

**Dover Township  
Childhood Cancer Investigation  
Public Health Response**

**Progress Report**

March 2001

A Summary of Activities Conducted Jointly by the  
**New Jersey Department of Health and Senior Services  
and the  
Agency for Toxic Substances and Disease Registry**



# Table of Contents

Background . . . . .	1
Major Elements of the Dover Township Childhood Cancer Investigation . . . . .	2
Site Public Health Assessments and Consultations . . . . .	5
Reich Farm Public Health Assessment . . . . .	5
Dover Township Municipal Landfill Public Health Assessment . . . . .	7
Ciba-Geigy Public Health Assessment . . . . .	8
Ciba Geigy Proposed Remediation Health Consultation . . . . .	9
Toms River Post Office Public Health Consultations . . . . .	10
Exposure Assessment and Environmental Characterization . . . . .	11
Drinking Water Quality Analyses Public Health Consultation . . . . .	11
Ongoing Community Water Supply Monitoring . . . . .	13
Exposure Investigation of Private Wells, Soils and Sediments . . . . .	13
Monitoring Wells at Reich Farm, Ciba-Geigy and Dover Township Municipal Landfill . . . . .	13
Community Water-Distribution System Model . . . . .	14
Air Emissions Source Exposure Model . . . . .	14
Ambient Air Monitoring Study . . . . .	15
Historic Dust Deposition Study . . . . .	15
Toxicological Evaluations . . . . .	16
Epidemiologic Investigations . . . . .	17
Case-Control Study of Childhood Cancer in Dover Township . . . . .	17
Study Planning and Development . . . . .	17
Interview Study . . . . .	17
Birth Records Study . . . . .	18
The Interim Report . . . . .	18
Highlights of the Interim Report Findings . . . . .	19
Next Steps in the Dover Township Case-Control Study . . . . .	21
ATSDR Brain Cancer Studies . . . . .	22
Multi-Site Ecologic Brain Cancer Study . . . . .	22
Multi-State Case-Control Study of Brain Cancer . . . . .	22
Community and Health Professional Outreach and Education . . . . .	23
Community Members . . . . .	23
Health Care Providers . . . . .	23
ToxRAP S Toms River Student Education Program . . . . .	24
Resources For More Information . . . . .	25

## Background

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In March 1996, residents of Dover Township, Ocean County met with state, federal, and local officials to voice concerns about childhood cancer in the community. In response, the New Jersey Department of Health and Senior Services (NJDHSS), the federal Agency for Toxic Substances and Disease Registry (ATSDR), and the Ocean County Health Department (OCHD), with input from the Citizens Action Committee on Childhood Cancer Cluster (CACCCC), developed a “Public Health Response Plan” to investigate childhood cancers and environmental concerns in Dover Township in June 1996.

The plan defined the actions that the state and federal health agencies would take, including: assessments of potential public health impacts of hazardous sites in the community; an updating and re-evaluation of childhood cancer statistics; extensive testing of the community water supply; involvement of New Jersey in a multi-state childhood cancer study; and community and health care provider education.

*The Public Health Response Plan (PHRP) outlined the work planned by NJDHSS and ATSDR in 1996. Since then, the scope of work has broadened to include environmental monitoring and an epidemiologic study to examine the possible roles of environmental and other factors in childhood cancer.*

*The purpose of all the activities undertaken as part of and in addition to the PHRP is twofold: to learn what we can about risk factors for childhood leukemia and brain and nervous system cancers, and to address concerns voiced by the community about local environmental contaminants.*

In the time since the plan was developed, the NJDHSS and the ATSDR have expanded the original scope of work outlined in the Public Health Response Plan. Environmental testing (to supplement data collected by state and federal environmental agencies) was expanded to include ongoing monitoring of the community water supply, testing of hazardous site monitoring wells, and evaluations of private well, soil and sediment quality. In 1997, based on findings of the updated cancer statistics analysis and environmental information, the NJDHSS and the ATSDR began an exploratory case-control epidemiologic study to examine possible risk factors for certain childhood cancers, including environmental contamination issues.

The CACCCC holds monthly community meetings to provide a forum for public discussion of the childhood cancer investigation in Dover Township. The NJDHSS, the ATSDR, state and federal environmental agency representatives, and

officials from local government participate in these meetings to respond to questions and concerns, and provide updates on the progress of the investigation.

This Progress Report, the third in a series, summarizes the current status of the Dover Township childhood cancer investigation. The report begins with a chart outlining the major elements of the investigation, followed by detailed descriptions of each of the activities. The report ends with a directory of resources for further information.

## Major Elements of the Dover Township Childhood Cancer Investigation

Activity	Elements *	Status
<i>Site Public Health Assessments and Consultations</i>	<b>Reich Farm Public Health Assessment</b>	<b>Draft for public comment released August 1999; final document completed March 2001</b>
	<i>Dover Township Municipal Landfill Public Health Assessment</i>	<i>Draft for public comment released August 1999; final document completed March 2001</i>
	<b>Ciba-Geigy Public Health Assessment</b>	<b>Draft for public comment released February 2000; final document completed March 2001</b>
	<i>Toms River Post Office Public Health Consultations</i>	<i>Completed September 1997 and July 1998</i>
	<i>Ciba-Geigy Proposed Remediation Public Health Consultation</i>	<i>Completed August 2000</i>
<i>Exposure Assessment and Environmental Characterization</i>	<b>Drinking Water Quality Analyses Public Health Consultation</b>	<b>Draft for public comment released November 1999; final document completed March 2001</b>
	<i>Community water supply monitoring</i>	<i>Ongoing</i>
	<i>Private well, soil and sediment testing</i>	<i>Completed 1997</i>
	<i>Monitoring well testing</i>	<i>Ongoing</i>
	<i>Ambient air monitoring for volatile organic compounds (EOHSI)</i>	<i>Completed 1998 - 1999</i>
	<i>Historic dust deposition study (EOHSI)</i>	<i>Ongoing</i>

Activity	Elements *	Status
<b><i>Exposure Assessment and Environmental Characterization, continued</i></b>	<i>Water distribution system modeling (in support of the epidemiologic study)</i>	<i>Ongoing</i>
	<i>Air pollutant source modeling (in support of the epidemiology study, EOHSI)</i>	<i>Completed; report in preparation</i>
	<b>Compendium of Dover Township known contaminated sites (NJDEP)</b>	<b>Completed 1996</b>
<b><i>Epidemiological Investigations</i></b>	<b>Childhood Cancer Incidence Analysis, 1979 - 1995</b>	<b>Completed December 1997</b>
	<i>Case-Control Study of Childhood Cancer, Dover Township, 1979 - 1996</i> <ul style="list-style-type: none"> <li>• <i>Study Design</i></li> <li>• <i>Interview and Birth Records Data Collection</i></li> <li>• <i>Environmental Exposure Assessments</i></li> <li>• <i>Data analysis and report preparation</i></li> </ul>	<i>Ongoing</i> <ul style="list-style-type: none"> <li>• <i>Completed 1997</i></li> <li>• <i>Completed 1999</i></li> <li>• <i>Ongoing</i></li> <li>• <i>Interim Report released December 1999; final report planned by the end of 2001</i></li> </ul>
	<b>Multi-site Ecologic Brain Cancer Study for NJ (ATSDR)</b>	<b>Completed 1998</b>
	<i>Multi-state Case-Control Study of Brain Cancer (ATSDR)</i>	<i>Ongoing</i>
<b><i>Toxicological Evaluations</i></b>	<i>Toxicological Consultation for styrene-acrylonitrile trimer and nine additional compounds</i>	<i>Completed 1997</i>
	<i>Participation in research plan for evaluation of trimer</i>	<i>Ongoing</i>

Activity	Elements *	Status
<i>Toxicological Evaluations, continued</i>	<i>Toxicological Consultation for 10 tentatively identified compounds (TICs)</i>	<i>Completed November 2000</i>
	<i>Toxicological Consultation for additional tentatively identified compounds (TICs)</i>	<i>In progress</i>
<i>Community and Health Professional Outreach and Education</i>	<b>Participate in and provide current status at monthly CACCCC meetings</b>	<b>Ongoing</b>
	<b>Develop and distribute Citizen's Guides with each report</b>	<b>Ongoing; seven completed to date</b>
	<b>Distribute Resource Guides to Ocean County health care providers</b>	<b>Completed</b>
	<i>Develop and distribute Health Care Provider Updates for physicians in Ocean County and Toms River school nurses</i>	<i>Ongoing; seven provided to date</i>
	<i>Conduct a one-day seminar to local school nurses on children's environmental health issues</i>	<i>Completed November 1998</i>
	<i>Provide teachers with information and resources on environmental health (EOHSI)</i>	<i>Completed September and October 2000</i>
	<b>Develop and distribute Progress Reports describing ongoing activities and providing background information</b>	<b>Ongoing; three provided to date</b>

\* **Items in bold** are elements of the Public Health Response Plan. *Items that are italicized* are expanded activities.

## Site Public Health Assessments and Consultations

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As part of the Public Health Response Plan, the NJDHSS committed to develop Public Health Consultations on the two “Superfund” hazardous waste sites on the National Priorities List (NPL) in Dover Township: the Ciba-Geigy Corporation site and the Reich Farm site. The Ciba-Geigy and Reich Farm health consultations were expanded in scope to become Public Health Assessments. A third Public Health Assessment was added to address issues relating to the Dover Township Municipal Landfill and the nearby Silverton area private well contamination. The NJDHSS also committed to preparing a Public Health Consultation describing the extensive water quality testing conducted on the community water supply. Two additional Public Health Consultations with environmental characterizations were developed by ATSDR

to discuss issues relating to the Toms River Post Office. Finally, ATSDR has completed a Public Health Consultation reviewing proposed remedial plans at the Ciba-Geigy site.

*A Public Health Assessment is a comprehensive review of environmental and public health data related to a hazardous site, to determine whether people have been exposed to site contaminants, possible health impacts of exposure, and the need for follow-up health actions.*

*A Public Health Consultation is similar to a Public Health Assessment, but focuses on a single issue or narrow question relating to an environmental exposure.*

### ***Reich Farm Public Health Assessment***

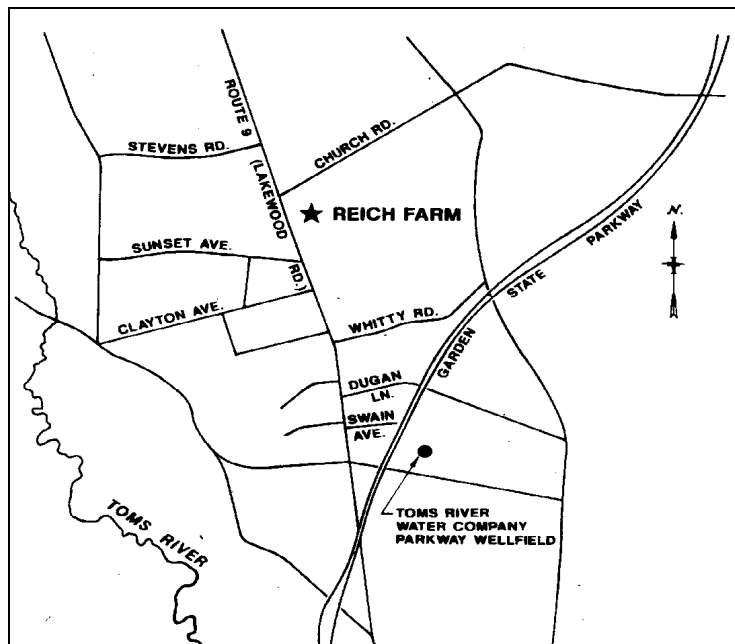
The Reich Farm Public Health Assessment examined site-related contaminant data, collected by state and federal environmental agencies as well as by the NJDHSS and the ATSDR, and evaluated actual and potential human exposures to those contaminants. A draft of the document

*Public Health Assessments are usually released for public comment before being finalized. Public input is sought throughout the planning and development of the documents, and the public comment process provides an additional, formal means of receiving and addressing public concerns.*

for public comment was released in August 1999 at a meeting of the CACCCC, and the final document was completed and released at a CACCCC meeting in March 2001.

In 1971, over 4,500 drums of chemical waste were illegally dumped at the Reich Farm. This led to local soil contamination and subsequent discharge to groundwater. As early as 1974, organic chemicals were found in water from private wells in Pleasant Plains near the Reich Farm site, as contamination spread away from the site. In 1986, additional private wells in Pleasant Plains and certain community water

supply wells about one mile from the site (at the Parkway well field) were found to be contaminated with volatile organic compounds. Contaminants included trichloroethylene, tetrachloroethylene, and others. It is not known with certainty when contaminants from the Reich Farm may have first impacted the Parkway well field.



**Reich Farm and surrounding area**

In 1996, testing of the community water supply revealed the presence of a previously undiscovered contaminant, styrene-acrylonitrile trimer, in several of the wells in the Parkway well field (see “Supplemental Environmental Characterization” below). This compound, which had been present but unidentified in earlier water quality tests, was one of the chemicals dumped at the Reich Farm site in 1971.

Exposure to Reich Farm-related contaminants has been eliminated or reduced between 1974 and the present through a number of actions required by local, state and federal environmental agencies, including:

- the removal of the 4,500 drums on the Reich Farm property in 1972 and 1974, preventing any additional materials in the drums from entering into the environment;
- the removal of contaminated soil from the site in 1974, and removal and treatment of additional soils in 1995;
- the sealing of many private wells in the area in 1974 and 1976, and the establishment of a well restriction zone, creating an area in which no new wells could be installed;
- the installation of air strippers on two community water supply wells to remove volatile organic compounds in 1988;
- treatment of water from two Parkway well field wells (#26 and #28) with activated carbon to remove styrene-acrylonitrile trimer beginning in 1996, and treatment of water from two additional wells at the Parkway well field (#22 and #29) beginning in 1999;
- installation of a new well (#26b) which, along with wells #26 and #28, controls the Reich Farm groundwater plume by preventing contaminated water from spreading to other wells.

The Reich Farm Public Health Assessment concluded that the site represented a public health hazard because of past exposures to organic compounds in drinking water. It also concluded that, because of actions taken to interrupt human exposure to site-related contaminants, the site represents no apparent public health hazard at the present time. The NJDHSS and the ATSDR recommended that the site be considered in the epidemiologic investigation of childhood cancer, and that monitoring of the groundwater and the effectiveness of treatment systems should be continued.

***Dover Township Municipal Landfill Public Health Assessment***



The Dover Township Municipal Landfill (DTML) Public Health Assessment examined environmental data related to the landfill. The landfill had accepted municipal and other wastes from 1956 to 1981. In addition, drums of waste from Union Carbide, also dumped at Reich Farm, were deposited at the DTML. Based on community concerns, the DTML Public Health Assessment also reviewed data from an investigation of private wells in the Silverton area of Dover Township (more than one mile east of the landfill). The Public Comment Draft of this Public Health Assessment was released in August 1999 at a meeting of the CACCCC, and the final document was completed and released at a CACCCC meeting in March 2001.

The DTML site contaminated nearby private wells on Silverton Road with volatile organic compounds and lead. The NJDHSS and the ATSDR concluded that residents were exposed in the past to contaminants through use of these wells; for this reason, the DTML represented a public health hazard in the past. In the late 1980s, these wells were sealed. The DTML is considered to represent no apparent public health hazard at present, because there are no known current exposures to contaminated ground water. Groundwater investigations currently being conducted by Dover Township will help determine the nature and extent of site-related contamination.

The Silverton area private well contamination is considered to have represented a public health hazard because of past exposures. Water samples from many of the wells contained more than one volatile organic compound at levels well above health comparison levels. Since these wells are no longer in use (as of the early 1980s), the area poses no public health hazard at the present time. A source of the environmental contamination in the Silverton area was never established by the NJDEP.



**Dover Township Municipal Landfill (DTML)  
and surrounding area**

The Dover Township Municipal Landfill Public Health Assessment supports the need to consider the potential for exposures discussed in the document in the epidemiologic study of childhood cancer in Dover Township.

## ***Ciba-Geigy Public Health Assessment***

The Ciba-Geigy Public Health Assessment examines the potential for human exposure to contaminants in multiple environmental media. A draft of the document for public comment was released in February 2000 at a meeting of the CACCCC, and the final document was completed and released at a CACCCC meeting in March 2001.

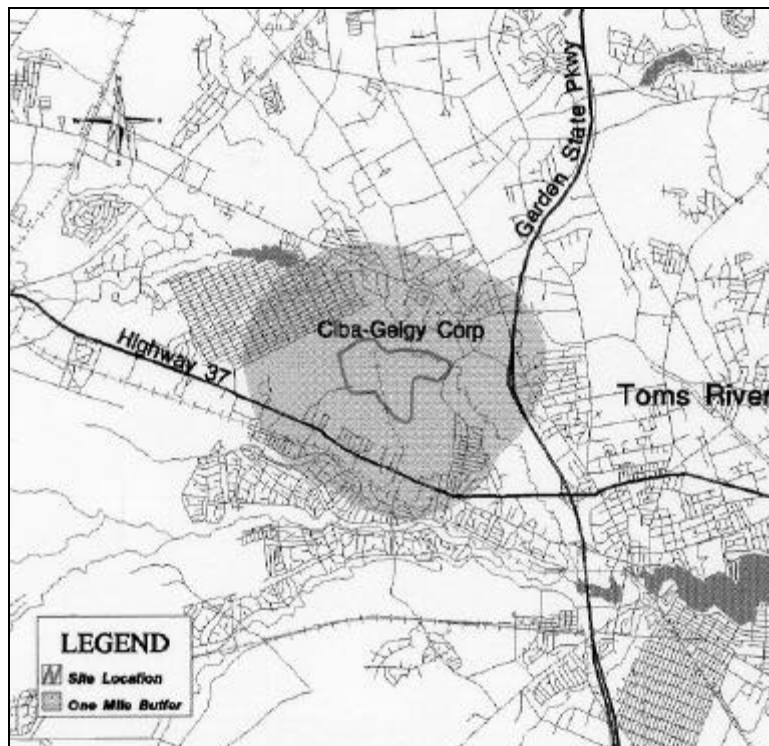
Three shallow wells (of the Holly Street Well Field) were located adjacent to the Toms River downstream from the site. In 1965 and 1966, contaminants relating to the site, including dyes, were detected in water from these wells. These wells were eventually sealed. Community supply wells currently in use are not impacted by the site. In the mid-1980s, volatile organic compounds (VOCs) were found in water samples from several private residential wells used for irrigation in the vicinity of Cardinal Drive and Oak Ridge Parkway. These wells have been sealed. Presently, no private wells in use are known to be impacted by the site.

From 1966 to 1991, treated wastewater from the Ciba-Geigy plant was discharged to the Atlantic Ocean by way of a ten-mile long pipeline which ran through Dover Township (mostly along Mapletree and Bay Avenues), beneath the Barnegat Bay, and through Ortley Beach, ending approximately 3,500 feet into the ocean. Several pipeline

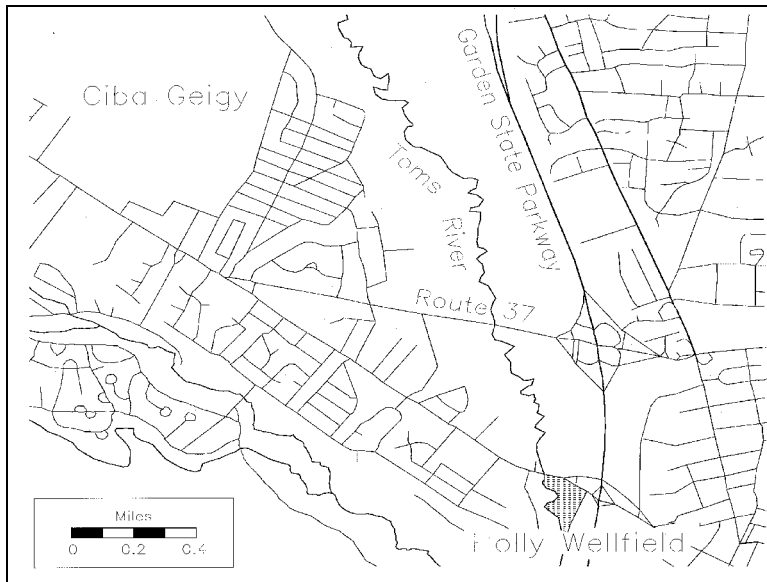
breaks were reported in the mid to late-1980s, resulting in uncontrolled discharges of treated wastewater. Potentially contaminated soils were removed and replaced with clean soils when pipeline breaks were repaired. Samples from private wells along the pipeline were tested for VOCs and heavy metals between 1987 and 1993. No pipeline-related contamination was found, although lead, mercury, and low levels of VOCs were found in several wells. The sources of these substances are uncertain, but they are unlikely to be related to pipeline spills.

Off-site air (in the marshlands of Winding River Park) was sampled in 1986. Several VOCs used at Ciba-Geigy were detected at levels above background, including benzene, chlorobenzene, and chloroform.

The NJDHSS and the ATSDR have determined that there was a completed exposure pathway to dyes and other chemicals from the Holly Street well field of the community water supply in the mid-1960s. Although the nature and length of exposures is not known, there is evidence that



**Ciba-Geigy site and surrounding area**



**Holly Street wells and Ciba-Geigy site**

groundwater from these wells were contaminated with dyes and nitrobenzene. Dye production involved the use of a number of chemicals, including known and probable human carcinogens.

VOCs, including benzene, chloroform, trichloroethylene (TCE), and tetrachloroethylene (PCE) were found in private irrigation wells in the Cardinal Drive/Oak Ridge Parkway area. The health risks associated with these compounds are dependent upon the degree of exposure from these private wells. The contaminants include known and probable

human carcinogens.

The NJDHSS and the ATSDR conclude that the Ciba-Geigy site was a public health hazard because of past exposures. Current conditions indicate that, although groundwater remains contaminated, exposure through drinking water has been interrupted. With the closure of operations at the plant, the air pathway is interrupted. Also, plant security measures have likely interrupted potential exposures of trespassers to on-site soils. Therefore, the site represents no apparent public health hazard under present conditions. Because on-site source areas remain contaminated, access restriction and remediation of these areas is essential to prevent further contamination of groundwater and the potential for future human exposure pathways to site-related contaminants.

The Ciba-Geigy Public Health Assessment supports the need to consider the potential for site-related exposures in the epidemiologic study of childhood cancer in this community.

***Ciba Geigy Proposed Remediation Health Consultation***

In response to a request from the CACCCC, ATSDR evaluated the public health implications related to the Environmental Protection Agency's (EPA) proposed remedial alternative for contaminated soils at the site (*Draft Final Report: Bioremediation Composting Pilot Study, Ciba-Geigy Superfund Site, Dover Township, New Jersey*. USEPA, July 2000). ATSDR's analysis of the proposed clean-up strategy determined that EPA's proposed remediation strategy will be protective of public health over the long term and that proposed deed restrictions will provide an additional safeguard to protect public health from contaminants that remain in soils after treatment. ATSDR recommends appropriate environmental monitoring to ensure that remedial activities perform as expected, that a system be established to ensure the appropriate enforcement of deed restrictions, and that site workers follow safe working practices.

***Toms River Post Office Public Health Consultations***

In response to concerns by postal employees and their union representatives, a United States Senator from New Jersey requested that ATSDR review environmental sampling results and health concerns regarding the Toms River General Post Office.

ATSDR conducted an analysis of historical environmental monitoring information. A health consultation, which was finalized in September 1997, concluded that the available information did not indicate that adverse health effects had been caused by chemicals in the post office's environment. ATSDR further concluded, however, that available information was insufficient to rule out the possibility of chemical exposures and the potential for adverse health effects. Collection of further data was recommended.

A second health consultation was conducted in which ATSDR worked directly with the U. S. Postal Service to collect information. This included indoor and ambient air sampling targeting a broad range of contaminants and exposure scenarios. The report was finalized on July 13, 1998 and stated that there are no chemicals in the Toms River General Post Office at levels that would be expected to present health concerns.

## **Exposure Assessment and Environmental Characterization**

To conduct the Public Health Assessments and Consultations described in the previous section, the NJDHSS and the ATSDR rely largely on the environmental investigations conducted by (or under the regulatory authority of) the U.S. Environmental Protection Agency (USEPA) or the New Jersey Department of Environmental Protection (NJDEP). At times, the NJDHSS or the ATSDR will collect supplementary environmental data to assist in the health assessment process or in epidemiologic studies. The following describes several activities undertaken by the NJDHSS or the ATSDR to better understand environmental contamination and human exposures.

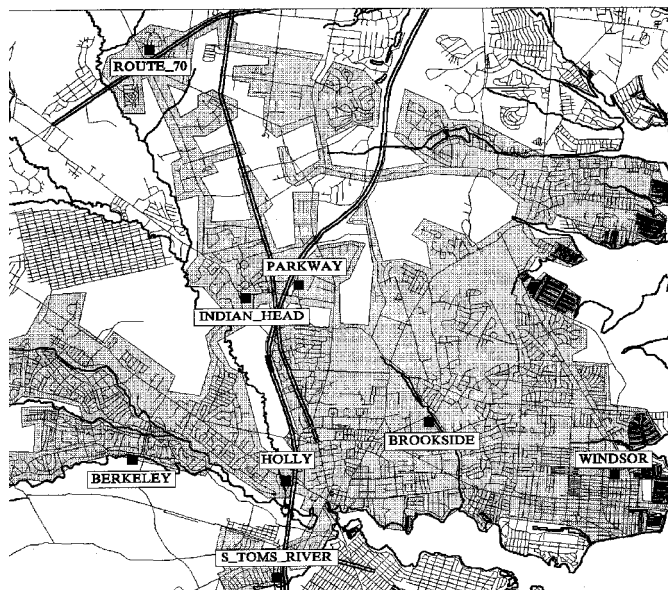
### ***Drinking Water Quality Analyses Public Health Consultation***

The Drinking Water Quality Analyses Public Health Consultation reviews and summarizes water quality data collected by the NJDHSS, NJDEP and ATSDR during March 1996 to June 1999 from the community water supply. This Public Health Consultation was developed jointly by the NJDHSS, the ATSDR and the New Jersey Department of Environmental Protection. A draft of this Public Health Consultation was released for public comment in November 1999 at a meeting of the CACCCC, and a final document was completed and released at a CACCCC meeting in March 2001.

Water was sampled and tested for over 250 chemical and radiological contaminants from 23 wells in the community supply system, 8 points of entry from the wells to the distribution system, and more than 20 locations in the distribution system, including public and private schools in the Toms River area. The purpose of the evaluation of drinking water quality of the community water supply was to identify whether there are any chemical or radiological characteristics of the water supply that are unique to this system, and, if so, whether these characteristics should be considered in the investigation of childhood cancer in Dover Township.

Several contaminants were detected, including:

*trichloroethylene, or TCE*, a volatile organic compound, in three supply wells (# 26, #28 and #29 at levels of less than 10 parts per billion) and the point of entry at the Parkway well field. It was also found in several locations in the distribution system at levels of up to 1 part per billion. The Maximum Contaminant Level (MCL) for TCE in drinking water is 1 part per billion. Water from wells #26 and #28 had been treated (by an air



**Well fields, United Water Toms River system**

stripper) to remove volatile organic compounds during the time these samples were taken. As a result of these analyses, water from well #29 was temporarily diverted through the air stripper. TCE is considered a probable human carcinogen. Epidemiologic studies in other communities have linked TCE in drinking water (at levels many times higher than those found here) to increased incidence of leukemia, but the studies are not conclusive.

*styrene-acrylonitrile (SAN) trimer*, found in two of the three wells that had TCE (#26 and #28), and sporadically detected in the third (#29). This chemical was characterized in late 1996, and had never before been identified as a contaminant in drinking water. It was also found in several of the distribution system samples. The toxicity of this compound is unknown. Tests are ongoing to learn about its potential health risk. (See “Toxicology Assessment” below.) Water from wells #26 and #28 is now being treated and pumped to waste. Water from well #29 and another nearby well (#22) is being treated for this contaminant as a precautionary measure.

*lead and copper*, found in a number of the first draw school samples (that is, water which is taken from the tap after it has been in contact with the plumbing overnight). Flushed samples (samples taken after the water has been run for a few minutes) did not have these metals. This indicates that the water entering the building is free of lead and copper, but leaches these metals from the plumbing system as the water remains in contact with the pipes, solder and fixtures. Lead is harmful to a child’s developing nervous system. Copper can cause gastrointestinal effects. School officials have been advised to run water before it is used each morning.

*radiological activity*, detected in a number of distribution samples, four points of entry, and several wells that draw from the shallow Kirkwood-Cohansey aquifer. This naturally occurring radioactivity comes from the decay of radium. Epidemiologic studies have linked exposure to radium in water with increased risk of leukemia in adults, but not children, and with bone cancer in adolescents, although these studies alone do not prove a causal connection.

SAN trimer is a by-product of plastics manufacturing, and is a known contaminant from the Reich Farm site. This unusual chemical is a distinctive characteristic of this water supply. TCE is a contaminant that has been frequently found in water supplies across the country. Lead and copper are often found in first draw samples in buildings with lead solder and copper pipes, particularly in areas where water is naturally corrosive. The natural radiological activity has been found to be widespread in southern New Jersey.

The NJDHSS, the NJDEP and the ATSDR recommend that treatment for water from wells impacted by the Reich Farm contamination be continued until the plume no longer threatens the wells; that the use of wells with higher radiological activity should be minimized; and that schools with elevated lead and copper levels should continue to run water at fountains each morning for a minute or two. The Public Health Consultation also recommends that the NJDHSS consider use of water from specific points of entry in the case-control epidemiologic study of childhood cancer in Dover Township, as a measure of possible exposure.

### ***Ongoing Community Water Supply Monitoring***

Water from the Parkway well field continues to be tested frequently for contaminants related to the Reich Farm groundwater contamination plume. Samples undergo enhanced testing beyond that which is required under state and federal drinking water regulations. Water quality reports continue to be provided to the community regularly through monthly CACCCC meetings.

As discussed in the previous section on Reich Farm, there are several treatment systems presently in place at the Parkway well field. The effectiveness of these treatment systems to remove contaminants is also being monitored regularly. Treated water from Parkway well field wells #26 and #28 is pumped to waste, but may be used in times of high water demand. As a preventive measure, water from wells #29 and #22 began treatment in June 1999.

### ***Exposure Investigation of Private Wells, Soils and Sediments***

To support the Ciba-Geigy, Reich Farm, and Dover Township Municipal Landfill Public Health Assessments, 54 homes with private wells were tested in 1997 to measure groundwater quality. Chemical analyses found low levels of several contaminants (including lead and volatile organic compounds) in some private wells, but there was no indication that contaminants were related to the sites discussed in previous sections. As with the shallow community supply wells, elevated radiological activity was found in several of the private wells. Each homeowner was provided with individual results, as well as information on appropriate treatment options.

The NJDHSS also sampled soils in the vicinity of known or suspected breaks in the Ciba-Geigy pipeline, and sediments in the Toms River and a creek near Brookside Drive. Soil and sediment analyses did not reveal any site-related contamination.

The NJDHSS and the ATSDR are preparing a Public Health Consultation summarizing the private well, soil and sediment data. This document is expected to be completed in the Spring of 2001.

### ***Monitoring Wells at Reich Farm, Ciba-Geigy and Dover Township Municipal Landfill***

In cooperation with the USEPA, the NJDEP, and the parties responsible for site clean-up, the NJDHSS collected and analyzed representative samples from monitoring wells at or near the Reich Farm, Ciba-Geigy, and Dover Township Municipal Landfill sites. These samples served to verify the nature and extent of groundwater contamination associated with these sites.

The NJDHSS and the ATSDR are preparing a Public Health Consultation summarizing the monitoring well water sampling results. This document is expected to be completed in the Spring of 2001.

### ***Community Water-Distribution System Model***

The ATSDR has developed, calibrated and tested a computer model (for 1998 conditions) that simulates the United Water Toms River (UWTR) water-distribution system serving the Dover Township area. Development of this model was a necessary first step to reconstruct historic water distribution characteristics. The historic distribution of water from different water sources, determined from the modeling process, will be used to estimate exposures to the different water sources in the case-control epidemiologic study (see the next section).

The computer model of the 1998 water-distribution system includes over 16,000 pipe segments, 23 wells, 3 elevated and 6 ground-level tanks, and 12 high service or booster pumps valves. Staff of the ATSDR and the NJDHSS collected field measurements of water pressure, storage tank water levels, and pump and well operations in the water-distribution system during winter-demand conditions in March 1998, and calibrated the model using these data. The ATSDR then verified the model with a second set of data gathered during peak-demand conditions in August 1998. In December 1998, the ATSDR convened a group of internationally recognized experts in hydraulics and modeling of water-distribution systems to review the ATSDR modeling approach and progress to date. The panel suggested minor modifications, but the consensus was that ATSDR was using the appropriate approach.

In June 2000, the ATSDR released a report of this modeling effort and presented it to the public at a CACCCC meeting. In January 2001, ATSDR staff completed the reconstruction of 420 monthly historical water-distribution system models (from January 1962 to December 1996) for use in the epidemiologic study. After peer review, the ATSDR is planning to release a report of the historical modeling in September 2001.

### ***Air Emissions Source Exposure Model***

The Environmental and Occupational Health Sciences Institute (EOHSI), part of the University of Medicine and Dentistry of New Jersey and Rutgers University, has developed computer models to estimate the potential for historic dispersion of air pollutants from the Ciba-Geigy facility in Dover Township and the Oyster Creek Nuclear Generating Station located about ten miles to the south. These two facilities were chosen because of community concerns, and because Ciba-Geigy was a major air emissions source in Dover Township in the past. Like the water modeling described above, this model is being used to estimate potential exposures to different air pollution sources in the case-control epidemiologic study (see the next section).

The air model utilizes historic weather data (and pollutant emission data when available) to determine how pollutants from specific locations may have spread or dispersed in the community. EOHSI developed models to estimate air dispersion of pollutants for each of the 420 months from January 1962 through December 1996.

EOHSI is preparing a report of the air emissions source exposure modeling, which should be available in the Fall of 2001.



### ***Ambient Air Monitoring Study***

To gain an understanding of the present day quality of the ambient air in Dover Township at present, EOHSI collected air samples every other week for one year, from October 1998 through September 1999. Samples were collected at two locations in the township (at the West Dover elementary School and at Toms River High School South) and were tested for 19 volatile organic chemicals.

Results were compared to a similar set of samples taken in Piscataway over the same time frame, and from samples taken elsewhere in New Jersey from the early 1980s through the late 1990s. The air concentrations of the 19 volatile organic chemicals in Dover Township were similar to those in other areas of the State taken around the same time, and were generally less than those taken from earlier time periods. This decrease most likely reflects regional improvements in air quality through time due to reductions in emissions from mobile and stationary air pollutant sources.

EOHSI completed a report of this study in July 2000 and presented it at a meeting of the CACCCC.

### ***Historic Dust Deposition Study***

EOHSI has collected attic dust samples from approximately 150 houses in several areas of Dover Township (and in other parts of the State) to learn about historical deposition of particulate air pollutants. Sample collection was completed in late 1999, and analyses have been completed for heavy metals, radiological contaminants, and dyes.

EOHSI is preparing a report of the historic dust deposition study, which should be available in the Summer of 2001.

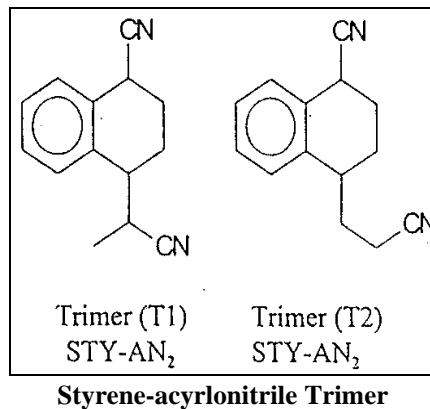
## Toxicological Evaluations

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The ATSDR has assisted the NJDHSS by researching the potential for toxicity of several chemicals of concern related to human exposure in Dover Township. In September 1997, the ATSDR completed an evaluation (Chemical-specific Toxicological Consultation) for specific dyes, dye intermediates, SAN trimer, and other chemicals. This evaluation consisted of a thorough review and summary of available toxicological data, as well as a review of chemical exposures potentially related to central nervous system cancers, leukemias and other diseases.

The ATSDR and the NJDHSS are also participating in the USEPA's effort to develop research protocols for toxicological testing of the SAN trimer. The USEPA has worked closely with the National Institute of Environmental Health Sciences (NIEHS), the New Jersey Department of Environmental Protection (NJDEP), a consultant to the Ocean County Health Department, and Union Carbide to develop these research plans.

The NJDEP has evaluated the potential for other chemicals to be present in the Reich Farm groundwater contamination plume. The ATSDR is evaluating the toxicological information available on those chemicals tentatively identified by the NJDEP. In November 2000, the ATSDR completed and released a Chemical-specific Health Consultation on 10 of these substances. The ATSDR is presently evaluating additional chemicals and expects to release another Chemical-specific Health Consultation in October 2001.



# Epidemiologic Investigations

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## Case-Control Study of Childhood Cancer in Dover Township

*The Childhood Cancer Incidence Analysis Health Consultation*, completed and released by the NJDHSS and the ATSDR in December 1997, confirmed the elevated rates for certain childhood cancers in Dover Township. Because of concerns about these rates and a possible link with environmental factors, a case-control study was designed and is currently underway in the community. The Case-Control Study of Childhood Cancer in Dover Township (Ocean County) is an exploratory epidemiologic study. Its purpose is to identify possible risk factors that might explain why there has been an increased rate of leukemia and nervous system cancers in children of Dover Township.

*A case-control study compares the histories of persons with a disease (cases) to those without the disease (controls). Experiences or characteristics that occurred more frequently in cases than controls may be risk factors for the disease.*

### *Study Planning and Development*

The NJDHSS began to design the study, with assistance from the ATSDR, in 1997. A protocol outlining a proposed design was reviewed and approved by the NJDHSS Institutional Review Board to ensure appropriate interactions with study participants. The protocol was also reviewed and critiqued by an expert panel convened by the NJDHSS, by a peer review panel convened by the ATSDR, and by “stakeholders” in the outcome of the study. The NJDHSS made adjustments to the study design in response to comments from these groups. A detailed Procedures Manual was developed as a companion to the protocol, and has also undergone review by a panel of experts selected by the NJDHSS, as well as by the stakeholders.

*Stakeholders are groups outside of the NJDHSS and the ATSDR with an interest in the study, and include the CACCCC, Dover Township government, Ocean County Health Department, Ciba Specialty Chemicals (Ciba-Geigy), Union Carbide Corporation, United Water Toms River, the NJDEP, and the USEPA.*

The study has two separate elements, each of which is a case-control study. One element uses interviews to gather information on the

subjects; the second uses birth records. These studies are described below.

### *Interview Study*

The interview study is a collection and analysis of data obtained through interviews of the families of children who were diagnosed with leukemia, brain, central nervous system, or

sympathetic nervous cancer during the time period from 1979 through 1996. Parents of children with cancer (cases) were interviewed, as were parents of children who did not develop cancer (controls). As part of the interview, parents were asked specific questions about family medical history, mother's pregnancy history, mother's and child's residence histories, parental occupations, mother's and child's illnesses, medications, medical procedures, diet, tap water use, and potential exposures to certain chemicals and biological agents.

Interviews began in early 1998 and ended in early 1999. Forty (40) cases and 159 controls were interviewed for this study. All eligible case families participated. The participation rate among controls was 80%, indicating that those interviewed represent an appropriate group for comparison.

### ***Birth Records Study***

The Birth Records Study collected data from birth certificate records from the years 1964 to 1996 on children who were born in Dover Township, and diagnosed with any type of cancer during the study years (1979 through 1996) while living anywhere in New Jersey. Each case was compared to ten controls born in the same year as the case, and drawn from a sample of all children born in Dover Township. Cancer registries in nine other states were surveyed to learn if children diagnosed with cancer in those states were born in Dover Township. No additional cases were identified.

Birth certificate data were collected in 1998 for 48 cases and 480 controls. From the birth certificates, the NJDHSS extracted information related to pregnancy and birth characteristics and mother's residence at the time of the child's birth.

### ***The Interim Report***

The NJDHSS and the ATSDR released an Interim Report of the Case-Control Study of Childhood Cancers in Dover Township at a December 1999 meeting of the CACCCC. The purpose of the Interim Report was to inform residents of the progress of the study, and to provide the results of the preliminary analyses conducted. The Interim Report contains information from case and control children and families on the following groups of factors:

- demographic, pregnancy and birth characteristics,
- family medical history,
- health, medical conditions and medical procedures,
- dietary factors,
- exposure to tobacco smoke and alcohol, and
- household exposures to chemicals, animals, and household appliance electromagnetic fields.

The highlights of the information collected and analyzed are presented on the following pages.

## Highlights of the Case-Control Study Interim Report

<i>Similar Between Cases and Controls</i>	<i>More Common in Cases Than Controls</i>	<i>More Common in Controls Than Cases</i>
<b>Demographic, pregnancy and birth characteristics (Interview Study)</b>		
<ul style="list-style-type: none"> <li>▶ <i>child's birth weight</i></li> <li>▶ <i>age of mother at time of child's birth</i></li> <li>▶ <i>mother's previous adverse pregnancy outcomes</i></li> </ul>	<ul style="list-style-type: none"> <li>▶ <i>mother having four or more total births (for leukemia cases)</i></li> </ul>	
<b>Demographic, pregnancy and birth characteristics (Birth Records Study)</b>		
<ul style="list-style-type: none"> <li>▶ <i>age of mother at time of child's birth</i></li> <li>▶ <i>complications of labor and delivery</i></li> </ul>	<ul style="list-style-type: none"> <li>▶ <i>high birth weight</i></li> <li>▶ <i>complications of pregnancy (for nervous system cancers)</i></li> <li>▶ <i>less than adequate prenatal care (for leukemia)</i></li> </ul>	<ul style="list-style-type: none"> <li>▶ <i>being first-born</i></li> <li>▶ <i>less than adequate prenatal care (nervous system cancers)</i></li> </ul>
<b>Family medical history (Interview Study)</b>		
<ul style="list-style-type: none"> <li>▶ <i>frequency of reported inherited problems or birth defects</i></li> <li>▶ <i>family history of cancer</i></li> </ul>	<ul style="list-style-type: none"> <li>▶ <i>reported cancer in parent (for nervous system cancers)</i></li> </ul>	
<b>Health, medical conditions and medical procedures (Interview Study)</b>		
<ul style="list-style-type: none"> <li>▶ <i>mother's illnesses during pregnancy</i></li> <li>▶ <i>mother's or child's dental x-rays</i></li> <li>▶ <i>child's history of previous illnesses</i></li> <li>▶ <i>child's reported immunization history</i></li> </ul>	<ul style="list-style-type: none"> <li>▶ <i>child's use of antibiotics 10 or more days</i></li> <li>▶ <i>child's exposure to x-rays, however, this was NOT more common when x-rays one year prior to diagnosis of case child are excluded.</i></li> </ul>	

<i>Similar Between Cases and Controls</i>	<i>More Common in Cases Than Controls</i>	<i>More Common in Controls Than Cases</i>
<b>Dietary factors (Interview Study)</b>		
<ul style="list-style-type: none"> <li>▶ <i>mother's and child's daily consumption of fruits and vegetables</i></li> </ul>	<ul style="list-style-type: none"> <li>▶ <i>mother's and child's above-average daily consumption of tap water from any source (for leukemia)</i></li> </ul>	<ul style="list-style-type: none"> <li>▶ <i>mother's use of prenatal vitamins (for leukemia)</i></li> <li>▶ <i>mother's consumption of cured meats</i></li> <li>▶ <i>child's consumption of cured meats (brain/central nervous system cancers)</i></li> </ul>
<b>Tobacco smoke and alcohol use (Interview Study)</b>		
<ul style="list-style-type: none"> <li>▶ <i>mother's smoking during pregnancy</i></li> <li>▶ <i>household smoking during pregnancy</i></li> <li>▶ <i>smoking in child's household</i></li> <li>▶ <i>mother's alcohol use during pregnancy</i></li> </ul>		
<b>Household-related exposures: chemicals, animals, and electromagnetic fields (Interview Study)</b>		
<ul style="list-style-type: none"> <li>▶ <i>home pesticide use</i></li> <li>▶ <i>child living with pet</i></li> </ul>	<ul style="list-style-type: none"> <li>▶ <i>child's use of electric blanket or heated water bed (for leukemia)</i></li> </ul>	

Since the analyses of important environmental exposure assessments and parental occupational risk factors are still underway, **conclusions are premature at this point.**

For most of the risk factors discussed in this Interim Report, there were no differences between case and control children and families. For some risk factors where there were differences between the two groups, observations made in this case-control study were similar to those reported in other scientific studies. These include observations on the child's birth weight, and the mother's use of multivitamins during pregnancy. This study and some other studies report that use of electric blankets is more common in children with certain cancers than control children, although other studies do not find this association. Finally, a number of published studies show that consumption of cured meats is a risk factor for childhood cancers, particularly brain cancers, which was not found in this study.

Differences between case and control children were also observed regarding tap water

consumption. Compared to controls, mothers of leukemia cases reported consumption of higher than average amounts of tap water daily during pregnancy; this difference was not observed for mothers of cases with nervous system cancer. However, information regarding the tap water source and the length of time that the water source was used must still be evaluated before interpreting this observation.

### ***Next Steps in the Dover Township Case-Control Study***

The NJDHSS and the ATSDR are currently developing the analyses of parents' occupations, sources of drinking water, potential exposure to air pollutant sources, and residential proximity to sites of concern.

As described above, the ATSDR is developing computer models of the community water supply to reconstruct the potential for exposure to different water sources over time. The models will generate estimates of the expected percentage of water from the different well fields at each residential address of study subjects, on a monthly basis from January 1962 through December 1996. Exposure to specific sources will be determined for each study subject based on the residential histories provided during the Interview Study or on the birth record. The study will also take into account time spent on private well water sources in Dover Township.

In a similar manner, the air pollutant dispersion models developed by EOHSI are being used to assess potential for exposure to air pollutants from Ciba-Geigy and the Oyster Creek Nuclear Generating Station for study subjects over time.

From the Interview Study, occupational histories of both parents are being analyzed to assess the potential for parental exposure to chemicals and radiation sources. Industrial hygienists at the NJDHSS have completed a thorough parental occupational exposure assessment based on a review of reported job titles and descriptions, chemical exposures, and other reported activities.

Finally, residential proximity to selected sites in Dover Township will also be assessed. Sites were selected based on documentation of off-site exposures or community concerns.

A final report of the Case-Control Study of Childhood Cancers in Dover Township will undergo review by an expert panel convened by the NJDHSS, and will be submitted for peer review by the ATSDR. Once these reviews have been completed, the NJDHSS and the ATSDR will release the final report for public comment. The target date for this release is December 2001.

## **ATSDR Brain Cancer Studies**

Prior to the Dover Township Childhood Cancer Investigation, researchers at the ATSDR were conducting a preliminary investigation to learn if people living near certain contaminated sites were at increased risk of developing brain cancer. New Jersey residents were included in this study, referred to as the Multi-Site Ecologic Brain Cancer Study, as part of the Public Health Response Plan. To learn more about possible risk factors for childhood brain cancers, the ATSDR undertook a second study, the Multi-State Case-Control Study of Brain Cancer. Both of these studies are described below.

### ***Multi-Site Ecologic Brain Cancer Study***

The ATSDR multi-site ecologic study was designed to examine the rates of brain cancer among residents living near hazardous waste sites in New Jersey and five other states. This study included people of all ages diagnosed with brain cancer during the period 1986 through 1990.

The analysis for this project included descriptive statistics for brain cancer cases diagnosed in residents living within one mile of a site on the National Priorities List, and a comparison of the observed number of cases diagnosed in residents living within one mile of a site with the expected number of cases.

ATSDR provided the analysis for New Jersey to the CACCCC in April 1998. It was found that the rate of brain cancers reported within one mile of hazardous waste sites did not exceed the national norm.

### ***Multi-State Case-Control Study of Brain Cancer***

Following the ATSDR's collaboration with the NJDHSS on the investigation of Dover Township childhood cancers, the ATSDR was approached by other states to assist in similar cancer incidence investigations. Because so little is known about what causes childhood cancers, the ATSDR has developed a multi-state case-control study of childhood brain cancers. The study is designed to identify risk factors applicable to diverse areas and populations and enhance the scientific understanding of the relationship between childhood cancer and exposure to toxic substances.

The ATSDR received final approval to conduct the study from the Office of Management and Budget (OMB) in August 1999, and has begun working with the states to gather data for the study. In New Jersey, the ATSDR obtained lists of eligible cases from the NJDHSS State Cancer Registry, and has completed interviews of all case and most control families. Selection of the final control families is expected to be completed by March 2001. The ATSDR also plans to collect blood samples from a subset of the participants who were interviewed and begin laboratory analysis by early 2002.



## **Community and Health Professional Outreach and Education**

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### ***Community Members***

#### *Presentations at CACCCC meetings*

In the Public Health Response Plan, the NJDHSS and the ATSDR promised to keep residents informed of the activities and progress relating to the childhood cancer investigation. The agencies continue to meet regularly with the CACCCC and the public to provide available information and status reports on all aspects of the investigation, and address additional public health concerns, in a timely manner.

#### *Citizens' Guides to Published Documents*

A Citizens' Guide has been developed for each document released by the NJDHSS, including the three Public Health Assessments, the two Public Health Consultations, and the Interim Report of the case-control epidemiologic study. These two- to four-page summaries provide a quick overview of the report, including the findings and conclusions.

### ***Health Care Providers***

#### *Dover Township Health Care Provider Updates*

A newsletter published by the NJDHSS provides periodic updates on the investigation to physicians in Ocean County and to school nurses in the Toms River school district. Seven newsletters have been completed and distributed to date, including three since the 1997 progress report. These last three covered the updated cancer statistics analysis, provided an overview of the epidemiologic study, and reviewed the findings of the Interim Report.

The NJDHSS will continue to develop and provide updates for health care providers. Although these documents are mailed directly to health care providers, citizens can also request to be placed on the mailing list by calling the NJDHSS Field Office in Toms River at (732) 505-4188 or the Trenton Office at (609) 633-2043.

#### *Conference on Children's Environmental Health Issues*

In November 1998, the NJDHSS, the ATSDR, and the Ocean County Health Department presented a one-day conference on children's environmental health issues for school nurses. The goal of this conference was to provide school nurses with:

- basic information on children's risks from exposures to environmental hazards,
- tools for assessing environmental exposures as they relate to a child's health, and
- resources for themselves and for parents with environmental health concerns.

Materials provided included the Ocean County Resource Guide, pamphlets on drinking water contaminants and human health, and a series of one-page fact sheets on media-specific environmental contaminants. In addition to completing a regular evaluation of the program, nurses were asked how they expect to use the information and materials provided. Information gathered was used to adapt the program and materials for use in other school districts and with other pediatric nurses.

### *Pediatric Oncology Grand Rounds*

To enhance educational opportunities for health care providers in the community, the ATSDR is working with specialists to develop a series of seminars on environmental issues and children's health, including pediatric cancers. These seminars will be included on the schedule of the noon grand rounds conducted at Community Medical Center in Toms River.

### ***ToxRAP S Toms River Student Education Program***

The ATSDR provides support to the Environmental and Occupational Health Sciences Institute (EOHSI) as it expands an existing partnership with the Toms River Regional School District. A result of this collaboration is the "ToxRAP Goes to Toms River" project. Under this project we have been able to:

- expand the Toms River school district's environmental health education program through the implementation of the award winning ToxRAP curriculum series,
- train 130 teachers in the Toms River school district to teach students about the evaluation of environmental health problems using a risk assessment framework and the principles of toxicology, exposure assessment, and industrial hygiene, and
- enable approximately 3,000 students to apply the risk assessment framework to many environmental health issues and thus reduce their exposure to potential pollutants.

ToxRAP is an innovative, hands-on curriculum series designed to teach K-9 students how to evaluate an environmental health problem. Activities and lessons use a framework that draws upon concepts from toxicology, environmental health risk assessment, and risk management. Through age-appropriate investigative science, math, health, and language arts activities, students learn to recognize, evaluate, and control their exposure to contaminants.

First and third grade teachers in the Toms River school district participated in a one-day training session in the Fall of 2000 on environmental health issues for their students, and have received grade-appropriate classroom materials. Teachers expect to implement this program into their curricula in the 2000/2001 school year.

## **Resources For More Information**

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The following materials are available upon request from the New Jersey Department of Health and Senior Services. Citizens may call the NJDHSS Field Office in Toms River at (732) 505-4188 or the Trenton Office at (609) 633-2043.

### *For more information on the **Public Health Response Plan***

Public Health Response Plan.  
NJDHSS and ATSDR (June 1996)

### *For more information in **Childhood Cancer Incidence in Dover Township:***

Childhood Cancer Incidence Health Consultation: A Review and Analysis of Cancer Registry Data for Dover Township, 1979 - 1995, Technical Report, Summary, and Citizen's Guide  
NJDHSS and ATSDR (December 1997)

### *For more information on the **Site Public Health Assessments and Consultations:***

Reich Farm Public Health Assessment and Citizen's Guide  
NJDHSS and ATSDR (March 2001)

Dover Township Municipal Landfill and Silverton Private Well Contamination Investigation  
Public Health Assessment and Citizen's Guide  
NJDHSS and ATSDR (March 2001)

Ciba-Geigy Corporation Public Health Assessment and Citizen's Guide  
NJDHSS and ATSDR (March 2001)

Ciba-Geigy Corporation Public Health Consultation on Proposed Remedial Alternatives  
ATSDR (August 2000)

Toms River Post Office Public Health Consultations  
ATSDR (September 1997 and July 1998)

### *For more information on the **Exposure Assessments and Environmental Characterization:***

Drinking Water Quality Analyses, March 1996 through June 1999, United Water Toms River  
Public Health Consultation and Citizen's Guide  
NJDHSS, NJDEP and ATSDR (March 2001)

Analysis of 1996 Water-Distribution System Serving the Dover Township Area, New Jersey:  
Field Data Collection, Activities and Water-Distribution System Modeling  
ATSDR (June 2000) (on the Web at <http://www.atsdr.cdc.gov/HS/dover>)

Ambient Air Concentrations of Volatile Organic Compounds in Toms River  
EOHSI (July 2000)

Known Contaminated Sites in New Jersey  
NJDEP (on the Web at <http://www.state.nj.us/dep/srp/kcs-nj/siteinfo.htm>)

*For more information on **Epidemiologic Studies**:*

Interim Report, Case-Control Study of Childhood Cancers in Dover Township (Ocean County)  
and Citizen's Guide  
NJDHSS and ATSDR (December 1999)

*For more information on **Toxicological Evaluations**:*

Chemical-specific Health Consultation: Toxicological Issues Related to Chemicals Identified by  
the New Jersey Department of Health and Senior Services  
ATSDR (September 1997)

Chemical-specific Health Consultation: Toxicological Information on Substances Identified by  
the State of New Jersey Department of Health and Senior Services  
ATSDR (November 2000)

*For more information on **Health Professional and Community Education** please request*

NJDHSS Health Care Provider Updates

- #1 Public Health Response Plan (August 1996)
- #2 Ciba-Geigy Health Consultation (November 1996)
- #3 Reich Farm Health Consultation (November 1996)
- #4 Public Water Supply Consultation (January 1997)
- #5 Childhood Cancer Incidence Health Consultation Update of Cancer Statistics (December 1997)
- #6 Childhood Cancer Epidemiologic Study Overview (July 1998)
- #7 Childhood Cancer Epidemiologic Study: Interim Report and Next Steps (July 2000)

Progress Report #1  
NJDHSS (September 1997)

Progress Report #2  
ATSDR (May 1998)

