

# Chlorpyrifos

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A neurotoxic organophosphate (OP) insecticide used in the production of fruits and vegetables throughout the U.S., chlorpyrifos has been widely studied for its neurodevelopmental effects on children.

Chlorpyrifos was prohibited for indoor home use in 2001, but it continues to be used in agricultural fields, with an estimated 8 million pounds applied annually. According to manufacturer DowDupont (now Corteva), chlorpyrifos has been registered for use in 100 countries for over 50 crops. Legal action by PAN and our partners has forced the manufacturer to revise its human health risk assessment for the chemical. In July 2015, EPA set the process in motion to take chlorpyrifos off the market, based on recommendations from scientists in March 2017, the current administration reversed this decision. Legal action continues, as does advocacy at the state level. Chlorpyrifos has been banned in Washington, D.C., and New York, and California has announced plans to cancel its registration.

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## Health effects

Chlorpyrifos is an organophosphate pesticide known for its damaging effects on the human nervous system. Like all OPs, chlorpyrifos blocks an enzyme ([acetylcholinesterase](#)) that our brains need to control acetylcholine, one of the many neurotransmitters mediating communication between nerve cells. These neurological effects pose especially elevated risks for children as their brains and nervous systems develop.

Short-term symptoms of low-dose exposure may include headaches, agitation, inability to concentrate, weakness, tiredness, nausea, diarrhea and blurred vision. High-dose exposure can lead to respiratory paralysis and death. Pregnant women may also be more sensitive to chlorpyrifos toxicity according to the [Agency for Toxic Substances and Hazardous Waste](#).

**Registry.** In addition to the immediate effects of exposure, chlorpyrifos is linked to a number of serious longer term health impacts:

- **Adverse effects on neurodevelopment:** There is a body of work around the negative impacts of chlorpyrifos (and other organophosphates) on various aspects of cognitive development. Chlorpyrifos has been well-studied in animal models and has been shown to cause a **range** of neurodevelopmental effects, such as irregularities in genes that control essential processes in developing brain cells. Exposure to low levels of chlorpyrifos or organophosphates has been shown to negatively impact various aspects of cognitive development in humans in several studies.
  - In California's Salinas Valley, a UC Berkeley **study** found that the group exposed to the highest levels of organophosphate during pregnancy was associated with a 7-point drop in IQ scores in 7-year-olds.
  - A Columbia University **study** found decreases in full-scale IQ and working memory of 7-year-olds associated with tiny increases in prenatal exposure to chlorpyrifos. Another study of the same group found that 3-year-old children with higher prenatal exposures to chlorpyrifos were likely to experience delays in development, attention problems, ADHD problems and pervasive developmental disorder problems.
  - A UC Davis **study** found that mothers who live within a mile of fields where chlorpyrifos and other organophosphate pesticides were applied had a 10 percent higher chance of having children with autism spectrum disorder. The link between autism and pesticides may be that gestational exposure **tip the balance** towards increasing autism risk.
  - In addition, a recent study found associations between exposure to chlorpyrifos and changes to the **architecture** of the brain in 7-year old children.
- **Reduced birth size:** A **study** on pregnant women exposed to chlorpyrifos through home insecticide use demonstrated a link between in utero exposure to chlorpyrifos and decreased birth length and decreased birth weight. These effects on size were no longer significant in newborns born after 2001, when indoor residential use of chlorpyrifos was phased out.
- **Endocrine disruption:** Chlorpyrifos is also a suspected endocrine-disrupting compound. Sex-specific behaviors in mice can be altered by chlorpyrifos exposure. These **neuroendocrine-disrupting** effects affecting mice differently depending on their sex. Moderate doses have been shown to alter hormone levels in other **studies**.
- **Lung and prostate cancer:** While EPA lists chlorpyrifos as providing evidence of no carcinogenicity, recent studies suggest possible links to both **lung** and **prostate** cancer.

## Exposure

Humans can breathe or be exposed to dust from chlorpyrifos that drifts from nearby fields into homes and schools. A **2014** report from California's Department of Public Health puts chlorpyrifos among the top 10 pesticides of concern most commonly used within ¼ mile of schools in the state.

### In our bodies

Human exposure to chlorpyrifos is evidenced by its presence in our bodies. **Data** from the Centers for Disease Control and Prevention showed chlorpyrifos breakdown in 93 percent of U.S. residents sampled between 1999 and 2002.

Children carry particularly high levels of chlorpyrifos — almost twice those of adults, the CDC study showed. Chronic exposure levels were 4.6 times the “acceptable” level for children (6–11 years) and 3.0 times the “acceptable” level for youth (12–19 years) (See: **Chemical Trespass**). Farmers, pesticide applicators and chlorpyrifos manufacturers likewise carry a greater body burden of the neurotoxic insecticide.

### Food and water

People are also exposed to chlorpyrifos from residue on **common foods** such as apples, peaches and sweet peppers. Chlorpyrifos contamination of drinking water is a concern; the state of Minnesota has named the pesticide a “**chemical of concern**” for this reason, and the **U.S. EPA** noted that chlorpyrifos use poses “drinking water concerns in small sensitive watersheds.”

### Drift

Like most organophosphates, chlorpyrifos is prone to drift. The semi-volatile chemical readily evaporates from leaf and soil surfaces to become airborne, especially when

temperatures are high. Once in gas form, the neurotoxicant can migrate to nearby homes and schools — exposing residents and their children.

A [drift study](#) in Lindsay, California, demonstrated the presence of chlorpyrifos in the air near or at homes in this agricultural community. Over 100 air samples were collected near homes and three-quarters of the samples had detectable levels. Only 11 percent of the samples were above the levels determined to be at an “acceptable” level for a 2-hour exposure by children. The highest concentration observed was nearly eight times the acceptable level. There is no legal standard for pesticide levels in the air — only advisory or regulatory target levels.

California's Department of Pesticide Regulation (DPR) 2014 [air monitoring data](#) found chlorpyrifos in 26 percent of the year's samples from three sites.

## Poisonings

Among pesticide poisoning cases, chlorpyrifos is a frequent culprit. From 1997 to 2000, chlorpyrifos drift from agricultural fields resulted in group poisonings in California's San Joaquin, Ventura, Tulare, Merced and Madera counties. More [recent](#) cases have been reported in the period from 1998–2006.

For more on chlorpyrifos poisonings and drift see: [Fields of Poison 2002: California Farmworkers and Pesticides](#).

## Environmental impacts

For animals that are highly sensitive to chlorpyrifos, exposure to minute concentrations can be lethal. [EPA](#) indicates that a single application of chlorpyrifos poses significant risks — especially to endangered species. Fish, amphibians, birds, reptiles and small mammals, as well as bees and other beneficial insects are vulnerable to the potent insecticide.

Chlorpyrifos is moderately persistent in soil and can take weeks to years to break down. The insecticide can also reach rivers, lakes and streams, where it concentrates in the fatty tissue of fish. According to the [National Water Quality Assessment Program](#), chlorpyrifos contaminated surface water in urban and agricultural streams at levels potentially harmful to aquatic life.

Chlorpyrifos can also travel long distances to remote areas far from its source. The [Arctic Monitoring and Assessment Program](#) reported the [presence](#) of chlorpyrifos at a number of locations:

- Surface water, ice, & fog from the Bering & Chukchi Seas
- Alaskan snow and fish from Alaskan parks
- Arctic & subarctic Canadian lakes

This contamination from transport has driven proposals to consider chlorpyrifos for global elimination under the Stockholm Convention on Persistent Organic Pollutants.

## Resources

[PAN Pesticide Info Database](#)

[PAN What's On My Food](#)

[PAN Chlorpyrifos Factsheet](#)

[NPIC on chlorpyrifos](#)

[EPA on chlorpyrifos](#)

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