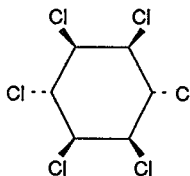




National Pesticide Survey

Lindane



Hexachlorocyclohexane
(gamma isomer or Lindane)

The U.S. Environmental Protection Agency (EPA) has completed its five-year National Survey of Pesticides in Drinking Water Wells (NPS), a study of the presence of 127 pesticides, pesticide degradates, and nitrate in community water system (CWS) wells and rural domestic drinking water wells. Lindane was one of the pesticides detected in the Survey. In sampling for lindane, EPA tested for the presence of four isomers of lindane -- beta-HCH, gamma-HCH, alpha-HCH, and delta-HCH. Two of these isomers, beta-HCH and gamma-HCH were detected in the Survey. This fact sheet provides a description of lindane, its potential health effects, and guidance on both treating and preventing well contamination.

What is Lindane?

Lindane (gamma BHC, gamma HCH, benhexachlor) is the common name of an insecticide which is a member of the chemical family of chlorinated hydrocarbons. Lindane was registered for use in the late 1940s. It has been sold under the trade names of Forlin, Gamaphex, Gammex, Isotox, Lacco, Lindagam, Lin-O-Sol, Novigam, and Silvanol. Lindane is also a component of other insecticides such as Agrox 3-Way, Gammatin, Granol NM, and Isopro. Lindane is an insecticide used primarily for treating wood inhabiting beetles and seeds. It is also used for soil treatment, foliage application on fruit and nut trees, vegetables, ornamentals, timber, and wood protection.

How Does Lindane Behave in Soil and Ground Water?

The behavior of a pesticide after it is released to the environment is dependent upon its movement in air, water, and soil as well as the rate at which it is transformed, or broken down. Pesticides applied to crops or the soil surface may volatilize (vaporize) to the atmosphere, be carried off by surface runoff, be carried to ground water through leaching, or remain in the soil through adsorption (adherence) to soil particles and undergo little movement in air or water. Pesticides may be transformed by reaction with water, microorganisms, and exposure to sunlight. The likelihood that lindane will migrate into ground water is influenced by its tendency to be transported (move) from soil to air and water and to be transformed by these various processes, as well as by the characteristics of the site, such as soil type, moisture, temperature, and depth to ground water. Lindane has a medium potential to be transported, and a medium potential to be transformed.

How Does Lindane Get into Ground Water?

Lindane migration into ground water could result from the presence of lindane in the soil due to agricultural applications of lindane on agricultural land, as well as domestic applications on home gardens. Lindane could also reach ground water from entry into a well through accidental chemical spills or improper storage near a well.



Findings of the National Pesticide Survey

Based on the results of the NPS, EPA estimates that lindane is present, at or above the analytical detection level of 0.043 µg/L used in the Survey, in about 13,100 (0.1%) rural domestic wells nationwide. Considering the precision of the Survey, EPA estimates that the number of rural domestic wells with detectable levels of lindane could be as low as 14 or as high as 120,000. Lindane is measured in micrograms per liter (µg/L) which is equivalent to parts per billion (ppb). Lindane was detected at concentrations above the proposed Maximum Contaminant Level (MCL) and Lifetime Health Advisory Level of 0.2 µg/L. EPA notified well owners and operators within 24 hours when detections exceeded health-based guidelines or standards. Lindane was not detected in any CWS wells.

What Health Effects Might be Caused by Lindane in Drinking Water?

Non-Cancer Effects: EPA has set a Lifetime Health Advisory Level for lindane in drinking water at 0.2 µg/L. A Lifetime HAL represents the concentration of a contaminant in water that may be consumed over an average human lifetime without causing adverse health effects. Lifetime HALs are based on health effects that were found in animals given high doses of the pesticides in laboratory studies. This level includes a margin of safety. Consuming lindane, however, at high levels well above the Lifetime Health Advisory Level over a long period of time has been shown to result in adverse health effects in animal studies, such as kidney and liver damage.

Cancer Risk: Lindane is considered by EPA to be a possible human carcinogen (cancer-causing agent). There is limited or uncertain information indicating that lindane causes cancer in animals receiving high doses of the chemical over the course of their lifetimes. EPA estimates that if an individual consumes water containing lindane at 0.03 micrograms per liter over his or her entire lifetime, that individual would theoretically have about a one-in-a-million chance of developing cancer as a direct result of drinking water containing this pesticide.

Standard: EPA sets enforceable standards for public water systems, called MCLs. These regulations set achievable levels of drinking water quality to protect human health. The proposed MCL for lindane is 0.2 µg/L (proposed as of May 22, 1990).

How is Water Treated to Remove Contaminants?

Lindane can be detected in drinking water by a laboratory using an EPA method such as #508. If lindane is detected in well water and confirmed by retesting to be above 0.2 µg/L, State or County health officials should be consulted. They may advise periodic retesting to get an accurate overall picture of the water quality because changes in seasonal precipitation and changes in pesticide use can cause variations in the amount of chemicals found in water wells. They also may advise using an alternative drinking water supply (bottled water is an example of a temporary alternative), treating the water, or drilling a new or deeper well. Public water suppliers are required to notify customers if the drinking water that they deliver contains a contaminant that exceeds its MCL.

You may also be able to treat your well water to remove pesticides and other contaminants. Treatment technologies that can remove lindane from water include granular and activated carbon, reverse osmosis, and oxidation. Certain treatment methods are more suitable for large community water systems than for individual domestic wells. State or County health officials should be able to provide advice on the best approach to follow.

How Can Well Water Contamination be Prevented?

Several steps may be taken to prevent pesticides or nitrate from entering wells, such as eliminating direct entry through the well wall, drilling a new well, or modifying or reducing pesticide and fertilizer use.

Eliminate Direct Entry Through the Well Water

If pesticides or nitrate are present in well water, they may be entering the ground water through the well itself rather than through the soil. If the well is old or poorly constructed, or if there are visible cracks in the well casing, obtain expert advice on whether or not improvements can be made to the well. In addition, investigate simple methods of capping the well or sealing it at the surface to prevent entry. Do not conduct any mixing activities near the well if you use well water to mix pesticides because a spill could lead to direct contamination of the well.

Drill a New Well

If the soil surrounding the well is the source of contamination, drilling a new or deeper well may make sense if water can be drawn from a deeper, uncontaminated aquifer. Unfortunately, it often is difficult to know the quality of the ground water without drilling or extensive testing. Seek expert advice before you drill.

Learn More about Pesticide Use

If you use pesticides, whether for agricultural or home lawn and garden purposes, you should consider attending training courses given by your State or County agriculture department on how to reduce activities that can contaminate ground water. You may find that you can eliminate or lessen the frequency or quantity of your pesticide usage by choosing alternative methods of pest control.

Why was the National Pesticide Survey Conducted?

EPA conducted this Survey to determine the frequency and concentration of pesticides, pesticide degradates, and nitrate in drinking water wells nationwide and to examine the relationship between the presence of pesticides in drinking water wells and patterns of pesticide use and ground-water vulnerability. The Survey sampled 566 community water system wells and 783 rural domestic wells for 127 pesticides, pesticide degradates, and nitrate. The wells were selected as a representative statistical sample to provide nationwide estimates of the presence of pesticides and nitrate in drinking water wells, and are not meant to provide an assessment of pesticide contamination at the local, County, or State level.

Where to Go for More Information

This fact sheet is part of a series of NPS outreach materials, fact sheets and reports. The following additional fact sheets are available through EPA's Public Information Center (401 M Street SW, Washington, DC 20460, (202) 382-2080):

<i>Survey Design</i>	<i>Analytical Methods</i>	<i>Project Summary</i>
<i>Survey Analytes</i>	<i>Summary Results</i>	<i>Glossary</i>
<i>Quality Assurance/ Quality Control</i>	<i>Fact Sheet for each detected analyte</i>	<i>How EPA Will Use The NPS Results</i>

Additional information on the Survey and on pesticides in general can be obtained from the following sources:

U.S. EPA Safe Drinking Water Hotline
1-800-426-4791 (In Washington, DC (202) 382-5533)
Monday-Friday, 8:30 am to 4:30 pm Eastern Time

Information on regulation of
pesticides in drinking
water

National Pesticide Telecommunications Network
1-800-858-7378
24 hours a day

Information on health
effects and safe
handling of pesticides

U.S. EPA Office of Pesticide Programs (OPP) Docket
401 M Street, SW Room NEG004
Washington, DC 20460
(202) 382-3587

Background documents
for Survey (available
for review)

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Copies of the
NPS Phase I Report
(available 1991)
and
NPS Phase II Report
(when available)

If you are concerned about the presence of pesticides and nitrate in your private water well, contact your local or State health department. Other experts in your State environmental agency or agriculture and health departments may also be helpful to you. If you receive your drinking water from a community water system and have questions about your water quality, contact your local community water system owner/operator or the State water supply agency.

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