NEW HAMPSHIRE ENVIRONMENT 2000

NHDES

New Hampshire Department of Environmental Services

Front cover: *Lake Umbagog, New Hampshire*

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NEW HAMPSHIRE ENVIRONMENT 2000

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

A Message from the Governor

We are fortunate to live in a state of unrivaled natural beauty with a rich culture and heritage. New Hampshire is a state where wide open green spaces are not confined to parks, where working farms can be found within the limits of cities, and where you can hike in solitude through miles of forest.

New Hampshire's environment is just one of many important reasons why our state is such a great place to live, raise a family, or vacation. Our environment is also a driving force behind our state's economic success. In an economy where businesses can locate anywhere, they choose New Hampshire because this is a place people want to live and work.

Our natural environment is a gift and a responsibility that we all share as citizens of New Hampshire. We have a responsibility to preserve it for future generations.

That is why I am working hard, in partnership with the Department of Environmental Services and other state agencies and organizations, on a number of initiatives designed to protect New Hampshire's environment.

In the past four years, we've reduced mercury emissions by more than 37 percent, and are working to cut dioxin emissions in half in the next two years. We've developed a Clean Power Strategy which would make New Hampshire the first state to implement an aggressive, multi-pollutant emissions reduction strategy, and are working to boost energy conservation. We are protecting open spaces and our state's heritage through the Land and Community Heritage Investment Program and combating sprawl with GrowSmart NH. We are protecting our drinking water supplies and working to remove the dangerous additive, MtBE, from our gasoline.

As citizens of this beautiful state, we must all share the responsibility of protecting our natural resources against future harm, restoring what has been harmed in the past, and laying the groundwork for a more sustainable future.

The New Hampshire Department of Environmental Services is committed to protecting our state's environment, and to keeping citizens informed about how they can assist in this critical effort. *New Hampshire Environment 2000* will provide you with up-to-date information about the state of New Hampshire's environment, and about critical environmental issues.

I encourage you to participate in our ongoing discussion of environmental issues, to get involved in the many available volunteer opportunities, to try some of the suggested environmental tips, and to visit the Department of Environmental Services' website. I look forward to our continued partnership as stewards of New Hampshire's environment.

Jeanne Shaheen

Jeanne Shaheen
Governor

NEW HAMPSHIRE ENVIRONMENT 2000

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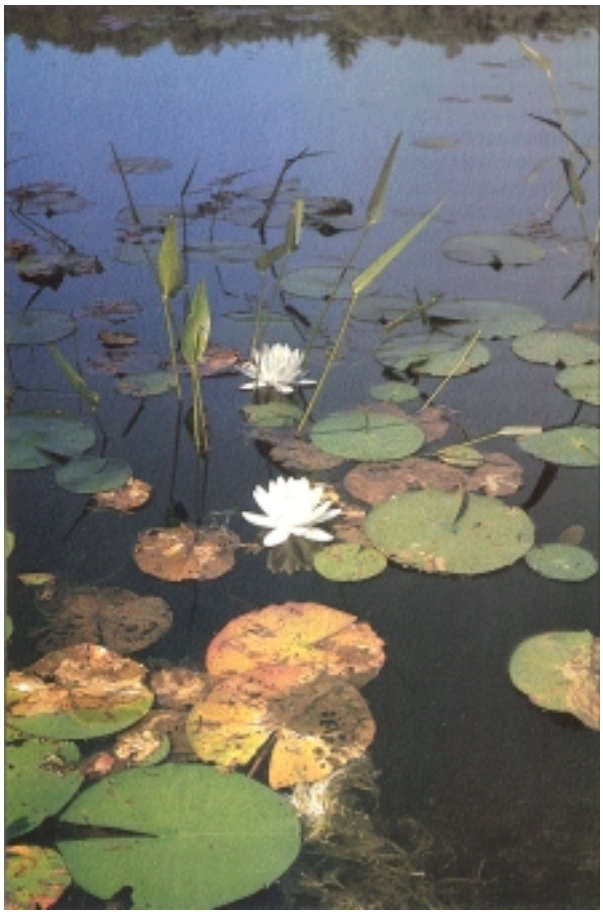
INTRODUCTION
from the Commissioner



I am pleased to present to you *New Hampshire Environment 2000*, a report that highlights environmental conditions, trends, and initiatives in our state. This report is designed to augment the Department of Environmental Services' continual efforts to convey environmental information to the public. It is also an important tool to help us better understand and evaluate progress in achieving our mission to protect, maintain, and enhance environmental quality and public health in the state, as embraced in the Governor's message.

Clean air, fishable and swimmable rivers and lakes, safe drinking water, uncontaminated land, safe dams, and healthy ecosystems – these are key Department goals. Great progress has been made toward accomplishing these goals in recent decades. However, some of the problems we face today are more complex and global in nature than those of the past. Today, we must deal with the cumulative environmental effects of a growing population, continued reliance on fossil fuels, increased loss of wetlands and wildlife habitat, and the creation and use of chemicals that persist in the environment.

The Department of Environmental Services will continue to work hard to protect and improve environmental quality and public health in New Hampshire. But we cannot do this alone. There is a great deal at stake here, and we need your help. We must all become environmental leaders. Together we can accomplish much and, in the process, leave our part of the world in better shape for future generations.

On behalf of the DES staff, we offer this state of the environment report to enhance our ongoing dialogue on these issues. I hope that you find *New Hampshire Environment 2000* informative and provocative, and that it inspires you to engage in this dialogue and get involved in the many volunteer opportunities at DES and elsewhere. Please read through the report, share it with others, and contact us at (603) 271-3503 with any questions, suggestions, and concerns you might have on these issues. Finally, please visit our website at www.des.state.nh.us to learn more about New Hampshire's environment and the Department's ongoing efforts.

~ Robert W. Varney, Commissioner

AIR QUALITY & CLIMATE CHANGE

In the past, a pollutant-by-pollutant regulatory approach was used to achieve reductions from New Hampshire's largest air pollution sources. While this approach worked well for achieving large reductions from New Hampshire's "easiest" targets, the era of relatively simple environmental cleanup is behind us.

Much of the challenge facing us today in terms of protecting our air quality arises from a large number of small sources such as vehicles, households, and small-to-medium-sized businesses. Although these sources, when looked at individually, emit small amounts of air pollution, when looked at in total, they contribute significantly to the air quality issues (acid deposition, smog, regional haze and visibility, and global climate change) facing New Hampshire today. Similarly, it is recognized that emissions from larger sources interact in ways that impact these multiple issues. As a result, air pollution issues are now so complex and interrelated that new, more effective, harmonized approaches are necessary to address these environmental and public health concerns. In this spirit, New Hampshire is currently developing a four-pollutant, integrated strategy addressing the state's oldest power plants. This strategy calls for reductions in sulfur dioxide (SO_2), nitrogen oxides (NO_x), mercury, and carbon dioxide (CO_2), and it promises to yield multiple environmental benefits.

Most air pollution problems that we face today share a common root: energy. The vast majority of air pollution comes from the burning of fossil fuels (coal, oil, and natural gas) for transportation, heat, and electricity. Just a few changes to use energy more efficiently could solve most of our air pollution problems, improve our health, and enhance our quality of life — all at the same time. Wise energy choices (more fuel efficient vehicles, *Energy Star* rated appliances, compact fluorescent lighting and other energy conservation measures) result in less fossil fuel burned. This ultimately translates into money savings and less air pollution. We have reached a cross-roads where it is necessary to call to action all industries, businesses,

and citizens to share in the responsibility for ensuring that the air is safe and healthy to breathe, and that natural resources are protected from the adverse impacts of air pollution.

MERCURY

Mercury is a naturally-occurring element that belongs to a class of harmful chemicals called *PBT*s because they are persistent, bioaccumulative, and toxic. Transported primarily by air, mercury is eventually deposited on the ground, washed into rivers and streams, taken in by plants, and consumed by animals. From there it works its way up the food chain,

New Hampshire Takes Steps to Eliminate Mercury

Projects such as the Concord Hospital thermometer swap, which collected 1,200 mercury thermometers and 1,400 mercury-containing lamps, are being encouraged to eliminate existing mercury sources in New Hampshire. The State is also continuing to monitor and regulate significant sources of airborne mercury emissions. Installation of activated carbon flue gas injection scrubbers on the Wheelabrator Company's Penacook incinerator resulted in an immediate 96 percent reduction in mercury emissions, preventing over 385 pounds, fully 24 percent of New Hampshire's total mercury emissions, from being discharged into the environment. Overall, since implementation of the *New Hampshire Mercury Reduction Strategy* began, mercury emissions in New Hampshire have declined 37 percent.

NEW HAMPSHIRE FISH COMPSUMPTION ADVISORY

Mercury. Women of childbearing age and children under six years of age are encouraged not to eat more than one meal of freshwater fish per month. All other people are recommended to limit their consumption of freshwater fish to no more than four meals per month.

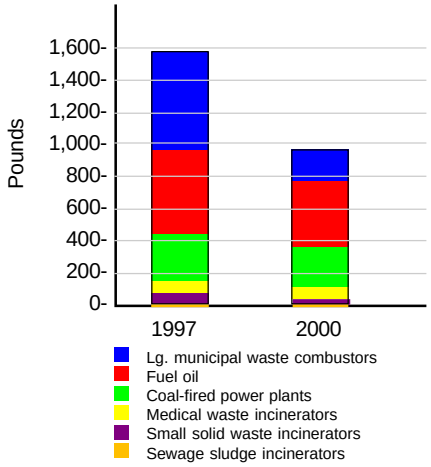
Dioxin. Since 1988, elevated levels of dioxin in fish tissue samples taken from the Androscoggin River downstream of the paper mill in Berlin have resulted in a public health fish advisory for the segment of this river from Berlin to the Maine border. Maine has issued a similar advisory for the remainder of the river. Pregnant and nursing women should avoid consumption of all fish species, and all other people should limit consumption to one or two eight-ounce meals per year. (See page 23 for more information.)

For more information, contact the N.H. Department of Health and Human Services at (800) 852-3345, extension 4664.

becoming increasingly damaging to animals' neurological systems. Since mercury has detrimental effects on human health, New Hampshire and 39 other states have issued health advisories on the consumption of freshwater fish, the main pathway for human exposure.

In 1998, Governor Shaheen announced the *New Hampshire Mercury Reduction Strategy*. The *Strategy* commits New Hampshire to reducing its mercury emissions 50 percent by 2003, and it recommends 40 action steps to achieve this goal. DES has already completed or initiated many steps, such as instituting stringent limits on large municipal waste combustors and medical waste incinerators, prohibiting the use of mercury in schools, prohibiting the sale of certain mercury-containing products, increasing mercury deposition monitoring activities, and assisting in the organization of several "thermometer swaps" where free, digital thermometers are given in exchange for mercury-containing thermometers.

37% Mercury Emissions Reduction in NH 1997-2000



Source: NHDES Mercury Emissions Inventory

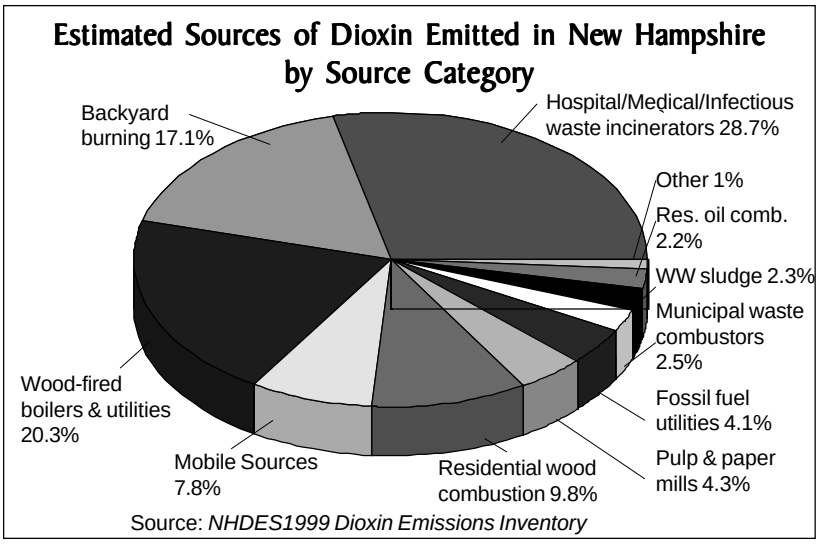
DIOXIN

Like mercury, dioxin is a persistent, bioaccumulative toxic. Dioxin is produced through incomplete combustion or as a by-product of industrial processes. Significant sources include medical waste incinerators, wood-fired boilers, and backyard burning of trash.

The main pathway for human exposure is the consumption of high-fat content foods, such as beef, fish, chicken, and dairy products. It is thought to be a human carcinogen even at extremely low exposure levels, and may also disrupt reproduction, development, and the immune system.

MERCURY & LOONS

Since 1993, members of the Northeast Loon Study Working Group have been sampling mercury levels in loons. Two hundred loon eggs have been sampled, as well as blood and feathers collected from 113 adults and 56 chicks from New Hampshire alone. Current findings show 18 percent of New Hampshire's loon population is at risk to some impact from mercury. Impacts include abnormal behavior, lowered reproductive success, and higher stress measured through hormones. In addition, individual loons captured and released in successive years show an increase in accumulation of mercury of 9 percent per year for males and 6 percent per year for females.



To address the increasing threat from dioxins, DES has released a *Dioxin Reduction Strategy* similar to that created for mercury. The goals of the new *Strategy* are to identify the sources of dioxin emissions, make specific recommendations to reduce dioxin releases to the environment, and educate the public about the health and environmental impacts of dioxins and how to minimize their exposure.

ACID RAIN

Acid rain is a phenomenon in which sulfur dioxide and nitrogen oxide gases react in the atmosphere to create acidic compounds. The acid is cycled back to the earth as acidic precipitation, harming aquatic and terrestrial ecosystems, visibility, and public health, including:

- Impairing the ability of certain fish, amphibians, and water plants to reproduce, grow, and ultimately survive, due to increased acidity in lakes and streams.
- Stripping forest soils of essential nutrients needed to sustain plant life.
- Deteriorating exterior surfaces such as stonework and paint on cars, statues, buildings, and other structures.
- Reducing visibility, and adversely affecting human health, as a result of the formation of very small acidic particles in the air.

While much has been published on the subject, many people are not aware that this is still a major issue for New Hampshire and elsewhere. Significant reductions in the emissions of sulfur dioxide (SO_2) and nitrogen oxides have taken place in New Hampshire and nationwide as a result of the federal Clean Air Act. However, despite these reductions, there is evidence that acid rain continues to degrade ecosystems in high-elevation forests and waters in the northeastern U.S. and eastern Canada.

This evidence suggests that sulfur and particularly nitrogen oxide emissions need to be reduced further and that recovery will take longer than previously thought. In an effort to protect public health and our natural resources, New Hampshire has been an active participant in developing and implementing a regional Acid Rain Action Plan, initiated in 1997 as a joint effort of the Conference of New England Governors and Easter Canadian Premiers (NEG/ECP).

For many years, DES has been monitoring the effects of acid rain by regularly taking water samples from New Hampshire lakes and ponds. Such monitoring is important because New Hampshire's waterbodies are extremely vulnerable to acid deposition. This is primarily due to the poor ability of granite bedrock to counteract or neutralize the negative effects of acid deposition. Long-term trends since the late 1930s reveal that most New Hampshire lakes have been relatively stable in pH, with 80 percent of the lakes having satisfactory pH levels (pH >6.0), and approximately 11 percent experiencing levels of high acidity (pH of 5.0 or less). However, the acid neutralizing capacity (ANC, or ability of a lake or pond to neutralize acid without becoming more acidic), declined in 25 to 50 percent of the state's lakes over the same period.

Evaluation of short-term trends for the time period 1983-1999 and 1990-1999 has revealed that pH generally has remained stable. Further, the acid neutraliz-

ACIDIFIED LAKES & REMOTE PONDS IN N.H.

Lake/Pond	Location	ANC*	pH
Baker Pond	Chesterfield	0.0	5.2
Barrett Pond	Washington	0.0	5.3
Bear Hill Pond	Allenstown	-1.3	4.5
Bowker Pond	Fitzwilliam	-0.3	4.8
Brackett Poond	Wentworth	-0.8	4.7
Cone Pond	Thornton	-1.0	4.7
Constance Lake	Piermont	-0.2	4.9
Darrah Pond	Litchfield	-1.3	4.5
Divol Pond	Rindge	-1.2	4.6
Four Mile Pond	Dix Grant	-0.2	5.1
Gordon Pond	Lincoln	-0.8	4.6
Kilburn Pond	Winchester	-1.3	4.5
Kinsman Pond	Lincoln	-1.9	4.5
Lily Pond	Alstead	-0.2	5.0
Long Pond	Lempster	-0.1	5.3
Loon Pond	Lincoln	-1.0	4.8
Lovewell Pond	Nashua	-3.0	4.3
Nancy Pond	Livermore	-0.8	4.7
Pisgah Reservoir	Winchester	0.0	4.4
Signal Pond	Errol	-0.6	4.9
Solitude, Lake	Newbury	-0.3	4.9
Spruce Pond	Deerfield	-0.3	4.8
Willey Pond, Big	Strafford	-0.7	4.7
Willey Pond, Little	Strafford	-1.0	4.6
Winkley Pond	Barrington	-0.2	5.1

*An acid neutralization capacity (ANC) value of zero or less denotes an acidified lake. Acidified lakes are unlikely to support a naturally reproducing fish population. Although minor changes occur between pH 6.5-6.0, significant adverse impacts to important aquatic food chain organisms begin to occur as pH drops below 6.0.

Source: *DES*

As this table shows, all areas of New Hampshire have acidified waterbodies, indicating that this problem is due to a combination of in-state and out-of-state pollution, and that certain waterbodies are more vulnerable than others.

ing capacity of New Hampshire's lakes have not improved as might be expected considering the declines in sulfur dioxide emissions and related reductions in sulfate deposition and sulfate levels in lakes. This is attributable to the decline in elements such as calcium and magnesium from soils caused by the leaching out of these minerals by acid rain. These results suggest that sulfur, and particularly nitrogen oxide emissions, need to be reduced further, and that there is still a long way to go to address the acid rain problem.

HAZE – Fine Particulate Matter

Clouds and/or haze often compromise visibility in the Northeast. While cloudiness is a natural occurrence in the mountains, generally haze is not. On a hazy day, visibility from the White Mountains can be reduced from about 100 miles to just a few miles.

Visibility is reduced by tiny particles and gases, which are small enough to block or interfere with the path of the visible spectrum of light. In the Northeast, the vast majority of visibility-reducing particles is composed of sulfate (the same particles that cause acid deposition). In the Northeast, these sulfates originate primarily from distant coal-burning power plants. According to the U.S. Environmental Protection Agency (EPA), power plants are responsible for over two-thirds of the sulfate particles in the United States. Organic carbon, nitrates, elemental carbon, and earthy materials make up most of the remaining particle content (in declining order of impact). The same particles comprising fine particulate matter can also contribute to serious health effects. Thus, actions to re-

Views of the Great Gulf Wilderness in New Hampshire's White Mountains, with haze (top) and without.

duce levels of fine particulate matter will benefit both public health and the environment.

In June 1999, EPA issued regional haze regulations for the protection of visibility in 156 national parks and wilderness areas. The rule requires that states establish reasonable progress goals to improve visibility on the haziest days and ensure no degradation on the clearest days over the next 60 years.

Visibility is not just about aesthetics; it has a dramatic economic effect on tourism, which is New Hampshire's second largest industry. EPA's regional haze regulations will help prevent the haze that limits visibility in the Great Gulf Wilderness and the Presidential Range-Dry River Wilderness in the White Mountains, as well as other important tourist attractions.

OZONE

Ozone can be good or bad, depending on where it is found. Ozone in the earth's upper atmosphere – 10 to 30 miles above the earth's surface – is beneficial because it protects us from the sun's harmful ultraviolet rays. Ozone in the earth's lower atmosphere, near the ground, is a harmful air pollutant.

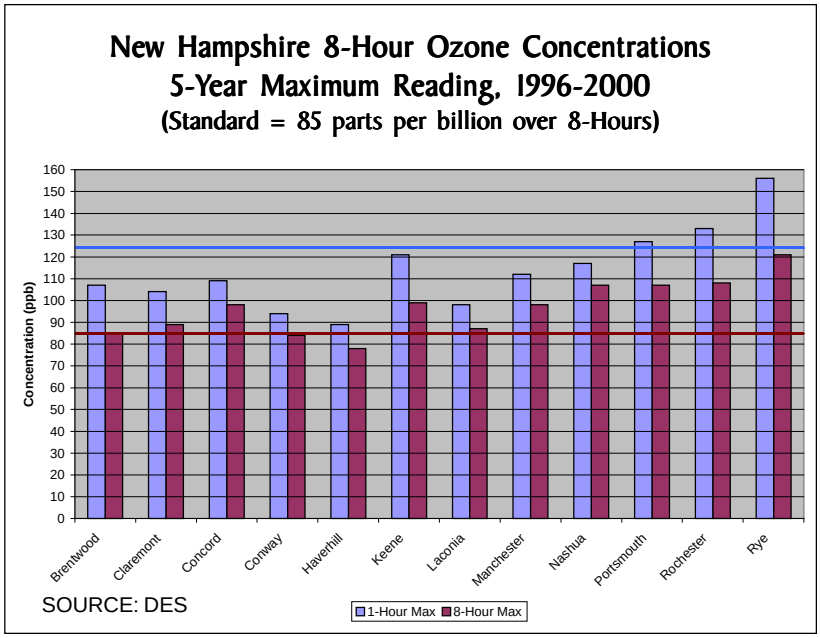
Ground-level ozone continues to be one of the most pressing air quality issues facing the state. Its formation is the result of chemical reactions in the atmosphere between nitrogen oxides (NOx) and volatile organic compounds (VOCs). These compounds react to produce ozone in the presence of heat, oxygen, and strong sunlight – explaining why ozone levels typically rise during warmer months.

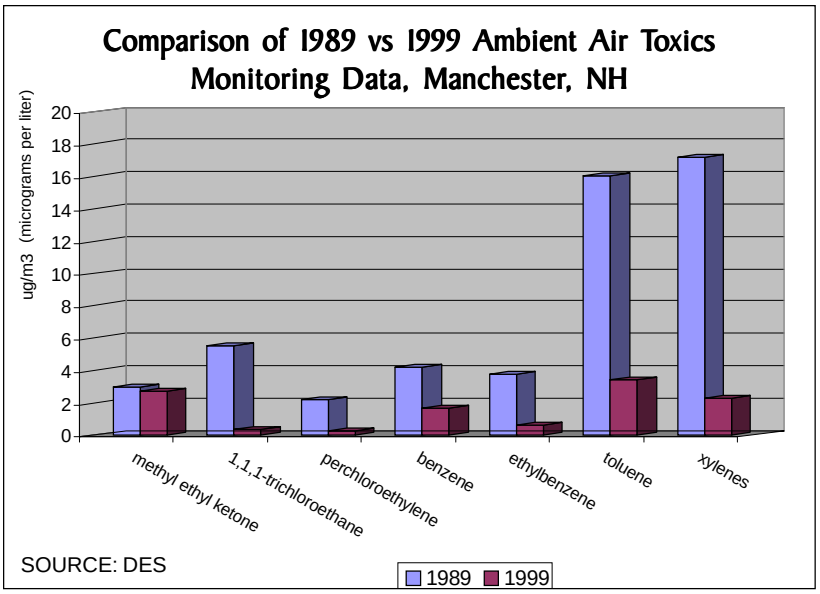
Elevated amounts of ground-level ozone are harmful to both human health and the environment. At elevated levels, ozone can cause coughing, chest pain, headaches and irritation of the nose, throat and lungs. These effects are seen especially in active children and adults and in people with respiratory diseases like asthma. In addition, ozone can be harmful to trees and other vegetation.

The difficulty of trying to control ground-level ozone is that elevated levels are largely the result of industrial activity and motor vehicle use not only in New Hampshire, but also in our neighboring Northeast and Midwest states. To help address this problem, New Hampshire will continue to support activities related to the reduction of ozone at the regional and national levels, such as more stringent vehicle emissions standards and fuel standards. New Hampshire will also continue to lead by example by encouraging, and in some cases requiring, NOx reductions from New Hampshire sources through cost-effective, environmentally protective programs.

TOXIC POLLUTANTS

DES has long recognized the risks posed by toxic pollutants to human health and the environment, and it has been a national leader in reducing exposure to these pollutants. The agency has instituted a multi-media approach in addressing toxic pollutants through programs that include pollution prevention, waste minimization, resource recovery, and pollution control. For example, DES adopted the New Hampshire Air Toxics Control Program in 1987, three years before the U.S. Environmental Protection Agency began regulating hazardous air pollutants under the 1990 Clean Air Act Amendments. Then, in 1991,





DES established the New Hampshire Pollution Prevention Program to assist businesses and industries in adopting practices that avoid the generation of waste and that minimize the transfer of pollutants from one medium (air, water or land) to another.

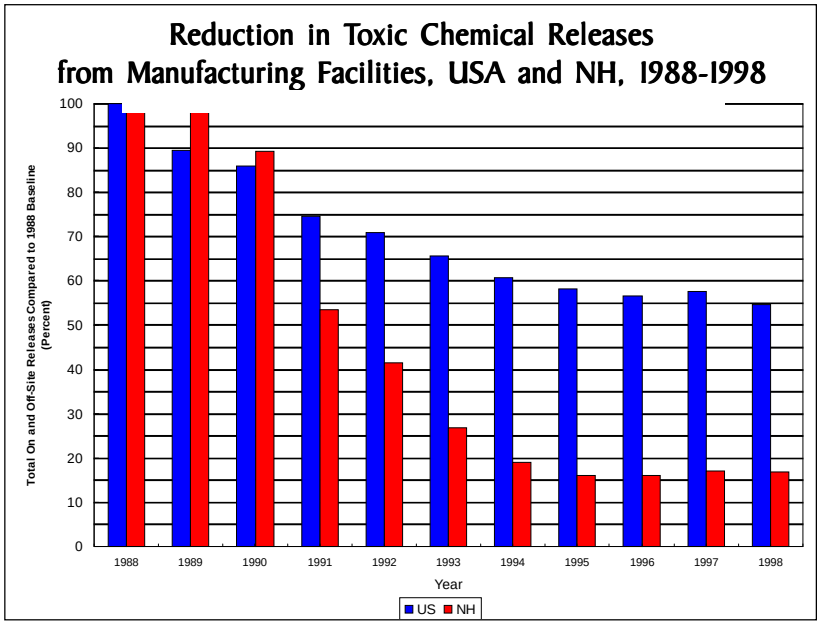
Toxic Air Pollutants

DES has also increased efforts to control emissions of pollutants known as toxic air pollutants or air toxics. Air toxics are those pollutants that, at sufficient concentration and exposure, have the potential to cause cancer or other serious health effects. Examples include: benzene, formaldehyde, mercury, chromium, arsenic, vinyl chloride and dioxin. Unlike the Clean Air Act's "criteria" air pollutants (sulfur dioxide, nitrogen oxides, ozone, carbon monoxide and particulate matter), toxic air pollutants are typically emitted in smaller quantities from a large number of sources.

Since 1990, DES has regulated the emissions of a variety of air toxics under the New Hampshire Air Toxics Control Program. This program now controls the emissions of over 750 toxic air pollutants from all New Hampshire businesses. As a new feature of the program, a comprehensive, long-term air toxics monitoring program was initiated in 1999 to determine the levels of exposure of New Hampshire residents in both urban and rural areas, and to gauge the effectiveness of DES air toxics control strategies over time. Despite evidence of significant improvements, serious health risks from air toxics still exist, particularly in our more urban communities. However, DES expects to see further improvements in toxic air pollutant reductions over the next few years.

Toxics Reporting: Toxic Release Inventory Emissions

New Hampshire continues to outpace most other states in reducing toxic chemical releases from manufacturing facilities. The U.S. EPA's Toxic Release Inventory (TRI) program, established in 1986, requires companies to annually report releases of certain toxic chemicals to the air, water, and land. EPA's TRI data shows that from 1988 to 1998, toxic releases from manufacturing facili-



U.S. EPA Toxic Release Inventory (TRI) data shows that toxic releases from New Hampshire manufacturers have been reduced by 83 percent from 1988 to 1998, far outpacing the nation as a whole.

ties in New Hampshire decreased by over 83 percent. By comparison, the national average for the same period shows a 45 percent decrease.

EPA used to require only manufacturing facilities to report their toxic releases as part of the TRI reporting program. They now require all electric utilities nationwide, including the three Public Service of New Hampshire (PSNH) utilities, to report their toxic releases as part of the TRI reporting program. In recent years, PSNH significantly reduced its emissions, including particulates, metals, and nitrogen oxides, through installation of a variety of pollution control measures, and 1998 data indicate that New Hampshire's emissions from all its electric power plants amounted to less than 1 percent of the nation's total power plant emissions.

Continued positive results will be achieved through pollution prevention at companies, technical assistance for small businesses, and increasing education and outreach.

GLOBAL CLIMATE CHANGE

Given the ever-increasing evidence of the earth's changing climate, it is imperative that we take action now to gain a better understanding of the causes and effects of climate change, and steps we can take to address it. The changes to the earth's climate, which are being influenced by human activities, have serious and long-term effects on many ecological systems, as well as on human health and the economy.

What is Global Warming?

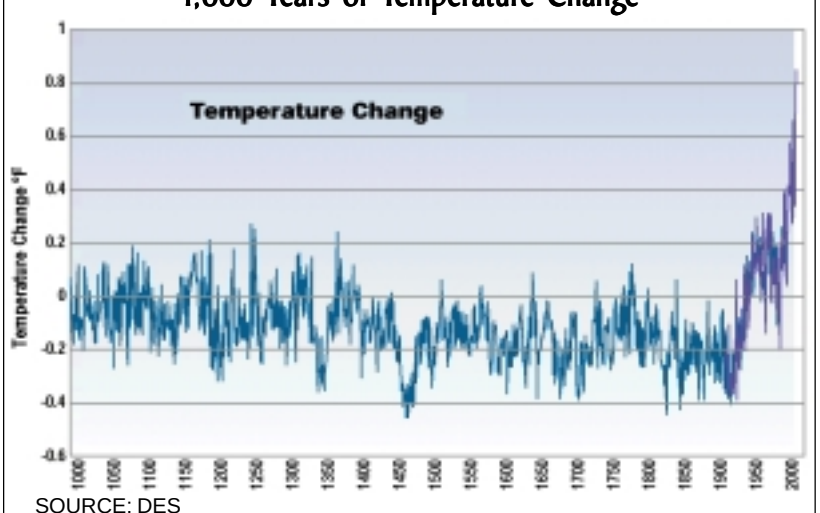
Life on earth is possible because the sun's energy warms the earth and its atmosphere. As this warmth radiates back into space, a portion is absorbed by certain gases in the atmosphere, called greenhouse gases. The greenhouse gases create an insulating layer that acts to elevate temperatures on earth, similar to how heat is trapped by the glass walls of a greenhouse, thus the name "greenhouse effect." Without this effect, temperatures would be much colder than they are now, and the earth's climate would be hostile to living things.

Many human activities are adding greenhouse gases to the atmosphere, carbon dioxide being the most prominent greenhouse gas (92 percent), followed by methane (7 percent), and nitrous oxide and fluorocarbons as the remaining contributors. Scientific observations and studies over the past decade have identified a correlation between the increasing concentrations of greenhouse gases from human activities and changes in the earth's climate. The primary source of greenhouse gas emissions from human activities is the burning of fossil fuels like coal, oil, and natural gas for energy use.

Greenhouse Gas Emissions and Concentrations

Since the beginning of the industrial revolution, greenhouse gas emissions from human activities have consistently increased. As a result, greenhouse gas concentrations in the atmosphere are increasing at a faster rate than at any time over the past several thousand years. Today's atmospheric concentrations of carbon dioxide are 30 percent above the pre-industrial levels of 200 years ago. At present rates, they will likely more than double from today's level by the year 2100, especially as Third World countries develop their industrial base. Additionally, concentrations of methane and nitrous oxide have climbed over 145 percent and 15 percent, respectively, since pre-industrial times.

1,000 Years of Temperature Change



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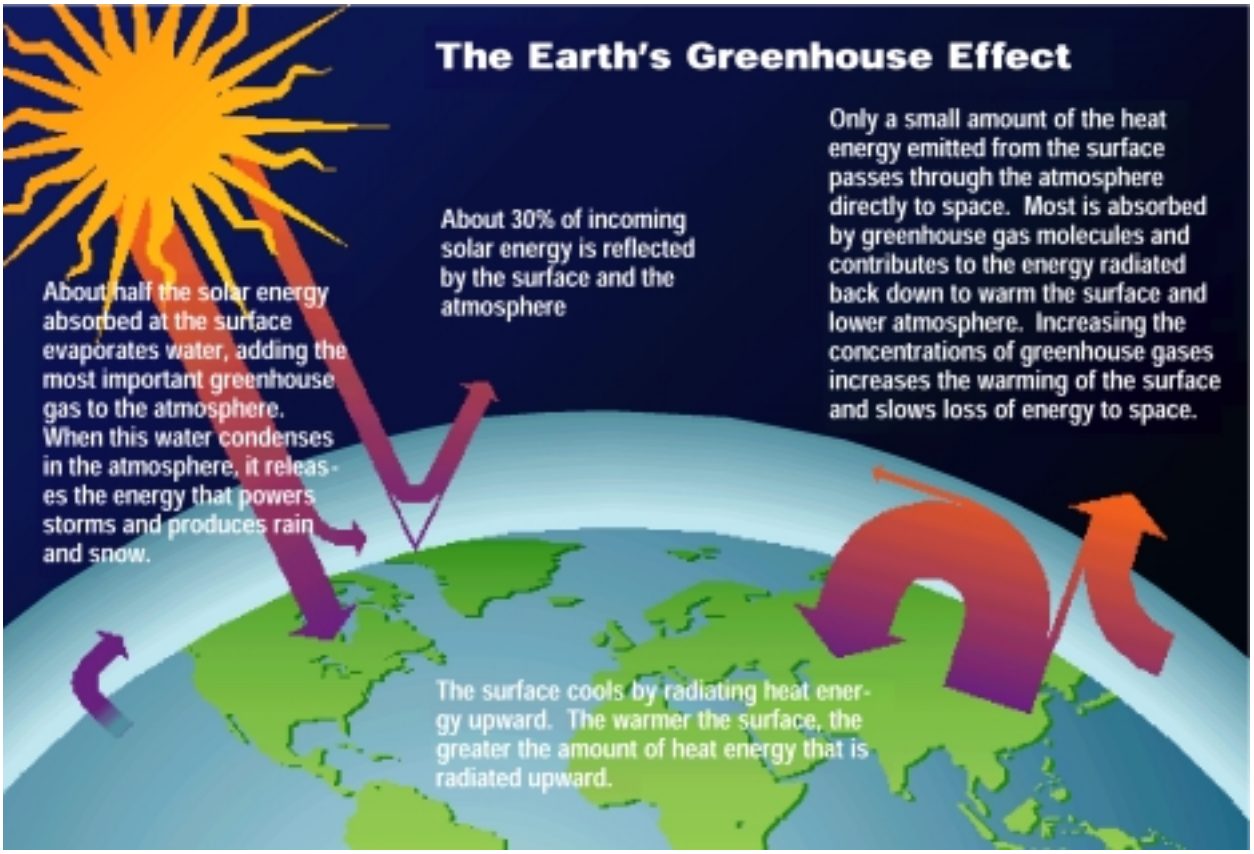
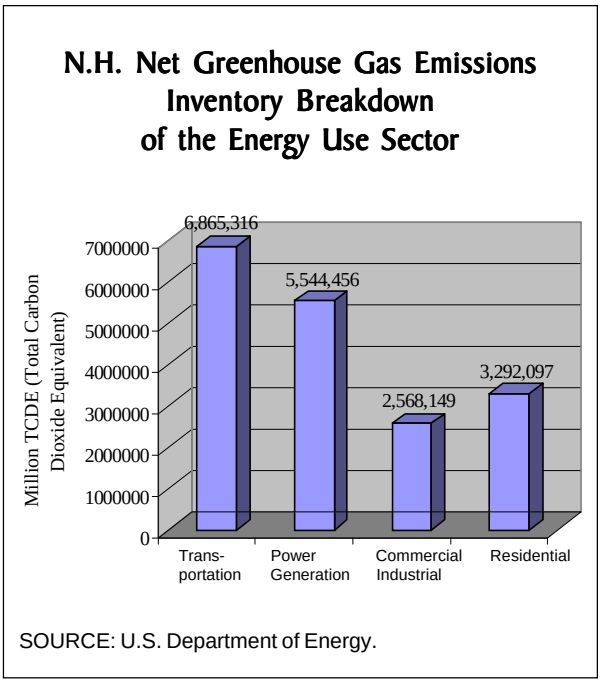


In New Hampshire

In general, warming is predicted to increase with latitude, and the most significant warming is predicted to occur in late autumn and winter. In fact, recent research indicates that temperatures in New Hampshire reflect that trend. The average annual temperature for the New England region has increased 0.7 F over the last 105 years, slightly below the national average of a 1.0 F increase. However, there is variation within the region, and New Hampshire has experienced an increase in average annual temperature of 1.8 F, nearly three times the regional average. Significantly, this increase in annual temperature for New Hampshire occurs primarily in the winter months, which have warmed by 2.0 F. In contrast, the summer months exhibit increases similar to the overall regional average of 0.7 F. The reason for these state-to-state variations is a topic of on-going research.

What does all this mean for New Hampshire?

New Hampshire's quality of life is directly tied to its lakes, rivers, ocean shoreline, mountains, forests



In New Hampshire, as elsewhere, energy use, in particular fossil fuels, is responsible for most of the Greenhouse Gas emissions. To reduce fossil fuel use, the focus must be on using fossils fuels more efficiently and seeking alternatives.

(whose deciduous trees produce brilliant fall foliage), scenic towns, and other natural areas. New Hampshire's economy relies heavily on tourism, as millions visit New Hampshire every year to enjoy the state's natural beauty. An increase in average temperature in New Hampshire will impact the habitat characteristics of forests and water resources, and may also have a detrimental effect on public health. Examples of industries that may, over time, be adversely impacted by global warming include tourism, forestry, maple syrup/sugar production, skiing, and game fishing. A more detailed assessment of the local impacts of climate change in New Hampshire is currently being conducted. This report of the New Hampshire Local Impact Assessment Project is expected to be released in December 2001.

Steps to Reduce Greenhouse Gas Emissions Produce Multiple Benefits

Burning fossil fuels for energy is the primary source of greenhouse gas emissions, as well as a source of many other air pollutants, including particulate matter, nitrogen oxides, sulfur dioxide, carbon monoxide, and air toxics. Strategies that focus on improved energy use and efficiency to reduce greenhouse gases will also result in less emissions of other air pollutants. New Hampshire's soon-to-be-released *Climate Change Action Plan* includes a menu of options and programs to effectively reduce greenhouse gases and other air pollutants simultaneously.

TIPS TO REDUCE GREENHOUSE GASES

- Be energy-wise. Select new appliances with *Energy Star* labels denoting efficient energy use. Use compact fluorescent light bulbs, which use 75 percent less energy, last ten times longer than regular light bulbs, and cost you less in the long run. Turn out unnecessary lights.
- Walk or ride a bike.
- Car-pool and use public transportation. Combine errands for fewer trips.
- Purchase vehicles with high gas mileage. Keep your car tuned-up and your tires properly inflated. Avoid idling.
- Run dishwashers and washing machines only with full loads.
- Use electric or hand-powered lawn care equipment. Replace your old lawn mower with a new, energy efficient model and take your old one to a scrap metal recycler instead of selling it or giving it away. Older equipment can be up to twice as polluting as the newer models.

Remember that each of us, in our small ways, contribute to greenhouse gases, and each of us can contribute to its reduction.

WASTE MANAGEMENT & SITE CLEANUP

The Department of Environmental Services, through its air, water, and waste management divisions, employs a variety of strategies for achieving the agency's major goals of public health and environmental protection. DES's Waste Management Division, with its staff of engineers, hydrogeologists, chemists, and others, focuses on ways and means to:

- Prevent the occurrence of events and practices which may lead to soil, air and groundwater contamination.
- Minimize the immediate effects of oil and hazardous waste spills when they occur.
- Clean up oil and/or hazardous waste contaminated sites.
- Provide funding to support prevention of contamination and cleanup work.
- Provide management and oversight of contaminated site remediation.

DES engineering and hydrogeological staff review the plans for a proposed waste management project.

AVOIDANCE STRATEGIES

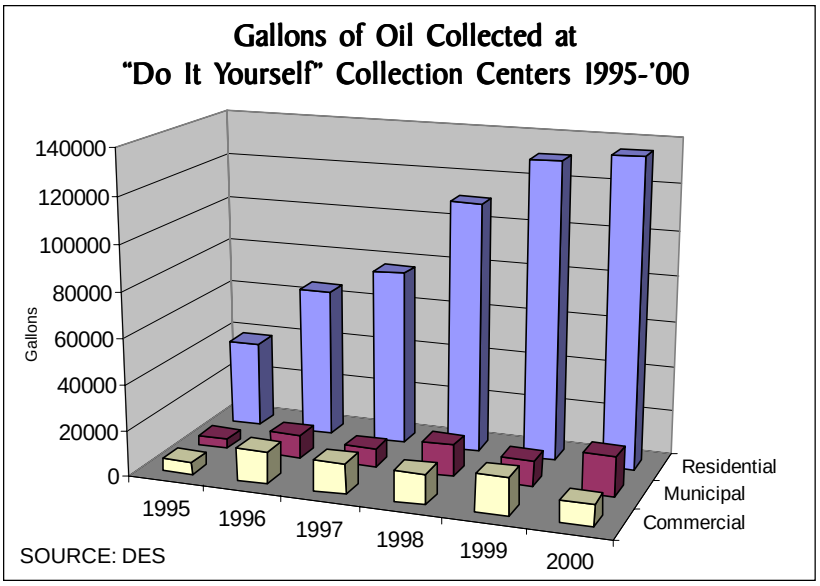
In recent times, increasing emphasis has been properly placed on the avoidance of pollution. This is because the cost of avoiding pollution in the first place is usually small compared to the cost that society must pay to clean up soils and water resources that have become contaminated. While "command and control" was the method of strategic preference for some time, compliance and "doing it right" in the first place have moved center stage as the means to achieve a clean, safe environment. At DES, multiple approaches have been taken to achieve this compliance goal, as described below.

Toxicity Reduction

New Hampshire enjoys renown as a tourist state while, at the same time, nurturing a vibrant manufacturing and technological economic base. With the booming economy of the 1990s, the state experienced rapid growth in new businesses, many of which use hazardous materials and which produce hazardous wastes. In fact, there are some 6,000 generators of hazardous waste in the state. Though most of these are small generators, experience shows that it sometimes takes but a small amount of waste to seriously threaten the environment.

One area of prevention is related to petroleum, either virgin product or used oil. Oil is a common groundwater and surface water contaminant. It takes only one pint of oil to produce a one-acre oil slick or one quart to contaminate 250,000 gallons of groundwater. In order to provide citizens with convenience in disposing of used oil, the State has provided grants to encourage the collection of used oil. As the chart on the next page shows, the growth of that program since its inception in 1995 has been dramatic. Since that time, used oil grants totaling over $260,000 have been made to 136 recipients, and the program has helped prevent the contamination of as much as 680,000 gallons of groundwater, the equivalent consumption of six four-person households for a year.

DES also is making vigorous efforts to promote pollution prevention, reuse of hazardous materials, and



A statistical review shows that the collection of residential oil from "do-it-yourselfers" has steadily increased since the inception of DES's Used Oil Grant Program in 1995. In fact, used oil collected in 2000 showed more than a three-fold increase over that collected in 1995. The total gallonage of used oil collected from commercial and municipal entities at the centers also increased.

recycling as means to assure proper management of these toxic wastes. Education, compliance assistance and enforcement all play an integral role in managing hazardous waste. The public is protected by such approaches since materials which must be either incinerated or landfilled have been made less toxic. Detoxification is particularly important since most of the design requirements for building a state-of-the-art landfill or a waste incinerator are related to the anticipated presence of toxic materials that may be an indistinguishable part of the waste stream.

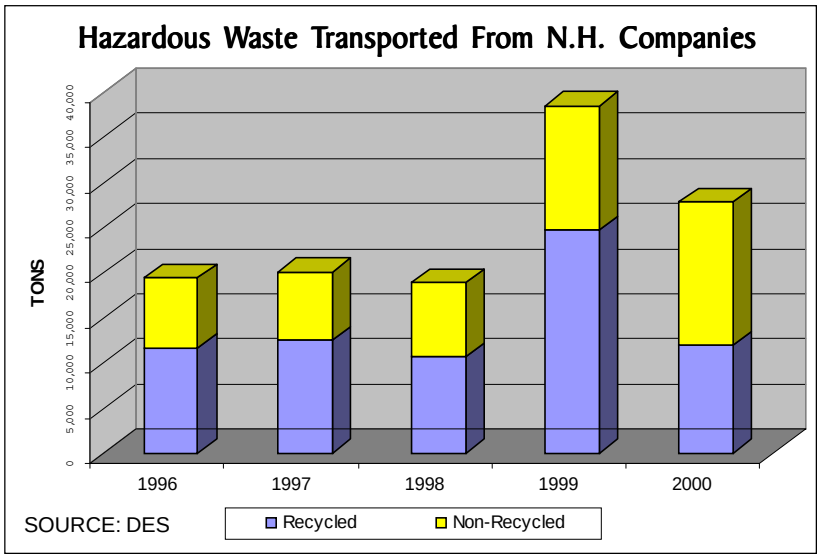
Toxics Tracking

The 1984 disaster in Bhopal, India in which 16,000 people died led two years later to Congress passing the world's first community right-to-know law. This fostered a national data base of toxic emissions from facilities known as the Toxics Release Inventory (TRI). Monitoring the releases of hazardous materials from facilities is critical to public health and the environment. Local Hazardous Materials (HAZMAT) response capability must be adequate for dealing with dangerous materials that exists in many urban and suburban manufacturing localities. Data from TRI also focuses attention on those facilities in need of greater pollution prevention, compliance monitoring, and inspection.

In New Hampshire, DES tracks the movement of hazardous waste, registers hazardous waste transporters, conducts compliance investigations, responds to hazardous material spills, and inspects generators of hazardous waste. DES also works with industry to encourage pollution prevention, recycling and waste minimization. The bar graph below shows the five-year history of hazardous waste recycling. Solvent recovery and energy recovery are the largest recycling uses. On average, 57 percent of hazardous waste was recycled. Year 2000 data suggests a continuation of the upward trend in hazardous waste recycling by industry.

Household Hazardous Waste Collection

Although household hazardous waste makes up an estimated 2 percent of the volume of solid



waste, it contributes over 80 percent of the toxicity. In the past ten years, the DES Household Hazardous Waste Collection Program (HHW) has provided over 300 grants totaling over $1.8 million for HHW collection projects. In 1999 alone, HHW events resulted in the collection of over half a million pounds of homeowner-generated hazardous wastes, which otherwise could have been improperly discarded. DES funding also supported the development of two permanent HHW collection centers, and several product reuse centers where hazardous household products, such as paint thinner, engine degreaser and other reusable products may be left or exchanged for other items. Statutory and regulatory revisions are underway, aimed at making the process of collection more convenient, cost-effective and efficient.

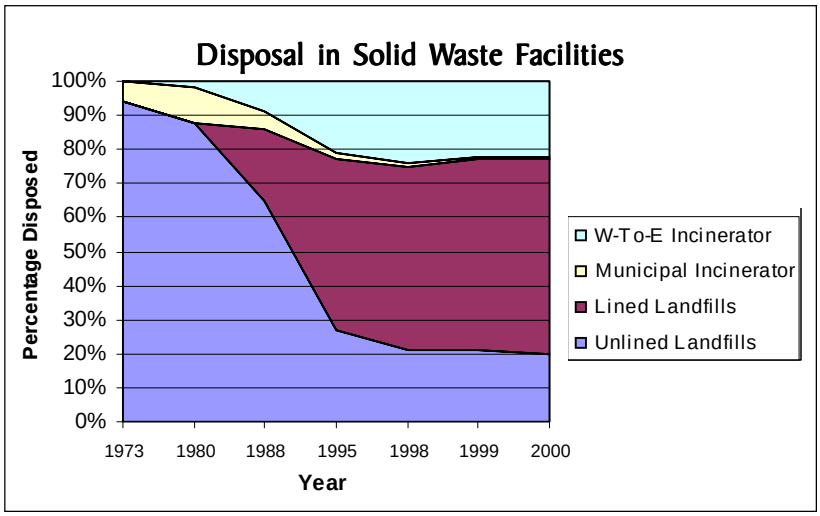
Household hazardous waste collections, such as this one held in Belmont for Lakes Region residents, helps to keep old paint, solvents, and other household chemicals from polluting the environment.

Pollution Prevention

In 1991, the Department established the N.H. Pollution Prevention Program (NHPPP) to promote pollution prevention strategies within the State's businesses, institutions and municipalities. Pollution Prevention is the cornerstone of the agency's approach to waste management. The program is non-regulatory and promotes pollution prevention through free, confidential site assistance, technical research, conferences, educational curricula development and stakeholder partnership projects. A highlight of the NHPPP's activities is the annual Governor's Award for Pollution Prevention that honors special projects and programs undertaken by New Hampshire manufacturers. Today, a pollution prevention philosophy has been incorporated into almost all the agency's activities, as well as New Hampshire schools, towns, and hospitals, in addition to businesses. Pollution prevention concepts are also being promoted to New Hampshire residents through DES's Household Hazardous Waste Program which, in addition to grants for household hazardous waste collections, also provides information on environmental consumerism and environmentally safe substitutes for toxic household products.

Landfill Closure Program

Unlined landfills which can negatively impact groundwater quality are being used less and less. Seventy-nine percent of wastes currently goes to three commercial lined landfills and two commercial "waste-to-energy" incinerators. Over 80 of the 154 municipally-owned solid waste landfills in New Hampshire have closed or are in the process of closing. An additional 74 active and inactive unlined landfills are scheduled for closure by 2011 through



an aggressive program funded by a combination of 20 percent state grants to the communities and low interest loans from the State Revolving Loan Fund.

As shown in the previous graph, there has been a substantial change in the mix of facilities over the past 26 years. Notably, the volume of waste managed by waste-to-energy facilities has remained essentially constant over the last four years, while new, lined-landfill capacity has increased dramatically.

Recycling

Many New Hampshire communities continue to provide recycling programs, offering people the chance to recycle common items such as newspapers, aluminum, glass, and plastic. To encourage recycling, 134 towns have mandatory recycling ordinances, 35 communities have a "pay-as-you-throw" disposal program, and 38 communities offer curbside recycling. Additionally, many communities are reaping the benefits of composting which lessens their costs of disposal and provides a valuable fertilizer to community residents.

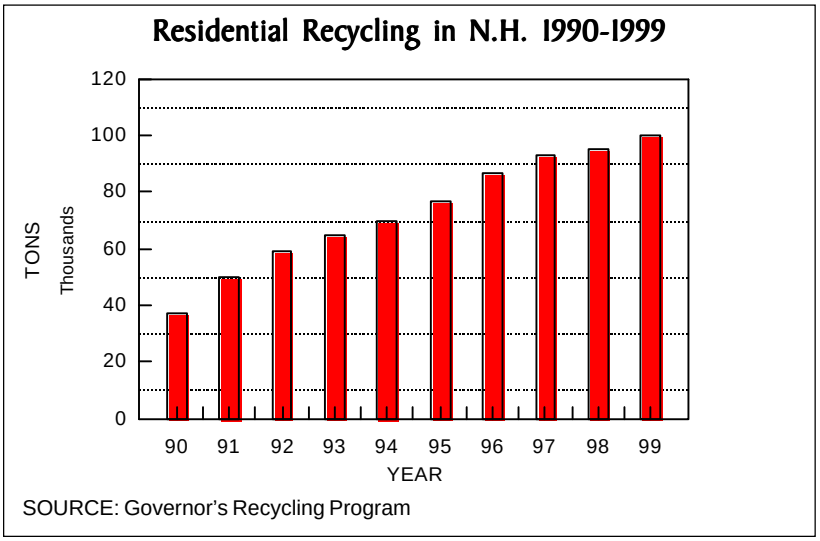
In 1990, the New Hampshire Legislature set a goal of 40 percent solid waste diversion (recycling) for the state, to be reached by the year 2000. The state's diversion rate in 2000 including recycling, composting, source reduction and reuse was in the range of 27-30 percent. The estimate may be low since reporting is not required for businesses, industry, and institutions. Two recent initiatives will boost recycling rates in New Hampshire – recommendations of the Governor's Solid Waste Task Force and DES's Solid Waste Plan for the state. Education to emphasize the financial benefit of recycling, compared to other more expensive disposal options, is the key to expected increases in recycling.

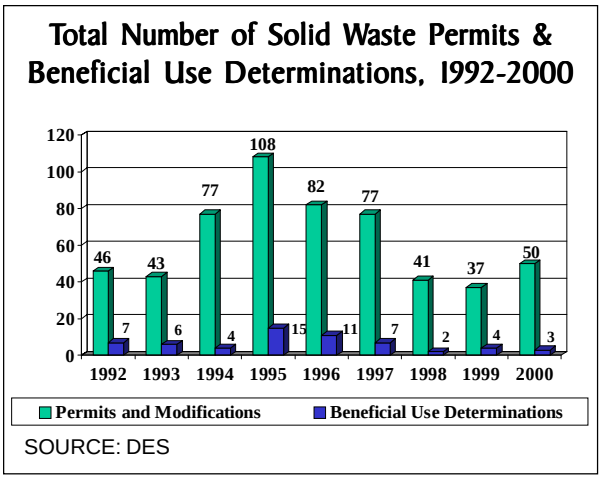
Solid Waste Facility Permitting

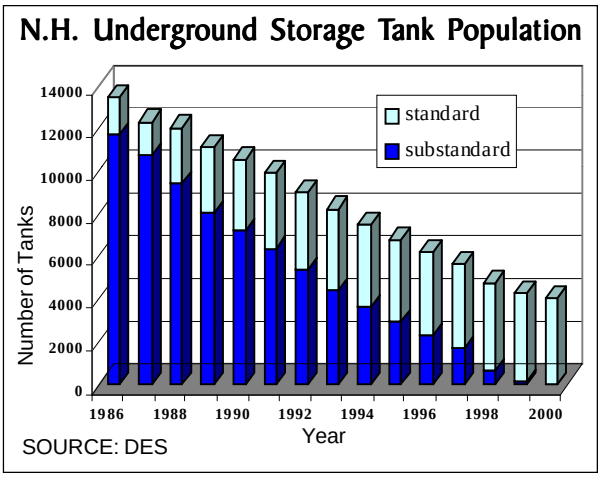
DES's permitting process operates to ensure that facilities are designed and built with emphasis on maintaining public health and protecting the environment. Toxics reduction, mentioned earlier, and contaminant control are central issues in design and permitting. Permitting requirements include measures that protect water quality by establishing set-backs to wetlands and waterbodies and design features such as leachate collection systems that protect groundwater. Air quality is protected by requiring the control of gaseous emissions for large sources of methane and toxics generated from some, but not all, landfills. Proper management of putrescible wastes is afforded by setting storage times and controls for disposal, providing training for facility operators, and by developing and implementing operating plans to achieve the design goals.

Specifically, permitting avoids problems by:

- Establishing siting restrictions to ensure that sensitive environments and potential receptors are protected.
- Ensuring that facilities are designed to protect the environment.
- Developing operation plans to ensure that waste is managed in an environmentally sound manner and that permit storage limitations are not exceeded.
- Requiring financial assurance to be provided for site closure.
- Requiring closure plans to ensure that after its useful lifetime, the site will be left in a manner that protects the public health and the environment.







- Performing regular inspections to ensure that facility operations are in conformance with the rules.

Permitting activities vary year to year as would be expected. In 1995, permits peaked due to fifty waivers and modification requests that were processed as part of the permit program. Beneficial Use Determinations vary year to year and reflect innovation in using materials that would otherwise be considered waste.

Solid Waste Operator Training and Certification

Over the last twenty years, the nature of solid waste management has become complex and critical due to an increase in urbanization and industrialization combined with pressure on solid waste disposal capacity. In response to this challenging situation, a Solid Waste Operator Training and Certification Program was developed by DES in 1990 to provide education and training on waste management technology and practices.

The program certifies operators at four different levels, from entrance level to the managerial level. In order to become certified, an applicant must fulfill certain education and experience requirements, attend training courses provided free-of-charge by DES, and successfully complete a written examination. To maintain certification, operators participate annually in a continuing education program comprised of nearly twenty workshops on a variety of topics such as equipment safety; development of management skills; household hazardous waste collection; recycling; and composting. Often, workshops are held at solid waste facilities throughout the state so that operators can learn through "hands-on" activities. Over 2,000 operators have now successfully completed the program.

Oil spill prevention

Underground storage tank (UST) systems have been regulated in New Hampshire since 1985. In 1988, USEPA required that all regulated steel USTs containing petroleum and hazardous materials be protected against corrosion by December 1998 or be permanently closed. In that pe-

13,700 substandard petroleum tank systems have been permanently closed since 1985.

Oil recovery equipment deployed in the Piscataqua River during a training exercise.

riod, 13,700 substandard systems (those without corrosion control and/or lacking overfill and spill prevention features) have been permanently closed. New Hampshire has thus achieved nearly 100 percent compliance compared to the 85 percent national average. In 1997, New Hampshire adopted its first set of regulations covering about 700 above ground petroleum storage tanks systems that are registered with DES.

In 1999, DES instituted a new *Safetank* program for residential homeowners having substandard heating oil tank systems. The program provides up to $1,000 per residential household for repair or replacement of such systems. This program is very important since, to date, 1,013 on-premise spills have been reported and close to $5 million dollars has been provided by the State to clean up these spills.

MINIMIZING IMPACTS

While avoidance and prevention of contamination are of paramount importance, DES is prepared to act rapidly to minimize the effects of spill events.

Emergency response

DES maintains a 24-hour per day, seven days a week emergency response capability for both oil and hazardous waste spill incidents on land or water. In a typical year, there are about two oil spills per day. These spills vary in magnitude, but typically they range from ten gallons to a few hundred gallons. On average there is a hazardous waste response required of DES every third day, half requiring on-scene participation or advice to the incident commander, typically the local fire chief. The balance are handled by providing telephone advice and involve incidents such as broken mercury bulb thermometers in the household or in schools. Hazardous waste incidents, though fewer in number and typically smaller in volume, may be very hazardous to human health and the environment due to the nature of materials involved.

DES has also established and equipped an Incident Command Center at the Pease International Trade Port specifically designed to support the control and cleanup of spills in the Piscataqua estuary. Cross training of DES staff with the help of the U.S. Coast Guard assisted by the Coast Guard Auxiliary is on-going and helps prepare the team for a multi-day response.

In addition, to allow for rapid deployment, cleanup equipment in trailers and sheds has been staged at various locations in the Piscataqua/Great Bay area such as the state fish pier and the Jackson Estuarine Marine laboratory. The importance of this capability cannot be overstated since the tidal currents in the Piscataqua estuary are among the strongest in the nation coupled with the vulnerability of the marine resources due to the large tidal flats exposed at low water in Great Bay.

CLEANING UP CONTAMINATED SITES

In the 1960s and 1970s numerous hazardous waste sites were discovered, and the public health and environmental risks that they represented became very apparent. Cleaning up these sites under both federal and state law has been and remains a high priority for DES. Leadership for cleanup actions is shared by the state and federal governments in some cases, and in others the governments provide oversight when the private parties assume the responsibility for cleanup.

Hazardous Waste Contaminated Sites

Superfund Sites. In 1980, Congress enacted the Superfund law, formally the Comprehensive Response, Compensation and Liability Act (CERCLA) and established a trust fund to provide for cleanup at sites where hazardous substances may endanger public health or the environment. New Hampshire has 18 such sites, most of which were discovered and listed on the National Priorities List in the 1980s. The last site, Beede Waste Oil in Plaistow, was listed in 1996. Remedial actions are underway at 15 of the sites and remedial design is done or soon to be completed at the others. Over the years, an estimated 100,000 human exposures to potentially harmful materials have been controlled through actions such as extending waterlines to homes with threatened or contaminated drinking water, the removal of hazardous materials from properties, and the demolition of buildings following decontamination. Approximately 2,100 acres comprise the 18 Superfund sites of which about 410 acres need no further cleanup.

Remediation has been completed at two sites. At Gilson Road in Nashua, treatment operations concluded in 1998, having begun in 1984. One billion gallons of groundwater was treated and 430,000 pounds of contaminants was removed. At the former Pease Air Force Base Site, construction of the last cleanup action required in the $140 million environmental restoration has been completed, allowing reuse of over 3,000 acres. This has enabled the Pease Development Authority to foster the creation of about 3,000 jobs as of Spring, 2001.

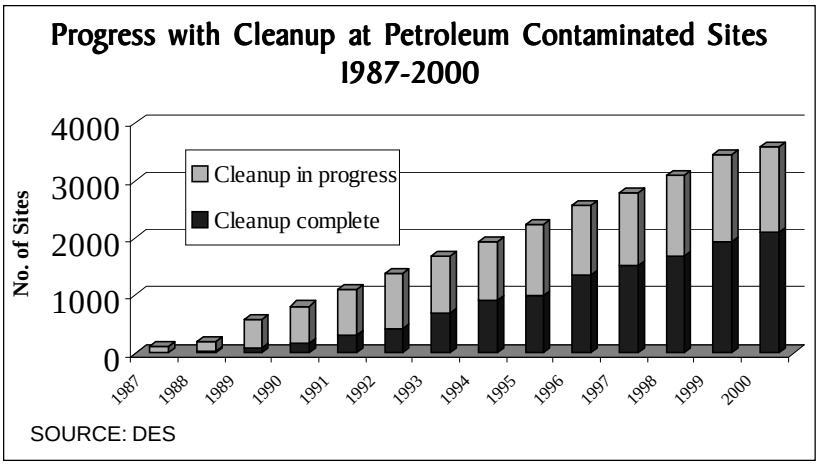
In addition, if an emergency situation occurs, the State, supported by U.S. EPA, has conducted emergency removal actions. These are short-term, immediate actions intended to stabilize a hazardous incident or remove contaminants from a site where an imminent public health threat exists. DES works closely with U.S. EPA in both long-term site remediation and in emergency response.

Aerial view of Coakley Landfill in North Hampton-Greenland as it appears today.

Non-Superfund Hazardous Waste Sites. New Hampshire has a total of 645 sites that are non-Superfund hazardous waste sites which have various degrees of public health and environmental impacts. Of that number, 155 sites have been added since 1996. Over 60 percent of the sites have been cleaned up or are performing clean-up under a permit. The majority of the active sites are being cleaned up by private parties under the State's voluntary cleanup program. Abandoned or active sites are being addressed using a combination of state and federal brownfields funding initiatives, local government resources and private development assets.

Petroleum Contaminated Sites

Leakage from underground petroleum storage tanks and spillage has resulted in over 3,500 contaminated sites in New Hampshire which have been identified since 1975. To date, DES has overseen the completion of cleanup efforts at more than 2,100 of these sites. As the following graph shows, about 2,000 sites have been cleaned up over 13 years, or on average, about 150 sites per year. While we can therefore argue that cleanup is nearly 60 percent com-



plete, it must also be pointed out that 209 new sites were discovered in 2000. Seventy percent of these newly discovered sites were on-premise-use fuel tanks, which are being addressed in part through the *Safetank* program previously mentioned.

Brownfields Redevelopment

Brownfields are abandoned or underutilized properties where redevelopment is complicated by real or perceived environmental contamination. The Brownfields Program at DES works to clean up and aid in the redevelopment of these sites, which are often located in or near town centers. This helps to revitalize communities and deter sprawl, by keeping jobs and services in our downtown areas. Further, it protects green-space areas from being consumed by new development.

DES estimates that there are at least 150 to 200 brownfields sites in the state. While the locations of these sites are often desirable, concerns about contamination and the attendant environmental liability discourage developers' interest. In 1996, a New Hampshire brownfields bill established liability protection for persons who assume responsibility for property remediation but who have no preexisting liability. In the 107th Congress, bills are being considered that would among other factors provide funds for site cleanup.

Some of the common environmental problems associated with Brownfield sites are unsafe buildings, fire hazards, chemical spills, leaking underground storage tanks, and soil and groundwater contamination. DES uses an integrated approach (utilizing local, state, and federal resources) to leverage private investment in Brownfields cleanup and redevelopment.

A brownfields site in Concord before cleanup ...

... and the same site after cleanup and redevelopment.

Financial assistance includes the funding of brownfields site assessments for municipalities, tax incentives, and the new Brownfields Cleanup Revolving Loan Fund. DES's Brownfields Covenant Program provides liability protection for prospective purchasers in exchange for a commitment to investigate and clean up the site. To date, over thirty New Hampshire sites have benefited from DES's Brownfields initiatives.

FUNDS FOR CLEANUP

CERCLA

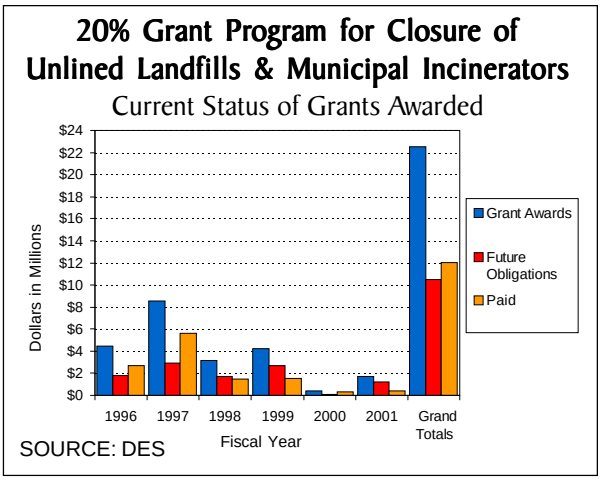
To date, the state and federal governments have expended approximately $162 million for design studies and construction, out of $310 million currently estimated as needed to remediate and clean up the state's 18 sites. Fur-

ther Superfund monies have been spent on contaminated brownfield sites that are abandoned or underutilized industrial, commercial, or residential sites. DES has managed several pilot grants and assessments using federal funds and is currently developing a state brownfields revolving loan fund based on a $2.45 million U.S. EPA grant.

Petroleum Cleanup Funds

DES provides funding from both federal and state sources to assist in oil spill containment and cleanup efforts. Federal assistance is derived from the Leaking Underground Storage Tank Trust Fund and the Oil Spill Liability Trust Fund established by the Oil Pollution Control Act of 1990. Since 1989, the Department has received more than $8 million from the LUST Trust Fund to coordinate cleanup activities associated with contamination originating from leaking underground storage tanks. DES has also received approximately $850,000 during the last four years from the Oil Spill Liability Trust Fund for removal actions to mitigate the impacts of oil discharges to navigable water or adjoining shorelines.

The New Hampshire petroleum reimbursement funds are a financial assistance program for owners of above and below ground petroleum storage facilities storing motor fuels, heating oils and motor oil. The fund provides insurance of up to $1 million for sites at which these fuels have caused a contamination problem. The fund disburses about $7 million per year to owners to clean up petroleum contaminated sites. The state petroleum remediation program investigates and remediates petroleum spills at sites not covered by the federally regulated underground storage tank program. These sites consist of heating oil underground storage tanks, petroleum aboveground storage tanks and inland oil spills not associated with storage facilities such as from petroleum tanker trucks. This fund has had average annual expenses over the last five years of approximately $1.6 million dollars and has expended $16.8 million since 1980.



Unlined Landfill & Incinerator Closure Grant Program

The State landfill closure grant program became effective on July 1, 1995 and was expanded to include 18 municipal incinerators constructed prior to July 1, 1998. Effective January 21, 2000 the purpose of these programs is to reimburse municipalities 20 percent of eligible capital costs associated with landfill and/or incinerator closures. These costs include hydrogeological investigation, engineering design, and construction of closure elements.

As shown in the bar graph, DES has awarded over $22.5 million since the inception of the grant programs in 1995. To date, over $12.2 million has been paid, with the remaining balance to be paid through the year 2020. Grant money awarded was much greater in the first few years of the program, due to already completed closures eligible to apply for reimbursement. Over the last two years, the rate of grant money awarded has been more consistent with the current rate of landfill and incinerator closures.

Management & Oversight

All of the programs mentioned above depend upon a skilled DES staff including hydrogeologists, engineers, chemists and other technical and information resource specialists. These individuals participate in permitting, remediation investigations and field work; facility inspection; financial management of federal and state funds; emergency response; addressing legal issues with the New Hampshire Department of Justice; and developing and providing testimony before the New Hampshire Legislature and the U.S. Congress.

WATER QUALITY

New Hampshire's water quality continues to improve through activities like establishing protection zones around drinking water supplies, correcting pollution problems to reopen shellfish beds for recreational harvest, addressing point sources of pollution, and improving water supply treatment. However, water quality continues to be adversely impacted by point and non-point sources of pollution such as urban and agricultural runoff; septic systems; site excavation and construction activities; and atmospheric deposition.

Newfound Lake

Water quality experts have learned that the quality of our surface and groundwaters is affected by *all* the activities occurring in the entire environment of a particular watershed. As a result, there is increasing focus on addressing water resources on a watershed basis through close collaboration among various state and local organizations. Regional planning commissions, conservation districts, and other watershed organizations are key players in implementing activities that will protect and restore water resources for the future.

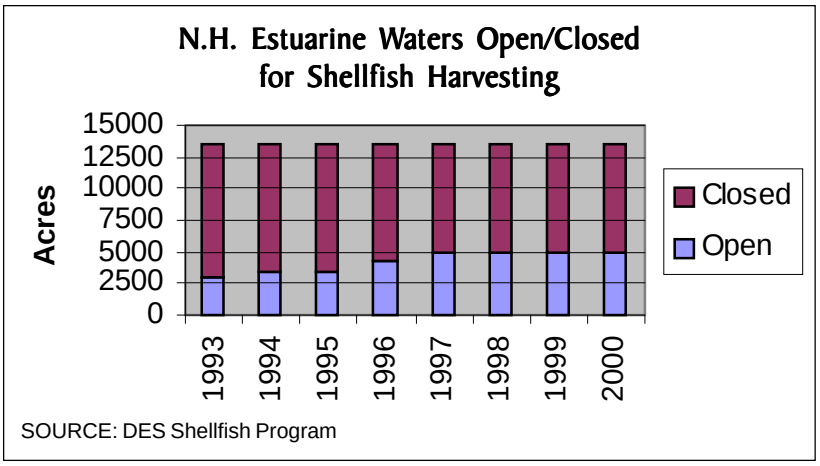
COASTAL WATERS

Many Shellfish Beds Reopen

Shellfish harvesting in tidal waters is a popular recreational activity in New Hampshire. New Hampshire has approximately 14,000 acres of estuarine waters and 42,000 acres of Atlantic Coastal waters potentially available for this activity. Shellfish, as filter-feeders, can concentrate harmful bacteria, viruses, and toxins in their bodies. When eaten by humans, contaminated shellfish can cause illnesses such as gastroenteritis and hepatitis. To protect the health of shellfish consumers, DES routinely evaluates the safety of the state's tidal waters for shellfish consumption. DES evaluates tidal water safety by collecting water samples, actively looking for and abating pollution sources along the shorelines adjacent to shellfish areas, and analyzing blue mussels, an "indicator species" for shellfish bed quality, for toxic contaminants.

After almost three years of being closed, approximately 42,000 acres of Atlantic Coastal waters were reopened for shellfish harvesting in January 2001. This reclassification was made possible as a result of extensive monitoring and pollution source investigations by DES, in cooperation the N.H. Fish and Game Department, N.H. Coastal Program, N.H. Estuaries Project, N.H. Department of Health and Human Services and volunteers from the Great Bay Coast Watch.

Harvesting shellfish in Hampton/Seabrook Harbor.



Approximately 7.5 percent of the coastal waters remain closed due to close proximity to wastewater treatment plant outfalls, or as a result of high bacteria levels from unknown sources. DES continues investigations to identify and eliminate the causes of the elevated levels of bacteria.

Since 1994, areas in Upper Little Bay, Lower Little Bay, and Hampton/Seabrook Harbor have been reopened to recreational harvesting. Currently, nearly 5,000 acres of estuarine shellfish waters are now "approved" or "conditionally approved" for recreational harvesting.

Despite this progress, 63 percent of the state's 13,596 acres of estuarine waters remain closed to harvesting. The majority of these areas are closed because they have not been evaluated for sanitary quality. In 1999, DES and the New Hampshire Estuaries Project began an aggressive schedule of conducting sanitary surveys of these areas. The goal is to have all areas surveyed by 2005, and 75 percent of shellfish beds open for harvesting.

LAKES & PONDS

There are nearly 1,000 freshwater lakes and ponds greater than 10 acres in size in New Hampshire, providing abundant recreational opportunities, and historic, cultural, and economic values. There are several indicators that demonstrate the ecological health of this vital resource.

In New Hampshire, all lakes and ponds are considered "impaired" due to a statewide freshwater fish consumption advisory for mercury contamination. With this advisory aside, 95 percent or 153,191 acres of the total assessed acreage is fully supportive of all uses as reported in New Hampshire's *2000 Section 305(b) Water Quality Report*.

Lakes are listed as "threatened" if DES has received citizen complaints or has staff knowledge that a particular waterbody has algal/or aquatic plant growth problems that may become worse in the future. Another reason for a threatened listing is excessive chloride contamination due to road salting, which may impact aquatic life. In New Hampshire 1,123 acres are classified as "fully supporting, but threatened." Another 6,276 acres are classified as "impaired," because they are not fully supportive of fishing and swimming uses. This is principally due to low pH from acid rain, exotic species, and excessive algal growth due to nonpoint sources of pollution.

Natural eutrophication is the process by which lakes gradually age and become more productive. This process normally takes thousands of years to progress. Although ponds may be naturally eutrophic, human activities around waterways also frequently accelerate the eutrophication process. Phosphorus from sewage, fertilizers, and urban runoff enters surface waters causing algae blooms and oxygen depletion. Six hundred eighty-three lakes were assessed for trophic status. Of these lakes, 154 were classified as eutrophic, that is, containing relatively high levels of nutrients and plants. Some of these lakes are naturally eutrophic. However, many are a result of increased nutrient loading from human activities. In general, the trophic status of New Hampshire's lakes is relatively stable and gradually improving. Over the past twenty-five years, only two lakes have shown a significant degradation change in trophic status and eight lakes showed improvements, most often because of restoration projects funded by EPA and the state. Our lakes will continue to be closely monitored in order to ensure that water quality continues to improve with time.

Beach at Pawtuckaway State Park.

Beach Monitoring Program

During the summer months, DES inspectors visit each public beach to ensure that bathing areas are safe. In 2000, inspections and water samplings were conducted at about 200 public beaches. Each year public health advisories are issued at approximately eight to ten beaches, less than 5 percent of those inspected. In 2000, DES posted public health advisories for ten beaches and local municipalities followed up by issuing three beach closings. Advisories are typically short term with contamination primarily attributable to waterfowl, weather conditions and bathing load. New Hampshire's beach program was recently recognized by the Natural Resources Defense Council as one of the top ten monitoring programs in the country.

Malformed Frogs

In 1995, a group of students discovered numerous and bizarre aberrations in leopard frogs in a small Midwestern pond. Since then, other regions have made similar discoveries, spawning scientific inquiries around the globe. In 1998, the Biomonitoring Program at DES developed a network of volunteers and began surveying the frog populations of New Hampshire to assess frog malformity rates and locate the "hot spots" for further research. Since the program's inception, over 4,000 frogs have been examined. Only very subtle abnormalities had been recorded up until 2000, when volunteers located some frogs with multiple limbs and unusual bloating.

There are numerous theories about the cause of the malformations including exposure to acid rain, ultraviolet radiation, chemical contamination, viral/bacterial diseases or parasitic infestation. It is also hypothesized that this may not be a new phenomenon, but

RESULTS OF MALFORMED FROG SURVEY (1998-2000)

Species	Total	Percent Malformed
Bullfrog	2,925	7.9
Green Frog	1,076	2.9
Pickerel Frog	264	3.8

SOURCE: DES

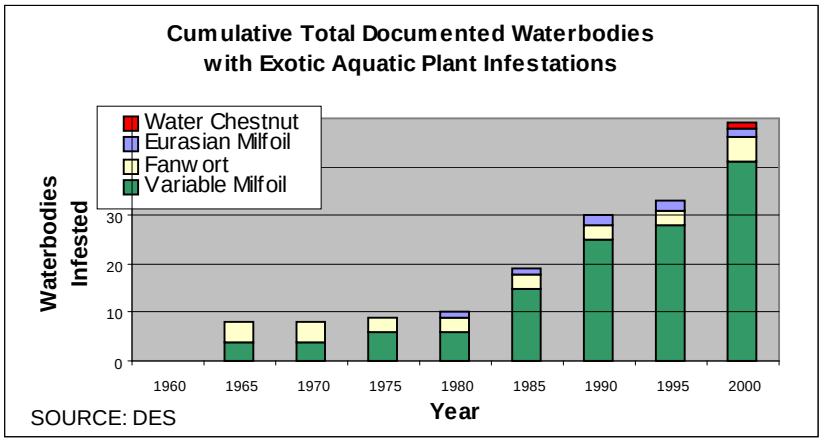
The New Hampshire Malformed Frog Survey focuses on the three most prevalent aquatic frog species in New Hampshire. Malformity rates measured during surveys vary from year to year and between species. At right is a multi-leg frog discovered during the 2000 Frog Survey.

natural species mutations that went largely undocumented until recently. More research is needed. DES will continue to be an active participant in these monitoring efforts.

Exotic Aquatic Plant Species

The detection of exotic species continues to increase from about ten known infestations in 1980 to fifty in 2000. The term "exotic" refers to any plant species not native to an area. Once established, these plants can quickly dominate waterbodies, choking out native plants and animals, and decimating both the ecology and the integrity of once healthy aquatic systems. Variable milfoil is, by far, the most prevalent of the exotics in the state, infesting over 40 surface waters. Other exotics include fanwort, Eurasian milfoil, purple loosestrife, and water chestnut.

The most common management practices to control nuisance species in New Hampshire are hand pulling and chemical treatment. Mechanical harvesting, bottom barriers, dredging and biological controls have also been used with limited success. Unfortunately, no cost-effective means of eradication presently exists to eliminate these plants, so prevention is the best means of protection. If introduced, early detection is key to optimum control. Through the help of volunteers involved in the DES's Weed Watcher Program, plant growth will continue to be monitored throughout the state. Over 200 volunteers on nearly 100 lakes are now active in the program.



Marine Engine Initiative

By 2006, all outboard engines and personal watercraft sold in the U.S. must meet strict standards for hydrocarbon and nitrogen oxide emissions. However, New Hampshire has launched two unique initiatives to address this issue years ahead of the 2006 federal mandate.

In February 2000, the New Hampshire Marine Trades Association and DES signed a voluntary agreement to encourage the accelerated sales of low polluting marine engines. DES has also spearheaded a regional coalition to encourage the purchase and use of these low polluting marine engines by state agencies and the boating public throughout the Northeast. This regional coalition is the first of its kind in the country to bring states, environmental groups, and the regulated industry to the table to facilitate such an effort. Consumers should look for the new four-stroke or direct fuel injection two-stroke engines when purchasing new boat motors to improve both air and water quality.

RIVERS & STREAMS

New Hampshire has over 10,000 miles of rivers and streams that need to be protected and restored as critical natural assets for present and future generations.

New Hampshire and other northeast states have statewide freshwater fish consumption advisories in effect for rivers and lakes due to mercury levels found in fish tissue. Because New Hampshire's advisory places limits on the amount of fish one can safely eat, all freshwater rivers and streams are currently reported as impaired.

Excluding the statewide mercury fish consumption advisory,

LEAD SINKER BAN
Another New Hampshire First

In an effort to reduce or eliminate the number of loon and other waterbird deaths from lead poisoning, New Hampshire enacted first-of-its-kind legislation that went into effect January 2000 prohibiting the use of small lead sinkers and jigs on the state's inland lakes and ponds. Non-lead alternatives are readily available to anglers.

According to the Loon Preservation Committee, between 1989 and 2000 at least 70 loons died in New Hampshire from lead poisoning after ingesting small lead fishing sinkers and jigs. Once swallowed by a loon, a lead sinker or jig is quickly dissolved by stomach acids and the grinding of the gizzard. The lead is absorbed into the blood and body tissues, causing lead poisoning to occur within two to three weeks.

It is suggested that anglers replace their lead sinkers and jigs with non-lead alternatives. Lead sinkers and jigs should be taken to a lead sinker collection site at one of these many locations: N.H. Fish and Game Department offices and hatcheries, many municipal recycling centers, the Loon Preservation Committee's visitor center in Moultonborough, and municipal household hazardous waste collections.

New Hampshire's rivers and streams are in very good condition. According to the *2000 Section 305(b) Water Quality Report*, over 83 percent of the 2,677 miles of rivers and streams assessed for fishing (aquatic life support) are of very high quality. Approximately 96 percent of the 2,769 miles of rivers and streams assessed for primary contact recreation are safe for swimming. Of the 2,714 miles of rivers and streams assessed for the ability to support fish and other forms of aquatic life, approximately 94 percent were found to be in excellent condition.

There are approximately 279 miles of rivers that are considered impaired because of pollutants, other than mercury in fish tissue. Along the main stem of the Connecticut River, a fish consumption advisory is in effect due to polychlorinated biphenyls (PCBs) found in tissue of fish collected over eleven years ago. A fish tissue study is currently underway along the Connecticut River to determine if this advisory should be revised. A fish consumption advisory is also in effect along the Androscoggin River, downstream of Berlin, due to elevated dioxin levels in fish tissue. The major source of dioxin was eliminated in 1994, and residual dioxin levels in fish tissue are expected to continue to drop, eventually allowing this advisory to be rescinded.

The New Hampshire Rivers Management and Protection Program was established by the Legislature in 1988 to afford long-term protection for rivers that have a demonstrated natural, historic or cultural value. Since 1988, 13 river segments have been designated, totaling 763 river miles. An additional 38 miles are protected under the federal Wild and Scenic Rivers Act, including 24 miles of the Lamprey River.

Wastewater Grant & Loan Programs Improve Water Quality

New Hampshire began a modest grant program in the early 1960s and expanded it in 1972 with federal Water Pollution Control Act funds. Until 1990, the program provided grants to municipalities that covered 95 percent of sewer and wastewater treatment facility project costs. It is now a state-funded program that contributes 20 to 30 percent of eligible project costs. To supplement the grant program, the State Revolving Loan Fund (SRF) was created in 1991 to provide low interest loans to municipalities for eligible wastewater projects, and it now also provides loans for municipal landfill closures. The grant program has awarded over $833 million in state and federal monies since 1960, and the SRF has disbursed $103 million since 1991. With the help of the grant and loan programs 92 municipal wastewater treatment facilities have been constructed or upgraded across the state, creating dramatic improvements in the quality of New Hampshire's waterways.

Over the past five years, the emphasis in the wastewater grant and loan programs has been focused on upgrading and improving existing wastewater treatment facilities to meet increasingly more stringent effluent discharge permit

limits, ultimately resulting in cleaner water. During this period, approximately $78.6 million ($30.2 million in grants and $48.4 million in loans) has been awarded specifically for wastewater treatment projects — roughly 80 percent of total grant and loan awards.

New Hampshire's wastewater grant and loan programs have resulted in significant improvements in water quality by helping to fund the over $1 billion spent on wastewater projects across the state.

Rochester's State-of-the-Art Treatment Facility

In the fall of 2000, the City of Rochester celebrated the completion of its new advanced wastewater treatment facilities at the Pickering Road plant. Constructed to meet stringent NPDES permit requirements, the $20 million project was financed through a State Aid Grant and a low-interest State Revolving Fund loan. Treatment efficiency at the upgraded plant is among the best in New England, providing 97 percent removal of oxygen-demanding organics and suspended solids, and 90 percent removal of the nutrient ammonia. It is anticipated that pollutant loadings to the Cocheco River will be reduced by 371,000 pounds annually, improving dissolved oxygen levels and enhancing aquatic life. Rochester's upgraded wastewater treatment facility – together with its aggressive campaign to replace old and leaking collection sewers – will protect Cocheco River water quality while also accommodating municipal growth through design year 2020.

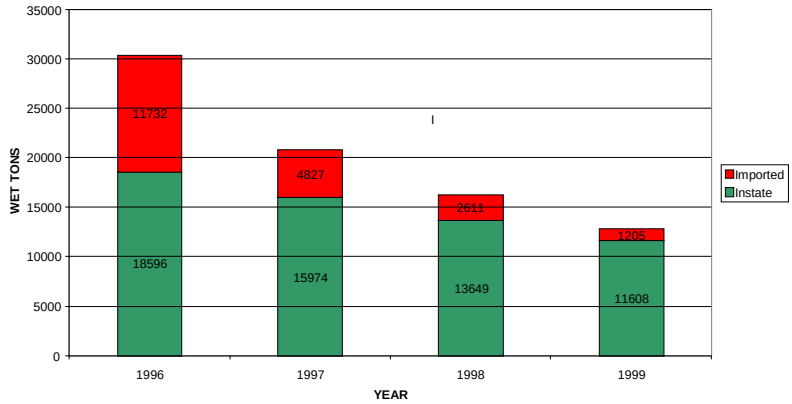
Managing Sludge, Biosolids & Septage

"Sludge" is the solid or semi-solid material produced by water and wastewater treatment processes. "Biosolids" is the term applied to any sludge derived from a municipal wastewater treatment facility that meets the standards of beneficial use specified by the DES. The methods of treatment and disposal of municipal sludge and biosolids are presented in the graph on the next page.

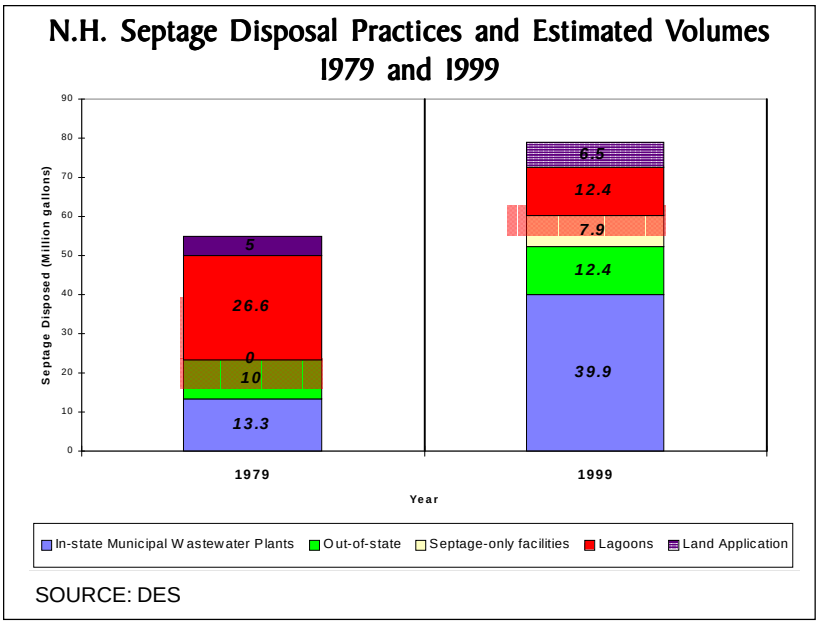
New Hampshire has seen a dramatic decrease in the amount of "Class B" biosolids land applied since 1996, especially from out-of-state sources. This is attributable to more stringent regulations on sludge quality and testing and to a trend towards treatment such as composting to "Class A" standards.

Class A compost can be used in a wide variety of ways, such as landscaping, gardening, beautification projects, cemeteries, along roadways, etc. For example, the Town of Merrimack has been composting its sludge for 19 years and upgraded its compost facility in 1994 to a state-of-the-art in-vessel system. Merrimack also processes sludge from Nashua, Durham, and Henniker into compost. About 80 percent of Merrimack's Class A compost is marketed out-of-state, with the remainder available for local use.

Septage is the material removed (pumped) from septic tanks. Most new housing relies on septic systems, thus increasing the amount of septage that needs to be pumped out and disposed. Currently, over 83 million gallons of septage is generated annually, up from 55 million gallons in 1979. New Hampshire's septage disposal capacity has not kept pace with the demand caused by popu-



SOURCE: DES



SOURCE: DES

lation growth because wastewater treatment plants have reached, or are approaching, septage disposal capacity, and more stringent regulatory standards, such as groundwater quality standards, have caused lagoons and land spreading operations to close. In 2000, a Septage Management Task Force evaluated this problem and made recommendations to promote and provide incentives to address the septage capacity shortfall. For example, one proposal currently before the Legislature is to provide higher funding percentages from the wastewater state-aid grant program for regional septage disposal facilities. Work by the Task Force and DES is ongoing to resolve this problem for the long term.

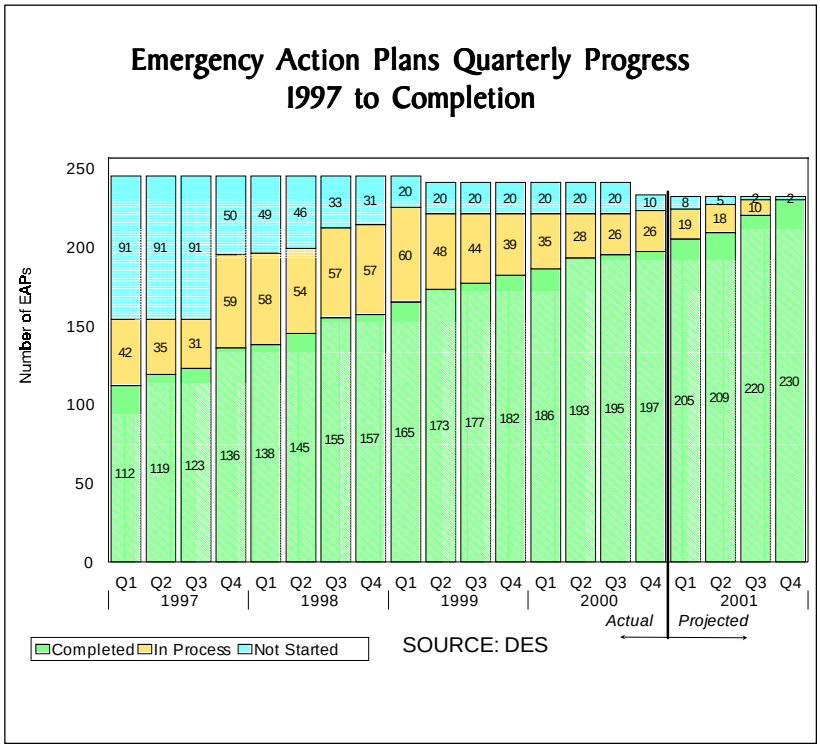
Dam Safety

Over 800 of New Hampshire's 4,800 dams could pose a threat to downstream life or property if they were to fail, while the other 4,000 are considered very low hazard. DES inspects these dams on a regular schedule, based on the risk each dam poses, to ensure that they are maintained in a safe condition. DES also requires that emergency action plans (EAPs) be prepared for all dams that could pose a threat to public health and safety upon failure. These plans assist state and local emergency response personnel in planning for possible dam failures. They contain maps that identify the areas where state highways could be seriously damaged, or homes or businesses that might be inundated by a dam failure. The EAPs also include emergency notification procedures developed in cooperation with local police and fire departments.

EAPs have been completed for 85 percent of the 234 dams for which they are required, including all State-owned dams. Full compliance is projected for the end of 2001.

Dam Removals

Dam removal restores rivers to healthy, free-flowing conditions to enable fish migration and enhance recreational and aesthetic values. Removal also reduces liability for



SOURCE: DES

Mast Point Dam on the Salmon Falls River in Somersworth was removed in 1996, restoring the river to its former free-flowing condition.

dam owners and eliminates safety hazards, if present.

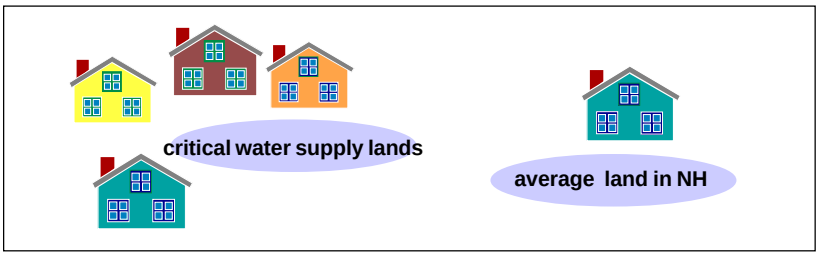
The River Restoration Task Force, comprised of members of state and federal governmental agencies and non-profit organizations, was formed in February 2000 to facilitate the process of removing dams that have become unsafe or outlived their economic usefulness, where substantial environmental benefit can occur by removal. The Task Force is currently working with the owners of six dams, where removal will cumulatively restore a total of 60 miles of river to their original, free-flowing condition.

DRINKING WATER

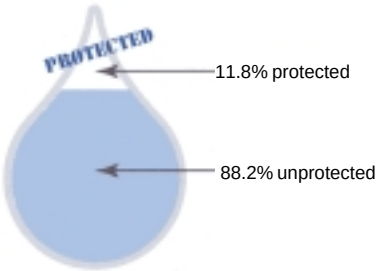
From establishing stricter standards for certain contaminants to providing grant funds to municipalities to protecting lands that surround critical water supplies, DES programs and activities help to ensure that the public has access to drinking water that is adequate and safe for human consumption.

Protecting Water Supply Lands

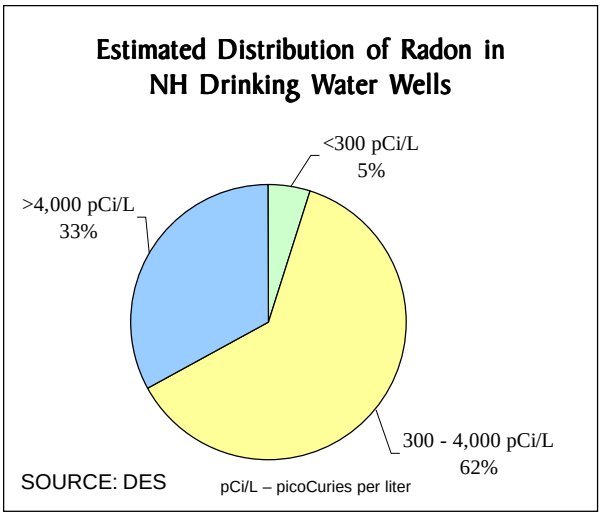
Protecting the state's surface and ground waters that provide drinking water is critical for New Hampshire's future. The lands associated with public water supplies tend to be four times as developed as the average for the rest of New Hampshire. And, since 1988, man-made sources of contaminants have been detected in over 100 sources of public drinking water. With only 11 percent of the critical lands surrounding existing public drinking water sources permanently protected in New Hampshire, and 39 percent of community water systems not even controlling the minimum sanitary protective areas around their wells, New Hampshire created a Water Supply Land Grant Program in 2000. Under this new program, an initiative of Governor Shaheen, the State is providing 25 percent of the costs for towns to acquire lands or protective easements for areas around public sources of drinking water to ensure the long-term protection of water quality. DES has partnered with the Society for the Protection of New Hampshire Forests to develop and implement this program. In 2000, seven applications were received requesting $1.8 million to protect 2,118 acres of water supply lands. Currently, $1.5 million is dedicated for matching grants, and identifying

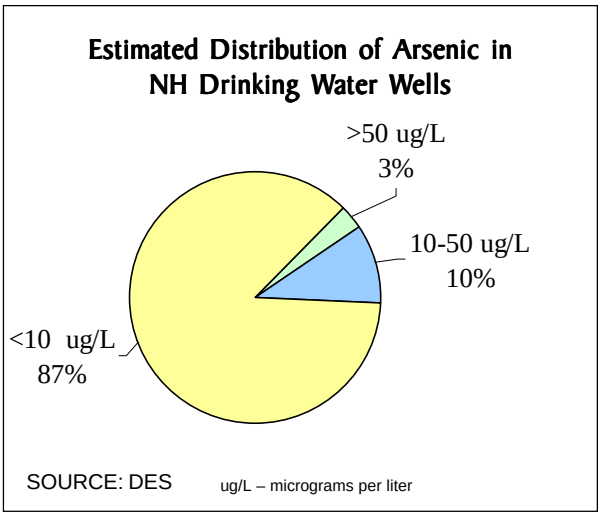


Critical water supply lands in New Hampshire are four times as developed, support twice as many roads, and are 25 percent less forested than lands in the state as a whole. SOURCE: The Society for the Protection of New Hampshire Forests.



Only 11.8% of the state's "critical water supply lands" are protected through ownership or easement.





a long-term funding source for this important program remains a high priority.

Radon

Radon, typically found in bedrock wells, is a colorless, odorless and tasteless radioactive gas produced from the decay of naturally occurring radioactive compounds in soil and rocks. It enters the home primarily through cracks and openings in the foundation, as well as releases to the air from groundwater supplies in which radon is present. The primary public health risk from radon is lung cancer. Other naturally occurring radioactive contaminants that impact drinking water include general alpha and beta emitters, including uranium and radium(s).

The proposed federal rule for radon in community water systems is 300 picoCuries per liter (pCi/L), or an alternative 4,000 pCi/L if a multimedia mitigation program is implemented. It is estimated that radon in 95 percent of New Hampshire's public and private water supplies exceeds the proposed 300 pCi/L standard and 33 percent exceed the proposed alternative 4,000 pCi/L. In preparation for the federal radon rule, DES has on-going public outreach initiatives to ensure greater understanding of radon risk and methods of remediation and to encourage water testing by private well owners.

Surface Water Filtration Success

Federal law requiring filtration of surface water supplies went into effect in 1986. Since that time, 60 New Hampshire public water systems have constructed new or improved filtration plants, or have constructed wells which have enabled abandonment of unfiltered supplies. To date, all previously unfiltered surface water supplies have been filtered or abandoned, with the exception of four unfiltered surface water supplies which meet stringent standards for watershed protection and disinfection. The New Hampshire Filtration Grants Program, provides for partial reimbursement of costs, including bond interest and principal, incurred in complying with the filtration requirement. Reimbursement, as of this year, to both privately and publicly owned water system owners is approximately $38.5 million.

Arsenic

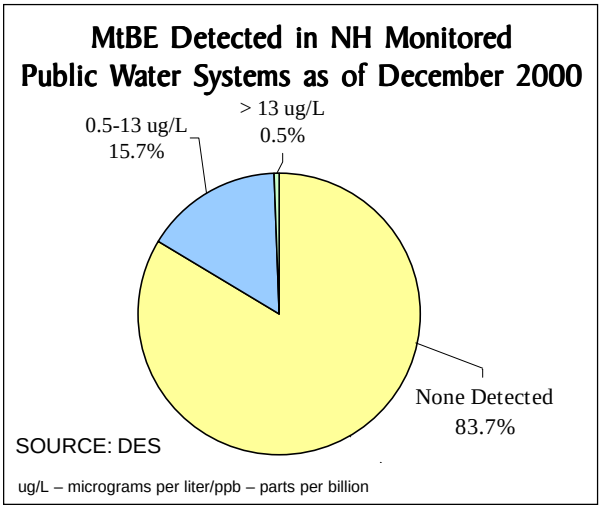
Arsenic is a concern due to the risk of developing skin, bladder, lung and possibly other cancers. In December, 2000 DES proposed a more stringent public drinking water standard for arsenic of 10 micrograms per liter (ug/L). This is a significant reduction of the current standard of 50 ug/L. It is estimated that 13 percent of public and private water supplies have arsenic levels above 10 ug/L and need treatment for arsenic removal.

Gasoline and MtBE

Methyl tertiary-Butyl Ether (MtBE) is a fuel additive used in reformulated gasoline to improve combustion efficiency, reduce carbon monoxide emissions, and enhance octane. Unfortunately, MtBE is also highly soluble and migrates readily in water. As a result of underground storage tank

DES wetlands scientist conducting a site inspection.

leaks, gasoline spills, and improper use and disposal of gasoline, MtBE has found its way into public and private water supplies. As of January 2001, 188 public water supplies (approximately 15 percent of the public systems in the state) had some level of MtBE present in the drinking water, almost all with concentrations ranging from 0.5 to 5 parts per billion. After technical review with the New Hampshire Department of Health and Human Services, DES adopted a new standard for MtBE in drinking water and groundwater of 13 ug/L in May 2000. New Hampshire is currently working with other northeastern states to adopt standards for a regional gasoline that would eliminate the use of MtBE in New England.

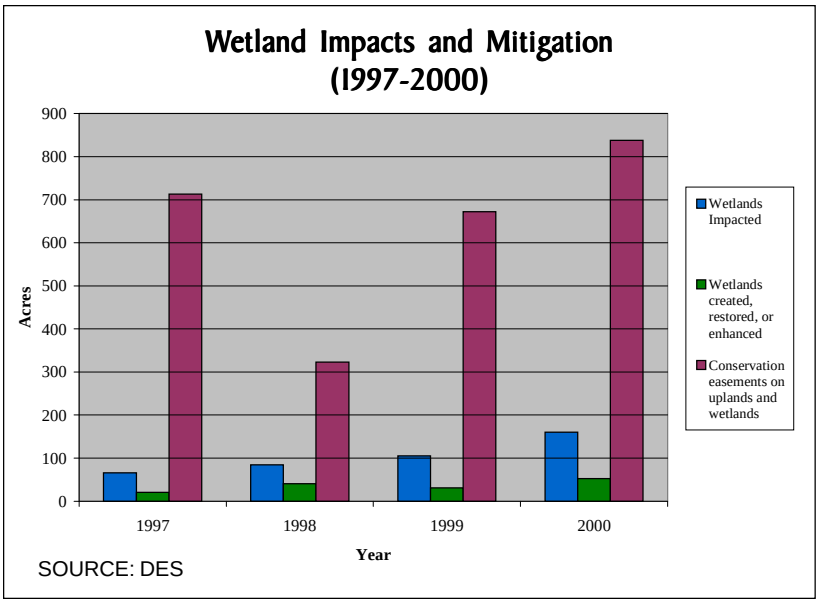


WETLANDS PROTECTION

New Hampshire has approximately 400,000 to 600,000 acres of nontidal wetlands and 7,500 acres of tidal wetlands (about 6 to 10 percent of the land area of the state). Since the 18th century, about half of the tidal wetlands and about one-tenth of the nontidal wetlands have been destroyed. Wetlands provide many valuable functions, including:

- Protecting the quality of water in our lakes and streams. By acting as filters, they retain sediments with contaminants such as metals or the nutrient phosphorus.
- Reducing peak flood flows and, consequently, flood damage downstream by storing large quantities of rainfall.
- Maintaining in-stream flows by slowly discharging groundwater in dry periods.
- Providing nurseries for finfish and shellfish, particularly in estuarine and coastal marshes which are among the most productive areas in the world. Tidal wetlands serve as spawning and nursery areas for juvenile fish, including those that are commercially harvested.
- Buffering wind and waves.
- Providing habitat for wildlife. More than half of the rare, threatened or endangered plant and animal species in New Hampshire depend on wetlands for their survival. Some smaller seasonal wetlands called vernal pools, which are temporarily flooded basins within forests, are the breeding habitat for rare amphibian species. Larger wildlife, such as moose, depend on wetlands for their food source, as well.

Adjacent upland areas are also critical to maintain the functions and values of wetlands as natural habitat, since most of the wildlife species that inhabit wetlands require the adjacent uplands to survive.



partially offset by the creation or restoration of 144 acres of wetlands. Also conservation easements have been placed on 2,546 acres of adjacent uplands and wetlands to protect the functions and values of important wetlands. Wetlands mitigation to offset permitted impacts is a significant positive trend that will help counter the effects of sprawl and improve how New Hampshire protects and preserves wetlands and adjacent uplands into the future.

New Hampshire's wetlands protection strategies continue to evolve and be refined to ensure that these valuable resources function unimpaired into the future, while recognizing the state's development needs. During the high growth period between 1997 to 2000, more than 400 acres of wetlands were lost due to permitted activities. Much of this loss is associated with increased sprawl. A pattern of land use characterized by scattered, low-density development, sprawl results in fragmentation and loss of open space, including the loss of wetlands and other wildlife habitat. DES is working with the N.H. Office of State Planning and others on "smart growth" planning efforts designed to reduce the impacts of poorly conceived growth and development.

Due to the implementation of a DES wetlands mitigation policy, for example, which is being adopted as rules, lost wetlands were

Grassy Pond Site Protected

To compensate for the loss of wetlands at the New Hampshire Plating Superfund Site in Merrimack, in 1998, New Hampshire, with financial assistance from the U.S. Environmental Protection Agency, purchased the Grassy Pond wetland in Litchfield. The $1.4 million purchase permanently protected a unique wetland ecosystems in the state, home to a variety of species, including rare spotted and Blanding turtles.

Surrounded by a group of school children, Gov. Jeanne Shaheen listens to author David Carroll as he dramatizes a story about turtles during a 1998 Earth Day event that announced the State's purchase of Grassy Pond in Litchfield.

VOLUNTEER ACTIVITIES AT DES

Protecting New Hampshire's environment is a big job. No single agency or organization can do this alone, and DES is no exception. To assess the condition of the state's many ponds, lakes, streams, and rivers, it is necessary to collect data, and a great deal of it. This section is dedicated to the tireless efforts of many volunteers, upon which DES relies to collect much-needed water quality data. To our many "eyes and ears" in the field, a heartfelt thanks!

Volunteer Lake Assessment Program

With so many lakes and ponds in the state, it would be impossible for DES personnel to keep tabs on each one. For this reason, volunteers have become an integral part of monitoring activities. Approximately 500 volunteers monitoring about 130 lakes through DES's Volunteer Lake Assessment Program (VLAP) that was established as a data-gathering and educational tool for lake associations in 1985. Trained volunteers collect lake and watershed samples, scout for potential problems, notify DES of non-point sources of pollution, and educate other association members about watershed management practices. The data is used to advise and inform lake associations about water quality, as well as to produce the state's water quality report to EPA and Congress.

NH Frog Survey Program – Froggers Wanted!

The recent discovery of frog abnormalities is a great concern to the public. The success of past survey efforts has been due in large part to committed volunteers. In 1998 DES began conducting surveys, looking specifically for troubled frog populations. This effort continues, with the assistance of over 80 frogging teams volunteering in 2000. Each summer DES hosts workshops to provide training to volunteers, introducing them to the data sheets and techniques involved in conducting a successful frog survey.

Weed Watchers Save the Day!

In an effort to enhance our ability to monitor New Hampshire's waterbodies for exotic species invasions, DES developed a volunteer Weed Watcher Program.

Volunteers, like these on Suncook Lake in Barnstead, play a key role in helping DES monitor the quality of New Hampshire's waterbodies.

The goal of the Weed Watcher Program is to train volunteer lake residents to identify exotic plants and report new infestations early. With over 800 lakes and ponds in the state, this program makes it possible to inspect a large number of waterbodies over the course of the summer.

Volunteer monitoring is easy and does not require a large time commitment … it's even fun! Volunteers use a boat to travel around the shallow portions of their lake once a month in the summer to look for suspicious looking plants. DES supplies a full guide to plant identification and exotics species to aid the volunteers in monitoring their waterbodies. Volunteers only need to report suspected exotic plants to DES. We have already had great success with this program, with a few lakes finding infestations early, before they could become full-lake problems.

Volunteer River Assessment Program

In 1997, DES established the Volunteer River Assessment Program (VRAP) to support volunteer monitoring in New Hampshire watersheds. The success and popularity of the Volunteer Lake Assessment Program and the interest in exploring local river water quality expressed by river groups led to the creation of VRAP.

Volunteers, many already contributing to other DES programs, were virtually waiting in the wings for this opportunity. In 1998 VRAP supported the initiation of monitoring programs on the Exeter and Lamprey Rivers and, just three years later, twelve New Hampshire rivers are now monitored by VRAP groups. River groups, watershed associations, or individuals may participate VRAP.

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Weed Watchers

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Volunteer River Assessment Program

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Cocheco River Watershed Coalition volunteer monitors exploring and sampling the Isinglass River with the DES Volunteer River Assessment Program (VRAP). The information gathered by dedicated VRAP volunteers assists both local organizations and DES in assessing current water quality conditions and trends.

CREDITS & ACKNOWLEDGMENTS

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FOR MORE INFORMATION

If you wish further information on topics discussed in this report, please contact DES's Public Information Center at (603) 271-2975 or visit DES's web site at www.des.state.nh.us.

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