach and education program was important to the resolution of residents' concerns. The primary purposes of the program were described in the 1988 Task Group Report as follows:

To allow individuals to make decisions about actions which may be taken by them or their families; and,

To stimulate community participation in the decision-making process related to the clean-up of the sites.

Consistent with the plans of the 1988 Report, most outreach and education efforts have been interactive ones. A close working relationship was established among community representatives, local officials, the New Jersey Department of Health (NJDOH) and the New Jersey Department of Environmental Protection (NJDEP) through Task Group meetings. From the period of January 1988 through September 1991, a total of 30 meetings of the Task Group occurred.

Implementation

Discussions held during development of the Task Group's first Report (1988) set the tone and structure of future Task Group actions. Meetings were informal and members openly exchanged information and expressed viewpoints. Working towards common objectives determined by consensus enabled members of the Task Group to build trust and to develop organizational roles and responsibilities. In the Autumn of 1988, the release of the Task Group's first Report served to document the process of decision-making as much as it documented the actual decisions.

The Task Group made consistent progress because participant organizations met their commitments within agreed timeframes. In order to provide new members with current information, several Task Group members created an Orientation Package. The collection of materials (which included several news articles, selected meeting summaries, and a Task Group contact list) improved the productivity of Task Group meetings by minimizing discussion of historical and previously resolved issues.

Objectives of Outreach and Education Efforts

The first outreach and education objectives were to provide general information regarding Task Group efforts to the community-at-large and were initiated with the input of news media representatives. Local and regional newspapers maintained a continuous interest in the Task Group's progress. The Task Group perceived this interest as an opportunity to reach a large audience when appropriate and provide new information to the general public. The presence of newspaper reporters at Task Group meetings was important in both providing information about the progress of Task Group activities and in establishing a feedback mechanism for Task Group members concerning how their efforts were perceived. Reporters assigned to cover Task Group activities were referred to members for verification or expert information. This established credibility for individual members as well as the Task Group as a unit. Through this cooperation, reporters obtained an education about community environmental concerns and Task Group activities.

Targeted outreach efforts occurred through contact of households in specific residential areas. Following newspaper articles about Community Demographic Survey efforts, a letter was sent to each of the 4,000 households in the vicinity of Global and Sommers sites which notified residents the survey was beginning. (A sample letter is located in Appendix #9.) Another example of a targeted outreach effort was the information provided to parents about upcoming comprehensive medical examinations -- first through newspaper articles and subsequently a letter was distributed to children at schools within the area. A more detailed description has been provided earlier in this report in Section 3.2, Pediatric Health Examinations.

Formation Of An Education Subcommittee

Residents of the nearby community had expressed concern about unrestricted access to the Global and Sommers sites and the use of those properties as recreational areas. While interviewing some local residents for a November 1989 news article, a Home News reporter discovered that several residents of the London Terrace apartments did not realize that a landfill containing hazardous waste was close to their homes. The Task Group was uncertain if this lack of awareness involved a few residents new to the area or a large portion of the community. The Task Group discussed the need to protect individuals from exposure to potential hazards (such as hazardous leachate and steep grades) by restricting access to the site. In response to the Task Group's concerns, action was taken by the administrator for landfill closure, Richard Sullivan, to post warning signs around Global Landfill.

The NJDEP remediation plans include fencing the perimeter of Global Landfill, blocking access roads, and posting additional signs. (Refer to Site Status, Section 2.1 of this report, for detail.) However, the Task Group has recognized that these measures alone would not effectively limit access if residents were unaware of the landfill. They agreed that residents, especially children, should be educated regarding the reasons for restricting access to the sites.

As a result of these concerns, in the Spring of 1990 members of the Task Group with an interest and expertise in education formed a subcommittee to plan outreach and education efforts. Most Education Subcommittee members were community representatives who could best facilitate the locally-based education efforts.

Education Activities

At the first meeting of the Task Group's Education Subcommittee in September 1990, Charles ("Chuck") McCarty was selected as the group's chairperson. Assistant Superintendents for the Old Bridge Township School District were contacted to discuss environmental education. The Old Bridge School District had been identified as having an innovative program in

environmental education. Old Bridge middle and high school students could join extra-curricula Environmental Clubs which provided various opportunities for involvement. The Education Subcommittee determined that stimulating the interest of students in the district's Environmental Clubs might be the beginning of a student-conducted education effort. The expansion of this effort to Sayreville Schools was discussed and interest was expressed by officials of both school districts.

In September 1990, the Education Subcommittee Chairperson met with the two Assistant Superintendents and various school personnel. Resources presented included:

- An activity guide: "Here Today, Here Tomorrow-Revisited", Division of Solid Waste Management/NJDEP;
- Teacher enrichment and in-service training for teachers of grades K-12: "Class Project", "Project Learning Tree", "Project Wild", and "Aquatic Project Wild", Office of Communication and Public Education/NJDEP;
- Public health oriented curricula: "The Environment and the Community" and others, Environmental & Occupational Health Sciences Institute (EOHSI) and the New Jersey Department of Health.

The presentations included curricula and programs specifically related to hazards associated with landfills as well as general environmental education issues.

Old Bridge School District officials were invited to share current environmental curricula or activities with the Task Group. In October 1990, the Old Bridge School District Assistant Superintendent for Elementary Education reviewed the programs then being presented in the district's primary schools. She also distributed copies of proposed additions to the science curriculum for grades K-5. These additions are designed to heighten the students' awareness of solid waste disposal and related concerns.

The Assistant Superintendent for Secondary Education reviewed the district's plan to include awareness of solid waste disposal and hazards associated with landfills into the present curricula. He discussed the various high schools' and middle schools' environmental programs. He also described Old Bridge's extra-curricula environmental clubs. At the middle schools, an advisor to each club facilitates group activities. At the high school level, students take a more active leadership role, dividing themselves into project groups to tackle specific environmental issues. The high school environmental clubs have a monthly organizational meeting and students work in project groups after school as activities warrant.

Meetings of the Task Group and Old Bridge School District officials resulted in several approaches to heighten student awareness of waste disposal issues and Task Group objectives. One such initiative was a workshop for fifty high school science and social studies teachers in November 1990. A presentation made by the Task Group's Education Subcommittee Chairperson included:

- A slide show developed by NJDEP which explains hazardous waste sources, disposal, ranking of hazardous waste sites, prevention programs, and the public's role in proper management of hazardous and household wastes.
- A discussion of the problems of people going onto Global Landfill and Sommers Brothers properties;
- A discussion of hazardous waste reduction, recycling and various other environmental issues.

Copies of materials emphasizing hazardous waste problems and relevance to individuals were provided to all in attendance.

Another initiative to heighten student awareness was the decision by the Task Group and Old Bridge School District officials to invite one student per high school (grades 9-12) and one student per middle school (grades 6-8) active in the Environmental Clubs to become representatives on the Task Group.

Names of interested students representing each environmental clubs were provided by the school district. The Task Group sent a letter to each student inviting them to attend future meetings. Schedules permitting, the students attended Task Group meetings during Autumn 1991 and Winter 1992.

The participation of students on the Task Group provides a valuable opportunity for both groups to cooperate on issues of mutual concern with greater positive results. The Task Group asked the four students to consider methods to increase community awareness about Global Landfill and Sommers Brothers property sites within the broader environmental context of hazardous waste sites and disposal issues. They were were also asked to contribute ideas to the development of the Second Report of the Task Group, particularly with respect to recommendations.

Early in January of 1992, the Education Subcommittee of the Task Group, (which included the Old Bridge officials and students), discussed numerous ideas regarding the design and implementation of educational activities. The group agreed there was a need to identify strategies designed to increase community awareness about the hazardous characteristics of Global Landfill and Sommers Brothers property, as well as, to provide specific information about health and remediation actions ongoing at those sites. Providing information to assist individuals in making informed decisions about potential health risks in the environment was also given a high priority by the group. Issues generally associated with hazardous waste disposal would be integrated into discussions. (For example, difficulties of landfilling, recycling, etc.)

To visually illustrate the location and potential hazards of Global Landfill and the Sommers Brothers site, the Old Bridge officials and students outlined production of a video program. A videotaped presentation has the potential to reach larger numbers of people through broadcast on the local, public-access television channel.

Old Bridge School District, Township, Board of Education and Environmental Club representatives will lead efforts to design and implement the outreach and education activities developed for student and local populations. Task Group Education Subcommittee members are willing to assist

in planning this effort or cooperating in problem-solving activities, as the need is identified through the Task Group. The student members felt it was important to involve and educate the environmental club members initially. The student members were enthusiastic about student-conducted educational activities to the elementary grades.

Utilizing student-conducted educational methods may be particularly well suited to this situation and has a high potential for effectively changing knowledge, attitudes, and behaviors. Messages regarding physical and toxic hazards at Global Landfill and Sommers may have high relevancy to Old Bridge and local area students of middle school and high school-age, which also describes a large share of the target population (high potential for "risk") which should be reached with educational interventions. The utilization of a student-facilitator is also associated with positive educational outcomes. These are a result of the strong influence of peer group communications, success in stimulating group participation, and, high potential for the development of problem-solving skills needed in helping students to critically analyze environmental messages.

The Task Group considers community outreach and education efforts to be integral to the success of efforts to alleviate or prevent community health concerns related to the Global Landfill and the Sommers Brothers site. The educational activities and peer education approach described earlier have promise, and the Task Group endorses further development of these plans, including consideration of conducting similar student-conducted educational presentations to students in the Sayreville School District.

Summary

Task Group members expressed a responsibility toward sharing their experience with other groups with similar concerns and goals. The Task Group hopes this report will document that progress can be achieved, as well as the limitations that may be encountered when public agencies and citizens join together to solve environmental problems. The Task Group hopes that this report will provide guidance to current and future groups comprised of citizens and public agencies.

4.0 ADDITIONAL ACTIVITIES TO ADDRESS COMMUNITY CONCERNS

4.1 Community Cancer Investigation

Introduction

Global Landfill is located in close proximity to a densely populated suburban area of Old Bridge and Sayreville. Global Landfill operated from the late 1960s to 1984. Numerous health concerns were noted by residents and attributed to possible exposures from Global Landfill and the Sommers Brothers property. A community activist group, Citizen's Helping Environmental Cleanup (C.H.E.C.), conducted a survey of the residential areas in the immediate vicinity of Global Landfill and the Sommers Brothers Property. Cancer was one of the health concerns reported in this survey.

The 1988 Report of the Task Group indicated that "the Department of Health will evaluate the incidence of cancer in Old Bridge". In New Jersey, all newly diagnosed cases of cancer are reportable to the New Jersey Department of Health. Cancer evaluation thus provides one objective indicator of community health status.

Methods:

Study Area And Population

The study area for the Global Cancer Investigation was developed to include a large enough population to provide meaningful statistics and restrictive enough to include only those persons living relatively close to the landfill. In order to accomplish this, seven census tracts surrounding Global Landfill were grouped together and defined as the study area. The Old Bridge Health Department assisted in designating the tracts suitable for inclusion. Census tracts are geographic areas defined by the U.S. Census Bureau for the purpose of compiling demographic information. The census tracts selected include 73.03, 73.04, 74.02, 79.01, 79.04, 79.05, and 80.00 (see Figures E and F for locations).

The study population consists of all identified residents living in the seven census tracts. For the purpose of calculating statistics for this investigation, the 1980 U.S. Census Bureau population figures were selected for the census tracts. The 1980 census figures were compiled within the study time period and provide the most representative estimate of the size and age structure of the studied population.

Cancer Case Ascertainment And Study Period

The New Jersey Cancer Registry was used for the ascertainment of cancer cases. The Cancer Registry, operated by the New Jersey Department of Health, is a population-based cancer incidence registry covering the entire state of New Jersey. By law, all newly diagnosed cancers are reportable to the Registry. In addition, the Registry has reporting agreements with neighboring states, New York, Pennsylvania, and Delaware, where information on New Jersey residents that are diagnosed in those states will be supplied to the New Jersey Cancer Registry. The Registry has been in operation since October 1, 1978.

The study period for this investigation was January 1, 1979, through December 31, 1987, nine full years of observation. A "case" was defined as an individual residing in one of the seven census tracts and was diagnosed with a new primary malignant cancer during the study period.

The information for each newly diagnosed case available from the Cancer Registry is limited. The basic source is documented information from the patient's medical record. The collected information includes demographic data on each patient and medical data on each cancer. Variables used to analyze the incidence of cancer in the study area include: name, address at time of diagnosis, state municipality code, census tract code, primary cancer site, histology type, date of diagnosis, age at diagnosis, date of birth, race, sex, and NJDOH Registry identification number.

Information on other risk factors such as occupational exposures or personal life style habits are not available in the abstracted medical information used in this study. The potential risk factors that cannot be accounted for in the study design may vary significantly within the study area or relative to the State as a whole.

To ensure that all possible cases for the study area were located, Registry data were requested for cases with any of four zipcodes covering the study area or an Old Bridge municipal code.

Cases with known census tract codes were easily evaluated for study area inclusion. However, cases without census tract codes required identification on street maps. Those cases that could not be located on area street maps were sent to the Old Bridge Health Department for their assistance in delineating study area and census tract status. The remaining cases that were not-locatable were coded as cases of unknown location.

Data Analysis

Cancer analysis was completed for all cancer types combined and for select cancer types for the entire study area (ie, all seven census tracts combined). The select cancer types analyzed include: colon, pancreatic, lung, bladder, leukemia, lymphoma, brain and central nervous system, rectal, stomach, kidney, female breast, and prostate. These cancer types were selected for review since State age-specific rates were available and published by the Cancer Registry. Males and females were evaluated separately. All races were combined in the analysis.

Analysis of the cancer incidence was completed using Standardized Incidence Ratios (SIRs). The SIR is calculated by dividing the observed number of cases by the expected number. The expected number was mathematically derived by multiplying the State age-sex-specific incidence rates and the study area age-sex-specific population figures. The calculated expected number of cases was based on the assumption that average annual

incidence rates for the whole State of New Jersey for 1982 would prevail in the population surveyed. The study area age-sex-specific population was determined from the 1980 U.S. Census data.

If the observed number of cases equals the expected number of cases, the SIR will equal one (1.0). When the SIR is less than one, we conclude that fewer cases were observed than expected. Should the SIR be greater than one, then more cases than expected were observed.

Statistical significance was evaluated using a 95 percent confidence interval (CI), which indicates whether the SIR is different than 1.0 due to chance alone. If the confidence interval includes 1.0, then the SIR is not considered to be statistically significantly different than 1.0.

Results:

Study Population

The total population in the seven census tracts was 32,978 (16,784 females and 16,194 males). Table 12 presents the study area age-sex-specific population figures. Of the total, nearly 31 percent of the study population is under 20 years of age and approximately nine percent is 65 or older.

Cancer Case Ascertainment

For the nine year study period, the New Jersey Cancer Registry identified 3,157 newly diagnosed cases of cancer with either a designated zipcode or an Old Bridge municipal code. Of these cases, 576 (18.2%) were from study area census tracts, 1,273 (40.3%) were from census tracts outside the study area and 1,308 (41.4%) did not have a census tract designation.

The 1,308 cases without a census tract code were searched using municipal street maps. Through use of street maps, 406 cases were located in the study area, 754 cases were outside the study area, and 148 were not-locatable.

These not-locatable cases were forwarded to the Old Bridge Health Department for their assistance. Of the remaining 148 cases, 18 were found within the study area, 82 were outside the study area, and 48 could not be located. The two main reasons for not identifying address location of the remaining cases were incomplete addresses and streets that were not locatable. The cases that were not-locatable have been included in the presentation of the summary cancer tables and in a separate sensitivity analysis of the SIRs.

Table 13 presents the municipality code (an identifier code for the town the case lived in) assigned to each case by the Cancer Registry. Although 70 percent of the study population resides in Old Bridge, only 14.2 percent of the located cases were coded with an Old Bridge municipal code. More than half of the located cases have a municipal code outside the study area (eg, East Brunswick, South Amboy, etc.), reflecting the difficulty in conducting a cancer investigation using only Registry data in this area. Of the 48 cases not-locatable, 17 (35.4%) were identified as East Brunswick residents, a much higher percentage than for the locatable cases. Based on this, it is likely that many of the not-locatable cases are not residents of the study area.

Tables 14 and 15 present the total study area cases by year of diagnosis and age at diagnosis, respectively. The 48 cases that were not-locatable have been presented separately since they may or may not have lived within the study area at the time of their diagnosis. Similar to the New Jersey State cancer incidence rates, the study area female cancer incidence increased sharply at an earlier age than the males.

A total of 1,000 cases of cancer have been verified within the study area over the nine year study period (502 males and 498 females). A description of all the cases by cancer type is presented in Table 16. Frequently occurring cancers within the study area for males were lung, prostate, colon and bladder, representing over 56 percent of all male cancers. For women, the most frequent study area cancers were breast, colon, cervix and lung, representing over 56 percent of all female cancers. These relative frequencies are similar to Statewide incidence figures.

Standardized Incidence Ratio Analysis

Standardized Incidence Ratios (SIRs) were calculated for all cancers combined and 12 site specific cancer types. Table 17 presents the results of the SIR analysis by primary cancer type. None of the SIRs were statistically significant over average State rates. The ratios for all cancers combined for both sexes were significantly lower than expected.

As noted earlier, the exact residential location of 48 cases potentially in or near the study area could not be determined from the data abstracted from the Registry. Because of the uncertainty of where these people actually lived in relation to the study area, they were excluded from the preceding SIR analysis. However, to account for the potential bias of excluding the 48 cases of unknown location, a sensitivity analysis was completed. SIRs were recalculated by adding in all not-locatable cases to the known cases for all cancers combined and each cancer type analyzed previously.

Table 18 presents the SIRs generated by the sensitivity analysis. The addition of the not-locatable cases had no significant impact on the original SIR analysis, none of the SIRs demonstrated statistically significant elevated values over average State rates. The ratios for all cancers combined for both sexes remained significantly lower than expected.

Discussion:

The number of all newly diagnosed cancers in the population living in the seven census tracts surrounding the Global Landfill was not elevated compared to average State incidence rates. The cancer incidence for the study area over the nine year period was significantly less than the expected amount. However, this information is difficult to interpret. It does not necessarily mean that no cancer cases are attributable to landfill emissions. The results only indicate that cancer incidence is lower than would be expected based on average State incidence rates and that if there is an effect from the

landfill, the effect is likely to be very small. Other reasons for these results could include: 1) community exposures may be poorly documented; 2) the pathways of exposure may be limited; 3) population mobility may reduce any potential for effect; and 4) the amount of time between exposure and disease (latency) may be too short to allow an effect to have emerged by the time of this study.

The most serious weakness of this study is the inability to assess past exposure levels to the population. The critical piece of information required to assure a meaningful evaluation of these data is actual personal exposure to chemicals emanating from the landfill over time; that is, who was exposed and who was not exposed and what was the magnitude of the exposure that did occur. Since personal exposure information does not exist, residential distance from the landfill was used as a surrogate measure for potential past exposure. This was accomplished by grouping the population living in the seven surrounding census tracts into a potentially exposed study area. Although distance from the landfill may have been the best way to estimate past potential exposures at the time the study was designed, it is also likely that not all of the residents in this area were exposed to landfill emissions due to the study area size.

An additional problem of evaluating the cancer data is the limited number of potential pathways for landfill contaminants to come into contact with the community. In general, the definition of environmental pollution is contamination in the air, water or soil. The three main pathways of human exposure to environmental pollutants are inhalation, ingestion and skin absorption. Potential contamination of the drinking water is not a major issue for the community at large since the area is serviced by public drinking water which requires testing and removal of hazardous chemicals. Excluding recreational activities on or very near the landfill, dermal contact with contaminants in the soil is likely to be relatively small in the study area since the site is not a normal thoroughfare for the study population. The major route of exposure, therefore, is believed to be air (inhalation). However, aside from bad odors emanating from the Global landfill, there is virtually no data regarding the composition of emissions potentially migrating

into the residential areas. Therefore, at this time it is not known if emissions contain chemicals that could impact the community cancer incidence. Further testing of landfill emissions is required to fully evaluate the landfill's potential threat to health in the community.

Another problem is population mobility. Information supplied by the Cancer Registry provides only an address at time of diagnosis for each case. No information is available on length of time an individual may have lived at the address before diagnosis. It is likely that some cancer cases occur in new, short-term residents with little or no exposure to the site. Furthermore, residents of the seven census tracts who moved out of the study area just prior to diagnosis are not available for analysis. Population mobility cannot be accounted for in this study. The current study assumes that in-and-out migration will off set each other and not have a major impact on study results.

A further possible limitation in the cancer data is an inadequate latency period. Latency is the delay between exposure to a disease-causing agent and the diagnosis of the disease, and may be as short as a few years or as long as several decades. Global Landfill operated from the late 1960s to 1984. The available cancer incidence data was more appropriate for study of cancers with shorter latencies, such as leukemia or lymphomas, than for other cancers. The maximum interval exposure to the end of the study was 21 years (1968-1987). Longer latency cancers, like lung cancer, therefore, may not have occurred until after the end of the study period.

In conclusion, total cancer incidence in the study area was significantly lower than expected when compared to average State incidence rates.

TASK GROUP CANCER INVESTIGATION

Figure E

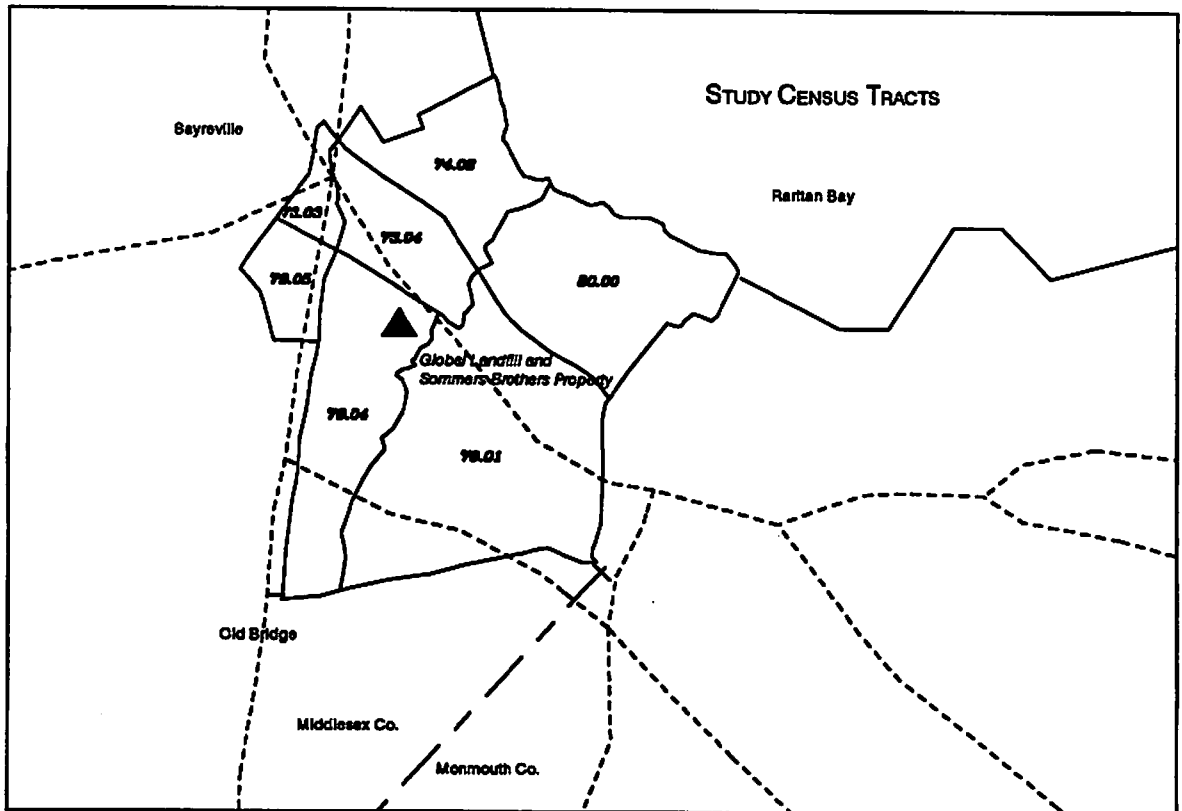
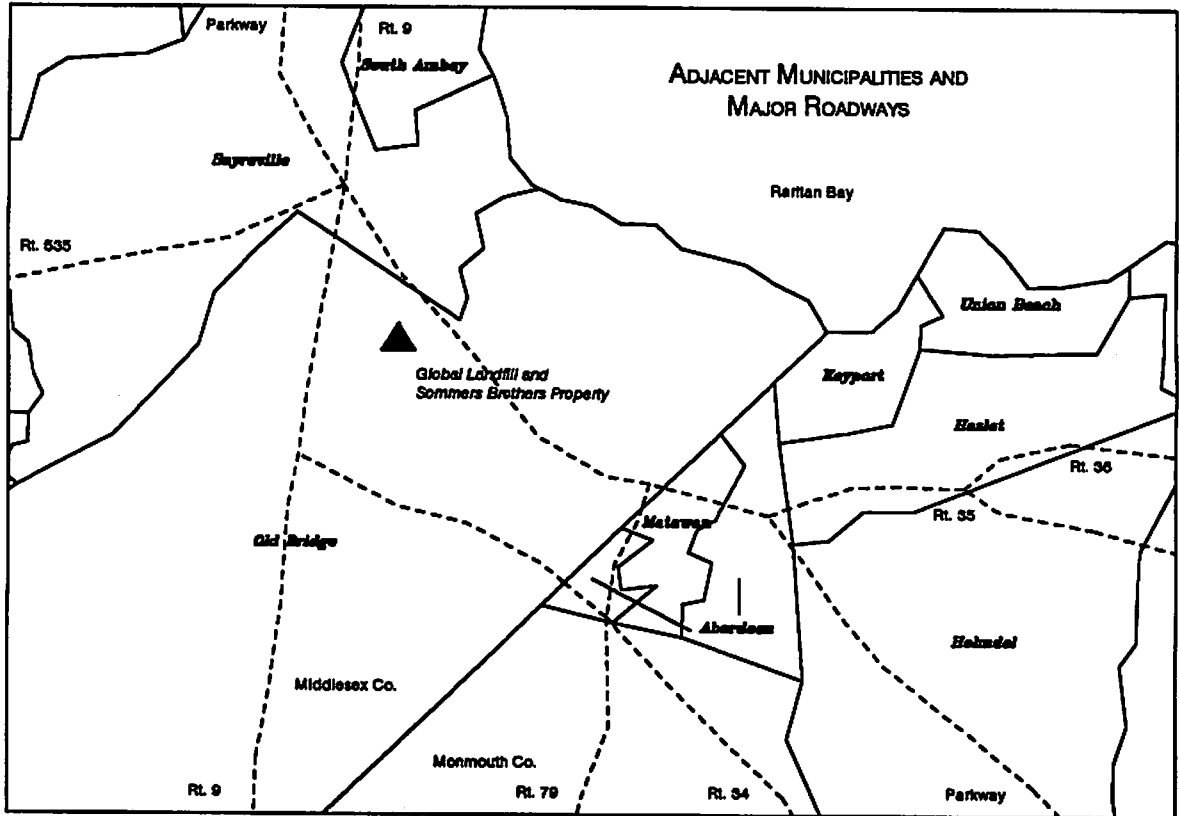


Figure F

TABLE 12

CANCER INCIDENCE BY YEAR OF DIAGNOSIS
 TASK GROUP CANCER INVESTIGATION
 (1979 - 1987):
 NEW JERSEY DEPARTMENT OF HEALTH, SUMMER 1991

YEAR DIAGNOSED	TOTAL	--LOCATED IN--		UN- LOCATABLE ADDRESSES
		STUDY AREA MALE	FEMALE	
1979	85	43	38	4
1980	107	59	43	5
1981	109	49	55	5
1982	119	57	58	4
1983	125	54	64	7
1984	132	67	58	7
1985	142	59	74	9
1986	132	63	65	4
1987	97	51	43	3
TOTAL	1048	502	498	48

TABLE 13

POPULATION SUMMARY BY AGE RANGE
(U.S. CENSUS BUREAU, 1980)
TASK GROUP CANCER INVESTIGATION:
NEW JERSEY DEPARTMENT OF HEALTH, SUMMER 1991

AGE RANGE	FEMALE	MALE	TOTAL
0-4	1037	1159	2196
5-9	1085	1212	2297
10-14	1310	1406	2716
15-19	1448	1450	2898
20-24	1619	1424	3043
25-34	2918	2879	5797
35-44	1981	1962	3943
45-54	1853	1857	3710
55-64	1752	1662	3414
65-74	1110	834	1944
75+	671	349	1020
TOTAL	16784	16194	32978

TABLE 14
 CANCER INCIDENCE BY REGISTRY MUNICIPAL CODE
 TASK GROUP CANCER INVESTIGATION
 (1979 - 1987):
 NEW JERSEY DEPARTMENT OF HEALTH, SUMMER 1991

MUNICIPAL CODE	CASES LOCATED	PERCENT LOCATED (N=1000)	CASES UNLOCATED	PERCENT UNLOCATED (N=48)
SAYREVILLE	327	32.7%	6	12.5%
SOUTH AMBOY	233	23.3%	8	16.7%
ABERDEEN	191	19.1%	3	6.3%
OLD BRIDGE	142	14.2%	13	27.1%
EAST BRUNSWICK	58	5.8%	17	35.4%
OTHER *	49	4.9%	1	2.1%
TOTAL	1000	100%	48	100%

* OTHER includes: Middlesex County - Middlesex Boro, Monroe Twp.,
 Perth Amboy City, Woodbridge Twp.

Monmouth County - Howell Twp., Manasquan Twp.,
 Matawan Boro, Monmouth Beach Boro, Union Beach Boro

Mercer County - Ewing Twp.

Somerset County - Franklin Twp.

NOTE: The towns listed above are not the actual towns of residence for the cancer study, they are only the mailing addresses as defined by the New Jersey Cancer Registry. The actual residence of all cancer cases in this study is either Old Bridge or Sayreville. The seven census tracts in this study are all located in Old Bridge (4 census tracts and 70% of the study population) or Sayreville (3 census tracts and 30% of the study population).

TABLE 15

CANCER INCIDENCE BY AGE AT DIAGNOSIS
 TASK GROUP CANCER INVESTIGATION
 (1979 - 1987):
 NEW JERSEY DEPARTMENT OF HEALTH, SUMMER 1991

AGE AT DIAGNOSIS	TOTAL	--LOCATED IN--		UN- LOCATABLE ADDRESSES
		MALE	FEMALE	
0-4	1	0	0	1
5-9	4	2	2	0
10-14	4	2	2	0
15-19	4	2	2	0
20-24	8	2	6	0
25-29	28	5	22	1
30-34	31	7	21	3
35-39	24	13	9	2
40-44	31	16	14	1
45-49	41	14	26	1
50-54	91	35	51	5
55-59	132	68	55	9
60-64	153	83	65	5
65-69	163	80	77	6
70-74	127	63	56	8
75-79	116	62	50	4
80-84	59	33	24	2
85+	31	15	16	0
TOTAL	1048	502	498	48

TABLE 16

CANCER INCIDENCE BY TYPE
 TASK GROUP CANCER INVESTIGATION
 (1979 - 1987):
 NEW JERSEY DEPARTMENT OF HEALTH, SUMMER 1991

CANCER TYPE	TOTAL	--LOCATED IN--		UN- LOCATABLE ADDRESSES
		MALE	FEMALE	
Oralpharynx	23	15	7	1
Esophagus	10	7	3	0
Stomach	24	15	9	0
Colon	107	51	51	5
Rectal	56	33	20	3
Pancreas	17	9	7	1
Liver	6	4	2	0
Gallbladder	5	4	1	0
Other digestive	5	4	1	0
Larynx	23	18	3	2
Lung/pleura	173	118	46	9
Other respiratory	2	2	0	0
Bones/joints	2	2	0	0
Soft tissue	4	3	1	0
Skin *	33	19	12	2
Breast	140	1	136	3
Cervix uteri	57	-	50	7
Corpus uteri	33	-	32	1
Ovary	26	-	26	0
Other female genital	3	-	3	0
Prostate	70	65	-	5
Other male genital	7	7	-	0
Bladder	69	51	14	4
Kidney	24	13	10	1
Eye	2	0	2	0
Brain/nervous system	15	10	4	1
Endocrine system	14	2	12	0
Hodgkin's disease	6	3	3	0
Non-Hodgkin's lymphoma	30	18	12	0
Multiple myeloma	8	3	5	0
Leukemia	28	15	12	1
Unknown primary	26	10	14	2
Totals	1048	502	498	48

* Skin cancer does not include Basal cell since it's not reportable.

TABLE 17

COMPARISON OF THE OBSERVED AND EXPECTED
LOCATABLE CASES ONLY
TASK GROUP CANCER INVESTIGATION
(1979 - 1987):
NEW JERSEY DEPARTMENT OF HEALTH, SUMMER 1991

CANCER TYPE	-----CASES-----		SIR #	95% C.I. ##	
	OBSERVED	EXPECTED		LOWER	UPPER
ALL CANCERS COMBINED:					
FEMALE -	498	597.20	0.83 *	0.76	0.91
MALE -	502	581.24	0.86 *	0.79	0.94
COLON CANCER:					
FEMALE -	51	60.39	0.84	0.63	1.11
MALE -	51	61.23	0.83	0.62	1.10
PANCREATIC CANCER:					
FEMALE -	7	13.31	0.53	0.21	1.08
MALE -	9	13.16	0.68	0.26	1.18
LUNG CANCER:					
FEMALE -	46	52.21	0.88	0.65	1.18
MALE -	118	117.12	1.01	0.84	1.21
BLADDER CANCER:					
FEMALE -	14	16.12	0.87	0.47	1.46
MALE -	51	44.86	1.14	0.85	1.50
LEUKEMIA:					
FEMALE -	12	8.58	1.40	0.72	2.45
MALE -	15	12.07	1.24	0.70	2.05
LYMPHOMA:					
FEMALE -	15	20.06	0.75	0.42	1.23
MALE -	21	21.77	0.96	0.60	1.47
BRAIN/CNS CANCER:					
FEMALE -	4	7.81	0.51	0.14	1.31
MALE -	10	8.05	1.24	0.60	2.29

TABLE CONTINUED

TABLE 17
CONTINUED

COMPARISON OF THE OBSERVED AND EXPECTED
LOCATABLE CASES ONLY
TASK GROUP CANCER INVESTIGATION
(1979 - 1987):
NEW JERSEY DEPARTMENT OF HEALTH, SUMMER 1991

CANCER TYPE	-----CASES-----		SIR #	95% C.I. ##	
	OBSERVED	EXPECTED		LOWER	UPPER
RECTAL CANCER:					
FEMALE -	20	23.46	0.85	0.52	1.32
MALE -	33	28.94	1.14	0.79	1.60
STOMACH CANCER:					
FEMALE -	9	10.49	0.86	0.39	1.63
MALE -	15	17.02	0.88	0.49	1.45
KIDNEY CANCER:					
FEMALE -	10	8.14	1.23	0.59	2.26
MALE -	13	15.13	0.86	0.46	1.47
BREAST CANCER:					
FEMALE -	136	154.52	0.88	0.74	1.04
PROSTATIC CANCER:					
MALE -	65	82.98	0.78	0.61	1.00

SIR - Standardized Incidence Ratio of Observed to Expected Number of Cancers (Age Standardized).

95% Confidence Interval. There is only 5% likelihood that the SIR is actually outside of this interval. If the confidence interval includes 1.0, then the SIR is not considered to be different from 1.0 using conventional definitions of "statistical significance".

* Statistically low, $p < 0.05$

** Statistically elevated, $p < 0.05$

TABLE 18

COMPARISON OF THE OBSERVED AND EXPECTED
LOCATABLE AND UNLOCATABLE CASES COMBINED
SENSITIVITY ANALYSIS
TASK GROUP CANCER INVESTIGATION
(1979 - 1987):
NEW JERSEY DEPARTMENT OF HEALTH, SUMMER 1991

CANCER TYPE	-----CASES-----		SIR #	95% C.I. ##	
	OBSERVED	EXPECTED		LOWER	UPPER
ALL CANCERS COMBINED:					
FEMALE -	520	597.20	0.87 *	0.80	0.95
MALE -	528	581.24	0.91 *	0.83	0.99
COLON CANCER:					
FEMALE -	53	60.39	0.88	0.66	1.15
MALE -	54	61.23	0.88	0.66	1.15
PANCREATIC CANCER:					
FEMALE -	8	13.31	0.60	0.26	1.18
MALE -	9	13.16	0.68	0.26	1.18
LUNG CANCER:					
FEMALE -	50	52.21	0.96	0.71	1.26
MALE -	123	117.12	1.05	0.87	1.25
BLADDER CANCER:					
FEMALE -	14	16.12	0.87	0.47	1.46
MALE -	55	44.86	1.23	0.92	1.60
LEUKEMIA:					
FEMALE -	13	8.58	1.52	0.81	2.59
MALE -	15	12.07	1.24	0.70	2.05
LYMPHOMA:					
FEMALE -	15	20.06	0.75	0.42	1.23
MALE -	21	21.77	0.96	0.60	1.47
BRAIN/CNS CANCER:					
FEMALE -	4	7.81	0.51	0.14	1.31
MALE -	11	8.05	1.37	0.68	2.45

TABLE CONTINUED

TABLE 18
CONTINUED

COMPARISON OF THE OBSERVED AND EXPECTED
LOCATABLE AND UNLOCATABLE CASES COMBINED
SENSITIVITY ANALYSIS
TASK GROUP CANCER INVESTIGATION
(1979 - 1987):
NEW JERSEY DEPARTMENT OF HEALTH, SUMMER 1991

CANCER TYPE	-----CASES-----		SIR #	95% C.I. ##	
	OBSERVED	EXPECTED		LOWER	UPPER
RECTAL CANCER:					
FEMALE -	20	23.46	0.85	0.52	1.32
MALE -	36	28.94	1.24	0.87	1.72
STOMACH CANCER:					
FEMALE -	9	10.49	0.86	0.39	1.63
MALE -	15	17.02	0.88	0.49	1.45
KIDNEY CANCER:					
FEMALE -	11	8.14	1.35	0.67	2.42
MALE -	13	15.13	0.86	0.46	1.47
BREAST CANCER:					
FEMALE -	139	154.52	0.90	0.76	1.06
PROSTATIC CANCER:					
MALE -	70	82.98	0.84	0.66	1.07

SIR - Standardized Incidence Ratio of Observed to Expected Number of Cancers (Age Standardized).

95% Confidence Interval. There is only 5% likelihood that the SIR is actually outside of this interval. If the confidence interval includes 1.0, then the SIR is not considered to be different from 1.0 using conventional definitions of "statistical significance".

* Statistically low, $p < 0.05$

** Statistically elevated, $p < 0.05$

4.2 Ambient Air Quality

According to the Report of the Task Group on Global Landfill and the Sommers Brothers Property Sites (August 1988), one of the principal recommendations presented by the Task Group is the implementation of a Community Ambient Air Monitoring Program, to be funded through the New Jersey legislature. The purpose of the program is to "describe the extent and magnitude of community ambient air exposure and evaluate the contribution of various sources to ambient air exposure." As designed, the Ambient Air Monitoring program would conduct an emission inventory of point and area sources in the vicinity of the sites, model the identified emission sources to predict potential human exposure, and implement a three to six month air sampling program for volatile organic and particulate contaminants.

Funding for the Ambient Air Monitoring program was never authorized by the State legislature; thus, it was never initiated. However, as part of the Remedial Investigation/Feasibility Study currently being conducted at Global landfill, an Air Quality Monitoring program has been implemented to evaluate environmental and public health risks. The NJDEP has long recognized that the release of offensive odors from Global Landfill has been a primary concern of the local residents. The objectives of the Global air program are two fold. The first objective is to characterize gaseous emissions at the site. A second objective is to ascertain the overall fate of gas emissions from the landfill including the air quality in the immediate surroundings.

The United States Environmental Protection Agency (EPA) has developed guidance on conducting Air Pathway Analyses (APA) for Superfund and non-NPL hazardous waste sites (EPA 450/1-89/001). As designed, an APA is a systematic

approach involving a combination of modeling and monitoring methods to assess actual or potential receptor exposure to air contaminants. This information is then utilized in the baseline risk assessment process. The primary components of an APA consist of:

- characterization of air emission sources;
- determination of the effects of atmospheric processes (e.g., transport and dilution); and,
- evaluation of the potential exposure to receptors.

In order to meet the air quality objectives for Global Landfill within the context of the air pathway analyses process, the NJDEP is implementing the air monitoring program in two phases. Landfill emissions monitoring has been conducted during the Phase I site investigation and, depending on the Phase I results, ambient air quality will be monitored during the Phase II site investigation.

The Phase I air monitoring program involved collecting evolved landfill gases from eight locations across the landfill during two different meteorological conditions. Landfill gases were captured directly at the surface in a modified flux chamber and collected for analyses with Summa Canisters and midget impinger trains. The air samples were analyzed for Target Compound List (TCL) volatile organics, methane, oxygen, nitrogen, carbon dioxide, hydrogen sulfide and mercaptans. Currently, the results of the Phase I air monitoring program are not available.

The Phase II ambient air monitoring, if warranted, will be accomplished using Summa Canisters alone to determine the characteristics and direction of fugitive landfill gas emissions. As currently proposed, a minimum of three sampling locations will be chosen, with sampling occurring on five concurrent days. Analytical parameters will be based on the Phase I results.

The intent of the phased approach to the air monitoring program is to first identify air contaminants that are evolving from the landfill. Phase II ambient air monitoring can then determine if these contaminants are reaching the residents; thus, possibly presenting an unacceptable public health risk. By identifying contaminants of concern that are specifically generated from the landfill, confusion over the potential impact from other sources of air emissions (e.g., other hazardous waste sites, vehicular exhausts, local industrial companies) can be avoided. While this information will not address the overall air quality of this area, it will inform the local residents about the impact Global Landfill has on the air they breath.

4.3 Agency for Toxic Substances and Disease Registry Health Assessment Process

In November of 1988, on behalf of residents in the vicinity of Global Landfill, an attorney for the group Citizens Helping Environmental Cleanup (CHEC) petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct a health assessment of the site. The ATSDR, a part of the U.S. Public Health Service, was created by the CERCLA (Superfund) legislation of 1980. ATSDR's mission is to prevent or mitigate adverse health effects and diminished quality of life resulting from exposure to hazardous substances in the environment. ATSDR conducts many activities including the preparation of health assessments for all sites placed on the U.S. Environmental Protection Agency's (USEPA) National Priorities List (NPL).

Health assessments are designed to evaluate data and information on the release of hazardous substances into the environment to: 1) evaluate any current or future impact on public health, 2) develop health advisories or other health recommendations, 3) identify studies or actions needed to evaluate and mitigate or prevent human health effects, and, 4) respond to community concerns regarding environmental health issues. The health assessment is used as an indicator of further need for continued ATSDR involvement which may include activities such as health studies, development of registries, health surveillance, or full-scale epidemiological studies.

The ATSDR determined that there was reasonable basis to justify conducting a health assessment for the Global Landfill. This decision was based upon evaluation of information and interviews with individuals from local, State and Federal agencies during the Spring, 1989. At that time, a site visit of Global Landfill by ATSDR Region 2 and Headquarters staff persons was also conducted with several Task Group members in attendance.

In March 1989, the USEPA officially placed Global Landfill on the National Priorities List (NPL). ATSDR has a Cooperative Agreement with the New Jersey Department of Health (NJDOH) to conduct public health assessments for NPL sites in New Jersey, such as Global Landfill. However, ATSDR Headquarters is responsible for preparing the health assessment of a site when the assessment is conducted in response to a public petition. As needed, NJDOH ATSDR staff provide assistance to the ATSDR Headquarters staff.

On May 9, 1990, ATSDR Headquarters staff attended a meeting of the Task Group and conducted a site visit of Global Landfill. The meeting provided a forum for the exchange of information regarding the health assessment process, for identifying the sources of information which ATSDR wanted to obtain and incorporate into the health assessment, and to find out the public's health concerns related to Global Landfill. Additionally, ATSDR staff met with New Jersey State Agencies to discuss the status of the Remedial Investigation, construction of a landfill cap, feasibility of accessing state vital statistics registries, and collecting other data and information concerning the site, such as air monitoring data.

At the time of NJDOH's printing of this report, the ATSDR health assessment of Global Landfill was in internal review at Headquarters pending release.

5.0 TASK GROUP CONCLUSIONS AND RECOMMENDATIONS

5.0 TASK GROUP CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Community Soil Monitoring Program

The purpose of the Community Soil Monitoring Program, as identified in the Final Report prepared by Eikon Planning and Design, Incorporated (see Section 3.1), was (1) to determine if the apartments bordering Global Landfill were built on a waste landfill, and (2) to ascertain whether any contaminants are present in the soils adjacent to residential buildings.

Based on the historic aerial photographs, the soil boring logs from the Community Soil Monitoring Program, and photographs from the slope failure adjacent to the London Terrace Apartments, the Eikon Report and the Task Group concur with the conclusion that the apartments were not built on a former landfill. Although Eikon also recommended a stereoscopic review of additional historic photographs to confirm this point, the Task Group was satisfied with the authenticity of the information reviewed and the deductions made.

The environmental investigation, conducted as part of the Community Soil Monitoring Program, revealed a random distribution of minor contamination in the area. Soil vapor results detected elevated volatile organics readings primarily along Westminster Boulevard and former unimproved access roads. Low levels of volatile and semi-volatile organic compounds were found in the soil samples collected from the borings. Total volatile organic compound levels ranged from "not detected" to 0.035 parts per million (ppm). Total semi-volatile organic compound levels varied between "not detected" and 9.6 ppm. None of the contaminant levels were above the New Jersey Department of Environmental Protection and Energy's (NJDEPE) Interim Soil Action Levels.

Two of the suspected sources of the soil contamination, according to the Eikon Report, were degradation of utility lines along Westminster Boulevard

and localized unauthorized dumping along former access roads. The Task Group concurs with these findings. Although the Eikon Report recommended further soil sampling and analysis to ascertain the origin of the contaminants and the fill material observed near the surface in the soil borings, the Task Group concluded that these activities would be beyond the original scope established by the State Legislature and the intentions of the Task Group. Therefore, this recommendation was not implemented.

The Eikon Report also recommended that an indoor/basement air monitoring program be instituted to evaluate the indoor air quality of residences and assess the health implications to the residents. The Task Group did not achieve consensus regarding the usefulness of an indoor air monitoring program and whether the data would be relevant to the Global Landfill or Sommers Brothers properties. No further action on this issue is planned at this time.

Impact Of Sommers Brothers Property Contamination

In 1991, the Trustees of the Sommers Brothers property submitted a report to the New Jersey Department of Environmental Protection and Energy (NJDEPE). Preliminary analytical results of the groundwater collected indicated contamination of the site by organic compounds. When considered from a regional perspective, the contamination levels found in the groundwater at this property were generally one or two orders of magnitude higher than groundwater samples collected at the Global site.

Despite the fact that the analytical data were not validated (since a complete Quality Assurance/Quality Control package was not received by NJDEPE), these results suggest groundwater contamination significantly above any found at Global Landfill. The proposed Groundwater Quality Standards for Global Landfill were often exceeded in the groundwater results found at the Sommers Brothers property. For example, the proposed standard established by NJDEPE for ethylbenzene at Global is 700 ug/l (micrograms per liter) or ppb (parts per billion). While results from monitoring wells at Global Landfill for this contaminant were generally less than 100 ug/l, ethylbenzene detected at the Sommers Brothers property ranged from 4 to 10,800 ug/l. Toluene at Global was generally less than 100 ug/l; at Sommers Brothers the results ranged from none detected to 28,000 ug/l.

These results caused concern among the Task Group about the contamination potential to the region and Cheesequake Creek. Members agreed that from these data, the potential for impacting the environment is significant at the Sommers Brothers site. While additional review of these data is not within the purview of the Task Group, the Task Group recommends that the NJDEPE initiate a focused investigation on the Sommers Brothers property as soon as practicable.

Pediatric Health Examinations

The purposes of this service were (1) to assess the current health status of the children residing in the vicinity of Global Landfill and the Sommers Brothers Property sites, and (2) to provide parents with guidance regarding their children's medical care. The health evaluations were not designed as a study to determine a link between exposure and symptoms. The Division of General Pediatrics of the University of Medicine and Dentistry of New Jersey (UMDNJ) agreed to perform medical examinations of children living and playing near the landfills and to interpret the findings.

Between August 1989 and February 1990, 175 children volunteered for comprehensive medical exams consisting of a complete history, physical examination and laboratory tests. The results of the majority of physical exams were within normal limits. Some data analysis was performed to examine potential relationships between reported health problems and proximity of the child's residence and play areas to the landfill. Of the common complaints reported during the medical history, a variety of respiratory problems were identified. Fifty-four of the children (30.9%) had problems with frequent coughing, wheezing or asthma, and the likelihood of such problems increased with proximity of residence to the landfill. Although hay fever, respiratory allergies, pneumonia, and bronchitis were also reported, no significant relationships for these respiratory problems and proximity to the landfill were found. There were no significant heart problems identified, but from a question asked during the cardiac review, UMDNJ found that 21% of the children were reported to have had pounding headaches. There was a significant trend correlation between headaches and living or playing near the landfill.

Analysis of the laboratory data found 8 children with mild anemia, 35 children with lead levels between 11 and 15 ug/dl (micrograms per deciliter), 3 children with lead levels between 16 and 20 ug/dl, and one child with a lead level of 23 ug/dl (all venous samples). The laboratory records of children with blood lead levels exceeding 10 ug/dl were forwarded to appropriate public health agencies for follow-up. There were no significant urinary abnormalities identified. Although most of the serum chemistries were normal, there were some children with mildly elevated liver function tests. Thirty-eight children had elevated aspartate aminotransferase (AST) levels, 8 children had elevated alkaline phosphatase levels and two children had mild elevation of both. Some relationships were noted between these elevations and distance of residence or play area to the landfill.

The Task Group concluded that the pediatric health examinations provided an important and valuable service to the community. Independent of the confirmation of the source of complaints and symptoms, health evaluations were designed in a manner most likely to find any childhood health problems present in this community. Since the medical examination was not designed to assess a link between exposure and symptoms, the findings should be interpreted with caution. The Task Group agrees with UMDNJ that any proposed cause-effect relationship must be considered speculative. However, the Task Group encourages parents of children experiencing any health problems to seek appropriate medical counseling.

Community Demographic Profile

The objectives of this effort were (1) to characterize the population of the community living near the sites, (2) to document in detail a representative sample of the residents' health concerns, and (3) to collect information necessary to develop specific education and outreach interventions.

A stratified random sample of 10% of the 4,000 households was selected for the survey. The low response rate (49.2% of households contacted) impeded accurate description of the community. Among households which responded, almost 8% of residents were preschool children (birth to 4 years old), while residents between 20 and 39 years comprised greater than 42% of the sample.

More than 68% of the survey area population was under 40 years of age. More than one-third of the households with children expressed concerns about their children's health. More than a quarter of respondents expressed concern over the health of at least one adult in the household. There was an increasing trend in the frequency of some types of self-reported respiratory health complaints when they were arranged according to their proximity to Global Landfill. The most frequently reported health concerns were respiratory complaints.

Limitations of the interviews and lack of information about the nonrespondents resulted in an inability to generalize findings from the survey to the approximately 4,000 residents living in the vicinity. However, although the poor response rate weakens the usefulness of the demographic survey, it points out the need for new strategies in community studies and awareness campaigns. The Task Group recognized that the process of conducting the Community Demographic Profile identified factors which present formidable barriers to a successful community outreach and education program. The Group expressed an interest in supporting efforts to increase participation of community members in ongoing activities. The Task Group concluded that the survey information has value in planning educational programs for this population.

Community Outreach and Education Activities

The primary purposes of these efforts are (1) to assist individuals in making decisions about actions to be taken by them or their families, and (2) to stimulate community participation in the decision-making process related to the clean-up of the sites.

Residents of the nearby community had expressed concern about unrestricted access to the Global and Sommers sites and the use of those properties as recreational areas. The Task Group discussed the need to protect individuals from exposure to potential hazards (such as hazardous leachate and steep grades) by restricting access to the site. Although fencing the perimeter of Global Landfill is a part of the remediation plans,

the Task Group concluded that, in addition to the fencing measures, residents, especially children, should be educated regarding the reasons for restricting access to the sites. The educational efforts should include specific information about health effects and remediation ongoing at those sites.

The Task Group believes it is important that schools build environmental issues into the routine K-12 school curriculum. Incorporated into this content should be information on proper safety behaviors when near landfills. Providing information to assist individuals in making informed decisions about potential health risks in the environment was given a high priority by the Task Group. Strategies were suggested by Task Group members including lessons consisting of visuals to reinforce learning concepts. Utilization of students to teach other students has been demonstrated as an effective teaching-learning strategy in similar situations. Students of high school and middle school levels could be considered. Educational sessions for teachers regarding this subject is imperative.

The Task Group concluded that stimulating the interest of students in the Old Bridge School District's Environmental Clubs was essential in order to begin a student-conducted education effort. One student per high school (grades 9-12) and one student per middle school (grades 6-8) were invited to become Task Group members. The Task Group and its student members are committed to student-conducted educational activities in elementary grades.

The Task Group considers community outreach and education efforts to be integral to the success of efforts to alleviate or lessen community health concerns related to the Global Landfill and the Sommers Brothers site. The Task Group endorses further development of educational activities.

Community Cancer Investigation

Cancer is a reportable disease and new cases of cancer are reported confidentially to the State Department of Health Cancer Registry. New Jersey Cancer Registry records were reviewed for the period from January 1979 through December 1987. Seven census tracts surrounding Global Landfill were grouped

together and defined as the study area. The investigation was an attempt to take a "snap shot" of cancer incidence in the study population over a defined time period. The investigation could not attribute any cause-effect relationships. Limitations of this investigation exist with respect to sufficient time for latency, mobility potential of the population and a lack of exposure information. The investigation found that total cancer incidence in the study area was significantly lower than expected when compared to average State cancer incidence rates.

The Task Group concluded that, based on this information, additional follow-up of cancer concerns is not justified at this time.

Ambient Air Quality

The release of offensive odors from Global Landfill has been a primary concern of the local residents. In 1988, the Task Group recommended implementation of a Community Ambient Air Monitoring Program in order to "describe the extent and magnitude of community ambient air exposure and evaluate the contribution of various sources to ambient air exposure." The 1988 plans have been superseded by an Air Quality Monitoring Program implemented as part of the Remedial Investigation/Feasibility Study currently being conducted at Global Landfill by NJDEPE. The objectives of the Global air program are two-fold. The first objective is to characterize gaseous emissions at the site. A second objective is to ascertain the overall fate of gas emissions from the landfill including the air quality in the immediate surroundings. This information will then be utilized in the baseline risk assessment process.

The Task Group considers an in-depth characterization of on-site and off-site air quality necessary to determine any potential health risks. The Task Group recommends State agencies fully evaluate air quality data for potential health impacts as soon as the data are available. The findings should be reported to the Task Group and the Agency for Toxic Substances and Disease Registry.

Community Concerns

Old Bridge Township has two other Federal Superfund sites besides Global Landfill, so a "hazardous waste site" is not new to the community. However, the other two sites lack involvement of the local community through the formation of a Task Group or advisory committee. The process of addressing the community's concerns regarding Global Landfill and the Sommers Brothers sites has involved a Task Group. This participatory, working group should continue.

The Task Group (consisting of representatives from the State Departments of Health and of Environmental Protection and Energy, the Old Bridge Health Department, the Old Bridge and Sayreville Environmental Commissions, and residents of the community representing Citizens Helping Environmental Cleanup or "C.H.E.C.") started meeting on at least a monthly basis on a weekday morning. The Task Group considered this time most convenient for those professionals who were permitted to attend during business hours. However, local experts working in the scientific and engineering fields and laypeople living adjacent to the sites who work during the day may have been unable to attend meetings. This limitation to community representation presented a disadvantage. At the outset of any project between the state and a local community, there is often a considerable amount of mistrust. The Task Group acknowledged that trust grew over time with familiarity. Task Group members asserted that strong, diversified representation from the community on this and similar task groups is important and should be reinforced. Evening meetings, which lend themselves to community involvement, should be considered.

The members of the Task Group felt fortunate to have received a State grant of \$75,000 to address the concerns of the community. However, time constraints and requirements of grant administration hindered the effectiveness of offsite soil monitoring and community demographic survey efforts. As the technical expertise does not currently exist to answer all community concerns, members of the Task Group made calculated assumptions regarding how to best utilize these monies. In reflection, the Task Group believes the monies may have yielded better results had there been greater

flexibility in the way the monies could be spent. An award of funds without time constraints, where funds would be drawn upon and accounted for as needed, would have facilitated Task Group responsibilities.

The final lesson the Task Group learned is that money is only part of the solution. To begin addressing community concerns, \$75,000 has been spent. Yet, from an engineering standpoint, work at Global Landfill is in an evaluation phase with a completion date five to seven years in the future. The Task Group is committed to continuing its' oversight responsibilities established under P.L. 1987, c. 368. Group members unanimously agreed upon the need to continue to meet, discuss and oversee the completion of all work related to the sites.

Task Group members unanimously support the participation of the community in the decision-making process relative to Global Landfill and the Sommers Brothers properties. The Task Group as a whole believes that the process has been constructive in improving the communities' understanding of environmental issues and trust in state government. The group encourages the formation of such groups in other, similar situations but cautions that such committees should enhance rather than place any delays on the clean-up process. The Task Group hopes this report will document that progress can be achieved, although limitations may be encountered when public agencies and citizens join together to solve environmental problems. Task Group members expressed a responsibility toward sharing their experiences with other groups with similar concerns and goals. The Task Group hopes that its' Second Report will provide some guidance to current and future groups comprised of citizens and public agencies.

RECOMMENDATIONS

Based on the above conclusions, the Task Group recommends the following actions.

- * The Task Group should remain and continue in its' current function.
- * The State Departments of Health and of Environmental Protection and Energy should continue to provide technical information and expertise.

- * The Task Group recommends that maximum energy be expended to develop and implement additional outreach and education strategies for the community in partnership with the local school districts.
- * The Task Group urges the State to proceed with capping Global Landfill (Operable Unit 1) as expeditiously as possible, including the installation of perimeter fencing to restrict access to the site.
- * The Task Group recommends that municipal police be made more aware of the site and urges that site access be monitored as part of normal patrol activities.
- * Results of the Community Soil Monitoring Program should be submitted to the Old Bridge Municipal Utilities Authority with a request for a thorough investigation of the integrity of the utility lines along Westminster Boulevard. The Old Bridge Health Department and the Task Group should be kept informed of this investigation as it progresses.
- * The Task Group should review and provide comment on the Remedial Investigation/Feasibility Study currently underway at the Global Landfill Superfund site.
- * The Task Group requests that NJDEPE initiate a focused investigation of the Sommers Brothers property contamination, as soon as is possible, to assess the potential impact on the environment and health of individuals living in the vicinity.
- * The Task Group recommends State agencies fully evaluate air quality data for potential health impacts as soon as the data are available, and report findings to the Task Group and the Agency for Toxic Substances and Disease Registry.
- * The Task Group recommends that individuals with concerns about their health seek a medical evaluation from their family physician.

Peer Review

A draft of three sections of this Report were reviewed in October by five peer reviewers. The reviewers were selected by the New Jersey Department of Health with input from the Task Group. Reviewers were asked to critique the methodology, interpretation of results, and written presentation of the Demographic Profile, Pediatric Health Examinations, and the Community Cancer Investigation section of the Report. Written comment are included in this report (see following pages).

Jack Brondum, D.V.M., M.S.
Epidemiologist, Chronic Disease and Environmental Epidemiology
Minnesota Department of Health

Margaret G. Conomos, M.P.H.
Health Statistician, Exposure Evaluation Division
United States Environmental Protection Agency

Palma E. Formica, M.D.
Pediatrician
Old Bridge, N.J.

Lynn R. Goldman, M.D., M.P.H.
Chief, Environmental Epidemiology and Toxicology Program
California Department of Health Services

Holly L. Howe, Ph.D.
Chief, Division of Epidemiologic Studies
Illinois Department of Health

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November 26, 1991

Michael Berry
Research Scientist
Environmental Health Service
State of New Jersey Department of Health
CN 360
Trenton, NJ 08625-0360

Dear Mr. Berry:

Thank you for inviting me to review the studies on the residents who live near the Global Landfill and Sommers Brothers property. I apologize for the tardiness of my response! Below are questions and comments in response to the reports.

I. Demographic Profile

The basic approach, as described, with a simple random sampling strategy and a door to door survey, was reasonable to meet the stated objectives. I agree with the authors that it would have been preferable to have obtained information on ethnicity. I would have liked to see more information about socioeconomic status as well. Education was collected for each individual, but it is analyzed for adults and children combined. Perhaps by looking at head of household it would be possible to get an idea of socioeconomic status. Household size would be interesting in this regard as well.

The low response rate was quite problematical. Did you attribute this solely to the litigation? Do you think this may be indicative of some sort of response bias? The reason I ask, is, that if those with illnesses were more likely to respond, this could affect the illness rates that you developed.

The descriptive analysis of the data was well presented. Data on health concerns for adults and children should be presented separately as well as grouped, because of the great difference in illness and symptom patterns. However, I would have been interested in seeing the demographic, health concern and child activity data categorized by exposure strata. (Since there are relatively fewer "low" and "medium" risk persons, you might want to combine these two groups.) Also, it might have been interesting to look at health concerns by other characteristics like education and smoking.

Individuals may over or under-report health concerns. When one individual reports for an entire family, the potential for bias is greatly magnified. If you are concerned about this, you may want to redo the analysis for health concerns just using the data for the respondent and for one child.

II. Pediatric Health Screening

New Jersey is to be congratulated for finding a way to provide a pediatric health screening service for this community. The evaluation of the health status of individual children was very thorough and should have identified any health problems requiring follow-up. The authors of the report correctly point to the inherent bias in choosing subjects for study by asking them to volunteer. However, for a screening program, this is probably a reasonable procedure since children with illness are most likely to be volunteered, biasing toward finding potential problems. This also means that any positive findings must be treated with caution, since the rest of the children in the community may be in much better health.

All in all, I felt that the analysis of the data and presentation of the findings was reasonable and that the interpretation of results was appropriate to the design of the study. There are several issues that need to be highlighted. First, is there a possibility of confounding by age, sex, socioeconomic status, parental smoking and/or ethnicity in the interpretation of differences between children living close to and far from the site? In the course of child development, rates of various symptoms and illnesses and interpretation of laboratory tests (as pointed out by the authors) vary greatly. There are great differences between ethnic groups for certain health problems, e.g., higher rates of certain allergic and respiratory problems among Black children. So, I would feel more comfortable with the conclusions (particularly the positive findings for increased headaches and respiratory problems and elevations of liver enzymes) if the differences persisted despite controlling for possible confounders.

A second issue is multiple comparisons. The researchers made multiple measurements using questions on questionnaire, physical examinations, and several laboratory tests. As you are aware, by chance alone, when making such comparisons, 1 of 20 tests will be "statistically significant" even when two groups are sampled from the same population. Given this, it may be that the number of "positive" findings is about what is expected for the number of tests performed and not indicative of anything unusual in the way of exposures.

In conclusion, without controlling for age, sex, socioeconomic status and ethnicity it is difficult to be certain that headaches, respiratory problems and elevated liver enzymes are indeed in excess in the closer group. However, these findings would not be inconsistent with findings around other sites. Certainly, the conclusion that residents should minimize exposure to the site is warranted. And, because this study was exploratory in nature, to more definitively define whether there is a causal relationship between the site and these symptoms would require further studies.

III. Cancer Investigation

The cancer investigation that was conducted also provided a very important community service. Although the authors rightly pointed out the limitations in terms of sufficient time for latency, small populations numbers, limited exposure information and population mobility, the study does show that the pattern of cancers observed in the community now is not unusual. Based on the findings, and the above limitations, I would not recommend further follow-up of cancer concerns at this time.

Mr. Michael Berry
November 26, 1991
Page 3

Thank you for the opportunity to review these studies. Please do not hesitate to contact me if I can be of any further assistance.

Sincerely,

A handwritten signature in cursive script that reads "Lynn R. Goldman". The signature is written in dark ink and is positioned to the right of the typed name.

Lynn R. Goldman, M.D., M.P.H., Chief
Environmental Epidemiology and
Toxicology Program

October 28, 1991

Michael Berry
Environmental Health Service
New Jersey Department of Health
Trenton, New Jersey 08625-0360

Dear Mr. Berry;

I have reviewed the three draft reports, Task Group Cancer investigation, demographic profile and pediatric health screening which I received on October 17, 1991. Specific comments are included on the enclosed drafts, which I am returning to you. I have several general comments that I would like to emphasize.

On the cancer investigation, you have overlooked what I believe are important limitations in the interpretation of your findings. The data are not controlled for race or population density, two factors known to be associated with cancer incidence. How does the study area compare to the State as a whole? You also could have under-reporting of cancer cases. How complete is cancer ascertainment for your Registry? Would an analysis of mortality data give you the same results? And finally, has the population age profile changed over the study period? You could use census data to examine whether the population appears to be getting younger. This trend could also explain why your expected numbers are higher than your observed.

For the demographic profile, you mixed the unit of analysis between individuals and households. This was confusing and raised the question whether the number of individuals per household was similar across all distance strata. Also a description of assurance/quality control procedures would strengthen the presentation of results as well as a discussion of non-respondents. How similar were respondents to non-respondents? Do you have any information on this group? What would happen to your interpretation if all non-respondents were biased to one extreme of your variables? How would this affect your interpretation of the results? And finally, from the background material I received, it appeared you had environmental data which could be used to define "exposure plumes". Why were these data not used to define areas of highest exposure potential and the more crude indicator of distance used for this purpose? Such a decision could be perceived as diluting your results.

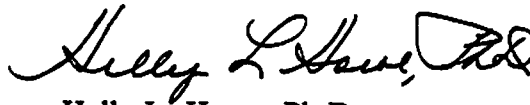
The report on the pediatric health screening was the most difficult to follow. I think several factors contribute to this. One, all data are presented in narrative form. Tables would improve clarity and reduce complexity. Two, change the verbs to the active voice and eliminate all instances where you include the words "There are/were...". I also found that although the draft is clear about how the data should not be interpreted, it did not give sufficient interpretation of the data presented. Questions like the effect of the biases on results would be insightful (recall bias and selection bias would maximize your ability to detect relationships). Even though you must be cautious (and you have been) in relating the results to any exposure,

Page 2, Berry

you can describe and interpret what you know in a descriptive sense about the health of the children.

I hope that you find these comments helpful. Thank you for the opportunity to review these community studies.

Sincerely,

A handwritten signature in cursive script that reads "Holly L. Howe, Ph.D." The signature is written in black ink and is positioned above the printed name and title.

Holly L. Howe, Ph.D.
Chief, Division of Epidemiologic Studies
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enc.



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October 23, 1991

Michael Berry
Research Scientist
Environmental Health Service
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CN 360
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Dear Michael:

I have completed my review of the Global Landfill/Sommers Brothers report and am returning the typescripts with my comments. My comments on the questionnaires are minimal, so I'm not bothering to send them back. I have made copies of the other documents for my records. The comments on these are fairly extensive and you may make whatever use of them you wish. I was impressed with the amount of work accomplished with the limited funding available. As I indicated on the phone, however, I have some serious concerns with the NJDOH and UMDNJ interpretations of the findings. A few summary observations merit special mention.

1) In the **Pediatric Health Screenings** document I say that I don't believe the conclusions in the last paragraph necessarily follow from the data presented. Rather than making an unsupported (though common-sensical) claim that the toxic exposures from the landfill should be minimized, I would focus on the inability of this study to make meaningful statements regarding health because of its serious limitations. The biases likely to be present mitigate against any substantive interpretation. In fact, given the high probability of bias and the researchers' almost certain prior awareness of this likelihood, I can't think of any scientific justification for having carried out this investigation. The political justification is apparent.

2) Sally Smith's rough draft was rough enough that I assume you gave it to me for background information only. Within this context, I have major difficulties with a) the statistical methods and presentations; b) the wordy narrative -- tabular presentation of much of the material would be more effective; c) the lack of importance (not "significance") of the differences reported between children "close" (distance never defined) to the landfill and those farther away; d) the absence of exposure information; and e) the limited biological plausibility of her arguments and her failure to substantiate concluding statements in the last paragraph.

3) The problem of biases is, again, my main concern in the **Demographic Profile** (a misnomer because of the health outcome information sought). Again, I wondered why no discussion was offered of the biological plausibility of landfill emissions causing the health outcomes in question.

4) In the Task Group Cancer Investigation (1979-1987) I would emphasize the results (negative) and the possible reasons for the flat SIRs, given the methods used, not the inability to assess probably meaningless landfill exposures. As with the other documents, I question the biological plausibility of statements made in the last two paragraphs.

5) Inhalation appears to be the potential exposure route of greatest concern to citizens and researchers, and asthma is a respiratory outcome which features fairly prominently in the **Pediatric Health Screenings** document. I find the idea that landfill emissions might cause or exacerbate existing asthma most unlikely. Without a comprehensive description of air contaminants or an assessment of their concentrations it is, of course, not possible to rule out entirely, although the reduced sulfur compounds and hydrocarbons generally associated with landfills do not elicit bronchospasm. I also find it unlikely that emissions from other compounds stored in the landfill (e.g., formaldehyde) would reach concentrations high enough to affect asthmatic children. It seems improbable, too, that day-to-day activities at the landfill (truck and bulldozer traffic) would be sufficient to generate dust carrying other bronchosensitizers (e.g., heavy metals) far enough and at high enough concentrations to affect respiratory health.

My colleague, Marian Marbury, and I studied asthma in children living near an oil refinery in a Minneapolis suburb from 1988 to 1991. We found, even there, with a facility belching approximately 6000 tons of sulfur dioxide into the air per year, air pollution levels were extremely low to nondetectable in neighborhoods closest to the refinery. Like you, we found an inverse relationship of asthma prevalence with distance of the children's homes from the refinery which we validated in medical records, but we could not attribute the difference in prevalence to outdoor air pollution levels. This is not an unreasonable conclusion since outdoor air pollution concentrations are generally lower than indoor concentrations and, on average, the vast majority of one's time is spent indoors. I am sending reports detailing this series of studies under separate cover for your information.

6) Probably the most fundamental issue that should be considered before attempting an effort like the Global Landfill/Sommers Brothers investigation is whether it is even feasible to carry out a study relating environmental exposures to health outcomes. In 1985, the Section of Chronic Disease and Environmental Epidemiology of the Minnesota Department of Health published a report dealing with just this topic entitled, **Feasibility of Community-wide Epidemiologic Studies of Drinking Water and Health: St. Louis Park & New Brighton**. They concluded that it was not feasible. I am also sending a copy of this report under separate cover. While the circumstances investigated in Minnesota are not, of course, identical to your investigation, some themes are common to both, e.g., limited assessment of exposure, range of health outcomes examined, long latencies for most cancers, multiple risk factors for cancer, multiple exposures to potential carcinogens, population mobility, and the need for large study populations to make study meaningful. These are summarized on pages E-6 to E-10 of the report. The main message conveyed by the Minnesota study is that it is prudent not to carry out such investigations because 1) they can almost never yield meaningful information, and 2) the savings in cost and time derived from not pursuing these investigations can be diverted to substantive efforts.

I want to thank you for the opportunity to review the Global Landfill/Sommers Bros. investigation. I found it very informative and stimulating, and I hope my comments have helped you in some way. If you have questions about anything I have written here or on the typescripts, please feel free to call me at (612) 623-5216.

Sincerely yours,

A handwritten signature in cursive script that reads "Jack Brondum". The signature is written in black ink and is positioned above the typed name.

Jack Brondum, DVM, MS

Epidemiologist

Section of Chronic Disease and Environmental Epidemiology



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

November 22, 1991

Mr. Michael Berry
Research Scientist
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Dear Michael:

Thank you for the opportunity to review the Task Group cancer investigation, demographic profile, and pediatric health screening. I focused primarily on the cancer section with some comments on the other sections. My comments are directly on the individual drafts. Overall, the sections are well-written and concisely describe both methods and results. Several of my comments relate to sources of bias which are invariably easier to identify than to correct in epidemiological studies.

Please let me know if there is any further assistance I can provide.

Sincerely,

Margaret G. Conomos

Margaret G. Conomos, M.P.H.
Exposure Evaluation Division
(TS-798)

Enclosure