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Does Diazinon Pose a Threat to a Neighborhood Stream in Tallahassee, Florida?

—YES, especially to aquatic life. Diazinon concentrations in 13 of 64 samples collected at Lafayette Creek exceeded the criteria established for the protection of aquatic life.

SIGNIFICANT FINDINGS

- Diazinon was detected in 92 percent of samples from Lafayette Creek.
- Overall, the diazinon levels were low and do not pose a risk to human health.
- Diazinon was detected throughout the year, indicating its frequency of use and persistence in the environment.

What is Diazinon?

Diazinon is an organophosphorus insecticide used in lawns, homes, gardens, in orchards, and other agricultural settings to control a wide variety of insects including ants, cockroaches, silverfish, and fleas. Diazinon is a contact insecticide, which means it kills insects by inhibiting the action of enzymes in the nervous system. It is classified as slightly to moderately toxic, depending on the formulation (Extension Toxicology Network, 1996). Diazinon is the only active ingredient in some products, but it is commonly combined with other insecticides or with fertilizers. In 1998, more than 150 products containing diazinon were registered in the State of Florida (Robert Moore, Florida Department of Agriculture and Consumer Services, written commun., 1998). Currently, diazinon is the most commonly used pesticide for homes and gardens.

Chemicals applied in yards and gardens can pollute nearby streams and lakes when stormwater runoff carries the chemicals into storm drains that ultimately feed into these bodies of water. This is especially true where these chemicals may be applied in excess. Since the 1960's, the use of organophosphorus insecticides, especially diazinon, has increased substantially. Past national studies have found pesticides (insecticides, herbicides, and fungicides) in streams in all regions of the Nation, and diazinon has been one of the most frequently detected (U.S. Geological Survey, 1997). In one nationwide study, diazinon was one of the four most commonly detected insecticides in urban stream samples (Fuhrer and others, 1999, p. 62).

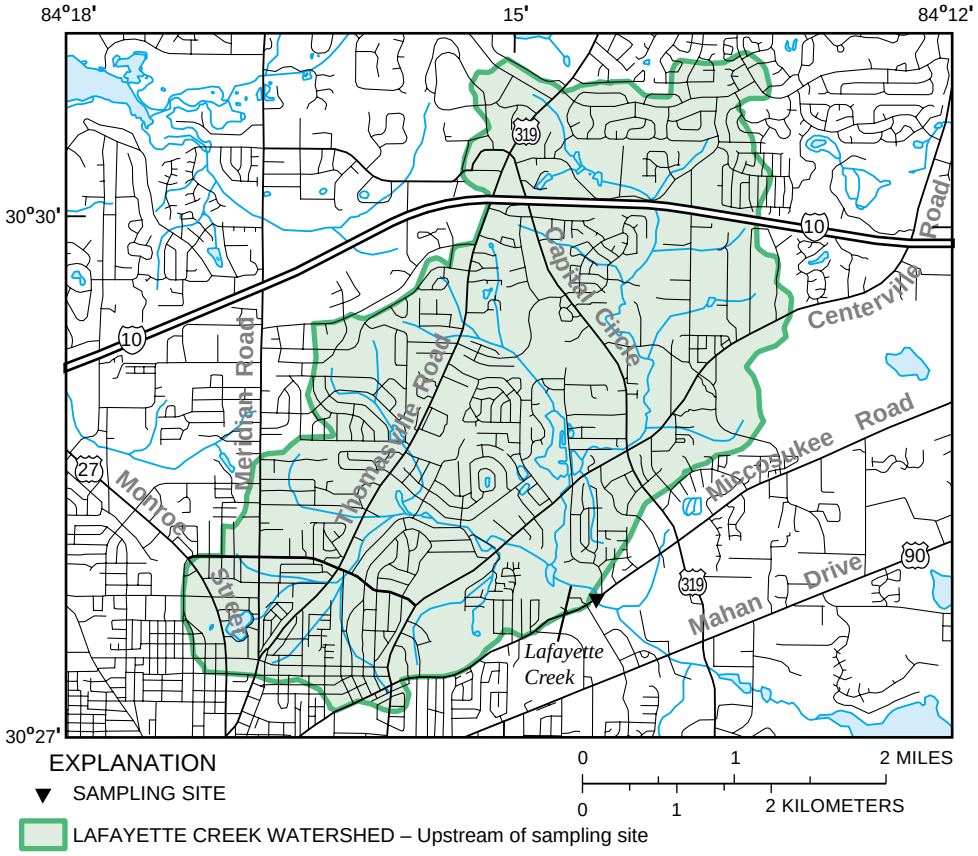
Why should I be concerned?

Although insecticides such as diazinon are poisons designed to kill insects, they can also kill or harm fish and other aquatic organisms and indirectly affect the health of other wildlife populations, such as birds. For example, when diazinon enters streams it can kill aquatic insects such as dragonfly and damselfly larvae. In the stream environment, dragonfly larvae and adult dragonflies are an important link in the natural food chain. Dragonfly larvae survive by preying on other aquatic organisms such as mosquito larvae; in turn, dragonfly larvae serve as a food source for fish.

Dragonflies that survive to adulthood become an important part of the diet for birds such as the purple martin. Although concentrations of diazinon that kill aquatic organisms such as the dragonfly larvae may not be high enough to kill fish and birds directly, these animal populations may still be harmed because elimination of the dragonfly larvae disrupts the food chain. As a result, adult mosquito populations that were once controlled by dragonflies and damselflies may become a nuisance, and fish and bird populations that were once dependent on adult dragonflies for part of their diets may decrease.

How does diazinon get into streams?

Diazinon and other pesticides applied directly to the soil or grass can be washed off into nearby storm drains and ditches which typically transport water to streams and lakes. The persistence of diazinon in soils affects how much of the chemical is available for transport to these surface-water bodies. In the soil, chemicals break down into other substances. The amount of time it takes for half the pesticide to break down is called the half-life of the chemical; the half-life of diazinon in soil is 39 days (Agricultural Research Service, 1995). Thus, a heavy rainstorm can wash a substantial amount of the chemical into streams and lakes, including diazinon that was applied several weeks earlier.



Location of Lafayette Creek and watershed in northeastern Tallahassee

Where is the Lafayette Creek watershed?

Lafayette Creek is a small stream located in northeastern Tallahassee (see map). The Lafayette Creek watershed is almost entirely residential (about 90 percent) and covers about 10 square miles. Water flow in the stream is low but variable, and is highly dependent on rainfall. During periods of little rain, the stream stops flowing or is dry; during heavy rains, the stream can overflow its banks. The Lafayette Creek watershed was selected because it is a small basin in a predominantly residential area, and because it would be a good indicator of the effect of residential land-use activities on water quality.

How was the study done?

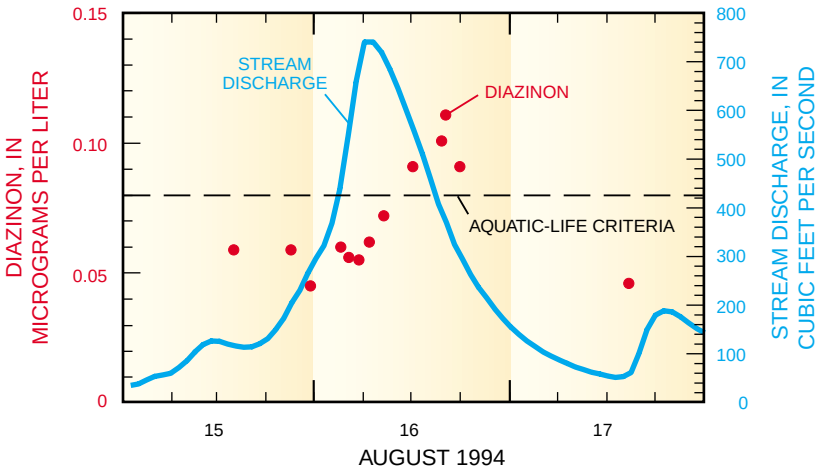
The water quality in Lafayette Creek was studied as part of the National Water-Quality Assessment Program of the U.S.Geological Survey. This is a long-term program designed to (1) assess water-quality conditions for large parts of the Nation's freshwater streams, rivers, and aquifers; (2) describe how water quality changes over time; and (3) improve our understanding of the factors that affect water quality. In streams, levels of contaminants and their potential effects on the environment vary throughout the year, and largely depend on the amount of water flowing. Frequent monitoring is needed to characterize variations in contaminants (Fuhrer and others, 1999, p.18). Samples from Lafayette Creek were collected weekly from March through October 1993, and monthly from November 1993 through December 1995. On several occasions during these time periods, the stream was not flowing or was dry, and scheduled sampling could not be completed.

Sampling streams during rainstorms for water quality can sometimes provide clues about how pesticides and other contaminants are transported to surface water. Increased monitoring during rainstorms is also necessary because the vulnerability of streams to contamination is related to the flow conditions. For these reasons, stream samples were collected more often (at intervals ranging from 1 to 11 hours) during a tropical storm that passed through the area in August 1994. This storm produced over 8 inches of rain from August 14-17 (National Oceanic and Atmospheric Administration, 1995).

What were the results of sampling?

About 20 percent of the samples collected at Lafayette Creek exceeded the aquatic-life criterion of 0.08 micrograms per liter (equivalent to parts per billion). The aquatic-life criteria are guidelines that establish the maximum acceptable concentrations of pesticides for protecting aquatic life. The aquatic-life criterion for diazinon was established by the International Joint Commission United States and Canada (1999), and is defined as the maximum concentration that should not be exceeded at any time. The human health guideline (also called the lifetime health advisory) for diazinon in drinking water is 0.6 micrograms per liter (U.S. Environmental Protection Agency, 1996); this guideline was not exceeded in any Lafayette Creek water samples.

Sampling Lafayette Creek during a storm on the upstream side of Miccosukee Road

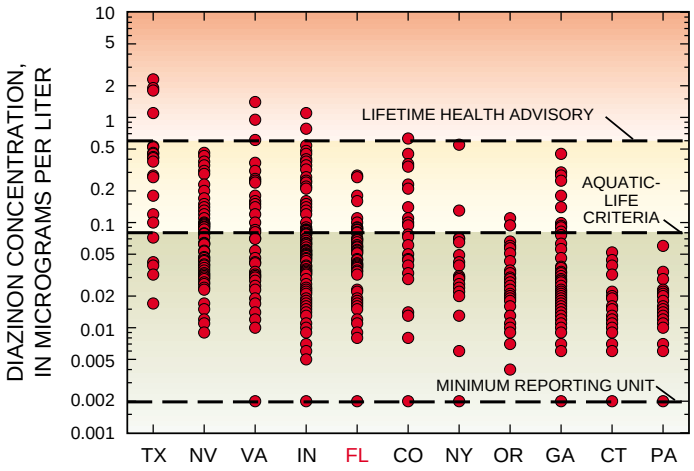


Diazinon concentrations and stream discharge during a 3-day period

Diazinon was detected in 92 percent of all samples collected from the stream and it was detected throughout the year during the sampling period, which indicates the frequency of diazinon use and its persistence in the aquatic environment. Diazinon concentrations were low ranging from about 0.002 to 0.28 micrograms per liter. Generally, there were no noticeable patterns in the diazinon concentrations; however, some increases in concentration were noticed during the more frequent sampling conducted during the tropical storm in August 1994. During that tropical storm, diazinon concentrations increased immediately after the peak in stream discharge occurred (see graph). Diazinon concentrations exceeded the aquatic-life criterion in four samples.The August 1994 tropical storm produced flood conditions on Lafayette Creek (see photos) and probably washed off much of the diazinon applied in the days or weeks since the last rain.

Lafayette Creek flood water on the downstream side of Miccosukee Road

Similar studies in other cities in the Nation have shown high percentages of samples with diazinon detections and exceedances of the aquatic-life criterion. For example, diazinon was detected in 90 to 100 percent of the samples collected from six urban streams in Georgia, Virginia, Indiana, Texas, Nevada, and Oregon. Diazinon concentrations in 9 of 11 urban areas exceeded the aquatic-life criterion in multiple samples. Unlike Lafayette Creek, streams in four urban areas (Dallas-Fort Worth, Virginia Beach, Indianapolis, and Denver) had diazinon concentrations that sometimes exceeded the human lifetime health advisory for drinking water.



Comparison of diazinon concentrations in streams from 11 States (TX, Texas; NV, Nevada; VA, Virginia, IN, Indiana; **FL, Florida;** CO, Colorado; NY, New York; OR, Oregon; GA, Georgia; CT, Connecticut; PA, Pennsylvania).

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By Marian P. Berndt and Hilda H. Hatzell

WHAT CAN I DO?

- Read and follow directions on the package label, especially usage amounts. Do not overapply.
- Apply only to affected plants or areas.
- Do not apply diazinon to the lawn before a heavy rain or before watering the lawn.
- Minimize spraying or spilling onto paved surfaces.
- Store package in a safe place protected from rain.
- Dispose of unused portions properly according to package label and local regulations. Do not pour down sink, into toilet, or down a sewer or storm drain.
- Consider using nonchemical methods of controlling insects.

FOR MORE INFORMATION ON PESTICIDE USE

The Florida Yards & Neighborhoods Program is a public education and outreach program available through many University of Florida Extension offices that shows homeowners how to design and maintain a yard that uses less water, fertilizer and pesticides. Contact the program in Leon County (850-487-3004) or statewide (852-392-7938). Publications available include:

A guide to environmentally friendly landscaping, Florida Yards & Neighborhoods Handbook

What's bugging me (ENY-292)

The smart way to avoid landscape pests and other problems (ENY-294)

The U.S. Environmental Protection Agency's Office of Pesticide Programs at: **http://www.epa.gov/pesticides/** contains the following publications:

Guide to Pest Control and Pesticide Safety (EPA 730-K-95-001)

Healthy lawn, healthy environment (EPA 700-K-92-005)

Paper copies of EPA publications may be ordered from the National Service Center for Environmental Programs at 1-800-490-9198 or **http://www.epa.gov/ncepihom/**.

Paper copies of this report can be obtained from the U.S. Geological Survey, Suite 3015, 227 N. Bronough St., Tallahassee, FL 32301.