Stressor Summaries

This section includes brief summaries of the information on stressor impacts produced by the Technical Working Group (TWG) analyses.

The purpose of these summaries is two-fold:

- Provide background information as a rationale for the stressor rankings given earlier
- Provide an introduction to the much more detailed information about the stressor and its impacts that appears in the analyses in Appendices 3-6

Each summary contains the following information:

- The name of the stressor
- The rankings given by each TWG that analyzed the stressor (see symbol key below)
- A trend indication (better, same, worse)
- A definition of the stressor and description of the kind of impacts it can cause in general
- A "What's at risk?" section outlining the areas or populations (human or ecological) in the state that are potentially threatened by negative impacts of the stressor
- One or more sections entitled "What are the [human health, ecological, and/or socioeconomic] impacts in New Jersey?," summarizing the type and magnitude of these impact types that seem most likely in the state
- A "What's being done?" section that describes the degree to which regulations or other environmental management strategies are currently being used to reduce the stressor's impacts.

Ranking Index

H	High
M - H	Medium-High
M	Medium
M - L	Medium-Low
L	Low

Although the NJCRP aimed to keep stressor names and definitions as consistent as possible across Technical Working Groups (TWGs), this was not always possible. These inconsistencies fall into the following categories:

- The nature of differing health, ecological or socioeconomic impacts. For example, for pesticides the Health TWG chose to focus on, and distinguish among, different routes of exposure: air, water, food, and (via skin contact as well as breathing) indoors; the Ecological TWG felt the distinction between historic uses (leading to concentrations of pesticides left in soils and sediments) and current uses was more pertinent to ecological impacts. The Socioeconomic TWG chose a single comprehensive analysis of pesticides, on the judgment that these impacts would not vary in kind across the types the other TWGs were defining (as well as reducing the workload of a TWG doing more analyses than the other groups). A separate summary was written for each of these except the socioeconomic result, which was inserted as a standard item in each pesticide summary.
- Convenience. With its larger workload, the Socioeconomic TWG was probably most inclined to combine multiple related stressors into one analysis. For example, it produced a single "Invasive Plants" analysis, to avoid having separate analyses for each of the ten individual plant analyses (see Appendix 4) that the Ecological TWG produced, and combined Radon and Radium into a single analysis. By contrast, for the other TWGs such combinations were most likely for "residual" stressors—that is, where some members of a large class of stressors seemed to deserve individual treatment (e.g., their impacts were judged to be higher, and/or they had a higher public profile and thus merited separate attention and/or there was more information about them), but analysts did not want to ignore the remaining stressors in that category. One Ecological summary (and its rankings in earlier tables in the report) comprises "Invasive Plants," in order to avoid having separate summaries or rankings for each of the ten individual plants analyzed.

Overlapping Stressors

The table below shows examples of stressors that fall into related categories, but may be assigned different names within or across Technical Working Groups (TWGs). For example, the first row shows that ecological impacts of habitat loss and fragmentation, and of impervious surfaces, are included in the analysis of socioeconomic impacts of land use change. The fourth row shows another form of overlap: each of the TWGs wrote an Endocrine Disruptors

analysis, but each also separately analyzed other stressors (e.g., dioxins, phthalates) that do or may have endocrine-disrupting properties. A similar phenomenon occurs for volatile organic compounds (VOCs). Note that a given stressor may appear in more than one of these overlap categories (e.g., disinfection byproducts).

Table 16. Overlapping Stressors

HEALTH	ECOLOGICAL	SOCIOECONOMIC
	Habitat loss Habitat fragmentation Increase in impervious surface	Land use change
Radionuclides	Catastrophic radioactive release	Catastrophic radioactive release
	Invasive plants (separate analyses of tree-of-heaven, Norway maple, multiflora rose, Japanese barberry, Asiatic bittersweet, Japanese honeysuckle, garlic mustard, purple loosestrife, Japanese stilt grass, common reed)	Invasive Plants
Dioxin Endocrine disruptors PCBs	Dioxin Endocrine disruptors PCBs Pesticides, historic & current	Dioxin Endocrine disruptors PCBs
Phthalates	Phthalates Tin (tributyltin)	Tin (tributyltin)
Pesticides, indoor Pesticides in drinking water Pesticides in food Pesticides, outdoor	Pesticides, historic Pesticides, current	Pesticides
Radium Radon	Radium Radon	Radium Radon
Nitrogen oxides Nitrogen pollution Ozone (ground level) Sulfur oxides	Acid precipitation Nitrogen pollution Ozone (ground level)	Nitrogen pollution Ozone (ground level) Sulfur oxides
1,3-butadiene Acrolein Benzene Disinfection byproducts Formaldehyde MTBE Ozone (ground level) Volatile organic compounds (VOCs), carcinogenic VOCs non-carcinogenic	VOCs Ozone (ground level)	1,3-butadiene Acrolein Benzene Disinfection byproducts MTBE Ozone (ground level) VOCs
Cryptosporidium Legionella Waterborne pathogens		Cryptosporidium Legionella Waterborne pathogens
Deer (collisions) Lyme disease	Deer	Deer (including Lyme disease)

Table 17. Issues Rankings (alphabetical order)

	Human Health	Ecological	Socioeconomic		Human Health	Ecological	Socioeconomic
1-3-butadiene	M		M - L	Genetically modified organisms		L	L
Acid precipitation		M - L		Greenhouse gases	L	M - L	M - L
Acrolein	M		M - L	Green/red tides		L	L
Airborne Pathogens	M - L			Habitat fragmentation		H	
Arsenic	M	M - L	M - H	Habitat loss		H	
Asian longhorned beetle		L	L	Hanta virus	L		L
Benzene	M		L	Hemlock woolly adelgid		M - H	M - L
Blue-green algae		L		Inadvertent animal mortality		M	M
Brown tide		M - L	L	Increase in impervious surface		M - H	
Cadmium	L	M	L	Indoor asthma inducers	M - H		M - H
Carbon monoxide	M - H *indoor* | M - L *outdoor*		L	Indoor microbial air pollution	L		M
Catastrophic radioactive release		M	M - L	Invasive plants		M	M
Channelization		L		Land use change			H
Chromium	M	M - L	M - L	Lead	H	M	H
Copper		M - L	L	Legionella	M		L
Cryptosporidium	M - L *recreational water* | L *drinking water*		L	Light pollution		L	M - L
Deer		M	M - H	Lyme disease	L		
Dermo in oysters		L	M - L	Mercury	M	M - H	M - L
Dioxin and Furans	M - H	M - L	M	Methyl tertiary butyl ether (MTBE)	L		M - L
Disinfection byproducts	M		L	MSX parasite in oysters		L	M - L
Dredging		M - L	L	Nickel	L	M - L	L
EHD virus in deer		L	L	Nitrogen oxides (NOx)	M		L
Endocrine disruptors	M	M	M	Nitrogen pollution	L	M	L
Extremely low freqency/ electromagnetic fields	L	L	M - L	Noise	L	M - L	M
Floatables		L	M - L	Off-road vehicles		M - L	L
Formaldehyde	M		M - L	Overharvesting (marine)		M	L
Geese		M	L	Ozone (ground level)	H	L	M

Ranking Index

H = High
M-H = Medium-High
M = Medium
M-L = Medium-Low
L = Low

Table 17. Issues Rankings (alphabetical order) - continued

	Human Health	Ecological	Socioeconomic
Particulate matter	H		M - H
Pesticides			M - H
Pesticides, present use		M - L	
Pesticides,food	M		
Pesticides, historic use		M - H	
Pesticides, indoor	M - H		
Pesticides, outdoor	M		
Pesticides, water	M		
Petroleum spills		M	M - H
Pets as predators		L	L
Pfiesteria	L	L	L
Phosphorus		M	M - H
Phthalates	M	L	
Polychlorinated biphenyls (PCBs)	H	M	M - H
Polycyclic aromatic hydrocarbons(PAHs)	L	M - L	M
QPX parasite in shellfish		L	L
Radionuclides	L		
Radium	M - H		L
Radon	H		M
Road Salt		L	L
Secondhand tobacco smoke	H		M - H
Starlings		M	L
Sulfur oxides (SOx)	M - L		M
Thermal Pollution		L	L
Tin		M - L	L
Ultraviolet radiation	M	M - H	M - H
VOCs		L	M - L
VOCs, carcinogenic	M - H	L	M - L
VOCs, non-carcinogenic	M - L	L	M - L
Waterborne pathogens	M (*recreational water*) | L (*drinking water*)		M - L
Water overuse		M - L	M
West Nile Virus	L	M - L	L
Zebra mussels		L	L
Zinc		M - L	L

Ranking Index
H = High
M-H = Medium-High
M = Medium
M-L = Medium-Low
L = Low

1,3-butadiene

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	M - L

1,3 -butadiene is a volatile chemical with a gasoline-like odor. It is used in the production of rubber and plastics, and is also a byproduct of incomplete combustion. Motor vehicle exhaust is the largest source of butadiene in New Jersey. Due to its volatility, the impacts of butadiene primarily result from the inhalation of contaminated air (see also the summary for Volatile Organic Compounds). At concentrations in air likely to be encountered in New Jersey, 1,3-butadiene may irritate the eyes, nose, and throat. Butadiene is classified as a known human carcinogen.

What's at risk?

The entire state is exposed to ambient levels of 1,3-butadiene as a result of motor vehicle traffic. People whose health is otherwise compromised may be at greater risk for health effects. Individuals living or working near traffic arteries are likely to be exposed to higher concentrations than rural residents. Individuals operating lawn mowers, motor boats, chainsaws, and other types of motorized equipment could also be exposed to higher levels, as 2-cycle engines appear to emit much greater quantities of butadiene than motor vehicles.

What are the human health impacts in New Jersey?

The average concentration of 1,3-butadiene in outdoor air was measured in Camden in 1997. This concentration (0.07 parts per billion), if extrapolated to the entire state, could be expected to result in 2-3 additional cancers per year statewide. However, concentrations are likely to be lower in less urban areas, and most people spend much of their day indoors, where concentrations are lower. Therefore, measured concentrations are likely to overstate the actual cancer risk.

What are the socioeconomic impacts in New Jersey?

Based on National Institutes of Health studies, medical costs for the treatment of cancer average $60,000 per case. Thus there are likely to be some costs associated with the effects of butadiene exposure. There are property value impacts associated with air pollution generally, a portion of which may be attributable to butadiene.

What's being done?

Concentrations of 1,3-butadiene in outdoor air have been decreasing. Like carbon monoxide, butadiene is a product of incomplete combustion, and its presence in automobile exhaust is controlled to a significant degree by catalytic converters. Regulations aimed at reducing ozone levels through the control of VOCs continue to reduce emissions of butadiene.

Acid Precipitation

Human Health Risk	
Ecological Risk	M - L
Socioeconomic Risk	M - L

Sulfur dioxide and nitrogen oxides are air pollutants that may be distributed hundreds of miles from their original sources. Coal burning power plants are the primary sources of sulfur emissions, while automobiles are largely responsible for emissions of nitrogen oxides. Both types of pollutants are acidic, and contribute to the acidification of lakes and streams when they are washed out of the atmosphere via rain, snow, and other precipitation. Other risks associated with each pollutant individually are discussed separately.

What's at risk?

Impacts to aquatic ecosystems are the primary concern, although forest systems are also affected by acid precipitation.

What are the ecological impacts in New Jersey?

Trout are especially sensitive to acidic conditions, and there have been occasions in New Jersey where reproduction has been reduced or halted as a result of melting of highly acidic snows. The natural buffering capacity of streams and lakes determines the extent to which they are affected by acid precipitation. Most New Jersey waterbodies have good buffering capacity, which somewhat protects these ecosystems from the impacts of acid deposition. So while the entire state receives acid precipitation, only 5-10% of New Jersey habitats are vulnerable to its effects.

What are the socioeconomic impacts in New Jersey?

Acid precipitation (particularly dry deposition) can cause discoloration of, or eat away at, stone buildings, monuments, and tombstones. Effects appear to be primarily aesthetic, less than the impacts of non-acidic rain, and can be fixed fairly easily. Socioeconomic impacts are likely to be low in New Jersey.

What's being done?

Sulfur dioxide emissions from power plants and nitrogen oxide emissions from vehicles are regulated under the Clean Air Act. Improvements made in control technologies can be offset, however, by increasing energy and fuel use.

Acrolein

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	M - L

Acrolein is a reactive chemical with a piercing odor that is a by-product of combustion. It is chemically similar to formaldehyde, and has similar effects. It is used in the synthesis of some chemical products, including tear gas, but most of the acrolein in the environment is the result of fossil fuel emissions from industrial and vehicle sources. Acrolein is an irritant, affecting mucous membranes and the eyes. It may also affect respiratory function, particularly in children.

Who's at risk?

Acrolein is a pervasive pollutant with higher concentrations in urban areas. Therefore, urban areas are exposed to increased risk compared with less urbanized areas in the state. Data are currently insufficient to evaluate indoor exposures. Children are more susceptible to infections after exposure and those reporting Multiple Chemical Sensitivities (MCS) may be particularly susceptible to acrolein because of its odor, and the relationship between odor and MCS symptoms.

What are the human health impacts in New Jersey?

Monitoring has shown that exposures in urban areas can be twenty times the Reference Concentration established by EPA. While these levels are still below the concentration at which laboratory (animal) studies have produced observable health effects, there may be thousands of people that will experience the irritant effects of acrolein. In other areas of the state, acrolein may contribute to respiratory irritation resulting from exposure to low levels of multiple respiratory irritants. There are approximately 330,000 children under age three in New Jersey that are potentially at risk for immune system effect; although the risk of such effects is considered low, a subset of these children reside in urban areas.

What are the socioeconomic impacts in New Jersey?

No individual socioeconomic factor poses a large risk in New Jersey, although acrolein contributes to reduced property value and increased medical costs associated with air pollution generally. The total costs for air pollution damage approach one billion dollars in lost property values and several million dollars in medical costs. Acrolein is a small part of the overall air pollution problem.

What's being done?

Acrolein concentrations are reduced as the result of general pollution controls on combustion sources.

Airborne pathogens

Human Health Risk	M - L
Ecological Risk	
Socioeconomic Risk	

Airborne pathogens include fungal spores and bacteria that are released to the air during wastewater treatment, sanitary landfill operations, composting, and various farming practices. Sources of these pathogens include fungal growth associated with warm wet areas, and agricultural activities that generate large quantities of organic dusts that may contain high concentrations of bacterial toxins. Some pathogens are associated with bird or bat droppings. Human health effects include respiratory infections, allergic responses, eye, nose and throat irritation, as well as more severe cases involving fever and shortness of breath. Related reports include *Legionella*, Hantavirus, indoor microbial pollution, and indoor asthma inducers.

What's at risk?

Exposure to low levels of airborne spores is universal, but disease is uncommon. Infants and the elderly are particularly subject to fungal infections. Individuals with compromised immune systems or other underlying disease are more susceptible to the health effects that may result from exposure to airborne pathogens. Asthmatics are also especially sensitive to fungal allergens. Workers near concentrated sources such as composting facilities are at increased risk of exposure, as are people who are occupationally exposed to higher than normal concentrations of bird or bat droppings.

What are the human health impacts in New Jersey?

There is very little information regarding the number of illnesses that may be attributed to airborne pathogens. Thresholds for allergic response are regularly exceeded near composting facilities. In some cases, elevated levels may exist up to 1 kilometer from the facility. Dust-inducing agricultural practices can produce concentrations of bacterial toxins far in excess of those known to affect lung function. Natural sources such as bird and bat droppings may also result in localized exposures to elevated levels of pathogens.

What's being done?

There are no regulations on airborne pathogen generation. Occupational guidance is available for protecting workers from exposure.

Socioeconomic costs probably run in the tens of millions.

Arsenic

Human Health Risk	M
Ecological Risk	M - L
Socioeconomic Risk	M- H

Arsenic is a trace element normally found in soil, water, food, and the human body. Trace amounts are believed to be essential for life. The former widespread use of arsenic in pesticides, its release from copper smelting, and its continued use in metal plating and wood treatment has resulted in greater concentrations of arsenic in certain areas. An inorganic form of arsenic, arsenic trioxide, is a known human carcinogen and is associated with cancers of the lung, skin, liver, kidney, and bladder. Inorganic arsenic may also cause neurological disorders.

What's at risk?

Up to 5% of New Jersey's land acreage may be affected by historical use of arsenical pesticides, and inadvertent ingestion of contaminated soil by children may occur. Lead arsenate was a pesticide used in fruit orchards, vegetable fields, golf courses, and turf farms, and conversion of such land to residential use provides opportunities for exposure through soil ingestion. Others at risk include individuals with elevated arsenic levels in their public water supplies or private wells, and industrial workers exposed to inorganic arsine gas released into the air.

What are the human health impacts in New Jersey?

A large fraction of the New Jersey population is exposed to slightly elevated levels of arsenic in the air. About 5 million residents are potentially at risk due to ground water sources of drinking water. Estimates show less than one case of cancer per year statewide is due to inhalation of ambient levels of arsenic in air.

What are the ecological impacts in New Jersey?

A large number of plant and animal species may be affected, potentially altering biological integrity, biodiversity and ecosystem health. Most historic exposures and effects have occurred in the vicinity of manufacturing or hazardous waste sites. Data on specific effects on organisms and populations, as well as a better assessment of the distribution of arsenic from widespread agricultural use, would help determine the ecological effects of arsenic exposure.

What are the socioeconomic impacts in New Jersey?

Socioeconomic impacts of arsenic include the costs of bladder and lung cancers, and the associated loss of productivity, which are estimated to be over $16 million per year. Assuming a 5% drop in property value for contaminated sites, property value losses may total over $2 billion to which arsenic contributes. Property values have been shown to rebound to normal levels once cleanup has been completed. Arsenic, along with other constituents of hazardous waste sites, is likely to cause high levels of worry for New Jersey residents unsure about the impacts of contamination in their areas.

What's being done?

The use of arsenical pesticides has been discontinued. Arsenic is included in federal regulations on air emissions, hazardous waste, and other environmental programs. In 2001, EPA reduced the acceptable level of arsenic in drinking water from 50 parts per billion to 10 ppb. New Jersey DEP has adopted a soil cleanup standard to apply in remediation of hazardous sites and has convened a task force to address historic pesticide contamination.

Asian longhorned beetle

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	L

The Asian longhorn beetle is an insect indigenous to China. The beetle has inadvertently been brought into the United States via Chinese imports shipped in solid wood packing material. Since its discovery in 1996, the beetle has been detected in warehouses in 14 states, including three in New Jersey. As with other wood boring pests, the beetle is a serious threat to many species of hardwood trees, especially maples. It has no natural enemies in the western hemisphere, and current treatment efforts focus on the destruction of infected trees.

What's at risk?

If introduced into New Jersey's forest ecosystems, potentially all the state's hardwood forests are at risk of damage from this beetle. There are approximately 1,991,000 acres of forested land in New Jersey.

What are the ecological impacts in New Jersey?

Beetles have been found in warehouses in Cream Ridge, Linden, and New Brunswick. Currently, there is no known forest infestation. If introduced into New Jersey ecosystems, the insects can be spread by movement of infested wood (firewood, lumber) and by adult beetles flying to nearby trees. The beetle affects terrestrial ecosystems by infesting and killing many species of hardwood trees. Destruction of trees could reduce the abundance of native species, increasing the proportion of invasive exotics such as Japanese barberry. Extensive forest loss can result in changes in forest function and lead to secondary impacts (e.g., increased erosion).

What are the socioeconomic impacts in New Jersey?

Although the potential impact could be enormous, the slow natural spread of the beetle, vigorous efforts to limit entry of new insects into the U.S., and immediate eradication of infestations when found should keep socioeconomic costs minimal for the foreseeable future.

What's being done?

The New Jersey Department of Agriculture maintains a Pest Detection Program and the New Jersey Forest Service (in DEP) has an Insect and Disease Management Program. In addition, the U.S. Department of Agriculture maintains forest monitoring programs, requires special treatment of wooden crates shipped to the United States, and quarantines affected areas. Although it is possible that the beetle has escaped detection in New Jersey ecosystems, the insects appear to spread relatively slowly. It is likely that federal and state surveillance efforts would detect an infestation before it reached widespread, catastrophic proportions.

Benzene

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	L

Benzene is a colorless liquid which is present as a constituent of petroleum. It has industrial application as a chemical intermediate and as solvent. Benzene is added to gasoline to increase the octane rating and is also a minor constituent of tobacco smoke. People become exposed to benzene through inhalation of vapors that are present at low background levels in the environment, as well as at elevated levels in some specific environments, particularly at gas stations. Benzene can contaminate ground water used for drinking, mostly as the result of leaking petroleum storage tanks. Benzene is a human carcinogen. It is also toxic to the liver and central nervous system, but these non-cancer effects are uncommon in non-occupational settings.

What's at risk?

The general population is exposed to relatively low, background concentrations and higher levels when fueling vehicles with gasoline containing benzene. Individuals working at service stations and in industrial facilities using benzene would have higher exposures than the general public. Drinking water is a potential source of exposure, but known cases of benzene-contaminated drinking water are quickly addressed.

What are the human health impacts in New Jersey?

Excluding occupational exposures, the general public is exposed to outdoor benzene levels that may result in a total of 30 to 109 additional lifetime cancer cases in New Jersey. The higher rate reflects exposures in more urban areas. This amounts to between 0.4 and 1.6 additional cases per year attributable to benzene. Non-cancer risks from benzene are likely to be low. This assessment did not focus on indoor exposures which may be significantly higher than exposures to outdoor ambient conditions.

What are the socioeconomic impacts in New Jersey?

No impacts are hypothesized with respect to unemployment or aesthetics. There is no evidence that the public is seriously concerned, or property values in New Jersey are negatively affected. Medical costs associated with the potential health effects of benzene are well below the threshold for moderate impacts, thus the socioeconomic impacts of benzene are judged to be low.

What's being done?

The benzene content of gasoline is regulated, and the use of benzene in consumer products is being phased out. Benzene in drinking water is often monitored in areas where there is a history of contamination.

Blue-green algae

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	

Blue-green or toxic freshwater algae thrive in eutrophic lakes and reservoirs. Eutrophication or growth of algae is a natural process of aging lakes that can take thousands of years, but it is often hastened by human addition of fertilizers and other nutrients. Like other forms of phytoplankton, blue-green algae grow excessively under these high-nutrient conditions. Also known as cyanobacteria, these toxic algal blooms appear as scum along shorelines, cause pungent odors and tastes in drinking water, and can cause fish kills. Freshwater algae blooms are readily treated with algicides, which are commonly used in water treatment processes and applied directly to affected water bodies that may be used for swimming.

What's at risk?

Livestock, pets, and wildlife are potentially at risk for ingesting water contaminated with toxic algae in eutrophic lakes, ponds, and reservoirs throughout the state. There is a potential for humans to become exposed to the toxin by ingesting water that has been treated for cyanobacteria. There is evidence that commonly used algicides promote rapid die-off of algae cells, consequently releasing harmful quantities of toxins subsequent to treatment.

What are the ecological impacts in New Jersey?

There is no information on the extent of impacts to New Jersey aquatic ecosystems from blooms of freshwater algae. Excessive algae interferes with light penetration and reduces oxygen levels in the water, creating adverse impacts to aquatic plants and organisms throughout the food chain. Moreover, the toxicity associated with cyanobacteria has the potential for causing massive fish kills, but there are no documented reports of this in New Jersey. Blooms have been severe enough to interfere with water intakes and treatment processes in New Jersey.

What's being done?

Studies have shown that lime or alum treatment may be preferable for the control of toxic algal blooms because these treatments appear to leave the cells intact after death, thus reducing the risk of releasing toxins via the control agent. However, neither material is registered by the EPA for use as an algicide. Further investigation is warranted regarding the presence of cyanobacteria in drinking water and/or swimming areas that have been treated for algal blooms.

Brown tide

Human Health Risk	
Ecological Risk	M - L
Socioeconomic Risk	L

Brown tide blooms are caused by rapid growth of a golden-brown algae in shallow saltwater estuaries. Natural processes that result in high salinity and low flow conditions could be causing these blooms, which typically occur during the months of May to July, and sometimes again in early fall.

What's at risk?

Blooms are a recurring natural phenomenon in southern Barnegat Bay and Little Egg Harbor. Blooms have also been documented in Great Bay, coastal bays, and Great Egg Harbor. Any shallow estuary with similar characteristics and the right combination of environmental variables could develop a brown tide bloom, potentially affecting 25-50% of the state's estuarine waters. Socioeconomic effects are restricted to bay-front property owners, commercial shellfish producers, and recreational users in Barnegat Bay and Little Egg Harbor.

What are the ecological impacts in New Jersey?

Recurring brown tide blooms have been documented for five of the past seven years. In 1999 and 2000, the blooms were significantly more severe. Blooms discolor the water, reducing the amount of light penetration, and subsequently the growth of underwater vegetation such as eelgrass. Eelgrass beds provide nursery habitat for young aquatic animals and are necessary to sustain healthy populations of fish and shellfish. Blooms also interfere with feeding and growth of juvenile clams, mussels, and scallops. Unusually high mortality rates (up to 80%) for bay scallops have been documented in Long Island bays experiencing brown tide blooms. Research is needed to determine the similarities between Long Island and New Jersey bay conditions to accurately assess risks to New Jersey bays. Populations may rebound once the bloom subsides, but blooms lasting longer than one to two months may cause severe impacts to shellfish populations.

What are the socioeconomic impacts in New Jersey?

Brown tide blooms are a significant concern in areas where they occur. Bay front property values may be negatively affected and there is a local employment impact associated with a reduction or loss of shellfish. However, these socioeconomic effects are restricted to a relatively small number of bay-front property owners, commercial shellfish producers, and recreational users in Barnegat Bay and Little Egg Harbor. Thus the statewide socioeconomic impacts are judged to be low.

What's being done?

The Brown Tide Assessment Project was established in 2000 to monitor the spatial and temporal extent of brown tide blooms through 2002. Because brown tide blooms are natural phenomena, environmental and biological factors need to be studied in order to assess the extent of impacts on marine ecosystems and to develop effective management strategies.

Cadmium

Human Health Risk	L
Ecological Risk	M
Socioeconomic Risk	L

Cadmium is a rare, naturally-occurring metal found in the atmosphere as a result of volcanic activity, ocean spray, and forest fires. Industrially, cadmium is used in electroplating processes, pigments, batteries, plastics, and alloys. Exposure can occur through direct ingestion of contaminated soil and by ingestion of plants grown in contaminated soil. Relatively high concentrations of cadmium can occur in shellfish. Shellfish ingest sediments as they feed, which may expose humans who consume them to harmful levels. Human exposures can also result from air and drinking water concentrations. Chronic low level exposures may result in kidney damage, and cadmium is a carcinogen by inhalation.

What's at risk?

The general population is exposed to low levels of cadmium in food. Subpopulations at increased risk include subsistence fishing populations and others who consume shellfish from cadmium concentrated waters. Increased dietary exposure may also result from consumption of crops grown on soil amended with cadmium-containing sludge. Freshwater aquatic organisms are most sensitive to cadmium, marine organisms are less sensitive, and mammals and birds are comparatively resistant. Since cadmium bioaccumulates, freshwater species higher on the food chain are particularly vulnerable.

What are the human health impacts in New Jersey?

Background levels to which the general population is exposed (including food, air, and drinking water pathways) are estimated at 30-50 micrograms per day. More than 95% of this exposure results from levels of cadmium in the general food supply. Changes in kidney function have been observed beginning at 200 micrograms per day. The extent to which these changes predict serious kidney problems is unclear. However, recent research indicates that even at background levels, about 1% of the population may develop adverse health effects. Subsistence shellfishing populations may be exposed to cadmium levels seven times higher than background, placing them over the threshold for changes in kidney function. New Jersey air concentrations are below the level at which scientists expect additional cancers might occur. There are few data indicating that cadmium exposure in New Jersey results in significant kidney effects.

What are the ecological impacts in New Jersey?

There are no regions in the state with excessively high cadmium levels as a result of industrial waste, however, the high sensitivity of aquatic invertebrates puts all aquatic habitats potentially at risk. These organisms are an integral part of the food chain, and cadmium can accumulate virtually everywhere as a result of atmospheric deposition. While there is no regular monitoring for cadmium in New Jersey, soil sampling for cadmium near contaminated sites has shown elevated levels. In most cases, the samples exceeded the benchmark by a factor of two or less.

What are the socioeconomic impacts in New Jersey?

Available evidence does not indicate that cadmium poses a threat to employment or property values. Estimates indicate that the cost of illnesses associated with cadmium are low, however, the damage to kidney function is permanent. Therefore, the socioeconomic risks are judged to be low to medium.

What's being done?

Industrial discharges of cadmium to the environment are regulated, and cadmium-contaminated hazardous waste sites are cleaned up in accordance with federal and state law. There are no regulations on food, which is the biggest source of exposure in human populations. Use of cadmium in consumer products is being reduced.

Carbon Monoxide (CO)

	M - H	M - L
	indoor	*outdoor*
Human Health Risk		
Ecological Risk		
Socioeconomic Risk		**L**

Carbon monoxide (CO) is a colorless, odorless gas formed as a byproduct of incomplete combustion. A component of motor vehicle exhaust, as much as 95% of outdoor concentrations may be attributed to vehicle emissions in urban areas. Carbon monoxide may also concentrate indoors as a result of improperly functioning home appliances such as furnaces, water heaters, and gas stoves. When inhaled, carbon monoxide affects the body's ability to bind oxygen to hemoglobin in the blood, depriving the body of oxygen. At low levels of exposure, symptoms associated with decreased oxygen availability may result; for example, CO may trigger an attack in angina patients. Extreme exposures can result in asphyxiation and death.

What's at risk?

The general population is exposed to low levels of carbon monoxide in the ambient (outdoor) air. Residents of urbanized areas are exposed to slightly higher levels, as are any individuals spending time in locations with a high concentration of vehicles (e.g., parking garages, traffic congestion). Households with gas appliances may be exposed to concentrations up to 15 times greater than ambient outdoor levels. Elderly residents are at increased risk of congestive heart failure resulting from the effects of CO exposure. The approximately 35,000 angina sufferers in urban New Jersey counties are particularly susceptible to the effects of carbon monoxide at observed levels. Smoking cigarettes increases personal exposure to CO significantly.

What are the human health impacts in New Jersey?

The National Ambient Air Quality standard for carbon monoxide is 9 parts per million (ppm) averaged over an 8-hour period, and 35 ppm maximum over a 1-hour period. Annual averages in New Jersey are in the 1-2 ppm range. About 1% of the time, urban counties may show slightly elevated concentrations, while remaining below the national standard. Health effects at these levels include the aggravation of angina or other conditions that are associated with decreased oxygen availability. About 35,000 urban residents suffer from chronic angina. Carbon monoxide has also been linked to congestive heart failure, especially among the elderly. About 6% of congestive heart failures in urban areas may be associated with elevated CO levels. At very high levels of exposure, CO can be deadly. Based on national estimates, about 400 New Jerseyans require medical attention for CO poisoning each year, with 4-25 deaths resulting. These exposures are generally due to intentional exposures to vehicle exhaust in enclosed areas, or malfunctioning home appliances.

What are the socioeconomic impacts in New Jersey?

The principal socioeconomic impacts of CO are the costs of health care associated with accidental exposures, heart failure, and treatment of other conditions that may be attributed to elevated levels of carbon monoxide. While it is difficult to estimate the incidence of health problems in New Jersey that are related to carbon monoxide levels, available information suggests these costs may total several million dollars per year.

What's being done?

Carbon monoxide is regulated under the National Ambient Air Quality Standards program. Emissions requirements have resulted in significant improvements over the last 30 years, and maximum recorded levels of CO in New Jersey have remained below the health standard since 1995. Household appliances are constructed to minimize CO generation, but poorly maintained burners may cause significant emissions and are not currently the subject of regulation.

Catastrophic radioactive release

Human Health Risk	
Ecological Risk	M
Socioeconomic Risk	M - L

A catastrophic accident at a commercial nuclear powered generating station would release large quantities of radioactive substances to the environment. The release of radioactive gases, aerosols, and particles, extending over a prolonged period of time, would result in impacts to all living species. A catastrophic release in Chernobyl killed nearby trees and resulted in acute and chronic effects among a wide range of species.

What's at risk?

There are four nuclear power plants in New Jersey and another six in nearby counties of neighboring states. Virtually the entire population is within a 50-mile radius of at least one of these facilities. All species in all ecosystems are susceptible to damage from radioactive release. Plants show a wide range of sensitivities to the effects of radiation and animals generally fall within this range. Mammals are most sensitive, followed by birds, fish, reptiles, and insects. Embryos and juveniles are more sensitive to radiation than adults.

What are the ecological impacts in New Jersey?

A catastrophic release in New Jersey could cause the death of many species, a long term risk for reproduction and development, and the possible extirpation of species already under population pressures due to reduced habitat. The probability of such an event, however, is low.

What are the socioeconomic impacts in New Jersey?

The costs of remediation from a significant accident at a nuclear power facility could be greater than one billion dollars. The psychological effects associated with the low probability of a catastrophic event is small but significant. There may also be property value reductions resulting from the possibility of an accidental release.

What's being done?

The Nuclear Regulatory Commission, the U.S. Environmental Protection Agency, U.S. Department of Energy, and U.S. Department of Transportation are responsible for establishing radiation protection regulations. These agencies work with international organizations to assure that regulations are based on internationally recognized scientific studies.

Channelization

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	

Channelization is the alteration of natural stream drainage patterns for the purposes of flood control or improved navigation. Stream channel alterations may involve dredging, straightening, and the construction of levees. Channelization is a controversial issue: projects can kill aquatic organisms, destroy wetlands, and cause erosion and additional flooding downstream. Some maintain that channelization projects actually increase flood damage in the long run.

What's at risk?

Aquatic systems and associated wetlands and riparian habitat are at risk. Most channelization occurred historically, and in urban areas. However, the U.S. Army Corps of Engineers currently has more than 20 flood control projects in New Jersey, whose taxpayers bear the costs associated with channelization projects. While impossible to predict the location or extent of the damage, it is anticipated that some private property owners downstream of the projects will suffer damage from increased flooding.

What are the ecological impacts in New Jersey?

Negative impacts include loss of habitat, increased flow and erosion, changes in aquatic populations, increased water temperature, and other physical and chemical changes. The majority of impacts most likely occurred historically. The exact extent of channelization in NJ and associated impacts have not been adequately characterized.

What's being done?

Channelization projects increasingly encounter opposition from environmentalists and resource managers who argue that flood control policies should focus on curtailing development rather than futile attempts to alter natural stream channels. Increasing emphasis on storm water programs that reduce paved surfaces and allow for more natural absorption of water may reduce the perceived need for channelization projects. Current flood control projects require minimization and/or mitigation of impacts. State permits are required for encroachment activities, such as channelization.

Chromium

Human Health Risk	M
Ecological Risk	M - L
Socioeconomic Risk	M - L

Chromium is a metallic element that exists in the environment in two different chemical states, Cr^{+3} and Cr^{+6}. Cr^{+3} can occur naturally, Cr^{+6} occurs solely as the result of human processes such as the manufacture of pigments, anti-corrosives, pressure treated wood, chrome steel alloys, and in leather tanning. A strong corrosive agent, Cr^{+6} can cause severe irritation of mucous membranes, skin, and the upper respiratory tract. It is also a prevalent allergen, found in many common home and workplace products. Cr^{+6} is a human carcinogen via the inhalation route of exposure.

What's at risk?

It is estimated that 1-2% of the general population is sensitized to chromium, and there are no known factors leading to increased susceptibility to cancer as a result of exposure to chromium. Exposures are elevated for residents adjacent to some waste sites known to be contaminated with chromium. Approximately 180 sites in and around Jersey City (Hudson County) were used as disposal sites for chromate production waste. Ecosystems are largely exposed via contaminated sediments and soils near waste sites. Drinking water contamination is isolated and sporadic.

What are the human health impacts in New Jersey?

Based on measured levels of total chromium in outdoor air at residences adjacent to historical disposal sites, the cancer risk was calculated at 4.8-8.4 additional cancers per 100,000 people. The number of people exposed on or near waste sites is unknown; however, most of these sites have subsequently been remediated. Average ambient air concentrations in New Jersey are estimated to result in a lifetime cancer risk of 1.7 in 100,000 people, corresponding to 2 excess cancers per year statewide. In the county with the highest estimated ambient air chromium levels the risk is estimated to be 28 times the overall New Jersey average. This estimate, however, is uncertain, as it assumes that Cr^{+6} constitutes a fixed fraction of Cr emissions from all sources. The actual proportion of Cr^{+6} as a fraction of all Cr emissions in New Jersey is currently unknown. Occasional exceedances (two incidents in the past six years) of drinking water standards have temporarily exposed tens of thousands of individuals to concentrations exceeding reference doses for short periods of time.

What are the ecological impacts in New Jersey?

Toxicity to aquatic organisms can lead to changes in biological integrity and biodiversity. In New Jersey, measured concentrations exceed benchmark values in sediments with a greater frequency in inland waters but greater severity in marine waters. Sediments from wetlands also show concentrations exceeding benchmark values. Urban/terrestrial areas with chromium contaminated fill are also at potential risk.

What are the socioeconomic impacts in New Jersey?

No individual socioeconomic factor poses a large risk in New Jersey although some aesthetic, psychological, monetary and employment costs may be evident.

What's being done?

Waste site clean up is slowly reducing the number of sites with known chromate contamination. Drinking water is regularly monitored to ensure that chromium contamination events are infrequent and not severe.

Copper

Human Health Risk	
Ecological Risk	M - L
Socioeconomic Risk	L

Copper is a metallic element with many industrial and consumer applications. Copper salts such as copper sulfate, are effective algicides that can be toxic to humans and wildlife at high doses. Copper sulfate is an odorless blue or green-white powder or solid that has been widely used to control algae in lakes, ponds, reservoirs, and irrigation systems. Direct application may result in a significant reduction in populations of aquatic life, including invertebrates, plants, and fish. Copper has a low toxicity for humans, although excessive levels in drinking water have resulted in mild symptoms including headaches, nausea, and diarrhea. Potential risks relate primarily to aquatic ecosystems, and a human health risk assessment was not conducted.

What's at risk?

Copper sulfate is very toxic to organisms that eat fish, and highly toxic to fish, amphibians, and crustaceans. The use of copper sulfate for temporary algae control can produce significant zooplankton mortality, and may also adversely affect trout, ornamental goldfish, and other sensitive fish in soft water. Soil organisms at industrial or hazardous waste sites are also at risk.

What are the ecological impacts in New Jersey?

In New Jersey the use of copper sulfate as an algicide has been on the rise since 1992. In addition, several hazardous waste sites contain copper concentrations above threshold values for ecological effects. The greatest impacts are to aquatic systems, due to its direct toxicity and indirectly because of oxygen depletion that results from the decay of large amounts of vegetation. Soil concentrations are below acceptable residential soil benchmarks, so effects on terrestrial systems are probably minimal. While copper continues to be ubiquitous in the environment, there is no evidence of substantial ecological impacts.

What are the socioeconomic impacts in New Jersey?

Costs associated with any copper-related illness appear to be minimal and there is little evidence that copper has enough of an adverse effect on ecosystems to threaten employment (in shellfish harvesting for example) or property values. There is also little reason to conclude that copper produces aesthetic impacts in New Jersey, or creates anxiety.

What's being done?

The use of copper sulfate has been regulated by the DEP Pesticide Control Program since 1989. Chelated copper products are available for use. These are less toxic to fish and aquatic invertebrates.

Cryptosporidium

Human Health Risk	L (*drinking water*)	M - L (*recreational water*)
Ecological Risk		–
Socioeconomic Risk		L

Cryptosporidium is an intestinal parasite that infects humans and animals. Infections in healthy people can result in relatively minor and self-limiting symptoms including nausea, cramps, diarrhea, and vomiting. In those with weakened immune systems, severe and potentialy life-threatening illness may occur. Egg stage organisms are excreted in the feces of infected individuals and animals, and are found in virtually all lakes, rivers, and streams. Able to resist most forms of chemical disinfection, large numbers of *Cryptosporidium* in public drinking water supplies caused widespread illness in the City of Milwaukee in 1993.

What's at risk?

Three million of New Jersey's eight million residents get their drinking water from surface water sources that could potentially be contaminated with harmful levels of *Cryptosporidium*. People may also become exposed while swimming, or coming in contact with the feces of infected individuals. Wildlife can also be exposed and infected, but ecological impacts are negligible.

What are the human health impacts in New Jersey?

There have been no confirmed reports of outbreaks due to drinking water in New Jersey since 1976. However, it is difficult to estimate how many people are affected by a waterborne illness because not everyone exposed will develop symptoms and many cases go unreported. In healthy populations, the increased number of cases of minor gastrointestinal illness may be as many as 19,000 or as few as 300 per year. Estimates for the subpopulation of immune-compromised people range from less than 1 death per year to a high-end estimate of 5-10 additional deaths per year. There was a single documented case of Cryptosporidium infection from recreational bathing in New Jersey in 1994 with 135 cases reported.

What are the socioeconomic impacts to New Jersey?

Costs associated with *Cryptosporidium* (doctor's visits, lost time) are relatively insignificant given the expected low frequency of illness, and while the possibility of an outbreak may cause concern, the psychological impacts associated with this stressor are also judged to be relatively minimal.

What's being done?

All public water supplies in New Jersey are filtered; filtration results in significant reduction in the number of organisms, to an average concentration of below 0.0001 organism per liter. Drinking water treatment technologies exist that would provide further protection, but these are not likely to be employed on a widespread basis because of the high costs involved. *Cryptosporidium* is not regulated in waters used for recreational purposes, except where they also serve as sources of drinking water.

Deer

Human Health Risk	
Ecological Risk	M
Socioeconomic Risk	M - H

White-tailed deer (*Odocoileus virginianus*) have the ability to rapidly increase their numbers, particularly in suburban areas where public parks can act as deer refuges, hunting is reduced and there is a lack of natural predators. Overabundance of deer can lead to agricultural damage, deer/vehicle collisions, increased incidence of Lyme disease, and damage to natural ecosystems. Statewide, the number of deer has increased to 200,000, more than double the population twenty years ago.

What's at risk?

Humans are at risk from auto collisions and Lyme disease (see separate summary). Also particularly at risk are hardwood seedlings, agricultural crops, suburban shrubbery, and plant communities in forested areas.

What are the ecological impacts in New Jersey?

Ecological effects from deer overpopulation include changes in diversity among plant species. Deer are selective browsers and prefer young woody plants, such as hardwood seedlings. Researchers indicate that once the density of 20 deer per square mile is reached for several years, noticeable changes in native plant communities occur. This threatens to reduce bird and mammal breeding habitat, and may change long term forest health and biodiversity.

What are the socioeconomic impacts in New Jersey?

Impacts include economic losses suffered from Lyme disease, loss of crops, reduced property values from damaged landscaping, replacement costs of landscaping, and auto collision costs. Passenger vehicles collide with deer approximately 20,000 times per year. Agricultural losses alone are estimated at $20 million to $40 million annually. New Jersey has one of the highest rates of Lyme disease in the country, with 1722 cases in 1999. The estimated cost of Lyme disease to New Jersey is approximately $75 million per year. No cost has been estimated for the psychological effects of severe disability caused by untreated cases. The total cost of deer overpopulation is estimated at $120 to $160 million. Other impacts include conflict over deer control strategies, and the possible long-term aesthetic and forestry employment effects of damaged tree seedlings. (Note: socioeconomic analysis combined "deer" and "Lyme disease" impacts.)

What's being done?

Intensive management of the state's deer herd is being undertaken, primarily through sport hunting and issuance of deer predation permits to farmers. Experimental deer management programs have also been implemented.

Dermo disease in oysters

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	M - L

New Jersey oyster yields today are less than half the level of twenty years ago, and less than one tenth of what they were fifty years ago. Parasitic infection by *Dermocystidium marinus* and other protozoa such as MSX (see separate report on page 149) are responsible for decimating the state's oyster population. The parasites were introduced into Delaware Bay in the mid-1950s via seed oysters imported from the lower Chesapeake Bay. Massive losses in the late 1950s were followed by a gradual period of recovery, until the oyster population was devastated by another outbreak in 1990.

What's at risk?

Eastern (aka American) oyster populations over most of the New Jersey side of Delaware Bay experience high rates of mortality. Eastern oysters on the Atlantic coast are also affected. Younger oysters are less likely to become infected and have lower mortality rates than older oysters.

What are the ecological impacts in New Jersey?

The Dermo parasite causes a reduction in shell and soft tissue growth in infected oysters. Infection impairs the oysters' ability to open and feed, resulting in severe emaciation and high mortality rates. In 1953, New Jersey harvested 8.5 million tons of Eastern oysters. Current yields of about 700,000 pounds have rebounded from a low of just 585 pounds in 1993. The distribution of the parasite is not linked to environmental contaminants; Dermo is prevalent in both clean and polluted water. Oyster population decline significantly reduces the filtration of suspended particles in estuary ecosystems, such as Delaware Bay.

What are the socioeconomic costs to New Jersey?

Returning the oyster industry to historic levels would restore hundreds of jobs and contribute an estimated $40 million to New Jersey's economy. (MSX parasites are included in this analysis.)

What's being done?

Management actions to reduce the impact of Dermo disease focus on maintaining low salinity levels that help protect young oysters from infection, and on the possible introduction of disease-resistant strains of oysters.

Dioxins and Furans

Human Health Risk	M - H
Ecological Risk	M - L
Socioeconomic Risk	M

Polychlorinated dibenzodioxins and polychlorinated dibenzofurans are a group of structurally similar chlorinated compounds that result from the combustion of complex organic material in the presence of chlorine. These compounds may also arise as by-products of paper production or the synthesis of certain pesticides. These trace contaminants are biologically active at very low concentrations and accumulate in soils and sediments via air and wastewater releases. Aquatic animals feeding on sediment-dwelling organisms accumulate dioxin in their tissues, and terrestrial organisms become exposed by feeding on aquatic organisms or other terrestrial species (including plants) that have taken up dioxin from the soil. Terrestrial food chains also accumulate dioxins through fat and dairy products.

What's at risk?

Because dioxin is ubiquitous in our environment, all species are exposed. Animals higher on the food chain can be exposed to greater quantities as a result of bioaccumulation in the environment. For humans, the primary sources of dioxin are meat, fish, and dairy products. Individuals may be exposed to high levels of dioxin when contaminated fish and shellfish are a significant part of the diet. Dioxin is a carcinogen and also affects other biological functions such as the reproductive system of many species.

What are the human health impacts in New Jersey?

In the general population, dioxin exposure may contribute to an additional 20-200 cases of cancer per year in New Jersey. Highly exposed individuals such as those who regularly eat contaminated shellfish from New York\New Jersey harbor may face individual risks that are forty times the general population risk of 1.8 – 18 excess cancers per 10,000 population. Non-cancer effects are also possible, but no concrete estimates are available.

What are the ecological impacts in New Jersey?

Species inhabiting dioxin-contaminated sediments are exposed to levels in excess of benchmarks established for ecological health. Some species of fish are very sensitive to dioxin and will experience reproduction and developmental effects at measured levels. Fish-eating birds may be exposed to significant dioxin contamination as a result of fish tissue contamination.

What are the socioeconomic impacts in New Jersey?

The socioeconomic risks from dioxin are generally low, although psychological impacts are noticeable because of well-publicized dioxin contamination at Love Canal, New York and in Times Beach, Missouri. Dollar costs associated with the health impacts from dioxin may be as much as $12 million per year.

What's being done?

Dioxin releases from several types of facilities are regulated, resulting in a steady decrease in emissions. Sites contaminated with dioxins as a result of chemical operations are being identified, isolated from human exposure, and slowly cleaned up. Bans on the consumption of shellfish that is known to be contaminated are intended to reduce the exposure to those for whom shellfish is a subsistence food.

Disinfection byproducts

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	L

Disinfection byproducts (DBPs) are a group of chemicals formed by the reaction of active chlorinating agents and simple organic molecules during the disinfective treatment of surface water. DBPs remain in the drinking water ultimately consumed by the public. DBPs have been linked to bladder and possibly other cancers, neural tube birth defects (such as spina bifida), and spontaneous abortions. The DBPs with the highest concentration include the trihalomethanes (THMs) and the haloacetic acids (HAAs).

Who's at risk?

About 55% of the New Jersey population is served by water utilities supplied by surface water, with varying levels of DBPs. Populations at increased risk include pregnant mothers and their fetuses, particularly when their drinking water is derived from treated surface water.

What are the human health impacts in New Jersey?

Based on population percentages established by EPA, DBPs may be expected to cause 40-350 cases of bladder cancer, 2 neural tube defects, and 200 miscarriages each year in New Jersey. About 25% of the New Jersey population, or half of people served by surface water based systems, are exposed to THM levels greater than 50 parts per billion (ppb), as compared to people served by private wells, which generally have less than 5 ppb. While the US EPA sets the standard for THM at 80 ppb, studies have linked neural tube defects with THM levels greater than 40 ppb.

What are the socioeconomic impacts in New Jersey?

The largest socioeconomic impacts of DBPs are the health care costs attributed to bladder cancer and neural tube birth defects. Estimates of bladder cancer costs range from about $5 million to about $17 million, and birth defect estimates range from $2 to $3 million per year. Overall, the costs total between $7 million and $20 million.

What's being done?

The Maximum Contaminant Level (MCL) for total THMs in drinking water was recently reduced to 80 ppb, and an MCL for total HAAs level was recently established at 60 ppb.

Dredging

Human Health Risk	
Ecological Risk	M - L
Socioeconomic Risk	L

Dredging is the removal of sediment from the bottom of a water body to deepen and/or widen channels for navigation. In more recent years dredging has been used to remove sediment that is known to be polluted. Dredging affects aquatic environments by killing plants and animals, clouding the water with sediment, and destroying habitat. There are also human health issues associated with dredging of contaminated sediments—these risks are described for each specific contaminant (e.g., PCBs) in the appropriate sections.

What's at risk?

Dredging activity affects aquatic plants, fish and bottom-dwelling animals such as oysters, scallops, and juvenile lobsters. Dredging activities and the creation of confined disposal facilities can lead to habitat loss and habitat disturbance. Dredging activities are concentrated in three areas in New Jersey: New York Harbor, the Atlantic Coastal Basin, and the Delaware Bay and River.

What are the ecological impacts in New Jersey?

Over 80 million cubic yards of material is dredged annually in New Jersey. New York Harbor accounts for more than 90% and nearly all is disposed of in the ocean at the Historic Area Remediation Site (HARS). New dredging eliminates habitat, while maintenance dredging keeps habitat in a continually disturbed state. Where dredging has resulted in a decline in aquatic species populations, they tend to recolonize in a few years, and dredging has never been found to be the cause of a major population decline. Disposal of dredged material can have adverse effects due to high concentrations of pollutants in the material. Bioaccumulation of these contaminants often occurs in organisms inhabiting the disposal areas.

What are the socioeconomic impacts in New Jersey?

While there are costs associated with dredging, they are small in comparison to the billions of dollars in economic activity that dredging supports.

What's being done?

The amount of dredging per year has more than quadrupled in New York Harbor since the channel deepening project was initiated in 1999. Dredging in the Atlantic Coastal Basin and Delaware River and Bay regions is relatively constant. Dredging is extensively regulated at the state and federal levels of government to avoid or minimize impacts. There are increasing possibilities for beneficial disposal methods that virtually eliminate contamination and bioaccumulation problems associated with disposal of polluted sediments.

EHD virus in deer

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	L

Epizootic Hemorrhagic Disease (EHD) is an infectious viral disease that kills wild animals, especially deer. There is no evidence that humans can become infected with the EHD virus. Most outbreaks in New Jersey have been documented in 20-year cycles.

What's at risk?

White-tailed deer populations statewide are at risk from EHD.

What are the ecological impacts in New Jersey?

EHD can have a significant effect on deer populations, but the disease does not wipe out entire herds, and does not affect domesticated animals. Historic documentation shows that up to 1,000 animals have been killed in a single year. New Jersey is currently experiencing a large overpopulation of deer, estimated at about 200,000 animals.

What are the socioeconomic impacts in New Jersey?

EHD poses minimal impacts, primarily associated with dead animal removal.

What's being done?

The New Jersey Department of Environmental Protection Division of Fish & Wildlife monitors the occurrence of EHD, and documents the cases in counties where it occurs.

Endocrine disruptors

Human Health Risk	M
Ecological Risk	M
Socioeconomic Risk	M

Endocrine disruptors are a subset of synthetic chemicals that interfere with the action of natural hormones in animals and humans. Chemicals with endocrine disrupting capability tend to be very persistent in the environment. Effects can vary from subtle to severe, and from temporary to permanent, depending on the chemical involved and the timing of the exposure with respect to normal hormonal activity. Resulting impacts are focused on adverse reproductive and developmental outcomes. Exposure to endocrine disrupting chemicals can occur directly from air, drinking water, or soil, and indirectly through the food chain, particularly for bioaccumumlating contaminants. A number of suspected endocrine disruptors have been evaluated independently; these include historically used pesticides, dioxin, PCBs, phthalates, and tributyltin.

What's at risk?

Because of the ubiquitous nature of endocrine disrupting chemicals, the entire population is exposed to some extent. As yet, unidentified subpopulations may be exposed to greater amounts due to geographic location or atypical dietary habits. Pregnant women and young children are especially sensitive to hormonally active agents. Endocrine disruptors can accumulate in breast tissue, potentially exposing nursing infants to elevated levels. Aquatic organisms, fish, and shellfish, and the birds and mammals that consume them are also exposed statewide. Wildlife in heavily polluted areas, such as Newark Bay and the Delaware River, is likely to be exposed to excessive levels of endocrine disruptors.

What are the human health impacts in New Jersey?

Scientists have only recently begun to study the effects of low doses of endocrine disrupting chemicals. Research thus far has focused on a small number of highly exposed subpopulations. The linkage between any particular exposure and these outcomes is unclear. There is also a lack of data quantifying the populations that may be at increased risk in New Jersey. Thus, the degree of uncertainty for this issue is large.

What are the ecological impacts in New Jersey?

All populations/ecosystems are at risk to some degree, and an estimated 20-40% of wildlife may be adversely affected. Because the limited amount of tissue sampling that has been done is typically associated with a suspected problem, it is difficult to accurately assess the risk to ecosystems statewide. Excessive concentrations are known to exist in polluted rivers and bays e.g., Delaware River, Newark Bay, but there are probably other areas where concentrations of endocrine disruptors exceed what is considered compatible with a healthy ecosystem. Ecological risks from PCBs and chlorinated pesticides such as DDT are described separately.

What are the socioeconomic impacts in New Jersey?

There are moderate psychological impacts linked to the effects of endocrine disruptors. Premature sexual development in girls may be linked to hormonally active chemicals in the environment. Premature development is known to have psychological effects for the girls, and creates significant worry for their parents. There continue to be many uncertainties regarding whether or not girls are maturing early, the extent to which endocrine disrupting chemicals are a cause, and the degree of harm induced by early sexual development.

What's being done?

Because of their abundance in consumer products and manufacturing processes, there are potentially significant amounts of endocrine disruptors that are released with little or no control. Current regulations that affect the production, use, and disposal of chemicals may not be effective in protecting ecosystems from the effects of very small quantities that subsequently magnify throughout the food chain. Research is being conducted to better assess the risks to human and wildlife populations from environmental concentrations of endocrine disruptors.

Extremely low frequency/ electromagnetic fields

Human Health Risk	L
Ecological Risk	L
Socioeconomic Risk	M - L

Electromagnetic fields (EMF) are produced by the generation, transmission, and use of electrical energy. United States' standards for delivering electrical current place these fields in the extremely low frequency (ELF) range of 3 hertz (Hz) to 3,000 Hz. Magnetic fields exist in conjunction with electric charges. Major sources of ELF magnetic fields are transmission and distribution lines, transformers, house wiring, appliances, train lines, and facilities that do electrogalvanizing, metal refining, induction heating, foundry work, and degaussing (demagnetizing recorded information). Magnetic fields have been hypothesized to be involved in promotion of cancer, specifically childhood leukemia and chronic lymphocyte leukemia in adults. This, however, remains highly uncertain.

Who's at risk?

Statewide, nearly all of the population is exposed to ELF/EMF via overhead power lines and household wiring. Electrical utility workers receiving greater exposure may be at increased risk for certain types of cancer. It is possible that children may be at a small, increased risk for certain types of cancers if their homes are near high voltage transmission lines or heavily-loaded distribution lines.

What are the human health impacts in New Jersey?

Studies to date have provided weak evidence connecting occupational exposure to magnetic fields (EMF) with adult chronic lymphocytic leukemia. Childhood exposures to magnetic fields might result in an additional 4-13 cases of leukemia statewide per year. However, the potential for any cancer from EMF is unclear and the number of attributable cancers may be zero.

What are the ecological impacts in New Jersey?

Studies involving birds, honeybees, wild animals, livestock, and fish have returned varying results. Most animals have not shown negative effects after exposure to high voltage power lines. Birds appear to be in greater danger of being electrocuted than of suffering from electromagnetic field exposure. The conflicting results shown from livestock studies may have been a result of stray ground voltage, rather than EMF. Honeybees have shown some decreased honey production and ability to survive in cold temperatures, however, researchers were unable to determine whether the results were due to EM fields or stray voltage. When the EM fields were shielded from the bees, their behavior returned to normal.

What are the socioeconomic impacts in New Jersey?

The socioeconomic impacts of EMF include the displeasure associated with viewing large metal structures along roadways and neighborhoods, concerns people have about unknown risk associated with EMF exposure, and concerns about reductions in property values. All New Jersey municipalities are affected by property value, worry, and aesthetic concerns. Approximately 240,000 acres of land are within 165 feet of overhead transmission wires. There is no quantifiable way to measure worry or aesthetic concerns. A general estimation of the reduction in property values due to close proximity of power lines is $1 to $2 billion. Costs of health care due to childhood leukemia may be several hundred thousand dollars.

What's being done?

Guidelines exist to restrict ELF electric fields at the edge of transmission line rights-of-way to 3 kilovolts per meter (kV/m).

Floatables

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	M - L

Floatables are solid wastes that litter waterways and beaches, degrading aesthetic quality and creating a hazard for wildlife. Plastic, wood, glass, metal, and styrofoam debris enter surface waters via storm drains, littering, and commercial transportation of garbage. Combined sewer outfalls are also a source of floatables, as increased flows during heavy rainfall overload the capacity of treatment plants and mixtures of storm water and sewage flow directly to waterways.

What's at risk?

Beach and bay communities bear most of the impacts from floatables, although inland rivers, lakes, and ponds are also affected. Birds and marine animals are at risk from injury or illness resulting from contact with litter. Residents of oceanside communities dependent on tourism are at increased risk for socioeconomic costs.

What are the ecological impacts in New Jersey?

Ingestion of or entanglement with floatables (e.g., plastic bags) can lead to strangulation, internal blockages, or other harm to birds, turtles, fish, marine mammals, or other wildlife. The impact on New Jersey ecosystems as a whole is judged to be small, particularly since the incidence of floatables has decreased in recent years and the trend is expected to continue. On the other hand, New Jersey does not conduct monitoring for impacts on aquatic life, thus these impacts are not fully understood.

What are the socioeconomic impacts in New Jersey?

In the 1980s, floatables were responsible for numerous beach closings in New Jersey. Oceanside communities dependent upon tourism lost hundreds of millions of dollars. Since that time, cleanup efforts have dramatically reduced the problem, and there have been no beach closings due to floatables since 1991.

What's being done?

Municipalities are required to remove floatables from sewage effluent. Following the beach closures of 1988, New Jersey initiated Operation Clean Shores in which prisoners remove debris from beaches. New Jersey also monitors floatables via aerial surveillance.

Formaldehyde

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	M - L

Formaldehyde is a chemical with industrial and commercial applications. Prior to 1980, it was present in urea formaldehyde insulating foam and levels of formaldehyde released from this product were high in some cases. It is also a by-product of combustion that leads to elevated outdoor concentrations. Mobile sources contribute 95% of the current outdoor releases. As a chemical pollutant, formaldehyde is an irritant and is considered a "probable" carcinogen.

What's at risk?

There are many individuals sensitive to the allergic effects of formaldehyde and levels inducing irritation are occasionally encountered in indoor environments. The cancer impacts from formaldehyde are the result of longer term chronic exposure that may be present in outdoor air and exposures are possible to the entire New Jersey population.

What are the human health impacts in New Jersey?

Cancer risks associated with average levels of formaldehyde in New Jersey are about 24 in a million, or about 2.5 additional cancer cases per year. The highest levels are found in Hudson County, where formaldehyde concentrations are four times the statewide median. At these higher exposures, the increased lifetime risk of cancer is about 1 in 10,000. The impacts from indoor exposure can be short term and acute, but the frequency of significant exposures is unknown although they are currently less than those in the period before 1980 when urea-formaldehyde foam was in regular use.

What are the socioeconomic impacts in New Jersey?

The medical costs associated with cancer cases attributable to formaldehyde exposure are expected to be about $250,000. There are no epidemiological studies available to estimate the number of cases of respiratory irritation or illness, but the impacts are unlikely to result in hospitalization. Thus, although formaldehyde exposure may be significant, there is no evidence that socioeconomic impacts (medical costs) are correspondingly so.

What's being done?

Indoor exposures have been reduced significantly as the result of the elimination of urea-formaldehyde use as insulating material. However, the use of formaldehyde in other products such as pressed wood furniture is still prevalent and not under current regulatory control. In the outdoor environment, formaldehyde is a by-product of combustion and subject to the general controls on automobile and stationary sources.

Geese

Human Health Risk	
Ecological Risk	M
Socioeconomic Risk	L

Suburban areas, with their expanses of short grass, make attractive habitat for Canada geese. In the 1980s, the population of geese living in New Jersey increased dramatically and has continued to rise. Overpopulation of geese creates a nuisance, reduces diversity of waterfowl, and may contribute to excess nutrient loadings in area waterways.

What's at risk?

Primary ecosystems at risk are urban and suburban lakes, parks, and golf courses. Atlantic (migrating) goose populations may also be at risk from the overabundance of year-round populations in New Jersey.

What are the ecological impacts in New Jersey?

The year-round goose population, estimated at about 100,000, may swell to as much as 280,000 in the winter as a result of migrating flocks. High populations of geese compete with other species of waterfowl for food and nesting sites, affecting species diversity. Resident geese are larger and better adapted to human environments, which favors their abundance relative to Atlantic (migrating) geese. At peak numbers, goose droppings may amount to more than 200 tons per day. In areas heavily populated by geese, their droppings increase nutrient loadings to streams and lakes, many of which are already overloaded from the effects of urban and agricultural runoff (see Phosphorus summary). This in turn can cause excessive algae growth, diminishing the aesthetic and ecological quality of the waterways. There is limited New Jersey-specific information on the ecological impacts of geese.

What are the socioeconomic impacts in New Jersey?

Goose droppings also create a nuisance on sidewalks, lawns, and golf courses. There have been two reports of individuals becoming sick from contact with goose droppings, but the effects appear to be minor as well as rare. Geese can also damage agricultural crops, but this is unlikely to be a significant concern in New Jersey.

What's being done?

Canada geese are protected under federal and state law. A winter harvest (i.e., hunting) has been recently allowed in New Jersey to help control resident populations. The U.S. Fish and Wildlife Service issues hunting permits to control local populations of resident geese. Short term deterrents include harassment with noise, dogs, or other means. Longer term strategies include modification of lake and pond shorelines to discourage geese.

Genetically modified organisms

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	L

For this report, genetically modified organisms (GMOs) are plants used in agriculture that are modified by applying laboratory techniques of biotechnology. The intent of their productions is to either increase yield, decrease pesticide use, decrease farm labor or increase nutritional value. Potential negative effects are cross pollination with wild species transferring unwanted genetic characteristics, and development of pest immunity to pesticides. There is also a general concern about unintended consequences of introducing species that have not evolved with natural controls in place to stop their spread.

What's at risk?

There may be human health impacts such as increased allergic responses or the encouragement of new bacteria and viruses. Economic impacts might be due to changes to agricultural and food processing industries. Ecological and psychological effects may arise if genetic material transfers to non-beneficial species. Non-target organisms may also be impacted by use of GMOs.

What are the ecological impacts in New Jersey?

The current effects in New Jersey are unknown due to lack of data. Potential ecological impacts include adverse effects on non-target organisms, development of pest immunity, and genetic exchange between transformed organisms and unaltered organisms. Information indicates low risk to tested species with the exception of butterfly species. These species may be at a low probability of risk near the edge or within corn fields. Overall, the risk from GMOs was deemed to be low. Data on the extent of GMO use in New Jersey should be collected and potential impact areas identified for study.

What are the socioeconomic impacts of GMOs in New Jersey?

The largest category of risk identified is currently psychological impacts. A 1993 poll revealed a minority of New Jersey citizens felt strong worry about GMOs. More recent national data suggest Americans are far less worried about GMOs than Europeans. There are no current large scale economic or ecological problems resulting from the use of GMOs but the potential exists for possibly devastating effects. There is significant disagreement regarding the likelihood of such problems.

What's being done?

The Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA) reviews applications each year from biotechnology companies that wish to field-test new transgenic plants or to have a plant deregulated. EPA regulates plant-incorporated protectants (i.e., pesticidal substances); that is, EPA regulates the pesticide protein and its genetic material, but not the GMO plant itself.

Green/red tides

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	L

Green and red tides are caused by excessive growth, or "blooms" of specific classes of single-celled plants in coastal waters. Blooms occur naturally under low flow conditions, and cause a red or green discoloration of the water. Blooms may result in fish and shellfish mortality, beach and shellfish bed closures, and mild to severe illness in humans. These can range from minor skin irritation associated with swimming in affected waters to serious illness associated with shellfish consumption.

What's at risk?

There have been chronic red tide blooms of various species in the Hudson-Raritan Estuary and New Jersey coastal waters for over three decades. Green tide has appeared as a greenish discoloration of the near shore coastal waters from Ocean City to Atlantic City during the summers of 1984-85. Algal blooms contribute to ecological problems in New Jersey, but there are few cases on record of human toxicity from algae in New Jersey waters, with the exception of moderate discomfort or illness reported from specific blooms.

What are the ecological impacts in New Jersey?

New Jersey has experienced chronic red tide blooms over many years, with green tide organisms appearing less frequently. Blooms are associated with reduced oxygen levels in the water, shellfish mortality, and fish kills.

What are the socioeconomic impacts in New Jersey?

The occasional appearance of discolored water may be considered a moderate aesthetic impact, but red and green tides have little impact on employment or property values, nor do the blooms impose any economic costs of significance.

What's being done?

The New Jersey DEP Bureau of Marine Water Monitoring monitors algae blooms throughout the summer. State and county officials have the authority to close beaches deemed unsafe because of algae. Harmful algal blooms are the subject of a national task force formed under the Harmful Algal Bloom and Hypoxia Research and Control Act of 1998.

Greenhouse gases

Human Health Risk	L
Ecological Risk	M - L*
Socioeconomic Risk	M - L *

Global climate change is a gradual rise in average global temperatures caused by increasing amounts of "greenhouse gases" in the atmosphere. More than 80% are the result of the combustion of fossil fuels, and atmospheric concentrations of carbon dioxide have increased nearly 30% since pre-industrial times. The buildup of heat trapping gases in the atmosphere is linked to a gradual rise in sea level and an increase in intense storm activity.

What's at risk?

Should the hypothesized effects of climate change materialize, all of New Jersey's population would be susceptible to health problems related to an increase in heat waves and air pollution. The elderly, infants, and people with cardiovascular or respiratory diseases would be particularly vulnerable. Coastal wetlands and the forested Pine Barrens ecosystems would be most vulnerable to climate change effects. People living in coastal areas would be at a greater risk from the effects of violent storms and flooding. It is impossible to predict the extent of secondary effects related to increases in disease caused by poor water quality or by the northern migration of disease-carrying insects.

What are the human health impacts in New Jersey?

The impacts of global warming are relatively uncertain and long term in nature. There are five major concerns about impacts of global warming on human health:

(1) increase in heat stroke and heat-related deaths due to hotter summers; (2) increase in respiratory diseases due to increase in air pollution; (3) increase in deaths from violent storm and flood activity; (4) increase in diseases carried by insects (e.g., malaria, and Lyme disease); and (5) illness related to poor water or food (e.g., fisheries) quality.

The total state population will be exposed; however, people near flood zones and coastal areas will be more susceptible to deaths from violent storm and flood activity. People in areas of the state that currently experience high levels of ground ozone might be increasingly exposed to respiratory diseases. The segments of the New Jersey population that might be particularly exposed are the elderly, infants and people with cardiovascular or respiratory diseases.

What are the ecological impacts in New Jersey?

Ecological impacts could be severe and irreversible, but they are very uncertain. Should sea levels rise to hypothesized levels, there is a potential for substantial damage to coastal ecosystems from saltwater intrusion and associated large impacts on biodiversity. Climate change may also influence the cycling of mercury in the environment, which would result in increased concentrations of mercury in fish.

What are the socioeconomic impacts in New Jersey?

Assessing the socioeconomic impacts associated with global warming is highly speculative. Should sea level rise as predicted, the economic costs associated with loss of property and tourism in coastal areas would likely be in the billions of dollars. Most people are aware of the potential for climate change impacts and this creates some degree of anxiety. However, major impacts are unlikely to occur within the next five years.

What's being done?

A treaty on greenhouse gas emissions may result in a slower warming trend, but most scientists agree that reducing emissions will not be enough to stop the increase in the greenhouse effect that will produce warmer temperatures in the coming decades. Impacts can be managed to some extent. Flood damage can be limited by controlling development in flood zones. New Jersey's existing health care system will, to some extent, be able to contain any major disease outbreaks.

*Note: Despite the potential for significant long-term human health and ecological impacts, the time frame over which such impacts may occur is longer than the five-year time frame encompassed by this comparative risk analysis. Over the shorter time frame of this analysis, few impacts are anticipated.

Habitat fragmentation

Human Health Risk	
Ecological Risk	H
Socioeconomic Risk	

Habitat fragmentation is the subdivision of habitat as land is converted from farms and forests to urbanized areas. While fragmentation is a frequent consequence of habitat loss, the ecological effects resulting in serious damage to ecosystems are distinct. Fragmentation results in the creation of "edge habitat" along the fragment border, which differs in microclimate and species composition from the original habitat. The continued expansion of urbanized areas and associated infrastructure interrupts watercourses, alters natural landscape patterns, and increases the proportion of edge habitat resulting in a number of ecosystem changes. Remaining habitat fragments support fewer species of plants and animals, and smaller populations of species that remain. Habitat fragmentation is often a contributing factor in the undesirable overpopulation of invasive plants and animals, as these species typically tolerate and even flourish in disturbed ecosystems.

What's at risk?

Virtually the entire state is at risk from the effects of habitat fragmentation. The New Jersey Pinelands and New Jersey Highlands are of particular importance because they still contain large tracts of critical wildlife habitat that are vulnerable to fragmentation and loss. The number and diversity of species present diminishes with forest size. Forest-breeding birds and other species that require moderate to large ranges of forested land are particularly at risk. Amphibian communities are severely impacted by fragmentation, especially by the presence of roads and other disturbances which can reduce or change their mobility patterns. Socioeconomic impacts of habitat fragmentation are included among the impacts discussed under Land Use Change.

What are the ecological impacts in New Jersey?

Studies have documented the effects of fragmentation in New Jersey. The habitat requirements of forest-breeding birds are relatively well studied, and a survey of New Jersey hawks and owls found that forest patches under 2,471 acres had no more than 4 different species, whereas forests up to 19,768 acres had up to 8 species. Data describing land use trends in New Jersey are also available. For example, between 1972 and 1988, the total amount of edge habitat increased 15% inside the Pinelands Reserve and 25% in neighboring areas outside. In the same time period, average mixed deciduous forest patch size decreased 21% inside the reserve, while outside the reserve forest patch size decreased 72%. Only 1% of the land area of the New Jersey Highlands consists of forest patches larger than 5,000 acres, and 75% of the land area is in forest patches smaller than 50 acres. Research suggests that 7,400 acres is the minimum forest patch size expected to retain all species of forest-breeding birds.

What's being done?

Major New Jersey land use and conservation plans identify habitat fragmentation as a management issue and New Jersey had 920,000 acres of permanently protected open space as of 1998. The Garden State Preservation Trust Act of 1999 establishes a stable funding source to preserve 1,000,000 acres of additional open space and farmland over the next ten years. Development is regulated in the 1.1 million acre New Jersey Pinelands National Reserve by the Pinelands Commission. Numerous other federal and state lands afford protection for areas already under public jurisdiction.

Habitat loss

Human Health Risk	
Ecological Risk	H
Socioeconomic Risk	

Habitat loss is the conversion of land from one use to another, specifically the development of wild or agricultural lands to urban and suburban land uses. Habitat loss also includes the conversion of natural habitat to agriculture, the conversion of dunes to seawalls, and the modification of wetlands by dams and channelization. Habitat degradation is the leading cause of endangerment for all groups of organisms in the mainland Unites States, ranking ahead of exotic species, pollution, over-exploitation, and disease. In New Jersey, these changes affect thousands of acres per year, resulting in the reduction of available habitat for native plant and animal species and decreasing the resilience of ecosystems to accommodate other natural and human caused stressors.

What's at risk?

Habitat loss affects all terrestrial and aquatic plant and animal populations and ecosystems statewide, especially those found on undeveloped, unprotected land. Unprotected forests and wetlands are particularly at risk. Regions that still contain large tracts of critical wildlife habitat are especially vulnerable to the effects of habitat loss. These include the Pinelands region (1.1 million acres) and the New Jersey Highlands (640,000 acres). Socioeconomic impacts of habitat loss are included among the impacts discussed under Land Use Change.

What are the ecological impacts in New Jersey?

Most of the plants and animals listed as endangered or threatened in New Jersey are imperiled due to habitat loss. Endangered tree frogs native to the Pinelands are being displaced by more disturbance-tolerant bullfrogs. Pinelands plant communities have also been altered as native species are replaced by invasive exotics in more developed areas. Bird species diversity is also known to decrease as the proportion of urban land increases. New Jersey has lost 40% of its wetlands and 35% of the Pine Barrens since pre-settlement times, and has 50% less farmland than in 1950. Naturally vegetated shoreline areas provide habitat and perform critical ecosystem services. Only 29% of Barnegat Bay's shoreline, for example, remains undeveloped. Rates of development continue to increase. During 1984-1995, 11 of New Jersey's 21 counties experienced rates of development greater than 20%, and several grew by more than 30%. Developed acreage in Salem and Cumberland counties increased by 50% and 42%, respectively, during this time. In addition to the direct effects on species composition, land use change also compromises ecosystem functions such as nutrient cycling and water purification and storage.

What's being done?

Due to human population pressures, returning currently developed land to its former state is not practical on a large scale. Consequently, the primary management focus should be on preventing further impacts. As of 1998, New Jersey had 920,000 acres of permanently protected open space (29% of New Jersey's total 3.2 million acres). Development is regulated in the 1.1 million acre Pinelands National Reserve, and most of Barnegat Bay's remaining salt marshes and undeveloped shoreline are under some form of protection.

Hanta virus

Human Health Risk	L
Ecological Risk	
Socioeconomic Risk	L

Hanta virus is an airborne viral pathogen generated from disturbed rodent saliva or droppings. It can be contracted by humans via inhalation of contaminated aerosols, or possibly through contact with broken skin or rodent bites. Once contracted, the infection may lead to pulmonary illness, which is often fatal.

What's at risk?

People can be exposed during activities (e.g., cleaning) which result in the generation of dusts or aerosols in indoor structures containing large numbers of deer or white-footed mouse nests. People who are occupationally exposed—grain farmers, field biologists, mill, construction, utility, and feedlot workers for example—may be at increased risk.

What are the human health impacts in New Jersey?

Risk is considered extremely low. There have been no known cases of hanta virus in New Jersey and a little over 200 cases in the Unites States since the disease was first characterized in 1993. In the northeastern Unites States, there have been 2 confirmed cases in New York, 2 in Pennsylvania, and 1 in Rhode Island.

What are the socioeconomic impacts in New Jersey?

There are no significant socioeconomic risks from hanta virus infection in New Jersey.

What's being done?

There are no regulations or controls in place. Hanta virus is a rare but serious disease with no known treatment, other than supportive care.

Hemlock woolly adelgid

Human Health Risk	
Ecological Risk	M - H
Socioeconomic Risk	M - L

The Hemlock woolly adelgid is an aphid-like insect pest that feeds on hemlock trees. Native to China and Japan, the insect was probably accidentally introduced in western North America in the 1920s and was first observed in eastern areas in the 1950s. It feeds at the base of the tree's needles, causing them to dry out and fall off. The trees become defoliated and heavy infestations can kill trees in about four years.

What's at risk?

All 26,000 acres of New Jersey hemlock forest are at risk. The loss of hemlock trees may also exacerbate other ecological risks by promoting the increased abundance of invasive exotic species, increasing fire hazard, and reducing shade necessary for maintaining stream temperatures.

What are the ecological impacts in New Jersey?

The pest poses a catastrophic threat to hemlock forests. All New Jersey counties have been infested, with more than 90% of hemlock forests exhibiting some degree of defoliation. Once it has occurred, defoliation is irreversible, and infested trees rarely recover. Indirect ecological impacts that may result from the decline or loss of hemlock stands include increased hazards from forest fire, changes in forest nutrient cycles, soil erosion, and loss of rare species habitat.

What are the socioeconomic impacts in New Jersey?

From a purely economic perspective, the loss of hemlock trees would be insignificant since they are a relatively small part of New Jersey's 1.8 million acres of forest. Similarly, any loss of recreational use of forests attributable to the loss of hemlock trees would likely be negligible. However, hemlocks are highly valued for their beauty. The loss of hemlock trees would probably be permanent. This must be considered a moderately serious socioeconomic impact.

What's being done?

There are no regulations concerning the transport of hemlock logs or trees in New Jersey. The state is experimenting with the introduction of exotic predators to control adelgid populations. If these prove successful, the risk to currently healthy stands (northwestern Sussex County) may be significantly reduced. However, there is little hope for hemlock stands that are already heavily infested.

Inadvertent animal mortality

Human Health Risk	
Ecological Risk	M
Socioeconomic Risk	M

Each year, animals are accidentally killed in large numbers due to traffic accidents, traps set for other animals, and as a result of nesting or other behaviors that are increasingly incompatible with human uses of their natural habitat. The risks associated with deer are discussed separately.

What's at risk?

Of particular concern is the diamondback terrapin, the only species of turtle in the United States that inhabits saltwater marshes. Once prized as a delicacy, terrapin numbers were so greatly depleted in the early 1900s that many states, including New Jersey, enacted protection policies that enabled terrapin populations to recover. No longer victims of overharvesting, terrapin populations are again threatened. Tens of thousands are unintentionally drowned in crab pots every year; another 1,500 are victims of traffic accidents.

What are the ecological impacts in New Jersey?

Excluding deer (addressed separately), there were about 18,000 animal-related traffic accidents in New Jersey during 1999. Shoreline development and associated erosion protection measures can destroy existing terrapin nests and force nesting females to venture into densely settled areas to lay their eggs. Hatchlings can become trapped in tire tracks in the sand and die before reaching the water.

What are the socioeconomic impacts in New Jersey?

Aesthetic and psychological impacts are likely, but they are expected to be fairly low. The costs associated with animal-related vehicle accidents are estimated at more than $16 million per year. Additional dollar costs are associated with terrapin rescue and management, but these have not been estimated.

What's being done?

Two promising management approaches may help combat the decline of terrapin populations. The "Life After Death" program rescues potentially viable eggs from freshly killed females; 30-50% of the rescued eggs become hatchlings. Another tactic is to increase the use of a "Bycatch Reduction Apparatus," a device that prevents 90% of terrapins from entering crab pots.

Increase in impervious surface

Human Health Risk	
Ecological Risk	M - H
Socioeconomic Risk	

Impervious surface is any material that prevents infiltration of water into soil. Roads, rooftops, and parking lots are examples of impervious surfaces. While the natural environment also contains impervious elements (e.g., bedrock surfaces), significant increases in the extent of developed areas have dramatically altered the proportion of impervious surfaces to natural vegetation. The resulting changes in the quantity and quality of storm runoff to receiving waterbodies creates adverse effects on ecosystem health by increasing erosion, degrading habitat, and altering natural stream flow patterns.

What's at risk?

Aquatic, wetland, floodplain, and upland animals and plants statewide are at some risk from increased imperviousness. Rare plant and animal species are likely at greater risk—particularly those that are directly impacted such as swamp pink and bog turtles. Approximately 36% of New Jersey's native plants and 7% of vertebrate species are in danger of becoming increasingly rare or extinct. Socioeconomic impacts of impervious surface are included among the impacts discussed under Land Use Change.

What are the ecological impacts in New Jersey ecosystems?

Major influences on stream quality for New Jersey include: increased human activity/density and paved surface; increased surface runoff and chemical use; and decreased base flow, forested area and wetlands—all factors which directly or indirectly relate to impervious surface cover. About one third of the land area in the state is already affected by an average impervious surface cover of over 10%, the threshold for impairments to benthic (bottom-dwelling) community structure. Sixty-five percent of monitored waterways in New Jersey have moderately to severely impaired benthic communities, and all but one small watershed with more than 25% impervious area showed moderate to severe impairment. Studies in New Jersey have also documented a relationship between storm water impacts such as erosion and decreasing or absent populations of the globally rare swamp pink and endangered bog turtle. Marine systems are similarly affected. Seventy-nine percent of near shore ocean waters were assessed as "threatened" based on dissolved oxygen levels. While there are multiple contributing factors, several, including river inputs and storm water runoff, are consistent with impervious cover.

What's being done?

There is a modest set of policy responses affecting the growth of impervious surface area. The Coastal Area Facility Review Act (CAFRA) limits development in coastal areas. New regulations for reducing storm water flows will apply to new developments. Stream encroachment and wetlands permits provide buffers for threatened and endangered species.

Indoor asthma inducers

Human Health Risk	M - H
Ecological Risk	
Socioeconomic Risk	M - H

Asthma is a complex condition affecting the small airways of the lungs. An initial exposure to allergens, viruses, pollution, or certain chemicals may induce the inflammation that leads to asthma symptoms in some individuals. Indoor asthma inducers include dust mites, animal/pet dander, mold, rodent protein, cockroach feces, and tobacco smoke. Asthma episodes may include lung inflammation, difficulty breathing, or in some cases, death. Episodes can be caused by inhalation of these same inducers, or other asthma triggers that may occur in either the indoor or outdoor environment, once an individual develops asthma.

What's at risk?

The risk is statewide, with certain occupational groups at higher risk, such as veterinarians or livestock workers. Children and adults in low-income communities are at increased risk, for reasons that are not entirely clear. African Americans are three to four times more likely than Caucasians to be hospitalized for asthma, and four to six times more likely to die from asthma. Individuals with atopic disease, an inherited tendency to get asthma, are more likely to develop asthma when exposed to these inducers. Estimates indicate that one third to one half of the United States population may be atopic.

What are the human health impacts in New Jersey?

Hospitalization and outpatient visits do not include all episodes, since many relatively mild episodes are self-treated with medication, but about 316,000 episodes of adult asthma and 123,000 episodes of asthma in children are estimated to occur in New Jersey in a given year (based on 2000 estimates). It is not known what fraction of these cases are the result of indoor asthma inducers.

What are the socioeconomic impacts in New Jersey?

Asthma has been determined to have significant health, societal, and economic consequences. The annual cost of asthma to New Jersey is $450 million. If one third of these costs are reasonably attributed to indoor allergens, this translates to a high socioeconomic risk. Persons with severe asthma account for 20% of the cases, and 80% of the costs associated with the disease. These chronic asthma sufferers may only be partially relieved by medication, and suffer from reduced quality of life.

What's being done?

Currently there are few controls placed on indoor air quality, with the exception of restrictions on smoking in some public areas.

Indoor microbial air pollution

Human Health Risk	L
Ecological Risk	
Socioeconomic Risk	M

Indoor microbial air pollution is caused by excessive growth of bacteria, fungi, or algae in warm, wet materials including lumber, ceiling tiles, books and papers, insulation, or hay. Microbes may also grow in central air systems and filters, or in humidifiers. A range of diffuse and often subjective symptoms known as "sick building syndrome" (SBS) may also result, in part, from indoor microbial air pollution. Health effects from airborne microbial pathogens include respiratory infection, ranging from flu-like, or pneumonia-like symptoms to possible neurologic damage, pulmonary hemorrhage, and even death.

What's at risk?

Airborne spores that cause no effect in some people may cause mild to severe effects in others. Persons with asthma, allergies, or weakened immune systems, and infants less than 6 months old are at increased risk, and may show more extreme reactions. At higher occupational risk are farmers, antique shop workers, greenhouse workers, or anyone occupying areas with excessive mold, or high moisture. Office workers in airtight buildings may be at risk for developing symptoms of sick building syndrome.

What are the human health impacts in New Jersey?

The population exposed to unsafe concentrations statewide is unknown, but it is estimated that hundreds of people are affected by indoor microbial air pollution each year. Incidence of severe symptoms, such as pulmonary hemorrhage, neurological effects, or death, is rare.

What are the socioeconomic impacts in New Jersey?

Indoor microbial air pollution is estimated to be responsible for 5-10% of the total costs of asthma in New Jersey, approximately $22 million to $45 million. Assuming that 10-20% of the total costs associated with sick building syndrome are attributable to indoor microbial pollution, New Jersey loses an estimated $230 to $460 million each year in direct health care costs and lost productivity.

What's being done?

Overall, indoor air pollution is increasing, but there are no regulations or standards for maintaining indoor air quality.

Invasive plants

Human Health Risk	
Ecological Risk	M
Socioeconomic Risk	M

Plants termed "exotic" species were introduced in North America either accidentally or intentionally from other parts of the world. Because these tend to have few if any natural predators or parasites on this continent, they are aggressive competitors for space and nutrients, and often form dense stands or thickets that crowd out native vegetation. Other invasive plants, such as the common reed, are native species that have spread out of control as a result of land disturbances that altered the original ecological balance.

What's at risk?

In addition to the loss of plant biodiversity, wildlife that depend on the displaced native species as a food source are also affected. Most invasive species flourish in disturbed habitats statewide, though they tend to be somewhat less prevalent in the Pine Barrens and coastal plains regions.

What are the ecological impacts in New Jersey?

Common to all invasives is a tendency for prolific seed dispersal and/or vigorous spread via root or rhizome. They also share competitive advantages such as the ability to germinate in shady, overly dry, or overly moist conditions. The table below summarizes the threats from common invasive plants.

What are the socioeconomic impacts in New Jersey?

Because of the many uncertainties associated with quantifying the extent of impacts, the estimated costs associated with the control of invasive plant species range widely, from about $50 million to $150 million. Many people find these plants attractive, thus there are assumed to be no significant aesthetic or psychological costs incurred.

What's being done?

There are no regulations for curbing the spread of invasive plants. Moreover, many continue to be sold and planted as ornamentals. Large-scale control efforts are generally not feasible, and would require years of vigilant eradication and subsequent reseeding of native vegetation. New Jersey DEP is collaborating with the New Jersey Department of Agriculture on the development of effective biological controls—the introduction of a leaf-eating species of beetle has had promising results with reducing purple loosestrife.

Scientific/ Common name	Type	Key Threats
Ailanthus altissima Tree-of-heaven	Tree	Affects abundance of important wildlife food sources such as Black Cherry and Black Walnut.
Acer platanoides Norway maple	Tree	Still one of the most commonly planted street trees in New Jersey. Unlike most invasives, also invades undisturbed habitat. Outcompetes other species.
Rosa multiflora Multiflora rose	Shrub	Once championed for use as wildlife cover and erosion control, forms impenetrable thickets and outcompetes other species, reducing abundance of native vegetation.

Invasive plants (cont.)

Scientific/ Common name	Type	Key Threats
Berberis thunbergii Japanese barberry	Shrub	Still sold commercially as an ornamental shrub; can tolerate low light, thus invading deep into forests with closed canopies.
Celastrus orbiculatus Asiatic bittersweet	Woody vine	Native populations of American bittersweet are particularly at risk from competition and hybridization with *Celastrus*.
Lonicera japonica Japanese honeysuckle	Woody vine	Tolerates low light and forms dense stands in forest understory. Twining growth habit can damage/kill other plants, including rare species.
Alliaria petiolata Garlic mustard	Biennial	Rapid spring growth may preclude emergence of important food species. Primary spread is via human transport (hiking, mowing).
Lythrum salicaria Purple loosestrife	Perennial	Invades wetlands. Direct threat to several state and federally endangered species. All limestone fens in northern New Jersey are seriously impacted.
Microstegium vimineum Japanese stilt grass	Annual	Forms dense "lawns" on disturbed sites. Particularly invasive on fertile sites disturbed by flooding. Increasing in New Jersey at exponential rates.
Phragmites australis Common reed	Perennial	Native species, the invasive spread of which appears to be associated with land disturbing activity. Has catastrophic effect on salt hay farming.

Land use change

Human Health Risk	
Ecological Risk	
Socioeconomic Risk	H

The dramatic physical transformation of open, wooded, agricultural, and wetland areas to suburban development in recent decades has had significant impacts. Most obvious are ecological insults including habitat loss and fragmentation, and increased impervious surface cover that worsens flooding hazards and pollutant runoff into surface waters. There are also important distributional socioeconomic impacts, as urban and rural areas lose jobs, tax revenues, and social capital to suburban areas. Statewide, suburbanization appears to provide net gains in employment and property values, and net losses in aesthetic and psychological terms. Sprawl imposes large direct costs due to increased commuting distances, congestion, and inefficient infrastructure investment.

What's at risk?

Land use change occurs statewide. Ecological effects are discussed under Habitat Loss, Habitat Fragmentation, and Impervious Surface. Socioeconomic effects include the pain associated with a spatial redistribution of wealth and opportunity, plus statewide aesthetic and psychological impacts. Ecologists analyzed impacts of habitat fragmentation, habitat loss and increase in impervious surfaces, rather than on land use change as a whole.

What are the socioeconomic impacts in New Jersey?

From a statewide perspective, employment and property values have only increased as suburbanization has progressed. A majority of New Jersey residents are voting with their feet and saying that they prefer suburban to urban living. There is growing evidence that this vast dispersal of population has also been costly. Some costs are simple transfers, as suburban areas attract housing and commercial investment and jobs, while cities suffer from declining property tax bases and a spatial mismatch between housing and jobs. For example, the magnitude of the transfer in property values away from New Jersey cities to the suburbs is estimated at $3.5 billion to $7.1 billion. Although there is no associated statewide loss in property values, these transfers diminish the overall level of social capital within the state, by pitting new winners and losers against one another, and by weakening long-established social networks. There are also direct costs associated with sprawling land use patterns relative to centralized development patterns, most significantly the higher cost to provide transportation, utilities, schools, and other public services, recently estimated at about $400 million annually in New Jersey. Both opinion polls and public support for open space preservation indicate that New Jersey residents perceive significant social costs associated with long commute times, traffic congestion, reduced housing choices, unwalkable neighborhoods, and less varied scenery.

What's being done?

Local governments largely control the development of land in New Jersey, and some municipalities actively encourage compact development while others do not. The New Jersey State Development and Redevelopment Plan details a voluntary approach for managing growth, and the Governor's Smart Growth Policy Council is attempting to coordinate the efforts of state agencies in this regard. Federal government involvement in this issue includes substantial highway subsidies and home mortgage guarantees that encourage sprawl development, and minor mass transit and urban revitalization subsidies that discourage it.

Lead

Human Health Risk	H
Ecological Risk	M
Socioeconomic Risk	H

Lead is a naturally occurring metal used in a range of industrial and commercial applications. Two uses of lead, which have since been banned, have contributed to widespread environmental contamination: leaded gasoline and leaded paint. Small amounts of lead continue to be emitted in diesel exhaust, and the majority of ongoing industrial emissions are attributed to steel and iron works. Coal burning power plants also emit lead. In New Jersey, human health effects arise through exposure to historic concentrations of lead in the paint of older homes, and in the soils adjacent to roadways and lead-painted structures. These can range from neurological effects, such as a learning deficit, to anemia and life-threatening encephalopathy at higher exposures. There may also be a link between long term exposure and hypertension in adults. Lead accumulates in soils, surface waters, and sediments presenting a toxic hazard to fish, amphibians, reptiles, birds, and mammals.

What's at risk?

Lead's environmental pervasiveness means that exposure of people and wildlife occurs statewide. Children are far more likely than adults to ingest contaminated soil or peeling paint; their bodies absorb it more efficiently, and their developing nervous systems are more sensitive to its effects. Although contamination is often greatest in urban/suburban regions, elevated lead levels are found in soils, sediments, and surface waters statewide.

What are the human health impacts in New Jersey?

There are no requirements for testing the general population for lead exposure, but New Jersey requires testing of children under 7. The Centers for Disease Control considers child blood lead levels more than 10 micrograms per deciliter of blood to be elevated, and children with levels more than 20 ug/dl are considered lead poisoned. In 1999, there were a total of 802 cases of lead poisoning in children under 7 in New Jersey. Preliminary data for 2000 indicates 4% of children tested had elevated blood lead levels. Since 1993, New Jersey has documented more than 15,000 cases of lead poisoning in children.

What are the ecological impacts in New Jersey?

Birds and mammals are at risk, due to bioaccumulation of lead up the food chain. While lead can cause death, chronic exposure is the more serious problem because of the irreversible reproductive and developmental effects. Limited sampling in New Jersey suggests that sediments in urban areas may contain lead at more than three times the ecological health benchmark. Lead levels in surface waters and sediments adjacent to contaminated sites have been sampled at extremely high levels—more than 200 times the benchmark. It is difficult to characterize the risks absent sufficient monitoring.

What are the socioeconomic impacts in New Jersey?

Based on national estimates, lead-related medical costs in New Jersey may reach $774 million annually. There are additional costs associated with lead abatement (removal of lead paint hazard in older homes) increasing the total economic cost. Urban parents and residents in older housing may suffer a moderate amount of worry regarding the risks from lead paint. Environmental justice activists have criticized the pace of lead removal from housing in minority areas.

What's being done?

Phasing out leaded gasoline has drastically reduced lead emissions to the air. Regulations restrict the amount of lead in air, drinking water, and consumer products. Laws also govern the cleanup of contaminated sites. Public health education, along with statewide pediatric screening, has also contributed to reductions in blood lead levels.

Legionella

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	L

Legionella is a specific group of bacteria, some of which are known to be pathogenic to humans. Under natural conditions, *Legionella* bacteria do not pose a threat. In certain (primarily indoor) conditions, they can multiply to unsafe levels. Humans may become exposed via inhalation of contaminated aerosols that arise from stagnant warm water found in indoor air handling systems. Inhalation of high numbers of these bacteria can cause a flu-like disease called Pontiac fever, or a more serious and sometimes fatal type of pneumonia called *Legionnaire's* disease, first recognized in 1977 following an outbreak of pneumonia at an American Legion convention in Philadelphia.

What's at risk?

Anyone has the potential to become exposed, but most healthy individuals will not become ill. People with an existing illness are more likely to become ill as a result of exposure. Smokers, the elderly, chemotherapy patients, and individuals with weakened immune systems are examples of more susceptible groups. Most cases have occurred in the 40-70 age group.

What are the human health impacts in New Jersey?

Reported cases of legionellosis in New Jersey from 1993-1996 averaged 33 cases per year. However, it is likely that only 5-10% of cases are reported. Based on Centers for Disease Control statistics, an estimated 237-533 people may contract legionellosis each year in New Jersey, with potentially 12-15 deaths resulting. Fatality rates are highest for immune-suppressed patients, or those with underlying disease. The occurrence of Pontiac fever is estimated to be 2 to 10 times more frequent than legionellosis.

What are the socioeconomic impacts in New Jersey?

Socioeconomic risks from *Legionella* infection in New Jersey include medical costs and the psychological impacts associated with the threat, which was widely publicized in New Jersey due to the proximity of the Philadelphia outbreak. Costs associated with the treatment of the disease may be several million dollars per year.

What's being done?

Growth of the bacteria can be controlled through the implementation of preventative procedures. Indoor air quality regulations apply to air handling equipment, and address microbial contamination specifically.

Light pollution

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	M - L

Concerns relate to vehicle safety (glare), energy efficiency, privacy, and aesthetics. Communications towers and other tall structures that are illuminated at night for aviation safety pose a threat to New Jersey birds.

What's at risk?

The proliferation of nighttime lighting has dramatically decreased the number of stars visible in New Jersey. While there are no health or ecological impacts that can be directly attributed to light pollution, the night sky seems to resonate deeply with people statewide. New Jersey bird populations statewide are at risk from collisions with towers, and regional biodiversity may be affected as migrating birds change flight patterns in relation to towers.

What are the ecological impacts in New Jersey?

Birds in flight can become disoriented near the light source and collide with the tower itself. Nationally, an estimated one million to five million birds are killed annually in collisions with towers. Lighted towers also affect migratory patterns, which could affect regional biodiversity. A number of studies outside the state have documented birds altering their flyways relative to lighted towers. More research is needed in order to determine whether light towers pose significant risks in New Jersey, but any existing impacts are likely to worsen as more and taller towers are constructed.

What are the socioeconomic impacts in New Jersey?

Economic costs, while impossible to quantify, would have to include the wasted energy used to produce unwanted light. The aesthetic impact of light pollution is not trivial, as evidenced by the growing number of night sky activists. There are likely some degree of aesthetic impacts and maintenance costs associated with the deaths of birds near light towers, but these are relatively insignificant.

What's being done?

At least one New Jersey community, Eatontown, in Monmouth County, has passed an ordinance declaring misdirected or unnecessary light to be a public nuisance. In 1997, the New Jersey Light Pollution Study Commission issued recommendations for reducing unwanted light on the basis of safety, privacy, efficiency, and preservation of the night sky. Widespread concern about the degradation of the natural nighttime environment has resulted in the growth of international advocacy for the control of inappropriate outdoor lighting.

Lyme disease

Human Health Risk	L
Ecological Risk	
Socioeconomic Risk	

Lyme disease is a multi-systemic, inflammatory disease caused by the spirochete *Borrelia burgdorferi* transmitted through the bite of infected black-legged ticks, *Ixodes scapularis*. Diagnosed and treated early, the effects are generally mild and transient. Misdiagnosed or undiagnosed/untreated cases may result in more severe complications, including cardiac, neurologic, or arthritic conditions. White-tailed deer (also evaluated as a biological stressor) are known to carry the tick that spreads the disease.

Who's at risk?

Specific populations at risk are those living or working in wooded suburban or rural environments in New Jersey. However, Lyme disease cases have been reported in all New Jersey counties. A large proportion of cases occur among children, presumably because of increased exposure and infrequent use of preventive measures.

What is the extent of human health problem in New Jersey?

Approximately 2,000 cases are reported annually (approximately 24 cases per 100,000 population). New Jersey consistently ranks among the top 5 states with respect to the number of confirmed cases reported each year.

What's being done?

Effective public education and surveillance are the extent of current intervention. No organized tick assessment or management programs have been established.

Mercury

Human Health Risk	M
Ecological Risk	M - H
Socioeconomic Risk	M - L

Mercury is a naturally occurring element that has been used in a variety of industrial and commercial applications. The primary source of mercury in the environment is air deposition—quantities of mercury are released from waste incinerators, manufacturing processes, and as a by-product of coal-burning power plants. Mercury emissions may travel hundreds of miles before precipitating out of the atmosphere and depositing on land. Thus, a portion of New Jersey's mercury deposition originates out of state. In aquatic environments, deposited mercury will react with bacteria to form methylmercury, an organic form that accumulates in biological (e.g., fish) tissue. It is this organic form of mercury that presents the greatest human and ecological hazards.

What's at risk?

Children whose mothers consume mercury-contaminated fish during pregnancy are at risk for neurological-developmental effects. A small number of private wells in New Jersey may also contain unsafe concentrations of mercury. Individuals with large numbers of dental fillings may be at increased risk, as are people who intentionally use mercury in their homes for folk/cultural reasons. Atmospheric deposition of mercury affects ecosystems statewide. Wildlife, particularly fish-eating species near the top of the food chain, are also at risk for adverse chronic effects. Areas at higher risk would include low pH systems such as the Pine Barrens, and near hazardous waste sites.

What are the human health impacts in New Jersey?

A child exposed to methyl mercury *in utero* may exhibit subtle cognitive deficits. About 10-20% of pregnant women in New Jersey who consume fish may expose their children to unsafe levels; thus an estimated 11,000-24,000 infants may be exposed each year. Adults who consume large amounts of fish with elevated levels of mercury may also experience neurological symptoms including tremors, weakness, and motor difficulties. Of 2,239 private wells tested in Ocean and Atlantic counties, 59% had detectable levels of mercury, and 14% had levels that exceeded the Maximum Contaminant Level (MCL). These percentages, however, cannot be generalized to New Jersey or to Ocean and Atlantic County residents. There are no reliable estimates of the numbers of people using mercury intentionally, or how many may be at greater risk as a result of dental work.

What are the ecological impacts in New Jersey?

Mercury may cause adverse impacts on aquatic and terrestrial species including reproductive, behaviorial and growth effects. Fish and wildlife at the top of aquatic food chains (fish-eaters) are especially at risk to the toxic effects of mercury, and because monitoring is limited, actual risks to aquatic species may be underestimated. Based on the samples that have been collected at some locations, mercury concentrations in soils, sediments, water, and fish tissue appear to exceed ecological benchmarks a significant portion of the time.

What are the socioeconomic impacts in New Jersey?

Statewide, the costs of mercury pollution are estimated at $2 million to $113 million per year. This includes medical costs for 1% of exposed infants, along with the costs of remediation for contaminated wells in the Pinelands area.

What's being done?

Fish consumption advisories are intended to limit consumption of mercury-contaminated fish, and increased education and public awareness should help reduce human health risks. Mercury in some consumer products has been reduced. Controls on emissions further reduce atmospheric concentrations. Assistance is provided for households with private wells exceeding the MCL.

Methyl tertiary butyl ether (MTBE)

Human Health Risk	L
Ecological Risk	
Socioeconomic Risk	M - L

Methyl tertiary butyl ether, or MTBE, is a fuel additive that reduces the generation of carbon monoxide and ozone-forming compounds when burned in automobiles. The chemical is water-soluble, and when spilled migrates readily through soil and into ground water supplies. Inhalation of high concentrations of MTBE can cause nervous system depression, and animal studies have shown long term exposure can result in kidney toxicity.

What's at risk?

MTBE can be inhaled during automobile refueling and ingested via contaminated drinking water. Therefore, the entire population is generally exposed, with some increased risks for those relying on well water that could potentially be contaminated with MTBE and for service station attendants.

What are the human health impacts in New Jersey?

Personal exposures, such as during refueling at service stations, can exceed the Reference Dose (i.e., the "safe dose"), but ambient concentrations are several hundred-fold lower. There are anecdotal reports of individuals suffering from acute symptoms, including headache, eye irritation, and dizziness. There are several wells contaminated with MTBE in New Jersey, but only one public water supply has exceeded the Maximum Contaminant Level (MCL). Contamination of private wells occasionally results in MTBE levels that exceed the MCL as set by the state.

What are the socioeconomic impacts in New Jersey?

No individual socioeconomic factor poses a large risk in New Jersey although psychological and aesthetic risks may be noticeable. MTBE does add a taste and odor to drinking water at concentrations less than those yielding a health concern.

What's being done?

The use of MTBE is being phased out to reduce its negative environmental impacts, particularly well contamination.

MSX parasite in oysters

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	M - L

MSX refers to a disease of oysters caused by the protozoan organism *Haplosporidium nelsoni*. MSX (which stands for "multinucleated sphere X") is also known as Delaware Bay disease. The protozoa were introduced to East Coast waters by an unknown source but have colonized oyster fisheries from Maine to Florida. MSX causes rapid death in highly susceptible oysters, and resulted in massive mortalities in Lower Delaware Bay estuary in 1957. Native populations in Delaware Bay have since grown quite resistant, although their numbers remain severely depleted relative to fifty years ago (see report on *Dermo* disease in oysters). Pollution does not appear to be a factor in the incidence or spread of the disease.

What's at risk?

Populations of the Eastern (aka American) oyster found in the Delaware Estuary and Atlantic coastal bays are at risk.

What are the ecological impacts in New Jersey?

Since the 1990s, the prevalence and severity of MSX disease has been very low in the Delaware Bay, even though the infectious organisms continue to be present. It is hypothesized that the current native population, having been descended from oysters that survived the 1957 event, is highly resistant. The general decline of native oyster populations due to periodic catastrophic infection events over the past fifty years remains a concern; current harvests indicate about a 90% loss since 1950. Oyster population decline significantly reduces the filtration of suspended particles in estuaries such as Delaware Bay.

What are the socioeconomic impacts to New Jersey?

Returning the oyster industry to historic levels would restore hundreds of jobs and contribute an estimated $40 million to New Jersey's economy. (Dermo parasites are included in this analysis.)

What's being done?

Control measures that are effective for Dermo disease are not generally effective for MSX. The best control for MSX is to culture resistant seed oysters in hatcheries, and to avoid seeding of wild oysters during the early summer, when risk of infection is highest.

Nickel

Human Health Risk	L
Ecological Risk	M - L
Socioeconomic Risk	L

Nickel is a naturally abundant metallic element that is ubiquitous in the environment. It is also used industrially for a variety of purposes. As an alloy, nickel is combined with other metals to form consumer products such as kitchen utensils, coins, and jewelry. Some nickel compounds formed as by-products from industrial processes using nickel as a catalyst are human carcinogens, but are of little concern for non-occupational exposures in New Jersey. Nickel is also a common skin allergen, and inhalation of low concentrations of nickel can contribute to asthma and respiratory infections.

What's at risk?

Because of the ubiquitous nature of nickel and its use in everyday household items, the statewide population is exposed on a daily basis. Risks to human and non-human populations will be greater in areas of increased nickel release (manufacturing facilities, oil and coal combustion sources, sewage sludge incinerators). Smokers and occupationally-exposed individuals are also at increased risk. Individuals with skin allergies to nickel may constitute 2-5% of the population.

What are the human health impacts in New Jersey?

Assuming that New Jersey ambient air concentrations of nickel are of the carcinogenic form, total air releases for New Jersey could be expected to add 5.1 lifetime cancers per million population, which is equivalent to a total of 40 excess cases, or less than one additional cancer per year. This assumption, however, is highly uncertain and is likely to result in a large overestimation of cancer risk. There have been no exceedences of the Maximum Contaminant Level (MCL) for nickel in New Jersey public drinking water supplies. Individuals with skin allergies to nickel may experience contact dermatitis, symptoms of which (e.g., itching) are mild and reversible.

What are the ecosystem impacts in New Jersey?

Nickel occurs regularly in river, marine, and estuarine sediments at levels greater than benchmark values but the impacts from these concentrations are not known. At toxic levels, nickel affects photosynthesis and/or growth in aquatic plants and animals. However, average concentration of nickel in surface waters are generally below levels of concern.

What are the socioeconomic impacts in New Jersey?

Medical costs associated with the additional cancer burden attributable to nickel are estimated at about $30,000 per year. There are no hypothesized impacts to property values, employment, aesthetics, or psychological well being.

What's being done?

Quantities of nickel in drinking water are regulated by federal law, with a Maximum Contaminant Level set at 0.1 milligrams per liter. Workplace exposures are regulated by OSHA. DEP has established that residential-use soils contain less than 50 parts per million of nickel.

Nitrogen oxides (NO_x)

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	L

Nitrogen oxides (NO_x) are by-products of combustion, with nitrogen dioxide (NO_2) being the most prevalent. Major sources of NO_2 in outdoor air are utility boilers and vehicles. Indoors, gas stoves and kerosene heaters also contribute to NO_2 exposures. Health effects are primarily to the respiratory system, although there are also immune system and cardiovascular impacts associated with exposure. Nitrogen dioxide is also a precursor to ozone as well as a constituent of acid precipitation; the effects of those are described separately.

What's at risk?

Virtually the entire population is exposed to NO_x and residents of urban areas are exposed to somewhat higher levels. As with other air pollutants, NO_x can accumulate to higher concentrations indoors and pose greater risk. At particular risk are asthmatics and children.

What are the human health impacts in New Jersey?

The concentration of NO_2 in New Jersey is below federal regulatory standards, but there is some evidence that the concentrations that do exist in New Jersey can increase the susceptibility of children to respiratory disease. There is some evidence of increased numbers of asthma episodes among the approximately 54,000 asthmatics that live in the three New Jersey counties with highest ambient NO_2 levels. For both children and asthmatics, indoor exposures increase the risk.

What are the socioeconomic impacts in New Jersey?

Any impacts are expected to concern medical costs, but even these are uncertain and likely to be low.

What's being done? .

New Jersey is required to reduce NO_x emissions to comply with federal regulations. These reductions have been effective in the past for industrial sources and to a lesser degree with mobile sources. Increasing use of automobiles makes it more difficult to keep emissions from increasing.

Nitrogen pollution (water)

Human Health Risk	L
Ecological Risk	M
Socioeconomic Risk	L

The natural nitrogen cycle is disrupted by the use of nitrogen fertilizers and by the production of nitrogen oxides (NO_x) during combustion. Excess nitrogen from fertilizers enters aquatic ecosystems, causing algal blooms and reducing oxygen levels and other ecological effects. Additionally, NO_x are present in precipitation, adding to the ecological impacts caused by fertilizer runoff. High nitrate levels in drinking water can contribute to "blue-baby syndrome," which reduces the ability of blood to carry oxygen. Atmospheric NO_x is considered separately, as are the impacts of ozone and acid precipitation, stressors to which NO_x are an important contributing factor.

What's at risk?

All freshwater and coastal ecosystems are exposed to excess nitrogen, but impacts are primarily to estuarine and coastal ecosystems. In the form of ammonia, nitrogen is toxic to fish, particularly trout.

What are the human health impacts in New Jersey?

No cases of "blue-baby syndrome" have been attributed to drinking water in recent years. Most drinking water in New Jersey meets the public health standard, and no cases of this syndrome have occurred at or below that level. Perhaps 10 to 20 infants a year, minus those who are breast-fed, would be at risk for exposure to clinically significant levels of nitrates in water from private wells in New Jersey.

What are the ecological impacts in New Jersey?

The effects of excess nitrogen in aquatic systems are most noticeable in marine and estuarine systems. Freshwater systems are more affected by excessive amounts of phosphorus (considered in a separate report). Ammonia can be toxic to fish, and its conversion to nitrate can result in oxygen depletion in aquatic systems. Low dissolved oxygen, or hypoxia, often occurs in coastal waters during summer, with severe ecological effects. High nitrogen levels contribute to the growth of problematic algae, resulting in the loss of submerged vegetation and fish and shellfish mortality (see reports on brown tide, red/green tide, pfiesteria). Ammonia levels exceeding water quality standards are found in about 10% of trout habitats.

What are the socioeconomic impacts in New Jersey?

Socioeconomic impacts were judged to be minor and associated with the potential for localized employment impacts.

What's being done?

Fertilizer use is not regulated, but efforts to reduce the incidence of excessive use are important in watershed management efforts.

Noise

Human Health Risk	L
Ecological Risk	M - L
Socioeconomic Risk	M

While noise is generally described as "unwanted" sound, excessive exposure to sound, regardless of desirability, can produce various physiological and psychological effects in both humans and animals. Workplace exposures to noise and personal exposures that are at least partially within the control of the individual are excluded from this analysis. As a result, the primary sources of concern are vehicle, railroad, and aircraft traffic noise, along with airports and highways.

What's at risk?

The entire population is exposed to some extent. Individuals living along transportation corridors or near airports constitute a population of concern, but these numbers have not been quantified. People with irregular sleeping habits, such as shift workers, and those with medical conditions that affect sleep are particularly vulnerable. Nesting shorebirds in the vicinity of heliports and airports are also impacted by excessive noise. Overflight noise affects special use lands, river corridors, beaches, forests, and wetlands totaling approximately 1.5 million acres.

What are the human health impacts in New Jersey?

There is a lack of data regarding the number of people exposed to excess noise and the magnitude of health effects that may be experienced as a result of exposure. Human health effects potentially include hearing loss, sleep disturbance, and effects on the cardiovascular system (e.g., blood pressure). The number of people exposed to excessive transportation noise has not been quantified. Likewise, the number of sleep-compromised individuals or otherwise vulnerable subgroups would be extremely difficult to estimate reliably. Excluding workplace and voluntary exposures, the remaining effects from environmental noise are minor and reversible.

What are the ecological impacts in New Jersey?

Animals also suffer from the effects of loud noise. Nesting birds exposed to heavy aircraft and helicopter traffic have been observed evacuating their nesting sites and fighting among themselves—abnormal behaviors that can affect reproductive success. There is little research that describes the extent of exposure or magnitude of effects in wildlife, including on the bird and aquatic wildlife impact of oceanic (ships; underwater broadcasts) and jet-ski noise. (The Ecological TWG produced two noise analyses, for overflights and watercraft, respectively.

What are the socioeconomic impacts in New Jersey?

Negative perceptions associated with noise are reflected in lower property values near airports. Estimated loss of property value due to the NY/NJ air transportation hub alone is nearly $25 billion. Additional property damages due to ground sources of traffic noise may bring the total to as much as $38 billion statewide.

What's being done?

There are significant controls in place to curb noise levels. Vehicles are required to comply with noise standards, noise ordinances are intended to keep environmental sources of noise down to acceptable levels, and New Jersey is second only to California in spending on noise barrier walls along its highways.

Off-road vehicles (ORVs)

Human Health Risk	
Ecological Risk	M- L
Socioeconomic Risk	L

The use of all-terrain vehicles (ATVs), snowmobiles, and jet skis is controversial. While resource managers claim moderate to severe impacts to terrestrial and aquatic ecosystems, use of motorized recreational vehicles continues to increase, creating conflict between ORV enthusiasts and non-motorized visitors to beaches, parks, and forests.

What's at risk?

Terrestrial and aquatic ecosystems where the use of ATVs, snowmobiles, and jet skis are used are at risk from the impacts of ORVs. Impacts appear to be more severe on sensitive ecosystems including wetlands and streams, but limited data prevents quantification at this time.

What are the ecological impacts in New Jersey?

Environmental impacts from ORVs include soil compaction and erosion, habitat degradation and/or wildlife harassment, loss of vegetation, noise, and air pollution. Jet skis also discharge quantities of unburned fuel which can be harmful to fish and marine mammals.

What are the socioeconomic impacts in New Jersey?

Motorized vehicles are considered a nuisance by non-users, and jet ski noise drives away significant numbers of tourists, costing an estimated $1 billion in lost revenue nationally.

What's being done?

Because of environmental concerns and negative public comments, the use of ORVs has been banned in many state and federal areas, including all New Jersey state parks. New Jersey has at least one park for off-road vehicles located in the Pine Barrens in Chatsworth. Operations such as this potentially reduce impacts by focusing activity to one area and reducing use in other areas/habitats.

Overharvesting (marine)

Human Health Risk	
Ecological Risk	M
Socioeconomic Risk	L

Harvesting of species such as clams, crabs, eels, and tuna at a greater rate than they can replace themselves is known as overharvesting. Overharvesting has been blamed for a decline in commercial fishing yields. Harvesting of horseshoe crabs was used as an example of overharvesting marine resources.

What's at risk?

Groups at risk include species with commercial value, such as horseshoe crab, tuna, clam, and eel. A critical aspect of overharvesting crabs is the annual reliance of more than a million migratory shore birds on horsehoe crab eggs as a food source to sustain the trip to their Arctic breeding grounds.

What are the ecological impacts in New Jersey?

Horseshoe crab eggs help maintain a healthy ecosystem by being a source of food for migratory shore birds, raccoons, foxes, turtles, and moles. Reduced availability of food for these species may result in decreased numbers, and a decline in ecological complexity and quality.

What are the socioeconomic impacts in New Jersey?

Employment impacts include the loss of several hundred commercial fishing jobs and declines in tourism income from birdwatching and recreational fishing. Aesthetic impacts of decreased bird nesting at Cape May are also notable, although very difficult to measure.

What's being done?

New Jersey requires a horseshoe crab permit and mandatory monthly reporting. Harvest by trawling or dredging is prohibited, and only hand harvesting is allowed. The harvest season has also been limited to April 15 to August 15. In addition, the National Marine Fisheries Service has recently established a horseshoe crab sanctuary off the mouth of Delaware Bay.

Ozone (ground level)

Human Health Risk	H
Ecological Risk	L
Socioeconomic Risk	M

Ozone is one of a class of compounds called photochemical oxidants that result from chemical reactions between various nitrogen oxides (NO_X) and volatile organic compounds (VOCs) in the presence of sunlight. Stationary sources and motor vehicles are the primary source of NO_X and VOCs. Inhalation of ground level ozone has been associated with a variety of respiratory problems, especially asthma, but also including acute and chronic bronchitis, chronic obstructive pulmonary disease (COPD), reduced lung function, and premature death. Ozone is also linked to various types of damage to agricultural crops, domestic plants, forests, and other plant life.

What's at risk?

All residents statewide are potentially exposed during the summer months. Children may be at increased risk of exposure because they are active outside during the summer, when ozone levels are at their highest. Adults and children with respiratory illnesses, such as asthma, bronchitis and emphysema, and adults who are active outdoors during the summer are also at higher risk. Ecosystems at risk include agricultural areas and urban vegetation, which are exposed to somewhat higher levels of ozone.

What are the human health impacts in New Jersey?

Studies on ozone exposure suggest that there is no minimum threshold for triggering respiratory responses and a significant proportion of hospital visits for asthma can be associated with exposure to elevated ozone levels. Federal health-based standards for ozone are set at 80 ppb measured over an 8-hour period, and 120 ppb for a 1-hour period. In 1999, one or more locations in New Jersey were in violation of the 8-hour standard on 46 days, and the 1-hour standard on 10 days. On an average day in 1999, peak 1-hour concentrations were in the range of 50-65 ppb. In New Jersey, there are more than 440,000 asthmatics and 430,000 persons with chronic bronchitis, who may be adversely affected by ozone levels.

What are the ecological impacts of ground level ozone in New Jersey?

Exposure to ground level ozone can suppress the growth of crops, trees, shrubs, and other vegetation, and increase susceptibility to insects and diseases. Agricultural crops are considered to be at increased risk, because of the economic impacts associated with reduced growth. New Jersey ozone levels are unlikely to have a visible impact on forest ecosystems, although ozone exposure may negatively affect individual tree species, such as the eastern white pine and black cherry, as well as urban vegetation.

What are the socioeconomic impacts of ground-level ozone in New Jersey?

Ground level ozone has been linked to a variety of respiratory problems, and agricultural crop and other plant damage. Socioeconomic impacts include costs associated with that damage, as well as worry due to respiratory illness, and reduced visibility on high-smog days. Minimum cost estimates of ground level ozone's contribution to respiratory illness total more than the $59 million, and crop damage to corn, winter wheat, and soybean crops are estimated at $1 million to $2 million.

What's being done?

During the 1980s, the 1-hour ozone standard was exceeded in New Jersey more than 30 times per year. In recent years, the standard is exceeded much less often—less than 20 times per year. This overall reduction in ozone levels can be attributed to reductions in allowable emissions from automobiles and industrial sources, and by controlling releases at fuel pumps.

Particulate Matter

Human Health Risk	H
Ecological Risk	
Socioeconomic Risk	M - H

Particulate matter is solid particles or liquid droplets from smoke, dust, ash, or condensed vapor that can remain airborne for long periods of time. Particulate matter results from all types of combustion, materials abrasion, and re-suspension of dust. Bioaerosols, which include plant pollen, animal dander, molds and yeasts, bacteria, and viruses, may be particularly high indoor contributors to particulate matter exposures. Particulates are usually measured in two size ranges. Coarse particles (between 2.5 and 10 microns in diameter) are formed as a result of crushing or grinding (e.g. mining operations), and natural weathering, and include the bioaerosols. Fine particles (less than 2.5 microns) result from condensation of volatile combustion products and reactions between atmosphere pollutants. Fossil fuel combustion (vehicles, power utilities, and industry), burning of vegetation, and metal smelting are sources of fine particulates. Inhalation can aggravate existing respiratory and cardiovascular disease, damage lung tissue, and interfere with lung function. Increases in particulate matter exposure are also associated with increased daily mortality, although the exact cause is uncertain.

What's at risk?

Groups most widely affected include young children, asthmatics, the elderly, smokers, and individuals with chronic lung or cardiovascular disease. Asthmatics show increased response to acid aerosols and bioaerosols. Smokers constitute approximately 80% of individuals with chronic obstructive pulmonary disease and a portion of cardiovascular disease patients. Children and adolescents may be at increased risk because they have higher respiration rates.

What are the human health impacts in New Jersey?

The entire state is currently in compliance with federal standards for coarse particles (PM 10). Recent studies have shown that fine particles (PM 2.5) may be of greater concern. Fine particulates are inhaled deeply into the lungs, where they become lodged and interfere with lung function. In contrast, PM 10 are cleared fairly rapidly from the nose and upper airways by sneezing and coughing. New standards for PM 2.5 are being developed. The average American person spends about 20 hours per day indoors. Cooking, smoking, dusting, vacuuming, and walking on carpets are all sources of particulates to which people are exposed daily. For most individuals, the effects are small and difficult to attribute to specific environmental conditions. Typically, the effect is a worsening of an existing health problem.

What are the socioeconomic impacts in New Jersey?

Damage costs associated with the soiling of homes are estimated at over $160 million. Health care costs cannot be quantified, because of the tendency of particulate matter to worsen existing conditions. Aesthetic impacts from reduced visibility in New Jersey attributed to particulate matter can be assigned a dollar cost using established "willingness to pay" rates for improved visibility in recreational and residential areas. These costs are estimated at $45 million, however there are significant uncertainties associated with this estimate.

What's being done?

Recent research focused on the significance of smaller (PM 2.5) particles, and their relation to illness. Controls are in place on large industrial facilities, and new standards for auto fuels have been released, which are expected to further reduce PM 2.5. There are indoor particulate matter standards for the workplace, but no regulations control residential exposures.

Pesticides, present use

Human Health Risk	
Ecological Risk	M - L
Socioeconomic Risk	

Pesticides include any compounds employed to destroy, prevent, or control pests. By their very nature, these chemicals present some risk of environmental harm. Approximately 600 substances are registered as pesticides—this analysis focuses on the risks associated with a subset commonly used in New Jersey. Aquatic herbicides such as copper sulfate are applied directly to surface waters to control weeds and nuisance insects. Oxamyl is an insecticide used on a variety of crops, typically apples, potatoes, and tomatoes. Diazinon is a versatile insecticide used widely on both croplands and turfgrass. Resmethrin is another broad-spectrum insecticide commonly used in mosquito control.

What's at risk?

Aquatic ecosystems throughout the state are at risk from unintended effects of weed and nuisance insect control pesticides. Atlantic, Burlington, Cumberland, Gloucester and Salem counties typically record the heaviest agricultural pesticide use in the state. Foraging birds, mammals, fish, and beneficial insects, such as honey bees, are at risk.

What are the ecological impacts in New Jersey?

Even when used in an appropriate and legal manner, commonly used pesticides create adverse impacts on non-target species. Oxamyl is typically applied to a variety of crops during critical periods of bird and mammal reproduction, increasing the risk of reproductive effects. Bird kills associated with diazinon application are well documented, as are its toxic effects on honey bees, fish, and aquatic invertebrates. Incidents of wildlife mortality associated with diazinon have been steadily increasing, with the majority occurring on turf sites, such as lawns. The use of resmethrin has increased in response to health concerns associated with mosquito-borne illness (West Nile virus) along with a corresponding increase in the risks to non-target populations.

What are the socioeconomic impacts in New Jersey?

The socioeconomic TWG estimated impacts from pesticide exposures from all sources. Using national estimates, at least $8 million in medical costs may be expected as a result of increased childhood cancers and accidental poisonings related to pesticide exposures. Studies have shown that most people worry about pesticide residues in food. Potential loss of biodiversity may also contribute to an aesthetic impact. Overall, socioeconomic risks from pesticides are considered high, but there are significant uncertainties.

What's being done?

There are controls on where oxamyl, diazinon, and resmethrin may be applied and by whom. The DEP Pesticide Control Program licenses professional pesticide applicators and conducts monitoring for ecological impacts in New Jersey. Outreach programs help to educate the public on the safe and responsible use of pesticides. Acute and chronic impacts to non-target organisms are occurring under legal uses; further exploration is needed to determine whether allowable uses are protective of ecological integrity.

Pesticides, food

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	

Pesticides include any compounds employed to destroy, prevent, or control pests. By their very nature, these chemicals present some risk of environmental harm. Approximately 600 substances are registered as pesticides, each having different chemical, physical, and toxicological characteristics. Many of these are used in growing and producing food crops for human consumption. Food monitoring studies have documented the consistent presence of many different pesticide residuals in foods, and because of the presence of long lasting pesticides in soils, there are no crops grown that can be guaranteed completely pesticide free.

What's at risk?

The general population is exposed as persistent pesticide residues continue to be detected in virtually all types of food products. Because of their immature systems, infants and children are more susceptible to the effects of pesticides. They also consume more food relative to body weight. Exposure to even trace amounts at crucial times in fetal or infant development may disrupt or damage developing hormonal, reproductive, neurological, or immune systems. The elderly, nursing mothers, and women and men of childbearing age are also more susceptible.

What are the human health impacts in New Jersey?

There are national estimates for residue content in selected foods: pesticides have been found in about 40% of grain samples, 55% of fruits, and 30% of vegetable samples. Only a small percentage of samples violate established tolerances, however, and this percentage has been decreasing over time. While DEP has recently initiated a pilot program to evaluate food grown in New Jersey, there are currently no data available to quantify exposures to residues from food grown in New Jersey. In addition to the difficulties in quantifying exposure, health effects associated with residues have not been systematically assessed even for particular chemicals. There are large data gaps hindering a valid assessment of the impacts that may result from chronic exposure to the myriad of pesticide residues on food.

What are the socioeconomic impacts in New Jersey?

The socioeconomic TWG estimated impacts from pesticide exposures from all sources. Using national estimates, at least $8 million in medical costs may be expected as a result of increased childhood cancers and accidental poisonings related to pesticide exposures. Studies have shown that most people worry about pesticide residues in food. Potential loss of biodiversity may also contribute to an aesthetic impact. Overall, socioeconomic risks from pesticides are considered high, but there are significant uncertainties.

What's being done?

The federal Food Quality Protection Act requires a reassessment of the underlying risks from pesticides in food. National efforts are under way to reevaluate tolerances to reflect residues in all types of food, to include risks other than cancer, and to factor in aggregate exposures from diet, drinking water, and other nonoccupational exposures. Over 9,000 commodity/pesticide combinations with existing tolerances will be reassessed by 2006. The limitation and regulation of the use of pesticides on food crops minimizes the risks of acute effects or poisoning.

Pesticides, historic use

Human Health Risk	
Ecological Risk	M - H
Socioeconomic Risk	

Pesticides include any compounds employed to destroy, prevent, or control pests. By their very nature, these chemicals present some risk of environmental harm. The widespread use of chlorinated pesticides such as DDT and chlordane began with the use of DDT during World War II as a highly effective, long lasting, and inexpensive insecticide. It was the most widely used agricultural insecticide from 1946 to 1972. Chlordane, also introduced in the 1940s, was used extensively throughout the 1960s and 1970s to control lawn and garden pests. Recognition of the ecological and human health hazards of chlorinated pesticides led to a United States ban on DDT in 1972, and chlordane in 1988. Because these compounds remain stable for long periods of time, residues continue to be detected in New Jersey soils, sediments, surface, and ground water.

What's at risk?

Since DDT, chlordane, and other chlorinated pesticides were used extensively, they continue to be detected throughout the state. Because these chemicals accumulate in animal tissue, species at the top of the food chain, especially fish eaters, are at greatest risk. Examples include osprey, bald eagle, and river otters.

What are the ecological impacts in New Jersey?

DDT and its metabolites (DDD, DDE) are found in soil samples throughout the state. Bald eagle and peregrine falcon eggs have been found to contain up to 30 parts per million of DDE in their eggs. High pesticide concentrations reduce eggshell thickness, making them vulnerable to breakage, thus impacting reproductive success for the population. Chlordane has been linked to large-scale bird poisonings in certain areas of New Jersey. During a 3-week period in 1997, chlordane-contaminated beetles, consumed by insectivorous songbirds, and ultimately birds of prey, resulted in a significant poisoning event that killed over 400 birds. Whether similar conditions exist throughout New Jersey is unknown, but sampling indicates the hazard may be restricted to suburban areas where chlordane was used on lawns in the 1960s and 1970s.

What are the socioeconomic impacts in New Jersey?

The socioeconomic TWG estimated impacts from pesticide exposures from all sources. Using national estimates, at least $8 million in medical costs may be expected as a result of increased childhood cancers and accidental poisonings related to pesticide exposures. Studies have shown that most people worry about pesticide residues in food. Potential loss of biodiversity may also contribute to an aesthetic impact. Overall, socioeconomic risks from pesticides are considered high, but there are significant uncertainties.

What's being done?

Bans on the use of chlorinated pesticides have decreased their presence over time, but as much as 50% of these persistent compounds may remain in the environment. Federal and state regulations control the levels of chlorinated pesticides permitted in drinking water and food. Contaminated sites requiring cleanup must meet federal and state requirements for chlorinated pesticide concentrations.

Pesticides, indoor

Human Health Risk	M - H
Ecological Risk	
Socioeconomic Risk	

Pesticides include any compounds employed to destroy, prevent, or control pests. By their very nature, these chemicals present some risk of environmental harm. Approximately 600 substances are registered as pesticides, each having different chemical, physical, and toxicological characteristics. Indoor exposure to pesticides results from their direct use as disinfectants or pest control as well as indirectly as a result of drifting or tracking in from outdoors. Rugs and floors are a major source of pesticide residues; household dust has been found to contain higher pesticide levels than the surrounding outdoor soils in a number of studies. Chemicals used for termite control, some of which have been banned for residential use, may continue to persist in indoor air years later. Pesticides that degrade readily in soils may persist for longer periods in indoor environments.

What's at risk?

Virtually everyone is exposed to some degree and infants and children are especially at risk from ingesting pesticide residues on floors and objects. Asthmatics or other sensitive individuals may also be at increased risk. Residents of older homes treated for termites and urban residents with persistent pest control problems may have elevated indoor levels. Suburban residents and homes in agricultural areas where large quantities of chemicals are applied outdoors may also have correspondingly higher indoor levels.

What are the human health impacts in New Jersey?

According to EPA data, many people receive 80% to 90% of their exposure to pesticides indoors. Exposure occurs via inhalation of residues in the air, skin contact, and ingestion of residue carried by dust or particles. Pesticide residues may be found in homes many years after chemical use has been discontinued—some of the most persistent pesticides such as DDT are still detected. The exposure level to specific populations in New Jersey cannot be quantified, but according to national estimates, 75% of American households used at least one pesticide indoors during the year. While it is unknown what percentage of these households are adversely affected by indoor pesticide levels, there is concern about the chronic impacts of low doses on the endocrine, reproductive, and neurological systems, immune response, and on learning and memory. There is also a potential for acute effects resulting from misuse or accidental poisoning. Several thousand calls related to pesticides are placed annually to the New Jersey Poison Information and Education System.

What are the socioeconomic impacts in New Jersey?

The socioeconomic TWG estimated impacts from pesticide exposures from all sources. Using national estimates, at least $8 million in medical costs may be expected as a result of increased childhood cancers and accidental poisonings related to pesticide exposures. Studies have shown that most people worry about pesticide residues in food. Potential loss of biodiversity may also contribute to an aesthetic impact. Overall, socioeconomic risks from pesticides are considered high, but there are significant uncertainties.

What's being done?

A number of the most persistent pesticides have been banned from use, but continue to be detected in indoor environments. Regulations govern the professional pest control industry. Product labeling and education efforts contribute to increasing consumer safety. There are currently no regulations pertaining to the safe storage of pesticides where they are sold to the general public.

Pesticides, outdoor

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	

Pesticides include any compounds employed to destroy, prevent, or control pests. By their very nature, these chemicals present some risk of environmental harm. Approximately 600 substances are registered as pesticides, each having different chemical, physical, and toxicological characteristics. Pesticides of every major chemical class may be detected in New Jersey ground and surface waters, a result of widespread use on croplands, lawns, gardens, golf courses, rights-of-way, and parks. Pesticides that have long been banned, such as DDT, are still detected in New Jersey surface water samples. The presence of pesticides in surface and ground water supplies poses risks to human health when these sources are used for drinking water. Most New Jersey residents obtain drinking water from public water supplies, about half rely on surface water sources, and half on ground water sources for raw water. In rural areas in the southern part of the state, many people rely on private wells that tap into ground water. There is a potential for any of these drinking water supplies to become contaminated with pesticides.

What's at risk?

The general population is potentially exposed. Because private wells are not monitored, households with private wells are at increased risk. Particularly vulnerable to contamination are shallow wells located in areas with high pesticide use. Infants, children, and the elderly may be at increased risk from the effects of pesticide contamination. Individuals with compromised immune systems or chronic lung disease or nervous system dysfunction are also at increased risk.

What are the human health impacts in New Jersey?

More research is needed to address the data gaps that make it impossible to quantify exposure levels and impacts of that exposure for the New Jersey population. There are currently no estimates regarding the incidence of pesticide-related illness, nor a means for assessing the severity of health effects. However, hundreds of thousands of pounds of chemicals are applied commercially in New Jersey, with the additional volume of usage by private citizens going unreported. Most pesticides have not been fully evaluated with respect to the potential for endocrine disrupting effects at low, chronic levels of exposure (see summary on Endocrine Disruptors), rather, evaluations for potential health effects have been heavily based on high dose animal studies. Pesticide use also carries a risk for acute effects resulting from misuse or accidental poisoning. Several thousand calls related to pesticides are placed annually to the New Jersey Poison Information and Education System.

What are the socioeconomic impacts in New Jersey?

The socioeconomic TWG estimated impacts from pesticide exposures from all sources. Using national estimates, at least $8 million in medical costs may be expected as a result of increased childhood cancers and accidental poisonings related to pesticide exposures. Studies have shown that most people worry about pesticide residues in food. Potential loss of biodiversity may also contribute to an aesthetic impact. Overall, socioeconomic risks from pesticides are considered high, but there are significant uncertainties.

What's being done?

Pesticide use is regulated, but current levels of contamination are occurring as a result of legal use. Reducing the risks associated with pesticides in drinking water will require changes in regulations controlling their use, as well as changes in agricultural practices that reduce application rates and control runoff.

Pesticides, water

Human Health Risk	M
Ecological Risk	
Socioeconomic Risk	

Pesticides include any compounds employed to destroy, prevent, or control pests. By their very nature, these chemicals present some risk of environmental harm. Approximately 600 substances are registered as pesticides, each having different chemical, physical, and toxicological characteristics. Outdoor herbicides are widely used for lawn care, rights-of-way, and golf courses in New Jersey. Pesticides of every major chemical class may be detected in New Jersey ground and surface waters, a result of widespread use on croplands, lawns, gardens, golf courses, rights-of-way, and parks. Pesticides that have long been banned, such as DDT, are still detected in New Jersey surface water samples. The presence of pesticides in surface and ground water supplies poses risks to human health when these sources are used for drinking water.

What's at risk?

The general population is exposed to pesticides through the ingestion of drinking water coming from public and private supplies. Because private wells are not monitored, households with private wells are at increased risk. Particularly vulnerable to contamination are shallow wells located in areas with high pesticide use. Infants, children and the elderly may be at increased risk from the effects of pesticide contamination. Individuals with compromised immune systems are also at increased risk.

What are the human health impacts in New Jersey?

There are currently no estimates regarding the incidence of pesticide-related illness, nor a means for assessing the severity of health effects. However, hundreds of thousands of pounds of chemicals are applied commercially in New Jersey, with additional use by private citizens going unreported. If only 1-5% of the applications reach surface water via run off, then a large quantity of the pesticide will be available through drinking water. Monitoring both surface and ground water shows a large percentage is vulnerable to pesticide contamination, although exceedances of health based limits are not currently observed. Most pesticides have not been fully evaluated for endocrine disrupting effects at low, chronic levels of exposure (see summary on Endocrine Disruptors). Evaluations for potential health effects have been heavily based on high dose animal studies. Pesticide use also carries a risk for acute effects from misuse or accidental poisoning. Several thousand calls related to pesticides are placed annually to the New Jersey Poison Information and Education System.

What are the socioeconomic impacts in New Jersey?

The socioeconomic TWG estimated impacts from pesticide exposures from all sources. Using national estimates, at least $8 million in medical costs may be expected as a result of increased childhood cancers and accidental poisonings related to pesticide exposures. Studies have shown that most people worry about pesticide residues in food. Potential loss of biodiversity may also contribute to an aesthetic impact. Overall, socioeconomic risks from pesticides are considered high, but there are significant uncertainties.

What's being done?

Drinking water is monitored for pesticide contamination. A number of the most persistent pesticides have been banned from use, but continue to be detected wherever samples are taken. Risks from current use pesticides are controlled in part by labeling requirements and EPA registration. The DEP Pesticide Control Program has responsibility for licensing and certification of commercial pesticide applicators. Applications for mosquito control increased in response to the 1999 West Nile virus outbreak (see related summary).

Petroleum Spills

Human Health Risk	
Ecological Risk	M
Socioeconomic Risk	M - H

Spilled oil and gas products can pose a threat to aquatic ecosystems in a number of different ways. Catastrophic oil spills on the order of the Exxon Valdez, while unlikely to occur, would have devastating effects on a marine or riverine environment. Minor oil spills, which happen much more frequently, can have significant cumulative impacts. Recreational vehicles such as jet skis release a significant portion of their fuel into the water. Finally, underground storage tanks may leak, allowing the contents to seep into the soil and ground water, eventually contaminating surface water systems.

What's at risk?

Fish, shellfish, and birds are most directly affected by oil spills. Most spills occur in Newark Bay, Arthur Kill, Kill Van Kull, and the Delaware River.

What are the ecological impacts in New Jersey?

The severity of the impacts will vary depending on (1) the properties of the specific product spilled, (2) natural conditions such as water temperature, wave action, and weather at the time of the spill, and (3) the feeding habits of affected wildlife—shore birds versus waterfowl for example. About 600 spills occur each year, averaging less than 10 gallons each. Major spills of more than 500 gallons occur much less frequently—11 occurred in New Jersey between 1997 and 2000.

What are the socioeconomic impacts in New Jersey?

Millions of dollars are spent by polluters, DEP, and tank owners for emergency clean ups. Additionally, the threat of a catastrophic tanker accident along with the unsightly appearance and odor associated with degraded ship channels creates moderate levels of psychological and aesthetic impacts.

What's being done?

The United States Coast Guard, EPA, and Department of Environmental Protection share responsibilities for helping to prevent, monitor, and clean up accidental oil spills in New Jersey waterways. EPA and DEP regulate the repair and closure of underground storage tanks. Despite regulations and programs aimed at reducing the risk of accidental oil spills, the volume of petroleum-related activity ensures that spills will continue to pose a threat as long as oil is transported, stored, and processed in New Jersey. There are no restrictions on the use of jet skis and other marine engines that routinely release quantities of fuel and engine oil to the water.

Pets as predators

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	L

Free ranging cats and other household pets that are allowed to roam outdoors can pose a threat to birds and other wildlife. Housecats are abundant predators, responsible for killing over a billion small mammals and hundreds of millions of birds in the United States each year. To a lesser extent, unleashed dogs can also harm wildlife, particularly beach nesting birds. Suburbanization has the compound effect of increasing the incidence of pets, while decreasing preferred habitat for prey species.

What's at risk?

Birds, mammals, and small reptiles including at least 18 endangered or protected species are at risk. Small perching birds and beach nesting species such as piping plover and tern are particularly vulnerable to pet predation in New Jersey. Cats also outnumber and outcompete some native predators such as hawks and weasels.

What are the ecological impacts in New Jersey?

There have been no studies done in New Jersey to quantify the problem. As a reference, data from other states have found that cats kill nearly 40 million birds per year (Wisconsin), averaging up to 91 birds per year apiece (Virginia). Predators are cited as the major cause of piping plover decline in New Jersey, but management for cats and dogs has been recommended at only 8 of 34 monitored breeding sites.

What are the socioeconomic impacts in New Jersey?

Predation of birds by pets could potentially have negative impacts for birdwatchers. Interest in birdwatching has grown in recent years, and more than 100,000 birdwatchers now visit the Cape May region each year. The economic impact associated with birdwatching has risen from $10 million in 1991 to $31 million in 1997. Since expenditures in New Jersey are rising, it appears that pets have not yet taken a measurable economic toll. If cats were to threaten the survival of enough species of birds, there could be a negative effect on birdwatching, but this is unlikely to occur within five years.

What's being done?

There are currently no regulations protecting wildlife from household pet predation. Nonprofit groups such as the American Bird Conservancy work to raise awareness among pet owners about the risks to birds and other wildlife when their pets roam freely.

Pfiesteria

Human Health Risk	L
Ecological Risk	L
Socioeconomic Risk	L

Pfiesteria is a type of algae that occurs naturally in New Jersey coastal waters. Generally harmless, *Pfiesteria* can become toxic under specific environmental conditions, notably the presence of large schools of fish. *Pfiesteria* has been associated with fish kills in Maryland, Delaware, Virginia, and North Carolina, but there have been no confirmed reports of *Pfiesteria*-type fish kills in New Jersey waters. *Pfiesteria* is not a source of human illness through seafood consumption, but it can cause adverse effects in individuals who come in direct contact with toxic-stage *Pfiesteria* during an outbreak. While the toxic stage lasts only a few hours, toxic effects (*e.g.,* fish kills) may persist for days or weeks afterward.

What's at risk?

There has never been a confirmed outbreak in New Jersey. Areas with large concentrations of fish (menhaden for example) where there is a potential for *Pfiesteria* outbreaks include the Navesink and Shrewsbury rivers in the Atlantic region and in estuaries along the shoreline of the Lower Delaware. Given the isolated and short-term nature of the organism's toxic stage, potential human exposure is very small—perhaps a few dozen individuals could become exposed.

What are the human health impacts in New Jersey?

Should an outbreak ever occur in New Jersey, the potential for human health impacts is likely to be very low, given the short duration and isolated nature of these events. Exposures in other states were limited to a few lab workers handling Pfiesteria cultures, and commercial fisherman who were exposed during fish kill events. These individuals experienced a wide range of symptoms, including lesions, respiratory problems, stomach distress, behavior changes, and memory loss.

What are the ecological impacts in New Jersey?

Under specific environmental conditions, such as high nutrient levels and the presence of large schools of fish, *Pfiesteria* populations may increase or "bloom" and become toxic to fish, causing lesions that are often fatal. Of 32 locations sampled for the presence of the organism, it was found at only one site, the Tuckahoe River near Corbin City. There are no confirmed reports of *Pfiesteria*-type fish kills in New Jersey waters.

What are the socioeconomic impacts in New Jersey?

New Jersey is unlikely to experience a *Pfiesteria*-related fish kill. Even worst-case estimates yield a very low level of socioeconomic impact due to the short term, isolated nature of the problem.

What's being done?

New Jersey wastewater treatment approaches tend to reduce the potential for nutrient overload which is thought to be a contributing factor. Secondary treatment, along with discharge pipes that extend far offshore, help keep nutrient loads low. In the unlikely event of a *Pfiesteria*-related fish kill, the Departments of Health and Senior Services and Environmental Protection have a contingency plan for emergency response.

Phosphorus

Human Health Risk	–
Ecological Risk	M
Socioeconomic Risk	M - H

Phosphorus, or phosphate, is an essential nutrient required for plant growth. Natural concentrations of phosphorus in freshwater environments support an ecologically balanced aquatic community. Excessive amounts of phosphorus result in an overabundance of plant and algae growth in lakes, a condition known as eutrophication. Phosphates enter New Jersey lakes from incoming streams which have been affected by fertilizer runoff from farms and lawns, discharges from sewage treatment plants and septic systems, and possibly other sources. Eutrophic lakes are characteristically cloudy and choked with weeds and algae, making them less able to support healthy populations of fish and other wildlife. Recreational and aesthetic value is also affected, potentially affecting lakeshore property values.

What's at risk?

Freshwater ecosystems statewide are at risk, although lakes are typically more vulnerable than streams or rivers. More than 100 lakes in New Jersey are classified as eutrophic, potentially affecting property values and local recreation opportunities.

What are the ecological impacts in New Jersey?

Eutrophic lakes are found throughout the state, and it is difficult to reverse a eutrophic trend once it has become established. Excess phosphorus stimulates plant growth, changing the ecological balance of plants and animals living in and near an affected lake. Eutrophication occasionally results in serious damage to ecosystems, with significant changes in habitat and wildlife populations. More frequently, habitats remain intact, but the distribution and abundance of some species are reduced. Increasing rates of development have the potential to increase phosphorus input, but there is also a potential for decreased phosphorus levels if regulatory efforts are strengthened or if agricultural and residential uses of fertilizers decline in the future.

What are the socioeconomic impacts in New Jersey?

The loss of water clarity and negative impacts on the overall health of lakes is considered a moderate aesthetic impact. Economic models suggest that the loss of amenities suffered as a result of eutrophication in New Jersey could be valued at approximately $20 million. Reductions in lakefront property values, should they materialize, would not create much of an impact at the state level, but could be locally significant where a large proportion of property is located on an affected lake. Eutrophication could also affect jobs in the tourism or recreation sectors, but even worst-case estimates demonstrate that this would be a very small impact.

What's being done?

Phosphates were banned from detergents in 1972. The federal Clean Water Action Plan specifies that states establish water quality standards for nutrients based on the characteristics of water bodies and the ecoregions where they are located. Department of Environmental Protection monitors nutrient levels in lakes and coordinates water quality planning for achieving state water quality goals, including reducing nutrient loads to streams, rivers, and lakes.

Phthalates

Human Health Risk	M
Ecological Risk	L
Socioeconomic Risk	

There are a number of manufactured chemicals that can mimic or inhibit the action of natural hormones in humans and wildlife (*see also the report on endocrine disruptors*). Phthalates are a category of these substances used in the production of a variety of consumer goods including many plastics and lubricants. Because of their widespread use, phthalates have become one of the most abundant industrial pollutants in the environment. Phthalates concentrate in body fat, and have been associated with adverse effects to the reproductive organs.

What's at risk?

Because of their abundance in the environment, virtually all populations are exposed to some extent and phthalates are detected in ground water, rivers, and drinking water. Human subpopulations may be exposed to greater amounts due to geographic location or atypical diets. Phthalates move easily in aqueous systems, placing a particular stress on aquatic systems.

What are the human health impacts in New Jersey?

The risks from phthalates in New Jersey is unknown. Several phthalates are known testicular toxicants. While virtually everyone is exposed, the severity of effects at given environmental levels has not been established. Subpopulations exposed to high concentrations may experience a wide range of developmental effects from mild and temporary to severe and life long. Effects depend on the properties of the specific chemical as well as the timing of the exposure relative to developmental stages. There are substantial uncertainties associated with the effects of endocrine disrupting chemicals in general.

What are the ecological impacts in New Jersey?

Sampling conducted for phthalates in or near contaminated sites during 1996-1999 documented sediment concentrations at levels far greater than benchmark values established for ecological health. There has been very little research on the effects of phthalates on environmental systems. Potential ecological impacts implied by observed phthalate levels include changes in reproductive capacity, which is critical to biological integrity, biodiversity, habitat and ecosystem health.

What's being done?

Because of their abundance in consumer products and manufacturing processes, there are potentially harmful quantities of phthalates released with little or no control. Current regulations that affect the production, use, and discard of chemicals may not be effective in protecting ecosystems from the effects of very small quantities that subsequently magnify throughout the food chain. Research is being conducted to better assess the risks to human and wildlife populations from environmental concentrations of endocrine disruptors.

Polychlorinated biphenyls (PCBs)

Human Health Risk	H
Ecological Risk	M
Socioeconomic Risk	M - H

There are many structurally similar polychlorinated biphenyls (PCBs) formerly manufactured for use in transformers and electrical components. They are chemically stable, which was a benefit for their industrial application but has become an environmental problem because of their persistence in the environment. PCBs enter the environment largely through accidental spills and historic disposal practices. Currently the greatest source of exposure to PCBs results from their presence in aquatic systems where they are taken up and concentrated through the food chain by aquatic organisms. Humans and wildlife may become exposed to PCBs through the diet. PCBs are probable human carcinogens and cause developmental and reproductive problems in humans as well as several species of wildlife.

What's at risk?

PCBs bioaccumulate in the food chain. For humans, the primary exposures are via the ingestion of meat products. For some species, exposure has its roots in aquatic systems. Therefore, consumers of large, fatty fish and shellfish, particularly from areas with elevated concentrations of PCBs in the sediment, are the most likely to be exposed. In New Jersey, PCB contamination is most evident in the Hudson River system and New York Harbor, primarily due to upstream sources and to a lesser degree in the Delaware River system resulting from several smaller sources.

What are the human health impacts in New Jersey?

As many as 2,000 to 2,500 cases of cancer per year may be attributed to PCBs in New Jersey. This is approximately one third to one half of the total incidence of breast, pancreatic, and non-Hodgkins lymphatic malignancies in the state. There are, however, significant uncertainties in this assessment. Current rates of PCB ingestion may reduce neurological development of children.

What are the ecological impacts of in New Jersey?

Species exposed to PCBs in contaminated sediments face levels in excess of benchmark values. Benthic invertebrates may suffer some effects in reproduction and development; fish species have higher body burdens and may also suffer reproductive challenges. But most obvious impacts are observed in raptors with significant portions of their diet resulting from fish ingestion. When PCB levels were higher, these birds had extreme difficulty reproducing. Current levels of PCB contamination still have some significant effects.

What are the socioeconomic impacts in New Jersey?

The socioeconomic risks from PCBs are moderate, with some increased psychological impacts because of general awareness of problems associated with contamination. Dollar costs associated with the health impacts from PCB contamination are significant and may exceed $100 million per year.

What's being done?

PCB production and use has been banned since 1979. Contaminated site clean up is taking place slowly and there are efforts to dredge contaminated sediments, including the large source that exists upstream on the Hudson River.

Polycyclic Aromatic Hydrocarbons

Human Health Risk	L
Ecological Risk	M - L
Socioeconomic Risk	M

Polycyclic Aromatic Hydrocarbons (PAHs) are chemical compounds containing hydrogen and carbon that result from incomplete burning of organic material, such as cigarettes, wood, food, and fossil fuels. PAHs are found nearly everywhere in the environment, both naturally and as a result of human activities. There are many individual PAHs; of particular concern are those that cause cancers, including skin, bladder, lung, and possibly gastrointestinal tract cancers. Other effects of long term exposure may include eye irritation and light sensitivity. Exposure to PAHs may occur via inhalation, ingestion of smoked or charbroiled foods, or as a result of skin contact with contaminated soils, coal tars in shampoos, or psoriasis treatment.

What's at risk?

All New Jersey residents and ecosystems have been and continue to be exposed to PAHs, however, the degree of exposure from these sources can vary greatly from region to region, with higher levels in urban areas. In addition, personal lifestyle choices such as smoking and ingestion of smoked and charbroiled foods contribute to an individual's body burden. PAHs must be acted upon by the body's metabolic processes in order to become carcinogenic. Children and adolescents may be at increased risk due to higher rates of metabolism. Additional groups at risk include roofers and coke oven workers, and individuals living near creosote and coal tar manufacturers.

What are the human health impacts in New Jersey?

There are insufficient exposure data available to quantify the number of illnesses in New Jersey.

What are the ecological impacts in New Jersey?

PAH levels above the normal background amounts may cause acute or chronic toxicity, leading to changes in the composition, diversity, and function of normal plant and animal populations and communities. There is little data on the effects of PAHs on amphibians and reptiles, but tests on earthworms have shown toxicity, as do tests on fish and benthic macroinvertebrates, the bottom-dwelling animals that are a food source for fish and other animals. PAHs have been shown to reduce plant health and reproduction, and increase illness and death in bird embryos. Benthic macroinvertebrates in urban and industrial areas or adjacent to PAH-contaminated sites are at increased risk, as are plant and animal communities near these sites.

What are the socioeconomic impacts in New Jersey?

The health care costs of cancers associated with PAHs are difficult to determine, in part because exposure to tobacco smoke contains a number of carcinogens, including PAHs. Over 10,000 cases of bladder cancer were diagnosed in New Jersey in 1997, and the contribution of PAHs to that number is unknown. Other socioeconomic impacts include a reduction in property values near hazardous waste sites, and worry about living near the sites, but again, PAHs are present with other toxic materials, and the direct effect of PAHs on property values and worry is unknown. While PAHs do have some ecological impact, it is unlikely that significant job losses will occur as a result.

What's being done?

Emissions from industrial facilities are regulated, industrial hazardous waste sites are undergoing mandatory cleanup, and protective clothing is being used in occupational settings to reduce risk.

QPX parasite shellfish

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	L

QPX stands for "Quahog Parasite X", meaning an unknown parasite. QPX kills quahog or hard clams and was first discovered in New Jersey in Barnegat Bay in the 1970s. Infections with the QPX parasite may be associated with conditions that are stressful to the clams, such as low temperatures and densely populated beds.

What's at risk?

Hard clam populations in Barnegat Bay Estuary (and possibly other estuaries) are at risk.

What are the ecological impacts in New Jersey?

New Jersey surveys have detected the presence of QPX in association with clam mortality in 1996 and 1997. The impact of these infections on New Jersey ecosystems has thus far been minimal, but infections may become increasingly severe with time. There is little known about the relationships among the QPX parasite, environmental conditions, and mortality rates in hard clam populations.

What are the socioeconomic impacts in New Jersey?

Quahog harvesting contributes about $7.6 million and about 250 jobs to the New Jersey economy. Since 1978 there has been a general upward trend in quahog harvests, so there has not yet been a demonstrable impact as a result of QPX infection. Should quahog harvests begin to decline in the future, the relatively small size of the industry limits the potential for more than a negligible impact on the New Jersey economy.

What's being done?

QPX itself is not regulated, but the National Shellfish Sanitation Program classifies shellfish harvesting beds according to the presence of potential sources of contamination. Good husbandry should minimize the potential for problems, and based on the historical trend, the threat of major impacts from QPX is unlikely.

Radionuclides (from Nuclear Power Plants)

Human Health Risk	L
Ecological Risk	
Socioeconomic Risk	

Radionuclides are radioactive products from nuclear reactions. Radiounclides are a source of ionizing radiation that can cause biological impacts in humans and other species. For this analysis, the focus is on radionuclides from the routine operations of nuclear power plants in and adjacent to New Jersey. Iodine-131 is of particular interest because it is the most abundant radioactive isotope measured at nuclear power plants. While this analysis evaluates the risks from nuclear power plants, there are many other sources of radionuclides and ionizing radiation. The New Jersey Comparative Risk Project has separate analyses for Radium and Radon and for Catastrophic radioactive releases from nuclear power plants.

What's at risk?

All species are at risk from the effects of ionizing radiation although this report focuses on the impacts to human populations. The populations at greatest risk of exposure to radionuclides from nuclear power plants are those living closest to the facilities. There is one nuclear power plant in Ocean County (Oyster Creek) and three in Salem County (Salem I and II, and Hope Creek). New Jersey is also in close proximity to nuclear power plants in other states.

What are the human health impacts in New Jersey?

Ionizing radiation is most notably associated with the induction of cancer. Other health effects include genetically associated disorders, developmental abnormalities and some degenerative diseases. While humans are exposed to levels of ionizing radiation that may result in these health affects, nuclear power plants contribute only about 0.1% of the total exposure (most exposures are from natural and medical sources) and national studies show no evidence of increased cancer or other radiation impacts in those populations living near nuclear facilities. Even accidental releases such as occurred at Three Mile Island in 1980 did not result in notable increases in health affects associated with ionizing radiation.

What's being done?

Radiation releases from nuclear power plants are monitored by the DEP Environmental Surveillance and Monitoring Program. The data includes monitoring for specific radionuclides in the immediate vicinity of each facility. In addition, the operations of nuclear power plants, including releases, are regulated by the Nuclear Regulatory Commission. The releases from New Jersey facilities are far below allowable standards set to protect human health.

Radium

Human Health Risk	M - H
Ecological Risk	
Socioeconomic Risk	L

Radium is a naturally occurring radioactive element that exists in rocks, soil, and groundwater. The main route of exposure to humans is via drinking water, although certain foods accumulate radium and may pose a significant source. There are also contaminated sites where historical use of radium has resulted in the potential for small populations to receive additional exposures.

What's at risk?

The risk varies with geographic region, mainly related to the level of radium in drinking water. The main risk to humans at exposures likely to be encountered in the New Jersey environment is cancer, including bone, lung, and stomach cancer. Drinking water with the potential for elevated radium levels appears to be confined to ground water sources.

What are the human health impacts in New Jersey?

In some areas of the state more than 50% of drinking water wells exceed health based standards. The total number of individuals with significant exposure depends not only on the particular source of the drinking water, but also on the extent and type of water treatment. It is estimated that 100,000 – 300,000 individuals statewide use water which exceeds the drinking water standard. In many cases ground water provides only a portion of the drinking water supply, with the remainder from surface water. Calculations of average exposure suggest that the risks from radium in drinking water can be expected to result in 21 additional lifetime cancers, which is less than one per year for the New Jersey population. However, there are significant uncertainties in these calculations and the actual numbers could be higher or lower. Individuals living near hazardous waste sites may be exposed to higher levels, but the additional population risk should be small.

What are the socioeconomic impacts in New Jersey?

The Socioeconomic Technical Work Group considered the risks from radium together with the risks from radon. Most of the socioeconomic risk is associated with health care costs and property damage, and most of that risk can be attributed to radon, therefore the socioeconomic risk attributed to radium should be small.

What's being done?

There are regulations in place to monitor the levels of radium in drinking water from public water supplies. Exceedances of standards lead to action to reduce exposure. Private water supplies are not monitored or regulated.

Radon

Human Health Risk	H
Ecological Risk	
Socioeconomic Risk	M

Radon is a radioactive gas that is emitted during the decay of uranium, a naturally occurring mineral found in New Jersey rocks and soil. While radon gas is not a threat in the ambient (outdoor) air, it can become concentrated in buildings where it enters and collects in basements. At these concentrated levels, radon is a human carcinogen. When radon is inhaled, small radioactive particles are retained in the lungs, increasing the risk of lung cancer. Radon may also be present in drinking water, and exposure via ingestion of contaminated water increases the risk of stomach cancer.

Who's at risk?

Some individuals are exposed to greater concentrations of radon because of the location and/or construction of their homes or businesses. Houses and other structures contain varying concentrations of radon gas due to differences in the radon content of underlying soils and rocks, and because of differences in ventilation. Smokers are at an increased risk because there is a synergistic effect from the combined exposures.

What are the human health impacts in New Jersey?

The total number of lung cancers resulting from radon exposure may be as high as 1700 per year. The number of stomach cancers attributable to radon may total 10 per year.

What are the socioeconomic impacts in New Jersey?

While total socioeconomic impacts are modest, economic costs may be significant. When combined with radium exposures, health care costs for the excess cancers may be as high as $90 million annually. In addition, there are costs for remediating homes with known high levels of radon. These costs add up to between $14 million and $70 million per year.

What's being done?

Legislation requires minimum standards for new home construction, and a federal rule has been proposed for mitigation of drinking water risks, in areas with elevated radon levels. New Jersey citizens are encouraged to monitor their homes for radon.

Road Salt

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	L

Various salt compounds are used to melt ice and snow that accumulates on roadways in winter. Salt-contaminated runoff from streets and highways can damage nearby trees and shrubs, and can also affect aquatic ecosystems when it reaches streams and other surface waters. There have been isolated instances of salt contamination of drinking water in New Jersey in recent years. Road salt also damages road surfaces, bridges, vehicles, and electrical fixtures.

What's at risk?

Areas along roadways statewide, particularly those adjacent to water bodies, are at risk. Areas next to highways and major routes, urban areas, and areas in the northern part of the state receiving greater snowfall are at increased risk because of greater salt application rates. Roadside vegetation and trees, birds, and aquatic life (especially young fish) are at risk for acute or chronic impacts. Elevated salt concentrations in the Oradell Reservoir in Bergen County can pose a health hazard for water customers with high blood pressure.

What are the ecological impacts in New Jersey?

In terms of water quality impacts, observable effects have not been documented in any New Jersey waterbodies. Screening data has indicated that 4 of 136 monitoring stations had concentrations of chloride above the EPA benchmark for the protection of aquatic life. These areas exceeded the benchmark at least once during the period from 1997-2000: Rahway River near Springfield, Cooper River at Haddonfield, Green Brook at Plainfield, and Ramsey Brook at Allendale. The potential impacts to New Jersey roadside vegetation and birds were not quantifiable with available information.

What are the socioeconomic impacts in New Jersey?

There have been isolated and unsubstantiated claims of road salt contamination of private wells resulting in a loss of property value. The cost of remediating salt contamination in Bergen County has been estimated at $300,000. Road salt causes substantial damages to roads, bridges, and motor vehicles; these costs have been estimated at nearly $8 million. Overall, however, the socioeconomic impacts attributable to the use of road salt are comparatively low.

What's being done?

Some of the salts and salt alternatives are less harmful than others and these may be used effectively to protect sensitive areas. Road salt in runoff has been included in local and regional plans in New Jersey; Bergen County's Hackensack and Hudson watershed plans include efforts to reduce quantities of road salt contaminating the Oradell Reservoir. There are significant opportunities to improve road salt storage and application techniques, thereby minimizing quantities available for runoff to the environment.

Secondhand tobacco smoke

Human Health Risk	H
Ecological Risk	
Socioeconomic Risk	M - H

Secondhand tobacco smoke is a complex mix of chemicals generated during the burning and smoking of tobacco products that can affect those nearby who are not smoking. It is also known as passive or environmental tobacco smoke. Over 4,000 chemicals, including 40 known or suspected carcinogens, have been identified in cigarette smoke. Exposure to secondhand tobacco smoke can cause or contribute to middle ear infections, asthma, bronchitis and pneumonia, ischemic heart disease, low birth weight, lung cancer, Sudden Infant Death Syndrome (SIDS), and Acute Lower Respiratory Tract Illness (LRI) in children up to eighteen months. All of the compounds found in the smoke inhaled by the active smoker are also found in secondhand smoke.

What's at risk?

Children are more susceptible to the harmful effects of secondhand tobacco smoke than adults, although all persons breathing in secondhand smoke are at risk. In infants and young children up to three years old, exposure to secondhand tobacco smoke causes an approximate doubling in the incidence of pneumonia, bronchitis, and bronchiolitis. There is also strong evidence of increased middle ear infection, reduced lung function, and reduced lung growth.

What are the human health impacts in New Jersey?

There is clear evidence that it can cause cancer in humans. There is no evidence that any particular group of individuals will remain unaffected. It is estimated that the following number of cases/deaths occur in New Jersey annually:

- Middle ear infection, 14,000-32,000 cases
- Asthmatic episodes, 8,000-20,000 cases
- Bronchitis and pneumonia, 3,000-6,000 cases
- New asthma cases, 160-520 cases
- Ischemic heart disease, 700-1,240 deaths
- Low birth weight, 194-372 cases
- Lung cancer, 60-80 deaths
- Sudden infant death syndrome, 38-54 deaths
- Acute lower respiratory tract inf., 2-4 deaths

In New Jersey, 53% of all effects from secondhand tobacco smoke exposure manifest as middle ear infections, occurring mostly in children. An additional 33% of all effects from secondhand tobacco smoke exposure are due to exacerbation of asthma. Ischemic heart disease, which usually ends in death, accounts for the majority of deaths associated with secondhand tobacco smoke exposure, followed by deaths due to lung cancer.

What are the socioeconomic impacts in New Jersey?

The health care costs of secondhand tobacco smoke are of greatest impact. Costs associated with secondhand tobacco smoke-related ailments are estimated at $186 million to $332 million. These costs do not include lawsuits, accidental death or property destruction through fires started by cigarettes, or cleaning cigarette odor out of fabrics.

What's being done?

Most restrictions on exposure to secondhand tobacco smoke have occurred at the municipal level, where restaurants, workplaces, and public places may have smoking bans. Commercial daycare centers are required to be smoke-free. State regulations do not restrict smoking in bars, shopping malls, hotels, or enclosed arenas.

Starlings

Human Health Risk	
Ecological Risk	M
Socioeconomic Risk	L

The European starling is an exotic species introduced to North America in the late 1800s. Within 60 years, starling populations had expanded as far as the West Coast. Starlings are highly adaptable, and have flourished in urban and suburban landscapes where they outcompete other native birds for food and nesting sites.

What's at risk?

Overpopulation by starlings affects bluebirds, great-crested flycatchers, common flickers, and other New Jersey native bird species.

What are the ecological impacts in New Jersey?

Much like invasive plant species, the ability of starlings to flourish in disturbed or human-altered landscapes has led to a dominant presence in a variety of habitats. Starlings exhibit a broad range of food habits, raise up to three broods per year, and aggressively defend their nest sites. Roosting flocks may number in the thousands to millions of birds. The primary impacts involve outcompeting other native birds, potentially changing the diversity of species inhabiting an area. Risks are lowest in already developed areas, higher in areas such as the Highlands that are relatively undeveloped.

What are the socioeconomic impacts in New Jersey?

Although many people may be annoyed by large flocks of starlings, there is no evidence of negative socioeconomic impacts associated with them.

What's being done?

The ability of the starling to successfully adapt to a variety of conditions has confounded attempts to control populations. In other parts of the country attempts have been made to reduce starling populations, but these efforts have not met with much success. The North American population has been estimated at over 200 million birds, and it is unlikely that future control efforts will be successful. Moreover, since a good deal of the success of the starling is related to widespread conversion of diverse habitats to urban and suburban landscapes, there are significant barriers to restoring the ecological balance that existed prior to the starling's introduction.

Sulfur oxides (SO_x/Sulfates)

Human Health Risk	M - L
Ecological Risk	
Socioeconomic Risk	M

Sulfur dioxide(SO_2) is the primary component of the class of air pollutants known as oxides of sulfur (SO_x). It is a product of fossil fuel combustion, primarily coal, and is a by-product of several chemical processes such as paper manufacture and smelting. This issue summary focuses on the human health impacts from sulfur dioxide.

What's at risk?

SO_x is a respiratory irritant. Elevated concentrations of SO_x cause respiratory problems. At particular risk are asthmatics and children. For asthmatics, exposure to SO_x increases incidence of asthmatic attacks. For children, there is evidence of increased incidence of respiratory disease and some evidence that SO_x exposure reduces their ability to respond to infection. SO_x also causes decreases in visibility which is of particular interest in recreation areas with important viewsheds.

What are the human health impacts in New Jersey?

The concentration of SO_x in New Jersey is below federal health-based regulatory standards, but concentrations are slightly elevated in some counties, possibly decreasing the ability of approximately 100,000 children who live in these counties to respond to infection. Throughout the state there is a slight chance that children will have increased incidence of respiratory disease as a result of SO_x exposure.

What are the socioeconomic impacts in New Jersey?

The greatest impacts are due to aesthetic degradation. A national study showed significant visibility benefits from reductions of sulfur dioxide, of which New Jersey should gain a part.

What's being done?

Federal regulations have reduced the emissions from most point sources significantly. Additional regulations are pending which may further reduce sulfur emissions.

Thermal pollution

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	L

Thermal pollution refers to elevated water temperatures that result from industrial discharges to streams, rivers, or other waterbodies. Elevated temperatures can have negative effects on aquatic organisms, and accordingly, temperature is one of the required parameters included in New Jersey state water quality standards. Thermal shock, such as when power plants shut down in winter, can also lead to impacts (e.g., fish kills).

What's at risk?

Based on the most recent information collected by New Jersey DEP, less than 1% of documented impairments to New Jersey waters are attributable to thermal pollution. Watersheds affected include the Middle Delaware-Musconetcong, Raritan, Hackensack-Passaic, Middle Delaware, Lower Delaware, and Cohansey-Maurice basins.

What are the ecological impacts in New Jersey?

Elevated water temperatures in these basins may increase metabolic and respiration rates, altering behavior patterns of aquatic organisms. Although rising temperatures may enhance the growth rate of some organisms, eventually higher temperatures can adversely affect reproduction and survival. The extent of damage depends on the rate of temperature change, duration of the exposure, and where the ambient temperature lies in relation to the tolerance range of a given species. Compared with other stressors, thermal pollution does not represent a significant category of water quality impairments in the state.

What are the socioeconomic impacts in New Jersey?

Given the relative insignificance of thermal pollution as compared with other water quality stressors and the fact that less than 1% of New Jersey's documented impairments are due to temperature, it is unlikely that thermal pollution would have any socioeconomic ramifications.

What's being done?

Stringent requirements on industrial discharges will continue to limit the potential for adverse impacts associated with thermal pollution of aquatic ecosystems. Nevertheless, New Jersey water quality status is updated every two years, affording an ongoing opportunity to monitor the extent of thermal pollution over time.

Tin

Human Health Risk	
Ecological Risk	M - L
Socioeconomic Risk	L

Tin is a naturally occurring element that is used in a wide variety of applications. In its inorganic (metallic) form, tin is used in products such as food cans, alloys (brass, pewter, bronze, and solder), and toothpaste (stannous fluoride). Organic tin compounds or organotins are synthesized for use in the manufacture of antioxidants and biocides, including marine paints. Tin is relatively benign in its metallic form and does not accumulate to harmful levels in either humans or ecological systems. Many organotins, however, are toxic to aquatic organisms, causing impaired behavior and reduced growth, reproduction, and survival. Tributyltin, an anti-fouling agent added to marine paint and regulated as a restricted-use pesticide, is markedly toxic to aquatic organisms, and is a suspected endocrine disruptor.

What's at risk?

Aquatic ecosystems are primarily at risk, particularly marine waters with large vessel traffic, marinas, and shipyards. The primary sources of tributyltin (TBT) to the aquatic environment include paint leaching from boat hull surfaces, runoff from sites where boats are painted, and accidental spills. The greatest impacts would be expected in high ship usage areas such as New York-New Jersey Harbor and commercial docks along the Delaware River.

What are the ecological impacts in New Jersey?

Aquatic biota in proximity to heavy usage areas (e.g., commercial docks and berths) are at increased risk from observed concentrations of organotins in the sediments. Evidence of organotin residues in blue mussels may indicate increased risk for mollusk populations in Upper New York Bay. Low concentrations of TBT have resulted in abnormal sexual development in snails, reducing the number of young and reducing the size of the breeding population. These populations will continue to be exposed as organotins leach from incoming ship traffic, release from sediments, and bioaccumulate in the food chain. Currently there is no comprehensive or regular monitoring of TBT levels in biological tissues in New Jersey. Ecosystem-level effects are poorly understood, and additional research is needed to better characterize the long-term and chronic effects of TBT discharge to the environment. However, exposure is expected to decrease over time as a result of an anticipated international ban on the application of organotins to marine vessels.

What are the socioeconomic impacts in New Jersey?

The socioeconomic risks associated with environmental concentrations of tin were judged to be low.

What's being done?

TBT is regulated as a restricted use pesticide under state and federal laws. In New Jersey, TBT paint can only be applied by certified applicators to vessels 25 meters or larger, or to aluminum hulls. In 1999, the International Maritime Organization passed a resolution banning the application of organotin compounds beginning in 2003.

Ultraviolet radiation

Human Health Risk	M
Ecological Risk	M - H
Socioeconomic Risk	M - H

Ultraviolet (UV) radiation is a form of electromagnetic energy whose only significant natural source is the sun. Stratospheric ozone absorbs harmful forms of ultraviolet light and depletion of the ozone layer results in increased UV radiation reaching the Earth's surface. Ultraviolet radiation is divided into categories based on wavelength; the impacts noted here are associated with ultraviolet radiation known as UV-B. UV-B damages biological systems by causing chemical changes at the molecular level and its effects are evident in animals, plants, and microorganisms. In humans, UV-B exposure is known to be associated with various skin cancers, accelerated skin aging, cataract and other eye diseases, and may reduce a person's ability to resist infectious diseases.

What's at risk?

Virtually the entire population of New Jersey is exposed to some level of naturally occurring UV-B daily. People with fair skin are more susceptible to burns and skin cancers than darker skinned individuals. However, eye damage can occur in all populations. Beachgoers and other outdoor enthusiasts are at increased risk. Ecologically, all species in all parts of the state are exposed and potentially susceptible to the damage caused by UV-B radiation. More research is needed to document the extent and severity of UV exposure and effects in human and ecological populations.

What are the human health impacts in New Jersey?

In New Jersey, several thousand persons are diagnosed with malignant skin melanomas. Available information documents an increase each year in the rate of melanoma for the years 1993 through 1996. While individual behaviors are a factor in exposure to UV radiation, the reduction in stratospheric ozone may also be contributing to increases in the numbers of cases of melanoma. Other forms of skin cancer (i.e., basal and squamous cell) may also be increasing in response to increased UV radiation, but since these are not reportable diseases, no data are available. The extent of health effects other than skin cancers (e.g., eye problems, immune disorders) attributable to UV radiation is not known.

What are the ecological impacts in New Jersey?

Ultraviolet radiation poses one of the greatest potential risks to New Jersey ecosystems. In aquatic ecosystems, UV radiation has adverse effects on the growth and photosynthesis of phytoplankton, thus affecting food webs, which in turn can damage the ecosystem's ability to function. In terrestrial systems, increasing amounts of UV-B may be causing a number of subtle changes in the competitive balance among plants. Specific exposures and effects are dependent upon site-specific variables such as cloud cover, reflection, and proximity to industrial areas. Species-specific traits also determine the severity of effects.

What are the socioeconomic impacts in New Jersey?

Economic costs and psychological impacts from UV radiation are significant. Medical costs associated with skin cancer treatments may total over $50 million annually. Cataract treatment for problems resulting from UV radiation may total an additional $31 million. People do worry about and avoid sun exposure, and parents are concerned about the exposure of their children.

What's being done?

The international "Montreal Protocol" agreement was intended to reduce and eventually eliminate the emissions of man-made substances that deplete stratospheric ozone. The federal Clean Air Act was subsequently amended to include provisions for the protection of the ozone layer. These regulations include a schedule that is currently being implemented for reducing the production and use of ozone depleting chemicals. Education efforts focused on reducing human exposures to ultraviolet radiation help to reduce human health risk.

Volatile organic compounds (VOCs)

Volatile organic compounds, or VOCs, are a class of compounds characterized by having high vapor pressure, meaning they readily volatilize from solid and water surfaces to the air. Dozens of these compounds are present in the environment as a result of fuel combustion, chemical manufacturing, and their use in consumer products. Exposure to these chemicals via inhalation, or presence in drinking water can lead to a variety of health effects ranging from irritation of mucus membranes to cancer. To help in distinguishing between the many kinds of VOCs, the Technical Work Groups divided VOCs into different categories. For this report, there are two categories of VOCs summarized: those VOCs causing cancer (p. 183) and those VOCs not thought to cause cancer (p. 184). Separate analyses were also conducted for the following specific VOCs: acrolein (p. 104), benzene (p. 108), 1,3-butadiene (p.102), formaldehyde (p. 127), MTBE (p. 148), and polycyclic aromatic hydrocarbons (p. 170). VOCs that originate as by-products of the drinking water treatment process itself (e.g., chloroform) are covered in the report for disinfection by-products (p. 121). VOCs contribute to the formation of ground level ozone, also the subject of another analysis (p. 156).

Volatile organic compounds (VOCs), carcinogenic

Human Health Risk	M - H
Ecological Risk	L
Socioeconomic Risk	M - L

This summary focuses on the risks from VOCs found in New Jersey ambient air and groundwater that are known or suspected to cause cancer. The chemicals of concern in both air and drinking water are: 1,3 dichloropropene, ethylene dibromide, ethylene dichloride, p-dichlorobenzene, trichloroethylene, vinyl chloride, acetaldehyde, acrylonitrile, hydrazine, ethyl acrylate, and ethylene oxide. Chemicals included in this summary based on risks from exposures through the air (drinking water exposures are covered within the Disinfection By-products report), are carbon tetrachloride, chloroform, methyl chloride, and methylene choride.

What's at risk?

The general population is exposed primarily as a result of the use of VOCs in chemical manufacturing. Residents of urban counties with industrial activity are at increased risk. Individual exposures vary depending upon proximity to industrial sources, workplace exposures, use of volatile consumer products, and source of drinking water. Plants and nesting birds near highways and industrial areas are also at increased risk.

What are the human health impacts in New Jersey?

Modeled and measured New Jersey concentrations of the carcinogenic VOCs considered in this analysis may result in 252 excess lifetime cancer cases, or 3.6 additional cases annually. Almost one-half of this risk is attributable to background levels of carbon tetrachloride and ethylene dibromide, which are found statewide with little local variation. Indoor concentrations may reach 100 times outdoor levels, but vary widely making statewide risks difficult to estimate. Drinking water exposures may contribute one additional lifetime cancer statewide.

What are the ecological impacts in New Jersey?

VOCs typically volatize before causing a long-term impact on an ecosystem. Potential effects on ecological systems are more likely to result from accidental exposures to high concentrations rather than continual exposure. VOCs will dissolve in water, and thus may cause short-term impacts to aquatic organisms, but evaporate quickly from water surfaces.

What are the socioeconomic impacts of VOCs in New Jersey?

Apart from the specific compounds reported on separately, the residual socioeconomic risk associated with VOCs generally is low. Health care costs may total as much as $1 million to $2 million annually when indoor exposures are considered. Aesthetic concerns related to the odors from indoor concentrations of VOCs are also possible.

What's being done?

Most consumer uses of halogenated VOCS have been phased out and industrial releases have been reduced significantly over the past 20 years. Concentrations of some compounds (e.g., carbon tetrachloride) reflect global background concentrations rather than New Jersey sources. Public drinking water suppliers are required to monitor for, and report the presence of carcinogenic VOCs.

Volatile organic compounds (VOCs), non-carcinogenic

Human Health Risk	M - L
Ecological Risk	L
Socioeconomic Risk	M - L

This summary focuses on the risks associated from a subset of VOCs that are suspected of having some health impacts and are found in New Jersey indoor and outdoor air. None of these compounds are suspected of causing cancer. The compounds included in this analysis are glycol ethers, methanol, methyl ethyl ketone, toluene, and xylene.

What's at risk?

The general population is exposed to low levels throughout the state, but exposure varies significantly due to local variations in industrial and transportation emissions. Certain populations may be sensitive to low concentrations of VOCs and exhibit symptoms of neurological distress. Plants and nesting birds in industrial areas may also be at greater risk.

What are the human health impacts in New Jersey?

Non-cancer effects—which may include irritation to mucous membranes, neurological effects, and liver damage—are negligible at concentrations likely to be encountered in non-occupational settings. A lack of certainty regarding the specific level of exposure and the inability to include all possible VOCs in the analysis resulted in the ranking of Low/Medium.

What are the ecological impacts in New Jersey?

VOCs typically volatize before causing a long-term impact on an ecosystem. Potential effects on ecological systems are more likely to result from accidental exposures to high concentrations rather than continual exposure. VOCs will dissolve in water, and thus may cause short-term impacts to aquatic organisms, but evaporate quickly from water surfaces.

What are the socioeconomic impacts of VOCs in New Jersey?

The residual socioeconomic risk associated with VOCs generally is low. Health care costs may total (including carcinogenic VOCs) as much as $1-2 million annually when indoor exposures are considered. Aesthetic concerns related to the odors from indoor concentrations of VOCs are also possible.

What's being done?

Industrial emissions are regulated via the permit process, and pollution prevention efforts are resulting in a general decrease in the use and release of VOCs. While many VOCs decreased in ambient concentrations during the 1990s, there is evidence that ethylene oxide increased by about 10% between 1990 and 1996.

Waterborne pathogens

Human Health Risk	recreational water	**M**	drinking water	**L**
Ecological Risk				
Socioeconomic Risk				**M - L**

Bacteria, viruses, and parasites that are present in the feces of infected individuals can contaminate surface waters that may be used as sources of drinking water or for primary contact recreation (such as swimming). Waterborne pathogens contributing to disease outbreaks in the United States include the bacteria Shigella, Salmonella, Leptospira, and Campylobacter; viruses caliciviruses, adenoviruses, and hepatitis A; and the parasite Giardia (*Cryptosporidium* and *legionella* are addressed separately.) The health effects from waterborne pathogens are generally mild, and may include diarrhea, cramps, nausea, and vomiting. Infections can sometimes result in more serious illness, or even death, particularly among sensitive populations.

What's at risk?

Everyone in New Jersey is potentially exposed via either contaminated drinking water or accidental ingestion while participating in water sports. While no more likely to become exposed, some individuals may be at increased risk for more serious health effects. These include people with weakened immune systems or underlying disease, pregnant women, infants, and the elderly. This sensitive population is estimated at 1.6 million to 2 million individuals.

What are the human health impacts in New Jersey?

Taking Unites States Centers for Disease Control (CDC) data for the United States as a whole, and apportioning cases among states according to population, suggests that waterborne pathogens in New Jersey may result in approximately 28,000 illnesses and 27 deaths annually. However, many of these go largely undetected, because symptoms are typically not serious or distinguishable from other potential sources of illness. New Jersey has not had a documented drinking-water-related disease outbreak since 1989, when 8 individuals were infected as a result of a contaminated well at a campsite. There have been 6 incidences of waterborne disease as a result of recreational exposures. There is a low risk of a large-scale disease outbreak in the event of a treatment breakdown at any of New Jersey's large drinking water facilities. If this should occur during a pathogen contamination event, a large number of people could be infected.

What are the socioeconomic impacts in New Jersey?

The vast majority of cases are undiagnosed, so it is difficult to estimate the number of actual cases, let alone the costs associated with them. Medical costs and lost wages due to waterborne illness in New Jersey may range from $10 million per year (using the above CDC estimate for cases) to $70 million per year or more if other estimation techniques are used.

What's being done?

Disinfection and filtration of water supplies derived from surface water sources eliminate all but very low levels of most pathogens. Testing requirements vary from once every 3 months up to 480 tests per month depending on the size of the facility. New legislation requires testing of private wells for indicator bacteria upon the sale of a residence, and landlords will be required to test every five years. Recreational waters are sampled for indicator bacteria on a weekly basis for designated swimming areas, or as part of the state surface water monitoring program for lakes and streams that are designated as primary contact recreational waters.

Water Overuse

Human Health Risk	
Ecological Risk	M - L
Socioeconomic Risk	M

When more water is used than can be replenished through precipitation, a water supply deficit occurs. As ground water levels are depleted, the risk of salt water intrusion increases, which can contaminate drinking water. Depletion of underground aquifers can also affect stream flows and lake levels, resulting in decreased water quality and associated impacts to the ecological community. Eight of the 21 water planning regions in New Jersey are currently experiencing water supply deficits and while there is not yet a statewide deficit, one is projected to develop by 2040 if population growth continues.

What's at risk?

Water supply deficits are experienced in several portions of the state. Areas include Camden/Delaware tributaries, Mullica River, South River, Metedeconk Creek/Toms River, Maurice River, Hackensack River, Cape May coastal area, and lower Passaic/Rahway rivers. Deficits range from less than 10 million gallons per day (MGD) to 56 MGD in the Mullica River region. Both marine (estuarine) and freshwater systems are at risk, and wetlands are particularly vulnerable to ecological impacts.

What are the ecological impacts in New Jersey?

Water overuse can lead to loss or reduction in stream flow, saltwater intrusion, and changes in estuarine salinities. Consumptive use or diversions of water impact downstream ecosystems as freshwater stream flows are reduced from natural levels. Flow conditions and salinity levels greatly influence the suitability of habitat for amphibians and aquatic organisms, and the magnitude of the impact varies depending on the duration of the reductions. Potential impacts include loss of specific habitat (such as pools), along with changes in the ecological community that result from the differential abilities of various species to adapt to changes in flows or salinities. Data documenting direct impacts to New Jersey ecosystems are limited—a survey of instream flow requirements and comparison with seasonal flows is needed to assess the impacts of water use on New Jersey streams.

What are the socioeconomic impacts in New Jersey?

Costs required for capital improvements to address current and projected shortages are expected to total over $300 million. Major improvements are planned for the Raritan/South River region ($128 million), Camden/Delaware ($170 million), and Cape May ($10 million). Higher water rates could potentially affect property values, but there is little evidence to demonstrate this. Water scarcity could also have a localized impact on employment in sectors such as agriculture which are highly dependent on water. Again, there is little evidence available to evaluate this possibility. If left unremediated, large-scale saltwater intrusion could create additional impacts. Since 1940, more than 120 wells in Cape May County have been abandoned because of saltwater intrusion.

What's being done?

The New Jersey State Water Supply Plan was formulated to guide water use management over the next 20 years. In addition to capital improvement projects designed to increase available supplies, the Plan also calls for water conservation and sustainable use. Water diversion is regulated by DEP, however, there are currently no requirements to protect ecological quality. Policies designed to encourage conservation could reduce long-term demand for water, and such measures could potentially be more cost effective than new construction. Research is currently underway to develop ecological flow goals and methodologies for New Jersey streams.

West Nile Virus

Human Health Risk	L
Ecological Risk	M - L
Socioeconomic Risk	L

West Nile virus is transmitted by mosquitoes and found throughout Africa, the Middle East, West Asia and Europe. In 1999, West Nile virus was identified in North America for the first time, during an epidemic in the New York metropolitan area. The virus has emerged as a significant threat to human, equine, and wild bird health in New Jersey and the entire northeastern United States. All human cases in the Unites States have resulted from mosquitoes biting humans after feeding on infected birds. There is no risk of human-to-human transmission of West Nile virus.

What's at risk?

Everyone in the state is potentially exposed to the bite of an infectious mosquito. The elderly are at increased risk of developing severe illness as a result of infection. Horses are at relatively higher risk than humans, and susceptible wild bird populations include crows, blue jays, hawks and falcons.

What are the human health impacts in New Jersey?

Infection with West Nile virus can cause a form of encephalitis or meningitis. Most infections produce no symptoms in people, or are mild or moderate. More severe infections may lead to death. In New Jersey in 2000, there were six confirmed cases of severe West Nile virus, from five counties including one death. The fatality rate is less than 1%.

What are the ecological impacts in New Jersey?

In 1999, West Nile virus was detected in birds from 16 of 21 New Jersey counties, with the majority in the north central area of the state. In 2000, 496 crows tested positive in similar areas, and infected mosquito pools were detected in Bergen County.

What are the socioeconomic impacts in New Jersey?

Socioeconomic risks from present incidences of West Nile virus were judged to be low, but it is impossible to predict the course that the disease will take over the next five years. It is clear that the virus is still spreading throughout the northeastern U.S.

What's being done?

New Jersey has set up monitoring systems and mosquito control operations to track and manage the threat.

Zebra mussels

Human Health Risk	
Ecological Risk	L
Socioeconomic Risk	L

Zebra mussels are thumbnail-sized freshwater mollusks that are native to western Asia. After accidental introduction in the Great Lakes via ballast water in ships, colonies of zebra mussels have invaded 20 states east of the Mississippi since 1986. Zebra mussels infest and devastate native mollusk populations and dramatically affect the food web because of their efficiency as filter feeders. In the Hudson River zebra mussels filter all the water in the tidal-freshwater part of the river every two to three days. Prior to the invasion all other filter feeders combined filtered the water about once every 50 days. Zebra mussels have not yet been detected in New Jersey waters, but it is probable that invasion will occur in the near future.

What's at risk?

Native freshwater mollusks are in danger of extinction if zebra mussels become established in New Jersey. All inland freshwater ecosystems would be at risk from severe and dramatic changes in habitat structure and food web dynamics. Socioeconomic costs would extend to all waterworks and utilities in the state with freshwater intake and outflow pipes.

What are the ecological impacts in New Jersey?

Based on the assumption that the zebra mussel does not currently exist in New Jersey, the risks are now low. Should the mussel become established in New Jersey waters, and this is likely, zebra mussels will pose a significant threat to freshwater ecosystems. All aquatic organisms which are subject to attachment by zebra mussel colonies would be at risk. Phytoplankton, which have declined by 90% in the Hudson River, would also be at risk statewide, as would the entire ecosystems that depend on them.

What are the socioeconomic impacts in New Jersey?

Massive colonies of zebra mussels clog water intake and outflow pipes used by water companies and other utilities. In affected areas, these costs exceed $5 billion annually. If zebra mussels invade New Jersey waters, and the costs are proportional, then this would result in annual costs of $336 million. However, these costs are hypothetical, as the zebra mussel has not yet been detected in New Jersey. Other socioeconomic impacts are harder to evaluate. While it seems reasonable to assume there would be socioeconomic consequences associated with the adverse impacts to native aquatic communities, there are also potential benefits. For example, zebra mussels are thought to have increased populations of yellow perch and other fish. Similarly, dramatic increases in water clarity have resulted in improved aesthetics and recreation use in affected waters.

What's being done?

New Jersey has a Zebra Mussel Watch program that depends on public assistance in reporting zebra mussel sightings. The New Jersey Department of Environmental Protection has formed a task force to manage and mitigate potential infestations.

Zinc

Human Health Risk	
Ecological Risk	M - L
Socioeconomic Risk	L

Zinc is a naturally occurring metallic element and a necessary nutrient for mammal metabolism. Meat, seafood, dairy products, nuts, legumes, and whole grains are dietary sources of zinc. Dietary deficiencies can result in health problems ranging from decreased immune response to skin problems and mental disturbances. Zinc is also used industrially for a variety of purposes—as a coating and alloy, and in the manufacture of tires. Industrial releases, combined with rubber tire wear, result in quantities of zinc discharged to the environment. This leads to high concentrations in nearby (typically urban) soils and sediments, which can cause toxic ecological effects.

What's at risk?

High concentrations of zinc can limit plant growth and inhibit reproduction in animal populations. Zinc is toxic to sensitive organisms living in soils and aquatic sediments. Bottom dwelling organisms in Newark Bay are at risk from high levels of zinc, as are organisms living in contaminated industrial areas.

What are the ecological impacts in New Jersey?

Background levels of zinc in New Jersey range from concentrations of 34 milligrams per kilogram (mg/kg) in rural soils to 162 mg/kg in urban soils. Concentrations in Newark Bay can reach 1900 mg/kg, with an average concentration of 532 mg/kg. Organisms in contact with contaminated sediments may experience negative effects on growth and organ function. Determining the extent of ecological impacts at given concentrations is complicated by the fact that soil and sediment properties greatly influence the degree to which organisms are affected, and it is difficult to isolate the effects of zinc from other contaminants outside of laboratory studies. Most of the risk attributed to zinc is associated with aquatic systems, with potentially substantial effects on benthic (bottom) habitat in Newark Bay. While zinc levels in terrestrial soils may also exceed benchmark levels for plant toxicity, these impacts are less well understood.

What are the socioeconomic impacts in New Jersey?

Though negative effects of large quantities of zinc have been observed in laboratory animals, there is no evidence that environmental levels of zinc pose a risk to humans. Its use as a dietary supplement and in the synthesis of drugs provides further evidence of its relative innocuousness. Thus it is unlikely that zinc produces measurable economic or psychological impacts.

What's being done?

Water, soil, and sediment criteria exist for industrial discharges and guidelines for contaminated site cleanup. Zinc loadings from non-point sources (particularly transportation-related), are not regulated.