

# WEST NILE VIRUS

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## FIELD HEARING

BEFORE THE  
COMMITTEE ON  
ENVIRONMENT AND PUBLIC WORKS  
UNITED STATES SENATE  
ONE HUNDRED SIXTH CONGRESS  
FIRST SESSION

TO CONDUCT OVERSIGHT OF THE STATE AND FEDERAL RESPONSE TO  
THE 1999 OUTBREAK OF THE WEST NILE VIRUS IN CONNECTICUT  
AND NEW YORK

DECEMBER 14, 1999—FAIRFIELD, CT

Printed for the use of the Committee on Environment and Public Works



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## WEST NILE VIRUS

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TUESDAY, DECEMBER 14, 1999

U.S. SENATE,  
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,  
*Fairfield, Connecticut.*

The committee met, pursuant to notice, at 9 a.m. at the Fairfield University School of Business, Fairfield, Connecticut, Hon. Joseph I. Lieberman [acting chairman of the committee] presiding.  
Present: Senator Lieberman.

### **OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT**

Senator LIEBERMAN. Thanks so much for joining us here today at Fairfield University.

I particularly want to thank Father Kelly and the entire Jesuit community here at Fairfield University and all our friends here for welcoming us for this very—this great institution, which is a great citizen of Fairfield and Connecticut.

Let me now call to order this field hearing of the U.S. Senate Committee on Environment and Public Works on the subject of the West Nile virus.

As all of us are aware, earlier this fall communities in southwestern Connecticut and, in fact, throughout the New York area, experienced an alarming outbreak of the West Nile virus, a mosquito-borne virus never before found, as I understand it, in the western hemisphere.

The emergency of the virus has had a major impact on nearby communities, generating widespread concern about the immediate health threat from the disease and also about the potential health impacts of the pesticides that were used to respond to the disease.

There was also, I know considerable frustration that answers to some of the natural pressing questions that people had about why the outbreak occurred and whether it was likely to reemerge were lacking.

We know, as fact, that there were a group of people in New York and its suburbs who were made ill, sickened by the disease, and, in fact, I gather the number that is agreed on is seven—seven people probably died as a result of the disease.

Connecticut did not experience, to the best of our knowledge, and human cases of the virus this past fall; however, the disease had a visible effect on wildlife in the State, killing a number of crows and other birds.

It was found—that is, the virus—in mosquitos and dead birds in the following towns in Connecticut: Darien, East Haven, Fairfield,

Greenwich, New Canaan, New Haven, Norwalk, Orange, Reading, Stamford, Weston, Westport, and Woodbridge.

My purpose in convening today's hearing is to continue the dialog and to try to engage some thoughtful responses from the distinguished panel of experts that have been good enough to come and be with us today.

Specifically, this morning the hearing is intended to gather information and to help educate the public and the Government about the West Nile virus, a kind of post-crisis look at how we all performed, including the various governmental agencies, and then to ask the natural question that people have, including myself, which is: is the West Nile virus likely to reoccur in the future? And what can we do to prepare for and hopefully prevent, or at least limit, another outbreak?

Now, to help us answer those questions, I am really pleased to have these witnesses, who were closely involved in the State and Federal response to the West Nile virus crisis.

Dr. Durland Fish of Yale University School of Environmental and Public Health will provide us with some background about the disease. He is also going to point out some areas, I think, where more research and training is needed to better understand and react to infectious diseases such as the West Nile virus.

Also, as I mentioned, with us is Dr. Ted Andreadis of the Connecticut Agricultural Experiment Station, a great—if I may say so—natural research for the State of Connecticut, let alone the country. Dr. Andreadis was literally on the ground this fall trapping mosquitos, testing them and the birds for the presence of the virus. He is going to give us, I think, an overview of the Experiment Station's efforts in response to the West Nile virus outbreak.

Our third witness, Dr. Bob McLean, is director of the U.S. Geological Survey's National Wildlife Health Center, and he will describe the Center's research into the effects of the virus on bird populations. Dr. McLean has previously held positions with the Centers for Disease Control and Prevention and the U.S. Department of Agriculture, so he is really uniquely positioned to address cooperative efforts among experts in human health and animal health.

I want to particularly thank Dr. McLean for traveling from Wisconsin to be with us today.

And, finally, Deputy Commissioner Jane Stahl of the Connecticut Department of Environmental Protection will, I hope, describe the history of mosquito control in Connecticut, give us an overview, and discuss the environmental impacts associated with different approaches to mosquito control.

While I realize that we are unlikely to hear definitive answers to some of the pressing questions that we have about the source of the virus and the likelihood that it will reappear in the spring, I am optimistic that this hearing can provide an opportunity for all of us to learn what already has been learned about the disease and to get an update on what steps are being taken to gather more information about the source of the virus and what we can do to avoid another outbreak in the future.

As the witnesses present their testimony, of course, I am also going to be interested in hearing at this distance, although it is

still close, but at least a couple of months after the crisis, what they think worked well, particularly in terms of the governmental response, and what did not, as local, State, and Federal agencies coordinated their reaction to West Nile virus.

To make the most efficient use of our time here this morning, I am going to ask each of the witnesses to try to limit his or her initial testimony to about 5 minutes. We have brought from Washington one of these ominous time clocks with lights. They are timed for 5 minutes. The yellow light will go on when there is a minute left. If you feel you have really got some important things to say after the red light goes on, you know, I will not give you the hook, I assure you, but it is a guide to the time.

The witnesses do have also, as I think you know, an opportunity to submit broader written testimony, which is included in the entirety of the printed record of this hearing and will be reviewed by me and my staff, and I believe by colleagues in the Senate. It is somewhat poignant for me to point out that the previous chairman of the Senate Environment and Public Works Committee, John Chafee, the late John Chafee of Rhode Island, who was a great leader in environmental protection and public health, passed away just several weeks ago.

This was the last—his approving my holding this hearing was the last contact that we had just prior to his death.

The record of this hearing will remain open, as is the custom, for at least 1 week for written statements by the witnesses and the public. Federal hearings generally are not—we hear from expert witnesses, but if anybody in the public does have a point of view, I really urge you to write it down, submit it to us, and I will personally review it and I will promise you that it will be part of the written record that the Congress will review, as well.

Elise Campaign is my legislative assistant, and will sit with me here at this table. You can see her or Cindy Lemick or any of the others from my staff to submit testimony or find out how you can do it in the next week or so.

With that, I am going to take a seat. I give the members of the panel the choice of sitting or standing, as they wish, and I will call first, with gratitude for your appearance here, on Dr. Fish.

Thank you.

[The prepared statement of Senator Lieberman follows:]

STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Ladies and gentlemen, welcome and thank you for joining us here today at Fairfield University. I will now call to order this field hearing of the United States Senate Committee on Environment and Public Works on the subject of the West Nile virus. All of us are aware that earlier this fall the communities in southwestern Connecticut and throughout the New York area experienced an alarming outbreak of the West Nile virus, a mosquito-borne virus never before found in the western hemisphere.

The emergence of the virus has had a major impact on nearby communities, generating widespread concern over the immediate health threat from the disease and about the health impacts of the pesticides that were used to respond to the disease. There was also a frustration that answers to the pressing questions of why the outbreak occurred and whether reemergence is likely were lacking. We know that several dozen people in New York City and its suburbs were sickened by the disease and seven people died. Connecticut did not experience any human cases of the virus; however, the disease had a visible impact on our wildlife, killing a number of crows

and other birds. The virus has been found in mosquitoes and dead birds in the towns of Darien, East Haven, Fairfield, Greenwich, New Canaan, New Haven, Norwalk, Orange, Redding, Stamford, Weston, Westport and Woodbridge.

My purpose in convening today's hearing is to continue the dialogue and to provide thoughtful responses to these public concerns. Specifically, the hearing is intended to: 1) to gather information and to educate the public and the government about the West Nile virus; 2) to take a look "post-crisis" and evaluate the performance of the government in responding to the outbreak this fall; and 3) to ask whether the West Nile virus is likely to reoccur in the future and what we need to do to prepare for or to prevent another outbreak.

We're honored to have with us today a number of witnesses who were closely involved in the state and Federal response to the West Nile virus. Dr. Durland Fish of the Yale University School of Environment and Public Health will provide us with some background about the disease. He will also point out some areas where more research and training is needed to better understand and react to infectious diseases such as West Nile virus. Also with us is Dr. Ted Andreadis of the Connecticut Agricultural Experiment Station, who was on the ground this fall, trapping mosquitoes and testing mosquitoes and dead birds for the presence of the virus. Dr. Andreadis will give us an overview of the Experiment Station's efforts in response to the West Nile outbreak.

Our third witness, Dr. Bob McLean, Director of the U.S. Geological Survey's National Wildlife Health Center, will describe the Center's research into the effects of the virus on bird populations. Dr. McLean previously held positions with the Centers for Disease Control and Prevention (CDC) and the U.S. Department of Agriculture (USDA), so he is uniquely positioned to address cooperative efforts among experts in human health and animal health. I would like to thank Dr. McLean for traveling from Wisconsin to be with us today.

And finally, Deputy Commissioner Jane Stahl of the Connecticut Department of Environmental Protection (DEP) will describe the history of mosquito control in Connecticut and discuss the environmental impacts associated with different approaches to mosquito control.

While I realize that we are unlikely to hear definitive answers to our most pressing questions about the source of the virus and the likelihood that it will reappear in the spring, I hope that this hearing will provide an opportunity to hear what has been learned about the disease and to get an update on what steps are being taken to learn more about the source of the virus and to avoid another outbreak in the future. As the witnesses present their testimony, I will also be interested in hearing what worked well and what didn't as local, state, and Federal agencies coordinated their response to the West Nile virus.

To make the most efficient use of our time here this morning, I will ask each of the witnesses to limit his or her oral testimony to 5 minutes. The witnesses do have an opportunity to submit comprehensive written testimony to be included in its entirety in the printed record of this hearing. The record of this hearing will remain open for 1 week for written statements by the witnesses and the public. Please see a member of my staff if you are interested in submitting a statement. I will personally review the submissions and see that they are included appropriately.

**STATEMENT OF DURLAND FISH, M.D., ASSOCIATE PROFESSOR OF EPIDEMIOLOGY, YALE UNIVERSITY SCHOOL OF ENVIRONMENT AND PUBLIC HEALTH**

Dr. FISH. Since I have two microphones here, I think I will sit here.

Good morning. I would like to thank Senator Lieberman and Senator Smith for organizing this event, and, in particular, for their foresight in recognizing that the threat of West Nile virus and insect-borne diseases are as much of an environmental issue as they are a public health issue.

The impact insect-borne diseases upon human health—which in Connecticut includes eastern equine encephalitis, Lyme disease, and now West Nile virus—have their origins in the environment.

Mosquitoes, ticks, and other parasites that feed upon human blood are products of the natural environment. The biologies are in-



extricably linked to environmental conditions and climatic events that regulate their abundance.

Viruses, bacteria, and other infectious agents are also common elements of the natural environment and have an important role in regulating populations in both plants and animals. Such agents often play an essential role in the balance of nature.

Humans become accidentally involved in the natural cycle of environmental disease agents when they are exposed to pathogens either directly, with contact with infectious wildlife, as with rabies, or when they are bitten by a mosquito or tick that has previously fed on an infected animal, as with West Nile virus and Lyme disease.

Humans are innocent bystanders in these environmental events, but the consequence of infection can be devastating, and even fatal. Such is the situation we are now facing with the threat of West Nile virus.

The West Nile virus has been known to cause epidemics there, as well as in Europe, from migrating birds from Africa who infect the local mosquito populations. Once established in the local mosquitos, the virus can be transmitted.

We were woefully ill-prepared for this epidemic of West Nile virus. We were not aware of an epidemic until some 40 suspected cases filled New York City hospitals. We did not even know what virus was causing the epidemic until a month after people had already become ill and some had died. We did not know where the infected mosquitoes were and, consequently, 10 million people were exposed to pesticides in an attempt to control the epidemic by indiscriminate aerial spray of the entire New York City metropolitan area, not once but twice.

Our lack of preparedness was obvious and costly.

These events, as shocking as they may seem to the general public, were actually predicted and warned by the scientific community. Two reports from the National Academy of Sciences warned of a decaying public health infrastructure, particularly in reference to insect-borne diseases.

The first report, entitled, "Manpower Needs and Career Opportunities in the Field Aspects of Vector Biology," published in 1983, warned of a serious manpower shortage in the field of vector biology, the science of studying insects that transmit diseases.

This report was totally ignored by Congress and the responsible Federal agencies. Consequently, there are now very few professionals in Government or academic institutions with the appropriate knowledge and training to address the threat of insect-borne diseases.

The second report, entitled, "Emerging Infections: Microbial Threats to Health in the United States," published in 1992, warned of the potential for the introduction of foreign pathogens and the degradation of public health infrastructure to combat such introductions. This report was taken more seriously by Congress and some Federal agencies, but the response has been neither adequate nor timely, as is evidenced by the recent events with West Nile virus.

Well, what can we do to prevent a recurrence of last summer's events and to prevent similar events from occurring in the future?

In the short term, every conceivable effort must be made to prevent West Nile virus from re-emerging next spring. It is quite likely to survive the winter months, either in infected wildlife or within the millions of mosquitoes hibernating in buildings and tunnels in the New York City metropolitan area.

Immediate efforts should be made to find and destroy any infected mosquitoes that may now be overwintering. Heroic efforts must be made next spring to find the virus in mosquitoes or wildlife and to focus mosquito control efforts on containing the virus before humans become infected. A preemptive strike on certain mosquito species known to be capable of transmitting the virus should be initiated early in the spring and directed at the larval stage, where environmental impact of insecticide usage would be minimal. Every conceivable effort must be made to control the virus transmission early enough to prevent human infection and to avoid the use of widespread aerial application to control an epidemic in humans. A repeat of last summer's response must be avoided at all costs.

In the long term, we must strengthen the public health infrastructure to effectively and intelligently combat the threat of new and reemerging diseases. If West Nile virus was a test of our response capabilities, we have failed miserably. Research is needed to better understand the human threat of infectious diseases that originate from the environment. This research should be interdisciplinary and include epidemiology, microbiology, entomology, and, most importantly, ecology. Government agencies responsible for the funding of peer-reviewed research on vector-borne diseases must be given increased resources to accomplish this goal. The training of a new breed of scientists, blind to interdisciplinary boundaries and comprehensively trained in both in medical and environmental sciences, should begin immediately in order to staff the increasing demand for expertise in government and academic institutions. Academic research institutions and government agencies at all levels should form working partnerships to integrate resources focusing upon this specific problem.

Epidemics of insect-borne diseases are preventable. We have eliminated the threat of epidemic malaria, yellow fever, and bubonic plague in this country years ago, but we have left our guard down against the threat of new diseases, such as West Nile virus.

Armed with new knowledge from academic research and the will of responsible government agencies to refocus and integrate prevention efforts, we can regain our capacity to combat new disease threats from the environment and look forward to an improved quality of life in the next millennium.

Thank you.

Senator LIEBERMAN. Thanks, Dr. Fish. That was a very provocative beginning, and I look forward to the response of others on the panel.

You did put it in historic context, introduction of a foreign insect-borne virus never before seen in the western hemisphere is a public health threat unprecedented in modern times.

Is there any evidence—you said in the two reports, which were early warnings if we had seen them—I want to ask you two ques-

tions and we will go on to the other witnesses and we will come back and have a general discussion.

One is: was there any evidence of human infection prior to this year? And then the second is: in the best of all worlds, what would we all have done if we had responded to those two reports you site?

Dr. FISH. Well, in response to your first question, in this particular virus at this point we have no evidence that it has occurred here before last summer.

Senator LIEBERMAN. So this was the first appearance.

Dr. FISH. A new introduction.

Senator LIEBERMAN. Right.

Dr. FISH. But there are other similar viruses, mosquito-borne viruses, that we know occur in this area. I mean, in the beginning this epidemic was thought to have been St. Louis encephalitis.

Senator LIEBERMAN. Right.

Dr. FISH. And it could very well have been St. Louis encephalitis. I mean, these things are out there, and we know they are out there, but they kind of surprise us. Every five or 10 years there is an epidemic. In the meantime, nobody seems to care about them. It is those times that support for research and support for surveillance just crumbles.

Senator LIEBERMAN. Let me go to that second question I asked, which is: what might we have done if we had heeded those reports? Is it exactly what you believe we should be doing now?

Dr. FISH. Well, first of all, we need to keep the training and the research going with these agents. We know they are out there. We do not always know what they are up to or how much of a public health threat they are going to be, but we need to know about them.

Senator LIEBERMAN. Finally, what is the source of support for the kind of research and training that you're talking about?

Dr. FISH. Primarily NIH at this point.

Senator LIEBERMAN. Yes. And I presume you're saying that there is not adequate support coming through NIH now for—

Dr. FISH. Well, there is kind of a problem. It's kind of a turf war between NIH and NSF. I mean, NSF does not fund medical research.

Senator LIEBERMAN. Right.

Dr. FISH. NIH generally does not fund ecological research. These kinds of problems just—

Senator LIEBERMAN. Fall in between.

Dr. FISH. They fall in between.

Senator LIEBERMAN. Yes.

Dr. FISH. And not only is there not emphasis on them, there is almost a prohibition against working in this area because of the division of responsibilities by these two major funding agencies.

Senator LIEBERMAN. Well, that's an important point, and, because of the obvious public interest and concern about this virus and, you know, vector-borne diseases, generally, I'd like to spend some time and see if there is a way in which, perhaps in the coming session of Congress, we might be able to create a visible and identifiable source of funding for that kind of research and training so it doesn't fall between the established categories.

Dr. Andreadis—just for the record, again, Dr. Andreadis is the soil and water department head of the Congress Agricultural Experiment Station.

Thanks for being here.

**STATEMENT OF THEODORE ANDREADIS, DEPARTMENT HEAD,  
DEPARTMENT OF SOIL AND WATER, CONNECTICUT AGRICULTURAL EXPERIMENT STATION**

Mr. ANDREADIS. Thank you.

I'd like to thank Dr. Lieberman for holding—

Senator LIEBERMAN. That's a promotion I do not deserve. I am a juris doctor, now that I think about it.

Mr. ANDREADIS. Thank you.

I am here today to report to you the research and surveillance activities that occurred in the State of Connecticut during the recent West Nile virus crisis.

I am going to focus my comments this morning on specific work that was done to isolate, identify, and determine the distribution of virus in birds and mosquitoes in the State.

Let me begin by stating that since 1997 the State of Connecticut has had in effect a comprehensive mosquito management program to monitor mosquito populations and mosquito-borne diseases that are known to cause human disease, most notably eastern equine encephalitis.

This program is a cooperative effort that involves three State agencies: the Connecticut Agricultural Experiment Station, which is responsible for trapping and testing mosquitoes; the Department of Environmental Protection, which is responsible for implementing all mosquito control measures; and the Department of Public Health, which is responsible for communicating health risks and protective measures to the public.

Mosquito trapping in this program is conducted daily from June through October at 37 permanent locations throughout the State, and since 1997 we have trapped and tested over 150,000 mosquitoes and detected the eastern equine encephalitis virus on nine occasions from six different locations. The map behind me shows the locations of these 37 sites.

Now, because we had this surveillance program in place, we were able to respond immediately to the West Nile crisis. On September 4, the New York City Health Department and the Centers for Disease Control announced the death of an elderly resident of Queens from what was originally thought to be St. Louis encephalitis, a mosquito-transmitted virus.

The following day, September 5, we placed mosquito traps in the town of Greenwich and began a supplementary mosquito trapping program that was eventually extended to 15 towns throughout lower Fairfield and New Haven Counties. This was in addition to our normal trapping in other areas of the State.

The purpose of our trapping was to determine the types of mosquitoes in the region, to assess their relative abundance, and to determine if these mosquitoes were carrying the potentially deadly virus, and, if they were, did this represent a public health threat.

Mosquito trapping was conducted over an 8-week period through the end of October, during which 261 traps were placed in 80 dif-

ferent locations throughout the region, and over 3,500 mosquitoes were trapped and tested in our laboratories.

The other map behind me shows the location of those trapping sites.

Shortly after we initiated our mosquito surveillance program, we began to receive reports of extraordinary numbers of crow deaths throughout lower Fairfield County. Similar crow die-offs were being observed in New York City, Long Island, and New Jersey, as well, and suspicion was rising that perhaps these crows were dying from the virus.

However, we knew this was highly unusual, since St. Louis encephalitis does not typically kill birds. A plan was then put into place to systematically collect and test dead crows. This effort was coordinated by the Department of Public Health, with assistance from local health departments and wildlife personnel from the Department of Environmental Protection.

Birds were sent to the Department of Patho-Biology at the University of Connecticut, where necropsies were performed by veterinary pathologists. Brains and other tissues from crows that had diagnostic symptoms consistent with viral encephalitis were then submitted to us for virus testing. Over 300 birds were assessed at the University of Connecticut from 38 towns from October 12, and 40 were tested in our laboratories for the virus.

Now, on September 21st, we obtained our first isolations of this virus from two species of mosquitoes, *aedes vexans*, which is a strong mammalian feeder, and *culex pipiens*. These mosquitoes were trapped on the evening of September 14 at the Innis-Arden Country Club in Old Greenwich, and we had an additional isolation from the brain of a dead crow collected in the town of Westport on September 13.

This announcement was made by Governor Rowland, who subsequently directed the Department of Environmental Protection to initiate limited ground spraying of insecticides against adult mosquitoes in the affected regions, only.

The isolation of the virus from adult mosquitoes and the brain of a domestic crow was a critical step in the eventual identification of this virus. Despite the increasing number of human cases that were being reported in New York City, the CDC had yet to obtain an actual isolation of the living virus from a human. We believe our isolations from mosquitoes and a domestic crow were the first in the area.

Following our announcement, we were immediately contacted by the Center for Disease Control, who requested that we submit our isolations to them. We complied on September 23. The following day, the CDC announced that the virus was not St. Louis encephalitis, but was a West Nile-like. Two days later, they informed us that the viruses that we had isolated from mosquitoes and the brain of this crow were identical.

We then proceeded to obtain specific re-agents to test for the West Nile virus and initiated molecular studies to sequence a portion of the genome of the virus, with the intent of definitively identifying this virus, determining its possible origin, and assessing its virulence for birds and humans.

Early information, which appeared in the British journal, "Lancet," on October 9, from studies conducted at the University of California at Irvine, had indicated that this virus was Kungin/West-Nile-like, which occurs in Australia; however, their analysis was incomplete, and our genetic analysis showed a much closer relationship to West Nile virus that has been isolated from mosquitoes and humans during a recent outbreak in 1996 in Romania, thus suggesting a common origin.

The results of our investigations are due to be published in the "Journal of Science" later this week.

Bird testing continued through mid-October, and, of the 40 birds that we tested, 29 were found to be positive for the West Nile virus. This included 28 American crows and one Cooper's Hawk that were collected from 18 towns in lower Fairfield and New Haven Counties along a 62-mile corridor from Greenwich to Madison. This is shown, again, on the map behind me. No virus isolations were made from additional crows and a Canadian goose that were collected from Hartford County.

Our isolations of the West Nile virus from birds and mosquitoes conclusively documented the presence of this virus in Connecticut during September and October 1999, and virus activity appeared, based on crow die-offs, to be limited to lower Fairfield and New Haven Counties.

All of the work that I have described to you this morning was accomplished in State with no assistance from the Center for Disease Control or any other Federal agency. Our timely, coordinated response in trapping and testing mosquitoes and birds provided indispensable data that was effectively used to inform and protect the public. Fortunately, no human cases were reported in this State.

The high mortality in crows and other bird species in the region suggests a recent introduction of the West Nile virus into a naive wildlife population that has never been exposed to this virus. The isolation of West Nile virus from a variety of native birds, which are likely capable of circulating this virus at relatively high titers over a broad geographic region, further suggests that this exotic virus is likely to become established permanently in the avian fauna of the United States.

How the virus will behave is unknown, but if established in North America, West Nile virus likely will continue to have severe effects on human health, horses, and on avian populations such as American crows and raptors. The environmental, social, and economic implications of permanent establishment of this exotic virus are considerable.

While many important questions need to be investigated, among the most urgent include: will the virus persist in this region? How widespread will it become? What impact will the virus have on native bird and horse populations? How will the virus affect humans? How will the virus overwinter? How will we monitor virus activity to protect the public? What birds will serve as natural reservoirs? And what mosquito species will serve as competent vectors?

Additional resources and funding are urgently needed to address these and other research questions. This will lead to a better understanding of the natural ecology and epidemiology of this new ex-

otic virus in North America. This information will provide critical fundamental knowledge that is presently unknown. This will be an essential component for developing effective virus surveillance, disease management, and mosquito control strategies throughout the region.

The information obtained in these studies will further aid in assessing the relative risk of the West Nile virus to human health and help to determine its impact on wildlife and domestic animals.

We would further anticipate that increasing our knowledge in the aforementioned areas will reduce—I repeat, reduce—the need for application of toxic chemical insecticides.

We are at a very critical juncture, and we stand ready to act. We have the expertise and the laboratory facilities to undertake these investigations. We have initiated studies on overwintering mosquitoes and wild bird populations, and, with additional funding, we can increase our mosquito surveillance program, continue our basic research on bird populations, and continue molecular studies to develop a rapid procedure for identification of this virus.

Thank you.

Senator LIEBERMAN. Thanks, Dr. Andreadis. Very interesting, helpful testimony.

I congratulate you and your colleagues on the fact that your work in this area is resulting in an article that will be published in the very respected “Journal of Science.”

I am fascinated by the conclusion you reached that this West Nile virus is similar to a strain of virus found in Romania, and I am just curious as to if you’d help us understand what conclusions we might draw from that. Does this mean that the virus that we saw here in the greater New York area and southwestern Connecticut was somehow brought from Romania, or is it just a coincidence that there are similar strains of a virus?

Mr. ANDREADIS. We cannot conclude that this virus came from Romania. In fact, the Center for Disease Control and laboratories at Irvine, California, have also identified the virus and found a very close match with an isolate that was made from a dead goose in Israel.

Our two papers are consistent with one another and suggest that the virus that we have here in the northeast United States probably had its origin from the Mediterranean region.

Now, we do not know how the virus was introduced. I think the highest likelihood that it was probably brought in with an infected bird; however, we cannot rule out an infected mosquito or an infected human. We simply do not know, and we may not ever know.

But I think the evidence that has accumulated from various laboratories that have worked on this would suggest a recent origin of the virus.

This virus is very widespread, and there are over 40 different strains that have been identified. It occurs in Asia. It occurs in Europe, as Dr. Fisher has indicated, and throughout Africa. It is probably the most widespread of these types of viruses anywhere in the world.

Senator LIEBERMAN. And, of course, one of the things, just to state for the record—and I’d invite a response if you want—we are traveling so much, people are traveling so much, goods are travel-

ing so much that presumably it is not just insects or birds that will carry viruses, but that people or planes, for instance, will carry them. And so it is—I presume you said that it might have been brought here, this virus might have been brought here by a bird. Does that mean a bird really flying on its own.

Mr. ANDREADIS. It could have been.

Senator LIEBERMAN. Yes.

Mr. ANDREADIS. Probably not a bird that flew on its own; a bird that was accidentally brought in.

Senator LIEBERMAN. Brought in. Right.

Mr. ANDREADIS. Right.

Senator LIEBERMAN. Or that something brought in might have had a mosquito, or a person might have—

Mr. ANDREADIS. That's also another possibility. Yes.

Senator LIEBERMAN. Yes. I wonder, just to put it in context, whether you want to react to Dr. Fisher's statement that this is a public health threat unprecedented in modern times and may be reminiscent of the introduction of Yellow Fever, or even Bubonic Plague in past centuries.

Mr. ANDREADIS. Well, I would reiterate what I said before—that we do not know how this virus is going to behave.

Senator LIEBERMAN. Yes.

Mr. ANDREADIS. Outbreaks that periodically occur in Europe are introduced with migrating birds that come up from North Africa. When a virus is then introduced into a region of Europe, you can have human cases, an outbreak that may last a couple of years, and then they disappear and then recur several years later.

But we simply do not know how the virus is going to respond.

Senator LIEBERMAN. OK.

Mr. ANDREADIS. That's why it is so important to have a really comprehensive surveillance program in effect to detect the virus early on.

Senator LIEBERMAN. Just take a moment, and then I want to go on to Dr. McLean. What do you mean by a comprehensive surveillance program?

Mr. ANDREADIS. We need a comprehensive surveillance program that includes trapping and testing of mosquitoes—

Senator LIEBERMAN. Right.

Mr. ANDREADIS.—and monitoring bird populations throughout the region so that we can detect the virus in either mosquitoes and/or birds early enough to provide warning.

Senator LIEBERMAN. Right.

Mr. ANDREADIS. And so appropriate measures can be taken to protect the public.

Senator LIEBERMAN. Now, you and your colleagues at the Experiment Station do that. Who else might be involved in that?

Mr. ANDREADIS. Well, in the State of Connecticut, there are three agencies involved—the Department of Environmental Protection, the Department of Public Health, our agency, and then the University of Connecticut is also assisting with the bird work. In fact, we met yesterday in a 1-day session to formulate plans for increasing our surveillance over the next year.

Senator LIEBERMAN. And do you have adequate funding for that?



Mr. ANDREADIS. No, we do not, presently. We are putting together a package that we would present, and hopefully that would be approved.

Senator LIEBERMAN. OK. I saw Representative Nopsham, and there must be other members of the State Legislature, so you're putting them on notice.

Are there Federal agencies involved, as well, in the surveillance program?

Mr. ANDREADIS. Not in the State of Connecticut. No. We have been pretty much doing all of this ourselves, in concert with CDC. We're in communications with them. This is generally through our Department of Public Health.

Senator LIEBERMAN. Right. You made an interesting point, just for the record, that there is an active kind of mosquito surveillance monitoring program in the State that results from an earlier outbreak, but not of the West Nile virus.

Mr. ANDREADIS. Right. The impetus for the development of the program that we now have in place occurred in 1996.

Senator LIEBERMAN. Right.

Mr. ANDREADIS. We had a real scare, where we were finding large numbers of mosquitoes carrying the eastern equine encephalitis virus, which is far more virulent than the West Nile virus.

Senator LIEBERMAN. Yes.

Mr. ANDREADIS. That was over in the southeastern corner of the State. And, because of our finding, the Legislature and the Governor did provide funding for us to develop this program.

Without this program in place, we could not have responded in the manner that we did, so that—

Senator LIEBERMAN. As quickly or as fully as you did.

Mr. ANDREADIS.—was really critical. Correct.

Senator LIEBERMAN. OK. Great. Thanks.

Now we go to Dr. McLean. Again, thanks so much for coming from Wisconsin, director of the U.S. Geological Survey's National Wildlife Health Center.

Good morning.

**STATEMENT OF ROBERT MC LEAN, DIRECTOR, UNITED STATES GEOLOGICAL SURVEY'S NATIONAL WILDLIFE HEALTH CENTER**

Mr. MCLEAN. Good morning.

Thank you, Senator Lieberman, for inviting me to participate in this hearing.

I request permission to attach my written testimony with some attachments, some background information on National Wildlife health alerts we disseminated during the outbreak and some information we provided to keep the public informed of what we were doing.

Senator LIEBERMAN. Thank you. That will be included in the record without objection.

Mr. MCLEAN. I will summarize my testimony to provide information on the involvement of wildlife species and the impact of wildlife populations related to the emergence of West Nile virus in the United States.

As you mentioned, I am the director of the USGS National Wildlife Health Center in Madison, Wisconsin, and our center provides direct technical support, knowledgeable guidance, and timely intervention to Federal and State wildlife managers who are regularly faced with sick and dead wild animals, frequently on a large scale.

Due to the mobility of wildlife and the potential spread of disease, timely and accurate determination of the causes of wildlife illness and death is a prerequisite to achieving the effective disease control and prevention.

The expertise and resources of our disease diagnostic laboratory are crucial in providing this rapid response to wildlife mortality events, and it was due to this national diagnostic wildlife system that we had in place that we became early involved in this epidemic in receiving dead crows from New York State during the first week in September.

Other people have mentioned the background information on the virus. I will present a little bit of that, go over it very briefly.

As mentioned, it is a mosquito-transmitted virus, very closely related to St. Louis encephalitis that occurs regularly in the United States. It was first isolated in Africa and Uganda in 1937, so it is a long history of this virus, and until recently it was only found in Africa, the Middle East, Europe, and Western Asia. Human epidemics were first reported in Israel in the 1950's, and later in Africa, Europe, and Asia. The latest epidemic there occurred in southern Russia this summer in 1999.

This virus infects a wide variety of vertebrate animals, and birds are the primary host. Resident and migratory bird species are involved in the natural transmission cycles.

West Nile virus seems to cause none or mild disease in birds in Africa and Israel, and there was one exception, an experimental infection study where there was high fatality in crows and house sparrows.

The virus that occurs in the United States, St. Louis encephalitis, causes little or no disease in animals; therefore, the high mortality that was observed in crows with this introduced virus was very unusual, and this suggests that it was a higher virulence for our naive native species or this was a much more virulent and deadly strain of virus for our native birds.

To give a little bit of the current status of the virus as we know it, obviously, human cases occurred only in New York City area, with one exception of a case that was exported to Canada. Infected mosquitoes were found in New York, New Jersey, and Connecticut, and virus-infected birds were found in New York, New Jersey, Connecticut, and Maryland. All but a few of these positive birds were found within about a 50-mile radius of New York City.

Some exceptions of that were one bird found 100 miles north in New York and a bird found positive in Baltimore, Maryland. This was an American crow we found dead in Baltimore. This crow certainly extends the infection area much farther south in U.S., about 250 miles south to Baltimore.

Senator LIEBERMAN. Doctor, can I interrupt you—just a curiosity. What conclusions can we draw about the location of that crow, infected crow in the Baltimore area? Can we assume that it flew

from the New York area, or that there is a separate occurrence of the virus, or neither?

Mr. MCLEAN. That's what we're trying to investigate. We are doing surveillance in the Maryland area, intensive surveillance with the State, and both possibilities exist. Certainly, crows could fly south that far. There are migratory portions of the crow population.

The other question is if it picked it up locally from mosquitoes, and that's one of the surveillance questions that is continuing at this time.

Senator LIEBERMAN. OK. Thanks.

Mr. MCLEAN. All the birds tested for West Nile virus coming from at least three of the States—as Connecticut mentioned, they tested their own. CDC tested 392 birds, and 192 of those were positive for West Nile virus. There were at least 18 species of birds positive, including some exotic and native birds in zoos, and there also was one mammal positive, a cat in New Jersey.

The National Wildlife Health Center conducted extensive field investigation for 3 weeks in New York and New Jersey during October and sampled more than 1,000 birds of 70 species at 21 sites, and their laboratory results of these are still pending.

At the same time, we established surveillance of bird mortality in a multi-State, mid-Atlantic region, and have and continue to receive wildlife specimens for necropsy and testing at our center.

We recently broadened this wildlife surveillance using crow mortality as an indicator of virus presence by expanding collaboration with Center for Disease Control and State agencies in 20 eastern States. The Center also established further surveillance efforts with USDA to sample bird populations in Atlantic and Gulf Coast States for early detection of any virus expansion farther south.

This combined, cooperative effort of three Federal agencies I think was unique in this investigation and was facilitated by USGS.

The question was addressed earlier: how, when, and where was this virus introduced? Certainly, importation, either legally or illegally, of infected animals, whether they were birds or domestic animals, which is a possibility, as well; humans or mosquitoes, which could hitch a ride on an airplane or in cargo are some of the possibilities.

It has been mentioned that migratory birds could have introduced it by flying to this country. That's very unlikely, and I will mention the reason why.

The normal infectious period in an animal is very short—four to 5 days at the most are they infectious for mosquitoes. Because of that, the very rapid transport of this animal would be necessary to be able to get the animal here within that short period of time.

There is one exception to that—if there are latent infections followed by a relapse in animals. If that occurs, that could extend the time.

There are efforts underway using molecular techniques that could also provide some clues as to where this virus came from by comparing the isolate in New York to isolates obtained in other countries, as previously mentioned.

CDC did report that the virus is very closely almost identical to an isolate from Israel, and I would agree that certainly the Middle East and that area is a likely source of this virus.

Senator LIEBERMAN. I assume it got its name for that geographic region.

Mr. MCLEAN. Yes. From West Nile region in Uganda.

Senator LIEBERMAN. Yes.

Mr. MCLEAN. It is part of the West Nile River system.

Senator LIEBERMAN. Right.

Mr. MCLEAN. There are also efforts underway to determine when and where it was introduced. If we assume it was introduced this year, you know, how do we know it wasn't here previously?

Senator LIEBERMAN. Thank you very much for your testimony, Dr. McLean.

Now may we hear from Ms. Jane Stahl, Deputy Commissioner of the Connecticut Department of Environmental Protection.

Ms. Stahl?

**STATEMENT OF JANE STAHL, DEPUTY COMMISSIONER, CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION**

Good morning. My name is Jane Stahl and I am the Deputy Commissioner of Environmental Protection here in Connecticut. I'd like to thank the committee for this opportunity to discuss the State's mosquito management program and its interest in this issue.

Mosquitoes are not our enemies. We need to be protective of both our insect population, our bird population, as well as our human population, as we study this disease and similar diseases and move forward in our approaches to preventing human disease that is related to them.

The cycle is, as we heard, very complex. We have mosquitoes biting birds, building up reservoirs of diseases, being fed on by more mosquitoes, and maybe transmitting disease to a human.

My final theme, and then I will go to my written testimony, is that, because that cycle is so complex, I believe it is still fair to say that the risk of disease to humans is low. That's not to say that we can ignore it. We cannot afford to ignore it. We cannot afford to not be concerned and not go forward with the specific kinds of study and protective measures and programs that have been talked about here, but I also do not want people leaving the room thinking that we are in a crisis mode. A concern mode, absolutely. A better-informed mode, absolutely. But I think that, you know, we need to keep that in perspective, and that perspective also helps us guide our response so that it can be measured and that we are not, my final theme, responding to politics as opposed to scientific information and expert measures.

I have gone way up to the yellow light already and haven't even gotten to my testimony.

Let me just hit the highlights, then, which is to say that mosquito management, when it began in Connecticut, began with the ditching and the filling of our wetlands. What we now know as some of our most-valuable ecological areas, the areas that we protect as nurseries to the fish and wildlife that we seek to maintain,

were the areas that we sought to destroy in our efforts to manage our mosquito populations.

Well into really modern days, when the Department of Health here in Connecticut took over the mosquito management program—and it was, even then, a response to disease threat—we were destroying wetlands in order to prevent the spread of mosquito-borne disease.

We have gotten way smarter. We have learned that wetlands and wetlands restoration is, in fact, one of the greatest tools that we have in managing mosquito populations. Some of the best enemies of mosquitoes and larvae are those healthy fish nurseries and bird populations that look to the wetlands for their homes and their breeding grounds.

So we have learned a lot and we have changed our approach.

Senator LIEBERMAN. I had the opportunity, as I think you know, to visit a site at Hemanas, in which it is very interesting, actually, that we are trying to turn around something we did earlier with wetlands we filled in. We now have a program—some of folks here are overseeing it—which is basically liberating the wetlands by removing the fill that was put in, and it is quite remarkable to see the natural process of mosquito control being restored—and, of course, all the other positive effects of those wetlands.

Ms. STAHL. Absolutely. And we will take you on as many site visits as you like, because we have wonderful examples of it throughout the State.

And it is, in fact, an interesting twist of fate that allowed Connecticut to have the first dedicated wetlands restoration program, and that was the demise of the mosquito management program in the Department of Health. It was a budgetary matter back in the early 1980's, but the mosquito management program had evolved to the State where it was employing what we now call "integrated pest management" and wetland restoration techniques as our best vehicles for mosquito control.

It was also the existence of that expertise that allowed us, as Dr. Andreadis said, to respond forcefully in 1996 when we had a—I will use little quotation marks here—a "crisis" in the realm of eastern equine encephalitis showing up in human-biting mosquitoes and the need to react to those findings. So we had a skeleton of a program in place. We had Dr. Andreadis' expertise at the Connecticut Agricultural Experiment Station. We had our experts in the Department of Public Health helping us evaluate the risk. And we had the formal mosquito management program, now the DEP wetland restoration program, able to mobilize to go out and do some local focused spraying for mosquito control, knocking the adult mosquitoes down.

It was that emergency response that led to the development of Connecticut's program, where we sat back and we said—my folks have heard me use this term far too often recently. We tried to design everything from the Volkswagen to the Cadillac of mosquito management programs, and then light upon something that would be, in fact, a functional vehicle—maybe a Chevy, maybe a Ford.

But what we ended up with was this cooperative, statewide approach, again, geared toward eastern equine encephalitis, that gave us our comprehensive testing and trapping program, our proactive

placement of larvacide in the off season, and our ability to respond with ground spraying should test results prove positive.

We developed an emergency contingency plan for eastern equine encephalitis that gave us levels of response, depending on the results of the trapping and testing that we were pursuing through the season.

It was because we had that program in place, as Dr. Andreadis said, that we were able to respond quickly, remobilize some traps, and conduct some very area-specific testing when the word came to us that we had this new disease or potentially a new disease emerging in this area of the State and Fairfield County.

And it was also having that program in place that allowed us to respond in a measured approach with very localized, focal ground spraying of a low-toxicity pesticide, because, again, we are very concerned about the collateral damage that could ensue from broader, more widespread pesticide application.

Among the things that was very successful in this last season was daily communication with all of our municipalities involved. We had conference calls with the chief elected officials and local health directors in all of the towns in Fairfield, southwestern Connecticut, Fairfield County area, that were involved in this situation.

Because we communicated with them, we were able to get the word out through them to the public as to the personal protective measures, the measures, the methodologies that they could undertake on a municipal level, and to get the word out as to what the State efforts were.

It helped us, as I mentioned earlier, guard against a more political response, if you will. By staying together and keeping our experts on the phone with municipal leaders, we were able to guard against a more emotional reaction and to undertake a more measured response.

Those are, in fact, the kinds of elements that we need to continue to undertake as we look toward how to address West Nile or West-Nile-like virus into these coming seasons. We cannot treat this as if it were a fluke, that it's not going to happen again. We have to go in assuming that we are going to be confronting this same situation again.

We also cannot forget the fact that we do continue to have an issue with eastern equine encephalitis in the other half of our State—and, again, as was stated earlier, a much more virulent virus and one that, when it occurs in humans, is fatal.

We have a lot of plates to keep on those sticks revolving in the air. I think we are well poised to do that. We begin—we have already begun. We continue today, and we will continue throughout the season.

One of the challenges that we need to address—and I state it here—is that we are dealing with a type of mosquito transmitting a disease that is less focal or localized than are the mosquito species that we were dealing with with eastern equine encephalitis, and that means that we need to change our protocol a little bit. But, because the protocol has worked so well, we are not going to disband it. We are not going to broaden it so much that we lose the benefits of a responsive, responsible program.

Why do not I stop here and allow the questions to take us where we want to go.

Senator LIEBERMAN. Thanks very much, Commissioner Stahl.

Ms. STAHL. Thank you.

Senator LIEBERMAN. That was very helpful testimony. I appreciate it very much.

Let me ask a few informational questions for me and others here and for the record, and then talk again about what we can now do as we go to the future.

I was interested in the assessment of how we should react to this, and ask if any of the other members of the panel, particularly Dr. Fish, want to—in other words, we do not want to panic, obviously, but, in terms of the impact of this West Nile virus on people, you have said that the eastern equine virus actually is more virulent, by our experience. On the other hand, we do know that apparently seven—the deaths of seven people in the New York area were attributable to the virus.

So how seriously should we take this? Dr. Fish, do you want to start?

Dr. FISH. Well, being that we do not have any experience with this virus in the western hemisphere before, it is really hard to predict what the total range of possibilities might be.

I think we should be prepared for the worst. We cannot afford not to be prepared for the worst. And I think many people—most people, I think, believe that this virus is not going to go away. We are going to have it in some form.

So I think it is important to take a preemptive strike—

Senator LIEBERMAN. Right.

Dr. FISH.—to control this virus and do everything we can this spring. In fact, there are things that we should be doing now. I mean, if it is overwintering in the mosquitoes, someone should be looking for them and doing something about it and trying to control some of the overwintering mosquitoes.

Senator LIEBERMAN. Hold that thought a minute, because I definitely want to come back to that.

Anybody else want to add a perspective on—this is new, and it was frightening to a lot of people. No one is saying, I know, that we should not be concerned about it. The question is the level of concern. Does anyone else want to respond to that?

Mr. MCLEAN. Yes, I'd like to respond. I think, since we are—not only wildlife but the human population is naive to this, that if the virus does persist it could go to other metropolitan areas where we could have similar experiences in the future, and so I agree with Dr. Fish that we should be very vigilant, at least from the public health standpoint.

Being from a wildlife center, we are very concerned because it is killing a lot of our native birds, and so we want to be vigilant, ourselves, to be on the alert to whether this could be a significant impact on bird population.

Senator LIEBERMAN. Sure. That's a good point.

Mr. MCLEAN. And it could very well be.

Let me go to a different kind of question.

Many of us have been concerned about the impact of weather, specifically, and the whole question of global climate change. I am

interested in knowing what effect you think weather conditions might have had on the outbreak of West Nile virus. Is there a need for better weather prediction, for instance, to help monitor for conditions that are conducive to mosquito-borne disease?

Just to throw into it before I give you a chance to respond, I was struck, looking over—for another reason, recently. The report of the Intergovernmental Panel on Climate Change issued a 1995—this is the international group of more than 2,000 scientists who reached the critical conclusion that the planet was warming and that it is probable that it is human activity that is warming it.

There is a sentence that says, “Indirect effects of climate change include increases in the potential transmission of vector-borne infectious diseases, for instance, malaria, yellow fever, and some viral encephalitis, resulting from extensions of the geographical range and season for vector organisms.”

In other words, I read it to mean that as certain parts of the planet and of this country get warmer, that diseases we haven’t known here will come into the area.

I do not want to ask you to sort of express your conclusions, particularly, certainly not at length about whether climate change is real, but to what extent are we in a position now to say that weather had an effect on this outbreak of West Nile virus?

Dr. FISH. It depends on whether you’re talking about weather short-term or long term.

Senator LIEBERMAN. Take a stab at both.

Dr. FISH. Both. OK. Well, my specialty area of research is in ecology of vectors, of disease vectors. I have done it for about 30 years. And I have seen this report, and I have seen many statements concerning the impact that global warming might have upon insect-borne diseases.

I, myself, am of the opinion that we know so little about how the environment influences these diseases and mosquito populations or the vector populations that we really cannot make those kinds of predictions.

Certainly, these disease systems, the vector populations and the virus circulation, are dependent upon climatic events, I mean, in the short term. Over the long term, you know, it is anybody’s guess.

It’s a nice story, but I wish there were some fact behind it.

I mean, global warming probably will be good for Lyme disease, because these ticks are cold-adaptive ticks. They like northern climates.

Senator LIEBERMAN. Right. It will have different effects on different species.

Dr. FISH. Sure.

Senator LIEBERMAN. And in different places.

Dr. FISH. I think it is hard to make a global conclusion from that.

On the short term, certainly there seems to be pretty good evidence that this summer’s drought had some influence on the populations of this *Culex pipiens* mosquito, which likes polluted water, small containers of water that have high organic material in them. They do well, they do best in that kind of situation, and when you have a lot of rain that tends to dilute the organic material and washes some of these structures out.



So I think that might have been important, but, of course, we do not really have good monitoring system in the New York City area to go back and find out how many mosquitoes there were in June and July and August.

But that's a reasonable scenario, so the weather may have had an influence, and if we have steady rains next summer we may have unnaturally low culex pipiens population and the virus may have a harder time getting started in the birds. Those things can happen.

Senator LIEBERMAN. Any other responses to the question?

Mr. ANDREADIS. Well, I would agree with everything that Dr. Fish has said. I think a more important issue is the global movement of organisms, and I think this is a greater threat than global warming to the introduction of an exotic virus or new disease.

I think that is a major concern, and that perhaps we need better quarantine facilities to examine the movement of animals or other carriers of disease.

We have a global economy. We have global movement. You can be in Europe today and in Asia tomorrow, and I think this is more important.

Another example—we have a newly introduced mosquito called *ades japonicus* that we have discovered is present throughout Connecticut. Its origin is somewhere in Asia, probably Japan or China, and it is not present throughout the State. Our best guess is that it was introduced with used tires imported into the region. It has also been detected in New Jersey, New York, and in Ohio now.

So we have another mosquito here that is a human biter that is a potential vector for disease. It's another instance of an accidental introduction.

Senator LIEBERMAN. We do not know that it is carrying a disease yet.

Mr. ANDREADIS. No, we do not know.

Senator LIEBERMAN. But it is a new species.

Mr. ANDREADIS. It is a new species here in the region.

Senator LIEBERMAN. Dr. McLean, do you want to—

Mr. McLEAN. Yes. I agree with both of the previous speakers. There is no question that weather in the short term can affect the extent and breadth of an epidemic. For example, if you have a warmer season or fall season that allowed virus transmission by mosquitoes to continue longer, which increases the risk—and that certainly occurred this past summer. The drought, as Durland mentioned, contributed probably to it. But then in this area you have a longer fall season, which allowed it to amplify more in the bird and mosquito cycle, which then had more spill-over to the human cycle.

Also, I think the introduction of exotic species is a very important consideration. We're studying a parasite that is killing thousands of birds in Wisconsin, and we're not sure how this parasite was introduced from Europe somehow—either came in a snail or some other way. And so there are introductions that we do not think about—ticks being brought in on animals and get established. So there are a lot of other methods of introduction that we have to be more vigilant about, I believe.

Senator LIEBERMAN. As you remember, when the outbreak occurred there were some stories about the possibility that this might be bioterrorism. I take it that the prevailing expert opinion that I heard after those stories occurred is shared by the panel, which is that there is no evidence to lead you to conclude that this was bioterrorism. Am I correct?

[No response.]

Senator LIEBERMAN. Let me ask, then, a question that's somewhat related, which is that, once those fears were eliminated, people began to ask: did the response to this outbreak of West Nile virus reveal for us any vulnerabilities, any weaknesses in our detection and response system in the case of bioterrorism.

So I do not—I welcome some comment on it, but what I really want to transition to now is your evaluation of—and you have touched on this, each of you, as you have gone along with your testimony—about how we responded, how the governmental agencies responded, and particularly what better could be done.

I know that CDC originally misidentified the West Nile virus as St. Louis encephalitis. I also understand—I have learned enough to know that these are not dramatically different, so that it was understandable that that might happen. And it went some period of weeks, I guess, before this was correctly identified.

I am curious as to whether the initial misidentification had any consequences, and, just generally, to give you an opportunity now to reflect on how the agencies that you are involved in work together and whether there is a need, for instance, for the Federal Government, since I am here as a member of the U.S. Senate, to assert a more active role in coordinating response to a disease crisis of this kind.

Commissioner, why do not you start?

Ms. STAHL. Let me take a crack, because of course I am going to tell you that we reacted appropriately, heroically, brilliantly, much of which I do believe is true. Again, I think that, you know, in answer to—the short answer to the question was the misidentification or the later identification of what we thought was St. Louis as West Nile, that did not make a difference in Connecticut's case in our response. I think it later allowed us to ask a different series of questions as we went forward in our response, but as soon as we had a disease in human-biting mosquitoes that was causing a health risk to humans we established the process that we ensued, which was, again, to relocate traps that we had and conduct additional testing.

Then, when we had the—in kind of the evolution, both in finding that it was, in fact, West Nile or West-Nile-like virus, and in making the correlation with the crow deaths that we were seeing, we began to broaden our response on terms of the trapping, the testing, our collection of birds to better evaluate the system or the situation that we were, in fact, responding to. But, again, I think the protocol was basically the same, regardless of the identification of the specific virus.

Again, I need to emphasize the fact that a coordinated response within the State was one of the keys to what I believe was our success. Could we have done more, better? Of course. I mean, these are always learning experiences. Is there a method or a message

for sister agencies in other States or for the Federal Government? I think yes. I think it would have been useful to have better coordinated information coming into the State from the CDC. I think their focus initially was—and, again, they, too, were evolving a response.

Senator LIEBERMAN. Right.

Ms. STAHL. But, you know, CDC responding to the New York situation, trickling out to the other States, and then leaving it for us to more actively get involved was something that I think will change in future endeavors.

Senator LIEBERMAN. How should it change?

Ms. STAHL. I think there needs to be a recognition of the region of response, as opposed to the specific area of response.

Senator LIEBERMAN. Yes.

Ms. STAHL. I think we also need to be aware of the various entities in any given State that are involved in mosquito management, mosquito-borne disease, and the responses.

So, for example, in Connecticut it is a matter of talking to and dealing with three or four different entities, all of whom are very good at coordinating within and among ourselves, but if CDC is only used to speaking to departments of health, we lose a quick, on-time, on-point opportunity to communicate.

I think we resolved that as the situation wore on this season, but, again, it is a lesson to have learned.

Senator LIEBERMAN. Is CDC the right Federal agency to be involved here? I mean, is there a—just keeping the bioterrorism threat in the background, understanding that the appearance of such—God forbid it ever happen—would have somewhat similar signs, but potentially could spread more rapidly and more virulently.

Did we learn anything from this experience with this virus and other vector-borne diseases that suggest some more active—was something going on that the public may not know about?

Dr. Andreadis, did you want to—

Mr. ANDREADIS. I was just going to comment that the immediate needs—I mean, within the State we have the ability to extend our surveillance trap, test mosquitoes, test birds. I think what we're looking for from the Federal Government, in addition to research dollars, would be the appropriate agencies—and this may be the Center for Disease Control—providing us with the technology and appropriate re-agents so that we can do all of our own testing so that we can implement our programs.

The great advantage that the Center for Disease Control has and the Federal Government is they have a larger source of resources available to them with all of these various reagents, and we would look to them in the immediate year to provide us with these reagents so that we can do the work here within the States, ourselves, and not burden them.

Senator LIEBERMAN. Dr. Fish, did you have a thought on that?

Dr. FISH. Yes. Connecticut is in pretty good shape. I mean, they did a commendable job in combatting this threat because they were prepared. My concern is New York City.

Senator LIEBERMAN. Yes.

Dr. FISH. If this virus maintains itself through the winter and it reappears next spring, it is going to happen in New York City, just because of the nature of these mosquitoes, these urban mosquitoes that transmit it. And New York City is the least prepared to do anything about these kinds of situations.

Senator LIEBERMAN. Focus on that. If you were the king, what would you have New York City doing? Or just if you were mayor of New York.

Dr. FISH. Well, at this point I am not aware of a plan, of even a plan, a time-delineated plan of what is going to be done between now and next summer.

Senator LIEBERMAN. Because you'd say we have to all act on the assumption that there will be a recurrence.

Dr. FISH. We have to.

Senator LIEBERMAN. You have the expertise. I assume that you all believe that this virus will stay alive through the winter.

Dr. FISH. We cannot afford not to think that.

Senator LIEBERMAN. It would be a great surprise if that did not happen.

Dr. FISH. That would be great.

Senator LIEBERMAN. Yes.

Dr. FISH. Everyone would be quite content.

Senator LIEBERMAN. But it would be a surprise.

Dr. FISH. Yes.

Senator LIEBERMAN. It is not what should be expected.

Dr. FISH. We need to be prepared, and there are things that need to be done now. As I said before, if this virus is overwintering, it is most likely overwintering in the mosquito population. These mosquitoes overwinter in the adult stage. They can be found in tunnels and basements in urban areas. And every effort really must be made to find these mosquitoes, find out where the infected ones are, and try to control them in some way.

Senator LIEBERMAN. Is that doable? It sounds like a massive undertaking.

Dr. FISH. Well, we ought to try. We really ought to try and then prepare in the spring. I mean, to go out and try to control a mosquito population in the larval stage really is the best way to control mosquitoes. If you have to kill them when they are adults, you lost the battle. They can be controlled in the larval stage, which means finding them, finding these water containers. Sometimes it is catch basins, abandoned swimming pools, and those kinds of structures. I mean, they need to be mapped out and located, and we need to be ready in the spring. When these adult mosquitoes come out and start laying eggs and producing larvae, we have got to be able to go in there and try to control the population before we have a lot of infected adults flying around. And that all has to be planned. I mean, it is going to be a big effort. You know, New York City is a big place, and lots of places for mosquitoes. But I think we ought to try.

Senator LIEBERMAN. Is there something we should be doing in this—go ahead, Dr. McLean.

Mr. McLEAN. I wanted to add, obviously, in the Federal perspective, I might say the same thing occurred in New York City. They

responded. Their response to St. Louis encephalitis was the same as if it was West Nile virus.

Senator LIEBERMAN. Right.

Mr. MCLEAN. So when they did respond, it was the appropriate response that they were doing.

From the Federal perspective, like Durland, I have been working for 30 years in these viruses, and 10 years ago we would have said that everybody did a remarkable job in identifying this virus so quickly. The technology is just advanced so much we need a lot more now.

Senator LIEBERMAN. It is important for us to have heard that. I agree.

Mr. MCLEAN. And the other thing, I think it was, at least for me, a unique experience at the Federal level that—of course, we are all resource limited. Everyone thinks Federal agencies have a lot of money, and we are very resource limited, but I think—

Senator LIEBERMAN. I hear you.

Mr. MCLEAN. What came out of this, I think, was a very unique collaboration that occurred—and I think we need to continue that and establish it—between three major agencies—the Center for Disease Control, USDA, and our USGS National Wildlife Health Center on wildlife diseases. Of course, this is a unique virus in that wildlife became not only important, because they were dying—

Senator LIEBERMAN. Right.

Mr. MCLEAN.—but wildlife mortality was being used to make public health decisions, which is the first time I know of any disease like this where that has occurred.

As a matter of fact, it was occurring so rapidly, public health officials wanted daily reports of positive crows to make public health decisions, and that is unheard of in these diseases.

So I think it has been a very good collaboration. We are continuing the collaboration. All three agencies are working together for surveillance, particularly in the Atlantic and Gulf Coast States to see if the virus was introduced there and if it has become established. That is going to be a second critical question related to whether it is persisting in New York. Did it go somewhere else? And will it be established there?

That, in the long term, will be as important for the persistence in the virus for the country, if there are some transmission sites established in the south for continuous reintroduction to the north in the future.

We are doing surveillance. It is limited, obviously. We are doing as much as we can. A lot of State agencies are collaborating with us on that, so that is ongoing now. We are getting in bird carcasses from all over the country, currently testing. We do an active sampling of bird populations. I think those are very important.

And I agree, too. I think the virus is probably mostly likely going to persist in the New York City area. There was so much intense virus activity that it probably filled the mechanisms; however, the virus survives the winter, and this is the area where it would most likely survive.

We have to be very vigilant in the spring in looking for the virus as it first appears, and then be very proactive in going after these spots where—it won't occur all at once in the New York City area.

There will be little, individual sites. We need to identify as many of those as we can and react to them quickly to prevent it from expanding further in the New York City area, including Connecticut. I think, obviously, mosquitoes were infected here, so it could persist here, as well.

Senator LIEBERMAN. That is good news about the collaboration between the three Federal agencies, and I assume that also would go over in this hopefully hypothetical case of bioterrorism.

I want to pick up from what you said and ask the broader question that I know was on a lot of people's minds here in Connecticut, which is about how we respond and just state it in a way that may be provocative.

I know some people felt that when the appearance of West Nile—the occurrence of the West Nile virus happened this fall, that in some sense we over-reacted, that perhaps it was a kind of panic reaction, we over-sprayed, and that may have been done to the detriment of both wildlife species and people.

So I would like to ask you to respond somewhat retrospectively, but also prospectively about if we all agree, as you do, and I think you make a very strong case that we have to assume the re-emergence of this virus next year and in future years, and that therefore we have to develop a plan and a program to try to control it, control those mosquitoes, particularly, that spread it, how do we do it? How do we do that control in the safest way?

Commissioner, do you want to respond first about what happened here with the use of insecticides, pesticides?

Ms. STAHL. Sure. And, again, I think that we were, in large—we were well prepared, but we were also lucky. I do not want to underplay that notion. We did not have a human case of disease to which we were responding in Connecticut. We did have, because of our eastern equine encephalitis protocol, a hierarchy of responses when we made findings of disease in different types of mosquitoes or in reports from sister States or in other findings that would have been informative or indicative of the level of threat to which we were responding.

So our first level of response is usually to get the word out for people to take personal protective measures and to avoid being in areas of mosquito concentration at times when mosquitoes are known to be actively biting.

Now, that changes when you have different mosquitoes with which you are dealing, and that is one of the things that we needed to look at a little bit more carefully with the West Nile virus, because we had a mosquito that was biting more frequently through the day and in populated recreation areas.

We need to be vigilant, both proactively and at the time of the occurrence in terms of larva siting and reducing the—I hope I do not use the term incorrectly with all these experts sitting here, but those nascent populations of mosquitoes and, most dramatically, when we, in fact, have disease in human-biting mosquitoes, we evaluate the need to conduct spraying of pesticides.

What we did in this past instance was to do very localized ground spraying of a low-toxicity pesticide to knock down the adult mosquito population in the areas where we had the positive test results. So we had very limited areas in which we actually sprayed.

We were on call and are still paying the bills, actually, for aerial spraying of pesticides should the test results have increased significantly. I mean, if we had greater numbers of positive test results in mosquitoes and in more widespread areas, we would likely have done aerial spraying of pesticides.

If we went aerial, we would have used the same pesticide that we used in the ground spraying, because it is a low toxicity, which is not to say harmless—

Senator LIEBERMAN. Right.

Ms. STAHL.—but low-toxicity pesticide.

Senator LIEBERMAN. So you were evaluating constantly the risks as against the danger of spraying.

Ms. STAHL. Absolutely.

Senator LIEBERMAN. What about, as I recall, New York State, I presume, did, in my recollection, wider aerial spraying. I know there was some concern about that, and, of course, we are just over the border and the winds move. So is that something for people in Connecticut to be concerned about? And is there—I hate to suggest this, but is there any sort of Federal role in trying to regulate or at least to make more logical or limited, sensible, the use of aerial sprays in a situation like this?

Ms. STAHL. 20/20 hindsight?

Senator LIEBERMAN. Yes.

Ms. STAHL. I think the role really is an educational and communication role. New York City dealt with a more urgent situation with a methodology that they had at hand and without the benefit of having years of experience with similar situations. It is not unlikely or unusual in States that have longstanding mosquito control programs with mosquito-borne disease to conduct continual aerial spraying of pesticides. That is something that is very difficult for us to sit here in Connecticut and second guess, because they, too, one would hope, are constantly measuring and weighing the risks to their population, the risks to their economy in States where the tourist trade is—

Senator LIEBERMAN. Sure.

Ms. STAHL.—important, and the risks to their ecological systems.

So I think we are in a—were this to happen again next year—and one of the points that I would like to make is that there is a very active mosquito management coordination scheme throughout the country. I mean, there is an organization of experts in this field who do get together, and New York is, in fact, participating in those organizations, and my hope, in fact, my understanding, is that they have learned from this experience and will deal differently with the situation.

Senator LIEBERMAN. Good.

Let me ask Dr. Fish, as an epidemiologist, your reaction briefly. Should the public not only be concerned about West Nile virus but about the way in which we tried to prevent its recurrence or limit it through the use of insecticides?

Dr. FISH. Again, Connecticut had a rational approach. I mean, they were monitoring the mosquito populations, they were monitoring for virus activity, and they had some information to base a decision on as to whether to spray and where to spray and how much to spray.

I know you represent Connecticut, but I keep going back to New York.

Senator LIEBERMAN. That is OK.

Dr. FISH. It is not that far away.

Senator LIEBERMAN. No.

Dr. FISH. What happens in New York influences the people in Connecticut.

Senator LIEBERMAN. I grew up in Stamford. I used to think that my Governor was Nelson Rockefeller. I think that has changed now.

Dr. FISH. I do not think New York City had any alternative other than to use aerial application of insecticides in response to the human cases. By then it was too late to do anything else. And they really did not have any idea where the mosquitoes were or where the infection was. All they had was human case data, and they had some cases in the Bronx and in Manhattan of people who had never left and must have acquired it there, so they were in a trap. I mean, they really did not have any choice but to spray. I do not know if they needed to spray twice. But they are not going to have that excuse next year. They are not going to be able to do that, I do not think. I mean, they have options. If they get a program in place and get out there in the field and learn what is going on, they can avert that kind of wholesale spray.

Senator LIEBERMAN. You have all been very helpful. I think we have—you certainly have helped me understand better how this happened, some of the understandings about how different groups work together fairly well in governmental agencies to try to limit its outbreak.

We were fortunate here in the State that there was no human effect. We have something to worry about the reemergence.

Let me just, as we head toward the conclusion of the hearing, just try to focus us on what we can do now and what the Federal Government, particularly, can and should be doing now.

You have made, I think, a very strong point that there is a real public health concern here and there is not commensurate or certainly not focused support for research in this area that is adequate to the problem, and the same about monitoring of surveillance. Some of the this money presumably you would ask for from the State governments, but maybe there is some role there for Federal agencies, as well.

Focus in now on what else, what are the practical next steps? Again, repeating, it is clear from what you said that we have to assume that this virus is going to reappear, and the question is how can we—and probably spread, and the question is: how can we inhibit that? How can we prevent that from spreading further and deeper?

I will give you each a shot at that. What are the things we could—

Mr. ANDREADIS. I think the immediate needs for the coming year are to greatly increase our surveillance activities throughout the region where we know we had virus activity last year, at the very least. This would include trapping and testing mosquitoes, monitoring bird populations, and, as Dr. Fish had indicated, doing preemp-



tive larval control, identifying the sites where these mosquitoes are breeding, and attempting to control them early on.

Senator LIEBERMAN. Now, for instance?

Mr. ANDREADIS. Well, in the spring time.

Senator LIEBERMAN. Yes.

Mr. ANDREADIS. Identifying sites now, and then controlling them in the spring before they have emerged as adults, because it is only through obtaining this type of data that you are going to be able to make the important decisions that may be necessary here.

This, hopefully, would prevent a human case from occurring, because we could detect the virus in either the mosquitoes or birds early enough to get the warnings out.

So I see that as our immediate needs for the coming season.

Senator LIEBERMAN. OK. Dr. McLean?

Mr. MCLEAN. Yes. I agree with what he said.

I would like to emphasize—again, this is my experience with St. Louis encephalitis—that the best surveillance method of predicting human risk is monitoring bird populations. Mosquitoes—it is more difficult to isolate virus in mosquitoes, and that occurs very close to when humans are at risk, where birds are involved much earlier in the transmission.

With our experience with St. Louis encephalitis, monitoring closely the bird populations in a number of species in urban and suburban areas that we selected as several species, the whole thing is driven by information. The more information you have, particularly by location, and the earliest you have this information, the better you are prepared and the more preventive measures you can institute, so it is all information driven.

Mosquito information is important to know where the risk will be as far as what species are around and their density of mosquitoes, so I think surveillance, early surveillance next year, is very crucial, both within the area and broader surveillance in a multi-State region.

Senator LIEBERMAN. Thank you. Thanks, again, for coming up for the hearing.

It strikes me what you are saying about the bird population. It really brings to life the old metaphor about the canary and the coal mine, doesn't it? We have an interest here not only in preserving the birds for their inherent value, but also they are a tremendous warning to us in terms of the potential danger.

Mr. MCLEAN. I would like to add to that. I would like to commend, actually, the public in this whole New York area, because they were so concerned about the birds, it really helped.

Senator LIEBERMAN. Yes.

Mr. MCLEAN. They found dead birds and turned them in, and there was a lot of concern.

Senator LIEBERMAN. Right.

Mr. MCLEAN. I guess New York City got 150,000 phone calls, and more than half were about birds.

Senator LIEBERMAN. Yes.

Mr. MCLEAN. So the public was very concerned about birds. And in this case, it was very helpful, from a public health standpoint.

Senator LIEBERMAN. Dr. Fish?

Dr. FISH. Senator Lieberman, yes, I think there is a really crucial role for the Centers for Disease Control in this. They are the lead Federal agency on these kinds of problems, and I think we need more leadership and they need more resources.

We have kind of a patchwork of local jurisdiction and local responsibility here of varying qualities, Connecticut having probably the best program, New York City having the worst. It is a mosaic of capabilities, and it is a regional problem. What happens in one municipality is going to affect the next. Mosquitoes do not respect political boundaries.

The CDC can show leadership, can put together a coordinated regional program to combat this virus, but they have got to do it now, immediately. I mean, we only have 5 months when we have to have a plan, an operational plan in place. Five months. And if you wrote a check out for CDC today, it would take them 4 months to figure out how to spend it.

Senator LIEBERMAN. I want to respond to that but I am going to give Commissioner Stahl—I would just really ask for a quick—what are the one, two, three things we should be doing now beyond what we have talked about in support for research and surveillance?

Ms. STAHL. I do apologize, by the way. I do not generally respond to those things, but we have—it was an issue that needed response.

Senator LIEBERMAN. Do not worry.

Ms. STAHL. I think we are really on target here. I think we cannot stop. We need to better refine our approach to deal with not only West Nile virus but other potential diseases that might come our way, so I agree that we need to stay vigilant.

I am delighted to hear about the coordination at the Federal level, because I think that is something that will serve us well, not only in this instance but in other instances as they may arise, and we need to always look toward the future.

With regard to CDC's role, I think that it is imperative that they continue to be a voice in this matter. Again, many of our decisions, there is much that we can do in preparation, but when push comes to shove and that first positive mosquito shows up in a trap, the decision is what do we do. We need a voice with credibility, integrity, and expertise to help us make those hard decisions. How do we weigh and measure the balances between application of pesticides, what kind of pesticides, how broadly, what is the risk from the mosquitoes, what is the risk from the pesticides. That, as well, is something that we have a great deal of expertise and experience with here at the State level.

It helps tremendously to have the voice of the CDC in making those determinations and taking those actions.

Senator LIEBERMAN. Thanks to all of you. For me this has been a very helpful informational exchange. I walk away both with a feeling that we ought not to panic, but that this is a serious problem here, and it is the kind of problem, because of the way in which we and goods and cargo are traveling, are going to continue to have for a good long time to come.

I am, in one sense, reassured by the response of the agencies here in the State this year and concerned and heartened also by some of the collaboration that you talked about going on at the

Federal level, but there is clearly more that has to be done, and I am going to think some about that, both in terms of trying to develop legislation or coalitions that will support additional resources from the Federal Government for the research and surveillance that you have talked about, and particularly to focus in on the Center for Disease Control and see what we can do in the immediate future to guarantee that the CDC is doing everything it can now in its role of national leadership and coordination to be taking preemptive steps to limit and impede the outbreak that we presume will happen next year and the years afterward.

So you have been real helpful in giving me some guidance as to what I can do to be helpful, as well.

I want to state again to people who are here, because I know there is broad public interest in this, that Elise Campaign—I have to run, but Elise Campaign, who is my chief staff person on this, will stay around. She is available to listen to you, but also to tell you exactly how you can file testimony that I promise you I will read and it will be part of the record as we go forward.

Again, thanks very much. If it seems appropriate, we will come back and do this again next spring.

Now I have this authority with this gavel brought specifically from Washington to officially adjourn the hearing.

Thank you.

[Whereupon, at 10:30 a.m., the committee was adjourned, to reconvene at the call of the Chair.]

[Additional statements submitted for the record follow:]

STATEMENT OF DURLAND FISH, PH.D., DEPARTMENT OF EPIDEMIOLOGY AND PUBLIC HEALTH, YALE SCHOOL OF MEDICINE

I would like to thank Senator Leiberman and Senator Smith for organizing this event and for their foresight in recognizing that the threat of West Nile virus and similar insect-borne diseases is as much of an environmental issue as it is a public health issue. The impact of insect-borne diseases upon human health, which in Connecticut includes Eastern equine encephalitis, Lyme disease, and now West Nile virus, have their origin in the environment. Mosquitoes, ticks and other parasites that feed upon human blood are products of the natural environment. Their biologies are inextricably linked to environmental conditions and climatic events that regulate their abundance. Viruses, bacteria and other infectious agents are also common elements of the natural environment and have an important role in regulating populations of both plants and animals. Such agents often play an essential role in the balance of nature.

Humans become involved in the natural cycle of environmental disease agents when they are exposed to pathogens either by direct contact with infected wildlife, as with rabies, or when they are bitten by a mosquito or tick that has previously fed upon an infected animal, as with West Nile virus or Lyme disease. Humans are bystanders in these environmental events, but the consequence of infection can be devastating, and even fatal. Such is the situation we are now facing with the threat of West Nile virus.

The introduction of a foreign insect-borne virus, never before seen in the Western Hemisphere is a public health threat unprecedented in modern times. It is reminiscent of the introduction of yellow fever and bubonic plague in past centuries. This event has three possible consequences: It could simply disappear and represent a kind warning from Mother Nature that there is more to come. It could establish itself and repeat the events of last summer. Or, it could explode into a raging epidemic that spreads far beyond the confines of New York and Connecticut. The preponderance of evidence suggests that West Nile virus is not going to go away by itself and therefore we must be prepared for the remaining alternatives.

We were woefully ill-prepared for this epidemic of West Nile virus. We were not aware of an epidemic until some 40 suspected cases filled New York City hospitals. We did not even know what virus was causing the epidemic until a month after people had already become ill and some had died. We did not know where the infected

mosquitoes were and, consequently, ten million people were exposed to pesticides in an attempt to control the epidemic by indiscriminate aerial spraying of the entire New York City metropolitan area, not just once, but twice. Our lack of preparedness was obvious and costly.

These events, as shocking as they may seem to the general public, were predicted and warned by the scientific community. Two reports from National Academy of Sciences warned of a decaying public health infrastructure, particularly in reference to insect-borne diseases. The first report, "Manpower Needs and Career Opportunities in the Field Aspects of Vector Biology" published in 1983, warned of a serious manpower shortage in the field of vector biology, the study of insects that transmit human diseases. This report was totally ignored by Congress and the responsible Federal agencies. Consequently there are now very few professionals in government or academic institutions with the appropriate knowledge and training to address the threat of insect-borne diseases. The second report, "Emerging Infections: Microbial Threats to Health in the United States" published in 1992, warned of the potential for the introduction of foreign pathogens and the degradation of public health infrastructure to combat such introductions. This report was taken more seriously by Congress and some Federal agencies, but the response has been neither adequate nor timely, as is evidenced by recent events with West Nile virus.

What must be done to prevent a recurrence of last summer's events and to prevent similar events from occurring in the future? In the short term, every conceivable effort must be made to prevent West Nile virus from re-emerging next spring. It is quite likely to survive the winter months, either in infected wildlife or within the millions of mosquitoes hibernating in buildings and tunnels in the New York City metropolitan area. Immediate efforts should be made to find and destroy any infected mosquitoes that may be now overwintering. Heroic efforts must be made next spring to find the virus in mosquitoes or wildlife and to focus mosquito control efforts on containing the virus before humans become infected. A preemptive strike on certain mosquito species known to be capable of transmitting the virus should be initiated early in the spring and directed at larval stage where environmental impact of insecticide usage would be minimal. Every conceivable effort must be made to control virus transmission early enough to prevent human infection and avoid the use of widespread aerial insecticide application to control an epidemic in humans. A repeat of last season's response must be avoided at all costs.

In the long term, we must strengthen the public health infrastructure to effectively and intelligently combat the threat of new and re-emerging diseases. If West Nile virus was a test of our response capabilities, we have failed miserably. Research is needed to better understand the human threat of infectious diseases that originate from the environment. This research should be interdisciplinary and include epidemiology, microbiology, entomology and, most importantly ecology. Government agencies responsible for the funding of peer-reviewed research on vector-borne diseases must be given increased resources to accomplish this goal. The training of a new breed of scientists, blind to interdisciplinary boundaries, and comprehensively trained both in the medical and environmental sciences should begin immediately in order to staff the increasing demand for expertise in government and academic institutions. Academic research institutions and government agencies at all levels should form working partnerships to integrate resources focusing upon this specific problem.

Epidemics of insect-borne disease are preventable. We have eliminated the threat of epidemic malaria, yellow fever, and bubonic plague in this country years ago, but we have left our guard down against the threat of new diseases, such as West Nile virus. Armed with new knowledge from academic research, and the will of responsible government agencies to refocus and integrate prevention efforts, we can regain our capacity to combat new disease threats from the environment and look forward to an improved quality of life in the next millennium.

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STATEMENT OF THEODORE G. ANDREADIS, CHIEF MEDICAL ENTOMOLOGIST,  
CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN, CT

I am here today to report you the research and surveillance activities that occurred in the State of Connecticut during the recent West Nile Virus (WNV) crisis. I will focus my comments on specific work that was done to isolate, identify and determine the distribution of the virus in birds and mosquitoes in the state. Let me begin by stating that since 1997, the State of Connecticut has had a comprehensive Mosquito Management Program to monitor mosquito populations and mosquito-borne viruses known to cause human disease, most notably eastern equine encephalitis (EEE). This program is a cooperative effort that involves three state agencies.

The Connecticut Agricultural Experiment Station (CAES), which is responsible for trapping and testing mosquitoes; the Department of Environmental Protection (DEP) which is responsible for implementing all mosquito control measures; and the Department of Public Health (DPH) which is responsible for communicating health risks and protective measures to the public. Mosquito trapping is conducted daily from June through October at 37 permanent locations (principally in freshwater swamps) throughout the state. Since 1997, we have trapped and tested over 150,000 mosquitoes and detected the EEE virus on 9 occasions from 6 different locations.

Because we had this surveillance system in place we at the CAES were able to respond immediately to the WNV crisis. On September 4, the New York City Health Department and the Centers for Disease Control (CDC) announced the death of an elderly resident of Queens from what was initially thought to be St. Louis Encephalitis, a mosquito transmitted virus. The following day (September 5) we placed mosquito traps in the town of Greenwich and began a supplementary mosquito-trapping program that was eventually extended to 15 towns throughout lower Fairfield and New Haven Counties. This was in addition to the normal trapping in other areas of the state. The purpose of this trapping was to determine the types of mosquitoes in the region, assess their relative abundance and to determine if these mosquitoes were carrying the potentially deadly virus and if they were did this represent a public health threat. Mosquito trapping was conducted over an 8 week period through the end of October during which 261 traps were placed in 80 different locations throughout the region and over 3,500 mosquitoes were trapped and tested in our laboratories.

Shortly after we initiated our mosquito surveillance program, we began to receive reports of an "extraordinary" number of crow deaths throughout lower Fairfield County. Similar crow die-offs were being observed in New York City, Long Island and New Jersey as well, and suspicion was rising that perhaps these crows were dying from the virus. However, this would be highly unusual, since St. Louis encephalitis does not typically kill birds. A plan was put into place to systematically collect and test dead crows. This was coordinated by the DPH with assistance from local health departments and wildlife personnel within the DEP. Birds were sent to the Department of Pathobiology at the University of Connecticut where necropsies were performed by veterinary pathologists. Brains and other tissues from crows that had diagnostic symptoms consistent with a viral encephalitis were then submitted to the CAES for testing. Over 300 birds were assessed from 38 towns through October 12 and 40 were tested in our laboratory for WNV.

On September 21 we obtained our first isolations of this virus from 2 different species of mosquitoes (*Aedes vexans* and *Culex pipiens*) that were trapped on the evening of September 14 at the Innis-Arden County Club in Old Greenwich, and from the brain of a dead crow collected in the town of Westport on September 13. This announcement was made by Governor Rowland who subsequently directed the DEP to initiate limited ground spraying of insecticides against adult mosquitoes in the affected areas.

The isolation of this virus from adult mosquitoes and the brain of a wild domestic crow, was a critical step in the eventual identification of the virus. Despite the increasing number of human cases that were being reported in NYC, the CDC had yet to obtain an actual isolation of the living virus from a human. We believe our isolations were the first from mosquitoes and a wild domestic crow. Following our announcement, we were immediately contacted by CDC who requested that we submit our isolations to them. We complied on September 23. The following day the CDC announced that the virus was not St. Louis encephalitis but was a "West Nile-like". Two days later they informed us that the viruses that we isolated from the mosquitoes and crow were the same.

We then proceeded to obtain specific reagents to test for WNV and initiated molecular studies to sequence a portion of the genome (RNA) of the virus with the intent of definitively identifying the virus, determining its possible origin and assessing its virulence for birds and humans. Early information which appeared in the British journal *Lancet* on October 9 from studies conducted at the University of California at Irvine had indicated that this virus was Kungin/WN-like virus which occurs in Australia. However, their analysis was incomplete and our genetic analysis showed a much closer relationship to WNV that had been isolated from mosquitoes and humans during a recent outbreak in 1996 in Romania thus suggesting a common origin. The results of our investigations are due to be published in the journal *Science* later this week.

Bird testing continued through mid-October and of the 40 birds that we tested, 29 were found to be positive for WNV. These included 28 American crows and one Cooper's Hawk that were collected from 18 towns in lower Fairfield and New Haven Counties along a 62-mile corridor from Greenwich to Madison, CT. No virus isola-

tions were made from 3 crows and a Canadian goose collected from Hartford County.

Our isolations of West Nile virus from birds and mosquitoes conclusively documented the presence of this virus in Connecticut during September and October 1999 and virus activity appeared to be limited to lower Fairfield and New Haven Counties. All of the work that I have described was accomplished in State with no assistance from the CDC or any other Federal Agency. Our timely coordinated response in trapping and testing mosquitoes and birds provided indispensable data that was effectively used to inform and protect the public and fortunately, no human cases were reported in Connecticut.

The high mortality in crows and other bird species in the region suggest a recent introduction of WNV into a native wildlife population that has never been exposed to the virus. The isolation of WNV from a variety of native birds, which are likely capable of circulating this virus at relatively high titers over a broad geographic region, further suggests that this exotic virus is likely to become established in the avian fauna of the United States. How the virus will behave is unknown but if established in North America, WNV likely will continue to have severe effects on human health, horses, and on avian populations, such as American crows and raptors. The environmental, social and economic implications of permanent establishment of this exotic virus are considerable.

While many important questions need to be investigated, among the most urgent include: Will the virus persist in the region? How widespread will it become? What impact will the virus have on native bird and horse populations? How will the virus affect humans? How will the virus over winter? How will we monitor virus activity to protect the public? What birds will serve as natural reservoir hosts? What mosquito species will serve as competent vectors?

Additional resources and funding are urgently needed to address these and other research questions. This will lead to a better understanding of the natural ecology and epidemiology of this new exotic virus in North America. This information will provide critical fundamental knowledge that is presently unknown. This will be an essential component for developing effective virus surveillance, disease management and mosquito control strategies throughout the region. The information obtained in these studies will further aid in assessing the relative risk of WNV to human health and help to determine its impact on wildlife and domestic animals. We would further anticipate that increasing our knowledge in the aforementioned areas will reduce the need for application of toxic chemical insecticides to the environment.

We are at a very critical juncture and we stand ready to act. We have the expertise and laboratory facilities to undertake these investigations. We have initiated studies on overwintering mosquitoes and wild bird populations and with additional funding we can increase our mosquito surveillance program, continue our basic research on bird populations and continue our molecular studies to develop a rapid procedure for identification of the WNV.



*THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION*

**1999 EMERGENCY MOSQUITO AND BIRD TESTING PROGRAM FOR WEST NILE VIRUS IN CONNECTICUT**

**MOSQUITO TRAPPING AND TESTING IN FAIRFIELD AND NEW HAVEN COUNTIES**

- DATES: September 5 - October 28, 1999
- NO. MOSQUITOES TRAPPED AND TESTED: 3,527
- NO. WEST NILE VIRUS ISOLATES: 2  
*Aedes vexans* – Sept. 13, Greenwich  
*Culex pipiens* – Sept. 13, Greenwich
- NO. TRAPS SET: 261
- NO. TOWNS: 15  
 Bridgeport, Darien, Fairfield, Greenwich, Milford, New Canaan, Newtown, Norwalk  
 Redding, Ridgefield, Stamford, Stratford, Weston, Westport, Wilton

**BIRD TESTING IN CONNECTICUT**

DATES: September 13 – October 12, 1999

- NO. BIRDS TESTED: 40
- NO. BIRDS POSITIVE FOR WNV: 29  
 28 Crows  
 1 Copper's Hawk
- NO. TOWNS WITH INFECTED BIRDS: 18  
*Fairfield County:* Bridgeport, Darien, Fairfield, Greenwich, New Canaan, Norwalk  
 Redding, Stamford, Stratford, Weston, Westport, Wilton  
*New Haven County:* East Haven, Hamden, Madison, Milford, New Haven, North  
 Haven



*THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION*

**MOSQUITO TRAPPING AND TESTING FOR WEST NILE VIRUS IN  
FAIRFIELD COUNTY**

**September 5 - October 28, 1999**

TOTAL NO. MOSQUITOES TESTED: 3,527

TOTAL NO. WNV ISOLATIONS: 2

*Aedes vexans*

*Culex pipiens*

Species	No. Trapped	WNV Isolates
<i>Ae. canadensis</i>	1	0
<i>Ae. cantator</i>	66	0
<i>Ae. cinereus</i>	182	0
<i>Ae. japonicus</i>	19	0
<i>Ae. sollicitans</i>	109	0
<i>Ae. taeniorhynchus</i>	123	0
<i>Ae. triseriatus</i>	28	0
<i>Ae. trivittatus</i>	133	0
<b><i>Ae. vexans</i></b>	<b>1,762</b>	<b>1</b>
<i>An. punctipennis</i>	82	0
<i>An. quadrimaculatus</i>	4	0
<i>An. walkeri</i>	2	0
<i>Cq. perturbans</i>	15	0
<i>Cx. erraticus</i>	4	0
<b><i>Cx. pipiens</i></b>	<b>782</b>	<b>1</b>
<i>Cx. restuans</i>	28	0
<i>Cx. territans</i>	1	0
<i>Cs. melanura</i>	77	0
<i>Cs. morsitans</i>	1	0
<i>Ps. ferox</i>	4	0
<i>Ur. sapphirina</i>	104	0
<b>TOTAL</b>	<b>3,527</b>	<b>2</b>





*THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION*

**BIRD TESTING FOR WEST NILE VIRUS**

**September 13 – October 12, 1999**

TOTAL NO. BIRDS TESTED: 40

TOTAL NO. BIRDS POSITIVE FOR WNV: 29

28 Crows

1 Copper's Hawk

Accession #	Species	Date Collected	Town of Origin	Virus Isolation
6337	Crow	9-13	Westport	WNV
6543-1	Crow	9-22	Greenwich	WNV
6534-2	Crow	9-22	Greenwich	NEGATIVE
6534-5	Crow	9-23	Greenwich	WNV
6534-6	Crow	9-23	Greenwich	WNV
6560-1	Crow	9-23	Stamford	WNV
6560-2	Crow	9-24	Stamford	WNV
6560-3	Warbler	9-23	Stamford	NEGATIVE
6560-4	Crow	9-22	Stamford	WNV
6560-5	Crow	9-23	Stamford	WNV
6560-6	Crow	9-23	Stamford	WNV
6569-4	Crow	9-24	Fairfield	WNV
6569-5	Crow	9-24	Fairfield	WNV
6569-6	Crow	9-24	Fairfield	WNV
6569-7	Crow	9-24	Fairfield	WNV
6635-1	Crow	9-29	Norwalk	WNV
6635-17	Crow	9-29	New Canaan	WNV
6635-21	Crow	9-29	North Haven	WNV
6635-22	Crow	9-29	Redding	WNV
6635-19	Crow	9-29	Woodbridge	WNV
6635-24	Crow	9-29	Darien	WNV
6635-30	Crow	9-29	Orange	NEGATIVE
6635-45	Finch	9-29	Branford	NEGATIVE
6651-1	Crow	9-29	New Haven	WNV
6651-2	Crow	9-29	New Haven	WNV
6651-3	Crow	9-29	New Haven	WNV
CAES	Copper's Hawk	9-25	East Haven	WNV

MOSQUITO ARBOVIRUS SURVEILLANCE IN CONNECTICUT, 1998

(By Theodore G. Andreadis and John F. Anderson)

INTRODUCTION

In 1997, the State of Connecticut established its first comprehensive arbovirus surveillance program as part of a state-wide Mosquito Management Program

(Andreadis, 1997; Capotosto, 1997). The program relies on the trapping and testing of mosquitoes for eastern equine encephalitis (EEE) and other arboviruses at 37 locations throughout the State. Locations include fresh water swamp sites (mostly red maple/white cedar) known or suspected to support mosquito populations that have historically tested positive for EEE, are capable of supporting such populations, or are proximate to locations where EEE-related equine or emu deaths have occurred. The results of the second full year of this program are presented herein.

#### MATERIALS AND METHODS

*Mosquito Collections.* Thirty-six of the 37 permanent locations identified in 1997 (Andreadis, 1997) were again selected to trap mosquitoes for virus testing. Due to low trap catches in 1997, the Stamford site was eliminated. One additional site in Waterford (Waterford Country School), where 3 EEE-related emu deaths occurred in 1997, was added. Trapping was conducted from June 1 through October 23 with CO<sub>2</sub>-baited CDC miniature light traps. Traps were routinely set once every 10 days at each location on a regular rotation. One trap per site per night was used. Mosquitoes were transported live to the laboratory where they were immediately frozen on dry ice and then identified microscopically on a chill table using the keys of Carpenter and LaCasse (1955), Darsie and Ward (1981) and Means (1979, 1987). Specimens were pooled by species, site, and collection date. The number of mosquitoes per pool was  $\leq 50$ . Specimens were stored at  $-80$  degrees C.

*Virus Assays.* All of the virus isolation work was conducted in a newly renovated laboratory at the Connecticut Agricultural Experiment Station using the same protocols established at the Arbovirus Research Laboratory at Yale University in 1997. In most cases, mosquitoes were processed for virus the day after collection.

Each frozen mosquito pool was homogenized in phosphate buffered saline containing 0.5 percent gelatin, 30 percent rabbit serum, antibiotic, and antimycotic. The homogenate was centrifuged for 10 min at 520 g to clear the mixture of mosquito debris. A 0.1-ml aliquot of each supernatant then was inoculated into a 25-cm<sup>2</sup> flask containing a monolayer of Vero cells and incubated at 37 degrees C in 5 percent CO<sub>2</sub> for up to 7 d (Tesh et al., 1992). One uninoculated flask was kept as a negative control. The remainder of the supernatant was stored at  $-70$  degrees C.

Flasks were examined daily for cytopathic effect. If cytopathic effect was noted, the cells were scraped from the flask and a cell lysate antigen was prepared (Ansari et al., 1993). Isolates were identified by enzyme immunoassay using reference antibodies that were prepared in mice and provided by the World Health Organization Center for Arbovirus Research and Reference, Yale Arbovirus Research Unit,

Department of Epidemiology and Public Health, Yale University School of Medicine. These included: Cache Valley (CV), EEE, Highlands J (HJ), Jamestown Canyon (JC), La Crosse, and St. Louis encephalitis virus antibodies. Positive and negative control cell lysates were included in each test. Highlands J and eastern equine encephalitis antibodies crossreact in the enzyme immunoassay, but were distinguishable on the basis of titer.

#### RESULTS AND DISCUSSION

*Mosquito Collections.* A total of 66,383 female mosquitoes, representing 28 species and 8 genera were collected, identified and tested for arboviruses. This represented over 20,000 more mosquitoes than in 1997. The increased numbers were attributed to the excessive amount of rainfall the region received in June that resulted in increased numbers of flood-water *Aedes*, *Anopheles* and *Culex* spp. The most abundant species were *Coquillettidia perturbans*, *Aedes canadensis* and *Culiseta melanura*. Thirteen additional *Aedes* species were collected, among which, *Aedes trivittatus*, *Aedes cinereus*, and *Aedes vexans* were the most numerous. *Aedes abserratus* was the most frequently caught univoltine "snow pool" *Aedes*. *Culex pipiens* and *Culex restuans* were equally abundant, and relatively large numbers of *Anopheles punctipennis* and *Uranotoenia sapphirina* were trapped.

*Eastern Equine Encephalitis.* Increased EEE virus activity was seen in 1998. Eight isolations from four different mosquito species in five locations were obtained. The first EEE isolations were made on September 29 from two pools of *Ae. vexans* and *Cs. melanura* mosquitoes trapped at Barn Island in Stonington (New London County). In response to this, a Phase II: Public Health Alert of the State Contingency Plan for Eastern Equine Encephalitis was implemented. Pesticide applications (truck-mounted ULV) were ordered by the Governor and subsequently implemented by the Department of Environmental Protection (DEP) in the affected region. Additional traps were set and no further EEE isolations were made at that specific location.

Six more EEE isolations were obtained from mosquitoes collected on October 6 and 7 from four widely scattered locations in Chester (Middlesex County), Newtown, Ridgefield (Fairfield County) and Voluntown (New London County). A Phase II Public Health Alert with pesticide spraying by the DEP was similarly implemented at Cockaponset State Forest in Chester due to the isolation of the virus from two species of human-biting mosquitoes *Be. canadensis* and *An. punctipennis*. However, because the virus was limited *Cs. melanura* in Newtown, Ridgefield and Voluntown, a Phase I Public Health Notification (no pesticide sprays) was implemented in those regions. No further EEE isolations were made from mosquitoes that were collected in additional traps that were set in any of the four locations.

Five equines with clinical symptoms consistent with EEE infection were tested. Specimens were obtained from the Connecticut Diagnostic Laboratory, Department of Pathobiology, University of Connecticut. EEE virus was isolated from the brain of a donkey that had died on October 16 in Canterbury. The animal was housed in an open barn surrounded by a wetland swamp. Previous history suggests the animal contracted the infection at this location which was approximately 3.7 miles from the trap site in Plainfield. No EEE isolations were made from any other the other four animals.

Results obtained in 1998 once again reinforce the highly focal nature of EEE which can be limited to mosquitoes and birds in a single swamp. The isolation of EEE from mosquitoes collected in Newtown and Ridgefield are particularly noteworthy as this area of the State has historically been considered to be at low risk for EEE. However, our findings now suggest that the EEE virus may be more widespread than had been previously thought. The isolation of EEE from mosquitoes in Stonington for three consecutive years (Andreadis, 1997; Andreadis et al., 1998) suggests that this region of the State is a focal center for the virus. The deaths of the donkey in 1998 and the 3 emus in 1997 clearly indicate that the present strain of EEE in Connecticut is a potentially serious public health threat and further emphasize the need for continued trapping and testing of mosquitoes in all areas of the State.

*Highlands J.* Twenty-three isolations of HJ virus were obtained from nine species of mosquitoes: *Cs. melanura* (10), *Cs. morsitans* (3), *Ae. canadensis* (3), *Ae. vegans* (2), *Ae. stimulans*, *Ae. triseriatus*, *An. punctipennis*, *Cx. pipiens* and *Cx. restuans*. These mosquitoes were collected from nine different locations in five towns (Ledyard, Lyme, North Stonington, Stonington and Voluntown) all of which were located in the southeastern corner (New London County) of the State. Both the number and geographic location of these isolates were similar to results obtained in 1997. The first isolation was made on August 5 and the last on October 15. Highlands J virus isolations were made in only two (Stonington and Voluntown) of the five locations where EEE was isolated, once again calling to question its usefulness as a reliable predictor of pending EEE activity in Connecticut.

*Cache Valley.* Twenty-two isolations of CV virus were made from seven species of mosquitoes (*An. punctipennis*, *An. quadrimaculatus*, *An. walker*), *Ae. canadensis*, *Ae. cinereus*, *Cq. perturbans* and *G. melanura*) collected in 13 towns throughout all regions of the State, from August 19 through September 17. More than half (14) of these isolations were obtained from *An. punctipennis*. This represents only the second isolation of this virus from Connecticut mosquitoes. The first isolation was made in 1979 from *Ae. triseriatus* (Calisher et al., 1986). This virus has been isolated from at least six genera of mosquitoes and is now recognized as the most widely spread Bunyamwera serogroup virus in North America, occurring in much of North America except the extreme southeastern States and southern Mexico (Calisher et al., 1986). Cache Valley virus has been isolated from large wild and domestic animals and has been associated with congenital malformations in sheep. In 1995, CV virus was isolated from a 28-year old male residing in North Carolina and presenting with severe encephalitis and multiorgan failure that ultimately resulted in death (Sexton et al., 1997). The broad distribution and relatively high prevalence of CV virus in mosquitoes known to feed on humans in Connecticut suggest wide spread exposure of humans to this virus which may be an etiology of unknown disease.

*Jamestown Canyon.* Six isolations of JC virus were obtained from four species of mosquitoes (*Ae. canadensis*, *Ae. stimulans*, *Ae. trivittatus* and *An. punctipennis*) collected in four widely distributed towns in four counties (Fairfield, Litchfield, Middlesex and New London) from June 25 through August 3. Three of the six isolations were made from *Ae. trivittatus*. These results were similar to those obtained in 1997 where seven isolations from five mosquito species were made from June 30-July 14 (Andreadis, 1997). Results obtained from this and other studies on mosquitoes (Andreadis et al., 1994) and white-tailed deer (Zamparo and Andreadis, 1997), indicate that JC virus is widely distributed throughout the State and appears to be mostly vectored by early summer *Aedes* mosquitoes.

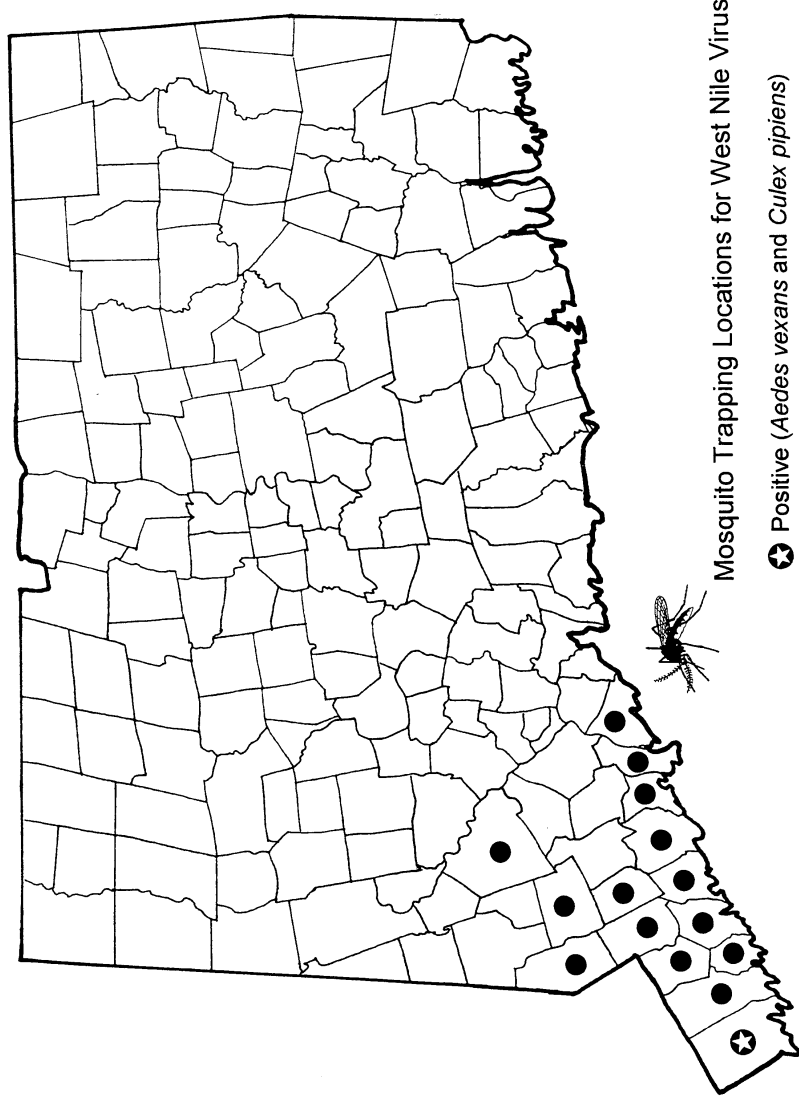
## ACKNOWLEDGMENTS

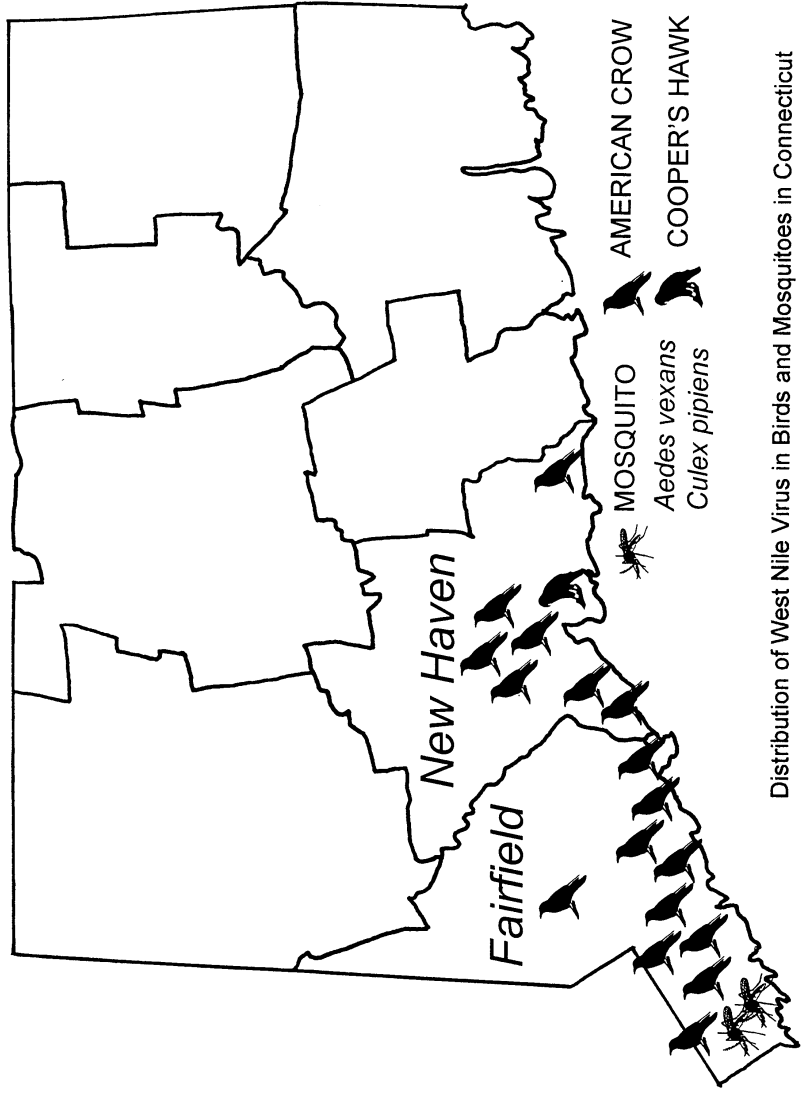
We wish to acknowledge the assistance of John Shepard, Jodi Corriea, Bonnie Harnid, Colleen Scott, Susana Cantu, J.R. Dubicki, Ronald Ferrucci Arwen Mohr, John Russo, Kristina Steiff (The Connecticut Agricultural Experiment Station); Shirley Tirrell-Peck (Yale University); and Lt. David Florin (U.S. Navy).

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86719 (caes)	Crow	9-29	Weston	WNV
6566-99 (#2)	Crow	9-24-99	Stratford	WNV
6567-99 (#1)	Crow	9-24-99	Milford	WNV
6571-99 (#2)	Crow	9-24-99	Bridgeport	WNV
6713-99 (#1)	Crow	10-1-99	Wallingford	NEGATIVE
6715-99 (#1)	Crow	10-1-99	Wethersfield	NEGATIVE
6754-99 (#1)	Turkey	10-4-99	Hamden	NEGATIVE <sup>1</sup>
6755-99 (#1)	Crow	10-4-99	Hamden	WNV
6803-99 (#2)	Canada goose	10-6-99	Storrs	NEGATIVE
6816-99 (#2)	Pidgeon	10-6-99	West Haven	NEGATIVE
6848-99 (#1)	Crow	10-7-99	Bloomfield	NEGATIVE
6894-99 (#2)	Crow	10-12-99	Hartford	NEGATIVE
6895-99 (#1)	Crow	10-12-99	Madison	WNV





Distribution of West Nile Virus in Birds and Mosquitoes in Connecticut

Table 1. Total Number Mosquitoes Trapped and Tested for Arboviruses in Connecticut, 1998

Mosquito species	No. Mosquitoes	No. Pools	No. Virus Isolations			
			EEE	HJ	CV	JC
<i>Aedes abserratus</i>	1,379	79				
<i>Aedes atropalpus</i>	1	1				
<i>Aedes aurifer</i>	494	54				
<i>Aedes canadensis</i>	14,005	503	1	2	1	1
<i>Aedes cantator</i>	134	31				
<i>Aedes cinereus</i>	5,645	341			3	
<i>Aedes communis</i>	119	12				
<i>Aedes excrucians</i>	301	47				
<i>Aedes sollicitans</i>	13	11				
<i>Aedes sticticus</i>	1,033	81				
<i>Aedes stimulans</i>	539	87		1		1
<i>Aedes taeniorhynchus</i>	8	3				
<i>Aedes triseriatus</i>	406	144		1		
<i>Aedes trivittatus</i>	5,848	225				3
<i>Aedes vexans</i>	1,981	213	1	2		
<i>Anopheles punctipennis</i>	1,644	275	1	1	14	1
<i>Anopheles quadrimaculatus</i>	194	51			1	
<i>Anopheles walkeri</i>	386	75			1	
<i>Coquilleltidia perturbans</i>	15,946	485			1	
<i>Culex pipiens</i>	4,334	256		1		
<i>Culex restuans</i>	3,133	236		1		
<i>Culex salinarius</i>	10	6				
<i>Culex territans</i>	16	14				
<i>Culiseta melanura</i>	6,441	398	5	10	1	
<i>Culiseta morsitans</i>	708	130		3		
<i>Orthopodomyia signifera</i>	2	2				
<i>Psorophora ferox</i>	355	53				
<i>Uranotaenia sapphirina</i>	1,308	168				
TOTALS	66,383	3,981	8	23	22	6

Table 2. Locations of Arbovirus Isolations Made From Mosquitoes in Connecticut, 1998

Town	Location	No. Mosquitoes	No. Virus Isolations			
			EEE	HJ	CV	JC
Barkhamsted	Hoyt Hayes Swamp	633				
Bethany	Bethany Bog	288				
Canaan	Robin's Swamp	9,237			1	2
Chester	Cockaponset St. For.	3,813	3			
Cornwall	Mohawk Pond	2,166				
Cromwell	Cromwell Meadows	3,173			3	
Fairfield	Catamount Rd.	872				
Farmington	Shade Swamp	4,243			1	
Franklin	Wildlife Refuge Area	2,483			1	
Groton	U. S. Sub Base	711				
Haddam	Little City Rd.	172			1	
Hampton	Fiske Rd.	1,338			1	
Killingworth	Chittenden Rd.	699				1
Ledyard	Cedar Swamp	1,736		1	1	1
Litchfield	White Memorial	1,942			1	
Lyme	Cedar Lake	1,069		1		
Madison	Rt. 80 Cedar Swamp	586				
Newtown	Key Rock Rd.	2,536	1			1
New Canaan	Hoyts Swamp	2,875				
North Stonington	Assekong Swamp	596				
	Bell Cedar Swamp	2,313		3		
	Exit 93	957		6		
	Pawcatuck River	2,141		1		
	Wyassup Lake	1,546		1	1	
Old Lyme	Great Island	3,583				
Plainfield	Cedar Swamp	1,584			5	
Redding	Lyons Swamp	369			1	
Ridgefield	Great Swamp	468	1		2	
Stonington	Barn Island	1,156	2	8		
	High School	2,690		1		
Stafford	Nipmuck St. Forest	477				
Tolland	Bolton Lake	1,581				
Voluntown	Mt. Misery	2,300	1	1		
Waterford	Country School	446			1	1
	Great Neck	2,418		1		
Windam	Bass Rd.	738		1	2	
Willington	Pinney Hill Rd.	448				
TOTALS		66,383	8	23	22	6



**Table 3. Eastern Equine Encephalitis Virus Isolations from Mosquitoes in Connecticut, 1998**

Date	Town	Location	Mosquito Species	Pool size
September 29	Stonington	Barn Island	<i>Ae. vexans</i>	23
			<i>Cs. melanura</i>	15
October 6	Voluntown	Mt . Misery	<i>Cs. melanura</i>	5
October 7	Chester	Cockaponset	<i>Ae. canadensis</i>	3
			<i>An. punctipennis</i>	1
			<i>Cs. melanura</i>	2
October 7	Newtown	Key Rock Rd.	<i>Cs. melanura</i>	3
October 7	Ridgefield	Great Swamp	<i>Cs. melanura</i>	1

**Table 4. Equine Testing for Eastern Equine Encephalitis Virus in Connecticut, 1998**

Date	Town	Breed	Tissue	Results
September 18	Marlborough	Horse	Brain	Negative
October 16	Canterbury	Donkey	Brain	Positive
October 28	Canterbury	Thoroughbred	Brain	Negative
October 28	Woodbury	American Quarter Horse	Brain	Negative
November 17	Lebanon	Appaloosa	Brain	Negative

STATEMENT OF ROBERT G. MCLEAN, DIRECTOR AND SUPERVISORY BIOLOGIST,  
NATIONAL WILDLIFE HEALTH CENTER, U.S. GEOLOGICAL SURVEY, MADISON, WI

Thank you for inviting me to provide information on the involvement of wildlife species and the impact on wildlife populations related to the emergence of West Nile virus in the United States. I will also provide information on the activities and efforts of the U.S. Geological Survey National Wildlife Health Center to investigate the wildlife aspects of this virus which has been recently identified in the United States.

#### *Background Information*

I am the Director of the USGS National Wildlife Health Center in Madison, Wisconsin, which provides Federal and state resource management agencies across the nation with information, technical assistance, and research on national and international wildlife disease and health issues. Our Center monitors disease and assesses the impact of disease on wildlife populations; defines ecological relationships leading to the occurrence of disease in free ranging wildlife; provides on site investigation and control for wildlife disease emergencies; and provides guidance, train-

ing, and technical information for reducing wildlife losses when outbreaks occur. Current investigations include the causes of deformities and disease in amphibians; tumors in green sea turtles; the mysterious eagle mortality in Arkansas and elsewhere; and management strategies to control avian botulism and avian cholera in migratory waterfowl. Major studies are underway at the Salton Sea in California.

The staff provides technical support, knowledgeable guidance, and timely intervention to wildlife managers who are regularly confronted with sick and dead wild animals, frequently on a large scale. Due to the mobility of wildlife and the potential for the spread of disease, timely and accurate determination of the causes of wildlife illness and death is a prerequisite to achieving effective disease control and prevention. The expertise and resources of our disease diagnostic laboratory are crucial in providing this rapid response to wildlife mortality events.

#### *West Nile Virus Background*

The West Nile virus (WNV) is a mosquito-borne virus belonging to the Flavivirus taxonomic group that also includes St. Louis encephalitis virus, Kunjin virus, Murray Valley encephalitis virus, and others. These viruses are structurally and genetically similar making them difficult to separate by traditional virological and serological procedures. West Nile virus was first isolated in the West Nile district of Uganda in 1937 and subsequently isolated in Egypt in the early 1950's. The normal distribution of West Nile virus is Africa, the Middle East, western Asia, and Europe. In September, investigators discovered West Nile virus in the New York City area. This is the first known occurrence of this virus in the Western Hemisphere.

West Nile Virus can infect a wide variety of vertebrate animals, but birds are the primary natural hosts for this virus. It can be transmitted from birds to other birds and animals, including humans, through the bite of mosquitoes. Human epidemics were first recorded in Israel during 1950–1954 and later in parts of Africa and Europe. An epidemic occurred in Volgograd, Russia, during the summer of 1999. The virus usually produces either asymptomatic infection or mild fever in humans, but WNV has not been documented to cause epizootics (epidemics) in birds throughout its known geographic range. Natural antibody to WNV was commonly found in crows and other birds in Africa and Israel suggesting asymptomatic or mild infection usually occurs in those regions. St. Louis encephalitis virus in the United States commonly infects wild birds which can become reservoirs for the virus, but are normally not harmed by it. Therefore, the disease in birds in the New York area producing high mortality in crows and other bird species is unusual for these viruses suggesting that this introduced West Nile virus is more virulent to the native bird species or represents a new virulent strain of the virus. Resident and migratory birds may play an important role in natural transmission cycles of this virus and in maintaining the virus in the United States. Migratory birds could also disseminate the virus to new states outside of the New York City area. Enhanced monitoring through surveillance for early and rapid detection of WNV in those states outside of the affected area will be important to guide prevention measures.

#### *Current Status of West Nile Virus in the United States*

West Nile virus infection has been detected in humans in the New York City area only; in mosquitoes in New York, Connecticut, and New Jersey; and in birds (mostly crows) in New York, Connecticut, New Jersey, and one crow in Baltimore, Maryland. Birds testing positive for the virus have been reported almost entirely from within about a 50-mile radius of the initial affected area in New York City except for one crow from upstate New York, one from southern New Jersey, and the crow from Maryland. As of November 5, 1999, 392 birds have been tested for WNV by the Centers for Disease Control and Prevention (CDC) and 192 were positive. The virus has infected 18 species of birds, including exotic and native birds at zoos, and about four species of mosquitoes. Mortality from the virus has been predominantly in American and fish crows. Bird mortality has been reported in multiple states in the region and may represent thousands of birds. The finding of the infected crow in Maryland extends the affected area a considerable distance southward. It is unknown if this crow was infected in the New York City area and moved to Baltimore before it died or if it was infected locally in Maryland. USGS and CDC have increased sampling of wildlife in that area in cooperation with the Maryland and Delaware wildlife agencies to determine if local transmission has occurred. Enhanced wildlife surveillance for detection of West Nile virus by USGS, CDC, U.S. Department of Agriculture (USDA), and other agencies is continuing and will expand to other Atlantic and Gulf Coast states. These agencies are continuing to collaborate on enhanced surveillance and what specific surveillance methods are needed for each region.

Efforts are underway by CDC to determine the source of the virus by conducting molecular comparisons with known strains from other continents. Several Federal and state agencies and private groups, including USGS are searching for stored human and animal specimens to test for West Nile virus or antibody to determine if the virus was present before 1999.

Results from these investigations should provide more insight into how, where, and when the virus was introduced.

*Additional Research Needed for Wildlife*

Additional wildlife research is needed to determine the principal wildlife host species of West Nile virus in the U.S., and to determine if wildlife species can maintain the virus in New York and other states and serve as an overwintering source for resurgence next summer. We need to determine the best wildlife species to be used as sentinels for detection of West Nile virus activity in surveillance programs. We need to determine the current distribution of the virus in bird populations in the eastern U.S., and if the virus distribution has been expanded by migratory birds. We want to know the impact of West Nile virus on bird populations, particularly for the American and fish crow species and to determine the susceptibility of other native wildlife species to this virus. Finally, we need to determine if threatened and endangered species and zoo animals can be protected from exposure and infection.

*USGS Collaboration and Interaction with Other Agencies*

USGS regularly interacts with other Federal and state agencies in providing diagnostic assistance and consultations on wildlife diseases nationwide. That interaction brought our lab into the West Nile virus investigation when we were asked to provide diagnostic assistance on crow mortality to the New York State Department of Environmental Conservation. I was personally contacted early in the outbreak for information and advice because of my expertise in avian mosquito-borne diseases, specifically St. Louis encephalitis. I also have experience from working with three of the Federal agencies involved in the investigation. USGS and CDC quickly established collaborative efforts to investigate the avian aspects of West Nile virus in the New York City area. This effort led to increased collaboration with CDC on multi-state surveillance for detection of the virus in birds. USGS later established further surveillance efforts with USDA's Wildlife Services and Veterinary Services. We increased our cooperative interactions with state agencies. We are using their staff to assist with bird sample collections. We are providing increased diagnostic support and an avian pathologist to assist at the New York state laboratory.

USGS was successful in establishing and maintaining these collaborations and cooperative efforts with the Federal and state agencies and they are working well. The combined expertise and resources of each agency are complementary to each other. This combined investigation by three Federal agencies will far exceed any effort that could have been accomplished alone by any one of the agencies. This completes my statement. I will be pleased to answer any questions you may have.

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STATEMENT OF JANE K. STAHL, DEPUTY COMMISSIONER, CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION

Good morning. My name is Jane Stahl and I am the Deputy Commissioner of Environmental Protection here in Connecticut. I'd like to thank the Committee for this opportunity to discuss the State's mosquito management program and its interest in this issue.

The mosquito issue in Connecticut has generally had two components: one the nuisance factor and, two, the thankfully never realized human health issues associated with mosquito-borne disease. Until this past season, the disease of concern has been Eastern Equine Encephalitis (EEE); and as we are here today to recognize, we now need to be similarly concerned about West Nile or a West Nile-like Encephalitis (WNV). Recent findings notwithstanding, it is still fair to say that the risk of EEE or WNV transmission to humans is low. However, we need to review our understanding of that risk, evaluate our approach to comprehensive mosquito surveillance and control, and adjust our program as necessary.

Organized mosquito control in Connecticut began in 1902 in response to hundreds of malaria cases reported from many coastal communities. The program was part of the Connecticut Agricultural Experiment Station (CAES) in New Haven. Operational control of mosquitoes consisted of hand ditching of tidal wetlands for drainage and application of pesticides and oils to kill mosquito larvae. Systematic "grid-ditching" climaxed in the early 1930's with the formation of the Civilian Conservation Corps. Some 90 percent of original Atlantic coast tidal wetlands from Maine to Virginia were altered in this fashion.

The virus that causes Eastern Equine Encephalitis (EEE) was first identified in 1938 in Massachusetts, although horse and human deaths in the region symptomatic of this disease had occurred prior to the isolation of this virus. Outbreaks of EEE have occurred sporadically among horses and domestic pheasants in Connecticut since 1938 but no human cases have ever been confirmed. In 1949, the mosquito control responsibilities were transferred to the Department of Public Health (DPH) primarily to maintain the tidal grid ditch network. With the advent of environmental awareness in the 1970's and 1980's, mosquito control evolved into a more natural resource oriented, interdisciplinary program coordinated with wetland and watercourse management. Because of this progressive approach to mosquito management, when in 1993 the Mosquito and Vector Control Section was eliminated from the DPH due to budgetary constraints, it was transferred to the Department of Environmental Protection (DEP) to function as a wetlands restoration unit. In 1996, with the identification of high incidence of EEE in human-biting mosquitoes in southeastern Connecticut, the DEP along with the Connecticut Agricultural Experiment Station (CAES) and DPH responded on an emergency basis. The following legislative session under the leadership of Governor Rowland and then Commissioner Holbrook, state funds were appropriated to institute and support the current Mosquito Management Program.

*Connecticut's Approach to Mosquito Management*

The state's Mosquito Management Plan is a public health-based monitoring and management collaboration involving the DEP, the CAES, and the DPH, which includes the systematic monitoring of mosquito breeding populations; monitoring the prevalence of disease within those populations; application of pesticides to control populations; communication and provision of technical assistance to municipalities regarding mosquito control. The program is coordinated by the DEP which is responsible for the systematic identification and monitoring of mosquito breeding sites, the provision of technical assistance to municipalities and private property owners regarding mosquito control, and the collection and communication of information and data. Long term mosquito breeding site management occurs through DEP's wetland restoration program.

The CAES, in consultation with DEP, identifies the locations for traps, conducts the trapping, identifies mosquitoes by species and conducts arbovirus testing. Trapping has been conducted in areas known or suspected to support mosquito populations which have historically tested positive for EEE, are capable of supporting such populations, or are proximate to locations where EEE-related horse deaths have occurred. Additional trap sites were established this past season in response to the identification of WNV and will inform the identification of additional trap sites this coming season.

The DPH reviews all mosquito test data and consults with the DEP and CAES regarding the epidemiological significance of such results. Based upon its evaluation of the potential human health risks, DPH advises as to appropriate personal, municipal, and state actions to reduce such risks. DPH also maintains direct communication with local health directors and the state veterinarian as necessary to evaluate and advise on mosquito borne disease issues. This season, DPH played an active and invaluable role as the State's liaison with neighboring state's health departments as well as the CDC.

*Increased efforts in response to West Nile virus*

This summer when human cases of West Nile virus were detected in New York City, the Mosquito Management team immediately responded. Working together and guided by our Eastern Equine Encephalitis Contingency Plan, with ad hoc modifications based upon the breaking revelations of the new virus, this team

- identified and implemented the strategic deployment of additional mosquito traps to augment existing traps and track the existence of this mosquito borne virus in lower Fairfield County;
- determined appropriate locations and methods of spraying adulticide and applying larvicide to control mosquito populations while minimizing any adverse impacts of pesticide application;
- conducted the spraying of a low toxicity, narrow band pesticide specifically targeted to mosquitoes and sprayed to maximize reduction of potential reservoirs of virus;
- established an effective communications system with all local officials simultaneously to advise and consult on all actions affecting their communities and to effectuate communication with the public;
- maintained continuous communication with the Federal Centers for Disease Control (CDC) and neighboring state officials;

- established a protocol for the collection and sampling of dead birds associated with the virus

It is important to note that because we had an existing monitoring and surveillance program already in place, we were able to be responsive rather than reactive. We relied on the data provided by the additional population monitoring to guide our decision as to where to conduct spray operations to provide the most control with the least risk to human health. Moreover, because of the scientific data available, we were able to make the decision to ground spray vs. aerial spray, further reducing the potential exposure of humans to pesticides.

*Looking towards the Future*

Towns in lower Fairfield and New Haven counties have expressed deep concern about West Nile virus and would like to see continued and additional efforts made to prevent any public health threat. Traditionally, the southwestern corner of Connecticut has had little arbovirus activity because it is highly urbanized. However, West Nile virus appears to be an urban disease; the primary vector (*Culex pipiens*) is an urban mosquito and both have been found in the most densely populated area of the state.

At a recent conference, the CDC indicated that an intensive monitoring program for WNV should be undertaken in this upcoming year and should include monitoring of the crow population (as a sentinel), monitoring of the human population and increased monitoring of the mosquito population. Also, monitoring of larval mosquito populations and preventative control through education, source reduction and the use of larvicides would reduce the adult mosquito vector population and potentially reduce the need for and extent of adulticides. Connecticut's team of experts is reviewing these recommendations and evaluating the efficacy of their implementation. The DEP has and will continue to provide technical assistance to towns and can increase operational mosquito control efforts in southwest Fairfield County. We are also aware of the concerns regarding increased pesticide use and are committed to continue our practice of a reasoned, measured response to the mosquito borne disease issue as well as a continued evaluation of pesticide usage.

All this must be done while maintaining the program of mosquito trapping and testing throughout the state. EEE remains a concern in our region and we cannot forsake this effort.

There is the potential for Federal action in two areas. First, we look for the continued support and encouragement of the CDC and the National Wildlife Disease Center. The continued participation of the CDC in evaluating the health risks associated with mosquito-borne viruses and its assistance in public information and outreach regarding those risks provides a voice of expertise and credibility beyond that which individual states may be able to provide alone. Second, here in Connecticut we rely on wetland and habitat management as a natural mosquito management tool. Additional Federal resources and support of our wetland restoration program would also be most welcome and could provide direct benefits to coastal communities beyond those associated solely with reduced mosquito populations.

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STATEMENT OF PAUL R. EPSTEIN, M.D., M.P.H., CENTER FOR HEALTH AND THE  
GLOBAL ENVIRONMENT, HARVARD MEDICAL SCHOOL

*Encephalitis: can we prevent the next outbreak?*

The means by which the virus causing mosquito-borne encephalitis entered the New York region in the fall of 1999 are not known. But the climatic conditions favoring diseases that cycle among birds, urban mosquitoes and humans are well understood, and there are important lessons to be drawn from this emerging disease and its association with climate variability and change.

Overall, we are in the midst of an emergence of new diseases and a resurgence and redistribution of old diseases occurring on a global scale. Since the mid-1970's the World Health Organization records the emergence of over 30 infectious diseases, including Legionella, HIV/AIDS, Hantavirus Pulmonary Syndrome, Ebola, toxic *E. coli* (O157:H7), a new strain of cholera, and a host of antibiotic-resistant organisms. In this decade malaria cases have quadrupled and local transmission has reappeared in northern US States, Canada and Europe. The issue of emerging infectious diseases is receiving serious attention from the Institutes of Medicine, the Centers for Disease Control and Prevention and the U.S. State Department.

In the New York area, the mosquito population explosion ushering in West Nile-like viral encephalitis came as a "surprise." But mild winters and summer dry spells favor breeding of city-dwelling mosquitoes (*Culex pipiens*), while extended droughts kill off their predators. The prolonged July heat wave may have amplified the virus

maturation and circulation among mosquitoes and congregating birds, while late August rains unleashed a new crop of *Aedes* mosquitoes, that may have acted as an additional “bridge” vector to humans.

West Nile virus may have recently evolved in strength, as it has not previously killed birds in such numbers. Meanwhile “generalist” urban birds—crows, Canada Geese and gulls—are out-competing the more sensitive “specialists,” that are losing their more restricted ecological niches. The generalists—with wide ranging diets—may, in general, be more tolerant to disease agents, thus more apt to maintain blood levels that favor disease transmission.

Warm winters are associated with climate change. A warming atmosphere holds more moisture, and the increase in clouds blocks nighttime and winter cooling. More precipitation in winter falling as rain, rather than snow, reduces snowpack, spring runoff, exacerbating spring droughts projected for the Northeast region of the United States. Enhanced evaporation from warming seas also raises humidity and heat indices, fuels hurricanes and reinforces greenhouse warming.

With an increase in the hydrological (water) cycle, protracted droughts, heat waves and intense, tropical-like downpours are also associated with warming of the atmosphere and the world’s ocean.

This decade, the International Federation of Red Crosses reports that extreme weather events have been especially punishing for poor nations, often spawning “clusters” of mosquito-, water-, and rodent-borne diseases in their wake. Severe weather has also been costly. The Munich Reinsurance Company calculates that weather-related losses (increasingly intense weather compounded by development patterns) exceeded \$90 billion in 1998, eclipsing the \$55 billion for all of the 1980’s.

This summer New York suffered acutely from extreme weather. The July heat wave strained the distributive capacity of the energy grid, and the loss of key medical research at Columbia highlighted the need for reliable generators, such as fuel cells. On August 26 an intense downpour carried farm waste into the underground aquifer supplying the Washington County Fair, resulting in 1061 cases of toxic *E. coli* infection and several deaths. Encephalitis, with its economic and psychological sequelae, was the final assault.

There are important lessons to be gleaned from this outbreak:

- Basic disease and sentinel species surveillance must be strengthened.
- Collaboration between wildlife ecologists and human health investigators must be forged, for many emerging diseases are transferred from animals.
- Forests and wetlands must be preserved, for these habitats maintain the biodiversity that provides primary prevention against pest and pathogen proliferation, and buffer against climate extremes.
- Health early warning systems based upon knowledge and projections of conditions conducive to disease outbreaks can help target surveillance.

Early warnings can facilitate timely, environmentally friendly public health interventions, such as selective treatment of mosquito breeding sites, in lieu of wide-scale dissemination of pesticides.

- This outbreak also serves warning that diseases emerging and evolving elsewhere—chiefly from poverty and environmental degradation (e.g., deforestation)—can come home to haunt us.

- And finally we have learned that the US is also vulnerable to extreme weather that can trigger epidemics. An increasingly unstable climate, with wide swings from norms, provides conditions favorable to disease emergence and spread.

While this epidemic has raised the necessity of strengthening surveillance and laboratory capability in order to prepare for the potential of biological terrorism, we must confront the enemy we know: the growing ecological and climatic vulnerabilities encouraging the reemergence of infectious disease. This resurgence, in the final quarter of the 20th Century, may be viewed as a symptom of global change—social, ecological and climatic. And sadly, we must prepare for more surprises.

Environmental cleanup, ecological restoration, clean energy sources and energy efficiency can become guiding principles. Clean energy sources (fuel cells, solar, wind and hybrids) can power transport, industry and housing, and can pump, purify and desalinate water. Such enterprises can become the engine of economic growth in the coming decades.

Ultimately we must shed inherited economic obstacles (perverse subsidies and unpayable debts) and adopt new incentives and new funds to create a “win-win” for the environment and the economy. Only then we will reverse the environmental assaults on public health and achieve clean, equitable and healthy development in the century before us.

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DEPARTMENT OF PUBLIC HEALTH, STATE OF CONNECTICUT,  
*December 23, 1999.*

The HONORABLE JOSEPH LIEBERMAN,  
*Senate Hart Office Building,  
 Washington, DC 20510.*

DEAR SENATOR LIEBERMAN: I am writing to submit formal testimony from the Connecticut Department of Public Health (DPH) to the United States Subcommittee on Environment and Public Works Regarding the West Nile Virus. This testimony is being submitted in conjunction with the Committee hearing held at Fairfield University on December 14, 1999.

Two Connecticut State agencies with which the Department of Public Health closely works on vector-borne illnesses presented oral and written testimony at the hearing on December 14. They are the Department of Environmental Protection and the Connecticut Agricultural Experiment Station. I will not reiterate their testimony. Rather, I will provide the Connecticut public health perspective on preparedness for and resources used in the initial response to the threat to human health posed by the presence of West Nile virus, and a perspective on what will be necessary to monitor for and respond to its likely re-emergence.

I am the Director of the Infectious Diseases Division at DPH and in that capacity am the designated State Epidemiologist. Connecticut is one of eight States that currently receives specie' Federal funding to conduct surveillance for emerging infections and has received Federal funding for bioterrorism preparedness. I am the project director for Connecticut for both of these Federal cooperative agreements.

*Preparedness for and Response to West Nile virus in Connecticut, 1999*

As the Committee has already heard, Connecticut had a state-funded surveillance system for mosquito-borne viruses and a capacity and plan to respond to their presence that was already in place when it became apparent that West Nile virus was in the greater New York area. In fact, the Connecticut system contributed directly to the rapid recognition that the crow die-offs and outbreak of what was thought to be Saint Louis Encephalitis (SLE) were related and due not to SLE virus, but to West Nile virus. Having this pre-existing system made it possible to quickly direct some of those resources to the parts of Connecticut likely to be initially affected, to rapidly determine the potential risk to humans and to have an information-directed response. Without this information, it is likely that our response would have been filled with extreme anxiety and highly conducive to over-reaction—and we would not have the kind of information that will help with future assessment of risk from the presence of West Nile virus.

However, several additional critical capacities were also mobilized and integral to the Connecticut ability to respond to West Nile virus: capacities fostered by regional bioterrorism preparedness and by federally supported emerging infections capacity. Functional regional communication systems had already been established as part of bioterrorism preparedness: e-mail networks between State epidemiologists, mass conference call capacity and, in New York, a confidential electronic health alert network. Connecticut was informed immediately by New York City and New York State as soon as it became clear that there was an outbreak of mosquito-borne disease in New York City. Beginning in early September, New York organized daily regional conference calls including affected States, counties and the Centers for Disease Control to discuss the breaking situation. Everything that was being learned about the situation was shared. Because of the incredible communication, we were able to intelligently communicate with hospitals, local health departments and the public and to rapidly establish intensive surveillance for human illness. We were able to use our own developing in-state systems to rapidly share information with local health departments and hospitals. If we had not begun to establish such communication systems, the mobilization would not have been as quick, the response not as coordinated and we would still be groping for unpublished information that was shared during this time. The communications aspects of the response to West Nile virus in 1999 are a real success story. I think Congress can be proud that they have recognized a need to support development of national and state-based communications systems as part of the preparedness to respond to bioterrorism—and that these communication systems can be used effectively in a variety of situations.

Connecticut's Emerging Infections Program was also very involved in the response to West Nile virus. Among other things, we used hospital-based networks established for surveillance of unexplained deaths and life threatening illness to conduct more active surveillance for people admitted with possible encephalitis. In addition, the professional and public demand for accurate information was insatiable. Because we had emerging infections "surge" capacity, we were able to devote 5 full

time equivalent professional staff for 6 weeks to answering telephone calls from hospitals, physicians and local health departments to provide them with more detailed answers to questions they had. Emerging infections surveillance and response capacity is invaluable and enables us to respond in much more depth to such situations.

*Monitoring for and Responding to West Nile Virus in 2000*

There is a high probability of West Nile virus becoming established in the Western Hemisphere. Dr. Robert McLean from the USGS National Wildlife Health Center testified on December 14 as to the possible scenarios for the emergence of West Nile virus in 2000. It is critical that we monitor for the re-emergence of West Nile virus in a variety of ways that anticipate each of these scenarios. If we have information about West Nile virus (or any other mosquito-borne threat to human health) early, before the virus cycle in birds and mosquitoes builds up to levels that threaten human health, we can take action to prevent the kind of outbreak that occurred in New York City this past fall.

Early detection of the re-emergence or re-introduction of West Nile virus will require special surveillance efforts, even in States like Connecticut that already have a significant capacity to conduct surveillance for arboviruses. Surveillance for West Nile virus will require an extra component that is different than that used for any other kind of mosquito-borne disease surveillance system—namely, surveillance for dead crows. Such a system will be resource intensive: staffing is needed to monitor crow deaths, to collect crows and to test them for West Nile virus. If West Nile virus is found, intensive local mosquito trapping and surveillance for human and horse illness will then be needed. At this stage, there will be a huge public demand for information similar to what we had this past fall in Connecticut. Thus, each State in the eastern half of the United States where West Nile virus is most likely to re-emerge or be reintroduced, needs to have resources dedicated to early detection of West Nile virus. For States without arboviral surveillance programs and without significant epidemiologic and laboratory surge capacity, this will be a formidable challenge. Even for those with such capacity, it will be a challenge to implement and maintain such a system for the 6–7 months during which there is mosquito activity each year. Given that this is an emerging challenge affecting a large number of States, Federal support may be needed to enable a widespread surveillance network for this critical next year.

Thank you for the providing an opportunity to comment on the West Nile virus situation. If you have any questions, I can be reached at the Department of Public Health at: 860-509-7995.

Sincerely,

JAMES L. HADLER, M.D., *State Epidemiologist,*  
*Infectious Diseases Division, Connecticut Department of Public Health.*

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES,  
UNIVERSITY OF CONNECTICUT,  
*Storrs, CT, December 27, 1999.*

SENATOR JOSEPH LIEBERMAN,  
*Hart Senate Office Building,*  
*Washington, DC 20510.*

DEAR SENATOR LIEBERMAN: I recently attended your December 14 hearing on the occurrence of West Nile virus in Connecticut during the fall of 1999. I write today with additional information that you may find meaningful.

During his testimony Dr. Andreadis of the Connecticut Agricultural Experiment Station spoke of three State agencies that collaborated during the surveillance. We, at the University of Connecticut, represent the fourth agency, the pathologists who received over 300 birds for necropsy and diagnosis, and who selected brain tissues for attempts at virus isolation. The now famous "Westport crow" was collect at our request after an alert from a New York colleague, and tissues were later forwarded to Ted Andreadis consistent with a pre-arranged liaison within the mosquito surveillance program. During the bird die-off, Drs. Wakem, French, Garmendia and I did the dissections on the submitted birds, four fifths of them crows, but including hawks, owls, and a great variety of backyard birds.

We continue to do microscopic, virologic and electron microscopic studies in an attempt to wrap up this extensive case material. One of the difficulties we have encountered is the lack of funds to immediately and effectively deal with these great numbers of cases within an epidemic. We have an immediate and continuing need to pay a full-time technician to enter data into a spreadsheet, to process tissues for



microscopy and to aid with new accessions, that continue to come to us even in December. Further, there is an immediate need for us to upgrade an existing laboratory from biohazard level 2 to biohazard level 3. At our present rate we will not complete our case studies for another 10–12 months, meaning that the data fail to be timely, for everyone's purposes.

I have been a member of the mosquito surveillance team for 3 years and I have participated in USDA-sponsored symposia that plan preparedness. At these sessions money is never set aside for rapid response. During the 1999 episode three of us worked day and night to deal with the birds. We had to come away from our other research, which we didn't mind, however there was inadequate technical support to make our chores easier, less time-consuming, and more efficient. We repeatedly had to borrow graduate students to help, a half-day here, a half-day there. I write not to say that we or they minded helping, but rather to ask now for funds to finish the work and to be properly prepared for the spring recurrence, in whatever form that might be. In a general sense then, I write to suggest that moneys need to be placed in escrow to deal with new and emerging diseases, and in a specific sense to ask for immediate moneys for the winter 2000 effort—to finish the epidemic of 1999. We have evidence that West Nile fever extended beyond Fairfield and New Haven counties and certainly beyond the artificial cutoff for submission of birds (Nov.S) initiated by the Department of Public Health and the DEP.

Thank you for your consideration.

Sincerely,

H. J. VAN KRUININGEN, D.V.M., PH.D., M.D.  
*Director, Northeastern Research Center for Wildlife Diseases.*

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DONALD R. MARANELL, FIRST SELECTMAN,  
*Stonington, CT 06378-0352, December 22, 1999.*

SENATOR JOSEPH LIEBERMAN,

SUBJECT: Public Clearing Comments for Encephalitis diseases borne by Mosquitoes

Attached is my testimony of January 31, 1997 to the members of the Connecticut Environmental Committee in support of bills that enacted the State of Connecticut's Mosquito happing and testing program after an outbreak of BEE in the mosquito population in Rhode island "d Connecticut in the summer and fall of 1996.

It is appropriate to educate the public and I support your efforts but we also need to do more. If not for Rhode Island's in place program in 1996, our first indication of trouble could have been tragic. This year, we were able to identify the cause of a health emergency due to the program enacted as a result of our 1996 experience. We, as Americans, should not have to depend on the actions of others to make us aware of health threats that are caused by insects and birds that ignore town, county and State boundaries. This is a national issue and interest. I support public awareness but urge you to investigate the creation of a national standard and a program that monitors, informs and controls diseases such as encephalitis in any of its deadly forms.

Thank you for your interest. The Town of Stonington and I stand by to assist your efforts In any way we can.

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STATEMENT OF DONALD R. MARANELL, FIRST SELECTMAN, STONINGTON, CT

SUPPORT OF SENATE BILLS 175/179/583 AND HOUSE BILLS 5192/5822

I stand here today in support of Senate Bills 175/179/583 and House Bills 5192/5822. As I am sure you are all aware, the Town of Stonington was the first Connecticut community to deal with the mosquito-borne Eastern Equine Encephalitis situation in September 1996. During this time, our residents were subject to restricted outdoor activity, the wearing of long sleeves/pants, altered school schedules, sprays, the onslaught of the press and the negative effects this type of news has on children, families and tourism-type businesses.

On September 24, 1996 Governor Rowland announced his intention to propose a \$850,000 mosquito control program to the Southeastern Connecticut Council of Governments at Stonington Town Hall. It is my understanding this program was to include larvaecide and adulticide mosquito control, monitoring and wetlands restoration. I hope today is step one of fulfilling that promise to the residents of Connecticut.

These bills are not only a human health issue but, also an economic health issue. Southeastern Connecticut is mayor tourist attraction In fact, over 60 percent of all

Connecticut tourists stop in Mystic (a section of the Town of Stonington). We cannot afford to allow our residents to tolerate this health-threatening problem and cannot allow the economy to suffer from inaction.

We were lucky. Commissioners Sidney Holbrook (DEP), Steve Harriman (DPH) and our talented and dedicated State employees were up to the task. They should be commended for their efforts. I know I will always be grateful for the support we received from them.

I hope the final program you support includes preventive measures and monitoring, not just monitoring and reaction. As a society we have chosen to preserve the environment. That comes with responsibilities. Not only to society but, to the Earth. Wetlands restoration funding is probably one of the key issue in this program. If Barn Island (a State Preserve in Stonington) and other protected areas are allowed to become or remain the "mosquito farms" they are when stagnate water is allowed to exist, this program will be very expensive to maintain. We must invest in our wetlands. Many of our older residents remember when the State would dig trenches to encourage water flow in the Barn Island and salt marsh areas. Please don't stop short, we must commit to a comprehensive program that protects our residents, removes fear from our population, protects the environment, and assists in the economic health of our State.

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STATEMENT OF NANCY ALDERMAN, PRESIDENT, ENVIRONMENT AND HUMAN HEALTH, INC.<sup>1</sup>, NORTH HAVEN, CT

The presence of the West Nile Encephalitis virus this fall in the tri-State area raised several concerns for the future. As winter approaches and the health hazard subsides, it is important to take advantage of this time to gain a broad-based understanding of the disease, and find the safest way to prepare for a re-emergence of the virus.

There are both serious health and ecological concerns to be understood. The Senate hearing that was held in Connecticut this past December showed clearly that preparation by the local communities as well as the States is essential if we are to avoid a major public health and environmental crisis next spring.

There are dangers from under- as well as over-reaction. Connecticut was fortunate in that there already was an infrastructure in place to deal with insect-borne diseases due to the past occurrences of Equine Encephalitis that had occurred in both Connecticut and Rhode Island.

However, next spring we must be prepared for a more serious outbreak of insect borne diseases, and therefore we need to plan now with our neighboring States. We also need to encourage public health officials to make their decisions in a transparent way. The transparency of decisions is needed in order to promote public trust.

It is vitally important for those that are in charge of managing the West Nile Virus be aware that State health agencies over the last decade have been "downsized" due to economic constraints, and this "downsizing" has left the environmental and public health agencies with limited experienced staff and resources. These resources are needed to address a crisis of this magnitude.

#### A: COORDINATION AND CREDIBILITY

##### 1. Co-ordination among neighboring States.

a. Co-ordination with NY, NJ, RI and CT is vital. All States should use the least toxic pesticide possible and should disperse that chemical in the least harmful way. Risk of disease and risk of pesticide must be weighed carefully.

b. Precautions for pesticides are different for different pesticides. There is potential for the public to become confused about advice given if this advice is not coordinated.

c. Because the media often covers more than one State, it is essential that information is coordinated, especially if different management approaches are taken. It will be important to communicate why and how the States' approaches are different.

##### 2. Credibility needs to be ensured by the political and health entities at the Local, State and Federal level. If there are conflicting messages it will reduce the public's confidence and support.

a. An infrastructure is needed to address problems such as the West Nile Virus. Local experts from both the environmental fields and the public health arenas can

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<sup>1</sup> Environment and Human Health Inc. is a nonprofit organization made up of doctors, public health professionals and policy experts, committed to protecting the public from environmental harms through research, education, and the promotion of sound public policy.

add perspective to the issue. Health care providers need to be aware of potential health problems that can arise from both the virus and also from the use of pesticides. Communities and grassroots organizations can be important outreach mechanisms. With proper funding and access to resources, they can help to get the word out to the public.

b. A technically expert support group is needed at the regional level to address the redundancy of effort at the local levels and to enhance the distribution of information and interaction of local staffs.

The regional EPA's relationships with State and local governments is one model that can be looked to.

#### B: ECOLOGICAL

##### 1. Pesticide applications.

a. Recordkeeping of pesticide use must be kept. The information of how, where, and how much materials are applied is necessary in order to address the ecological impacts.

b. Standards need to be set for selecting those companies and staff who are hired to spray pesticides.

c. We must evaluate and document the effects on the ecology of the region when widespread use of pesticides has been undertaken.

#### C: PUBLIC HEALTH

##### 1. Adequacy of information.

a. Information should be geared toward the most sensitive of populations as opposed to the general population.

b. Because we are a multi-cultural population, information should be prepared in additional languages.

c. The public needs to have an honest evaluation of the relative health risks of decisions made, as well as complete advice on what precautions to take for the protection of themselves and their families.

##### 2. Misuse of the mosquito repellent, DEET

a. There is a great potential for parents and care givers to misuse DEET. DEET is a neuro-toxin and should be used carefully and never on children under 2 years of age. Coordination and expansion of good information about DEET is needed in order to reach a wider audience that includes children and their care givers.

b. In a crisis such a vector-borne disease, there is the potential for the public to misuse other pesticides as well as DEET. Sound advice with pesticide use health implications needs to be made available.

While the Senate Committee focuses on the environmental impact of the disease and spraying, those managing the problem cannot divorce themselves from the public health implications associated with its environmental management.

STATEMENT OF ANDREA L. BOISSEVAIN, M.P.H., HEALTH RISK CONSULTANTS,  
FAIRFIELD, CT

#### *Ecological and Public Health*

This Fall's West Nile Encephalitis virus presence in the tri-State area raises several concerns. As winter approaches and the health hazard subsides, it is important that a broad-based understanding of the issues be sought.

The health and environmental agencies of Connecticut, New York, and New Jersey are to be commended in their response to the potential health crises. However, this coming spring, when the mosquitoes and other vectors again become active, the region should be prepared on both the public health and the environment fronts.

Environmental and public health responses need to be coordinated. There are both serious health and ecological concerns. We raise but a few of them here today:

#### A. ECOLOGICAL

##### 1) Pesticide application.

a) Is there record keeping in place of how, where, and how much material was applied? This will be necessary in order to address ecological impact.

b) What are the criteria in selecting those who spray?

c) We will need to evaluate the widespread use of pesticide and its effect on the ecology of the region.

##### 2) Coordination among three States (CT/NY/NJ).

a) Precautions are different if malathion is used versus resmethrin. There is the potential for the public to become confused.

b) Because the media is tri-State, it is essential that information is coordinated especially if different management approaches are taken. It will be important to communicate why and how the approaches are different.

3) Study Issues.

a) Recommend an "expert" panel to assess effect of outdoor pesticide application (e.g. lawn grooming) and how that may affect biological balance of mosquito growth cycles.

#### B. PUBLIC HEALTH

1) Adequacy of information campaign—especially next spring.

a) Equity in information and in dissemination. Information should be prepared in additional languages because we are a multi-cultural population.

b) Clear warnings not just for the general population. Information should be geared toward sensitive populations as well (e.g. potential for anti-cholinergic drug interactions is of greatest concern such as some medications used to treat glaucoma).

c) The public needs a perspective on health risks as well as what precautions to take for their children and themselves.

2) Misuse of the mosquito repellent, DEET.

a) There is a great potential for parents and caregivers to misuse DEET—another aspect of adequate information campaign. This is the most immediate health hazard. There are health education programs in CT and NY that are designed to inform regarding the use of DEET in the prevention of ticks and tick-borne diseases. There needs to be coordination and/or expansion of these programs with mosquito-focused campaigns in order to reach the wider audience that includes children and their caregivers.

While this committee focuses on the environmental impact of the disease and spraying, those managing the problem cannot divorce themselves from the public health implications associated with the environmental management. Furthermore, it is imperative that health information be provided by health agencies, not only the Department of Environmental Protection.

An infrastructure needs to be created to address problems like this one where we could benefit from hearing from local experts from both environmental and public health perspectives. Communities and grassroots organizations can be a great outreach mechanism. With proper funding and access to resources, they could really help to get the word out.

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#### STATEMENT OF THOMAS R. BAPTIST, NATIONAL AUDUBON SOCIETY, GREENWICH, CT

Thank you for your interest and leadership regarding insecticide spraying to control mosquito-borne illnesses, such as the West Nile Virus that occurred in Connecticut and New York this summer and fall. I appreciate the opportunity to provide comments relating to this important matter.

As you are aware, this is a complicated issue, and one that goes far beyond the short-term goal of eradicating the infected mosquitoes and preventing the spread of a potentially fatal disease. On the one hand, it seemed clear that pesticide spraying was the only known short-term response to limit the spread of disease when it was discovered this summer and fall. On the other hand, the widespread spraying raises serious questions about the long-term implications of insecticides in the environment.

The impact on our natural systems received little attention during the course of the field hearing in Fairfield last week. It is critical that ecological and environmental health issues be carefully considered, in addition to the public health concerns, as we move forward to establish a comprehensive mosquito management program.

Here in Connecticut, our State officials deserve praise for their cautious approach in developing a response to the presence of the West Nile Virus in mosquito and bird populations. State health and environmental officials sought input from scientists, evaluated what our neighbors to the west were doing in the face of similar threats, and came up with a reasonable and effective approach. After careful research and evaluation, Connecticut's response included ground spraying of Scourge, with the principal ingredient of Resmethrin rather than aerial spraying of Malathion—the approach used in New York.

Ground spraying allows better control, allowing the spray to be more effectively targeted at problem areas. Resmethrin is known for its low toxicity and short persistence in the environment. It is intended to control adult mosquitoes, midges and black flies. In humans, it is harmful if absorbed through the skin or if swallowed.

However, for humans and house pets, it is fairly simple to avoid exposure by staying indoors while spraying is occurring, closing doors and windows, turning off air conditioners and fans, and preventing children and pets from playing in areas that are still wet from spraying. For all other fish and wildlife, the answers are not so simple.

According to the manufacturer's information, Scourge is highly toxic to fish. If large fish kills were to occur, the effects would be felt all the way up the food chain, with possible implications for the overall health of the environment in our communities.

Like the canary in the coal mine, birds sounded the early warning of the presence of the encephalitis threat. The death of crows, which apparently host the virus that causes the disease, early this summer served as a biological indicator that something was amiss. This underscores the important role that native bird populations and other fish and wildlife species play as indicators of environmental and human health, and provides a rationale for continued close monitoring of bird populations.

With the advent of the cold weather, the mosquito populations have diminished, and the immediate threat appears to be over. But, as Dr. Fish pointed out, it is quite likely that the threat will resurface next year and we will again find ourselves facing a crisis situation. Whatever the actual level of risk, there will undoubtedly be huge public demands for continued mosquito control next year.

What should we be doing between now and then to ensure long-term public and environmental health protection?

Federal, State and local agencies should institute active monitoring programs, similar to that which is in place here in Connecticut, to assess the level of threat. The existing mosquito control program in Connecticut should be enhanced to allow officials to carefully focus insecticides on problem areas, rather than employing more handful broadcast spraying. However, in all cases, spraying of pesticides should be the method of last resort to control mosquito-borne illnesses. Adequate resources should be provided for Federal, State local agencies to identify and carefully examine mosquito problem areas, and specific action plans should be developed to correct hydrologic conditions that are causing infestations.

In many cases, mosquito problems are the result of human impacts on our wetland systems, and restoring wetlands and waterways to a more natural condition can help restore Nature's own mosquito control processes. For example in a healthy tidal wetland system, fish eat large numbers of mosquitoes and their larvae, helping to control insect populations. Wherever tidal flow has been restricted or wetlands have been dammed, ditched, filled or otherwise impacted, this natural balance may be disrupted.

Over the past decade, the Connecticut Department of Environmental Protection has been working to restore key wetlands. The agency has restored approximately 1,800 acres of salt marsh along the Connecticut coast, including wetlands at Barn Island in Stonington, the Last River in Guilford and Madison and Sliver Sands State Park in Milford. This common sense approach—which protects human health, our feathered friends and all other fish and wildlife—should be expanded, and consistently applied as the most effective long-term solution to our mosquito ills. In addition, adequate funding is needed for research to help identify other means of preventing the threat of mosquito borne illness in this country.

Again, thank you for the opportunity to provide comments in this important matter. My staff and I stand ready to assist in any way we can to prevent human illness from mosquito borne disease while protecting the health of our environment and precious natural resources.

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STATEMENT OF LISA SANTACROCE, ENVIRONMENTAL AFFAIRS OFFICE, CONNECTICUT  
AUDUBON SOCIETY

I attended your hearing last week in Connecticut on the West Nile virus and I am very pleased to see your attention to this issue, and particularly your foresight in trying to address this issue before it escalates into a crisis next summer. From the testimony presented, this is certainly an issue where being proactive can make a difference.

The hearing was very helpful in learning more about this virus and the mosquitos that transmit it. Connecticut Audubon is concerned about the potential impact in native bird populations, but it is clearly too early to tell what those impacts might be. We are also concerned with large scale pesticide applications in terms of their impact on human health and the environment.

We were very pleased to see, based on DEP Commissioner Stahl's testimony, that Connecticut exhibited a much more measured and deliberate response to the West

Nile virus outbreak than New York. New York instituted broad aerial-spraying of malathion, which is a very toxic pesticide, without any knowledge of where the infected mosquitos were concentrated. Granted, they did have human fatalities due to this outbreak while Connecticut did not have a human case at all. Our response was ground spraying in the areas where infected mosquitos had been located (due to trapping).

We are pleased that our State's experience with the EEE virus led to the development of an action plan to deal with mosquito-borne viruses and this plan will serve us well as these threats continue to develop. However, we would like more information about the actual pesticides being used and any toxic impacts they may have. We would also like to know exactly what the DEP's response hierarchy is in terms of how they make decisions about what pesticides to use and how and where they are applied. We think this kind of information should be readily available to the public and particularly elected officials. We were aware of chief elected officials in southwestern Connecticut who wanted aerial spraying and clearly did not feel that the DEP's efforts were adequate. We need to educate these officials and the public about exactly what the State's policies are and how they will be implemented. We believe this will go a long way to reduce the inevitable fear and anxiety that will surround this issue. Without this information we fear that the public will demand more radical solutions than are necessary and also detrimental to human health and the environment.

Connecticut Audubon would also like to offer their support for any increase in funding for mosquito programs at the State and Federal level. Clearly, we could use increased funding for more trapping and testing of the mosquito population and to broadly disseminate information to the public on ways they can protect themselves and prevent the virus from spreading by controlling mosquito populations. We are also very supportive of the CT DEP's Open Water Marsh Management program as a natural method of mosquito control and would support increased funding for these efforts.

We would also like to offer our services, and those of the birding community at large in Connecticut, to help locate and report incidences of dead crows or any other dead birds or animals. There is a large network of active birders in the State who are out in the field on a regular basis and we can educate them on what to look for and how to report it (birders tend to keep very good field notes!). We also participate in Federal bird banding activities in the spring and fall, mostly, along the shoreline. We could certainly take blood samples from the birds being banded and send them to the appropriate labs for analysis Connecticut Audubon and National Audubon plan to arrange a meeting with the DEP and Connecticut Agricultural Experiment Station to discuss ways we might be able to help monitor and track the virus through bird populations.

Again, thank you for hosting a very informative session and providing a forum to learn more about this new health threat to Connecticut citizens. We appreciate your foresight in trying to develop a proactive solution before we see another crisis situation. We would be interested in more information about pesticide usage and seeing that information disseminated as widely as possible to the general public. And we are certainly eager to help, as stated above, in any way we can.

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STATEMENT OF DIANE WORDEN, THE NATURE CENTER FOR ENVIRONMENTAL  
ACTIVITIES, INC., WESTPORT, CT

My concerns about the recent widespread application of pesticides are directly related to the work I am involved in at The Nature Center for Environmental Activities located Westport, Connecticut.

I am sure you are aware of the time, energy and money that has been spent improving the water quality of the region's rivers and streams. More recently, the focus of funding sources has turned to habitat restoration projects for our local waterways.

As a participant in the Norwalk River Watershed Initiative, I have seen the combined resources that the EPA, CT DEP, and local municipalities have brought together in this model project. The Initiative's Watershed Action Plan, being carried out in conjunction with local environmental organizations, has accelerated habitat restoration efforts in the Norwalk River basin, which includes 8 towns in central Fairfield County.

As a monitor of migratory fish species in our local rivers, I am aware of the variety of life forms in the waterways. My own prior research into the downstream effects of pesticides on aquatic life brought the recent mosquito spraying to my attention.

As you may know, the pesticide, Resmethrin, that was used in the Fairfield County ground spraying, is in a classification considered "Restricted Use" by the EPA due to its toxic tendencies in the aquatic environment. The chemical, known as a pyrethroid, has a prolonged breakdown time in bodies of water, increasing its likelihood of causing problems, especially if repeated applications are made, as was done in Westchester County.

While ground spraying from trucks along roadways provides for more controlled application of spray, it does not reach into the rear of large residential lots in towns like Westport with large lot zoning. If the point was to reach the majority of mosquitos, that did not happen.

If aerial spraying was initiated for broader coverage, the smaller waterways and ponds could not have been avoided; and as the pesticide product label clearly states—application into water bodies should be avoided due to its toxicity. This was not a good scenario.

An expanded monitoring program based on the CT DEP's existing mosquito management program for Eastern Equine Encephalitis with its emphasis on larval treatment will help prevent a repeat of this past season's situation.

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STATEMENT OF SUE REIDMAN, ECOLOGICAL HEALTH ORGANIZATION (ECHO),  
HEBRON, CT

I am writing on behalf of the Ecological Health Organization, a statewide support and advocacy group for people with Multiple Chemical Sensitivity. Like many others in our slate, we are concerned about the recent West Nile Encephalitis outbreak in nearby New York. We realize this is a serious public health concern, but we also feel that it is important to make sure the solution doesn't create a new set of health problems. There is a growing number of the population who are severely sensitive to chemicals, and an epidemic of asthma in this country, especially among children. It is very important that the needs of these individuals be considered when developing a mosquito abatement plan, and that the public be informed or any possible health effects of pesticide spraying. We were appalled at the massive aerial spraying of Malathion that took place in New York, as were many New Yorkers, and we feel it posed an unnecessary health risk to the citizens of New York since there were less toxic options available that were not used.

We strongly urge that least toxic methods be used in the event of another encephalitis outbreak and that nontoxic preventive methods be used to reduce risk of future outbreaks. Connecticut has an IPM program in place and has been using a nontoxic product to kill mosquitoes in their larval state. We want to encourage more treatments of this kind and we urge that the DEP be given the funds it needs to aggressively fight mosquitos using least toxic methods. It makes much more sense to utilize safe methods to kill the mosquitos at the larval stage, than to spray an entire relation with a poison. While we know that the Resmethrin used here in Connecticut is a safer choice of pesticide, we still have many concerns about the handling of the mosquito control program in our State.

We are upset by the misinformation about Resmethrin that was broadcast over the news. While it is considered a safer pesticide, Resmethrin can cause severe reactions in sensitive individuals. The news stations were reporting that Resmethrin, according to the DEP, was totally harmless to humans, while at the same time they were advising people to shut windows, bring their children and pets indoors, and to wash any vegetables they eat from their garden. This certainly was a mixed message. People were also told that the pesticides would be gone in 4 hours, and we have learned from an EPA approved resource, that the half life of Resmethrin is 30 days.

We would like more information about the total formulation of the pesticide that was used. We know that the so-called inert ingredients in a pesticide can sometimes be more toxic than the active ingredient. We feel the public should be informed about all the ingredients in the pesticide that was used. We need to know if there have been EPA safety studies done on the formulation as whole, or are all the safety studies industry generated, and test only the active ingredient?

We would like to know if there is any medical treatment, recourse, compensation, available to people who are injured by mosquito spraying? What assistance is available for people who might have to vacate their home for a period of time due to severe sensitivity to pesticides?

Pesticide health effects should be monitored and treated. It is imperative that real experts with experience treating patients who have been chemically injured, be involved. While we hope that the need for future spraying can be averted by an aggressive IPM program, if any spraying is done in the future, we feel that there

should be a hotline set up for people to report any health problems relating to the mosquito spraying and medical treatment should be made available. Resmethrin, for example, is known to trigger asthma attacks in sensitive people. Malathion is an organophosphate insecticide that functions by interfering with cholinesterase, an enzyme essential to normal nervous system function. Most doctors are not trained to recognize symptoms of chemical injury. If an injured individual calls his/her personal physician, there is strong likelihood the illness will not be properly diagnosed, and will go unreported.

How effective is massive spraying in eradicating the disease? Does it even work? Resmethrin is toxic to fish. What happens to mosquito populations the next year if natural predators have been killed by the spraying? The spraying in our State took place a few days before we had our first freeze. Considering the time of years was the spraying warranted?

We encourage the State to continue to broaden its IPM program for mosquito control that uses a nontoxic product to kill mosquitoes in the larva usage. It makes a lot more sense to kill mosquitoes in their larva (before they can spread disease) than it does to do a massive spraying at a later date. The State should be carefully monitoring mosquito populations, and if necessary least toxic pesticides should be used only in target areas, as opposed to a blanket spraying over large populated area. The State should also on educating the public on using least toxic methods to control mosquitos on their property, such as removal of breeding habitat by reducing standing water, and how to safely kill mosquitoes in the larva stage.

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STATEMENT OF PAMELA CLARK, FAIRFIELD COUNTY CITIZENS CONCERNED ABOUT PESTICIDES (FCAP)

Fairfield County Citizens Concerned About Pesticides (FCAP) was active during the West Nile Fever (WNF) "crisis" earlier this year by providing an opportunity for public dialog. FCAP also took reports of Scourge exposure symptoms through a telephone "Action Line."

The attached sheet outlines some of the problems associated with the handling of the WNF "crisis." These problems and their recommended solutions were presented to representatives of the Department of Environmental Protection (DEP) and the Department of Public Health (DPH) in Hartford on November 22, 1999 by FCAP Chairman Pamela Clark.

We request that this information, as well as the attached letter to Congressman Shays, be entered into testimony at the West Nile Fever hearing on December 14 at Fairfield University.

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FCAP'S NOVEMBER 22, 1999 MEETING WITH THE DEP AND THE DPH REGARDING 1999 PESTICIDE SPRAYING FOR WEST NILE FEVER (WNF)

*Problem: Information given by local health departments was problematic, i.e. not accurate, complete, or consistent.*

Example: Questions regarding the concentration level of Scourge (the pesticide compound used in Fairfield County), the full list of possible pesticide exposure symptoms, the spraying locations, etc. were often answered inaccurately and answers varied from town to town.

Solution: Set up an interactive hotline in a central location with an 800# using trained staff to answer questions beyond press release statements.

*Problem: Press releases overstated the dangers of West Nile Fever (WNF) and underplayed the dangers of widespread pesticide spraying.*

Example Public officials stated that the concentration of Scourge sprayed was so low that it was "harmless." In fact, the concentration of Resmethrin (the active pesticide in Scourge) was sprayed at 0.00175 pounds per acre, a concentration consistent with label application directions, label warnings, and EXTOXNET research data (see attached).

Solution: Give equal time in news releases to the dangers of widespread pesticide spraying as is given to the dangers of WNF. Provide a full list of pesticide exposure symptoms in every press release. Identify at-risk groups for both pesticide exposure and WNF. Set up an action line to receive reports of pesticide exposure symptoms in humans and wildlife. Report all cases of pesticide exposure symptoms in humans to the locational Pesticide Telecommunications Network.



*Problem; Spray zones were not adequately described and the public was not properly notified.*

Example: Citizens did not know how to determine the spraying locations and schedules, callers to hotline numbers were given inaccurate or incomplete information, etc.

Solution: Place flyers in all homes on spray route 24 8 hours prior to spraying.

*Problem: Scourge was misapplied.*

Example: Scourge was sprayed on streets not listed in planned spray routes, Scourge was sprayed on river banks and near water sources despite warning labels to the contrary.

Solution: Follow the DEP mosquito management plan. Place stricter controls on application. Provide documentation of concentration levels, application areas, etc.

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FAIRFIELD COUNTY CITIZENS CONCERNED ABOUT PESTICIDES (FCAP),  
Westport, CT 06880, October 13, 1999.

The HONORABLE CHRISTOPHER SHAYS,

DEAR CONGRESSMAN SHAYS: Thank you for your time last Friday at Fairfield University. FCAP members ask that you bring our concerns about the dangers of Scourge, the pesticide used in widespread ground spraying in Fairfield County recently, to the attention of the Connecticut Department of Environmental Protection (DEP) and the Connecticut Department of Health.

DEP press releases and statements have misinformed the public by overstating the dangers of a viral strain which poses a slight threat to a small portion of the population and downplaying the dangers of widespread pesticide spraying.

DEP assurances that pesticide spraying is completely safe have had horrifying repercussions. A mother in Westport was observed by one FCAP member spraying her child with "Raid" insecticide before soccer practice for mosquito protection.

*The truth about pesticide dangers must be admitted and pesticide spraying must stop*

Due to the human and environmental risks posed by Scourge and the fact that as of this writing there are no human cases of the disease in Connecticut, further spraying would be reckless.

*Pesticide sensitive people are being ignored*

One point that has been not been adequately addressed by public officials is the negative health effects of pesticides on the very same human population that is most susceptible to the virus—the sick, the aged, the very young, and those with weak immune systems. Pesticide-sensitive children and adults include those with asthma and other respiratory diseases.

*Despite DEP rhetoric, it is clear that the concentration of Scourge used is not low enough to void all warnings regarding this chemical poison*

According to the DEP, Scourge was sprayed at a level which delivered 0.00175 pounds of Resmethrin (the active insecticide in Scourge) per acre. Because this concentration falls within the recommended spraying levels on the Scourge label, all warnings apply.

*Scourge is not harmless to humans at the level being sprayed*

The National Pesticide Telecommunications NetNork (NPTN) Pesticide Information Sheets on Resmethrin indicate that Resmethrin may cause adverse effects on the central nervous system. Symptoms of exposure to Resmethrin listed by the NPTN include incoordination, twitching, loss of bladder control, seizures, numbness, itching, burning, and tingling. This list has not been announced to the public.

Residents have reported most of these symptoms to FCAP's Action Line after recent sprayings.

Scourge contains Piperonyl Butoxide (PBO), which "affects mammals by depressing liver function, thus lowering their ability to detoxify chemicals," according to the National Coalition Against the Misuse of Pesticides (NCAMP). PRO is a synergist which, when added to Resmethrin, increases Resmethrin's toxicity, according to the New York Coalition for Alternative to Pesticides (NYCAP).

Scourge contains petroleum distillates which "can cause allergic reactions and even a dangerous chemical pneumonia when inhaled," according to NYCAP.

*Scourge is toxic to fish at the level being sprayed*

The Scourge label states, "This pesticide is highly toxic to fish. Do not apply directly to water, to areas where surface water is present or to intertidal areas below

the mean high water mark. Drip and runoff from treated sites may be hazardous to fish in adjacent waters. . . Do not contaminate waters by cleaning of equipment or disposal of equipment wash waters. . . Application of this product to any body of water is prohibited."

"The spraying [of pesticides such as Scourge] kills off natural predators of insects . . . and results in insect resistance, which in turn leads to a larger problem in the future," according to NCAMP.

FCAP members report spraying on the banks of the Saugatuck River in Westport! Pear Tree Point in Darien, and other Fairfield County waterways and runoff areas.

*Scourge is toxic to bees and other insects at the level being sprayed*

According to NPTN, "Resmethrin is highly toxic to bees" and a lethal dose (LD50) of Resmethrin is a mere 0.063 micrograms per bee. Assuming uniform application, every square inch sprayed in Connecticut received two tinges that amount.

Resmethrin is a poison. If not, it wouldn't be able to kill mosquitoes, bees, and fish.

*Resmethrin does not disperse as quickly as has been indicated*

According to NCAMP, synthetic insecticides such as Resmethrin were developed to be stable in light, "yielding longer residence tamest According to NPTN, it takes at least 1 month for just half of the Resmethrin that gets into water or soil to break down. Unfortunately, just because breakdown occurs, that does not mean toxic effects vanish—Resmethrin breakdown products are chemicals which have health and environmental risks of their own.

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EXTOXNET, EXTENSION TOXICOLOGY NETWORK, PESTICIDE INFORMATION PROFILES

Pesticide Information Project of Cooperative Extension Offices of Cornell University, Oregon State University, the University of Idaho, and the University of California at Davis and the Institute for Environmental Toxicology, Michigan State University. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

EXTOXNET PRIMARY FILES MAINTAINED AND ARCHIVED AT OREGON STATE UNIVERSITY

REVISED JUNE 1996

*Resmethrin*

*Trade and Other Names:* Trade names include Chryson, Crossfire, Derringer, FMC 17370, Isathrine, N DC 104, Pynosect, Raid Flying Insect Killer, Respond, Scourge, Sun-bugger #4, SPB-1382, Synthrin, Syntox, Vectun, and Whitmire PT-10.

*Regulatory Status:* Resmethrin is a slightly toxic to practically non-toxic compound in EPA toxicity class III. Products containing resmethrin must bear the Signal Word CAUTION on the label. All products containing resmethrin for pest control at or near aquatic sites are classified as Restricted Use Pesticides (RUP) by the EPA because of potential fish toxicity. RUPs may be purchased and used only by certified applicators.

Chemical Class: pyrethroid

*Introduction:* Resmethrin is a synthetic pyrethroid used for control of flying and crawling insects in homes, greenhouses, indoor landscapes, mushroom houses, industrial sites, stored product insects and for mosquito control. It is also used for fabric protection, pet sprays and shampoos, and it is applied to horses or in horse stables. Technical resmethrin is a mixture of its two main isomers (molecules with the same chemical formula but slightly different configurations); a typical blend is 20 to 30 percent of the (1RS)-cis-isomer and 70 to 80 percent of the (1RS)-trans-isomer.

*Formulation*

Technical resmethrin is a mixture of its two main isomers (molecules with the same chemical formula but slightly different configurations); a typical blend is 20 to 30 percent of the (1RS)-cis-isomer and 70 to 80 percent of Me (1RS)-trans-isomer.

*Toxicological Effects*

*Acute toxicity:* Resmethrin is slightly to practically non-toxic by ingestion. The oral LD50 for technical resmethrin in rats is variously reported as greater than 2500 mg/kg or 1244 mg/kg [3,12]. Resmethrin is only slightly toxic through the dermal route as well. The reported dermal LD50's for technical resmethrin are: greater than 3000 mg/kg in rats, greater than 2500 mg/kg in rabbits, and greater than 5000 mg/kg in mice [3,12]. It is slightly toxic via inhalation, with a 4-hour inhalation LC50 for

resmethrin of greater than 9.49 mg/L [3]. Symptoms of exposure by any route may include incoordination, twitching, loss of bladder control, and seizures [12]. Dermal exposure may lead to local numbness, itching, burning, and tingling sensations near the site of exposure. Resmethrin is reported to be nonirritating to the skin and eyes of test animals and not to cause skin sensitization in guinea pigs [3].

*Chronic toxicity:* In a chronic feeding study with rats, 25 mg/kg/day (the lowest dose tested) caused liver enlargement. At 125 mg/kg/day, there were pathological liver changes in addition to increased liver weights. Doses of 250 mg/kg/day caused increased thyroid weight and thyroid cysts [3]. In another study over 90 days, doses of 150 mg/kg/day did not produce any adverse effects in exposed rats [12]. Increased liver weights occurred in dogs fed 30 mg/kg/day for 180 days. No effects were observed in dogs in this study at dose rates of 10 mg/kg/day [3]. In a 90-day inhalation study with rats, 0.1 mg/L, the lowest dose tested, produced behavioral changes, decreased blood glucose levels in males, and decreased body weights and increased serum urea levels in females [3]. Resmethrin was not neurotoxic to rats at doses of 62.5 mg/kg/day for 32 weeks, 250 mg/kg/day for 30 days, or 632 mg/kg/day for 7 days [4]. It is unlikely that chronic effects will be seen in humans under normal circumstances.

*Reproductive effects:* A three-generation study with rats showed a slight increase in premature stillbirths and a decrease in pup weight at 25 mg/kg, the lowest dose tested [4]. Since these doses are much higher than expected human exposures, it is unlikely such effects will occur in humans.

*Teratogenic effects:* No birth defects were observed in the offspring of rabbits given doses as high as 100 mg/kg/day [4]. Skeletal aberrations were seen in the offspring of rats given doses higher than 40 mg/kg/day [3]. No teratogenic effects were observed in mice at dose levels of 50 mg/kg/day over an unspecified period [12]. It is unlikely that teratogenic effects will be seen in humans under normal circumstances.

*Mutagenic effects:* Resmethrin was not mutagenic in a test performed with the bacterium, *Salmonella typhimurium* [6].

*Carcinogenic effects:* No evidence of tumor formation was observed in a 2-year rat feeding study with doses as high as 250 mg/kg/day, nor in an 85-week study with mice given doses as high as 50 mg/kg/day [3,4].

*Organ toxicity:* Pyrethroids may cause adverse effects on the central nervous system. Long-term feeding studies have shown increased liver and kidney weights and adverse changes in liver tissues in test animals [12].

*Fate in humans and animals:* Resmethrin is quickly eliminated by chickens. When oral doses of 10 mg/kg resmethrin were given to laying hens, 90 percent of the dose was eliminated in urine and feces within 24 hours [46]. In another study with hens given the same treatment, residues were low in hens sacrificed 12 hours after the treatment, with the highest levels found in the liver and kidneys. Low levels were found in the hens' eggs, with levels peaking 1 day after treatment in the whites and 4 to 5 days after treatment in the yolks [47].

#### *Ecological Effects*

*Effects on birds:* Resmethrin is practically nontoxic to birds. Its LD50 in California quail is greater than 2000 mg/kg [3]. In Japanese quail, the 5-day dietary LC50 is greater than 500C ppm [48].

*Effects on aquatic organisms:* Resmethrin is very highly toxic to fish with 96-hour LC50 values generally at or below 1 ug/L (0.001 mg/L) for most species tested. The LC50 for resmethrin in mosquito fish is 7 ug/L [49]. The LC50 for resmethrin synergized with piperonyl butoxide in red swamp crawfish, *Procambarus clarkii*, is 0.00082 ug/L [48]. The LC50 in bluegill sunfish is 0.75 to 2.6 ug/L, and 0.28 to 2.4 ug/L in rainbow trout [3]. Other reported 96-hour LC50's are 1.8 ug/L in coho salmon, 1.7 ug/L in lake trout, 3.0 ug/L in fathead minnow, 16.6 ug/L in channel catfish and 1.7 ug/L in bluegill sunfish [50]. Fish sensitivity to the pyrethroids may be explained by their relatively slow metabolism and elimination of these compounds. The half-lives for elimination of several pyrethroids by trout are all greater than 48 hours, while elimination half-lives for birds and mammals range from 6 to 12 hours [20]. Effects on other organisms: Resmethrin is highly toxic to bees, with an LD50 of 0.063 ug per bee [3].

#### *Environmental Fate*

*Breakdown in soil and groundwater:* Resmethrin is of low to moderate persistence in the soil environment. Its half-life has been estimated at 30 days [51]. Observed half-lives will depend on many site-specific variables. In aerobic Kentucky loamy sand, the compound showed a half-life of nearly 200 days. Degradation end-products reported for resmethrin are chrysanthemic acid, benzaldehyde, benzyl alcohol, ben-

zoic acid, phenylacetic acid, and various esters [52]. Resmethrin is tightly bound to soil and would not be expected to be mobile or to contaminate groundwater, especially in light of its extremely low solubility in water [51]. Breakdown in water: Resmethrin may enter surface waters through particulate run-off or misapplication. In pond waters and in laboratory degradation studies, pyrethroid concentrations decrease rapidly due to sorption to sediment, suspended particles and plants. Microbial and photodegradation also occur [22]. The half-life in water is 36.5 days. Breakdown in vegetation: No information was found.

*Physical Properties*

*Appearance:* Resmethrin is a waxy, off-white to tan solid with an odor characteristic of chrysanthemums [12].

*Chemical Name:* 5-benzyl-3-furylmethyl(1RS)-cis,trans-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate [12].

*CAS Number:* 10453-86-8.

*Molecular Weight:* 338.45.

*Water Solubility:* <1 mg/L at 30 C [12], insoluble in water.

*Solubility in Other Solvents:* s. in hexane, kerosene, xylene, methylene chloride, isopropyl alcohol, and aromatic petroleum hydrocarbons; m.s. in methanol [12].

*Melting Point:* 43-48 C [12].

*Vapor Pressure:* 0.0015 mPa @ 30 C [12].

*Partition Coefficient:* Not Available.

*Adsorption Coefficient:* 100,000 [51].

*Exposure Guidelines*

ADI: Not Available.

MCL: Not Available.

RfD: 0.03 mg/kg/day [30].

PEL: Not Available.

HA: Not Available.

TLV: Not Available.

Basic Manufacturer: Roussel Uclaf Coup., 95 Chestnut Ridge Road, Montvale, NJ 07645. Phone: 201-307-9700. Emergency: Not Available.

References: References for the information in this PIP can be found in Reference List Number 2

DRAFT RESOLUTION FOR STAMFORD BOARD OF REPRESENTATIVES  
REGARDING THE CITY SPRAYING OF PESTICIDES

WHEREAS in response to an outbreak of a mosquito-borne, rarely life-threatening disease, called West Nile Fever, Mayor Malloy, in conjunction with the CT Department of Environmental Protection, had promoted and consequently undertaken a program of ground spraying south of I-95 and along the coastal areas of Stamford with the pesticide RESMETHRIN; but

WHEREAS there are now grave and widespread concerns being raised by the scientific, medical and academic communities about the safety and long term impact of RESMETHRIN and other synthetic pyrethroids. All have side effects and all must be applied under the strictest and very specific guidelines to prevent contact with human-, animal- and aquatic habitats. These guidelines extend also to proper storage and concentrations of the pesticides.

WHEREAS there has been mounting evidence about repeated and irresponsible disregard of the mandatory storage and application precautions by ground crews.

WHEREAS Officials insist that these neurotoxins are applied properly and are completely harmless to the population and the environment. The Community education has neither been comprehensive, timely or accurate about the health hazards that adults and children who have been exposed to these pesticide sprays and their residue, can suffer.

WHEREAS in addition to the spraying, the program has not undertaken to fully disclose extensive precautions necessary to prevent contact with the pesticides, incl. thorough wash-down of playground equipment after spraying, as well as the dangers from residue and extended periods of some dangerous breakdown chemicals on all contaminated surfaces. Scientific research clearly identifies the link of repeated pesticide exposure to life threatening forms of cancer, sterility, and immune deficiencies.

WHEREAS more experienced jurisdictions, incl. LA County, Southern Florida, portions of Michigan, and Amherst, NY have come to rely on implementing more effective and "least toxic" measures with Integrated Pest Management (IPM). Integrated Pest Management being a process by which the use of preventative, non-toxic

and least toxic alternatives with the latest technology and management techniques are prioritized. I.e. statistically valid surveillance, big-control with natural predators, source reduction of breeding sites, least toxic larvicides, combined with thorough public education.

NOW THEREFORE BE IT RESOLVED that SAFE<sup>1</sup> of Fairfield County urges the City of Stamford to immediately undertake a high priority study and educational process of all agencies involved about the full spectrum such as the small affect on adult mosquitoes but of all potentially harmful side effects and long term impact on the eco system from the spraying of pesticides versa the implementation of Integrated Pest Management.

BE IT FURTHER RESOLVED that SAFE of Fairfield County urges the Mayor and City Council to provide adequate funding and authorization to form a Review Panel comprised of government officials as well as of independent scientists specializing in entomology, toxicology and physicians to devise the most effective and least invasive alternative, safe method of mosquito management to protect the population and the environment responsibly. This approach must include adequate year round surface and followup blood sampling.

AND BE IT FURTHER RESOLVED that the current emergency response system be reviewed by the H & S Committee to assure that appropriate, measured responses are triggered before declaring an emergency, and make this available for public review with full disclosure before the Spring of 2000.

BE IT FURTHER RESOLVED that the City of Stamford work with the State of Connecticut Department of Environmental Protection, the Department of Health (DEP & DOH), and Fairfield County SAFE, to immediately adopt and implement IPM policies and programs.

BE IT FINALLY RESOLVED that this review be undertaken immediately and be finally available by February 28, 2000, before the next emergence of the vector.

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NEW YORK PUBLIC INTEREST RESEARCH GROUP,  
*Albany, NY, November 17, 1999.*

The HONORABLE JOSEPH LIEBERMAN,  
*U.S. Senate,  
Hart Office Building,  
Washington, DC 20510.*

DEAR SENATOR LIEBERMAN: We understand you will be holding a public forum November 18 on the West Nile Virus outbreak this fall. As two of New York's leading nonprofit advocates for pesticide use reduction, Environmental Advocates and the New York Public Interest Research Group (NYPIRG) are very interested in helping ensure that our region's health agencies design and implement preventative, least toxic mosquito control programs as soon as possible in order to avoid future aerial spraying of pesticides.

Enclosed is a copy of the testimony which our groups presented at a hearing last month before the New York City Council which lays out some of the key issues which need to be addressed. We are currently developing more detailed recommendations on mosquito monitoring and prevention programs to submit to State and local health departments. Although many of our recommendations are specifically directed at New York City, the questions we raise must also be evaluated at the Federal level. We therefore urge you to request that the General Accounting Office prepare an analysis of how State, local, and Federal authorities responded to the public health threat posed by the West Nile virus. We would be happy to discuss our recommendations further with you and your staff. Thank you for your investigation into this matter.

Very truly yours,

LAURA HAIGHT, *Senior Environmental Associate, NYPIRG*  
AUDREY THIER, *Pesticide Project Director, Environmental Advocates.*

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<sup>1</sup>SAFE of Fairfield County is a supporting chapter of New York SAFE which stands for "Seeking Alternatives For the Environment. SAFE is both a task force and a clearing house dedicated to working hand-in-hand with government agencies to establish safe, non-toxic solutions to public health and/or environmental problems.

## STATEMENT OF NYPIRG BEFORE THE NEW YORK CITY COUNCIL, OCTOBER 12, 1999

## PESTICIDE SPRAYING FOR MOSQUITO CONTROL

*Introduction*

The New York Public Interest Research Group and Environmental Advocates want to thank the New York City Council for holding these important hearings. In the midst of this crisis of competing health risks, it is essential to take a step back and view the broader picture of what this experience can teach and how to avoid a repeat of it. It is also a good opportunity to look more broadly at the city's pest problems, for there are many, and its routine pesticide use, which is prodigious, in order to devise strategies that deal with these in a comprehensive, preventative, and least-toxic manner.

There is no foolproof means of preventing infectious disease outbreaks, and the risks of these will likely be exacerbated and entail more exotic illnesses as global warming and global travel increase microbe circulation. We will always be at risk. But, when faced with similar hazards, other communities across the country have found that it is possible to keep such hazards in check and preclude the need for the kind of wholesale pesticide exposure spawned by this current outbreak. In Houston, Los Angeles, St. Louis, and other areas where mosquito-borne diseases erupt repeatedly, widespread aerial spraying of mosquitoes with adulticides rarely if ever occurs. We have an example of a comprehensive mosquito control program closer to home in Suffolk County, but if the preventative measures it employs are not consistently followed regionwide, everyone remains at risk.

It is essential to implement such preventative measures, not only because, ideally, outbreaks should be prevented, not contained after they have claimed lives, but also because the cure—pesticides—entails risks of its own. The following briefly summarizes the risks of the pesticides used in New York City.

*Malathion*

Malathion is an organophosphate insecticide that functions by interfering with an enzyme, cholinesterase, essential to normal nervous system function in insects and humans alike. Although it is one of the less acutely poisonous of this family of pesticides, exposure to malathion nonetheless entails real toxicity concerns, including respiratory distress, headache, dizziness, and nausea.<sup>1</sup> Like all organophosphates, at high doses it can cause more serious symptoms.<sup>2</sup> For example, malathion was the second leading cause of hospitalization for occupational pesticide poisoning in the United States during the period 1977–1982.<sup>3</sup>

Infants and children, whose immature nervous systems are more vulnerable to insult, and newborns, whose metabolisms are less capable of detoxifying malathion, are more susceptible than adults to its toxic effects.<sup>4</sup> Organophosphate poisoning in children may also result in a different set of symptoms than adults commonly experience, including increased muscle tension and rigidity.<sup>5</sup>

Information on long-term, chronic effects is less abundant. Currently, malathion has not yet been classified by the United States Environmental Protection Agency (EPA) as to its carcinogenic potential, although a decision on its classification is pending.<sup>6</sup> Over the years, reports in the epidemiological literature have indicated

<sup>1</sup> Reigart, J.R. and J.R. Roberts. 1999. *Recognition and Management of Pesticide Poisonings*. United States Environmental Protection Agency. EPA 735-R-98-003.

<sup>2</sup> Ibid.

<sup>3</sup> Blondell, J. 1997. Epidemiology of Pesticide Poisonings in the United States, With Special Reference to Occupational Cases. *Occupational Medicine: State of the Art Reviews*. 12(2):209–221.

<sup>4</sup> National Research Council. 1993. *Pesticides in the Diets of Infants and Children*. National Academy Press. Washington D.C.

<sup>5</sup> Lifshitz, M. et al. 1999. Carbamate and organophosphate poisoning in young children. *Pediatric Emergency Care*. 15(2):102–103. see also Wagner, S.L. and D.L. Orwick. 1994. Chronic Organophosphate Exposure Associated with Transient Hypertonia in an Infant. *Pediatrics*. 94(1):94–97.

<sup>6</sup> Burnam, W.L. August 25, 1999 Memorandum. *Office of Pesticide Programs List of Chemicals Evaluated for Carcinogenic Potential*. United States Environmental Protection Agency.

that malathion may compromise the immune system,<sup>7</sup> cause reproductive harm,<sup>8</sup> and cause genetic mutations or interfere with normal cell replication.<sup>9</sup> Being a broad spectrum insecticide, malathion kills other insects as well as mosquitoes, including honeybees, to which it is highly toxic. It is also highly toxic to many aquatic organisms and the aquatic stages of amphibians.<sup>10</sup>

#### *Resmethrin*

Resmethrin is a synthetic pyrethroid insecticide. Pyrethroids, like organophosphates, affect the nervous system, though they do not inhibit cholinesterase. They are of relatively low acute toxicity, although poisoning can occur and allergic responses have been reported.<sup>11</sup> There are also reports of persistent symptoms when exposures occurred indoors.<sup>12</sup>

Information on chronic effects is spotty. Resmethrin has not been classified with regard to carcinogenicity, although products that contain resmethrin often include the synergist piperonyl butoxide (PBO), which has been classified by the EPA as a possible human carcinogen, as have several other pyrethroid compounds.<sup>13</sup> There are indications that pyrethroids may interfere with the immune<sup>14</sup> and endocrine systems.<sup>15</sup> Other adverse chronic effects, including effects on the liver and thyroid, have been reported in toxicology testing.<sup>16</sup> Resmethrin is highly toxic to bees and fish.<sup>17</sup>

How these reports of possible chronic health problems of malathion and resmethrin may relate to the dose or frequency of exposure encountered in the current New York City spraying campaign is unknown. It is also impossible to say how they may interact with the other pesticides to which city residents are exposed. Data on such chemical interactions are virtually nonexistent.

#### *Alternative mosquito control*

Clearly, avoiding the need for adulticides should be item one on the city's agenda. They are a strategy of last resort, when all other control possibilities have been exhausted and a public health emergency requires action. In addition to health concerns about pesticides, repeated use of these chemicals breeds resistance and reduces their effectiveness for times when they may be the only option.

Effective preventative mosquito control relies on a combination of before-the-fact measures, including:

- Removal of breeding habitat by reducing standing water wherever possible.<sup>18</sup>

<sup>7</sup>Fan, A. 1998. *1998 Malathion Literature Review*. Memorandum from Anna M. Fan PhD, Chief, Pesticide And Environmental Toxicology Section to Richard Kreutzer, M.D. Chief Environmental Health Investigations Branch, Department of Health Services, California Environmental Protection Agency. June 26, 1998. see also State of California Department of Health Services. 1991. *Health Risk Assessment of Aerial Application of Malathion-Bait*. Berkeley, CA. Desi, I. et al. 1978. Studies on the Immunosuppressive Effect of Organochlorine and Organophosphoric Insecticides in Subacute Experiments. *Journal of Hygiene, Epidemiology, Microbiology, and Immunology*. 1:115-122.

<sup>8</sup>Contreras H.R. and E. Bustos-Obregon. 1999. Morphological alterations in mouse testis by a single dose of malathion. *Journal of Experimental Zoology*. 284(3):355-9. see also Balasubramanian, K. et al. 1987. Effect of malathion on the testis of male albino rats. *Medical Science Research*. 15:229-230.

<sup>9</sup>See State of California and Fan note 7 above. See also Rupa, D.S. et al. 1991. Frequency of Sister-Chromatid Exchange in Peripheral Lymphocytes of Male Pesticide Applicators. *Environmental and Molecular Mutagenesis*. 18: 136-138. see also New Jersey Department of Health and Senior Services. 1997. *Hazardous Substances Fact Sheet: Malathion*. Trenton, New Jersey.

<sup>10</sup>Extension Toxicology Network. 1996. *Pesticide Information Profile: Malathion*. Oregon State University.

<sup>11</sup>See Reigart and Roberts note 1 above. See also Extension Toxicology Network note 10 above.

<sup>12</sup>Muller-Mohnssen, H. 1999. Chronic sequelae and irreversible injuries following acute pyrethroid intoxication. *Toxicology Letters*. 197:161-175.

<sup>13</sup>See National Research Council note 4 above.

<sup>14</sup>Diel, F. et al. 1999. Pyrethroids and piperonyl-butoxide affect human T-lymphocytes in vitro. *Toxicology Letters*. 107:65-74. see also Stiller-Winkler, R. et al. 1999. Immunological parameters in humans exposed to pesticides in the agricultural environment. *Toxicology Letters*. 107:219-224.

<sup>15</sup>Eil, C. and B.C. Nisula. 1990. The Binding Properties of Pyrethroids to Human Skin Fibroblast Androgen Receptors and to Sex Hormone Binding Globulin. *Journal of Steroid Biochemistry*. 35(3/4):409-414.

<sup>16</sup>Extension Toxicology Network. 1996. *Pesticide Information Profile: Resmethrin*. Oregon State University.

<sup>17</sup>Ibid.

<sup>18</sup>Olkowski, W. et al. 1991. *Common-Sense Pest Control*. The Taunton Press. Newtown, Connecticut.

- The use of meteorologic data to identify weather patterns known to exacerbate specific vector-borne diseases and followup with enhanced monitoring when such conditions exist.<sup>19</sup>

- Control of mosquito populations when they are in the larval and pupal stages. There are a variety of non-toxic and least toxic methods of larval control, such as applying bacillus thuringiensis israelensis (BTI) bacteria to stagnant waters, bacillus sphaericus to storm sewers, and stocking isolated water bodies with mosquito-eating fish. Some of these products have effects on non-target species and thus each use should be evaluated from this perspective.<sup>20</sup>

- Trapping and monitoring mosquitoes to detect the presence of mosquito-borne illnesses. Trapping not only indicates the presence or absence of disease, but can localize the source of infectious agent so that targeted responses with least-toxic insecticides can be implemented, instead of blanket spraying of wide areas. In addition to monitoring, new traps are on the market, using carbon dioxide as a lure, which are designed to control mosquito populations for areas of up to an acre.

- The use of sentinel birds to detect the presence of disease before it reaches humans. For instance, chickens are commonly used bird hosts for monitoring whether St. Louis encephalitis is present in the local bird population. Like trapping and monitoring of mosquitoes, sentinels detect the presence of disease before it reaches human populations and help to locate the areas where it must be controlled.<sup>21</sup>

- Educating the public about how they can eradicate mosquito breeding habitat around their homes (such as removal of standing water) and measures they can take to avoid being bitten (such as installation of window and door screens).

The benefits of preventive control and monitoring are myriad. They reduce the likelihood that a surprise outbreak will occur while minimizing the use of hazardous pesticides. Harris County (Houston), which has one of the most active St. Louis encephalitis programs in the country, has not conducted aerial spraying for years. Through effective monitoring, their program can identify infected areas a month before any human comes down with the virus, and thereby address potential outbreaks at the source. This approach not only saves human lives, but also reduces pesticide use and saves the county approximately one million dollars each year.<sup>22</sup>

#### *Recommendations*

The city must now address a range of issues and report fully to the public on each:

- How the city handled advance warning of spray schedules and the quality and accuracy of pesticide health effects information dispensed to the public regarding the spraying. Reports of people caught directly in the spray due to lack of warning, inadequate advice from poison control centers and misrepresentations by public officials that the pesticides sprayed are harmless must all be documented and assessed.

- The observed adverse effects of spraying (from surveys of poison control centers, hotlines, citizen networks, emergency rooms and clinics), and the potential size and virulence of the West Nile epidemic had it not been checked (based on other epidemic sizes across the globe, mosquito population data and infection rate now being gathered by the CDC, local serological studies, and cataloguing of case outcomes). A complete accounting of all adverse effects associated with this crisis, whether from the disease or the spraying, is essential in order to evaluate their relative risks.

- Develop a vector control plan to guide the city in responding to future arboviral disease outbreaks. These response guidelines should include different response recommendations for each potential arbovirus keyed to threshold levels of disease in sentinel birds and mosquitoes, mosquito activity, and human cases.

- The immediate implementation of preventative mosquito control strategies to fend off a similar outbreak next spring and in future years. Surveillance, larvaciding and breeding site elimination are still useful this season.

- Development of a long-term mosquito monitoring and control plan, together with sufficient funding for implementation. When spring arrives, a comprehensive mosquito control policy must be in place—one which uses all of the various techniques outlined above and also investigates newer, non-toxic adult mosquito trapping technology for potential effectiveness. Regardless of whether the West Nile virus reemerges this spring, the City must maintain a constant vigilance for poten-

<sup>19</sup>Moore, C.G. et al. 1993. Guidelines for Arbovirus Surveillance Programs in the United States. Centers for Disease Control.

<sup>20</sup>See Olkowski et al. note 18 above.

<sup>21</sup>See Moore et al. note 19 above.

<sup>22</sup>Interview with Dr. Ray Parsons. Harris County (Texas) Mosquito Control Division. September 11, 1999



tial mosquito-borne disease outbreaks, including those of a far more serious nature, such as eastern equine encephalitis. Early detection and control is safer for humans and the environment, because it minimizes the use of pesticides and uses animal sentinels, not humans, as a surveillance tool. A preventive approach is far less expensive and more effective than the after-the-fact spraying that the City has resorted to this fall. Coordination among State and local public health officials in the tri-State New York City metropolitan region with regard to improved surveillance, control measures, and emergency response planning. The City should work with neighboring counties, some of which have very effective mosquito control programs, to develop a regional plan for monitoring and preventing disease outbreaks, and to share information and resources in implementing such a plan.

These actions will help evaluate the handling of the current crisis and ideally ward off a repeat next spring. But mosquito-borne disease is by no means the city's only pest problem. And aerial spraying, while dramatic, is by no means the city's only pesticide exposure the city must deal with. New York State's pesticide reporting data, the first year of which was available for 1997, demonstrated that New York City tops the State in the amount of pesticides used overall. Furthermore, the majority of the pesticides used are neurotoxic organophosphate and carbamate insecticides. The most heavily used pesticide in the city, chlorpyrifos, is, like malathion, an organophosphate insecticide, but substantially more acutely toxic and persistent, and with a host of adverse chronic and developmental health effects associated with its use.<sup>23</sup>

The city should regard this current crisis as a wake-up call to examine all of its pest problems and its pesticide use risks, and devise preventative, less hazardous methods of dealing with them. We recommend the establishment of a New York City Pest Management Board (such as the City of Buffalo has had for approximately a decade), that would include local residents, public health and environmental interest groups, physicians, scientists, and municipal leaders.

We urge the City Council to establish the Board as a watchdog to solve pesticide and pest issues in the city, instead of the current situation—lurching from crisis to crisis with incomplete information and no long-range planning and solutions.

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STATEMENT OF WILLIAM R. OPP, DIRECTOR, LEE COUNTY MOSQUITO CONTROL DISTRICT, FORT MYERS, FL

Your public hearing on mosquito control is of concern to me as the director of the Lee County Mosquito Control District in Ft. Myers, Florida. This District uses many tools/materials to protect the public health of its citizens, as well as visitors to the area (which includes Sanibel/Captiva Islands). Without the proper tools and materials, the public health and welfare could be placed into question.

Please support good mosquito control.

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STATEMENT OF DOMINICK NINIVAGGI, SUPERINTENDENT, SUFFOLK COUNTY VECTOR CONTROL, YAPHANK, NY

I regret that I am unable to attend your hearing on West Nile Virus (WNV), but as Superintendent for New York's largest mosquito control program, I would like to comment. First, Connecticut is to be commended for its outstanding laboratory operation under Dr. Ted Andreatis. The excellent work done by this lab helped provide critical information about WNV. This information allowed Connecticut to respond in a measured and limited manner.

Jurisdictions that lacked this information base in New York were forced to resort to "broad-brush" spraying, because they could not determine nature and the extent of the threat. Connecticut also has outstanding mosquito control professionals such as Paul Capotosto and Roger Wolfe in its DEP, and I urge you to listen their counsel. Here in Suffolk County, we have an integrated mosquito control program that uses laboratory surveillance to guide a full spectrum of physical, biological and, when necessary, chemical controls to prevent and limit mosquito problems before an epidemic is threatened. We were also able to limit the need for pesticide applications in residential areas. During the WNV outbreak, chemical control of adult mosquitoes was appropriate and necessary, and such measures may be needed again in the future.

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<sup>23</sup>Thier, A. et al. 1998. Plagued by Pesticides: An Analysis of New York State and New York City's 1997 Pesticide Use and Sales Data. Environmental Advocates and the New York Public Interest Research Group. Albany, NY.

In the long term, however, an integrated program that includes surveillance and emphasizes prevention is the most effective and environmentally sound approach. I urge you to support and strengthen these programs in Connecticut and elsewhere. Please bear in mind that WNV is unlikely to be the last exotic mosquito-borne pathogen that we will have to deal with. Having good laboratory and mosquito control programs in place and running is the best means to insure that will be ready when (not if) that happens again. Please feel free to contact me if you would like further information on Suffolk's program.

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STATEMENT BY E. ALLEN JAMES, EXECUTIVE DIRECTOR, RISE (RESPONSIBLE INDUSTRY FOR A SOUND ENVIRONMENTS, WASHINGTON, DC)

RISE appreciates the opportunity to file the following statement for insertion in the Field Hearing Record held in Fairfield, CT, as noted above. RISE is the national association representing the manufacturers, formulators, distributors and other industry leaders involved with pesticide products used for public health protection as well as in turf, ornamental, pest control, aquatic and terrestrial vegetation management and other non-food/fiber applications.

West Nile encephalitis, a deadly mosquito-borne virus, killed seven people and infected dozens of others in the New York metropolitan area this year. This situation is just one example of the grave consequences of reliance on emergency or "catch-up" pest control . . . or no pest management at all. Effective public health protection from disease-carrying pests, such as mosquitoes and other insects and vermin, is dependent on a continuous pest management program.

Regrettably, more and more communities are being pressured by anti-pesticide groups to restrict use of pesticides in schools, homes and public buildings in the absence of any proven health or safety hazard. Successful efforts to reduce or eliminate pesticide use allow insect-borne health threats, such as encephalitis, to continue to emerge as significant public health problems. Systematic, well-managed Integrated Pest Management (IPM) programs are the solution.

As pointed out by expert witnesses during the Committee's field hearing December 14, 1999, a variety of measures is safe and effective—in combination—for control of such disease carriers as mosquitoes. Insect traps and identification, elimination of breeding sites, use of larvacides to kill larvae, ground and aerial applications of pesticides were mentioned. These methods are all part of IPM programs established in most States, many schools and communities.

Integrated Pest Management (IPM), as defined by Federal law in the Food Quality Protection Act of 1996 (P.L. Law 104—August 3, 1996), is a "sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health and environmental risks." Federal agencies have been directed to use IPM techniques in carrying out pest management activities. RISE and its members not only support IPM, but actively promote development and implementation of such programs for pest control and public health protection.

Children and adults deserve an environment free of carriers of filth and disease. Such carriers include cockroaches that contribute to asthma among inner-city children, ticks that carry Lyme and other diseases, rats that bear numerous dreaded diseases and mosquitoes that transmit encephalitis, dengue fever, malaria, and other human maladies.

In reference to the current West Nile virus concern when testifying during this Committee's field hearing, Ms. Jane Stahl, deputy commissioner, Connecticut Department of Environmental Protection, warned "We can't treat this [outbreak] as a fluke, like it's not going to happen again." Effective IPM programs provide the answer.

Anti-pesticide activists are extremely vocal in their advocacy of "chemical-free" pest control. Real-world evidence, however, shows that pests are the problem; pests cause public health threats, not the safe and responsible use of pesticides.

Thank you for this opportunity to provide this statement for insertion into the record.

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STATEMENT OF ROGER KERR, STAMFORD, CT

I understand you are cosponsoring hearings on the events surrounding the recent West Nile Virus outbreak in the New York area.

I hope that you will fully explore the use of alternatives to pesticides, as from my research I am convinced that the pesticides used in both New York City and in Westchester County, NY and Fairfield County, CT (my home) are significantly more

dangerous than the threat of the virus itself. There are more natural methods that can be used to control the mosquito population, and I believe they should be the foundation of a national (or regional, for that matter) program.

I believe that if we continue the spraying of pesticides we will find other health problems emerging in future years. To me this risk is much greater than the risk from the virus itself.

I hope during your hearings you require the various parties testifying to use real numbers from this year's experience and not some hypothetical or estimated set of numbers. We certainly had enough experience this year to use it as the base for decisionmaking. In addition please make sure they fully outline the real situation both before spraying began and after it started. If that is done I believe it will be obvious that the spraying not the prime factor in the reduction of the incidence of this disease as it was already decreasing before spraying began.

Thank you for exploring this topic for us.

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STATEMENT OF CONNIE EASH, CHESHIRE, CT

I understand that you will be holding a Senate hearing next week on the West Nile Virus Outbreak. I hope that several things are made clear during this hearing. I understand that the public is not invited, so I would like to give information that I have researched during the last few months. As a pharmacologist and a mother of a boy who was diagnosed with pesticide poisoning in 1993 and now is sensitive to pesticide exposures, I know that the effects of pesticides are not widely recognized, even by the "experts" and that often such knowledge is vehemently attacked by pro-chemical people who have certain interests in protecting the reputation of chemicals.

During the coming hearing, I hope you will be sure the following things are done: 1) Real experts in pesticide poisoning are used in equal balance with the virologist experts. Pesticide health effects should be recognized, monitored and treated. 2) Real numbers should be used to compare the threat of WNV to other diseases. My source is CDC numbers. 3) Real information benefits of pesticide spraying. The lack of benefit is illustrated in the CDC report quoted below. Pesticide effects can be obtained from EXTTOXNET, through the EPA. 4) Any National Policy should mandate that safer methods of mosquito control be used prior to spraying. Safer methods exist and were not employed during the New York incident.

First, a sign that an "expert" is NOT an expert is when he says "pesticide spraying creates no or minimal risks to humans or the environment," or that he calls reactions to pesticides "allergic".

Medical professionals who deal with pesticide poisonings should be used as experts. These are hard to find, however the American Academy of Environmental Medicine does have a list of medical experts in most States. William Rea, MD, of Texas is one of the foremost experts in actually treating pesticide and chemical poisoning. Risks of pesticide use should be considered, publicized and recognized. Just as there are efforts at monitoring and treatment of encephalitis, there should be monitoring and treatment available to those poisoned with the pesticides. Presently, the doctors involved are not trained in the recognition of pesticide poisoning or performing tests for pesticide poisoning. Health departments are not required to document cases of pesticide poisoning.

Secondly, the Senators should be made aware of the low risk of West Nile virus. Presently, the opinions of DEP and CDC officials are that the West Nile strain is less virulent than than the St. Louis strain of virus. The CDC keeps records of deaths across the country from certain diseases, including four strains of encephalitis: Eastern equine, California, St. Louis and Western equine. According to the CDC "records of deaths from selected diseases, 1986-1995" deaths from all four of the encephalitis strains during those years were 48. Please compare this to 948 deaths from chicken pox and 1006 deaths from acute rheumatic fever during the same time period. Outbreaks of chicken pox, in spite of it being highly contagious, are rarely a cause for panic. These facts, coupled with the lack of human evidence, lead us to believe that the panic occurring here is mostly due to an exaggerated sense of danger created by an imbalance in the information, which must be addressed in the coming hearing.

Next, ask the question, "have mosquito control methods had any effect on the progress of WNV?" CDC's MMWR Weekly, October 22, 1999, shows a graph illustrating a decline in new cases of WN before the spraying even started. New cases in New York peaked the week of August 22-28 at 17, then declined to 7 the following week of August 29-September 4. The malathion spraying started September 5.

Finally, they should have experts in alternative methods of mosquito control which may become necessary should a more virulent mosquito-borne virus ever appear. Such alternatives should strive to maintain the natural predators of mosquitos so that the mosquito population does not explode when its aquatic and other predators are killed due to pesticide spraying. Indeed, we should call for an investigation into the deaths of the lobsters and fish during the spraying. Were they tested for pesticide poisoning? Were their deaths consistent and fish kills due to pesticide poisoning? If less toxic mosquito control are not being utilized, why not?

I am glad that the hearings will be held. I'm concerned because of the handling of the whole issue in the past few months, that information will again be twisted and suppressed.

Thank you for your time and interest.

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*Westport, CT 06880, November 16, 1999*

SENATOR JOSEPH LIEBERMAN,  
*Senate Office Building,*  
*Washington, D C. 20510.*

DEAR SENATOR LIEBERMAN: I was upset to find that the public hearing on the PESTICIDE ISSUE would not include time for public comments. I am a Connecticut resident who was dumbfounded by the way the mosquito issue was handled in the tri-State area this fall.

It is imperative that local and national government officials consider the drawbacks as well as the benefits of pesticide use. I do not feel virologists should be the only health professionals consulted when the decision to spray is made. The possible short- and long-term effects of these chemicals on humans need to be weighed carefully. So do the effects on wildlife—including the natural predators of the targeted organism.

In the case of the West Nile-like virus, new cases in New York City had peaked and begun to decline approximately 2 weeks before the city even began spraying. They sprayed us here in Connecticut when there were NO human cases. Worse still, they sprayed around dead crows, despite their known 50-100-mile vector. The decision to spray was not based on good science. Compare the death toll from West Nile to that of say, chicken pox. This was the classic mountain-out-of-a-molehill.

Though the CDC got everyone riled up about the virus, even before they were sure which virus it was, the DEP downplayed the very real health effects of the pesticides. I have a letter from the Connecticut Governor's office telling me that Resmethrin comes from chrysanthemums. I have a memo from our local Board of Education saying that Resmethrin is safe for bees (which the label says it is not). Repeated calls to local and State officials to find out the truth about Resmethrin got me nowhere—I finally got what I needed (including the product label) off the Internet.

Furthermore, the pesticides were sometimes misapplied. It says right there on the label that Resmethrin should not be sprayed on or around water. In Fairfield County they paid that caveat no heed. It was also applied on windy nights, and under cold conditions, conditions contrary to what is stated on the label.

When people reported immediate effects of pesticide poisoning (including shortness of breath and numbness in the extremities), many were told they were just "sensitive". No agency kept track of poisonings as far as I know no one is monitoring the long-term effects on the area either. Since we've already been made unwitting guinea pigs, someone should pick a similar, nonsprayed community and do a statistical analysis over time for increased cancer and central nervous system problems.

When it comes to insect-borne illness, education is the best defense. People need to be told that personal prevention is the first and most effective line of defense—dressing appropriately, for example, and avoiding buggy times/areas. It's important that people know the symptoms of the disease in question so they can get treatment, especially since no amount of spraying will kill all the bugs. And most important, people need to know that a strong immune system is the best defense against disease, and that—pesticides depress the immune system.

I would respectfully ask that, when considering the recent West Nile spraying fiasco and in making plans for the future:

1) REAL experts in pesticide poisoning balance the virology experts. (Anyone who say "pesticide spraying creates no or minimal risks to humans or the environment," or who maintains that a reaction to pesticide poisoning is "allergic" is NO expert.)

2) REAL numbers are used in comparing the threat of an insect-borne pathogen, comparing it to that of other diseases.

3) REAL numbers are used in analyzing the risks of pesticide spraying.

4) Health effects of pesticide use be recognized, monitored, and treated.  
 It is not the job of Government to pander to people's ignorance or convenience. Pesticide use to "protect" people in the short run cannot be justified if it comes without a full, public explanation of the potential immediate and long term problems it may cause.

Sincerely,

STACY PRINCE.

*Fairfield, CT 06430, December 1, 1999.*

SENATOR JOSEPH I. LIEBERMAN,  
*Hart Senate Office Building,  
 Washington, DC 20510.*

DEAR SENATOR LIEBERMAN: I am writing in regard to the upcoming meeting on the West Nile virus on December 14, 1999 at Fairfield University in Fairfield, CT. I would like to ask this committee to help promote and educate the public in successful non-pesticide methods of mosquito control that have been used elsewhere in the country.

The use of pesticides should be a control method of last resort. Many of the natural predators of mosquitoes may be killed or negatively affected by the use of pesticides. Mosquitoes have also been reported to develop resistance to the pesticides.

This fall, in Connecticut, pesticides became the method of first resort. Mosquitoes carrying the virus were reported in only one town (Greenwich) which was on the New York State border. However, many towns chose to spray as a precaution with some calling for aerial spraying. Even the State elected to do ground spraying in the Sherwood Island State Park located in Westport!

#### *Concerns*

My first concern involves the negative impact on human health and the environment from the use of pesticides to control mosquitoes. My second concern is with the overall lack of knowledge of non-pesticide methods and the lack of understanding of the importance of these methods by local officials and the media.

Most of the spraying that was done in Connecticut occurred south of Interstate I-95. Many of the beaches, marshlands and rivers adjacent to Long Island Sound were subjected to pesticide drift and runoff. Scourge was the pesticide that was selected. The AgrEvo Material Safety Data Sheet, which I received from the Connecticut Department of Environmental Protection, states that this pesticide is toxic to fish and birds. Others reported that the pesticide was also toxic to bees, butterflies and other beneficial insects.

While Connecticut may have selected the least toxic pesticide available, there were questions that this chemical does negatively impact human health. Special concerns were noted for those with upper respiratory illness such as asthma and emphysema. Also, some of the information suggested that the same two groups (the elderly and children) are susceptible to both the virus and the negative effects of the pesticides. Choosing not to spray has been a very difficult decision for our local officials.

Another problem has been the local media pressure "to spray or else you're not taking any action to protect the public." This approach by the media only made a difficult decision more difficult. I saw only one article on Fairfield's restored salt marsh as well as a brief mention that town officials had been using BTI. The press did not seem to understand the importance of these non-chemical steps.

With this in mind, I would like to ask your committee the following questions:

1) Would this committee arrange to educate the media and State/local officials about non-pesticide methods that have been used successfully in other parts of the country?

2) Could you develop a team of individuals that specialize in non-pesticide control methods that could go to any area and help design programs for towns suddenly faced with this type of an emergency?

3) Can you provide funding for this training?

4) Can you provide emergency funding for the State to set up additional mosquito trapping sites and testing? Faster turnaround time on test results is also needed.

The State mosquito hotline reported only one permanent test site for Fairfield. Just before the Fairfield decision to spray was made, only few 1-day test sites were established. No mosquitoes had been found with the virus, however the decision was then made to go ahead and spray. Luckily, the temperature dropped and no spraying was done. Faster turnaround times on testing would have confirmed that there were no virus detections, which would have reduced the pressure to spray.

5) The USGS website provides a link to the EPA's "Pesticide Mosquito Control (10/6/99)" report. Can your committee request that the EPA create a report on non-pesticide methods of control?

I would like to thank you for having this hearing in Fairfield. Even though the public will not be allowed to speak at this hearing, I hope you will enter my letter into the record and look forward to any information the speakers can provide on non-pesticide methods of mosquito control.

Sincerely,

KRISANN E. BENSON.

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STATEMENT OF LYNN PRITCHARD, WESTPORT, CT

On the evening of Tuesday, 28 September, at 10 p.m., family fed and baby in bed, my nice safe world was breached by a nightmare.

I'm educated, I'm conscious and my decisions are based in careful consideration of information sought, gathered and sifted. I feed my family organic foods; I breast feed and stay at home with my son. I use cloth diapers and environmentally safe cleaning products. I raise my own organic herbs and vegetables and I preserve the surplus. I compost and I recycle. Basically I care.

While watching the news on Wednesday, September 22, I saw there was to be spraying for the mosquitoes carrying the encephalitis virus. I felt uneasy, but I thought that if I couldn't stop it, I could prepare. I made a point to find out where and when they would spray our neighborhood and with no easy effort I gleaned the information piecemeal.

The night I knew they were to spray, I covered my gardens, I taped my leaky windows, I covered the sandbox, locked in the cat, covered the neighbor's sandbox and toys (they were away), closed their windows and locked in their cat and then left town for 2 days (my husband returning the next morning for the cats). Basically, I played ball.

A week later, with the local newspaper this time reporting there was to be spraying and where, I was able to calculate the risk of the spraying which was to be a half mile away. I thought that we'd stay home, close the windows and watch a movie. I made a point to tell the neighbors not to drive or walk in those areas. Again, I played ball; the town of Westport didn't.

At 10 p.m. we heard the muffled, unintelligible sound of a bullhorn. We rushed to the window. It was the advance car with lights flashing. Five car lengths behind came the spray truck. Our home, situated on a corner close to the road, was coated. We saw the spray. The fog was everywhere I called my pregnant neighbor. She had just closed her windows because, her husband had arrived moments before. He had jogged through it. The advance car telling him, "Oh, it can't hurt you." We went back to what we were doing. Fifteen minutes passed. I tasted metal in my mouth. My husband did as well. We doubted ourselves—but both of us? Our son coughed in his sleep. We moved him from his corner room into our bedroom with a more modern window. We stuffed towels under the door and sat there. My throat and sinuses became increasingly irritated. I could smell it. . . I could taste it. . . I could feel it. . . I couldn't do anything about it! It was a gas seeping into my body. . . into my child's body. . . but to leave was to walk into it. We waited an hour. A very long hour. We wrapped a towel around our sleeping son's head. We breathed into cloths. We fled our home in the middle of the night to my mother's home, a town away.

I awoke the next morning completely hoarse. I called the Westport Health Department. I got an apology—that felt a little better. I felt sorry for the Health Department lady—she was under a lot of pressure. The day went on. . . By midday, I had lost feeling in the upper half of my face and the tips of my fingers. My vision and reactions were "fogged" I watched my son play. I tried to calm myself. His eyes were ringed with red, as were mine. I called the family doctor. I left a message with the nurse around 2 p.m. I thought about how the Health Department lady had told me that it was "the public crying out for spraying". . . I called the newspaper so this couldn't happen again! I was dropping things. My hands, mostly my left, just weren't getting the information from my brain as fast as I was thinking it. How the hell could this happen? I called the doctor again. . . Again I spoke to the nurse. He wasn't in today. He'd call in the morning, OK? No. . . Not OK. I was poisoned, my family was poisoned. I had to say something. My Mama always said, "Don't make a spectacle of yourself." But my God, I couldn't hold a cup! The tremors began around 6 p.m. There I was. I'd found a group holding a press conference about the spraying. . . but, I couldn't drive. My mother had to, so there she was, helping me make an spectacle of myself.

How did I come from a place of being quietly conscious to being loudly poisoned? How was it that in the United States of America, I came to be gassed in my own home? Well, they were just clearing the spray from the trucks. You see, they park the trucks down the street. We were exposed to an untold concentration of the toxin—as were at least 20 small children, at least 2 pregnant woman, at least 10 elderly people, among 100 or so others. On a warm night, windows open, without our knowledge, against our will and if you ask me. . . against our constitutional rights.

The lack of notification mixed with misinformation; the symptoms way beyond the bounds of the pesticide's application label; the fact that my family and the food we eat were exposed to a toxin against our will and without warning! Mad, yup I'm mad. I'm jaded and I want to move, but the fact is that there are people here: friends, relatives and neighbors that I care about and love. If I let them be poisoned without saying anything, it would be just as bad as doing it myself and I can't, in all good conscience, allow that to happen. But, I guess the question at hand is, "Can you?"

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STATEMENT OF SUSAN FENLEY, NEW YORK, NY

I understand you are holding a hearing on the W. Nile virus and spraying. First, I urge you to recommend safer ways to handle the mosquito population rather than spraying malathion randomly on people and their surroundings. There are safe ways to do this. If you like, I'll send them to you .

Malathion is not safe, and few people believe it is. Just look on the label. It's not a mystery as to the lethality of the pesticide. Second, the encephalitis outbreak was certainly not at epidemic proportion to warrant spraying to such a degree as was done last summer. I am afraid what will happen next year when they rematch. Are you going to spray randomly again? More and more people will protest and your constituency, in order to protect itself, may turn against those who support the spraying. Worse, they may suffer physical consequences from malathion exposure. Please take safe measures now to curb the mosquito population—but not lethal chemicals that will not only ineffectively destroy mosquitos, but kill their natural predators, harm people and that may bring about other, unforeseen future harmful effects. Please stop the malathion and dangerous chemical exposure to people.

Thank you.

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STATEMENT OF MARTHE SCHULWOLF, PIERMONT, NY

I am not a Connecticut resident, but am nonetheless taking the liberty of writing to you, as you are about to hold Senate hearings on an issue of vital importance to all of the residents of the tri-State region. I refer to the planned hearing on the handling of the West Nile virus. I am concerned that the dangers and side-effects of broadcast spraying of have received short shrift, in comparison to the dangers of the West Nile virus. I would not like to minimize the latter, but I feel that former have been largely ignored. It is crucial that true experts on the dangers of pesticides, the symptoms of pesticide poisoning, be involved in any cost/benefit analysis of pesticide use. Any national policy on mosquito-borne illness should mandate a true Integrated Pest Management approach, i.e., one that relies on accurate scientific monitoring of the pest species in question and on safer methods of mosquito control, specifically habitat control, water management, mosquito fish and other predators of mosquitoes, public education, and especially use of larvicides rather than the "adulticides" (the types of insecticides that were sprayed last few months were "adulticides," designed to kill adult mosquitoes and carry considerable risk to humans and other species. Larvicides, on the other hand, are far more biologically specific and are also generally applied in a more targeted fashion.

I am aware of the fact that many "experts" minimize these dangers, and also refer to reactions to pesticide exposure as "allergic." In fact, such reactions are not allergic, but rather neurotoxic. Organophosphates such as malathion were originally developed as nerve poisons for purposes of warfare. They act upon the nervous system of humans and insects alike. Of course, some people are more sensitive to their effects than others. But the fact that some can easily tolerate exposure hardly justifies risking the health of those who are not able to tolerate it. Furthermore, long-term effects are far more difficult to assess than short-term effects, as are possible synergies with other products and medications. Furthermore, as most mosquito control experts will tell you, adulticide is not the most effective method of mosquito control, as mosquitoes develop tolerance and resistance to insecticides. This is a vicious cycle which must be stopped. It is essential that our governmental bodies devote the

funds necessary to proper forms for mosquito control, utilizing the newest and safest methods.

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STATEMENT OF BRITT D. PASTOR BOLNICK, MOHEGAN LAKE, NY

First and foremost, I would like to thank Senator Lieberman for holding this forum. As a resident of Westchester County, I feel that all the counties in this area must work together to ensure the safety of our human residents, our non-human residents, and the natural environment that supports us all. Decisions are being made which will have both known and unknown repercussions on all forms of life.

Although I feel we are making great strides simply in holding and attending these forums, I was concerned with two main issues after hearing the panel speak.

The first concerns the definition of a "public health crisis". I have heard this term used twice now, once in justifying Rockland County's \$390,000 single application of aerial pesticides and then again today, especially in Dr. Fish's testimony. His use of phrases such as a "public health threat unprecedented in modern times" and comparison of the West Nile Virus to the introduction of yellow fever and bubonic plague I found to be extreme. Considering the fact that neither Fairfield County nor Rockland County saw a single human confirmed case of question whether or not this warrants such strong language.

I also noticed that Dr. McLean omitted a sentence from his written testimony, one the important in terms of our reaction to this situation. The sentence that he omitted reads as follows: "The virus usually produces either asymptomatic infection or mild fever in humans. . ." Then he goes on to talk about the effect on the bird population.

Now, given that in two counties that found it necessary to spray, not one person was affected, and given the information that for normally healthy humans this virus usually produces symptoms that are less severe than the common flu, my question is: What was the public health "crisis" that warranted the dumping of toxic chemicals over us? Who gets to define this? My issue is that I no longer trust local government, State government or the CDC to define a "public health crisis", since my concept and theirs obviously differ so extremely. The CDC even gives statistics that cite from the years 1986-1995, the total U.S. deaths from all four strains of encephalitis were 48. The total deaths from chicken pox were 948, and the total deaths from acute rheumatic fever were 1006.

Another point that was not addressed sufficiently for me in this forum was the extreme danger of the chemicals used. If no one had this virus in Fairfield County, and people are so worried about all the bird deaths, why would spraying be a solution, even temporarily? Rachel Carson wrote about the dangers of pesticides and other chemicals on wildlife and the natural world back in the early 1960's (she even wrote on Malathion, which is still being used today). Have we learned nothing? I believe it was Dr. Andreadis with whom I was speaking briefly after the meeting, and I mentioned Carson's book, *Silent Spring*, and he thought that it was not Malathion that she wrote about, and that there isn't really conclusive evidence that all these pesticides are harmful. I urge you, Senator, to please pick up a copy of *Silent Spring* and find out for yourself what people knew almost 40 years ago, because I am worried that some of the people on this panel weren't working with all the information they could have.

In closing, I feel that the risks to human life do not warrant such extreme and irreversible reactions as the aerial spraying of pesticides. Please reconsider using this as a solution, even if you only plan minimal use. There is evidence that these chemicals can harm people with compromised immune systems (which I believe most of the people who died from the WNV had) so you can only expect more deaths and ill health by using aerial pesticide application as a solution.

Thank you so much for hearing us.

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STATEMENT OF DOREEN DIORIO, STATEN ISLAND, NY

This is to support any efforts to protect our public health from the toxic use of Malathion (and other toxic spraying) and to urge your further efforts to promote safe alternatives in dealing with occurrences of West Nile disease.

Where non-toxic sprays are available and where this disease has been, as is widely felt, overreacted to, I'm sure you'll agree that safer and saner alternatives must be endorsed. In addition, a program should be instituted which would prohibit such future hazardous spraying in cases such as these.



Particularly where children and pregnant women are especially affected (not to mention the detrimental toll on our wildlife and overall ecology), our future health lies in the hands of responsible politicians like yourself.

Thank you for your prompt attention to this matter.

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STATEMENT OF HENRY R. RUPP, NORTH BRUNSWICK, NJ

We in New Jersey are delighted that a person of your caliber is holding a hearing on the West Nile virus outbreak and the means whereby the possibility of such a future event can be reduced. Those of us in New Jersey who have managed mosquito control agencies stand willing to offer you the benefit of our experiences in conducting surveillance, habitat management, the use of biological controls and larviciding. We would have hoped that your panel would have had someone with operational experience to address this very important part of mosquito control. Although we do not oppose the use of adulticides, we believe their use should be as a last resort when environmental conditions overwhelm us or when disease becomes apparent. Connecticut has a good mosquito man in the person of Paul Capotosto and we would welcome the opportunity to be of assistance to him. The West Nile virus outbreak might not have happened with surveillance, inspection and a larval control program, but if it did happen it would have been in spite of the efforts made not because of the lack of them. Best wishes in your search for information and in finding a reasonable approach to the resolution of this problem.

