A Survey of Private Drinking Water Wells for Lawn and Tree Care Pesticides in a Connecticut Town

Environment & Human Health, Inc.

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Conducted and written by
Environment & Human Health, Inc.

Testing of wells by
The CT Agricultural Experiment Station in conjunction with The Quinnipiack Valley Health District

This study would not have been possible without the help of the Town of Woodbridge and the cooperation of the many citizens of Woodbridge who volunteered their residential wells for analysis.

Second Printing, November 2006

Original publication of this report was made possible by the support of the W. Alton Jones Foundation.

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Printed on recycled paper using soy-based inks.

Preface to the Second Edition

Many new water quality studies have been performed since this study was first published in 1999, but there is still no more comprehensive study of private residential wells reported.

Therefore, Environment and Human Health, Inc. (EHHI) decided that it was important to reprint this benchmark study. The 2,500 original copies of this report have all been distributed. There are one or two important additions that have been made to the original document. The first report, released in 1999, did not include the month of the first well water collection or the month of the second sample collection from those wells that had pesticide contamination. The months in which well water is collected and sampled is very important, as lawn and tree care pesticides are applied in the spring and early summer and the majority of applications stop by late summer. Therefore, sampling should take place in May, June, or the beginning of July to get the most accurate results, and the revised text notes that this was done.

EHHI has also changed the recommendations that had urged towns and individuals to use Integrated Pest Management (IPM) methods. EHHI has learned over the past seven years that applicators often profess to use IPM methods when they are actually applying pesticides as usual.

Because IPM methods allow pesticide use, there is no valid way to monitor and assure that there is actually a reduction of pesticides on lawns and trees, and therefore EHHI is now recommending that towns and individuals use organic strategies for their lawns and trees in order to protect their drinking water wells.

This residential well water study shows that when lawn and tree care pesticides are used anywhere in a town, it is possible for pesticides to be found in any well, even in the wells of the non-users of pesticides.

Introduction

Approximately 500,000 people in Connecticut get their drinking water from private residential wells which remain largely untested for pesticides. Studies in California, Texas, Florida, the Midwest, and Connecticut have demonstrated contamination of groundwater by pesticides in agricultural use, but very little data exist on the effects of lawn and tree care pesticides on private wells. Environment & Human Health, Inc. (EHHI), in conjunction with the Connecticut Agricultural Experiment Station and the Quinnipiack Valley Health District, conducted a survey of 53 private residential wells in the town of Woodbridge, Connecticut in June, 1998.

Six of the wells, or 11%, were found to contain traces of seven pesticides. Five of the six wells contained more than one pesticide, with one well having five pesticides.

These results indicate that lawn and tree care pesticides are capable of filtering down through the soil and entering residential drinking water wells, even deep wells. This study demonstrates that further testing of private wells is needed and that greater protection of drinking water supplies from pesticides is indicated.

Summary of Findings

- **Widespread Use of Pesticides:** Of the 53 homeowners that volunteered to have their wells their wells tested for pesticides, 72% used pesticides on their lawns and/or trees. This indicates a widespread use of lawn and tree care pesticides, even when drinking water wells exist beneath lawns.

- **Forty-two percent of users were regular users:** Of the 53 homeowners, 22 identified themselves as regular users of lawn and/or tree care pesticides.

- **Eleven percent of wells contained pesticide traces:** Six wells (11%) were found to have trace levels of pesticides. Five of these wells had more than one pesticide in them.

- **No research on multiple pesticides:** One well was contaminated with five pesticides. Pesticides are tested for health effects one compound at a time. There is no research on the interaction or synergy of these chemicals found together, or on their compounded effects on human health.[1]

- **No guarantee of pesticide-free well water:** Choosing not to use pesticides on one's property is not a guarantee that pesticides will not be found in

[1] EPA. Goldman, L. 1998 (Dec. 9). Report to FIFRA Scientific Advisory Panel on need for additional developmental toxicity testing.

one's well water. Pesticides used in one part of a community may show up in the groundwater in another part of that community.

- **Federal licensing is no guarantee of safety:** Federal licensing of pesticides is no guarantee of safety. Federal registration of a pesticide in no way guarantees that it has been fully tested to determine toxic effects on the immune, nervous and endocrine systems of fetuses, infants and children.[2]

- **Safety levels set for pesticides are often compromises:** Maximum Contaminant Levels (MCLs) that set the enforceable levels of pesticides in drinking water are often compromises between public health standards, technological feasibility, and cost. Of the seven pesticides found in this survey's wells, only two, chlordane and lindane, have established Maximum Contaminant Levels (MCLs),[3] showing how slow the government is in regulating the safety standards of pesticides. The government has not yet established MCLs for the majority of pesticides and other hazardous substances.

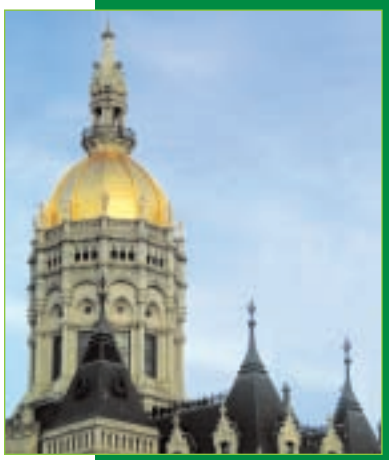
[2] EPA. Goldman, L. 1998 (Dec. 9). Report to FIFRA Scientific Advisory Panel on need for additional developmental toxicity testing. See also: EPA, 1998 (Nov. 30) Toxicology data requirements for assessing risks from pesticide exposure to children's health. Draft.

[3] Connecticut Agricultural Experiment Station Report on Woodbridge Residential Well Tests; 1998.

Background

While it is not known with certainty how many of Connecticut's citizens live in homes with private wells, this group is part of the one-third of Connecticut citizens who derive their drinking water from groundwater. The State Department of Public Health estimates that approximately 225,000 homes are on private drinking water wells, representing about 500,000 people.[4]

There is very little information about actual potential contamination of private residential wells by pesticides. Until 1997 there were no regulations for testing private wells in Connecticut except when a new well was drilled or a new home was built. In these cases a standard water test was done to assess total coliform organisms, color, turbidity, odor, pH, and hardness, and to determine the presence and levels of nitrates, chloride, sodium, iron, detergents and manganese.



In 1997 new State regulations were passed requiring that wells be tested whenever a home is sold. The new regulations recommend that Volatile Organic Compounds (VOCs) be added to the standard water test, but VOCs are still not required. Pesticide tests are neither required nor recommended unless the

[4] Ray Jarema; Connecticut Department of Public Health, 1999.

nitrate levels are extraordinarily high. Although testing for pesticides was considered by the Connecticut Department of Public Health, the decision not to require it was made because of the high cost of analysis. The state did not want to burden the public with such costly tests.[5] As a result, most people do not know to test for pesticides in their well water.

In response to a mandate from the Connecticut General Assembly to the Department of Environmental Protection (DEP) that there be a statewide study of pesticide contamination in groundwater, the DEP in 1987-1989, working with the Connecticut Agricultural Experiment Station and the U.S. Geological Survey, surveyed 59 well sites that included croplands, orchards, golf courses, and residential areas. The samples were categorized as coming either from agricultural or non-agricultural lands.

The results of this study showed that pesticides move down to groundwater in detectable quantities. Thirty-nine of the 59 sites, or 66%, had detectable quantities of pesticides in the groundwater. Dacthal (DCPA) was the most commonly found pesticide in the non-agricultural sites, being found in 11 of the 13 wells tested. Dacthal was found not only in wells on land where it had been applied but also in wells down gradient of where it had

[5] Conversation with Michael Haige; Connecticut Department of Public Health; 1997.

been applied,showing its ability to leach and flow off site. Dacthal is an herbicide used for the pre-emergence control of crabgrass on turf.[6]

In addition to the Connecticut DEP study there are studies from the midwest and California that report widespread groundwater contamination by agricultural pesticides.[7] There are few studies, however, focusing on suburbia, that could give information about whether lawn and tree care pesticides used on residential properties are leaching into groundwater.

Due to this lack of information, EHHI established a research project to investigate whether lawn and tree care pesticides were leaching into private wellwater. The town of Woodbridge was chosen as the site for the project for three main reasons: (1) almost all the homes in Woodbridge derive their water from private wells; (2) the homes are on large lots and many people in the town use lawn and tree care services; and (3) the town historically has few agricultural uses and no industry.

Because of the complex nature of the laboratory testing of well water, the Connecticut Agricultural Experiment Station was asked to join the project. The Connecticut

6 Pesticides in Groundwater, soil, and unsaturated-zone sediments at selected sites in Connecticut; U.S. Geological Survey in co-operation with the Connecticut Department of Environmental Protection and the Connecticut Agricultural Experiment Station; 1991.

7 Environmental Working Group; Weed Killers by the Glass; August, 1995.

Agricultural Experiment station is a state governmental agency, and had been looking for an opportunity to investigate residential well water quality.

Both EHHI and the Connecticut Agricultural Experiment Station saw the need to include the Quinnipiack Valley Health District in this project. The Health District has responsibility for the private wells of the town of Woodbridge, and it was the most appropriate organization to collect the well water samples and bring them to the Connecticut Agricultural Experiment Station for testing.

A model for the collection and testing of the water samples was developed. At a meeting held in November, 1997 with the Quinnipiack Valley Health District, the Connecticut Agricultural Experiment Station and EHHI, it was agreed that the well water samples would be taken the following June when the Connecticut Agricultural Experiment Station and the Health District would have their summer interns. Also, June would be a time when the water table would be high, therefore giving a conservative estimate because any pesticide residues would be diluted.

The pesticides tested for were **insecticides:** carbaryl, chlordane, chlorpyrifos, DDT-DDE, diazinon, dicofol, isenphenfos, lindane, malathion and methoxychlor; **herbicides:** dicamba, 2,4-D, dacthal (DCPA), MCPA, MCPP, and trifluralin; and **fungicides:** chlorothalonil.

Methods

It was important to establish a model that would protect individual homeowners' confidentiality with respect to the findings of their well water tests. Both the Quinnipiack Valley Health District and the Connecticut Agricultural Experiment Station, as public agencies, have the responsibility to report contaminants found in drinking water supplies. Their reports therefore enter the public domain. EHHI believed that homeowners would not volunteer their wells for testing without the promise of confidentiality. Therefore a model was devised that afforded complete protection of the findings. Only EHHI as a non-profit organization, without reporting responsibilities, could ensure the complete confidentiality of the results.

The Quinnipiack Valley Health District collected the water samples and gave the samples a number. The Health District then took the numbered samples to The Connecticut Agricultural Experiment Station where they were tested. The Connecticut Agricultural Experiment Station, after its analyses, gave the numbered test results to EHHI. Only EHHI had all three pieces of information, and thus, only EHHI could connect the results with the homeowner.

A community meeting was held in the Town of Woodbridge on March 3, 1998, after substantial notice, including articles in local newspapers and the posting of flyers in numerous locations in the town. The

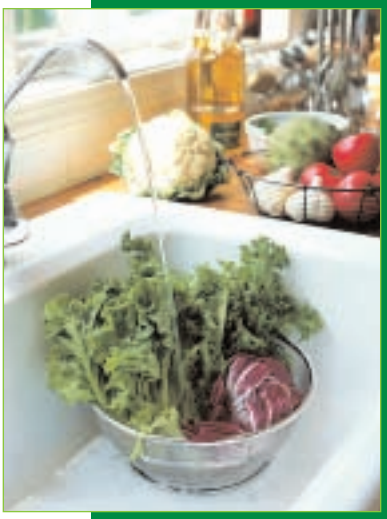
project was explained to those in attendance, and residents who wished to participate in the testing were asked to fill out a questionnaire at the meeting detailing the history of any use of lawn or tree care products on their property. They were also asked if they treated their lawns for ticks and if their homes had been treated for termites. Potential volunteers were asked to provide information about any known prior use of their land for agricultural purposes as well as about the existence of farms, orchards, or golf courses, past or present, in near proximity to their homes. If known, the depth and type of their wells were also to be included. **Respondents were categorized as "regular," "intermittent," "hardly ever," or "non-users" of lawn and tree care pesticides.** A copy of this questionnaire is available at the end of the report.

Fifty-seven applications were originally received. After review of these, 50 were chosen for underwriting at a cost of $125 to EHHI and a cost of $75 to the homeowner. Seven additional sites were accepted but not underwritten.

The cost to these homeowners was $200, the price established by the Connecticut Agricultural Experiment Station for the testing of a well. Letters were sent to those in both categories, again explaining the project and laying out the costs to the homeowner. Four homeowners subsequently dropped out, leaving a final sampling of 53 well sites. The addresses for these sites were sent to the Quinnipiack

Valley Health District so that appointments could be made for the collecting of samples in June. Reminder letters were sent out at the end of April.

Well water samples were collected in June of 1998 in one-liter brown glass bottles, without preservatives. The samples were taken from points before any filtration equipment in the home. The sample-takers were not told what the samples were for. Each sample was double-coded, with the code number placed on the bottle and on the address list to be returned to EHHI. The samples were then taken to the Connecticut Agricultural Experiment Station to be analyzed. All sites were indicated on a town map to assess geographical distribution and to ascertain if there was any geographical clustering of positive results.



All participants in the survey were notified of the findings by EHHI during the summer of 1998. Those homeowners with negative findings were notified by mail. The six homeowners with positive findings were notified by phone and told what was found in their wells and at what levels. They were then asked if they would agree to a second sample taken in the same way as the first, at no additional cost. The second sampling of the contaminated wells was performed in July of that year. All agreed to a second testing except one homeowning couple who never made themselves available. Thus, one contaminated well site, the site that contained only one pesticide, did not have a second testing.

Findings

The findings indicate a widespread use of lawn and tree care products, even when drinking water wells exist beneath lawns.

Figure 1: Homeowners Who Had Their Wells Tested for Pesticides (N=53)

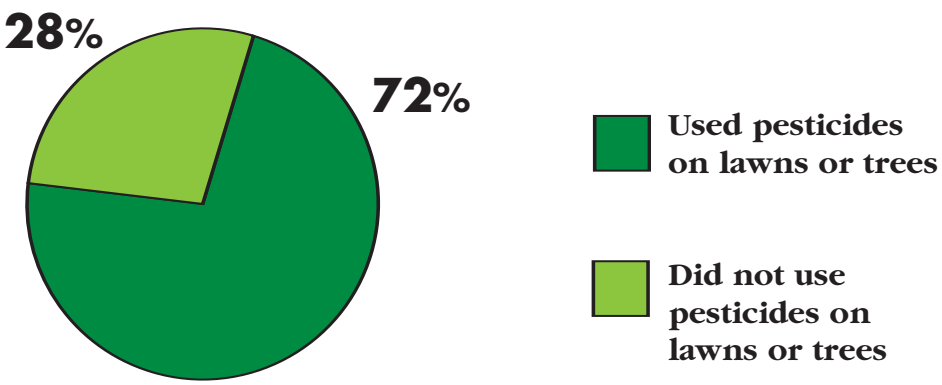


Figure 1 shows that of the 53 homeowners who volunteered to have their wells tested for pesticides, 72% used pesticides on their lawns and/or trees.

Figure 2 shows that of the 53 homeowners, 42% were routine users of lawn or tree care pesticides, 30% were intermittent users, and 28% did not use pesticides on their lawns or trees.

Figure 2: Homeowners' Use of Lawn and Tree Care Pesticides (N=53)

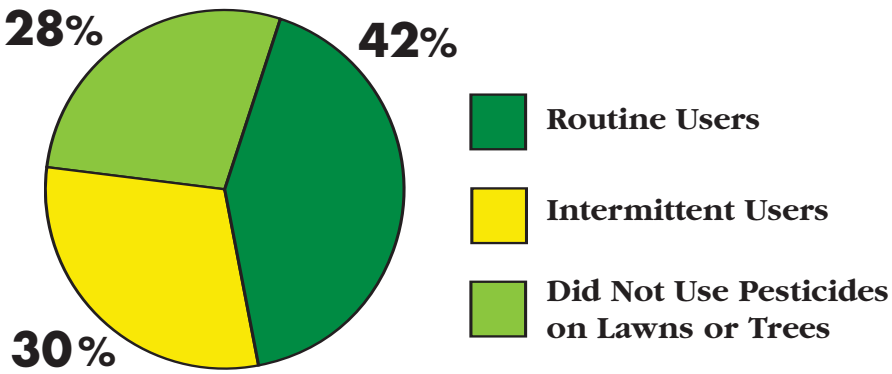
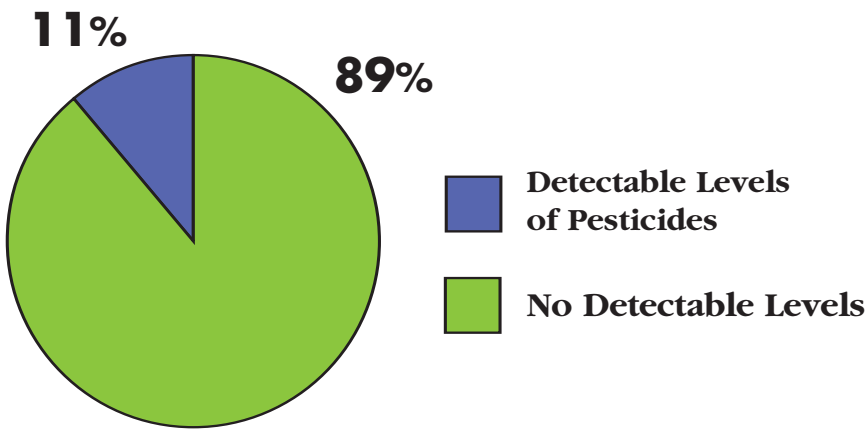


Figure 3 shows that six (11%) of the 53 wells were found to contain trace levels of pesticides, in all cases

Figure 3: Wells Tested for Pesticides (N=53)



well below the EPA Maximum Contaminant Levels (MCLs), where such levels have been established, or below the Reference Daily Doses (RFD) where there were no MCLS. The RFDs are amounts of contaminants allowed to be consumed per day per kilogram of bodyweight. RFDs are set, as are the MCLS, by testing one compound at a time.

The pesticides detected in six wells were: chlordane, chlorpyrifos, chlorothalonil, dacthal, diazinon, lindane and trifluralin. Of the seven pesticides found in the six wells, only two, lindane and chlordane, have established Maximum Contaminant Levels (MCLs). The other five pesticides do not have MCLs. All the pesticides found were detected at trace levels of less than 1 ppb (part per billion).

One of the six contaminated wells tested positive for five pesticides and two wells tested positive for four pesticides. Of the three remaining wells, one well contained three pesticides, one contained two pesticides and the remaining well contained one pesticide. Two of the six homeowners whose wells tested positive for pesticides were regular pesticide users, three were intermittent users and one was a non-user. The non-user had five different pesticides in his well.

Although all six homeowners with positive findings agreed to have a second sample drawn, only five homeowners made themselves available for the collection. The second sample was drawn as the first was, before any filtration system. The chlordane and the chlorpyrifos that were found in one of the first original samples were not found in the second samplings; of the five wells that had diazinon in the original samples, four did not contain diazinon in the second sampling. (The fifth well was not resampled.) Dacthal (DCPA), a more persistent compound, was found in four of the original samples and in all four of the resamplings. It was also found in a second sample where it had not been detected in the first.

In three of the repeat samples, dacthal appeared in greater quantities than in the original sample. One well had four pesticides in the first sampling and two pesticides the second. Another well had two pesticides in the first sampling and four in the second. It must be noted, however, that the levels at which these pesticides were found were at or just above the detection level, so that small variations between two samples may be a function of the sensitive testing techniques. The wells that were contaminated with trace levels of pesticides were not in any geographical cluster. The well with the greatest contamination, five pesticides, belonged to a "non-user," but was in close proximity to a working orchard.

Discussion

- This survey of suburban wells is a preliminary investigation into the potential of residential use of lawn and tree care pesticides to leach into groundwater used for drinking. What can be said with certainty is that in an analysis of water from 53 wells in a single Connecticut town used primarily for tree and lawn care use were detected at trace levels in six wells.

- It also can be said that pesticides used somewhere in a community may produce at least trace levels of pesticides in the groundwater somewhere in that community, as witnessed by the non-pesticide-using homeowner whose well contained traces of five pesticides. Choosing not to use pesticides on one's property is not a guarantee that pesticides will not be found in one's well water.

- It is not clear by what mechanism pesticides applied on the ground may penetrate down through several hundred feet of soil. The wells that had pesticides in them were 300 to 400 feet deep. This shows that soil depth alone does not protect wells from lawn and tree care pesticides. The second testing of the contaminated wells revealed that the pesticides varied from the first sample to the second, showing that contaminant levels do not stay constant.

- The one well contaminated with five pesticides raises the question of exposures to mixtures and their health effects. Pesticides are tested for health effects one compound at a time. There is limited research on the interaction or synergy of these chemicals found together, or on their compounded effects on human health.[8]

- The results of this study raise concerns about the ability of homeowners who choose not to use pesticides to protect their drinking water from contaminants. If there are pesticides being used in a community, no one can be assured that traces of pesticides will not infiltrate into their drinking water supplies. This is a broad societal problem.

- Federal licensing of pesticides does not guarantee safety. Federal registration of a pesticide in no way guarantees that it has been fully tested to determine toxic effects on the immune, nervous and endocrine systems of fetuses, infants and children.[9] Furthermore, Maximum Contaminant Levels that set the safety standards for pesticides in drinking water are often compromises between public health standards, technological feasibility and cost. Of the seven pesticides found in the six wells, only two

[8] EPA. FIFRA Scientific Advisory Panel. 1998.

[9] EPA. Goldman, L. 1998 (Dec. 9). Report to FIFRA Scientific Advisory Panel on need of additional developmental testing.

of these pesticides — lindane and chlordane — have Maximum Contaminant Levels, showing how slow the EPA has been in establishing pesticide toxicity data.

- This study shows that lawn and tree care pesticides can filter into private wells and therefore there is a need for further studies into this issue to provide additional data. The appropriate next steps should include larger studies with samples taken from a wider distribution of residential wells, and repetitive sampling of some wells. The state should put resources into investigating this issue further.

- In the state's study of 1989, *Ground Water in Connecticut,* the state itself called for the additional testing of residential private wells. Environment & Human Health, Inc. has shown, through this independent study, that there is a need to do just that.

Connecticut Well Water Regulations

The Connecticut Well Regulations require that a basic well water test be conducted when a house changes hands. This test includes bacteriological quality, physical characteristics and some chemical characteristics, including some metals. The State recommends testing for Volatile Organic Chemicals (VOCs), but does not require it.

Environment & Human Health, Inc. recommends that homeowners test their private drinking water wells for what is presently in the Connecticut Department of Public Health's "Guidelines for Private Drinking Water Testing," plus VOCs and pesticides. The pesticides should include those that are commonly used on lawns and trees, as well as some that are used in agriculture and in termite eradication.

The pesticides that were found in well water in this study were: chlordane, chlorpyrifos, chlorothalonil, dacthal, diazinon, lindane, and trifluralin, showing that lawn and tree care pesticides should be added to the State's list of pesticides that are recommended for well water testing.

Water is the most consumed food in the human diet. Children will be more exposed than adults to contaminants in water because they have a large intake of fluids in relationship to their total diets.[10]

[10] Wargo, J. 1998. *Our Children's Toxic Legacy.* Yale University Press. 2nd edition.

EHHI's Recommendations for Residential Well Testing

Wells Should be Tested for:

1. **Bacteriological Quality:** Total Coliform Organisms

2. **Physical Characteristics:** Color, Turbidity, Odor, pH

3. **Chemical Characteristics:** Nitrate/Nitrite, Chloride, Sodium, Iron, Hardness, Manganese

   Numbers 1–3 are the Connecticut Department of Public Health's Drinking Water Guidelines.

4. **Volatile Organic Chemicals (VOCs):** As listed in the Connecticut Department of Public Health Code 19-13-B102.

5. **Pesticides:**

   Insecticides: carbaryl, chlordane, chlorpyrifos, DDT-DDE, diazinon, dicofol, isenphenfos, lindane, malathion and methoxychlor;

   Herbicides: dicamba, 2,4-D, dacthal (DCPA), MCPA, MCPP and trifluralin;

   Fungicides: chlorothalonil.

   Additional Pesticides: if you live near land used for agricultural purposes you might want to broaden the list of pesticides you test for.

Recommendations *for the State*

- The State should conduct additional studies that look at private residential wells to determine the magnitude of pesticide contamination in private wells.

- The State should add commonly used lawn and tree care pesticides to its present list of pesticides that are recommended for well water testing.

- The State should adopt aquifer regulations to protect Connecticut's groundwater from chemical contamination.

Recommendations
for Towns and Municipalities

- Towns and Municipalities should set the examples of protecting their groundwater and residential wells by instituting organic methods on town properties.
- Towns and municipalities should hold educational meetings for their citizens where lawn and tree care pesticides can be discussed and alternate pest control strategies can be explored openly. Pesticide information should be disseminated along with the short- and long-term health effects of these products.
- Communities as a whole should take responsibility for the preservation of the purity of citizens' drinking water. Citizens, as well as town officials, need to understand that lawn and tree care pesticides do travel down into groundwater, and that pesticides applied in one part of a community may affect the groundwater in another part of a community. Therefore, towns and municipalities need to be more involved with this issue.
- Towns and municipalities need to involve their local health departments in the preservation of the purity of drinking water wells. A town does not have to wait until its contamination levels are above drinking water standards to involve its health department. Communities should start to plan pesticide reduction strategies as soon as possible and solicit advice from their local health departments.

Recommendations
for Citizens

- People with private wells should take particular care to reduce their uses of pesticides. This study shows that these chemicals do indeed leach through the soil, and homeowners should be aware of the need to protect their drinking water.

- When professional lawn or tree care companies are used they should be asked if they know how to use organic methods that better protect groundwater.

- Pesticides should only be used on lawns and trees when there is a serious pest problem that cannot be remedied in any other way. Because pesticides are toxins, their use should be minimized, with the knowledge that there is no guarantee of their safety with respect to long-term health effects.

- If a pesticide is applied to your property, ask for the name of the chemical and its long-term health effects.

- If you have a private well and you live in an area where there is heavy use of lawn and tree care pesticides, have your well tested for pesticides. If they are found you might want to inquire about installing a filtration system.

- Wells should be maintained, including checking the well seal and the well cap. Bacteria and nitrogen levels should be checked periodically, as they are often a symptom of structural problems with the well itself.

- Ask your town to provide educational meetings for its citizens to discuss lawn and tree care pesticides. This issue is important to the entire town as our study shows that pesticide practices in one part of a community may affect the groundwater in another part of the community, often in an unpredictable way. Communities as a whole need to take more direct responsibility for the preservation of the purity of their citizens' drinking water.

- Ask your town if they would use organic methods, limit lawn and tree care pesticide use on town grounds and buildings, and help the community learn the importance of reducing pesticide uses. This study shows the interdependency of us all.

WOODBRIDGE WELL WATER TESTING APPLICATION FORM

Name _____

Address _____

Woodbridge, CT

Phone (H) (203) _____

How many years have you lived in this home? _____

Is your home next to or near an operating farm or orchard?

If **yes,** which? _____

Is your home next to or near a former farm or orchard?

If **yes,** which? _____

Is your home built on former farmland or a former orchard?

If **yes,** which? _____

Have you ever used lawn or tree care pesticides? _____

If your answer is no, answer the next three questions and then go directly to the WELL SECTION of the survey. If your answer is yes, then please answer all the questions below.

1. Do your close-by neighbors use lawn or tree care pesticides? **Yes** ____ **No** ____

Do not know about my neighbors. ____

2. Do you treat your property for ticks? ____

If the answer is **yes,**

How often do you treat? _____

and what do you use? (if you know) _____

_____

3. Has your house been treated for termites around the outside of the foundation? If the answer is **yes,** about how many years ago was it treated?

If you know, what chemical was used? _____

_____

If your answer was yes, we use lawn and tree care pesticides, please answer the next three questions.

1. If you are using lawn and tree care pesticides, how many years have you been using them?

Lawn-care pesticides **Years** _____

Tree care pesticides **Years** _____

2. Would you say you are a ❶ Regular; ❷ Intermittent; or ❸ Hardly ever user of these products? Please answer the category that most closely describes your lawn and tree care pesticide use.

Your lawn-care pesticide use _____

Your tree care pesticide use _____

3. Do you have any other comments that you would like to make about your use of lawn and tree care products that you think we should know?

Environment and Human Health, Inc.

Mission Statement

Environment and Human Health, Inc., founded in 1997, is a non-profit organization made up of doctors, public health professionals and policy experts dedicated to the purpose of protecting public health from environmental harms through research, education and the promotion of sound public policy. We are committed to improving public health and to the reduction of environmental health risks to individuals.

Our mission is:

1. To conduct research to identify environmental harms affecting human populations.

2. To promote public education concerning the relationships between the environment and human health.

3. To promote effective communication of environmental health risks to those exposed and to responsible public and private officials, thereby empowering individuals and groups to take control over the quality of their environment and be more protective of themselves and their families.

4. To promote policies in all sectors that ensure the protection of human and environmental health with fairness and timeliness.

Environment and Human Health, Inc. has put human health at the center of its environmental agenda.

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Environment and Human Health, Inc.

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