Widely Used Pesticide in Food Production Damages Children's Brains

EPA science on chlorpyrifos ignored as agency reverses decision to stop insecticide's agricultural use

Bills Introduced in Congress to Ban Chlorpyrifos

In response to the EPA reversal of its proposal to revoke tolerances of allowed chlorpyrifos residues on food, legislation was introduced in the U.S. Congress in July, 2017, and several states. The bills were introduced in the U.S. Senate and House of Representatives after an appeals court refused to require EPA to make a decision on the scientific issues supporting its earlier proposal to ban the chemical.

U.S. Senators Tom Udall (D-NM), Richard Blumenthal (D-CT), and eight cosponsors introduced *The Protect Children, Farmers and Farmworkers from Nerve Agent* Pesticides Act of 2017, S. 1624. U.S. Representatives Nydia Velázquez (D-NY) and 49 cosponsors introduced a companion bill, *Pesticide Protection Act of 2017,* H.R. 3380.

Bills have been introduced to ban or restrict chlorpyrifos in California, Hawaii, Maryland, and New Jersey.

One of Administrator Scott Pruitt's first acts, some would say politicized act, as head of the U.S. Environmental Protection Agency (EPA) was to rescind the agency's 2015 proposal to revoke the food tolerances, or allowable residues, of one of the most neurologically toxic pesticides on the market. The planned revocation of food tolerances would effectively ban the use of the organophosphate (OP) insecticide, chlorpyrifos, from agriculture and eliminate agriculture-related exposures to farmworkers and their children. Instead, Mr. Pruitt's EPA indicated the agency will continue to study chlorpyrifos, without any planned action until 2022.

Residential indoor uses were banned in 2000 due to elevated neurological risks to children. Since then, EPA scientists and regulators have been reviewing this hazardous pesticide, which is currently mostly used in agriculture, for mosquito-borne disease control, and on golf courses.

THE SCIENCE ON ADVERSE EFFECTS IS CLEAR

Chlorpyrifos is a neurological toxicant that damages the brains of young children. Exposures lead to decreased cognitive function, lower IQs, attention deficit disorder, developmental delays, and a host of other pervasive developmental and learning disorders in children. Because of this, it is evident to scientists and regulators that this chemical must be taken off the market.

DECADES OF SCIENCE CAST ASIDE

Chlorpyrifos is a cholinesterase inhibitor that binds irreversibly to the active site of an essential enzyme for normal nerve impulse transmission, acetylcholinesterase (AChE), inactivating the enzyme. In doing this, the chemical causes damage to the central and peripheral nervous systems and disrupts neurological activity.

Although the acute toxicity of OPs, such as chlorpyrifos, has been attributed to inhibition of AChE, there is growing evidence that this may not account for all the long-term neurotoxic effects of OPs. Studies show that OPs can induce additional neurotoxic effects at very low level concentrations below those demonstrated to inhibit AChE. Some studies find that OPs interfere with proper neuronal development and function. Others find that OP pesticides may influence the nervous system by disrupting the lipid profile of the nerve tissue; disrupting axonal transport (movement of mitochondria, lipids, synaptic vesicles, proteins, and other cell parts to and from neuron cells), and decreasing the number of nerve cells.

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CHLORPYRIFOS EFFECTS ON CHILDREN'S BRAIN FUNCTION

Studies have documented that exposure to low levels of chlorpyrifos during pregnancy can impair learning, change brain function and alter thyroid levels of offspring into adulthood, especially in females.[1,2,3,4]

One pivotal body of science is the work conducted by Columbia University researchers at the Center for Children's Environmental Health (CCCEH), which measured chlorpyrifos in umbilical cord blood of pregnant mothers and conducted intelligence tests for children of these mothers later in childhood. This is part of a series of ongoing prospective cohort studies in inner-city minority populations that link exposure to chlorpyrifos to early childhood developmental delays. One study from this research group compares motor and mental development to levels of exposure to the pesticide at birth in 266 children born between 1998 and 2002 living in low-income New York City neighborhoods of the South Bronx and northern Manhattan. The study finds that concentrations of chlorpyrifos in umbilical cord blood correspond to a decrease in the psychomotor development and a decrease in the mental development in three-year-olds.[5] A follow-up study finds that children with high exposure levels to chlorpyrifos have changed brain anatomy.[6] Changes in brain structure attributable to low-dose chlorpyrifos exposure correlate with reduced IQ.

Additional data from CCCEH was rigorously reviewed by EPA scientists, who concurred that children exposed to high levels of chlorpyrifos had mental development delays, attention problems, attention-deficit/hyperactivity disorder problems, and pervasive developmental disorder problems.[7,8] The results of these cohort studies have consistently found that depressed cognitive development, birth weights, and other neurodevelopmental endpoints are adversely affected by chlorpyrifos and other pesticidal exposures.[9]

Further research at the University of California, Berkeley, examining families in the agricultural-intensive region of the Salinas Valley, California, found that IQ levels for children with the highest OP exposure were a full seven IQ points lower than those with the lowest exposure levels. The Berkeley team also found that every ten-fold increase in OPs detected during a mother's pregnancy corresponds to a 5.5 point drop in overall IQ scores in the seven-year-olds.[10] Researchers at Mount Sinai School of Medicine also found that prenatal exposure to organophosphates is negatively associated with cognitive development, particularly perceptual reasoning, with evidence of effects beginning at 12 months and continuing through early childhood.[11]

ENVIRONMENTAL JUSTICE: DISPROPORTIONATE IMPACTS WILL CONTINUE

Research on chlorpyrifos underscores that certain subpopulations are disproportionately affected by chlorpyrifos exposures. Low-income African American and Latino families, including farmworker families, continue to be at the highest risk of injury, and this disproportionate impact creates an ongoing environmental justice issue.

EXPOSURE IS DOCUMENTED

For farmworkers and their families, the threats from chlorpyrifos exposure are dire. Farmworker families tend to live in communities adjacent to treated fields, and within the buffer zones of many agricultural fields. Farmworker studies routinely show high exposure injury and disease from pesticide drift in these

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communities.[12,13] Drift incidents with chlorpyrifos in California after field applications have been documented, including cases that required medical attention.[14] Air monitoring data in the state reveal that chlorpyrifos residues are pervasive with levels more than 18 times higher than federal levels of concern.[15] Because residues move from outside to inside homes, indoor residues of chlorpyrifos have been detected in relatively high concentrations,[16] and farmworkers have been found to have multiple detections of pesticides in their urine, with chlorpyrifos detected in 44 percent of samples.[17] Residues are also found on workers' clothing and on hard surfaces, such as portable toilets used by the workers in the field[18]—demonstrating direct and indirect exposures.

Pregnant women in these communities are especially at risk. Research from a University of California, Davis study, *Childhood Autism Risks from Genetics and the Environment* (CHARGE), finds that pregnant women who live within a mile of agricultural fields treated with insecticides like chlorpyrifos are more likely to have a child develop autism.[19] For women who live less than one mile from crops sprayed with OP insecticides during their pregnancy, the chance of a child being diagnosed with autism increases by 60%. Women in the second trimester living near chlorpyrifos-treated fields are 3.3 times more likely to have their children diagnosed with autism. The UC Berkeley Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS) study team evaluating OP effects in women and children in the Salinas Valley, CA finds that every 522 pounds of combined organophosphate pesticide applications within one kilometer of a pregnant woman's home correlates with a two point IQ loss in her children at seven years of age.[20]

EPA'S REGULATORY RECORD ESTABLISHES EXCEEDED RISK CRITERIA

In 2015, EPA announced it would revoke all food tolerances for chlorpyrifos. This announcement came on the day of a court-ordered deadline for EPA to respond to a petition filed by Pesticide Action Network North America and the Natural Resources Defense Council a decade prior. That lawsuit called on the agency to ban all uses of the insecticide in light of the scientific evidence. Despite several assessments showing unacceptable risks, EPA made continued attempts to mitigate exposures by banning the residential use of chlorpyrifos in 2000, and imposing no-spray buffer zones in 2012 around public spaces, including recreational areas, schools, and homes, to reduce bystander exposure risks or, in the words of EPA, ensure that "any chlorpyrifos exposure outside the application site will not reach harmful levels." Thus, the decision to revoke tolerances resulted from an agency assessment that it could not meet "acceptable" risk criteria with additional mitigation measures, given the overwhelming data showing elevated risks to human health. EPA's assessments have repeatedly found 'significant risks' to children, farmworkers, and drinking water as a result of the chemical's normal agricultural use.

The unacceptable risk finding is based on the aggregate exposure assessment required by a provision in *Federal Food, Drug, and Cosmetic Act* (FFDCA), adopted in the *Food Quality Protection Act of 1996,* which requires that regulators determine dietary (i.e., food and water) and non-dietary (e.g., drift) exposure effects in combination, but explicitly not including occupational exposure. FFDCA requires the agency to consider all sources of exposure, except occupational, to the food use pesticide under review. EPA's risk assessment concludes that no level of exposure from drinking water is acceptable because both dietary risks from food exposure alone and residential exposure alone exceed levels of concern.

In 2016, EPA convened a Scientific Advisory Panel (SAP) meeting to discuss its proposed revocation of tolerances. Overall, the SAP agreed with the conclusions of the CCCEH study—that there is an association between prenatal chlorpyrifos exposure and neurodevelopmental outcomes in children. Following the SAP meeting, EPA released an updated human health assessment that stated, "[The] revised analyses do

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not result in a change to the EPA's proposal to revoke all tolerances but it does modify the methods and risk assessment used to support that finding in accordance with the advice of the SAP."[21] EPA concludes that there is "sufficient evidence that there are neurodevelopmental effects occurring at chlorpyrifos exposure levels below that required for AChE inhibition,"[22] and EPA's current approach for evaluating chlorpyrifos's neurological impact is "not sufficiently health protective."

From a scientific perspective, the data and risk assessment that EPA generated on chlorpyrifos resulted in a finding that does not meet the health standards set forth in FFDCA. EPA was clear in its 2016 revised assessment that "risk from the potential aggregate exposure does not meet the FFDCA safety standard."

Based on its scientific assessment, and in accordance with the standards set forth in food safety law, EPA moved ahead with a proposal to revoke food tolerances. However, in March 2017, under extreme political pressure orchestrated by industry groups, the agency disregarded the conclusions of its scientists and risk assessors, put aside its proposal, and called for further study. News reports cite a meeting between Administrator Pruitt and CEO Andrew Liveris of Dow Chemical, maker of chlorpyrifos, only weeks before reversing the agency's decision on chlorpyrifos.[23]

WHAT NOW?

Now that EPA will continue chlorpyrifos use, at least until 2022 when the agency revisits the chemical, attention is turning to legislation in Congress and the states. (See box on p.16.) The data sets cited in this piece and others accumulated over years of study support a need to protect children from chlorpyrifos. Disregarding this wealth of research runs counter to the public health and environmental protection mission of EPA.

In June 2017, several farmworker and environmental groups filed an administrative appeal seeking to reverse Mr. Pruitt's decision. The appeal, which was unsuccessful, challenged EPA's action that allows chlorpyrifos to continue to be used on food crops. At the same time, attorneys general from California, Massachusetts, Maine, Maryland, New York, Washington, and Vermont filed a legal objection to the order, calling for its reversal and a revocation of all tolerances. The state of California's Office of Environmental Health Hazard Assessment has listed chlorpyrifos as a chemical known to cause cancer, birth defects and reproductive harm under its Proposition 65 law, which will trigger statewide warnings on product labels on December 15, 2018. Allan Hirsch, chief deputy director of the office, said, "The [Prop 65] panel was able to look at [the] studies, and they felt that all of the information from these studies taken together clearly showed that exposure to chlorpyrifos can harm the development of a child."

How are you exposed to chlorpyrifos?

Food: Chlorpyrifos is used to treat insect pests on a range of food commodities, and residues can remain in soil and on crops. Almonds, cotton, citrus, grapes, corn, broccoli, sugar beets, peaches, and nectarines receive the highest application of chlorpyrifos.[24] It is also used on soybeans, Brussel sprouts, cranberries, and broccoli. Non-agricultural uses include golf courses, turf, greenhouses, wood treatments, such as utility poles and fence posts, and area-wide mosquito adulticiding for public health reasons. There are some cockroach and ant products used in secured baits.

Water: Chlorpyrifos drift contaminates surface water, including sources of drinking water. The breakdown product of chlorpyrifos, chlorpyrifos-oxon, persists in water and even through water treatment. It can remain in drinking water for at least 72 hours.[25] EPA has determined that there is potential exposure risk from chlorpyrifos and chlorpyrifos-oxon in finished drinking water.

Air: Residues of chlorpyrifos have been detected in indoor air, including child care centers.[26] Air monitoring reports have found chlorpyrifos at levels exceeding federal guidelines.[27] Vapors of chlorpyrifos from treated fields can cause adverse effects, especially to those nearby. In 2012, the agency proposed new rules to reduce bystander exposure to chlorpyrifos drift from agricultural fields, including the use of buffer zones for vulnerable areas, such as residential areas, schools, hospitals,[28] but drift from these sites still occurs, putting people at risk.

NOW IS THE TIME TO ACT! THERE ARE ACTIONS YOU CAN TAKE TO HELP STOP CHLORPYRIFOS USE.

- Urge your elected state officials to support efforts to stop the use of this highly toxic chemical in your state.
- Call your U.S. Senators and U.S. Representative and ask them to co-sponsor S.1624 and H.R. 3380, respectively, to ban chlorpyrifos.
- Tell EPA that its decision to reverse a chlorpyrifos ban is dangerous to children's health.
- Use your purchasing power. Support organic agriculture, which does not use chlorpyrifos in food production.
- Get involved: educate your neighbors, family and friends about the dangers of this and other neurotoxic pesticides.

For more information, see Beyond Pesticides' chlorpyrifos page at bp-dc.org/chlorpyrifos.

Nichelle Harriott, Terry Shistar, PhD, and Jay Feldman contributed to this piece.

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